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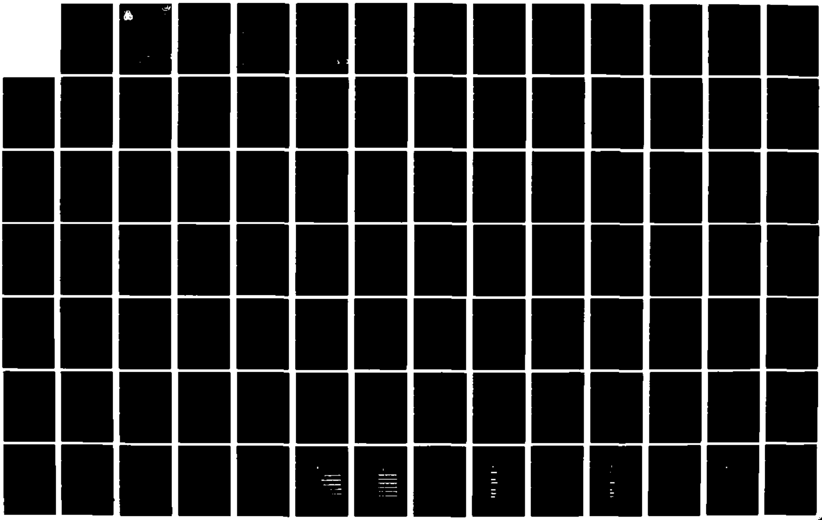

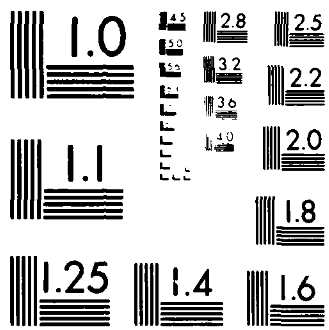

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Health Care Studies
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Proceedings of the

TRI-SERVICE

PERFORMANCE MEASUREMENT

CONFERENCE

Edited by

LTC John A. Coventry

REPORT #84-002

October 1984

US ARMY
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This report contains papers submitted and presentations made to the Tri-Service Performance Measurement Conference held 11-15 June 1984 in New Braunfels, Texas. Representatives from the Army, Navy, and Air Force Medical Departments, the Office of the Assistant Secretary of Defense (Health Affairs), OCHAMPUS, the Veteran's Administration, and several civilian academic speakers met to discuss problems in medical workload accounting, productivity measurement, and resource allocation within military medical treatment facilities. Discussions centered around potential application of Diagnosis Related Groups to these problems.

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Proceedings of the

TRI-SERVICE PERFORMANCE MEASUREMENT CONFERENCE

Sponsored by

The Army Medical Department

11-15 June 1984

T-Bar-M Ranch
New Braunfels, Texas

PREFACE

As Commander of the Health Care Studies and Clinical Investigation Activity (HCSCIA), it was my pleasure to host the very first Tri-Service Performance Measurement Conference on behalf of Major General Floyd W.Baker, Commander, US Army Health Services Command (HSC), and Lieutenant General Bernhard T. Mittemeyer, Surgeon General of the Army. We at HCSCIA were very excited at the prospect of such a conference and continue to be excited by the results. These Proceedings from the Conference should prove invaluable for all of us interested in improving the way we account for the very important work done in delivering health care to members of the Uniform Services and other beneficiaries.

Under the direction of Colonel Gerald D. Allgood, Chief of Staff, Health Services Command, HCSCIA was given the task of conducting the Army Medical Department Performance Measurement Study (AMEDD PMS). This study is currently examining various possibilities for replacing the Medical Care Composite Unit (MCCU). Very early in this project, it became apparent that many of the complex issues surrounding workload measurement and productivity analysis are not unique to any one military medical department. In addition, any contemplated replacement of the traditional measure of work, the MCCU or Composite Work Unit (CWU) as it is known in the Navy and the Air Force, would involve all three Services and the Office of the Assistant Secretary of Defense for Health Affairs (OASD[HA]). General Mittemeyer was convinced that Tri-Service involvement was not only desirable but very necessary. Thus, the need for this Conference.

The very excellent agenda of noted civilian academic speakers, the presentations by members of the Department of Defense interested in the general topic of performance measurement, and the spirit of cooperation which permeated all activities during the Conference, resulted in an exciting and productive week. The agreements that members of the three Services would continue working informally together on the important issues discussed provide a real opportunity to change "business as usual" in area of performance measurement, resource allocation, quality of care monitoring, and interface with the civilian health care delivery community. I know the record of the Conference in these Proceedings will serve as a basis for future research, similar future meetings, and continued cooperation and progress.

I would like to thank all participants in the Conference, especially our civilian guest speakers. Finally, I would like to formally thank all members of HCSCIA who had a role in the many details of preparing for this Conference and publishing these Proceedings. Their hard work and dedication to excellence were in large part responsible for the success of the Conference as reflected in these Proceedings. These personnel include: LTC John A. Coventry, LTC Terry R. Misener, MAJ David V. Wright, MAJ Michael P. Crutchfield, CPT(P) James M. King, CPT Linda P. Sauer, SFC Timothy M. Canavan, SSG Robert A. Lamb, Dr. A.D. Mangelsdorff, Mrs. Pat Twist, Mrs. Pat Gilbert, and Mrs. Louisa Lohman.

October 1984

Fred A. Cecere
Lieutenant Colonel, Medical Corps

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Tuesday - 12 June 1984

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0830-1000 DRG Background and Use in Productivity Monitoring (Dr. Jean Freeman, Yale University and Dr. Robert Mullin, Director, Continuing Care, Hospital of St Raphael.)

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1030-1200 DRG Based Prospective Payment - Past, Present, and Future (Dr. Stephen Jencks, Health Care Financing Administration)

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1300-1500 Impact of Severity of Illness on Cost and Length of Stay (Dr. Susan Horn, Johns Hopkins University)

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Wednesday - 13 June 1984

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(LTC Steve Arnt and LTC Fred Vago, OASD(HA))

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(LTC Joseph C. H. Smith, OCHAMPUS)

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- 1330-1400 Navy: CDR Karen Reider, Naval School of Health Sciences and LCDR Lee Tompkins, NAVMEDCOM
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(CPT Scott Optenberg, WHAFMC)

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1530-1630 Productivity Measurement at the Fort Ord MEDDAC
(LTC C. H. Moore, Ft Ord MEDDAC)

1630-1645 Development of a Nonpatient Care Model for the Performance Measurement Study
(CPT(P) James King, MAJ Don O'Brien, Dr. A.D. Mangelsdorff, HCSCIA)

1645-1715 Military Availability and Physician Productivity
(MAJ John Abshier, Ft Leonard Wood MEDDAC)

1715-1730 Quality Assurance Implications of the Performance Measurement Study (MAJ Don O'Brien, CPT(P) James King, Dr. A.D. Mangelsdorff, HCSCIA, and MAJ Stuart Baker, PASBA)

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1100 Depart from Conference Site

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DRGs: Background and Applications in Utilization Review and Hospital Management

Jean L. Freeman, Ph.D. and Robert L. Mullin, M.D.

Since the implementation of Medicare's prospective payment system, the three letters DRG have often provoked rather extreme reactions particularly among physicians and hospitals administrators. Some have expressed cautious optimism that the system will have at least some impact on cutting the rising costs of hospital care, while others feel DRGs represent a hospital acquired disease, hopefully of limited duration, which will disappear in a short time. In fact, the Diagnosis Related Groups are basically a classification system for hospital discharges with much broader applications for utilization review and hospital management.

It is these applications, other than prospective payment, which are the focus of this paper. Prior to presenting this material, however, a brief historial background on the development of the DRGs is given. The major point of this historical perspective is that group definition is a process that has evolved over the past 10-15 years in response to updated diagnostic and procedure coding and to comments by users of the system regarding its utility as a payment system, as a utilization review mechanism, and as management tool. In the future, the classification will continue to be reviewed and revised to accommodate change in medical practice pattens, advances in technology and possibly the incorporation of other factors thought to affect resource use.

Historical Background

The initial development of a patient classification system at Yale Univeristy began in the late 1960s and was largely motivated by the needs of two utilization review programs. It was at this time that the general methodology was established and an approach developed that was to be used in all future versions. Briefly, the scheme was constructed by initially dividing all principal diagnosis codes into major diagnostic categories. These major categories were then partitioned into subgroups based on values of variables associated with length of stay--the only utilization measure available at that time. This partitioning process was done by evaluating the clinical meaningfulness of subgroups formed using the A.I.D. algorithm. A special statistical system was also developved at this time, AUTOGRP, to support an interactive version of the A.I.D. algorithm.

The first documented version of the "patient groups" as they were referred to then, was described in a 1973 working paper [1]. There were 54 major diagnostic categories that were further partitioned into 333 final groups based on values for the variables age, presence or absence of specific surgery and secondary diagnoses. The data used to construct the scheme consisted of discharges from selected Connecticut hospitals

In this first version there was a heavy emphasis placed on the statistical attributes of the groups and it is unclear as to the extent of physician involvement. The scheme was used to examine case mix differences in Connecticut hospitals and the extent to which differences in hospital utilization are a function of differences in case mix. Another working paper produced in 1974 [2] suggested further applications for hospital management and reimbursement. Research was started around this time in the development of a cost model that would enable one to determine the costs of treating patients of a certain case type.

The second version, produced in 1977, was constructed under contract with the Social Security Administation specifically for prospective reimbursement. The number of major diagnostic categories was expanded to 83 and the number of final groups to 383. The database used to form the groups contained hospital discharges from New Jersey, South Carolina, and a local New Haven hospital.

Again, group definition appeared to be based largely on statistical criteria with limited physician involvement. This was the first version to receive considerable public exposure, largely because of its implementation for reimbursement in the state of New Jersey.

This increased exposure brought with it a number of criticisms and comments regarding the scheme's weaknesses. Much of the criticism was constructive and it centered around the way the groups were formed based on surgical procedures and secondary diagnoses. Some procedure groups included any surgical procedure that was not specifically contained in other groups, often resulting in a bizarre mixture of patients grouped together in the same DRG with no clinical interpretability. Other groups were formed on the basis of the presence of any listed secondary diagnosis so that diabetes as a comorbidity was given the same weight as a hang nail.

In addition, the generalizability of the findings were questioned since the data were for the most part limited to hospital discharges from two states. Other criticisms seemed to arise out of a general confusion with the underlying conceptual framework for the DRGs and what was their purpose. Terms were used such as hospital product, and never really defined. Certain constraints were implicitly adopted in the formation of the patient classes, but never actually documented in print. What was written about the research was largely contained in working papers and appendices to contract reports. So, there was clearly a need to document more completely the entire "grouping" process.

The research group responded to the documentations problems by publishing a supplement in a major health services journal - Medical Care - in 1980 [3]. Many of the problems with the surgical procedures groups were addressed in a third version of the DRGs generated in 1978 for the state of New Jersey.

However, a major revision of the system began in 1980 and resulted in the fourth version of the DRGs which was released in 1982. Since then, only a few modifications have been made to selected DRGs to correct for errors made in the placement of certain diagnosis and procedure codes. The current version containing these updates was distributed by Health Systems International, a private consulting firm, in 1983. This version represents a significant improvement over the earlier versions largely because of its increased "clinical coherence," attributed to the physicians who consulted on the project as well as to physicians from the various specialty groups who approved the final version.

Overview of the DRGs*

Diagnosis Related Groups (DRGs) methodology is one approach to measuring case mix. The current version was developed by the Health Systems Management Group of the Yale University School of Organization and Management under a grant from the Health Care Financing Administration of the Department of Health and Human Services. [4] The purpose was to develop an inpatient classification system that differentiates the amount of hospital resources required to provide care.

Data bases used were:

1. A Commission on Professional and Hospital Activity (CPHA) base of 1.4 million records representing each region of the country, teaching and non-teaching hospitals, and representative bed size and containing the Uniform Hospital Discharge Data Set elements (UHDDS). This data set contains, among other things, patient age, sex, diagnoses, surgical procedures, and disposition.

2. A New Jersey State Department of Health financial database.

The International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) is the coding source used by all hospitals and was the basis of the groupings. The diagnoses in ICD-9-CM were divided into twenty-three (23) Major Diagnostic Categories (MDCs) corresponding to the various body organ systems and medical specialties (Figure 1). The data base was then used

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* This material appears in an article published by Dr. Mullin (Mullin RL: DRG's: A brief description. Connecticut Medicine 47: 281-282, 1983.) and is republished here with the permission of Connecticut Medicine.

Figure 1

LISTING OF TWENTY-THREE MAJOR DIAGNOSTIC CATEGORIES

Major Diagnostic Cateogry Number	Major Diagnostic Category English Description
01	Diseases and Disorders of the Nervous System
02	Diseases and Disorders of the Eye
03	Diseases and Disorders of the Ear, Nose and Throat
04	Diseases and Disorders of the Respiratory System
05	Diseases and Disorders of the Circulatory System
06	Diseases and Disorders of the Digestive System
07	Disease and Disorders of the Hepatobiliary System and Pancreas
08	Disease and Disorders of the Musculoskeletal System and Connective Tissue
09	Disease and Disorders of the Skin, Subcutaneous Tissue and Breast
10	Endocrine, Nutritional, and Metabolic Diseases and Disorders
11	Diseases and Disorders of the Kidney and Urinary Tract
12	Diseases and Disorders of the Male Reproductive System
13	Diseases and Disorders of the Female Reproductive System
14	Pregnancy, Childbirth and the Puerperium
15	Newborns and Other Neonates with Conditions Originating in the Perinatal Period
16	Diseases and Disorders of the Blood and Blood-forming Organs and Immunological Disorders
17	Myeloproliferative Diseases and Disorders and Poorly Differentiated Neoplasms
18	Infectious and Parasitic Diseases (Systemic or Unspecified Sites)
19	Mental Diseases and Disorders
20	Substance Use and Substance Induced Organic Mental Disorders
21	Injuries, Poisonings and Toxic Effects of Drugs
22	Burns
23	Factors Influencing Health Status and Contacts with Health Services

to develop statistically and clinically coherent groups. The principal diagnosis (the diagnosis, after admission and investigation, which is the principal reason for the admission to the hospital) places the patient in an MDC. The first partition in most MDCs is the presence or absence of a surgical procedure most likely performed in an operating room.

The operating room procedures in each MDC were arranged in a hierarchy from most resource intense to least resource intense. Those patients not having an operation were likewise grouped in broad categories of illness from the most resource intense to the least resource intense. Some of these first groupings (medical and surgical) were further subdivided on the presence or absence of malignancy, substantial comorbidity or substantial complication. Age was also a factor in some partitionings.

Age seventy (70) was found to be the significant point for the older groups and age seventeen (17) for the younger groups. An interesting combination of age and presence of a complication or comorbidity proved to be a powerful determination of resource consumption. Patients with a substantial comorbidity or complication fell in the one group, while all patients under age seventy (70) without a substantial comorbidity or complication made up the other group.

The groupings were accomplished by a computer program which developed distinct groups based on the greatest reduction of variance in length of stay. These initial groups were then reviewed by the clinicians and reassignments made for clinical coherence.

There are 467 final groups or DRGs. Patients are assigned to a DRG by a computer program (grouper) which looks at the principal diagnosis (for MDC assignment), secondary diagnoses (for presence of substantial comorbidities or complications), surgical procedures (for presence of an operating room procedure and placement in the surgical hierarchy), age, sex, and discharge status. Thus, the entire DRG assignment process requires only readily available information and not record reviews or subjective evaluations. Accurate recording of the above elements is absolutely essential to the assignment of the correct DRG.

Trim points (low and high lengths of stay) were developed for each DRG. Patients falling outside of those points are called outliers. This permits separate consideration for the small group of truly different patients that cannot be neatly categorized by a specific DRG.

Utilization Review Based on Practitioner Profiles *

Utilization review for Medicare, Medicaid, and maternal and child health programs was required by PL 92-603 (1972). The Joint Commission on Accreditation of Hospitals (JCAH) has, for many years, required a utilization review program to "address over-utilization, under utilization, and inefficient scheduling of resources." [5]

It became increasingly apparent that the system of concurrent utilization review consisting of admission certification and continuing stay review for all patients was neither cost-effective nor efficient. The JCAH Standard specified: "Concurrent review shall be focused on those diagnoses, problems, procedures and/or practitioners with identified or suspected utilization-related problems." The establishment of some type of focused review was soon required for federal programs.

Efforts to date have centered mostly on patient categories, either by diagnosis, service, patient classification, or some other patient profile. Since only physicians and dentists can admit and discharge patients, and are thus responsible for the patient's length of stay, it seemed logical to use practitioner profiles to establish a focused review system.

* This material is based on a paper presented at the 16th Hawaii International conference on System Sciences, Honolulu, Hawaii, January 1983 and published in the Journal of Medical Systems 7: 409-412, 1983). It is republished here with permission of HICSS and the Journal of Medical Systems.

The profile developed shows the actual versus the expected percentage of a practitioner's patients discharged at the 50th, 75th, and 90th length-of-stay (LOS) percentiles of the comparison norms.

In late 1979, a profile was established for each admitting practitioner on the Yale-New Haven Hospital medical staff. The comparison norms (numerical or statistical measures of usual observed performance) were obtained using the data from the Conference of Boston Teaching Hospitals. Standards (range of acceptable variations from the norms) were developed by the hospital's Patient Care Evaluation Committee.

All patients of practitioners whose profiles did not meet these standards or who admitted fewer than 10 patients per year were subject to review.

The actual review is performed by using criteria for acute hospital stay developed by the Patient Care Evaluation Committee. The patients are reviewed within 48 hours of admission and then every 3 days.

A steady decline in the LOS of focused patients was noted; however, there was little effect on the overall length of stay of all patients. The profiles were regenerated in January 1981 using more up-to-date data from 32 primary university affiliated teaching hospitals throughout the country to establish norms. The drop in LOS focused patients continued, but the overall LOS still remained virtually the same.

In October 1981 the Patient Care Evaluation Committee tightened the standards, and the LOS of focused patients continued to decrease and, for the first time, the overall LOS showed a significant decline.

A computer program was developed to generate the profiles illustrated in Table 1. The diagnosis-related groups (DRGs) were used to adjust for individual case mix in order to compare practitioners.

Table 1

PRACTITIONER PROFILES

PHYSICIAN	TOTAL PATIENTS		PERCENTILE 50th	75th	90th
A	107	Actual	56.07%	81.31%	92.52%
		Expected	53.74%	76.60%	90.59%
		Difference	-2.33%	-4.71%	-1.93%
B	183	Actual	43.72%	65.03%	81.42%
		Expected	54.39%	76.96%	90.61%
		Difference	10.67%	11.93%	9.19%

The Actual Percentage is the composite percentage of patients discharged for the practitioner's entire case load. It is computed as follows:

1. Multiply the number of the practitioner's discharged patients in each DRG by the percentage of those patients discharged on or before the specific LOS percentile.
2. Sum the products over all DRGs with practitioner's case load.
3. Divide the sum by the total number of the practitioner's patients.

The Expected Percentage is the percentage of th practitioner's patients that would have been discharged at the specific LOS percentiles if the LOS of those patients in each DRG was identical to the LOS of the comparison group's patients in the same DRG. It is computed as follows:

1. Multiply the number of the practitioner's discharged patients in each DRG by the percentage of all patients in the comparison group in that DRG discharged on or before the specific in LOS percentile.
2. Sum the products over all DRGs in the practitioner's case load.
3. Divide the sum by the total number of patients in the practitioner's case load.

Total patients is the total number of discharges. Percentiles are the length-of-stay percentiles in whole days.

In this example Practitioner A Discharged 107 patients. The percentage of his patients discharged at each LOS exceeded the expected values. His patients are not reviewed. Practitioner B discharged 183 patients. The percentage of his patients discharged at each percentile was less than the expected values by more than the allowed amount (+5%). His patients are subject to review.

The profiles are regenerating approximately every 6 months, thus eliminating from review those practitioners who have modified their practices and fall within the standards, and adding those practitioners whose practices have fallen below the standards.

The original standards were: Actual Percentage not greater than the Expected Percentage by more than +10% at the 50% percentile, +10% at the 75th percentile, and +5% at the 90th percentiles. The revised standards established in October 1981 were: Actual Percentage not greater than +5% at the 50th, 75th, and 90th pecentiles. Current standards established in October 1982 are: Actual Percentage not greater than +4% at the 50th, 75th, and 90th percentiles.

Table 2 shows the experience to date of the system. It is readily apparent that the original standards (+10%, +10%, +5%), while dramatically reducing the LOS of the focused patients, had no effect on the overall LOS.

A significant effect on total LOS is seen for FY 1982, coinciding with the tighter standards starting in October 1981. This, of course, is the result of reviewing more patients.

We have attempted to develop a rational system of focused review of bed utilization. The diagnosis related groups (DRGs) are the basis for case mix adjustment, and specific computer programs have been developed to compare each practitioner's performance against established norms. The system has been extremely successful in directing review to the correct areas.

Table 2

LENGTH-OF STAY RESULTS*

All Patients
Year-To-Date

	Focus	Nonfocus	Total
FY 1980	12.16	5.83	7.76
FY 1981	10.50	6.45	7.76
FY 1982	9.51	6.40	7.61

* Standard revised October 1981.

Although the overall effect, i.e., a .15-day drop in average LOS, may not appear to be substantial, this represents approximately 5,400 patients days.

Management Applications

From a management perspective, the DRGs were designed to form operational definitions of the products of a hospital. Specifically, the production process is described in Figure 2. The hospital's outputs are the specific goods and services it provides to patients. These include the X-rays, medications, and lab tests ordered by physicians as well as nursing care, and certain hotel and social services. The special set of services ordered by a physician for a given patient is defined as a "product of the hospital."

The DRGs were constructed to identify types of patients who are expected to receive a similar set of services by any given physician. Several examples of the more common DRGs are listed in Figure 2. Various department heads in the hospital are responsible for the conversion of inputs to outputs. The physician, however, is responsible for the "bundling" or "packaging" of outputs which are ultimately provided to the patient.

Figure 2

DEFINING THE PRODUCT OF THE HOSPITAL

HOSPITAL OPERATIONS

PHYSICIAN ORDERS

INPUTS	OUTPUTS	PRODUCTS
Labor Materials Equipment Management	X-rays Medications Lab Tests Nursing Care Meals * * *	Vaginal Delivery w/o Complicating Diagnoses Appendectomy w/o Complicated Principal Diagnosis, Age <70 w/o CC Lens Procedures * *

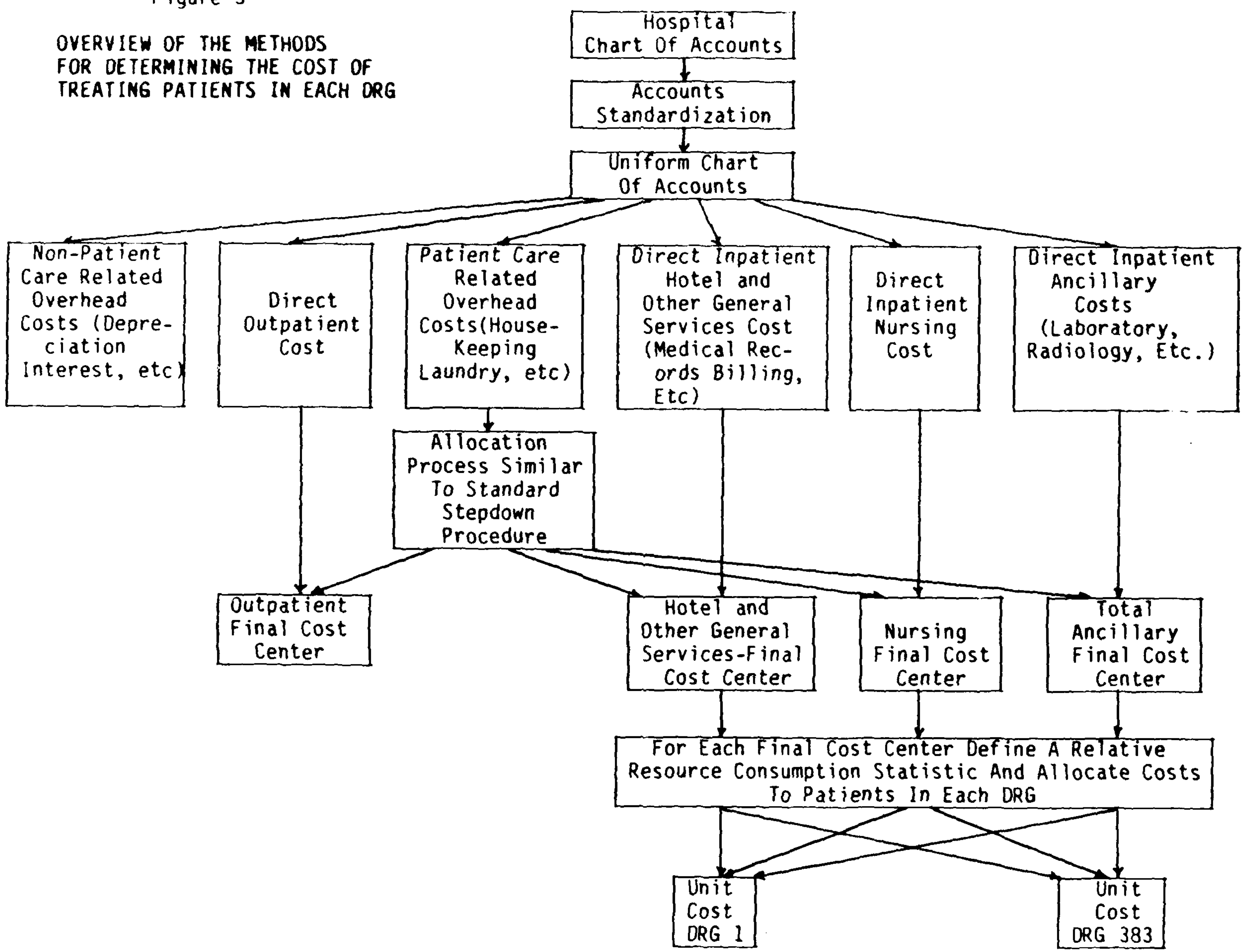
Under Medicare's prospective payment system (PPS), hospitals are paid a specific amount for each patients stay based on a DRG specific rate. If the hospital's cost are less than the rate, it may keep the difference but if its costs are higher than the rate the excess must be absorbed by the hospital.

Clearly, it is critical that an institution have a detailed knowledge of its costs for treating specific types of patients. For the past ten years, research has been conducted by various members of the Health Systems Management Group into methods of cost finding by DRGs and the general approach that has been developed is referred to as "case mix accounting." Case mix accounting has been extensively documented elsewhere. [7, 8] Presented here is only an overview. The reader is referred to the articles for more details. (See Appendix E)

Figure 3 (refer to [7]) summarizes the process of determining the costs of treating patients in each of the DRGs for a given hospital. The ultimate objective of the process is to allocate all hospital costs on per patient basis. Initially a hospital's chart of accounts is divided into six areas: 1)

Figure 3

OVERVIEW OF THE METHODS FOR DETERMINING THE COST OF TREATING PATIENTS IN EACH DRG



nonpatient care related overhead accounts (such as depreciation), 2) outpatient accounts, 3) patient care related overhead accounts (such as laundry, housekeeping), 4) direct inpatient hotel and other general services (such as medical records, billing), 5) nursing accounts, and 6) ancillary accounts (such as laboratory, radiology). What are referred to as *final cost centers* are defined from the latter three categories involving direct patient care related costs. For these final cost centers resource consumption statistics are developed which allow us to allocate costs to patients in each DRG.

Prior to this step, patient care related overhead costs are allocated to the final cost centers. This initial allocation process for the overhead accounts is similar to the standard hospital accounting step down procedure. For example, housekeeping is allocated on the basis of hours worked, laundry and maintenance on the basis of square feet.

Once this is done, the direct costs of each final cost center and the allocated overhead costs represent the total cost of providing the serivce associated within each cost center. As mentioned earlier, this total cost is then allocated to individual patients on the basis of some resource consumption statistic such as relative value units or charges for the ancillary cost centers, patients days weighted by DRG, for nursing.

Once costs have been allocated to patients, managment analyses and reports can be generated which give a summary and detailed breakdown by each DRG by the various cost centers. Consider, for example, Tables 2 and 3 in Thompson et. al., [7]. The tables present a summary of selected utilization and cost statistics for a given DRG. Note that 69 patients were treated for a total cost $271,037.87 or a per patient cost of $3,928.00. A detailed breakdown such as that appearing in Table 3 gives the costs arising from each final cost center. Cost comparisons may also be made from year to year as in Table 2.

In addition to cost finding in a given year, this approach may be used for hospital budgeting. That is, expenses may be predicted using historical cost information and patient volume predictions.

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THE HCFA EXPERIENCE AND WORK MEASUREMENT FOR THE MILITARY

Stephen Jencks, M.D.

A. INTRODUCTION

This paper is about three aspects of the HCFA experience with DRGs which may be useful to the Department of Defense as it considers whether to revise or replace its workload measurement formula:

1. The present and future status of the DRG-based system which HCFA operates for Medicare.
2. The way in which HCFA calculates weights and the usefulness and limitations of these weights in the DoD system.
3. The problems of variations in case mix which are not measured by the DRG system and the implications of this unmeasured variation for DoD.

To start this discussion, however, some differences and similarities in perspective are important. First, HCFA is interested in reimbursement, which means that it is interested in the amount of money necessary to care for a patient. Although DoD is interested in this issue, it is also interested in certain issues which do not interest HCFA. For example, DoD must decide the manning and staffing of medical activities. Some missions of DoD medical activities, such as readiness, may get underplayed or unfunded if comparison of HCFA and DoD costs is overemphasized. Although I am aware of these issues, I have, in general, not addressed them.

But HCFA shares with DoD a feeling that some medical activities use their resources more efficiently than others and that knowing which are which would be most useful for both management and resource allocation. We have in common a belief that not all care costs are necessary and that a formula for allocating resources invites very useful comparisons and adjustment of practices if the formula is roughly fair (and abuse if it is not). And we both are now dividing a finite total pot, not drawing from a bottomless well. The question for DoD is whether a formula using DRGs could be more fair than the current formula.

B. THE PRESENT AND FUTURE OF PPS

I want to make very clear that what I am about to say does not represent an official HCFA position, not because I disagree with the HCFA position but because HCFA does not have an official position on many of the issues I will be discussing. What follows is only the best judgment of an informed observer, which I believe to be consistent with HCFA policy. I have framed my thoughts around five questions:

1. Is Medicare's Hospital Prospective Payment System (PPS) Here to Stay?

PPS is the entire system of regulations, weights, and conversion factors which makes DRGs a way to pay hospitals. PPS was enacted by Congress, and PPS could be repealed by Congress at any time. One must be especially cautious because PPS went from idea to law so very rapidly by Congressional standards that further rapid changes must not be ruled out. Nevertheless, I think that, for some years to come, changes in Medicare's payment system will be evolutionary rather than revolutionary. The direction of evolution will be toward more comprehensive payment systems leading toward capitation, regardless of the administration in Washington. I think we will move toward capitation because so many people either like the idea or are coming to like it. Those who want to reduce the Federal bureaucracy like a system which permits just turning over a capitation; fee to a provider chosen by the Medicare beneficiary; those who want more prevention and efficiency like the flexibility of capitation, some whom we might once have labeled liberals like the concept of HMOs. And I think that organized medicine is rapidly finding capitation more attractive as the very aggressive cost control intentions of both Congress and the Administration becomes clear. I personally doubt that there will be another revolution comparable to PPS between now and capitation, although I expect some very interesting innovations. But PPS came very fast and something else could come equally fast.

2. Are DRGs here to stay?

I think that DRGs are very unlikely to be displaced by one of the competing systems such as Patient Management Pathways, Staging, Severity, or MEDISGRPS. On the other hand, I think it is very likely that DRGs will be somewhat modified over coming years, and somewhat likely that they will be a great deal modified. There are enough areas of significant recognized difficulty--such as psychiatric, rehabilitation, and pediatric hospitals--and enough specific technical questions so that modifications seem inevitable. And, I would add, if such growth were not possible DRGs would constitute a serious disservice to the delivery of health care. On the other hand, DRGs have some practical advantages over the competition which makes more likely an engrafting of features of other systems onto the DRG system.

3. What research is in progress?

There is a great deal of research in the area of prospective payment, and summarizing it would take a long time. In addition, a number of private sector projects are underway. But I think there are several areas which I should highlight:

a. HCFA, ASPE, and NCHSR are currently supporting work on a number of alternative systems, including but not limited to Staging, Severity of Illness, Patient Management Categories and APACHE. In addition, we are watching with interest work on MEDISGRPS. Other systems seem likely to come over the horizon.

b. HCFA is looking for ways to improve DRGs so that currently uncovered hospitals--pediatric, psychiatric, and rehabilitation--can be covered.

c. HCFA is looking at ways of solving a number of more specific problems such as simultaneous replacement of two hips, treatment of major burns, different types of pacemakers, hospice-related care, and the differences between alcohol detoxification and rehabilitation.

d. HCFA is beginning to look at the impact of PPS on various types of hospitals to see whether there are groups of hospitals which fare well or poorly under PPS.

e. Under orders from Congress, HCFA is investigating conducting a number of other investigations: whether physicians should be reimbursed for in-hospital care under DRGs, whether the DRG system adequately describes variations in case-mix, whether urban-rural price differences should be preserved, the adequacy of outlier payments, the impact of PPS on sole community hospitals, the costs of uncompensated care, the position of large rural teaching hospitals, the effect of providing cost of care information to patients, the recalibration of weights, the impact of state alternatives, and last, but by no means least, the actual impact of PPS on hospitals.

Some of these issues, such as the costs of uncompensated care, appear to be of limited interest to DoD while others, such as the position of the sole community hospital, with attendant costs of large variation in occupancy, appear to have a direct relevance to DoD's problems.

4. What changes in DRGs should DoD anticipate?

a. There will be new weights for DRGs and those weights will continue to change in the future. This has practical implications for the way in which DoD might choose to adopt weights from the civilian sector.

b. The DRG algorithm will change, even though it might not. I do not think that you would be wise to adopt the DRG algorithm without deciding to include future changes as part of your adoption. This is, or ought to be, a dynamic system. But you should also anticipate that these changes will, at least initially, be compatible with the current system and that DoD, like HCFA's fiscal intermediaries and carriers, will be able simply to mount a new program on a computer without reorganizing all of its implementation.

c. The algorithm will continue to rely on the Uniform Hospital Discharge Data Set in the near term. I frankly do not know whether there will be changes further down stream, but am willing to bet that changes in the basic data set will occur if we do not have universal capitation by 1990.

d. Changes to make DRGs more workable for psychiatric and rehabilitation services, two current deficiencies should, I think, be of special concern to DoD.

e. Changes in physician reimbursement by HCFA, although it is unclear whether physician DRGs, relative value scales, or some other option will be chosen.

5. What is HCFA's approach to integrating inpatient and outpatient services for work measurement or payment?

To date, HCFA has not been able to obtain satisfactory approaches to the problem. Two strategies are currently on the research agenda:

a. For care surrounding a hospitalization, we are seeking to define service windows which might be used to include those ambulatory services as part of inpatient care.

b. For general ambulatory care, we have systems which characterize individual visits but no system which adequately characterizes episodes of care. The episode of care seems to be the appropriate unit of work for outpatient care just as the admission is the unit of work for inpatient care under DRGs. But it is very difficult to define these episodes normatively and it is fairly difficult to define them from a medical record. Accordingly, we are not optimistic that a solution to this problem is within the state-of-the-art. The risk one runs is that if recognition of workload is by the visit, facilities which use an unnecessary number of visits to manage their patients will be mistakenly recognized as efficient; there is even a risk that this will function as a perverse incentive driving the system in directions in which you would not wish it to go. DoD should consider adopting a procedure code compatible with HCFA in order to more reasonably reflect the resource cost of ambulatory care.

C. WEIGHTS

The way in which HCFA has derived the weights for DRGs is complicated and fairly specific. In essence these weights are based on HCFA's determination of costs compared to an average admission, but to understand this concept you need to understand a number of features of the system:

1. HCFA calculates costs in a very special way which is founded as much in law as in either accounting or economics. Certain costs are allowable and others are not--for example, teaching costs are covered in a special way rather than as part of overall operating costs, bad debt is excluded, depreciation is covered outside of the weights, and weights are synthesized in a relatively complex manner. Nevertheless, the correlation of weights derived from HCFA's "costs" to weights derived from hospital charges is about .98 or .99, so I don't think you need to be too concerned about HCFA's cost-finding procedures. There are other data sets to which you would want to go for information, in any case, because there weren't enough cases in some DRGs in HCFA's experience to weight them properly and because HCFA relied primarily on a data set which overwhelmingly consists of the elderly.

2. HCFA trims its data base.

HCFA has a system for paying outliers--that is, cases which stay either much longer or less long than was expected from the DRG--which takes those cases out of the weighting system. The reason for this decision is that, statistically, the DRG system becomes highly unstable if outliers are included. So HCFA pays for outliers separately. DoD would need either to treat outliers the same way or to compute new weights. The outlier system is probably a prudent way of handling one of the shortcomings of the DRG system.

3. HCFA data does not include physician charges. Such data will become available in the next year or two, and DoD could take advantage of it, but current weights will not include physician charges. Further, it is arguable that there are great differences between DoD physician costs and civilian physician charges, and I am unsure whether we could find data to approximate DoD's cost of physician services.

4. HCFA converts weights to costs with a multiplier which considers urban/rural and regional differences in costs of running a hospital. DoD would probably need to use a rather different formula because labor costs vary in a very different way in civilian and military settings, and DoD might wish to make overall adjustments because of its cost structure.

5. HCFA does not recognize administrative days or any equivalent thereof as part of a DRG weight. This is an important policy call in implementation for DoD.

6. HCFA has a system for paying for transfers which DoD would do well to examine very carefully and to which there may be preferable alternatives.

7. HCFA uses special adjustments for teaching costs. Although DoD could adopt these, it may not want to: surely residents are the individuals whom we should be most able to monitor and to teach to practice efficient medicine. If we can't modify their behavior, whose behavior can we modify?

8. HCFA does not distinguish between categories of patients but DoD might, for example, wish to apply different weights for active duty personnel. An overall special weight, applied as a general multiplier, could easily be calculated by regression techniques using the hospital as the unit of analysis, percent active duty and the hospital case mix index as independent variables, and cost per admission as the dependent variable.

D. VARIATIONS IN CASE MIX UNMEASURED BY THE DRG SYSTEM

I did much of the thinking which follows as I was trying to work out how HCFA should approach the problem of case mix variation. Thus, I have laid out the problems in terms of how they might be addressed, rather than their analytic relationship. I offer no promise that HCFA will do the research envisioned, but this approach may give you my ideas as to how solutions might develop. In no possible sense is this discussion to be construed as the HCFA research agenda--it is one person's notion of how such research might be approached.

1. The Nature Of The Problem: Unmeasured case mix variation is important because, if it is unevenly distributed across hospitals, it results in inequitable judgments as to hospital performance. Such inequities can be unhelpful and could result in a system which is even more perverse than Consolidated Workload Measurement. It is uncertain, at present, how serious this problem may be with DRGs.

a. Necessary Treatment v. Severity and Intensity: To frame our approach, we should first recognize that while many critics of the DRG system focus on severity of illness and intensity of care, unmeasured "severity" or intensity of care may not be the most important issues in considering the adequacy of DRGs. Both HCFA and DoD are more appropriately concerned about the resources necessary to treat the patient's condition, and severity of illness and intensity of care are only clues to the resources required for necessary treatment. Necessary treatment may be quite different from severity in many cases, such as terminal cases in which little treatment is appropriate and early cases in which intensive treatment may prevent complications. The distinction between necessary treatment and the intensity of treatment actually rendered is sometimes difficult, but a central premise of PPS is that, in a large number of cases, less treatment is necessary than has actually been rendered and that economies can be achieved through eliminating surplus treatment activities such as prolonged hospital stay. Therefore we should also be careful to distinguish intensity of care from necessary treatment. This distinction does not require that we develop norms of treatment or that we base weights on some hypothetical ideal treatment, but we must keep in mind that PPS was introduced on the assumption that a significant amount of treatment not rendered is not necessary.

In thinking about these problems we should adhere to the language of treatment requirements and consider "severity" and intensity of care" only as approaches which may prove useful in measuring treatment requirements.

b. Hospitals v. Cases: Although case mix indices seek to classify individual cases, no proponent of an index has suggested that any index can exactly describe each individual case. The operational requirement is that an index accurately describe the average case mix of each hospital, since the hospital is the unit at which risk is pooled and to which performance is assessed. The ultimate test of a case mix system, whether DRGs or a modification, is fairness to hospitals.

Our criterion in thinking about case mix variation should be the impact on hospitals and classes of hospitals rather than the characterization of individual cases.

c. A Hierarchy of Solutions: In approaching the problem of unmeasured variation in requirements for treatment, we should consider a heirarchy of solutions which, if we start on all of them now, can be available at various times in the future.

(1) For the short range consider new ways to compute weights for DRGs, ways to merge DRGs with Staging and Patient Management Categories, and refinements based on previous patient treatment. The present lack of computerization in Severity of Illness precludes merging it with the DRG system at this time.

(2) For the intermediate range consider ways to test variations between hospital types and determine whether hospital type weights would make the system more equitable. Such solutions should be available by 1986-7.

(3) For the long range, consider ways to create types of case mix systems which represent a full generation of advance over the present DRGs.

2. Short-Range Solutions: There are three kinds of short-range solutions--those using cleaner data or better procedures to weight the DRGs, those using methods from other UHDDS-based systems to improve DRGs, and using treatment history to improve DRGs.

a. Weighting procedures:

(1) The data used for creating weights should be as clean as possible.

(a) We should institute a diligent search for the most reliable Medicare data sets. This particularly means using PROs, the work of former PSROs, PHDDS, and intermediary information to identify those intermediaries, states, and regions with especially low error rates. We should also search for editing procedures which may improve data cleanliness.

(b) We should exclude care which has been disallowed by review. This may imply a preference for data from regions where review has been especially vigorous or effective.

(2) We should test modifications to the weighting system which would counteract known or suspected biases. For example, we know that the use of flat per diems understates the variation in nursing costs. We also know that data errors are likely to cause weights to be erroneously close to the mean. This suggests the possibility that the variance of DRG weights is less than it should be and that the entire set of weights should be rescaled to a larger standard deviation. This procedure is mathematically easy and can be tested by

determining whether the calculated hospital reimbursements more closely match historical costs. A study of nursing intensity such as that proposed by Thompson at Yale would shed further light on this issue.

b. Synthesize DRGs with Staging and Patient Management Categories: Staging and Patient Management Categories are computerized systems which operate on the current Medicare data set. Although merging the methods presents substantial technical problems, work on such a synthesis for staging of a few categories is already proceeding under an ASPE contract. A broader effort involving both Staging and Patient Management Categories is conceptually straightforward and should go forward as soon as the 1983 MEDPAR file is in hand. The fundamental technique is to examine areas in which the performance of Staging or Patient Management Categories appears to be as good as or better than that of DRGs and then to synthesize systems.

c. Previous Treatment as a Patient Variable: An important piece of information about patients--previous inpatient and perhaps outpatient treatment--is available from Medicare files and from DoD files but has not been used for case mix analysis. Previous treatment may be an indicator of comorbidity and the severity of disease, and may be more effective than the comorbidity indicators used in the current Medicare system. The Medicare file record of previous admissions may also be a useful tool for approaching the problem of "split admissions": cases in which medical judgment would permit managing a problem on either a single admission or on two admissions.

We should be aware, while seeking to refine DRGs by these methods, that enlarging the number of DRGs presents no theoretical problems so long as enough data is available to calculate suitable weights. The case mix of a hospital will generally be more accurately estimated if there is a small number of cases in each of a large number of DRGs than if there is a large number of cases in each of a small number of DRGs.

3. Intermediate Range: In the middle range we should be able to complete studies to characterize the case mix of hospitals using either of two strategies:

a. Overall characterization using multiple methods: This approach seeks to characterize the case mix of hospitals using MEDISGRPS, Severity of Illness, and other methods to supplement the refined DRGs developed in the short range program. Because using these methods requires primary data collection, it cannot be accomplished in the near term. The methods can assume special power if they are used to cross-validate one another. The goal is to reach more sophisticated conclusions than are now possible regarding differences in hospital case mix. In particular, this strategy would allow us to determine whether certain categories of hospitals such as teaching hospitals should have special weights.

Using multiple methods will address the problem that different methods have different weaknesses, and, specifically, that different methods are vulnerable in different ways to confusing the care which was necessary with the care which was actually rendered. The most clinical of classification systems (e.g., Staging, MEDISGRP, Patient Management Categories) include the results of whatever diagnostic efforts have been made, and for some diagnoses this implies that expenditures have already been made on diagnostic activity. More often (e.g., DRGs), the system also describes some of what was done (e.g., procedures), and thus depends on an external system of review to determine whether such treatment was necessary. Sometimes (e.g., Severity), the system uses the details of the chart in a relatively impressionistic way and it becomes difficult to determine whether the reviewer is responding to the patient's clinical condition or to what was done. Admitting diagnosis, which can illuminate reasons for differences between discharge data and treatment rendered, may well become available on the Medicare data set; this data could contribute to the cross-validation analyses.

The goal of this combined analysis would be to clarify the degree to which indices such as Severity of Illness characterized the care patients needed or only the care which they received. With this validation accomplished, it would be possible to compare different hospitals and classes of hospitals with an order of magnitude and more confidence in our results than we can now achieve with DRGs.

b. A second approach to determining differences in case mix is to carefully analyze certain tracer conditions to determine whether hospitals have different costs for conditions which are identical when fully corrected for intensity of illness and other variables. An example of this kind of study is List's 1983 study of management of myocardial infarction in Maryland and Oregon. Such studies can shed great light on the relative efficiencies of different kinds of hospitals; with such information on relative efficiency, relative costs can be used as indicators of case mix differences.

The effect of either of these strategies would be to permit us to differentiate with greatly improved accuracy between hospitals which are winners and losers under PPS because of unmeasured case mix variation and hospitals which are winners and losers because they are efficient or inefficient. Although some of the strategies cannot be applied directly to DoD facilities, many of the results could be.

4. Long-Term: Long-term strategies rest on more sophisticated concepts of case mix. These strategies assume that by the end of the intermediate phase we will have a system of case mix analysis which characterizes hospitals on the basis of the patient's condition. However, factors other than patient condition influence treatment needs and should be measured in a more sophisticated system:

a. The purpose of treatment:

(1) A patient admitted for terminal care will receive very different care from a patient whose physician is determined to save him. A recent

article by Garber et al in the New England Journal of Medicine observes that a significant part of the greater costs of treatment by teaching hospitals may be related to the fact that in a non-teaching setting more patients with a high risk of dying were admitted for essentially supportive care. It is interesting that, although the teaching patients appeared to have a lower in-hospital mortality, their mortality at nine months follow-up was the same, suggesting that the teaching facility may spend much more effort prolonging the inevitable.

(2) Treatment goals may vary widely for other reasons. For example, two patients in identical condition may be admitted to a rehabilitation hospital with quite different rehabilitation goals. A psychiatric hospital may set very different goals for two very similar schizophrenic patients depending on the degree of chronicity and response to previous treatment. An oncology service may have very different goals for a specific admission of patients at the same disease stage.

b. The extent of knowledge about the patient at admission: When the diagnosis is known before admission, one can expect less for diagnostic activity and diagnostic cost and, since the admission is more likely to be for treatment, we can expect more treatment activity and treatment cost. Current systems are especially insensitive to the degree of diagnostic uncertainty in a case.

c. Patterns of clinical practice: Well-trained physicians treat similar patients in different ways. Some operate on asymptomatic gallstones, others do not; some hospitalize for unexplained chest pain, others do not. Thus, there will be considerable variation in the treatment defined as necessary by different experts.

d. Referral Practices: In communities, there are often patterns of referral which result in differential assignment of the most difficult or treatment-resistant cases to certain hospitals. A dramatic example occurs in many communities where general hospitals skim the most treatable psychiatric patients and refer or commit the most difficult to state hospitals or similar institutions. Often the decision-making processes are extremely intuitive and difficult to quantify, but studies of the communities can make clear that such patterns do exist and are significant.

e. Psychosocial Characteristics of Patients: Large urban hospitals have argued that psychosocial factors (such as whether patients have a fixed address, have sufficient money to alter living arrangements, have someone at home to care for them) strongly influence length of stay and care costs for medical-surgical patients. Research of the type proposed by Arnold Epstein at Harvard/Brigham & Women's would substantially help in clarifying these issues. Although this variable may be less important for DoD's active duty performance, it probably is important for retirees.

The difficulties of pursuing soft variables such as these is evident from the problems which have beset Horn's efforts to move from her initially promising results to a system which can be quantified, summarized adequately in a training manual, and reduced to abstractable and mathematically summarizable elements. Nevertheless, we have every reason to believe that the variables listed above are very important, and we would have to be extremely suspicious that a system which purports to explain a very large portion of the cost variation without taking these variables into account may be measuring actual treatment rather than need for treatment.

These tasks involve developing measures for new variables as well as collecting data to measure their impact and their importance for prospective payment. Finally, we need to begin to think about a problem raised by Garber's work: how do we reimburse cases when some physicians would believe it desirable to keep the patient alive and others would not consider that goal in the patient's best interest? We might expect social forces to take care of the problem, but recent articles in the New England Journal confirm a widespread impression that physicians are providing more care than their patients want, and economic pressures to contain that trend may be appropriate.

5. Capitation: The steps of refinement discussed above are important to and supportive of movement toward a capitation system, because a competitive capitation system is likely to need methods for setting capitation rates which are more precise and sensitive than the methods of the current Medicare Average Annual Per Capita Charge (AAPCC). Each of the steps described above provides data which will support the development of appropriate patient-specific capitation rates. If HCFA were DoD it would be moving very quickly in this direction.

6. How to Compare Case Mix Systems: With this in mind, I would like to suggest a few ideas to use in comparing case mix systems and thinking which ones you might wish to adopt and which to engraft onto others.

a. Necessary Data: DRGs, Patient Management Paths, and Staging all run on the Uniform Hospital Discharge Data Set. This is a major advantage. On the other hand, this data set has very little clinical texture. APACHE and MEDISGRPS run on a defined clinical data set which could be collected as part of discharge abstracting but would require additional effort and would, in consequence, present significant problems if you look for calibration data sets from which to calculate weights. Severity, which is the most impressionistic or implicit method, requires chart reading.

b. Ability to Distinguish Necessary Care from Care Rendered: On this score, PMCs, Staging, APACHE, and MEDISGRPS are strongest. However, PMCs and Staging depend on great detail in discharge diagnoses, and this may well be strongly correlated in existing data sets with having residents and interns and hence with teaching status.

DRGs depend heavily on whether an operating room procedure was performed but not on other elements of care. Because the weights reflect the cost of the operating room procedures, DRGs are actually neutral to performance of surgery, which may be an appropriate stance in the absence of adequate guidelines. DRGs are, however, not neutral to how efficiently the surgery was managed, implicitly rewarding efficient management.

The most serious criticism of Severity of Illness is that it depends so heavily on the "feel" of the medical record that it may actually reflect the care rendered rather than the need for this care. Ultimately, any method which did this would return to cost-based reimbursement, or, for DoD's purposes, to saying that resources used equals performance. The validity of this criticism is impossible to assess at this time, although I have suggested above that we must have concerns about any system which explains more than 90% of variance without including certain major categories of information.

c. Objectivity: Although all of these systems except Severity of Illness are computerized and therefore appear objective, there is always considerable leeway in the nuance of diagnosis and in whether complications (so important to DRGs in particular) are recorded. Severity has a high rater reliability, but the way in which the individual scales are scored is still soft; the way in which the overall score is determined is, in some ways, a greater concern regarding objectivity, since it is disturbing that the combining of the scale scores has evaded summary in a formula for several years.

d. Clinical Reasonableness: Clearly, the chart-reading methods of the Severity index are the most clinically reasonable way to reach a conclusion. The dependence on vital signs and critical findings in APACHE and MEDISGRPS is highly reasonable for conditions where emergency admissions and critical illness are likely, but their application to elective surgery and non-critical illness is less clear. By contrast, many clinicians would be suspicious of the adequacy of systems resting exclusively on diagnosis to describe the variations in necessary care.

d. Neutrality: Various systems are neutral to different aspects of medical practice. For example, DRGs are relatively neutral to whether surgery is performed while staging appears to impose a penalty for surgery. DoD will want, I think, to give special attention to whether a case mix system is as supportive of full restoration to duty as service policy may dictate.

E. SUMMARY: The choice of a case mix system and a way to implement it pose very complex problems for DoD, but the HCFA experience suggests that the problems are solvable and would improve DoD's measurements of medical activity performance.

THE IMPACT OF SEVERITY OF ILLNESS ON DRG BASED COST ANALYSIS

Susan D. Horn, Ph.D.*

It's my pleasure to be here this afternoon and share with you some of the work we've been doing on quantifying hospital case mix. I'll talk mostly from slides because I think it will help to bring out many of the points that I'm trying to share with you a lot more clearly than if I just tried to explain it to you verbally. We're going to examine the connection between DRGs and Severity of Illness. Before we get started I want to share with you some other case mix grouping systems just to go over their definitions so that you can see the different kinds of philosophies that people have used to try to quantify hospital patients and what the products of the hospital are. We'll go through the definition of six different case mix groups, but our concentration will be mostly on DRGs and Severity of Illnesses. I don't think that'll be much of a loss in terms of our discussion today, because research has been able to show that the other case mix grouping systems, the ICD9 codes, the CPHA PAS List A, Disease Staging, and, although we are not quite sure about Patient Management Categories, but at least the other three, research has shown are really equivalent to the 467 DRGs in terms of their ability to predict resource use.

The very first way people thought about grouping hospital patients was just using the ICD9 code system itself, where each disease is given a specific code. Aggregating codes at the three digit level, we end up with 1,000 codes and hence 1,000 cells to group patients into. At the four digit level, we have 10,000 code groups and now with the new ICD9-CM system, we have more than 10,000 code groups. That's one way of grouping hospital patients, but many people looked at this and said, "Well that's a start, but there can be much more wrong with a

* Edited by LTC John A. Coventry from Dr. Horn's taped presentation

Figure 1

COMMON CLASSIFICATION SYSTEMS

<u>ICDA CODES</u>

EACH DISEASE IS GIVEN A SPECIFIC CODE. DEPENDING ON THE CODING SYSTEM, THERE ARE:

3 DIGIT	--	1,000 CODES
4 DIGIT	--	10,000 CODES
ICD9-CM	--	10,171 CODES

patient than just how sick they are in what level they have been classified in terms of principle diagnosis." Many people felt this was not sufficient to quantify what different patients were in different hospitals. CPHA took another approach to grouping hospital patients. They took those over 10,000 I9 codes

Figure 2

COMMON CLASSIFICATION SYSTEMS

<u>CPHA</u>

	398	PRINCIPAL DIAGNOSIS CODE GROUP (ICD9-CM)
X	2	PRESENCE OR ABSENCE OF O.R. PROCEDURE
X	5	AGE GROUPS
X	2	PRESENCE OR ABSENCE OF SECONDARY DIAGNOSES
	7,960	GROUPS

and collapsed them down to 398 principle diagnosis code groups. Then to answer some of the criticism of the other systems not taking into account secondary diagnosis, etc., they broke each one of those code groups into two depending upon presence or absence of an operating room procedure. Then they broke them into five different age groups and two more, depending upon presence or absence of a secondary diagnosis. By the time they were done splitting, they ended up with almost 8,000 code groups. In terms of numbers, that was going in the right direction. Many people felt 10,000 was too many, so 8,000 was 2,000 less than that and we're going in right direction. Other people looked at this and said, "You have just asked if they had an operation or not, you haven't said what kind of an operation it is. Also you just ask if they have a secondary diagnosis, you haven't said anything about the type of secondary." Maybe we can do even better than that in describing differences in hospital patients.

Another attempt to describe hospital patients is the Disease Staging System. This took a very different approach. This approach was trying to look at the seriousness of the disease and in that sense we're getting a little closer to the idea of severity. They quantified seriousness and at this time I believe there are 412 diseases that have been staged. Each stage is supposed to quantify progressively a greater physiological extent of the disease in the body. (See Figure 3) The idea was to take each disease condition and have a team

Figure 3

DISEASE STAGING

STAGE 0 - NO DISEASE PRESENT

STAGE 1 - DIAGNOSIS IS CERTAIN
NO LOCAL OR SYSTEMIC COMPLICATIONS

STAGE 2 - DISEASE PROCESS LIMITED TO AN ORGAN OR SYSTEM

STAGE 3 - SIGNIFICANTLY GREATER PROBLEMS THAN STAGE 2
MULTIPLE SITE INVOLVEMENT
GENERALIZED SYSTEMIC INVOLVEMENT
POOR PROGNOSIS

STAGE 4 - DEATH
THE MOST SEVERE STAGE POSSIBLE
THE FINAL EVENT OF THE ILLNESS

of specialists for that disease condition describe the patients in this kind of generic grouping system. For each disease condition each of these stages are further defined in terms of specific conditions. The first stage is no disease present, Stage 0. Then Stage 1 is a certain diagnosis but no local or systemic complications. The Stage 2 is disease processes limited to an organ or a system, with significantly increased risk of complications. Stage 3 is greater problems than Stage 2 and finally Stage 4 is the most severe or death. Although this is again a generic way of describing the disease condition that you look at in terms of the staging criteria, they have specific descriptions of levels--how the patient would look as a Stage 1, 2, 3 or 4. This was getting closer to how sick hospital patients were. Many people felt it had a lot of positive ramifications. People looked at this and said it represented a progressively greater physiological extent of disease in the body but they also said it only included the principal diagnosis. Patients can have, in addition, other kinds of disease conditions that also need to be treated in the hospital, so although we're getting closer to how sick the patient is, it is only in one dimension. We need a mechanism of looking at the total burden of illness that a patient presents; not only their principal diagnosis, but their secondary diagnoses too. In addition, it also did not look at how the body responded to it's diseased condition because we know with a specific disease condition, some people may respond very quickly, and other people may respond more slowly. So, while proceeding in the right direction, people weren't sure it was the complete description they wanted for hospital patients.

Another different approach is the Patient Management Category approach. (See Figure 4) This one we haven't seen very much of so I can only briefly describe to you what I understand it's philosophy is. The idea behind this system is to look at final diagnosis, that's the discharge diagnosis or the principal diagnosis. Also look at the reason the patient was admitted to the

Figure 4

PATIENT MANAGEMENT CATEGORIES (PMCs)

> PMCs TAKE INTO ACCOUNT BOTH REASON FOR ADMISSION AND FINAL DIAGNOSIS. FOR EACH PMC, PHYSICIAN PANELS SPECIFIED COMPONENTS OF CARE (DIAGNOSTIC SERVICES, TREATMENT PROCEDURES, AND EXPECTED LOS) THAT ARE REQUIRED FOR THE TYPICAL PATIENT. THESE COMPONENTS OF CARE FORM THE BASIS FOR DERIVATION OF RELATIVE COST WEIGHTS FOR EACH PMC.

hospital. Then for each one of those combinations ask physicians to specify the components of care you would expect in the care of that patient, both diagnostically, and therapeutically, and what expected length of stay that patient would have. So, you are looking at a typical patient coming in with certain symptoms and having a final diagnosis and then asking physicians, what would you typically do to them. That's why they're called Patient Management Categories. To date, this system is still under development by people of Blue Cross of Western Pennsylvania. We don't have a lot of descriptions in terms of what their categories look like except that we're told there are going to be about 750 groups. In terms of our hierarchy of numbers we started out with 10,000 I9 codes and went to 8,000 CPHA groups. Depending upon how you look at the Disease Staging system, you can end up with 412 diseases times four stages, or about 1,600 groups. Based on other considerations, I understand there can be up to 3,300 groups there. Now with Patient Management Categories, we get down to 750. But again it's a very different philosophy. It's what do you typically do to a patient that describes their management path.

With all of that as a background in terms of different ways people have looked at how to quantify hospital patients, let's look at what the DRG people did. Their approach was very different. (See Figure 5) Rather than having people speculate on what's the extent of the disease in the body, or speculate on how patients are treated, or automatically put patients into different

Figure 5

DIAGNOSIS RELATED GROUPS (DRGs)

23 BROAD MUTUALLY EXCLUSIVE ORGAN SYSTEM

CATEGORIES ARE DIVIDED INTO 467 GROUPS

DEPENDING ON:

-- TYPE OF SURGERY PERFORMED
-- MORBIDITY OF SECONDARY DIAGNOSIS
-- AGE
-- SEX
-- DISCHARGE STATUS

TO PRODUCE GROUPS WITH SIMILAR LENGTHS OF STAY

groups, the DRG people took a very large data base and modeled it. They took those over 10,000 I9 codes, collapsed them down to 23 organ systems or Major Diagnostic Categories (MDCs); then took about 1,500,000 cases to determine how they could subdivide those cases within the different organ systems to produce groups that had similar lengths of stay. They used a very sophisticated operations research program, an optimization program, to put together patients that had similar lengths of stay. They took into account three aspects of the previous systems that people felt may have limited them. They took into account the type of surgery performed, unlike the CPHA system which automatically split on operation versus nonoperation. Here they differentiated on what type of operation it was. Secondly, instead of just noting if the patient had a secondary diagnosis or not, they included the types of secondary. They made a special list of the complications and/or comorbidity diagnoses, called the C.C. list, such that if you had that secondary diagnosis they thought that you were sicker than if you didn't have that secondary. Finally, they didn't automatically split on age. They only split on age when they felt it made a difference to produce groups with similar lengths of stay. The philosophy behind the DRG system, I think, has many compelling features. The philosophy was to model a data set to see what the data was telling you; to use very high powered operations research techniques and to take into account the criticisms of the other grouping systems by looking at additional factors that would affect the severity of the patients.

As an example to show you they really did use these criteria, MDC 1, the Nervous System, divides into 35 DRGs. (See Figure 6) The first three DRGs

Figure 6

MDC 1 - NERVOUS SYSTEM (DRGs 1 to 35)

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DRG  1 - CRANIOTOMY EXCEPT FOR TRAUMA, AGE >= 18
DRG  2 - CRANIOTOMY FOR TRAUMA, AGE >= 18
DRG  3 - CRANIOTOMY, AGE < 18
      .
      .
DRG 24 - SEIZURE & HEADACHE, AGE >= 70 AND/OR C.C.
DRG 25 - SEIZURE & HEADACHE, AGE 18-69 W/O C.C.
DRG 26 - SEIZURE & HEADACHE, AGE  0-17
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refer to a specific procedure, Craniotomy. If the patient has a diagnosis that's not a trauma diagnosis and they're over 17, they are assigned to DRG 1. If the diagnosis is trauma and they're over 17, they are assigned to DRG 2. If they're under 18 they'll go into DRG 3. So, you see how the type of procedures performed, type of diagnosis, trauma or not, and age, are all used in describing the patients in that area. If they don't have a procedure, as an example seizure and headache, they take age into account and or complications. You see the age breaks turn out to be over 70, 18 to 69, or under 17. Then we consider with or without secondary diagnoses, referring to the complication/comorbidity list. They really did use their definitions and stick to their criteria and the fact is, by using this high powered operations research technique and modeling their data, they were able to produce 467 DRGs that were equal in their ability to describe hospital resource use to the other systems that had many more groups. So I think the power of that system and the techniques they used has really come through.

In contrast to all of these systems, let me explain to you how we devised the Severity of Illness index. This index actually started back in the mid 1970's. Maryland had formed a cost review commission in the early 1970's. Unlike the state of New Jersey, where the commission went to each hospital and said, "All our patients are going to be grouped by DRGs and then we're going to pay you on the basis of DRGs," in Maryland the head of the commission said to the hospitals, "You choose the case mix grouping system you want, but once you've chosen it you have to stay with it for future perspective reimbursement." I thought that was kind of silly because I realized all hospitals would be using different systems in the state of Maryland and we wouldn't have a lot of comparative data. But now that I look at it many years later, I think that it was probably a rather brilliant move on the part of the director of our commission. He didn't want the hospitals coming back to him and saying "I don't like the case mix grouping system you use," and talking about all the problems with it. Hopkins Hospital looked at the case mix systems that existed at the time. They looked at the ICD9 code system itself. They looked at the CPHA system that existed then. They looked at the 383 DRGs that existed then. The criteria that they were looking for, in terms of a good grouping system, was homogeneity of resource use--having patients in a group that required similar resource use. What they found, however, was whether they grouped by ICD9 codes or CPHA or DRGs, many groups had patients with huge variability in resource use, some requiring $1,000 in resource use with other patients in the same group requiring over $200,000 in resource use. When they saw this kind of variability, they called me because they thought it was a statistical problem. I looked at their data and I saw just what they saw -- huge variability of resource use within these groups. Very often the standard deviations were larger than the means and consequently all the grouping systems, no matter which one they used, had problems. They ultimately decided to investigate the DRG system because all of them, as I mentioned, had problems and the DRGs had the fewest number of groups. But at the same time they needed to figure out why it wasn't working. So we took some of the DRGs with cases that had low resource use in a DRG and high resource use in the same DRG. We asked physicians to look at these cases. The physicians came back and said, "It's obvious. The patients with $1,000 of resource use run into no complications, have no other diseases, respond promptly to therapy and go out of the hospital. On the other hand, patients with $200,000 in resource use suffered complications and other diseases." They said we couldn't think of them in the same group.

That's what led us to the idea of trying to conceptualize this difference of no problems versus lots of problems. We gathered a team of physicians and nurses together and said, "Please tell us all the dimensions you think about when you go to a colleague and say I'm treating a sick patient. What is it that you conjure up in your mind?" Now we had certain goals of where we were heading. We had the goal of trying to produce a system of describing how sick these patients were. That was simple. That was something of a four-category system. The physicians wanted a five-category system. But I was very concerned about a five-category system. If you allowed a middle value, I thought we'd find 85% of our cases in the middle and we wouldn't have distinguished anything. So that's how we ended up with the four-category system. And then we wanted something that could be used across all disease conditions. We wanted a generic type system and we wanted something that was simple enough so that we wouldn't have to have specialty people using the instrument. Our idea was that if we could break this idea of severity down into subparts, maybe that would be a useful way to build a system that would be reliable. In other words, people with very little medical education could score the same severity as somebody with a lot of medical education. So what we ultimately ended up with is what you see in Figure 7; seven dimensions that are used as a guide to come up with the overall severity of illness. Rather than just asking "How sick do you think this patient is, 1, 2, 3, or 4?", we said, "Please answer seven questions about this person first." The way I envision it is like a CAT scan that looks at a patient from a variety of different angles and then tries to put the whole picture together in terms of what it's seeing. That's what we're trying to do in our seven dimensions of severity; look at a patient in seven different ways, many of which are related to each other.

Figure 7

PATIENT SEVERITY INDEX

DIMENSION	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
STAGE OF PDx	ASMYPTOMATIC	MODERATE	MAJOR	CATASTROPHIC
COMPLICATIONS	NONE/MINOR	MODERATE	MAJOR	CATASTROPHIC
INTERACTIONS	NONE/MINOR	MODERATE	MAJOR	CATASTROPHIC
DEPENDENCY	LOW	MODERATE	MAJOR	EXTREME
NON-O.R. PROC	NONINV DIAG MINOR THER	THERAPEUTIC INV DIAG	NONEMERGENCY LIFE SUPP	EMERGENCY LIFE SUPP
RESPONSE/RATE	PROMPT	MOD DELAY	SERIOUS DELAY	NO RESPONSE
RESPONSE/RESID	NONE/MINOR	MODERATE	MAJOR	CATASTROPHIC

Let's look at the seven dimensions we took into account. The first was how sick were they in the principal diagnosis. Their stage of principal diagnosis. But unlike the Disease Staging system that had disease specific criteria, since we wanted this to be generic, we had to define stage in terms of symptoms; for example, from an elective surgery patient being asymptomatic up to patients having catastrophic symptoms such as coma or arrest. Then we looked at the extent of complications, from none or very minor types of complications that develop after the patient gets into the hospital that really don't influence their hospitalization at all, up to something catastrophic. For example, a patient could be admitted in respiratory distress but then go into pulmonary failure. Interactions looks at what other diseases the patient has and to what extent they get out of line while the patient is in the hospital. They can have a variety of other diseases but if they stay under control and if they continue with their regular maintenance therapies, that's going to be a Level 1. In a patient who comes in for diabetes but also has a renal problem as an underlying condition, that for us would be an interacting condition. If they went into total renal shutdown, that would be a catastrophic interaction level.

Dependency and nonoperating procedures are two other dimensions that we added as internal monitoring checks in the instrument. They are two dimensions that I wasn't sure we really should include in the instrument but the team said when you're looking at an instrument and you're asking people to answer questions, you should have some questions that force them to go back and ask "Did I answer the parts up above correctly?" That's what I mean by an internal monitoring check. So we define dependency in the following way. Unlike the usual acuity systems that define dependency to be what types of tasks you do for a patient, dependency here is defined to be the usual amount of care for that disease condition which could be from a low level up to having more than the usual amount of care. Now the only way someone can get more than the usual amount of care for a disease condition is if something has gone wrong up above. Either they're at a significantly higher stage in their disease or some complications develop that need extra care or some diseases are out of line that need much more care. That's why this is an internal monitoring check. If by reading through the nursing notes, you think that the patient is getting more than the usual amount of care, you should see it reflected up above. On the other hand, if you don't see it reflected up above, either you may have missed something up above or you've misread the nursing notes. So you see how it's an internal check within the instrument itself and we find that it doesn't drive severity at all. When we do our regression equations to see the effects of these seven dimensions on predicting severity, it's always an insignificant variable because of the way it's defined. The same thing was true with the variable non-operating procedures. It was put in there to distinguish patients that went onto life support versus non-life support. When a patient went onto life support, the team felt that it really meant the patient was very sick. Something really had to be wrong. Life support are things like renal dialysis, ventilator, etc. If a patient went onto life support, again you should see it reflected in either something major or something catastrophic up above. Again, you see how it's an internal monitoring check. In fact, it's a variable that trained people very often feel is one of the variables that's going in the wrong direction in our severity instrument. By that I mean the following: Very often there are patients at Level 3 or 4 overall in terms of how sick they are, that don't have any life support procedures. Hence, no matter how many procedures are done to them in terms of non-operating room procedures, they can't get above a Level 2 on this dimension unless they've gone onto life support. Consequently, most of the time when we see this variable working, it doesn't influence things at all. Again it's to check to see if they've gone onto life support has it been picked up above. Very often what happens with that variable is it's only used for that purpose and completely ignored when the overall pattern is examined. Most of the time, frankly, we find these Level 3 and 4 patients don't have that kind of life support procedure.

Finally, we look at response to therapy. How quickly a patient responds is defined in the following way. Prompt means the best response you can expect--one course of therapy and the patient gets better. Moderate delay means they do respond, the slope is positive, but it's much slower and you have repeat courses of therapy that take much longer. Serious delay is also easy to detect, you have setbacks. The patient gets better and gets worse, gets better and gets worse. Finally, no response is also easy to detect. The last dimension is a remission of their acute symptoms, which we called residual. What were looking for when a patient is hospitalized in terms of their acute care is remission of their acute symptoms that brought them into the hospital. For example, when someone comes in with emphysema and in respiratory distress, we know we're not going to cure the emphysema, but what we're trying to cure is their respiratory distress.

So these are the seven dimensions, the seven questions asked about a patient. Each of them is answered and then a pattern appears. What typically happens is for those patients who don't run into any problems, have no complications or other diseases, and respond promptly to therapy, they're going to end up a Severity Level 1. Those that run into some kind of problems, (the driving variables turn out to be complications, interactions and response to therapy) are going to end up as Level 2's. Running into major problems, they're going to be at Level 3 severity. Catastrophic problems are going to be Level 4. That, in general, is how the instrument works.

I can share with you very quickly four different patients that end up at four different severity levels and you can see a bit more clearly how these criteria are used. I happen to remember these four patients because we were using them last week in explaining this instrument to the people in the Maryland Cost Review Commission. Hopkins is negotiating with the Cost Review Commission to be reimbursed on the basis of the severity adjusted DRG system. All four of these patients were Parkinson's disease patients because we happened to be working with neurology at the time. The first patient came in with tremors from Parkinson's disease and was considered moderate in terms of stage of disease. He had no complications so he was at Level 1 there. The patient had a history of peptic ulcer which was kept under control with diet so that was considered none in terms of interactions. He got the usual amount of nursing care. They did no special testing for the patient. They titrated the patient's medication, the patient promptly responded, the tremors went away, and the pattern was essentially a Severity Level 1. The second patient was a gentleman who also came in with tremors and also had his medications titrated. But this patient had a history of heart problems and three days into his stay developed chest pains. They were detected quickly and it was realized that this patient was going into congestive heart failure. Because of that congestive heart failure, they had to do considerably more testing for the patient. They also had to get that congestive heart failure under control first before they could get the tremors under control, which significantly delayed his response in terms of his tremors getting under control. He had no other complications but for us the congestive heart failure was considered a moderate interaction and that patient went out an overall Severity Level 2. Now that patient also brings up another feature of the severity index--the severity index does not look at quality of care. At the time this patient was being explained to the Commission, the nurse who was explaining said she has been to other places across the country where hospitals have been collecting severity data. In some of those institutions, they might not have caught that congestive heart failure as quickly as they did at Hopkins. Consequently, that patient could have deteriorated into much more serious congestive heart failure. They could have had serious set-backs and could have required much more than the usual amount of nursing care. They could have even had to have some type of life support procedure and that patient could have gone out as an overall Level 3. So quality of care doesn't come into this instrument. We just ask how sick is that patient, we don't ask how they got that sick. The third patient also came in with tremors but this was a sicker patient. This was a patient who had a history of renal problems and went into renal failure in the hospital. That was considered a major interaction for us. They had to go onto dialysis which was not a scheduled dialysis. As a result the patient had a very up and down course. They'd get the renal failure under control and the tremors would go out of line, and then the renal failure would go out of line. That was really a very rocky road for a long period of time. That patient went out as an overall Level 3. And finally, the last patient. It was really debatable that they called it a Parkinson's disease case in the first place because this was an elderly gentleman who, in addition to his Parkinson's, had cancer of the liver. While in the hospital, he had a stroke, had heart failure, had a total respiratory failure in addition to the heart failure, and ended up dying. So at the end of our scale, that patient was really considered catastrophic and an overall Severity Level 4. So you see how different those four patients are in terms of the straight forward one not running into any problems, the one that had the congestive heart failure that was caught, the one that had renal problems, and the one that had all the other disease conditions and died. That's what we're trying to differentiate with severity on this index.

These seven dimensions about the patient are taken into account to come up with an overall Severity Level of 1, 2, 3, or 4, and then this data is merged with discharge abstract data so that we can analyze each of these severity groups divided into three parts: those patients with no operating room procedure; those with a moderate procedure; and those with a major procedure. (See Figure 8) Operating room procedures in themselves in no way influence the severity level, but the data can be analyzed separately by what type of procedure is done. In that sense, when people are first learning about severity it's a little bit distressing to them. I think that possibly our labeling of this index as a "Severity of Illness Index" may be a misnomer. Perhaps we should have labeled this a "Deviation from the Minimum Index," because, for example, you can have a Severity Level 1 open heart surgery patient. The reason they're going to be at Severity Level 1, although that's a very serious major operating room procedure, is because they're not going to run into complications, they're

Figure 8

SEVERITY OF ILLNESS CATEGORIES

STAGE OF PRINCIPAL DIAGNOSIS		NO O.R. PROCEDURE
COMPLICATIONS		
INTERACTIONS		
DEPENDENCY	OVERALL SEVERITY 1 2 3 4	WITH MODERATE O.R. PROCEDURE
PROCEDURES NON - O.R.		
RATE OF RESPONSE TO THERAPY		
RESIDUAL FOLLOWING THERAPY		WITH MAJOR O.R. PROCEDURE

not going to have other diseases getting out of line, and they're going to respond properly to therapy. But we're not going to compare Severity Level 1 open heart patients with Severity Level 1 OB patients. That's how this instrument has been able to be used in all those different areas. It really is a deviation from the minimum, the way we use it. In terms of moderate versus major procedures, we had a team of surgeons at Hopkins look through the I9 procedure code book. They ended up with about 15% of the procedures they thought were major operating room procedures and 85% were put in the moderate category. A major procedure was a surgery that took a long time to recover from or took a great deal of skill to perform--things like open heart surgeries, total hip replacements, organ transplants, etc. All the other operating room procedures we classify as moderate.

In summary, we've been looking at a variety of different ways to describe hospital patients. They're really based on two different data sets, the discharge abstract data or the total chart. (See Figure 9) All the other case mix systems, even those that were originally developed by looking at the total

Figure 9

CASE MIX DATA SETS

DISCHARGE ABSTRACT DATA	CHART DATA
ICD-9-CM CODE SYSTEM	SEVERITY OF ILLNESS
CPHA-PAS A LIST	STAGING
DRGs	PATIENT MANAGEMENT CATEGORIES
COMPUTERIZED STAGING	
COMPUTERIZED PATIENT MANAGEMENT CATEGORIES	

chart, have been implemented using the discharge abstract data set, including the DRGs. We felt, when we were conceptualizing severity, that abstract data was just not rich enough to describe how sick patients were. When you think about it historically, the discharge abstract data was developed back in the mid 1960's when people were asking epidemiologic questions about hospitals. They were asking counting questions, such as how many of this disease did you treat, how many of that procedure did you perform, or how old were your patients. They weren't asking questions about how sick are your patients or what resources do they require. Consequently, we feel the labels that exist in the current discharge abstract data set-- principal and secondary diagnoses, procedures and age--are just not sufficiently rich to describe how sick patients are. That's why when we conceptualized severity we based it on the total chart. But that is one of its limitations because to collect severity data people have to go back to the total medical record. I'll share with you how they do it now. It's very efficient the way they do it, but still it is a limitation. In our current research we are developing a data base that I view as a bridge between these two, an expanded discharge abstract data base. (See Figure 10) It's really based on two steps. First we're taking the current I9 code book and adding a sixth

Figure 10

COMPUTERIZED SEVERITY OF ILLNESS INDEX

(Based on expanded discharge abstract data set)

DISCHARGE ABSTRACT DATA	EXPANDED DATA SET
Principal Diagnosis	+ Sixth Digit
Secondary Diagnoses	+ Sixth Digit
Procedures	Procedures
Age	Age
Sex	Sex
Discharge Status	Discharge Status
	Rate of Response to Therapy

digit to each of the five digit codes. The sixth digit for each disease will tell how sick the patient is in that disease category, whether they're at Severity Level 1, which is the least or most minor symptoms for that disease up to a Level 4, the most severe symptoms for that disease. Each diagnosis will have a sixth digit and the new discharge abstract data set can have a sixth digit for the principal diagnosis and six digits for each of the secondary diagnoses. We'll still use procedure, age, sex, and discharge status, and add as another variable into this data set a rate of response to therapy. With that as our new expanded discharge abstract data set, a computer formula just like the DRG formula can be used to weight those different values and come up with an overall severity for the patient. Also, with that same data set, DRG people can redo their DRG AUTOGRPing, the Disease Staging people can recode their system, the Patient Management Category people can recode their system, and we'll all have a richer data base to work with. But that's about another year in the completion process.

The data I'm going to share with you today has been collected using the manual Severity of Illness system, the one I just shared with you. It's been

Figure 11

MANUAL SEVERITY OF ILLNESS INDEX

WHO: Medical Records or Utilization Review

WHEN: Along with usual discharge abstract coding or discharge UR report

TRAINING: Three day training program

RELIABILITY/FOLLOW-UP TRAINING: Monthly for three months, quarterly thereafter

RESULTS: Accurate, reliable, comparable Severity of Illness data

collected by medical records and utilization review personnel because our studies originally showed that whether a physician specialist rated the case or a physician generalist, like an internist or general surgeon, or a nurse specialist or a nurse generalist, or a medical records person, they all would come up reliably with the same overall level of severity because of the guide of those seven dimensions. So now, on an ongoing basis, it's the medical records or utilization review personnel that collect this data along with their usual discharge abstract coding, or discharge utilization review reporting. They find that it takes them almost no extra time to collect that data when they're doing it in the process of looking at the chart for another purpose. So it's a very efficient system to implement in a hospital. They're trained in the definitions in a three day training program and that's followed on a monthly basis for the first three months with reliability follow-on training, and quarterly thereafter. That's how we're sure everybody collecting severity data across the country is rating the severity at the same level. In other words what they're calling a Level 1 in Boston is what they're calling a Level 1 in California and all across the country in all of the 30 or so hospitals that are now collecting severity data on an ongoing basis. To be sure the data is reliable, we go in and recode blindly samples of the cases that have been coded within a hospital. We're getting between 90% and 100% agreement rates. We know that those levels are comparable across the country. So that's the kind of data that I'm going to share with you this afternoon; data collected from about 30 different institutions on about 200,000 cases. I'm not going to show you all 200,000 but I'm going to show you some examples from them.

Before we look at some example data, we've got one other piece of housekeeping that we have to take care of and that is to look at some statistical definitions. I was telling you earlier that Hopkins' criteria for a good grouping system is homogeneity, but I really didn't define it for you. Homogeneity means similarity. In this case we're looking at similarity of total charges or similarity of resource use. There are three statistical tests to help us evaluate homogeneity. (See Figure 12) I'm going to use all of them in my discussion and you should see what the differences are in terms of the definitions. The three different types of homogeneity statistics are Reduction in Variance (RIV), Coefficient of Variation (CV), and the Analysis of Variance (ANOVA) F test. Each of them are slightly different in their approach to asking how good is a group.

Figure 12

HOMOGENEITY STATISTICS

$$TSSQ = \sum_{j=1}^{k} \sum_{i=1}^{nj} (X_{ij} - \overline{X})^2 \qquad s = \sqrt{\frac{TSSQ}{n-1}} \qquad TWGSSQ = \sum_{j=1}^{k} \sum_{i=1}^{nj} (X_{ij} - \overline{X}_j)^2$$

$$BGSSQ = \sum_{j=1}^{k} n_j (\overline{X}_j - \overline{X})^2 \qquad RIV = \frac{TSSQ - TWGSSQ}{TSSQ} \qquad CV = \frac{s}{\overline{X}} \qquad F = \frac{BGSSQ/(k-1)}{TWGSSQ/(n-k)}$$

The first measure of homogenity is Reduction in Variance. Incidentally, this was the criteria the Yale people used to produce the DRGs. This asks the question, how variable is your group to start with, and then if you divide that group into different subsets, how small is the variability within the subsets. Now, when you break a large group into subsets you don't automatically get a better group because if you don't do such a good job when you break the group up, you can take some patients from one end of the scale and some patients from the opposite end of the scale and put them into a new group. You can repeat this process using data from opposite ends of the scale and put them into a second new group and you can form lots of new groups but none of them are any better than what you started with. When you look at this statistically, it means the variability you started with is large (TSSQ) and the variability in all your subgroups you put together is also large (TWGSSQ). The difference in the numerator is 0 and the RIV is very small. That's when you don't do such a good job. But when you do a good job you start with a lot of variability (TSSQ) but each of your final groups takes patients that are close together in terms of resource use. The total variation within groups (TWGSSQ) is much smaller so you take a large number minus a small number and get a large number over a large number which results in RIV of almost 100%. So large Reduction in Variance is what we look for in terms of a good grouping system. We've taken a large amount of variability and reduced it down to a small amount variability.

A second way to evaluate groupings is to look at the Coefficient of Variation. That asks for each individual group how variable is the group compared to the magnitude of what you're measuring. Many people look at that and wonder why we have to compare variation to what we're measuring. Why don't we just look at how variable is the group using the standard deviation? If you keep in mind the following example I think you'll see why you have to divide by something. If you had a group of patients whose average resource use was $2,000 and they vary plus or minus $400, wouldn't that appear very different to you from a group of patients whose average resource use was $100,000 and who also vary plus or minus $400? You see how variability depends very much on what you're measuring, and that's just what CV looks at. How variable is the group compared to the average of what you're measuring? Our goal now is to have a low CV.

The last measure is the ANOVA F test. This test suggests that if you've put together a lot of subgroups that have the same mean and same amount of variability as you started out with why do you bother. What you want in this case is a large F value which means that some groups you've produced are very different from the other groups and the variability within the groups is small.

Those are three different measures of homogeneity, somewhat related, but really different in a sense of determining how good are the groups. An example will show how these can be used. This is a contrived example to bring the point home very clearly. Figure 13 shows a data set within eight patients. We're looking at their lengths of stay and they range from 2 days up to 18 days. Suppose these are all gallbladder patients and we see a lot of variability in this group. The standard deviation is 7.8 days. That looks pretty clear because the mean plus one standard deviation is 10 plus 7.8 or roughly 18 days, and 10 minus 7.8 is roughly 2 days. Now we're going to break that group into two parts. Suppose we look at those eight patients and determine who has blonde

Figure 13

EXAMPLE OF GROUPING HOMOGENEITY

$n = 8$ LOS = 2,2,3,4,16,17,18,18

$\bar{X} = 10$

$$TSSQ = \sum_{i=1}^{8} (X_i - 10)^2$$

$$= 8^2+8^2+7^2+6^2+6^2+7^2+8^2+8^2$$

$$= 426$$

$$s = \sqrt{\frac{426}{7}} = \sqrt{60.85} = 7.8$$

$$CV = \frac{s}{\bar{X}} = \frac{7.8}{10} = .78$$

RIV = 0 (no groups)

GROUPING METHOD A

Group 1	Group 2
LOS = 2,3,16,18	LOS = 2,4,17,18
$\bar{X} = 9.75$	$\bar{X} = 10.25$
$s = 8.42$	$s = 8.42$
$CV = \frac{8.42}{9.75} = .86$	$CV = \frac{8.42}{10.25} = .82$
WGSSQ = 212.75	WGSSQ = 212.75

TWGSSQ = 425.5

$$RIV = \frac{426-425.5}{426} = \frac{.5}{426} = .001 = 0.1\%$$

Grouping Method B

Group 1	Group 2
LOS = 2,2,3,4	LOS = 16,17,18,18
$\bar{X} = 2.75$	$\bar{X} = 17.25$
$s = .96$	$s = .96$
$CV = \frac{.96}{2.75} = .35$	$CV = \frac{.96}{17.25} = .06$
WGSSQ = 2.75	WGSSQ = 2.75

TWGSSQ = 5.5

$$RIV = \frac{426-5.5}{426} = \frac{420.5}{426} = .987 = 98.7\%$$

hair and who doesn't have blonde hair (Grouping Method A). All the blondes go into group one and all the non-blondes go into group two and we look at their length of stay. The blondes' lengths of stay are 2, 3, 16, and 18 and the non-blondes are 2, 4, 17 and 18. You can see we've broken them into two groups but we haven't done such a great job because our criteria hasn't made a lot of sense. The means in these groups are not very different from each other and their variation is even larger than it was before. Coefficients of Variation are also quite large and we look at our RIV statistic and see that we explained less than one tenth of a per cent of the variability in resource use. Now we can take those same patients and group them based on those without a secondary diagnosis and those with a secondary diagnosis (Grouping Method B). Suppose those without a secondary had lengths of stay 2, 2, 3 and 4, and those with a secondary had lengths of stay 16, 17, 18 and 18. Now you see the difference. The means are very different from each other, the variability and the standard deviation is much smaller within each group. The CVs are also much smaller and the RIV is 98.7%. So you see how we can take a group and divide it. One way gets you some place and the other doesn't. So I wanted you to see how these three criteria are really useful in determining how well groups are put together.

Let's move on to some real data. First I'll share with you some data from a few different DRGs that I've selected for two purposes. One is to show a variety of different organ systems represented, and the second is to show a variety of different types of bias we found in the DRG system. In Figure 14 DRGs represent the nervous system, pulmonary, circulatory, musculoskeletal, nutrition metabolic, and female reproductive. We see a spread of severity across these cases. What happened is that this is a data set from a university teaching hospital. They sent us discharge abstract data merged with severity and charge data so I could run this through the DRG grouper. These are all I9

Figure 14

UNIVERSITY TEACHING HOSPITAL

I9/DRG by Severity

I9/DRG	DRG DESCRIPTION	Severity 1	2	3	4	TOTAL
1	Craniotomy Age ≥ 18	22	54	21	11	108
14	Specific Cerebrovascular Disorders Except TIA	4	22	1	6	33
75	Major Chest Procedures	19	24	3	1	47
108	Cardiothoracic Procedures Except Valve and Coronary Bypass, with Pump	21	26	5	8	60
214	Back & Neck Procedures Age ≥ 70 and/or CC	32	39	3	2	76
296	Nutritional & Misc. Metabolic Disorders Age ≥ 70 and/or CC	19	24	6	3	52
354	Non-Radical Hysterectomy Age < 70 w/o CC	15	18	7	2	42

DRGs, the new 467, so I put them into the approprite DRGs and cross-classified them by severity. For example, for all these patients that had craniotomy, except for trauma, over 18, DRG 1, some of them looked straight forward, not running into any complications or other diseases, and were assigned Severity Level 1. Twenty-two patients ended up in that category. Fifty-four of them ran into some kinds of problems and were coded at the Level 2 severity. Twenty-one ran into more major problems resulting in Level 3 severity. Finally, 11 were catastrophic. All the deaths go into group 4, but there can be live 4's. Those cases where they try to save patients with major operations, really have very great financial resource impact on the facility.

Now that we've seen that kind of spread of severity, let me show you some of the financial ramifications. All of these examples have been taken from different hospitals but each illustration represents only a single hospital's data. So within each example we have no variability on different costs, the charge ratios, wage rates, etc. Figure 15 is an example of DRG 75. Forty-seven

Figure 15

DRG 75 - MAJOR CHEST PROCEDURES

MIN = $1117 MAX = $205747

	N	MEAN	CV
DRG 75	47	11684	251
SEV W MOD PR			
1	6	2650	43
2	11	6341	52
3	3	14789	8
SEV W MAJ PR			
1	13	5891	38
2	13	10523	55
4	1	205747	0

RIV = 98.5% F = 761.8 WT.CV = 53.0

patients in this DRG averaged $11,700 to treat. Patient charges ranged from $1,000 to more than $205,000. This is one of the DRGs that originally stimulated our development of the severity index. You'll notice the Coefficient of Variation, is 2.51 or 251%, meaning the standard deviation is two and a half times the size of the mean. Those patients, it turns out, fell into four severity levels but also two procedure types. Interestingly enough, even though the DRGs have categorized all these patients as major chest procedures, when our surgeons looked at the different I9 codes some of them were categorized as only moderate. Among those patients with a moderate procedure we still saw three levels of severity; six of the patients were Level 1 severity averaging $2,600 to treat, 11 of them ran into some problems designated as Severity Level 2, averaging $6,300 to treat, and three of them ran into major problems such as some kind of failure as we were discussed before, averaging almost $15,000 to treat. So even though they're within some subset of a DRG having what we consider to be moderate operating room procedures, we still see dramatic differences in resource use. Even among those with major operating room procedures we still see a spread of severity. Thirteen of them were Level 1. That's again sometimes puzzling when it's a major procedure but they can be Level 1's because they don't run into complications, don't have other diseases, and respond promptly to therapy. But notice the difference in resource use. It's almost $5,900 to treat a Severity Level 1 in this DRG with a major procedure compared to $2,600 to treat a moderate operating room procedure Severity Level 1 patient. Thirteen of them were Level 2 averaging $10,500. We had no Level 3's but had one catastrophic Level 4 patient. I think all of us could consider that patient as an outlier and could choose to ignore that in this data set. But even ignoring that patient, what you see is really two forms of bias in this DRG. One is the bias of type of procedure, moderate versus major, and second is the bias of severity within that procedure. Notice also the CVs are much smaller here than what we started out with.

The next example, shown in Figure 16, goes in what I consider to be the opposite direction. This is DRG 354, Nonradical Hysterectomy either among the elderly or patients with a complication. Looking at this DRG we would think all

Figure 16

DRG 354 - NON-RADICAL HYSTERECTOMY
AGE $\geq$ 70 AND/OR C.C.

MIN = $2940 MAX = $73805

	N	MEAN	CV
DRG 354	42	10000	115
SEV W MOD PR			
1	15	5283	37
2	17	7547	39
3	5	14717	33
SEV W MAJ PR			
2	1	11589	0
3	2	23329	54
4	2	40313	118

RIV = 50.5% F = 7.34 WT.CV = 42.2

of these patients would have moderate operating room procedures. Clearly a nonradical hysterectomy is a moderate operating room procedure. So it was strange when we found five patients here with major operating room procedures resulting from definitions in the DRG grouper. It looks at the principal diagnosis and all listed procedures. If any procedure agrees with the principal the patient goes into that group as you see most of them did. But it turned out for these five women, one of them had an operation on the pericardium, two of them had total splenectomies, and two had total colostomies, which we consider to be major operating room procedures. But even among those that had only a moderate operating room procedure, you again see dramatic differences in resource use by severity level. Fifteen of them were Level 1 severities, not running into any problems, averaging about $5,300 to treat; seventeen of them were Level 2 severities averaging $7,500 to treat; and five were Level 3's averaging $15,000 to treat. Among those with major operating room procedures our numbers are small but again you can see differences by severity level. You can see the difference that it makes to have a moderate versus a major operating room procedure. Overall we find a wide spread of resource use, but not quite as bad as we saw before. Now it's $2,900 to $74,000. Still we see a high CV, greater than one, and much lower CVs for these severity adjusted groups except for one Level 4 patient who had a major operating room procedure and then died. When these patients die early we do have a drop in resource use with Level 4 patients, causing a greater spread.

In Figure 17, DRG 108 is one where we have no different classification of procedures. Here we agreed that all these cardiothoracic procedures, except

Figure 17

DRG 108 - CARDIOTHORACIC PROCEDURES
EXCEPT VALVE AND CORONARY BYPASS, WITH PUMP

MIN = $5133 MAX = $289207

	N	MEAN	CV
DRG 108	60	30180	163
SEV W MAJ PR			
1	21	9678	45
2	26	19162	60
3	5	27885	24
4	8	121243	76

RIV = 55.1% F = 22.9 WT.CV = 54.0

valve and coronary bypass with a pump, are major operating room procedures. But notice again we've got a huge spread of resource use from $5,000 up to over $289,000. A third of these patients were straight forward, not running into complications or other diseases, responding promptly to therapy even though they'd had this major operation, and averaged around $10,000 to treat. Twenty-six of them were Level 2 severities running into some kinds of problems averaging $19,000 to treat. Five of them are Level 3 severities running into more major problems averaging almost $28,000 to treat, and eight of them were catastrophic averaging $121,000 to treat. Of those eight patients five lived and they averaged $169,000 to treat. So those catastrophic level patients have great financial implications. I think you can see why those institutions treating proportionally more of the Level 2, 3 and 4 severity cases end up having an average for this DRG that's $30,000. Whereas, most other institutions that don't see that kind of spread of severity within this DRG may have an average of about $12,000 to $15,000, which is what we have found for most of the hospitals that we're working with. In fact, there's one hospital collecting severity data now that is known nationally as being a major teaching hospital, but it also has a very large heart program. We first looked at their data by DRGs in the heart area. We noticed for every DRG they had one of the highest average cost in heart DRGs; one of the highest averages of any of our data sets across the country. In fact, when they were in negotiations with a third party payer in their state, the third party payer said, "We can't send any of our patients to you because your costs are entirely too high, particularly in the areas where you have your specialties, heart, pediatrics, etc." We were able to take their data, score it for severity, and were able to show that by severity level in each of these DRGs they had among the lowest charges of any of the hospitals in our data base. In other words, although their averages were very high it was being driven by the fact that they were seeing proportionally more of the severely ill patients. But they were in fact less expensive to treat Severity Level 1's, and they were less expensive to treat Severity Level 2's because of the expertise that they had developed there. I was surprised to see that because of the name of this place. I figured no matter who walks in the door, no matter how sick they are, they're going to give them everything they have the ability to do. We found that wasn't the case at all. In fact they were among the most efficient hospitals we have in our data base in treating patients by severity level. So that's why being able to quantify that kind of effect can be so important.

DRG 296 shown in Figure 18 is another example showing spread of severity in a DRG with no procedures. You don't have to have operating room procedures to

Figure 18

DRG 296 - NUTRITIONAL & MISC. METABOLIC DISEASE, AGE ≥ 70 AND/OR C.C.

MIN = $347 MAX = $57295

	N	MEAN	CV
DRG 296	52	7482	143
SEV W/O PR			
1	19	2167	108
2	24	6006	90
3	6	14658	62
4	3	38605	53

RIV = 65.1% F = 30.0 WT.CV = 91.3

have this kind of problem. This is Nutritional and Miscellaneous Metabolic Diseases. The range is a lot smaller but again we see the spread of resources used by severity level.

Finally, Figure 19 shows an example of a good DRG. There are many of them so I couldn't just show you DRGs with a lot of spread. This is DRG 42 which has quite a low CV--in fact, the lowest of any we've seen so far. This is Intraocular Procedures except Retina, Iris and Lens. These patients fell into three types of operating room procedures and mostly two severity levels. You

Figure 19

DRG 42 - INTRAOCULAR PROCEDURES
EXCEPT RETINA, IRIS, AND LENS

MIN = $446 MAX = $23890

	N	MEAN	CV
DRG 42	164	2761	79.4
SEV W/O PR			
1	2	2428	8.5
2	1	6773	0
SEV W MOD PR			
1	115	2236	39.1
2	44	3540	56.7
3	1	23890	0
SEV W MAJ PR			
1	1	4496	0

RIV = 66.8% F = 63.7 WT.CV = 43.5

see no Severity Level 4's here and only one Severity Level 3 patient, but even among those patients that are Severity Level 1 versus 2 you see about a $1,300 difference in resource use. For those hospitals that are treating proportionally more of their patients at one end of the scale, even though they're only two levels apart and it's a small difference, by the time you multiply those small differences by large numbers of cases there can be a great financial impact.

In summary, this is some data to show you why we are concerned about DRGs as a mechanism for describing hospital patients. Patients in a DRG even within a given hospital can vary greatly in charges because DRGs don't take severity of illness into account directly. Those hospitals with more than a typical proportion of the most severe cases are exposed to great financial risk as a result.

The next three examples, shown in Figure 20, are from a talk I am giving on Friday at the National Cancer Institute (NCI) about what the cancer DRGs are going to look like. Some people from NCI visited me and noticed some of these characteristics in our data set and asked me to prepare this talk for them. This is DRG 405 Leukemia or Lymphoma, Age 0-17. We've got 106 patients in this DRG in a hospital that happens to be a cancer treatment center. These children range from $700 to $233,000 for their care, so again it's one with a very large resource use spread. Notice they break down into no operating room procedure, moderate, and major. Notice by severity level there are dramatic differences in resource use under no operating room procedure, under moderate and under major. We see the same kinds of trends only now under major procedure the costs are much higher than we saw before. That's because of the bone marrow transplants that they're doing on these patients. Now look at that same DRG in another teaching hospital not having a specialty cancer program. They only have the patients without an operating room procedure and you notice the cost is $3,000 for Level 1 and $10,000 for Level 2 which is almost identical to the cost of Levels 1 and 2 in the previous hospital. Yet the average for this hospital is $7,500 whereas the average for the other hospital was $33,000 because they're seeing all the more severe patients. Next, we have data from a non-teaching hospital. This is a community hospital, that had 11 patients in this DRG. Now the range is from $1,500 to $20,000 and again you see by severity level almost the same resource use for Severity Levels 1 and 2 as we saw before. This data has not been adjusted for cost-to-charge ratios but what we are finding in looking at data across hospitals is much greater similarity by severity level across hospitals and much greater differences between severity levels within a hospital. Those hospitals that have very [illegible] DRG averages are most of the time that way because of the proportion of more severely ill patients that they're treating.

Figure 20

DRG 405 - LYMPHOMA OR LEUKEMIA AGE 0-17

TEACHING HOSPITAL
WITH CANCER PROGRAM

MIN = $747 MAX = $233,122

	N	MEAN$	CV
DRG 405	106	33,012	128
SEV W/O PR			
1	24	4,259	59
2	39	9,772	74
3	7	30,339	71
4	3	54,786	137
SEV W MOD PR			
3	2	33,211	63
4	1	100,307	
SEV W MAJ PR			
2	14	60,777	25
3	10	77,077	29

RIV = 79.1% F = 45.9 WT.CV = 58.9

TEACHING HOSPITAL
WITHOUT CANCER PROGRAM

MIN = $2,535 MAX = $17,197

	N	MEAN$	CV
DRG 405	11	7,542	73
SEV W/O PR			
1	5	3,023	15
2	4	9,941	50
4	2	14,043	32

RIV = 68.8% F = 8.8 WT.CV = 30.8

NON-TEACHING HOSPITAL

MIN = $1,558 MAX = $20,806

	N	MEAN$	CV
DRG 405	11	8,229	83
SEV W/O PR			
1	3	3,914	52
2	8	9,847	75

RIV = 16.5% F = 1.8 WT.CV = 68.8

When the DRG people were developing the DRGs they were working with a limitation of wanting to keep the number of groups under something like 500. Some people thought that allowing each of these DRGs to be split up into a number of different groups might be the total reason why we're getting this extra explanatory power. But the Disease Staging system has 1,600 to 3,300 groups and they haven't done any better in explanatory power than DRGs and the CPHA system has 8,000 groups and they haven't done any better than the DRGs, so we really didn't think it was a numbers problem. We thought it was more what we were conceptualizing about the patient. So we went back and analyzed our data by looking at severity and procedure type within the organ systems. Severity is attached to a case and one of the advantages of this system we have now found but never intended in the beginning is that we don't start with any hierarchy. Severity is attached to a case depending upon complications, other diseases, and response to therapy so we can use severity within any other grouping strategy. We could put it within DRGs, we could put it within Major Diagnostic Categories (MDCs), we could put it within Disease Staging groups, or within CPHA's groups. Some hospitals have even looked at it within services in their hospital. Severity of Illness doesn't run into the same kinds of problems that all the other patient classification systems do, once they've started from a very different hierarchy. So, for example, to try to put Disease Staging within DRGs would be a problem. I was reading an article today about that. One DRG had over 200 Disease Staging groups within the DRG because they start with a different hierarchy. The beginning hierarchy for DRGs is the 23 organ systems, the MDCs; the hierarchy for Disease Staging is 412 diseases; the hierarchy for CPHA is 398 principal diagnosis code groups. They start at different hierarchies and they can't fit together, but severity can fit within any of them because we don't have any hierarchy under which it's done. Let me show you three different MDCs. One is the most homogeneous, MDC 2, the Eye. Figure 21 shows

Figure 21

MDC 2 — EYE

TOTAL CHARGES N = 619 UT2

SEVERITY	N	MEAN	ALOS	DRGs	N	MEAN	ALOS
W/O PR				36	237	2333	5.2
1	69	1710	4.4	37	17	2459	4.1
2	27	3215	8.2	38	6	1566	5.0
W/MOD PR				39	63	2199	3.4
1	402	2113	4.2	40	39	2021	5.6
2	116	3291	7.1	41	10	1614	2.2
3	2	16040	12.5	42	164	2761	5.2
W/MAJ PR				43	6	823	2.8
1	2	4240	4.0	44	13	1947	7.0
3	1	63296	51	45	11	2752	5.7
				46	8	2975	7.3
				47	20	1275	3.2
				48	5	1555	2.0
				468	10	10200	11.1

METHOD	# GROUPS	RIV	F TEST	WT.CV
SEVERITY	7	78.9%	381.4	48.2
DRGs	14	12.9%	6.9	62.9

619 eye cases from a hospital that has an eye clinic and an eye specialty service. We grouped them by their severity levels and type of procedure. Notice we have no Severity Level 4's here and only three patients at Severity Level 3 so they're mostly Severity Levels 1 and 2. But there is a difference in resource use by Severity Level 1 versus 2. Using only these seven groups of patients we were able to explain almost 79% of the variability in resource use, with a very high F test indicating group averages are very different from each other, and a weighted CV of 48%. We took those same patients and put them into their corresponding DRGs, including allowing for category 468. The data fell into 14 DRGs but only explained 13% of the variability in resource use with a much lower F value and a higher CV. So even among the DRGs that are good, you're going to see much worse CVs.

As a second example, take an intermediate MDC involving the heart. Figure 22 shows a data set from one hospital with about 800 patients categorized into MDC 5, Circulatory System. Now we see all four levels of severity and all three procedure types. Notice that as severity increases we get increasing resource use except for Severity Level 4's without an operation. That's because those patients either die before they can do anything for them, or they're considered so hopelessly ill that they don't put a lot of resources into them. But when they try to save those patients, the example shows, there are dramatic increases in resource use for the Level 4's. With these 12 groups we were able to explain 45% of the variability in resource use with a good high F and CVs in the 60's. We took those same patients and put them into 41 different DRGs. Notice, even though this results in more than three times the number of groups, we explain only 25% of the variability in resource use with a much lower F and a higher CV. But even though 45% is higher than 25% it's really not that exciting. That's because deaths are included in the data. So in Figure 23 I've taken that same data and eliminated the deaths. Now with these 11 groups we're explaining 71%

Figure 22

MDC 5 CIRCULATORY SYSTEM
TOTAL CHARGES

SEVERITY W/O MAJ PROC	N	MEAN	CV
1	237	2948	60
2	215	5316	71
3	15	13290	49
4	15	8517	104
W MOD PROC			
1	47	5546	62
2	38	10322	49
3	10	24525	68
4	4	67880	154
W MAJ PROC			
1	80	12028	51
2	116	22183	49
3	32	34746	56
4	26	76578	102

SEVERITY:	12 GROUPS	DRGs:	41 GROUPS
RIV	45%	RIV	25%
F	61	F	7
CV	62	CV	91

of the variability in resource use compared to the DRGs explaining 28% of the variability in resource use. Notice we've jumped from 45% to 71% and the DRGs have gone from 25% to 28%. I believe that's one of the reasons why in the Medicare prospective payment system deaths have been left in the DRGs, because we have found, as well as most other researchers, that deaths in or deaths out of the DRGs don't seem to make much of a difference in homogeneity. But in our groups it does because of who ends up in group 4. Group 4 for us includes catastrophic patients of different types; those that die early, those that they decide not to do anything for, or those that they try to save.

Figure 23

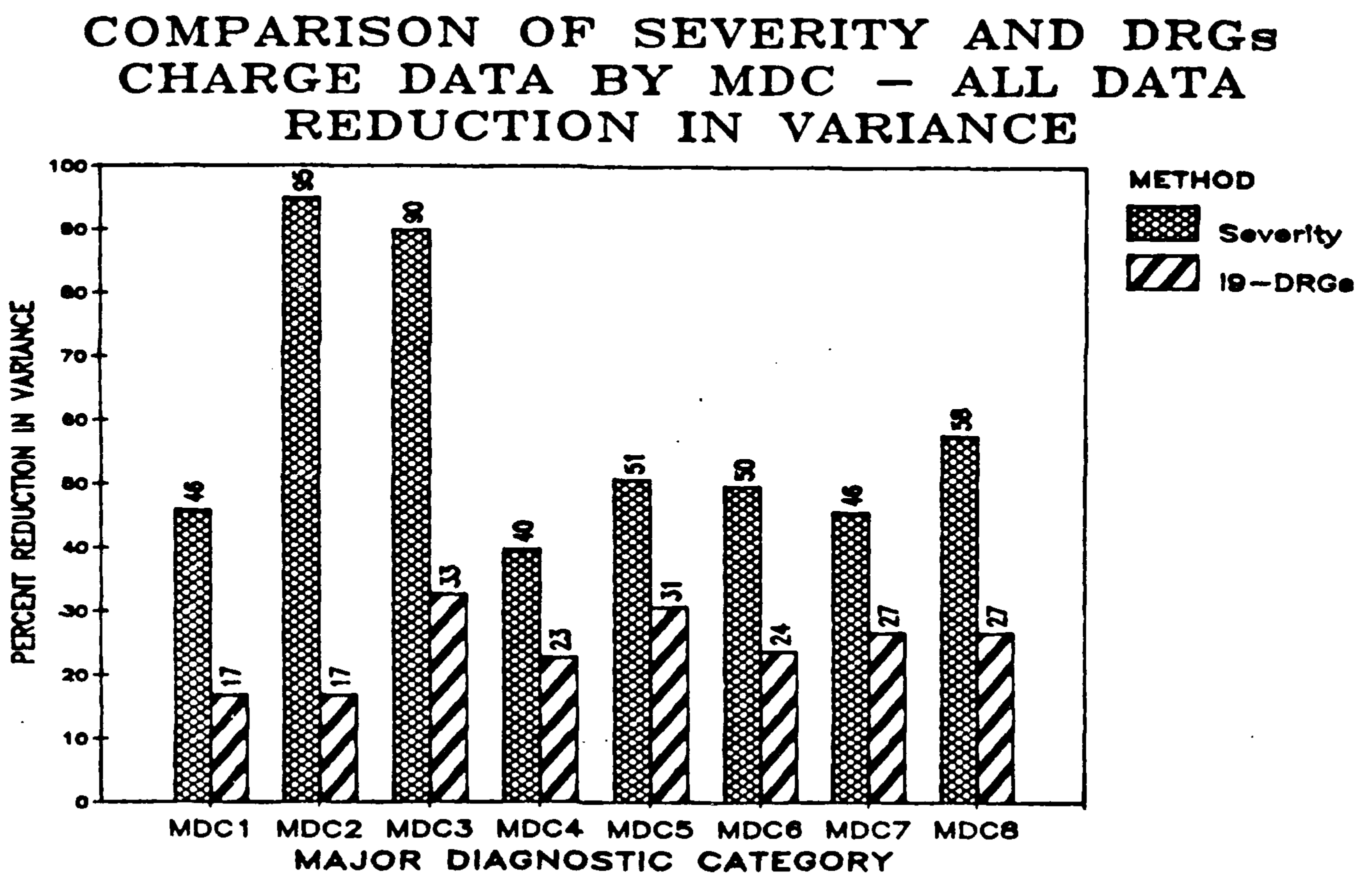
MDC 5 CIRCULATORY SYSTEM (D&SC REMOVED)
TOTAL CHARGES

SEVERITY W/O MAJ PROC	N	MEAN	CV
1	237	2948	60
2	204	5168	67
3	14	13735	48
4	1	9193	0
W MOD PROC			
1	46	5574	62
2	36	10141	50
3	7	21144	84
4	0	-	-
W MAJ PROC			
1	79	12103	50
2	113	21948	49
3	27	34554	60
4	5	169388	59

SEVERITY:	11 GROUPS	DRGs:	40 GROUPS
RIV	71%	RIV	28%
F	183	F	7
CV	59	CV	77

Figure 24 is an example of the first eight MDCs in a data set from one hospital comparing variability explained by severity to the amount of variability explained by DRGs. Consistently, across all the organ systems with death included, severity adjusted groups, even though they are fewer in number, explain more of the variability, just as in those previous examples. The same is true with other charges, not only total charges. We find the same is true with lab charges, with length of stay and with routine charges. One place where it's not quite as dramatic is in the area of radiology charges. We've consistently found that severity adjusted groups do better, but only slightly better, than the DRGs. A number of radiologists have told me they think that

Figure 24


COMPARISON OF SEVERITY AND DRGs
CHARGE DATA BY MDC – ALL DATA
REDUCTION IN VARIANCE
PERCENT REDUCTION IN VARIANCE
0
10
20
30
40
50
60
70
80
90
100
46
17
95
17
90
33
40
23
51
31
50
24
46
27
58
27
MDC1 MDC2 MDC3 MDC4 MDC5 MDC6 MDC7 MDC8
MAJOR DIAGNOSTIC CATEGORY
METHOD
Severity
19–DRGs

may be the case because radiology is more of a diagnostic tool than a therapeutic tool so they determine diagnostically what's wrong with the patient but then the therapeutic aspects of the patient are what are being driven by the complications and the other diseases in response to therapy.

Across an entire hospital, when we put severity within MDCs we end up with about 200-250 groups, compared to putting the patients into their corresponding DRGs, which results in 400-450 groups. Figure 25 shows an example of data sets from three university teaching, and two community teaching hospitals. We find severity explaining between 60% and 85% of the variability in resource use. DRGs are explaining between 30% and 50%. In the example shown in Figure 26, we have four university teaching hospitals, one community teaching and one community non-teaching hospital grouped in four different ways. First, we group the patients by DRGs just as you saw before. Then we group the patients by DRGs and the physician who treated the patient because I've often heard some of the DRG researchers say that all the remaining variability in DRGs that's not explained by the DRGs is due to which physician was treating the patient. So we wanted to investigate to what extent physicians influence that. Then we looked at DRGs and divided them by severity similar to the previous examples. Finally, we put all three together: DRGs, severity, and physician. DRGs, as the previous examples showed, explained between 30% and 50% of the variability in resource use. DRGs and physicians explain about 50% to 80% of the variability. DRGs and severity explain 70% to 90% and all three together explain 90% to 96%. I find that exciting for the following reasons. No matter which hospital we're in, DRGs and severity don't explain everything. There's still some portion left that's due to physicians in each of these institutions. It varies by size, but there's still something left due to physicians. It appears that there are at least two factors to which we can attribute that extra amount of explanatory power. One is that DRG and severity groups are nice and tight. They are good

Figure 25

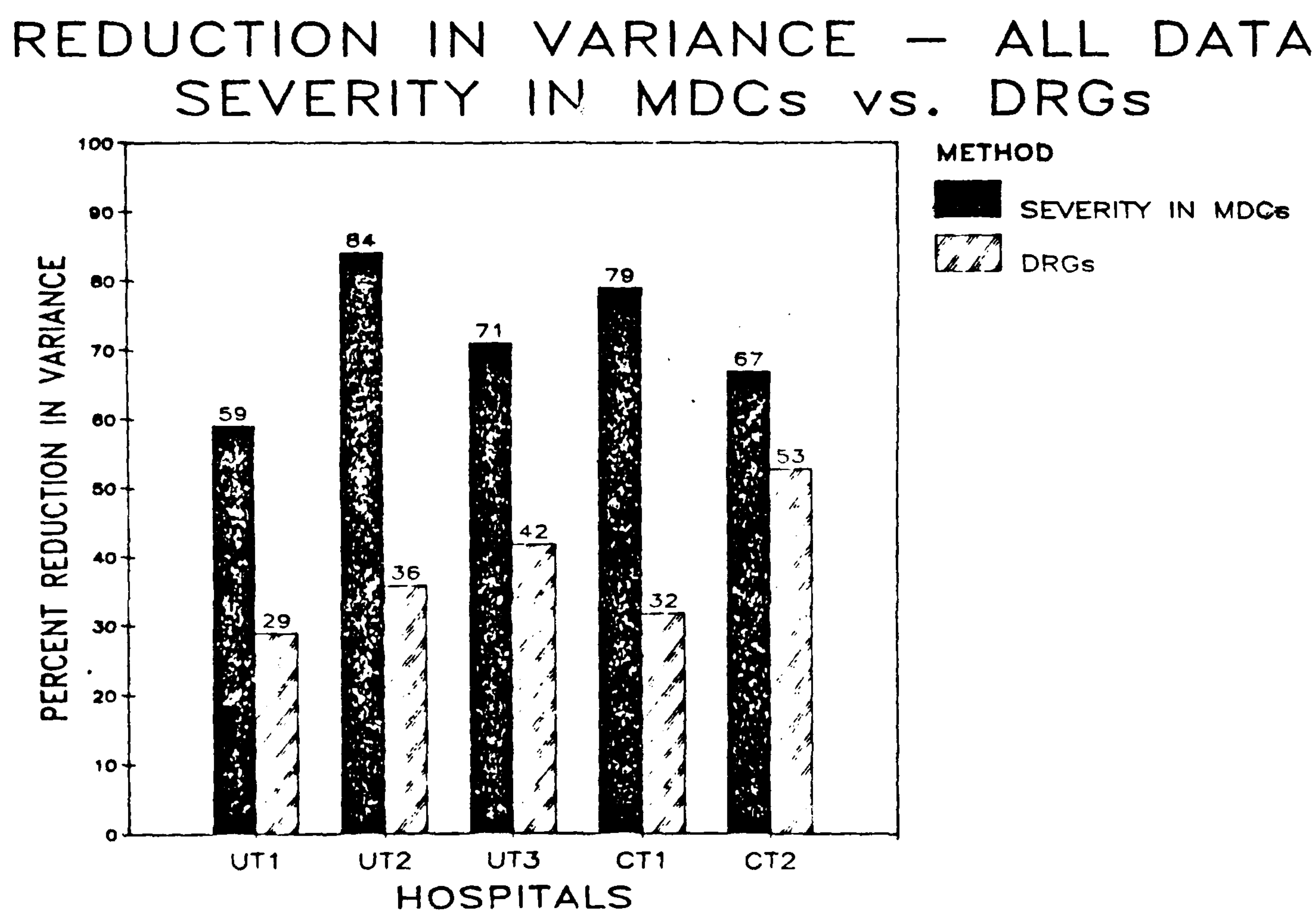
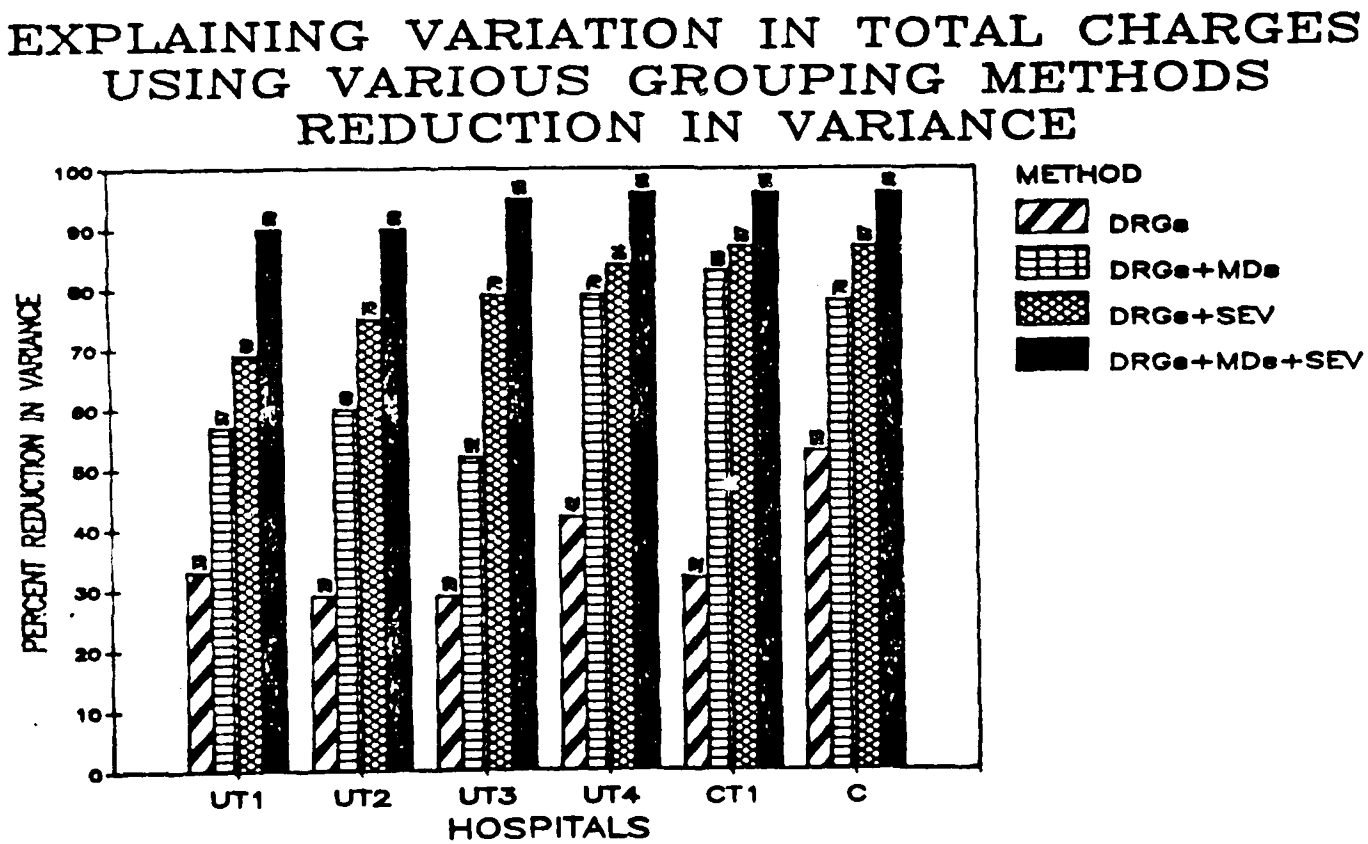

REDUCTION IN VARIANCE — ALL DATA
SEVERITY IN MDCs vs. DRGs
METHOD
SEVERITY IN MDCs
DRGs
PERCENT REDUCTION IN VARIANCE
100
90
80
70
60
50
40
30
20
10
0
59
29
84
36
71
42
79
32
67
53
UT1
UT2
UT3
CT1
CT2
HOSPITALS

Figure 26

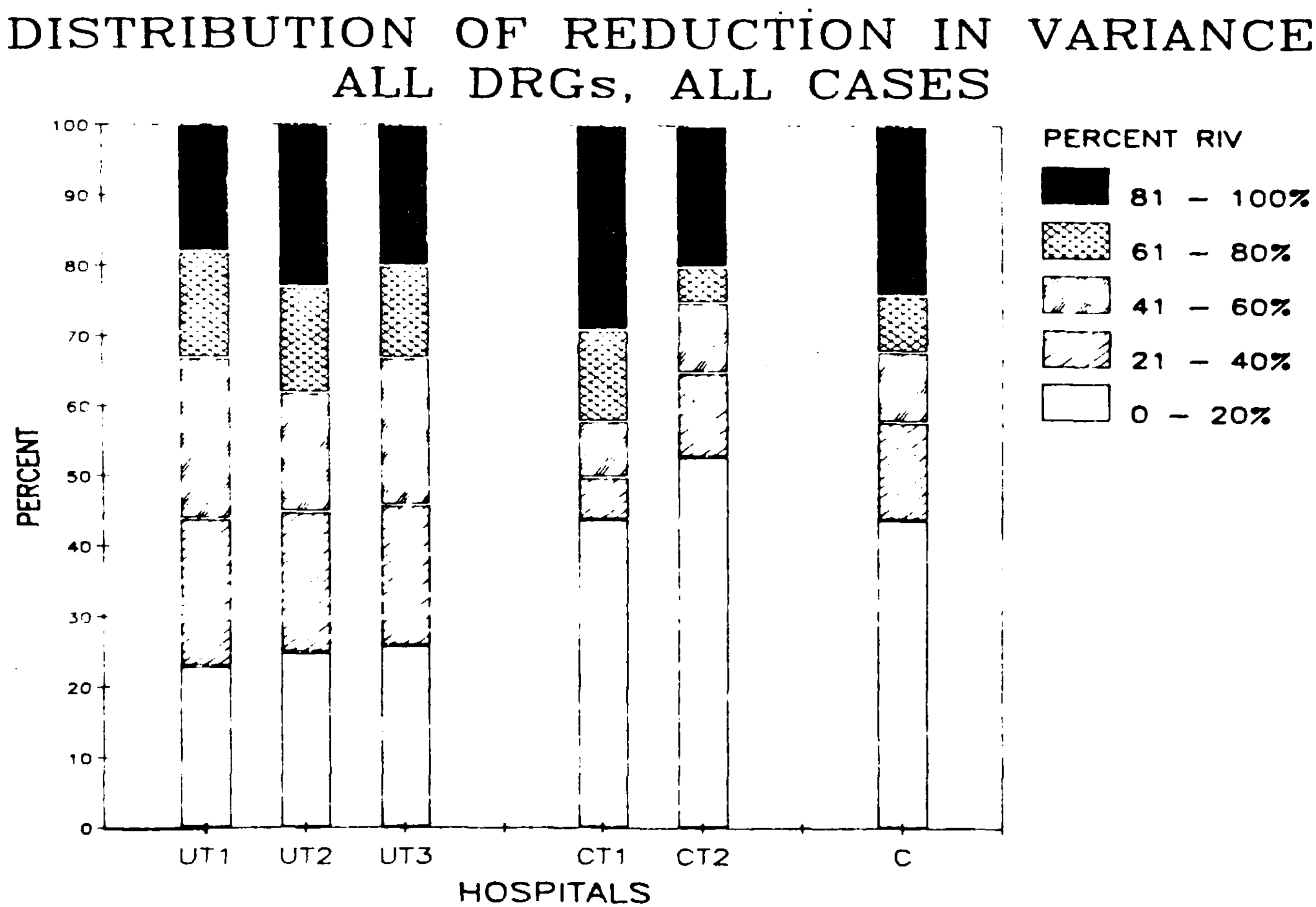


EXPLAINING VARIATION IN TOTAL CHARGES
USING VARIOUS GROUPING METHODS
REDUCTION IN VARIANCE
PERCENT REDUCTION IN VARIANCE
100
90
80
70
60
50
40
30
20
10
0
UT1
UT2
UT3
UT4
CT1
C
HOSPITALS
METHOD
DRGs
DRGs+MDs
DRGs+SEV
DRGs+MDs+SEV

descriptors of the patients, but different physicians treat those patients differently. Consequently this amount of explanatory power is due to differences in the efficiency of physicians. A second possibility is that DRGs and severity groups are not that tight and the different physician specialists may have different kinds of patients within the same DRG and severity group. In other words, this may be a classification problem. We're now looking at a number of hospitals that are collecting this data to determine what differences are. I'm sure we're going to find some of both. But the exciting thing about that is that I think it's removable. If it's due to a classification problem we can redefine the DRGs to take it into account. If it's due to a physician practice problem we can work with physicians in changing their practice pattern. Then a DRG type grouping system together with the severity measure will be able to explain 90% to 96% of the variability in resource use within an institution. That, I think, is sufficient for prospective reimbursement purposes. I think, however, with DRGs currently only explaining 30% to 40% of the variability in resource use, with 60% to 70% unexplained, that may be too much unexplained variance to expect hospitals to be reimbursed on a prospective basis--especially when hospitals are expected to run on a one to three percent margin without a lot of room for error.

To show how much variability within DRGs is explained, Figure 27 is an example of how we've tried to put this data together. It's really difficult for me to picture what this is doing and try to share with you what I see. This is data from three university teaching hospitals, two community teaching, and one community non-teaching hospital. The patterns show various ranges of percent RIV distributed across each hospital's DRGs. First of all what we see is the university teaching hospitals (UT1, UT2, & UT3) look similar in terms of the explanatory power of severity. There are about 20% of their DRGs where severity isn't explaining much--the homogeneous DRGs. Then there are about 20% that have

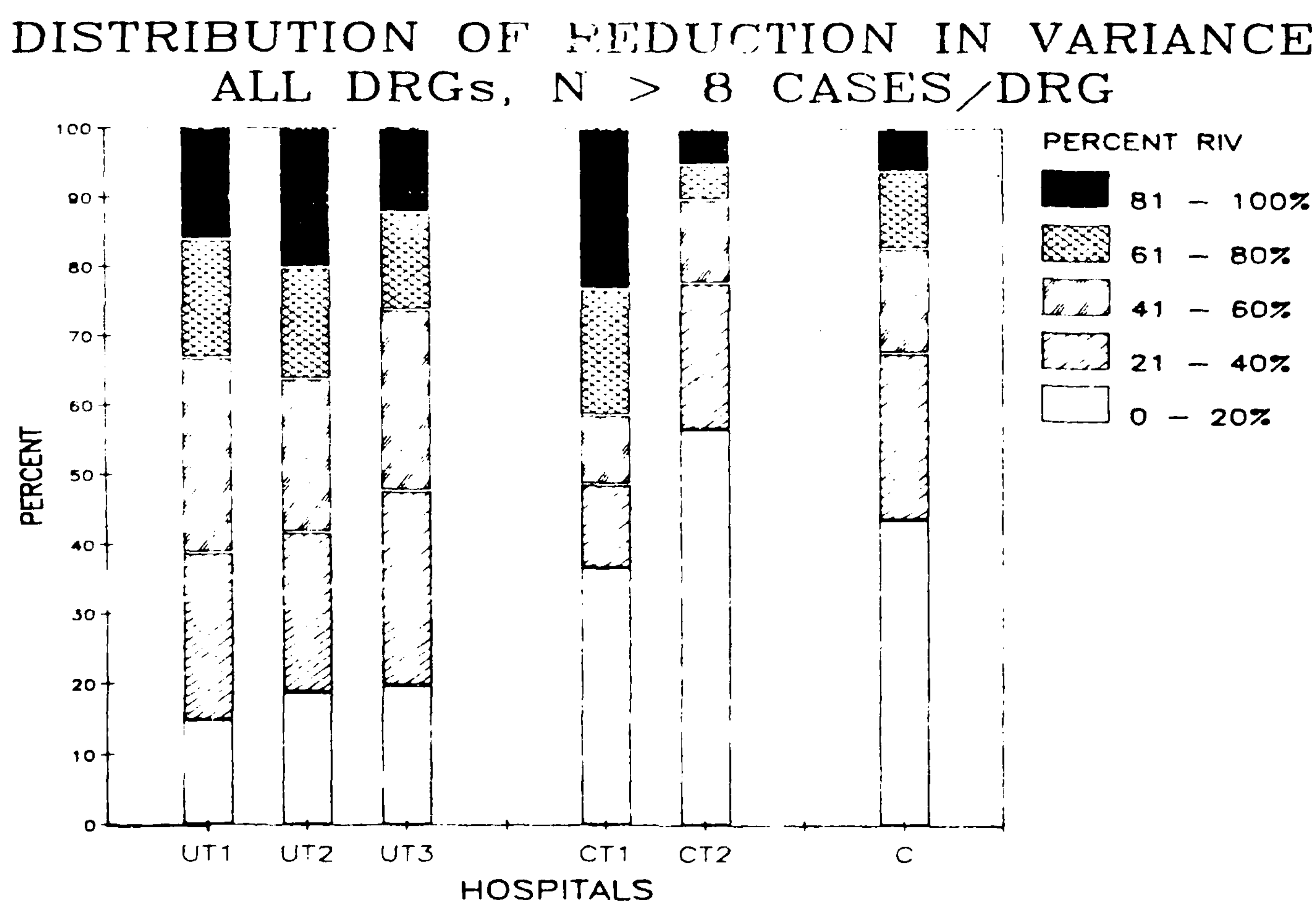
Figure 27


DISTRIBUTION OF REDUCTION IN VARIANCE
ALL DRGs, ALL CASES
PERCENT
100
90
80
70
60
50
40
30
20
10
0
UT1
UT2
UT3
CT1
CT2
C
HOSPITALS
PERCENT RIV
81 – 100%
61 – 80%
41 – 60%
21 – 40%
0 – 20%

from 20% to 40% explained, 20% with from 40% to 60% explained, about 20% with from 60% to 80% explained, and about 20% of their DRGs have from 80% to 100% variability explained by severity. It's generally what we see in university teaching hospitals, which means that the average explanatory power is around 50% in terms of RIV by severity within DRGs. Notice how different the patterns are for these community teaching or community non-teaching hospitals (CT1, CT2, & C). They show that within 40% to 50% of their DRGs, severity has no explanatory power. In other words, they are not seeing a spread of severity in the same DRGs. The middle range is very condensed. They have about the same number of DRGs or percentage of DRGs that have between 80% and 100% of the variability explained by severity. Figure 28 repeats the example but eliminates all DRGs that had less than eight cases in them. Notice that it doesn't change much for university teaching hospitals. In fact, the proportion with no explanatory power goes down. But it does change to some extent for these community hospitals. What we're finding is for the teaching hospitals, sample size has not made that much difference in terms of the explanatory power. But for the other institutions it has made a little difference.

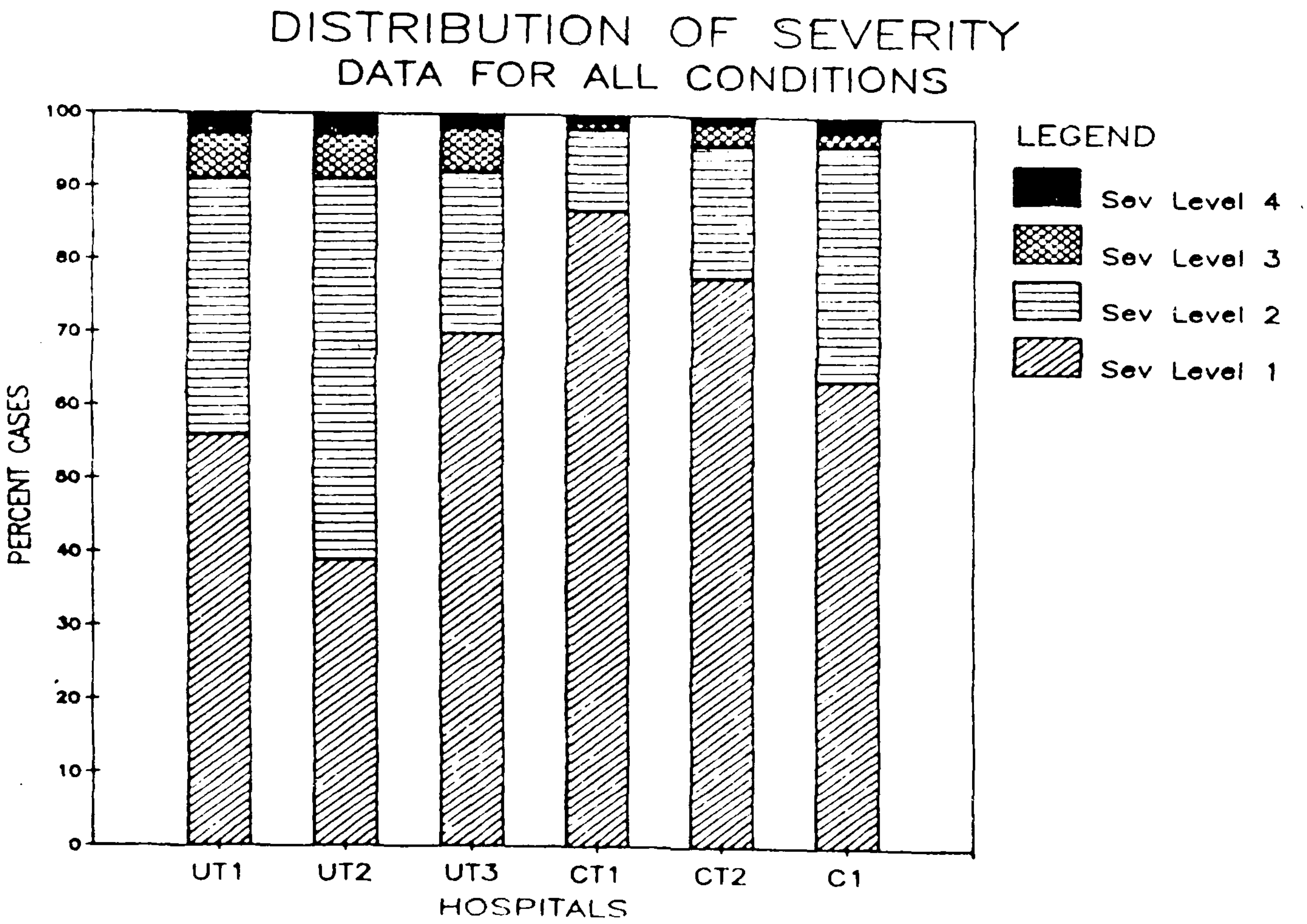
Since I've shared why I think homogeneity is so important in terms of resource use, as a statistician who knows that you can lie with statistics, I want to state that it is not necessarily a fatal problem that DRGs have a spread of resource use in them. In other words, if the DRG distribution has a peaked normal distribution (with most of the patients having resource use around the mean, with some at the high end and some at low end, but most of them are around the mean), and if that's the way all hospitals' data looked and everyone saw the same proportion at the high end as they see at the low end, then having a DRG system for reimbursement would not be a fatal problem. Because, if they ever got a high cost case they would eventually get a low cost case and it would balance out and all hospitals would be equitably treated. The next examples

Figure 28


DISTRIBUTION OF FEDUCTION IN VARIANCE
ALL DRGs, N > 8 CASES/DRG
PERCENT
100
90
80
70
60
50
40
30
20
10
0
UT1
UT2
UT3
CT1
CT2
C
HOSPITALS
PERCENT RIV
81 — 100%
61 — 80%
41 — 60%
21 — 40%
0 — 20%

show, *unfortunately*, that such is not the case. We've now discovered that there can be very bad incentives in the DRG system. One of them was described in an article in the Wall Street Journal back in February. It was an editorial on how some hospitals in the United States are contracting with the physicians in their area to bring the less severely ill patients into those institutions. The patient comes in and uses less resources than what the DRG reimbursement amount is. They split the difference with the physician--the physician gets half and the hospital gets half. So, even if the patients were randomly distributed before, with those kinds of incentives being allowed in the system, we know in the long run they won't end up being normally distributed. But now let me indicate how different hospitals may look by severity level. Figure 29 is an example of three university teaching, two community teaching and one community non-teaching hospital. This represents the proportion of patients over the whole institution that are Level 1, the proportion that are Level 2's, the proportion of 3's, and the proportion of 4's. Notice how different the range of proportions of Level 1's are even within the teaching hospitals from 40% up to 70%. On the opposite end of the extreme the percent of 3's and 4's seem to be quite similar here. In terms of community hospitals, in fact, we see a sort of inversion where this community non-teaching hospital has the lowest percentage of Level 1 patients in the state, and the community teaching hospital (CT1) has the highest percent--almost 90% of their patients are Level 1 severity. You see dramatic differences in the proportions of Level 1 severity and also not quite as dramatic differences in the proportions of Level 3's and 4's, but realize the financial implications of those higher levels of severity--one percentage point at that end of the scale can mean millions of dollars for a hospital. But that's not the only thing you have to look at. Because it turned out that for UT2 one of the reasons they may have had so few Level 1's is that they have no OB service and no pediatric service. Now a lot of OB and pediatric patients are

Figure 29


DISTRIBUTION OF SEVERITY
DATA FOR ALL CONDITIONS
LEGEND
Sev Level 4
Sev Level 3
Sev Level 2
Sev Level 1
PERCENT CASES
0
10
20
30
40
50
60
70
80
90
100
UT1
UT2
UT3
CT1
CT2
C1
HOSPITALS

Level 1. So, you have to look at how they distribute into different DRGs. That we've done in Figure 30. We're going to go from a specific case to a more general case. DRG 148 is Major Small and Large Bowel Procedures. We see data from two university teaching hospitals and two community teaching hospitals. Notice that UT1 has 9% Level 4's and 25% Level 3's. About 35% Levels 3 and 4 patients are accumulating 72% of their dollars so they have great financial implications even though they are small in terms of numbers. UT2 also has a disparity in terms of the percentage of patients versus the dollar implication, having only 18% of their patients at Level 3 but 37% of their charges. So you can see dramatic differences in percentage of severity across different types of institutions within a DRG. You might ask, "Susan, did you pick the one DRG that happened to show that kind of a difference?" Let me first tell you about one hospital's data and then we'll compare it with other hospitals. First, the question is, how many DRGs have that problem? One data set from a university teaching hospital had about 10,000 cases going into 441 DRGs and accumulating 62 million dollars in charges. We found in this case 20% or 83 DRGs had only one severity level in them. Those are nice and homogeneous with respect to severity. Those are the kind we want. However, we found that they had almost none of the hospital's charges for the patients in that group and only 3% of the patients, so we've got a number of homogeneous DRGs; it's just that in this institution they have no financial implications--almost nobody's in them. Most of the DRGs had two levels of severity. Forty-five percent or 197 DRGs had only two levels of severity. They affected 19% of the charges and one-third of the patients. In combination, 64% of the DRGs in this institution are either homogeneous or have two levels of severity. They are affecting 20% and about one-third of the patients. On the other hand, 93 and 68 DRGs, respectively, or a total of 36% of the DRGs have three or four levels of severity in them. Those are heterogeneous with respect to severity but they are the minority of the

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CONFERENCE HELD AT..(U) ARMY HEALTH CARE STUDIES AND
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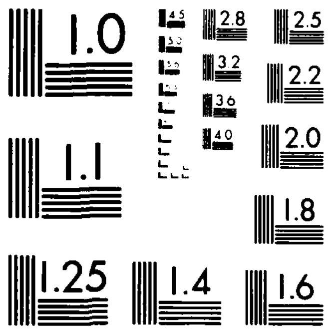
UNCLASSIFIED OCT 84 HCSCIA-84-002 F/G 6/5 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

Figure 30

PERCENTAGE DISTRIBUTION OF PATIENTS AND CHARGES BY SEVERITY: DRG 148
MAJOR SMALL AND LARGE BOWEL PROC. AGE $\geq$ 70 AND/OR C.C.

			SEVERITY			
	N		1	2	3	4
UT 1	66	PATIENTS	16	50	25	09
		CHARGES	04	24	34	38
UT 2	17	PATIENTS	05	77	18	0
		CHARGES	03	60	37	0
CT 1	11	PATIENTS	63	37	0	0
		CHARGES	42	58	0	0
CT 2	19	PATIENTS	42	42	16	0
		CHARGES	30	35	35	0

BEDS: UT 1 = 800 CT 1 = 400
UT 2 = 500 CT 2 = 200

DRGs. Unfortunately, however, for this hospital they are affecting 80% of the charges and two-thirds of the patients. So those heterogeneous DRGs, even though they are minorities in terms of their numbers, have enormous financial implications and lots of patients in them. But again this wouldn't be a problem if all hospitals looked the same. But I'm sure you can imagine they don't. Let's see how that looks for different hospitals. First let's look at severity levels in DRGs for two university teaching and three community teaching hospitals. (See Figure 31) Notice that in UT1, this is the university teaching hospital we just discussed, 20% of the DRGs had one level of severity, 45% had two, 21% had three and 15% had four. So there's a total of 36% having three or four levels of severity compared to UT2 that has 40% of their DRGs with one level of severity and only 15% with three or four, and the other institutions having 50% to 60% of their DRGs with one level of severity and only 10% to 12% of their DRGs with three or four levels of severity. So there are dramatic differences in how many DRGs and the proportion of those DRGs in different hospitals. There are also dramatic differences in how many patients are affected. In the Figure 32 recall UT1 with 63% of the patients in those DRGs with three and four levels of severity compared to 35% for UT2 and CT1 and 20% to 25% for CT2 and CT3. Finally, notice the dollars at risk as seen in Figure 33. In UT1 there are 80% of the dollars at risk in those DRGs with Severity Levels 3 and 4, compared to 50% in the next two institutions, and 40% in the last two institutions. You can't tell where differences are going to be just knowing it's a university teaching hospital because UT1 and UT2 look dramatically different. The community teaching hospital, CT1, looks more like UT2.

The National Cancer Institute noticed something I really had never seen in looking at the data. They were specifically interested in the Cancer DRGs and in answering the question that maybe some of you have read about that's being raised in Congress now or in Washington with HCFA, about creating a DRG 471 for

Figure 31

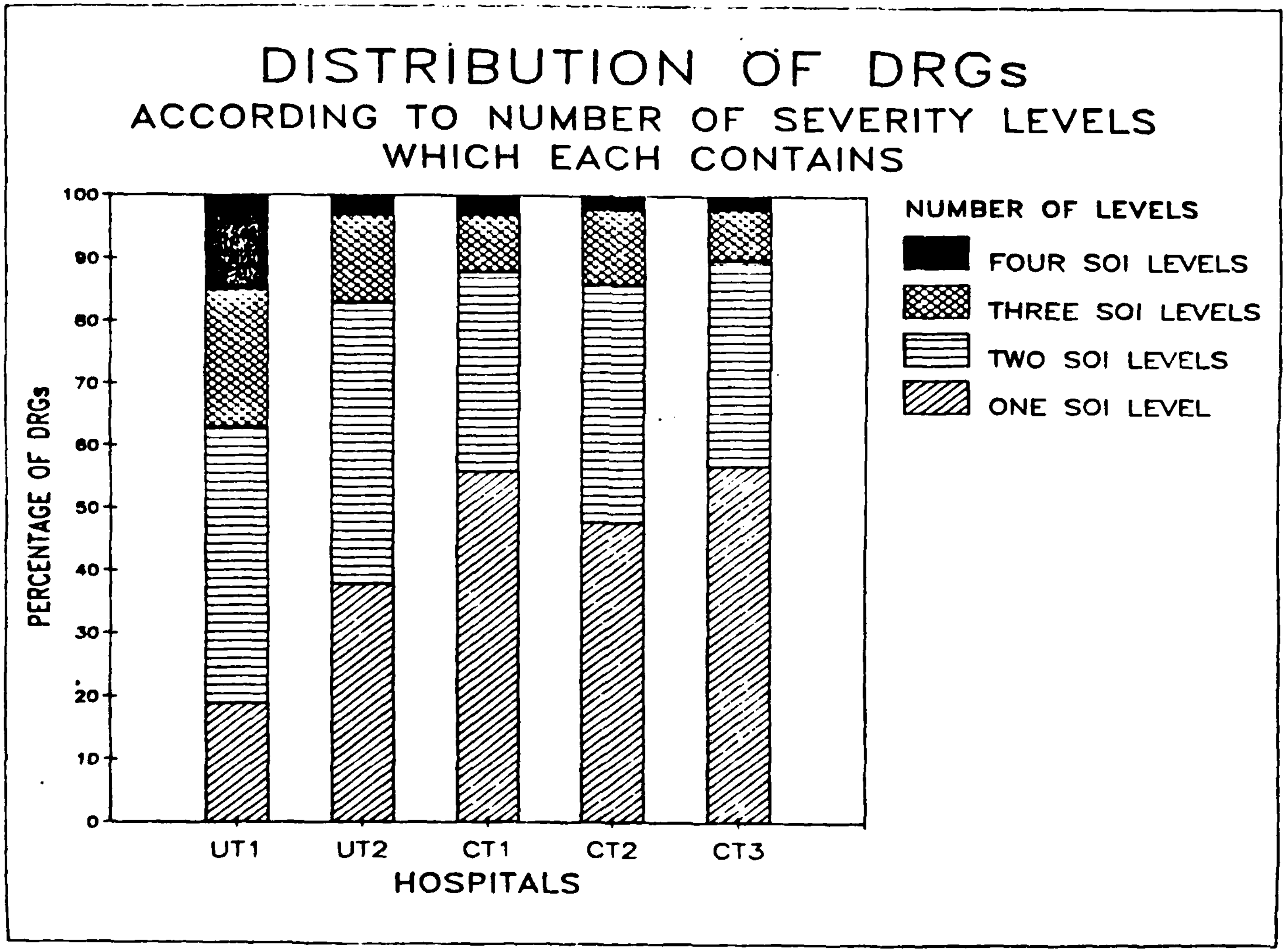

DISTRIBUTION OF DRGs
ACCORDING TO NUMBER OF SEVERITY LEVELS
WHICH EACH CONTAINS
PERCENTAGE OF DRGs
100
90
80
70
60
50
40
30
20
10
0
UT1
UT2
CT1
CT2
CT3
HOSPITALS
NUMBER OF LEVELS
FOUR SOI LEVELS
THREE SOI LEVELS
TWO SOI LEVELS
ONE SOI LEVEL

Figure 32

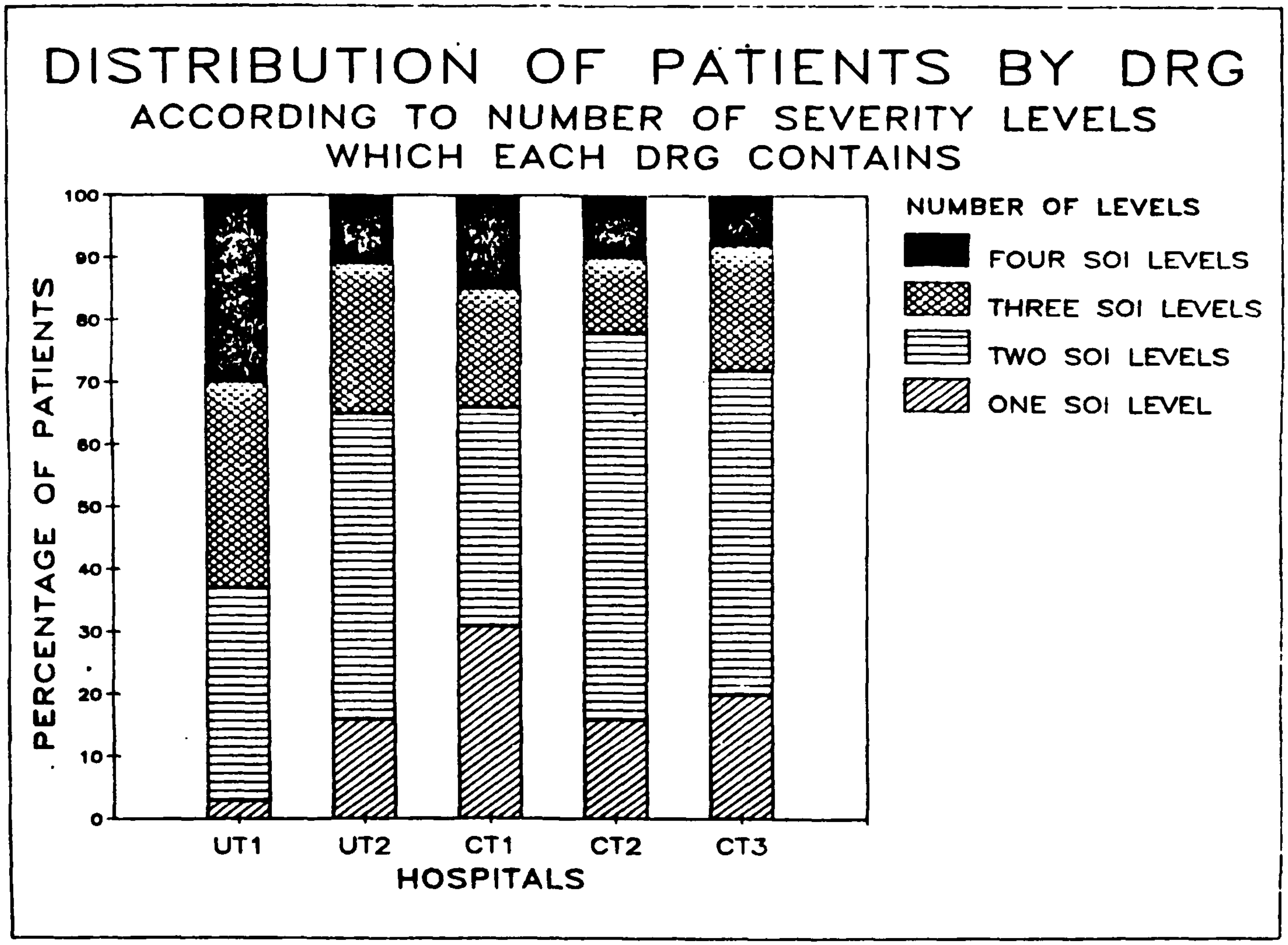
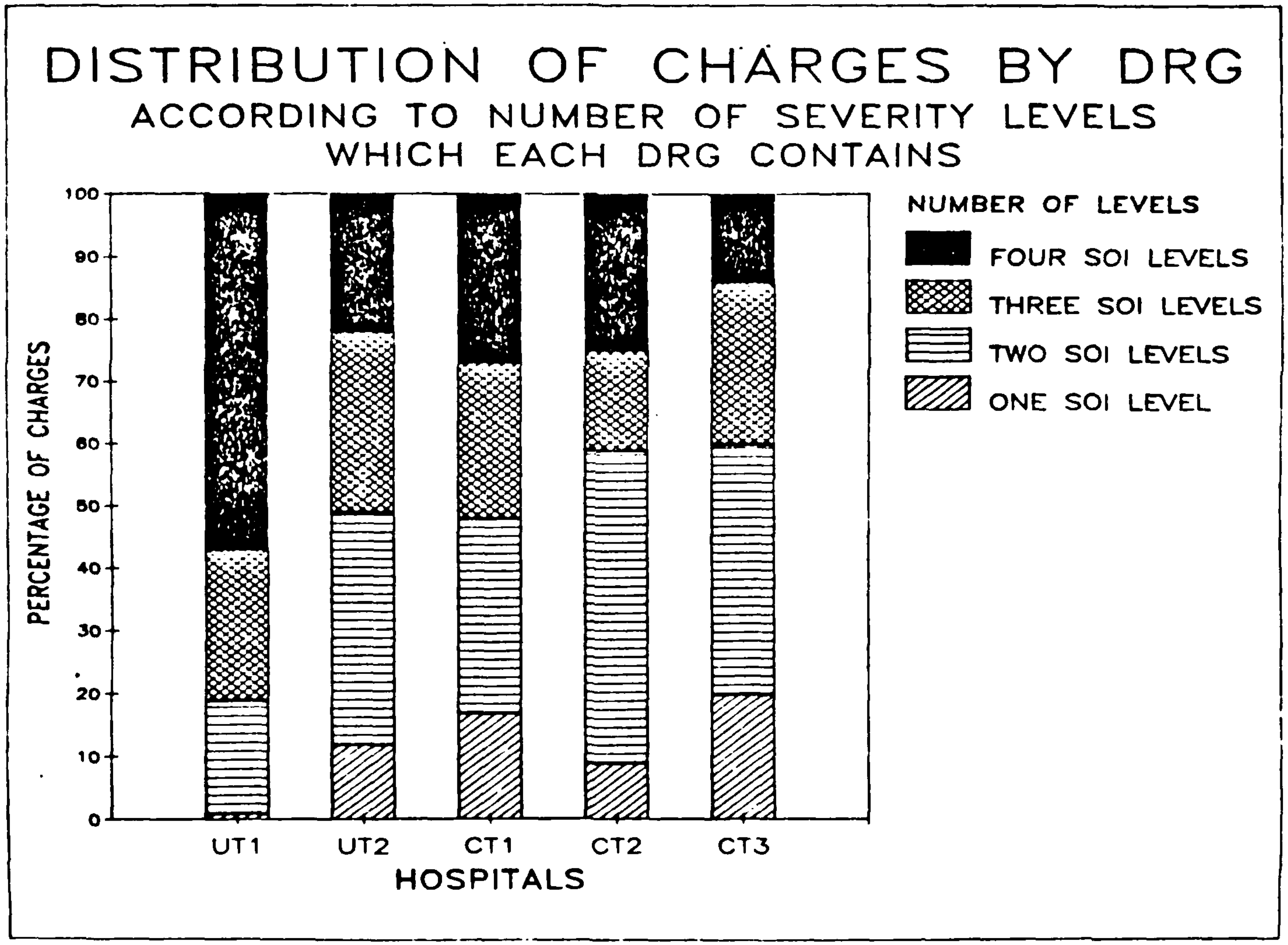

DISTRIBUTION OF PATIENTS BY DRG
ACCORDING TO NUMBER OF SEVERITY LEVELS
WHICH EACH DRG CONTAINS
PERCENTAGE OF PATIENTS
100
90
80
70
60
50
40
30
20
10
0
UT1
UT2
CT1
CT2
CT3
HOSPITALS
NUMBER OF LEVELS
FOUR SOI LEVELS
THREE SOI LEVELS
TWO SOI LEVELS
ONE SOI LEVEL

Figure 33

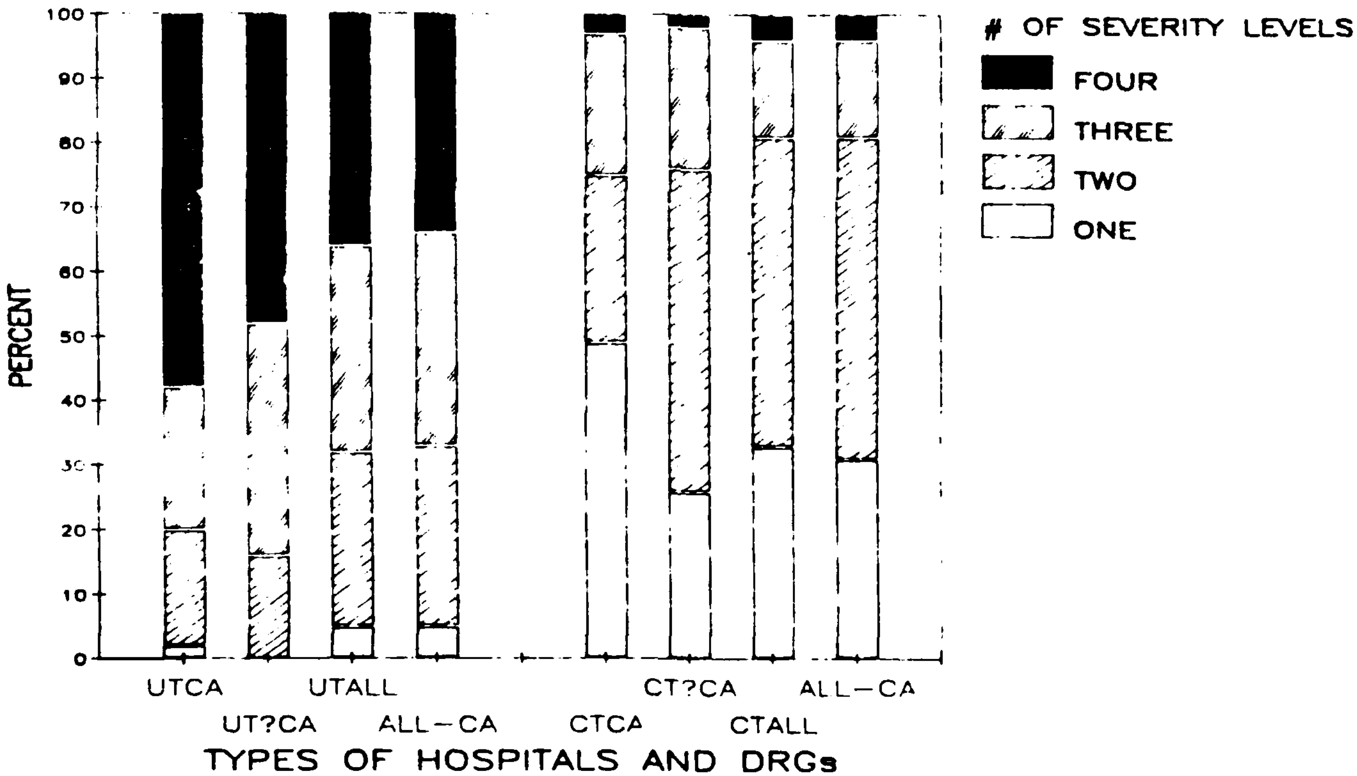

DISTRIBUTION OF CHARGES BY DRG
ACCORDING TO NUMBER OF SEVERITY LEVELS
WHICH EACH DRG CONTAINS
PERCENTAGE OF CHARGES
100
90
80
70
60
50
40
30
20
10
0
UT1
UT2
CT1
CT2
CT3
HOSPITALS
NUMBER OF LEVELS
FOUR SOI LEVELS
THREE SOI LEVELS
TWO SOI LEVELS
ONE SOI LEVEL

cancer protocol patients versus nonprotocol patients. We did not have the definition of protocol in our data set, but we were able to look at the cancer DRGs by severity and I think the people at NCI were shocked to see the results. We looked at the DRGs that they called cancer DRGs. They labeled 35 that they felt were cancer DRGs. They asked what did a cancer center see in the spread of severity in those DRGs compared to a community hospital. So we took four community hospitals' data and looked at the maximum number severity levels in each of those 35 cancer DRGs. If any community teaching hospital saw a spread of severity we picked it up. Then we looked at one university teaching hospital that had a cancer treatment center. (See Figure 34) Only in one of the 35 cancer DRGs did the university teaching hospital see only one level of severity. In almost 60% of the cancer DRGs, 58% to be exact, they saw four levels of severity. About 20% of the DRGs saw two levels of severity and about 20% saw three levels of severity. Compare this to the community hospital, the maximum in any of our community hospital data sets, where 50% of their DRGs showed only one severity level and only 4% showed four severity levels. Within the cancer group in particular (UTCA, CTCA), we have a much worse dichotomy in the spread of severity of DRGs than even the overall hospital. We then looked at the 55 DRGs that they said could possibly have cancer in them, things like crainiotomy which could be for cancer or not. The "may have cancer" (UT?CA, CT?CA) looks very similar to the "cancer" in terms of their distribution of the four levels of severity. And then we took all the DRGs in terms of the whole hospital to see whether cancer was showing greater spread than overall. And what you see is there really are dramatic differences in the cancer DRGs that are even more striking in terms of the proportion of DRGs that have four levels of severity in them. Now that the NCI people have seen this data, they're wondering if the protocol issue is the right issue for them to be looking at. It may really be a

Figure 34

DISTRIBUTION OF NUMBER OF SEVERITY LEVELS PER DRG

CANCER DRGs

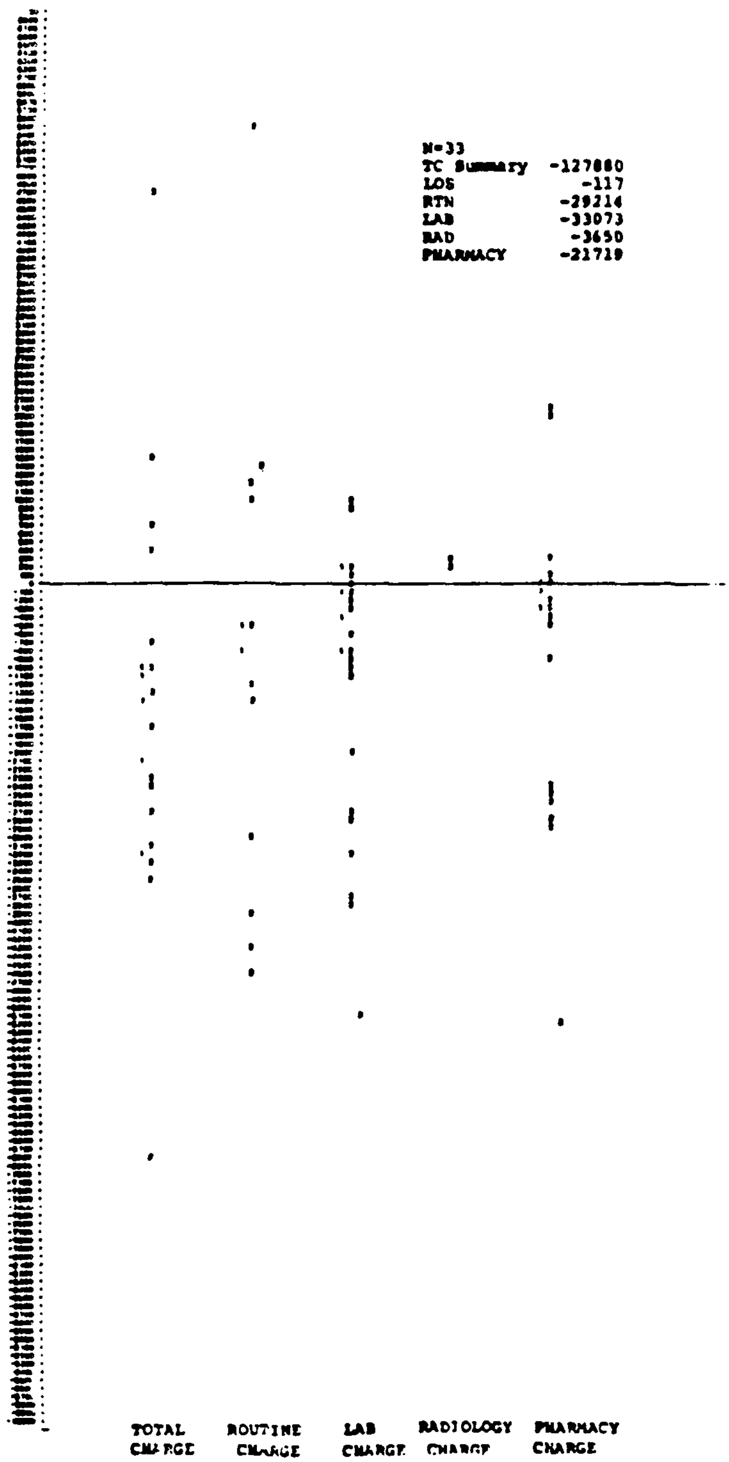


much greater problem in terms of the spread of severity and could have much greater financial implications than the protocol or nonprotocol concern.

Now let's discuss some internal uses of severity data. None of the hospitals that are now collecting severity data across the United States, except for Hopkins in its experiment with the Maryland Cost Review Commission, are being reimbursed on the basis of a Severity of Illness Adjustment. They are collecting this data more for internal management purposes. We have looked at physician practice patterns within a hospital to see which physicians are practicing differently from their colleagues, controlling for severity. We analyze the data by grouping it as finely as I know how, putting the patients into their DRG, dividing by severity and dividing by procedure type, just the way it was done in those DRGs we examined previously. This gives us the greatest explanatory power, between 70% and 90% for each hospital. We don't want to add physicians here, we want to get what the hospital standard is by DRG severity and procedure type. Then we take each physician's patient in a DRG severity and procedure type and compare the resource use for that patient to the norm for the whole hospital. The solid line in Figure 35 represents the zero line, so any patient that is treated with the norm for the whole hospital will fall on that line. If they fall below that line that means that the physician has used less resources than the norm for the corresponding DRG severity and procedure. Above the line means more resource use than the corresponding DRG severity and procedure norm. We examine those deviations for total charges, for routine charges, for lab, for radiology, and for pharmacy. We can look at a physician's practice pattern and see how he differs from the norm for each of the respective DRG severity and procedures categories. Thus, we can put all of his patients on one graph because each one of the dots is compared to the respective DRG severity and procedure norm. Now, looking at Physician 116, who treated 33 patients during this period, notice that there are some above, but most of them are

Figure 35

PHYSICIAN 116 PRACTICE PATTERN



falling below the line. Whether it's Severity Level 1, 2, or 3, he's falling below the line for most of his patients in terms of total charges, below the line in terms of routine, below the line in terms of lab, around zero for radiology, and below the line in terms of pharmacy. Overall this physician, no matter what he's treating, tends to treat his patients very consistently with what we might call more efficient resource use than his colleagues compared to the DRG severity and procedure category into which that patient falls. I found this kind of consistency remarkable in the beginning, but this is the pattern we see. Physicians practice very consistently. Of course they don't all practice consistently low. Physician 117, shown in Figure 36, is an example of a physician who has a few below the norm but most of them are high in terms of total charges--more resource use than his colleagues. Most of it results from routine charges being higher. Notice the pattern for lab, radiology and pharmacy is near zero. When we accumulated data for all 41 patients, they accumulated almost $147,000 more than we would have expected if he treated them at the norms for the hospital. Thus, this physician was "costing" the hospital $147,000. It was because he kept the patients 551 days longer than the norm, resulting in $112,000 more in routine charges. The lab, radiology, and the pharmacy charges were just plus or minus a few thousand dollars--really within noise levels. This physician is not using more ancillary support, he's keeping his patients longer for whatever reason. When we talk to these people, they usually say, "That's what I've always done, I like to keep my patients around a little longer." You can pick it out very clearly with this adjustment. That again is what we typically see--incredible consistency. When physicians practice, they practice consistently no matter what DRG or severity or procedure type they are dealing with and it's either consistently around zero, consistently high, or consistenly low. Very rarely do we see a physician who varies his practice greatly as it appears Physician 40 in Figure 37 does. This physician appears to

Figure 36

PHYSICIAN 117 PRACTICE PATTERN

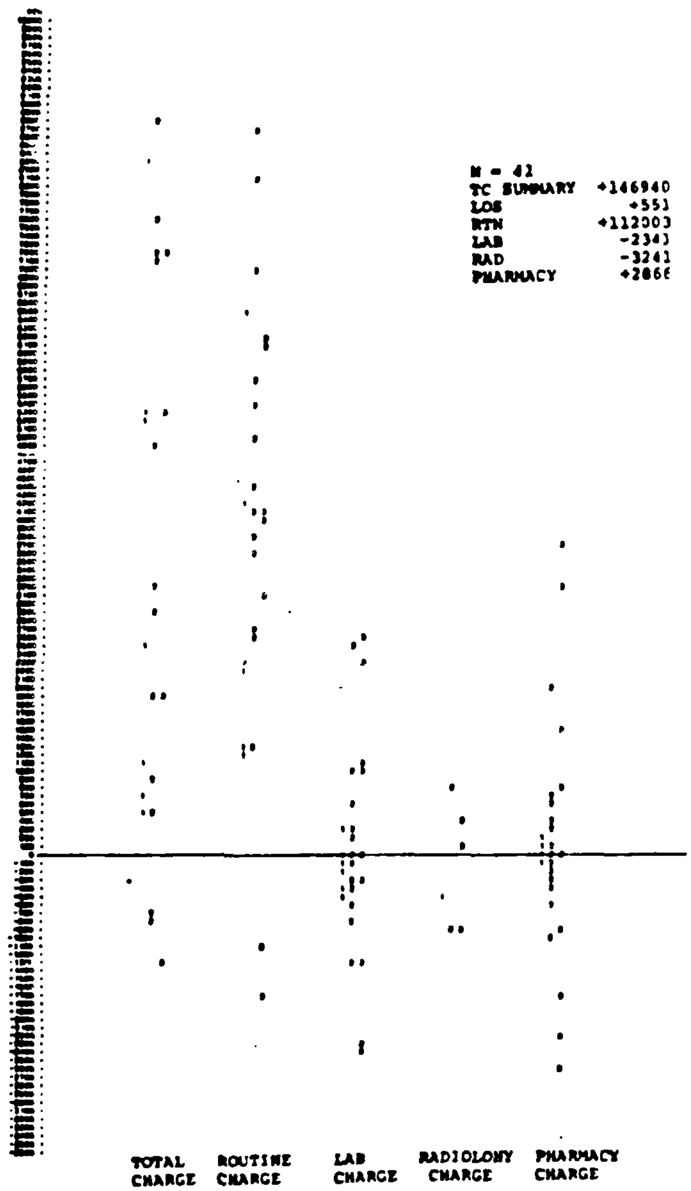
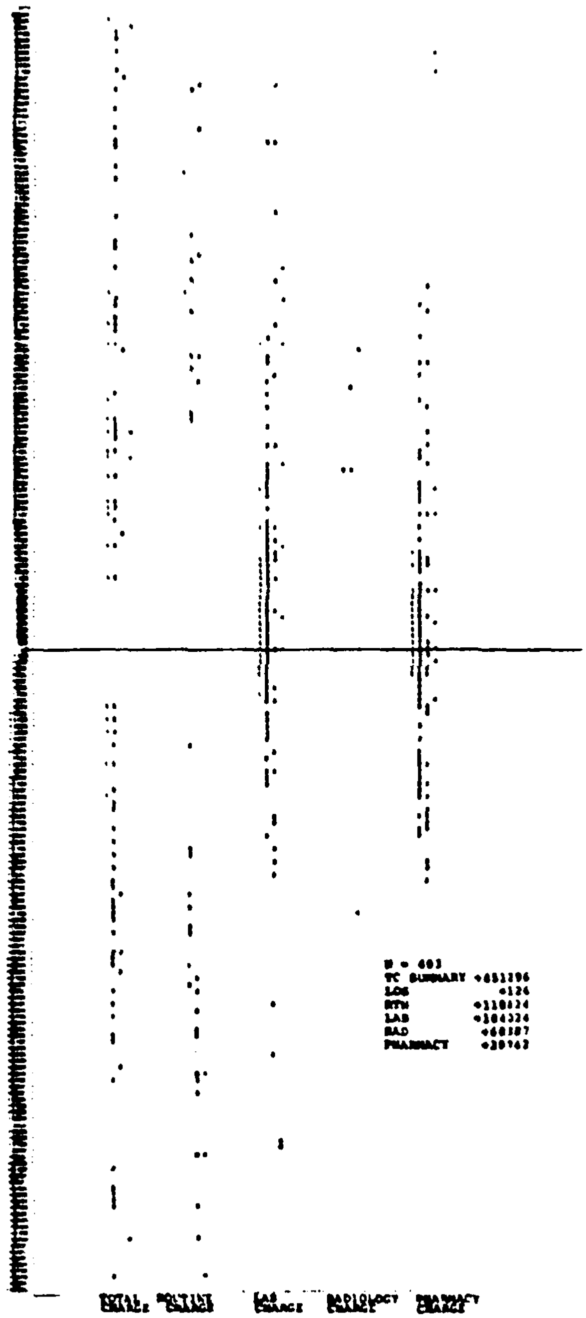


Figure 37

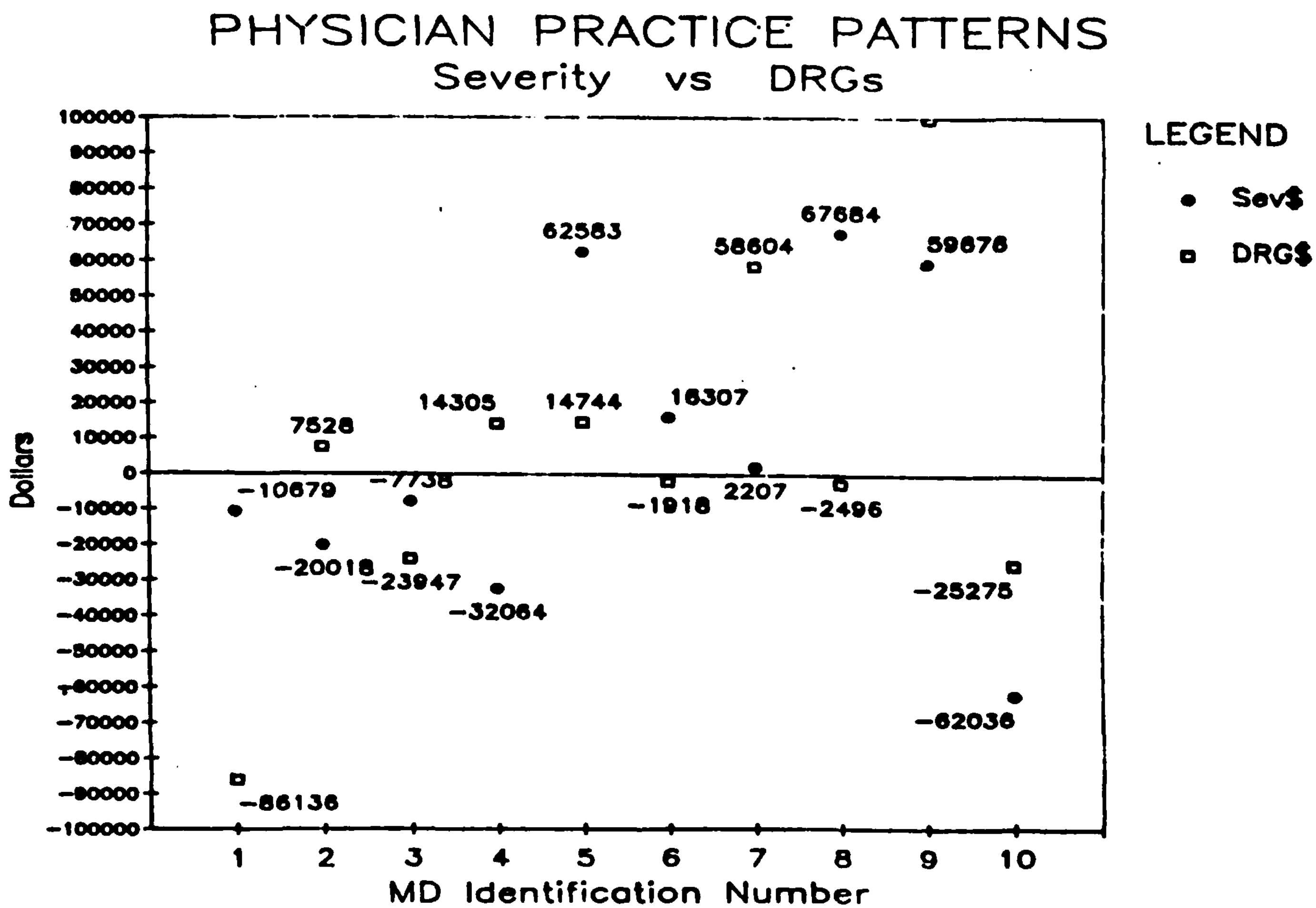
PHYSICIAN 40 PRACTICE PATTERN



go from the bottom to the top on every single dimension. When we first found this physician, we hypothesized all kinds of events in his life during the course of the collection of this data that could have caused this to happen. We ultimately went back to the hospital and they identified the physician. We never know the identity of a physician. We only have an attending physician code attached to the discharge abstract and severity data. We first noticed a very large number of cases and it turned out that this physician was the chief of his service and insisted that everybody be admitted with him as the attending physician. But then the residents took over. So there were some residents who used less resources and other residents who used more resources and the ramifications for the hospital were quite extensive. Notice these 403 patients accumulated $451,000 more in resource use than we would have expected in the same DRG severity and procedure groups--not because of length of stay, interestingly enough, which is only 126 days over for 403 patients, or about a quarter of a day per patient. It was high routine charges, $118,000, because they stayed in the ICU and CCU too long; $184,000 more in the lab--they were doing a lot of lab testing; $60,000 more in radiology and $30,000 more in pharmacy. What this hospital learned was that this chief was not monitoring his residents very closely. They subsequently hired an assistant to help him work with the team and they also started working with the residents, looking at those on both sides of the norm. They worked particularly in the areas of the ICU and the lab to reduce their resource utilization. With this kind of adjustment we can pinpoint when there are differences and deviations and what the causes are.

You might say, "Susan, it now looks exciting but we can do that with DRGs too." Let me share with you what some of our data has revealed because this is some of the data that I find to be most disconcerting. Somehow I'm able to separate myself from the situations involving an individual hospital where severity analysis may go against that hospital, because I see a hospital as an entity. But I have trouble with this data when I see the results by physician. I tend to think more of physicians as people I work with and human beings and I know what it means when you are criticized and when that criticism may be inappropriate. The example of physician practice patterns in Figure 38 was created from a sample of 10 physicians. The data has been accumulated in two different ways. For each physician's patients we've accumulated their deviations from the norm where the norm is created by producing DRG severity and procedure groups, the best ones I know. This is represented by the solid dots. Then we've done the identical calculations but only used the DRG as the basis for the norm, not controlling for severity and procedure. That is, we use the DRG average as the standard and compare that physician to the DRG average. We've accummulated the total charges in each of these ways and that's what is represented on the graph for each physician. The disconcerting part about this data is that often you get a very different picture of a physician when you've controlled for severity and DRG compared to DRGs alone. Physicians 4 and 5 look almost identical by DRGs. They both look like they're using slightly more resources, about $14,000 more (14305 and 14744), than their colleagues when you compare each of their patients to the DRG norm. But for Physician 4, when we control for severity, we actually find that he was much more efficient than his colleagues treating his patients with $32,000 less in resource use (32064). Whereas, for Physician 5, who looked identical to him in DRGs, when we control for severity, we find he was using almost $63,000 more in resources than his colleagues (62583). So two physicians who look identical in DRGs can have very different results when we control for severity. Based on DRGs, you probably would have talked to Physician 7 saying "Look, you're using $58,604 more than the norm for your patients, what are you doing to them?" When we control for severity, however, we find he is right on the average, only $2,207 above.

Figure 38


PHYSICIAN PRACTICE PATTERNS
Severity vs DRGs
Dollars
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
-10000
-20000
-30000
-40000
-50000
-60000
-70000
-80000
-90000
-100000
62583
67684
58604
59676
14305
14744
16307
7528
-10679
-7738
-1918
2207
-2496
-20018
-23947
-32064
-25275
-62036
-86136
1
2
3
4
5
6
7
8
9
10
MD Identification Number
LEGEND
Sev$
DRG$

Physician 8, by DRGs alone, looks in fine shape, but when you control for severity, you find out that he is really overutilizing. So by looking at only the DRG data you can be criticizing or praising the wrong physicians. Where that's going to take medical practice in the future, I'm not sure. But I think it's something that we have to be very cautious about using this kind of data.

The question is asked as to how the above results may be tied to quality assurance and risk management procedures within the various facilities that we've worked with in terms of those physicians that have higher severity patients possibly due to quality of care problems. There have only been two hospitals where we've looked at that in detail--Hopkins and Stanford. At Stanford they're having their utilization review personnel collect the severity data and at the same time flag those cases that they think are possibly higher severity due to quality of care. I understand, though, that the numbers of those cases have been very few. In terms of the individual physicians they've looked at, they have not come back and said that these kinds of differences are due to quality of care problems. Of course the physician who uses $62,000 less by severity of case is not necessarily a winner. He could be a physician who is just not doing anything for his patients. Then the quality of care would come in and we'd have to look at that sort of situation. We've got to go beyond this in terms of determining the reasons for some of these deviations. The other possibility is that you may have a person who keeps his patients at Levels 1 and 2 by a more costly expenditure by predicting complications, watching for them, etc., and he may actually look above the norm for the level of severity he's seeing. But when we look at his pattern of practice he may very seldom get into avoidable complications--high quality care. But all of that has to be looked into and this is what the individual hospitals themselves do. They look at the quality of care that has been provided to these patients to see whether quality might possibly be one of the explanations for these differences. To date, as I mentioned, none of the hospitals have come back and said they've been able to explain even some of their physicians' performance differences by quality of care issues. It's been more of a practice pattern situation and when the physicians see it, they're able to adjust their practice.

Many of these questions have come about because we've found that some hospitals have higher costs per case, longer lengths of stay per case; we've found that some physicians have higher costs per case and longer lengths of stay per case; and when we ask people about that their usual answer is that we treat sicker patients. The question then becomes how can you quantify sicker patients so that you can accurately assess what is attributable to differences in severity of illness. Someday we'll be able to determine what's due to quality of care, but we don't yet have that. I believe that if we could use a severity based system it could be very useful in controlling cost in a prospective payment system. Many people, when they initially see this kind of data and see the various resources used by severity, say, "If you pay more for a sicker patient isn't that going to cost the whole system more money?" I believe, used properly, it will cost the whole system less money in the long run, and Figure 39 shows the four reasons why. First, if we equitably reimburse for all severity levels we'll reimburse to a Level 1, then a Level 2, then a Level 3, and then a Level 4 appropriately. We would not have an incentive to over admit less severely ill patients. That's a problem in our current system. I was at a conference yesterday morning with people involved with the Medicaid system. Every Medicaid patient is reviewed in the State of Maryland, but they are still finding increases because there's a large gray area as to whether you'd admit a patient or not. If you want to find reasons to admit him, you find reasons; and if you do not want to admit him, you find reasons not to. But if there were no incentive to admit, say, a Severity Level 1 patient, you wouldn't. I heard some people in the Administration saying, "Susan, we might even be able to do

Figure 39

USES OF THE SEVERITY INDEX
FOR COST CONTROL IN A
PROSPECTIVE PAYMENT SYSTEM

- EQUITABLE REIMBURSEMENT FOR ALL SEVERITY LEVELS

  No incentive to over-admit less severely ill patients
  No incentive to transfer out more severely ill patients

- RATIONAL CONTROL OF RESOURCES BY SEVERITY LEVELS
- IDENTIFY PHYSICIANS WITH ATYPICAL PRACTICE PATTERNS
- RESOURCES DEVOTED TO MOST SEVERELY ILL PATIENTS

  Cost and moral issues for Severity Level 4 patients

what some HMOs are currently doing by paying their physicians more to treat patients that are less severely ill on an outpatient basis." There are several HMOs I know of around the country that are paying their physicians 125% of their usual fee to treat certain patients, who otherwise might be admitted, on an outpatient basis and everybody saves money. Also there'll be less incentive to transfer out more severely ill patients if the hospital could be appropriately reimbursed. Again, there wouldn't be the dumping phenomenon if the hospital could take care of them and be reimbursed. That wouldn't necessarily save money but what it would do is make the system more equitable.

The second and third points are where we're going to get our big savings--rational control of resource use by severity level and identification of physicians with atypical practice patterns. We've already seen the extent to which this point could have an effect in an institution, but let me tell you a little more about how hospitals have used their severity data related to this point. A number of our institutions have taken their severity data and looked at it with a physician group that had a desire to do something. One example comes from a hospital in New England where several of the cardiothoracic surgeons went to the hospital president and said they'd like to open a heart and liver transplant program. The head of the hospital said that would be great but it costs money and in this day and age that's not possible. But he said maybe they could earn the money to do it. So the physicians had an incentive--they wanted something. He first worked with them and said "Do you like the way the DRGs are defined for your patients and what you're doing for them?" They decided it wasn't the way they wanted to define them. They redefined the DRG groups. Different procedures were grouped together. Then they divided those patients by severity because they were collecting severity on an ongoing basis. So they had severity data on these patients and because severity has no hierarchy they could put severity in these new groups they had formed. Then they pulled the patient records and a team of surgeons went over each of the patients in groups. Severity Levels 1, 2, and 3 were in their DRGs. They didn't include the 4's because of their variability. They decided in every single case that there were things they were doing that they could do better. They could improve on the efficiency, how quickly they were doing it, and some of the tests they found they really didn't need. So as a team they made these decisions. Then they tried it out for three months to be sure that it wasn't hurting the quality of care in any way. Once they saw that they could do this in a stable way in terms of how they were all treating patients at a similar severity level similarly, they went to some of the local HMOs and were able to make contracts with the HMOs agreeing to treat their patients on a contract basis for a fixed price per new DRG and severity level. They set the price in advance as long as the HMO agreed to send their patients to the hospital. Thus, the hospital agreed to be at risk because if the patients got sicker because of poor quality of care the hospital would be reimbursed at the lower level of severity. They were able to become the most economical place to go for this kind of surgery, because they analyzed very carefully what they were doing with these groups. With the money they earned from treating these patients they were able to fund their heart and liver transplant program. The physicians are thrilled and the hospital is thrilled. Now the orthopedic surgeons are doing something similar in the orthopedic area. The physicians in medicine are now getting together to see how, by severity level, they can rationally examine what they're doing. In the past, with DRGs that ranged from $1,000 to $200,000, they couldn't tell where they were efficient, where they were inefficient, or what they were doing differently because of the types of patients that were in there. I believe that can save us a great deal of money because I know there are things we're doing, and I'm sure all of you know there are things that are being done, that if we looked at them more rationally could be eliminated.

Finally, the resources devoted to the most severely ill patients, the Level 4's in our system, can be examined. You can see in the data I shared with you today there are moral issues involved with those patients. Currently they are hidden within DRGs but I think this is a group of patients that we should really look at separately because they are very expensive. The question is, when we have limited resources, what should we be doing--what are we getting as a result of this resource use. It's something that I think we're going to need to examine as a society. So for these reasons, I believe by controlling for how sick the patients are and getting more homogeneous groups we can save money in reimbursing hospitals for the delivery of health care.

CASE MIX: IMPLICATIONS FOR MANAGEMENT

Forrest W. Graves, Ph.D.

Utilization of hospital resources, hospital management, market share, financial stability, capital formation, and a hospital's organizational goals and primary mission are but a few of the key elements in the strategic planning process. Strategic planning in health care is moving hospital administrators further away from a preoccupation with routine operational issues and focusing their attention on issues concerned with past performance and predicting future trends in new technologies and clinical program viability. As a technique for managing changes in health care and long-range hospital planning, the strategic planning process is especially suited to address the need of hospital managers and medical staff to keep abreast of the inevitable changes resulting from a prospective hospital cost-based reimbursement system with its emphasis on cost containment.

One of the specific objectives of strategic planning in health care today is to assist hospital managers in defining the hospital's product. Merged clinical and financial records for a specific incident of care as defined by Diagnosis Related Groups or some alternative clinical program categories will provide information to drive the strategic planning process and allow hospital managers to analyze case mix, monitor admissions, assess averge length of stay, and manage physician practice patterns. These activities are viewed as prerequisites for determining which products are winners and which are losers and will help guide efforts at managing changing utilization.

Use of Comparative Data in Hospital Management

Sound hospital management demands in-depth and thorough information about utilization that accurately reflect the complexities of patient care. Dramatic variations in admissions, length of stay, resource consumption, and ancillary utilization impact decision-making and influence the direction of the hospital's strategic planning process. To accurately assess hospital and physician performance, and to further define the hospital's product line, hospital managers must have national comparative data that account for these variations.

Successful strategic planning depends on the ability of hospital managers to turn available data into information necessary for monitoring utilization. The success of a strategic plan is dependent upon the availability of reliable information about the hospital's internal operations and the hospital's share of the health care marketplace. A comprehensive comparative data base provides this valuable information. Utilized as an integral part of a hospital's overall information system, hospital managers can use such data to:

* Develop a credible business plan based on case mix.
* Define and measure the hospital's "products."
* Monitor changes in hospital utilization and physician practice patterns.
* Relate changes in patient mix to changes in medical staff activity or composition.
* Bridge the gap between operating data and management information requirements.
* Assess market share and competition.

Comparative data allow the hospital manager to monitor changes in utilization within the hospital over time (longitudinal analyses) and to compare the hospital with its "peers" at any given point in time (cross-sectional analyses). Criteria for selecting peer hospitals is largely determined by the objectives of the hospital manager's strategic plan, but should take into account the need to develop measures which assess hospital performance, case mix complexity, and resource utilization.

Summary

A successful strategic management plan is dependent on comparative data that will enable hospital managers to make accurate assessments of hospital utilization and use this information to direct the institution. To remain viable in a volatile health care market, effective hospital management implies the availability of comprehensive and accurate comparative information about hospital utilization. While this is only one element in the overall strategic planning process, hospital utilization information will enable hospital managers to evaluate patterns of resource within their own institutions and assess utilization changes across hospitals which are similar to theirs in location, size, and patient mix.

The complexities of hospital management require a strategic planning approach to assessing changes in utilization especially in light of continuing changes in methods of defining the hospital's products. Comparative data are available which allow flexibility in defining a hospital's peer institutions and provide year by year comparisons in changing patterns of hospital utilization. Use of this comparative information should be included as an integral part of a hospital's overall information system for strategic planning and management.

The following pages contain in outline form the substance of Dr. Graves' presentation to the conference. The material was organized around the framework given in Figure 1.

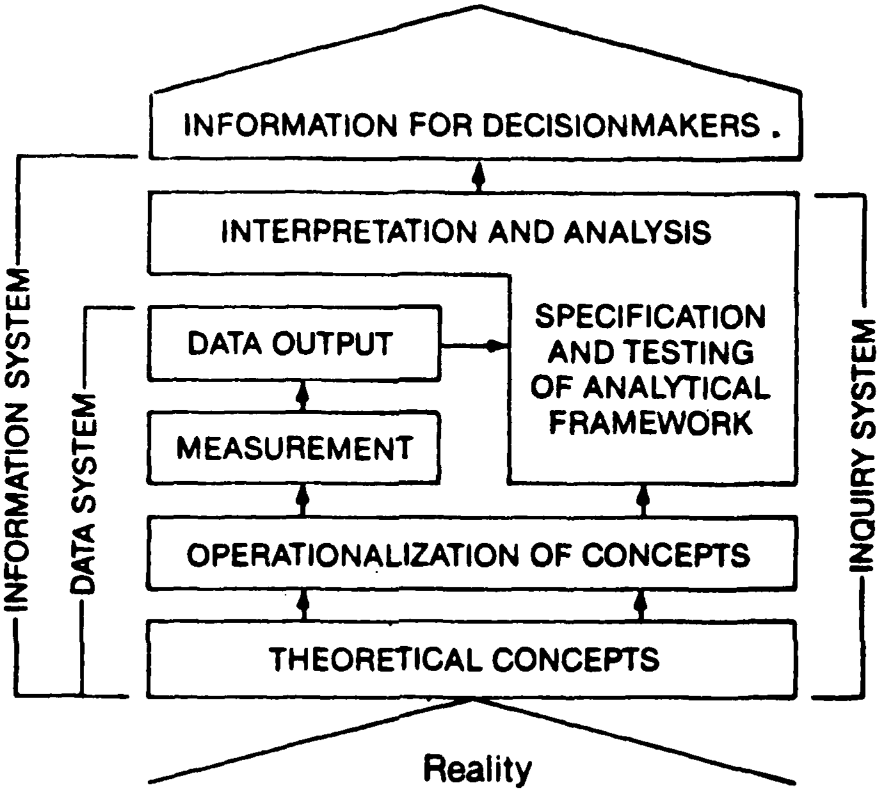


Figure 1.

Framework for a Hospital Information System

Adapted from: James T. Bonnen. "Improving Information on Agriculture and Rural Life," American Journal of Agricultural Economics, Vol. 57, No. 5, December, 1975 p. 758.

REALITY

The Hospital Must Deliver To Its
Patient Mix Quality Care At A Cost
Below Reimbursement

THEORETICAL CONCEPTS

Product Definition (Clinical Programs)

Complexity

Costliness

Treatment Patterns

Treatment Effectiveness (Quality of Care)

OPERATIONALIZATION OF CONCEPTS

How you operationalize your theoretical concepts will determine the data elements you need in your data base.

To operationalize a concept means to put the concept in a form that permits some kind of measurement.

DATA REQUIREMENTS

Availability of data in addition to the UHDDS elements:

- Care unit utilization
- Patient specific charges
- Hospital Service or Clinical Programs
- Physician-admitting, consulting, attending

COMPLEXITY

The concept of "complexity" lacks a precise definition. Before hospital case mix complexity can become a useful factor in understanding hospital costs, a clear definition of the concept of complexity must be established and an operational means of measuring case mix developed.

SEVERITY OF ILLNESS

The relative level of loss of function and mortality normally caused by a particular illness.

RESOURCE INTENSITY

The relative volume and types of diagnostic, therapeutic and bed services used in the management of a particular illness.

ALTERNATIVE PRODUCT DEFINITIONS

MDCs and DRGs

CPHA's Cross-Classification

SysteMetrics' Disease Staging

Severity of Illness

Patient Management Categories

Or A Combination Of The Above

Grouping Patients

	A	B	C
Your Hospital's Data	30%	25%	45%

All of your hospital's patients are assigned to the appropriate group based upon each patient's principal diagnosis.

The example shows one possible distribution.

Complexity Index

(Case Mix Index)

	A	B	C
Your Hospital	30% 1700	25% 3500	45% 8000
National	40% 1700	30% 3500	30% 8000

Since the Case Mix Complexity Index is a comparison of your patient distribution to some standard or norm (here the national data base), only your hospital's proportions are used. Your hospital's costs are not relevant to this determination.

CASE MIX COMPLEXITY INDEX

YOUR HOSPITAL (numerator); NATIONAL (denominator)

$$\frac{30\% \times 1700 + 25\% \times 3500 + 45\% \times 8000}{40\% \times 1700 + 30\% \times 3500 + 30\% \times 8000}$$

$$\frac{510 + 875 + 3600}{680 + 1050 + 2400}$$

$$\frac{4985}{4130} = 1.2070 \text{ YOUR HOSPITAL'S INDEX}$$

The calculations are shown. The numerator in each instance is your hospital's data (proportion of patients), and the denominator utilizes the national base. The national data base average cost (weight) per group is used in both numerator and denominator.

The Complexity Index calculated for your hospital is higher than most of those listed in the September 30 issue of the Federal Register.

Calculating Your Hospital's Case Mix COMPLEXITY Index

Grouping Patients

A	B	C
Minimally Complex	Moderately Complex	Very Complex

For purposes of example a patient grouping system is constructed to contain just three cells, ranging from minimally complex to very complex. This is accomplished by combining physicians' clinical judgement with patient data and financial information with special emphasis on length of stay and cost data.

All assignments to the three cells or groups is made on the basis of the PRINCIPAL diagnosis.

Grouping Patients

A	B	C
1700	3500	8000

National Data Base

From a national data base, e.g., the MEDPAR file, a 20% sample of all Medicare claims, an average cost is calculated for all of the patients falling into each group. These average costs are often referred to as "weights."

Grouping Patients

A	B	C
40% 1700	30% 3500	30% 8000

National Data Base

At the same time the proportion of patients falling into each group is recorded.

To determine your hospital's COMPLEXITY Index, all patients are assigned to the appropriate group and the proportions recorded. Your hospital's cost information is not required for determination of this index.

See the reverse side for the calculations.

Calculating Your Hospital's Efficiency (Performance) Index

EFFICIENCY (PERFORMANCE) INDEX
(CASE MIX ADJUSTED)

$$\text{COST INDEX} = \frac{\text{ACTUAL COST}}{\text{EXPECTED COST}}$$

$$\text{CHARGE INDEX} = \frac{\text{ACTUAL CHARGES}}{\text{EXPECTED CHARGES}}$$

$$\text{LOS INDEX} = \frac{\text{ACTUAL LOS}}{\text{EXPECTED LOS}}$$

$$\text{FATALITY INDEX} = \frac{\text{ACTUAL DEATHS}}{\text{EXPECTED DEATHS}}$$

ETC. ETC.

The Efficiency (Performance) Index is a calculation of a hospital's actual performance for their patients as compared to the expected performance (suggested standard or a norm derived from a data base) for the same groups of patients.

EFFICIENCY (PERFORMANCE) INDEX

	A	B	C
Your Hospital	30% 1600	25% 4000	45% 9000
National	30% 1700	25% 3500	45% 8000

The proportion of patients is your hospital's and is multiplied by both your hospital's performance (cost weights) and the performance of the data base, e.g., the Medicare MEDPAR file.

EFFICIENCY (PERFORMANCE) INDEX

YOUR HOSPITAL

$$\frac{30\% \times 1600 + 25\% \times 4000 + 45\% \times 9000}{30\% \times 1700 + 25\% \times 3500 + 45\% \times 8000}$$

NATIONAL

$$\frac{480 + 1000 + 4050}{510 + 875 + 3600}$$

$$\frac{5530}{4985} = 1.1093 \text{ YOUR HOSPITAL'S INDEX}$$

This panel displays the calculations. The numerator is your hospital's data (cost figure) and the denominator again utilizes your hospital's proportions of patients multiplied by the national cost figure.

Values greater than 1.00 are presumably "bad." Numbers below 1.00 are presumably "good." Values from a selected peer group of hospitals or other sources can be substituted for the national data base.

HOSPITAL COMPLEXITY INDICES

$$\text{RNI} = \frac{\text{HOSP EXPECTED AVERAGE TOTAL CHARGE* PER PATIENT}}{\text{NATIONAL EXPECTED AVERAGE TOTAL CHARGE* PER PATIENT}}$$

*SPC DATA BASE 1976-1980

$$\text{PCI} = \frac{\text{HOSP EXPECTED AVERAGE TOTAL COST* PER CASE}}{\text{EXPECTED AVERAGE TOTAL COST* PER CASE ACROSS PEERS}}$$

*1982 SCHEDULE OF REIMBURSEMENT RATES FROM NEW JERSEY COST INFORMATION FOR 467 YALE DRGs (BY TEACHING STATUS)

$$\text{ANC} = \frac{\text{HOSP EXPECTED AVERAGE NURSING COST* PER DIEM}}{\text{EXPECTED AVERAGE NURSING COST* PER DIEM ACROSS PEERS}}$$

*NEW JERSEY NURSING COST FOR 67 ICD-9-CM BASED YALE DRGs

$$\text{ICU-CCU} = \frac{\text{HOSP EXPECTED AVERAGE ICU-CCU DAYS* PER CASE}}{\text{EXPECTED AVERAGE ICU-CCU DAYS* PER CASE ACROSS PEERS}}$$

*NATIONAL PATIENT SAMPLE FILE FOR CY 1981 FOR 467 YALE DRGs (WEIGHTS FOR TOTAL PATIENTS AND PATIENTS 65+)

$$\text{ERD} = \frac{\text{HOSP EXPECTED AVERAGE FATALITY RATES*}}{\text{EXPECTED AVERAGE FATALITY RATES* ACROSS PEERS}}$$

*NATIONAL PATIENT SAMPLE FILE FOR CY 1981 FOR 467 YALE DRGs (WEIGHTS FOR TOTAL PATIENTS AND PATIENTS 65+)

COMPARATIVE DATA

Longitudinal - your hospital historically

Cross-sectional - your hospital compared to other hospitals

ISSUES TO CONSIDER IN DEVELOPING A COMPARATIVE DATA BASE

Coverage

Representativeness

Data quality-edit checks and corrections cycle

Methodology-patient exclusion criteria

Classification-meaningfulness of the patient groupings used

APPLICATIONS OF COMPARATIVE DATA

Define and Measure Hospital's Product

Monitor Case Mix for Changes in Type of Severity

Capital Formation

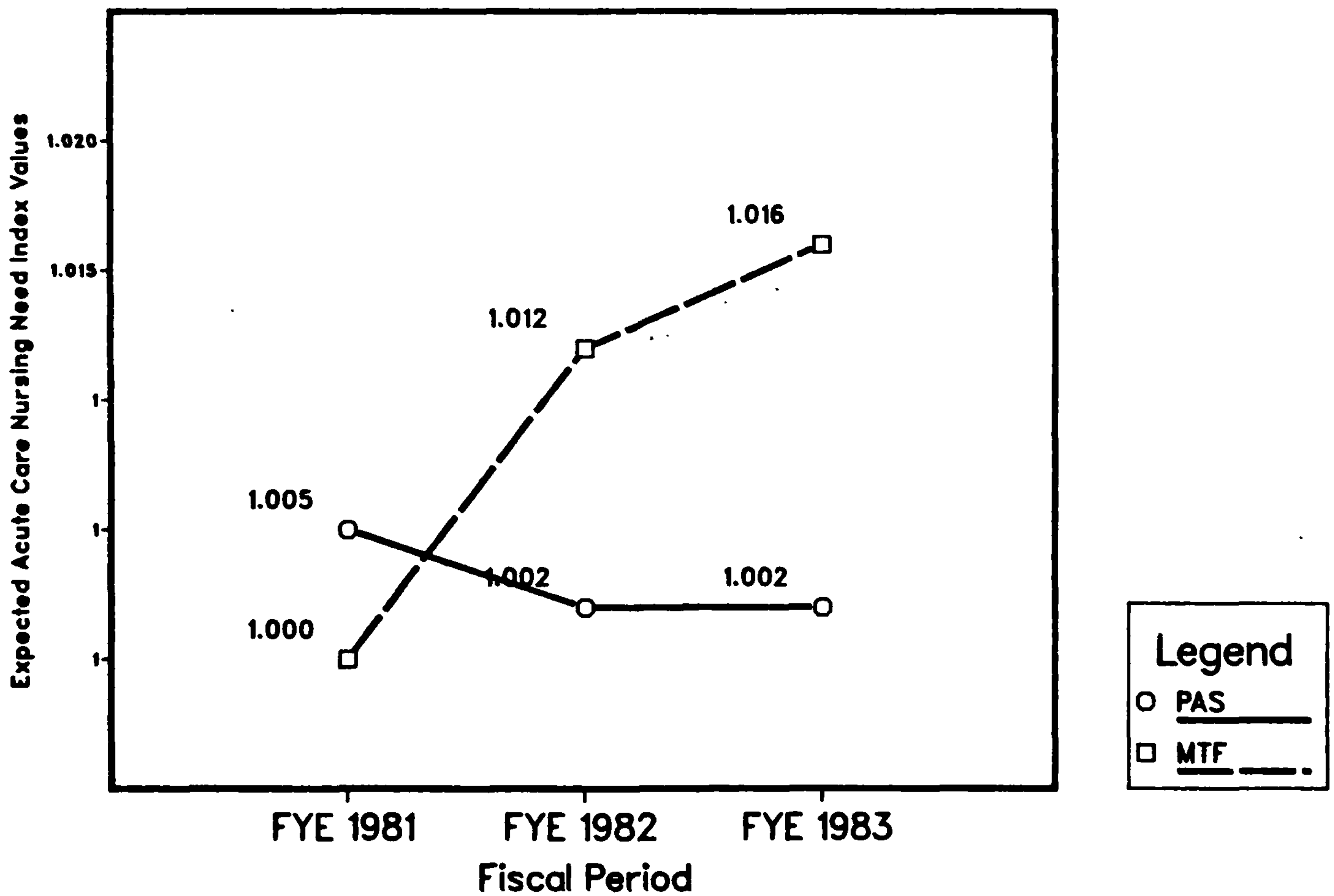
Rate Review

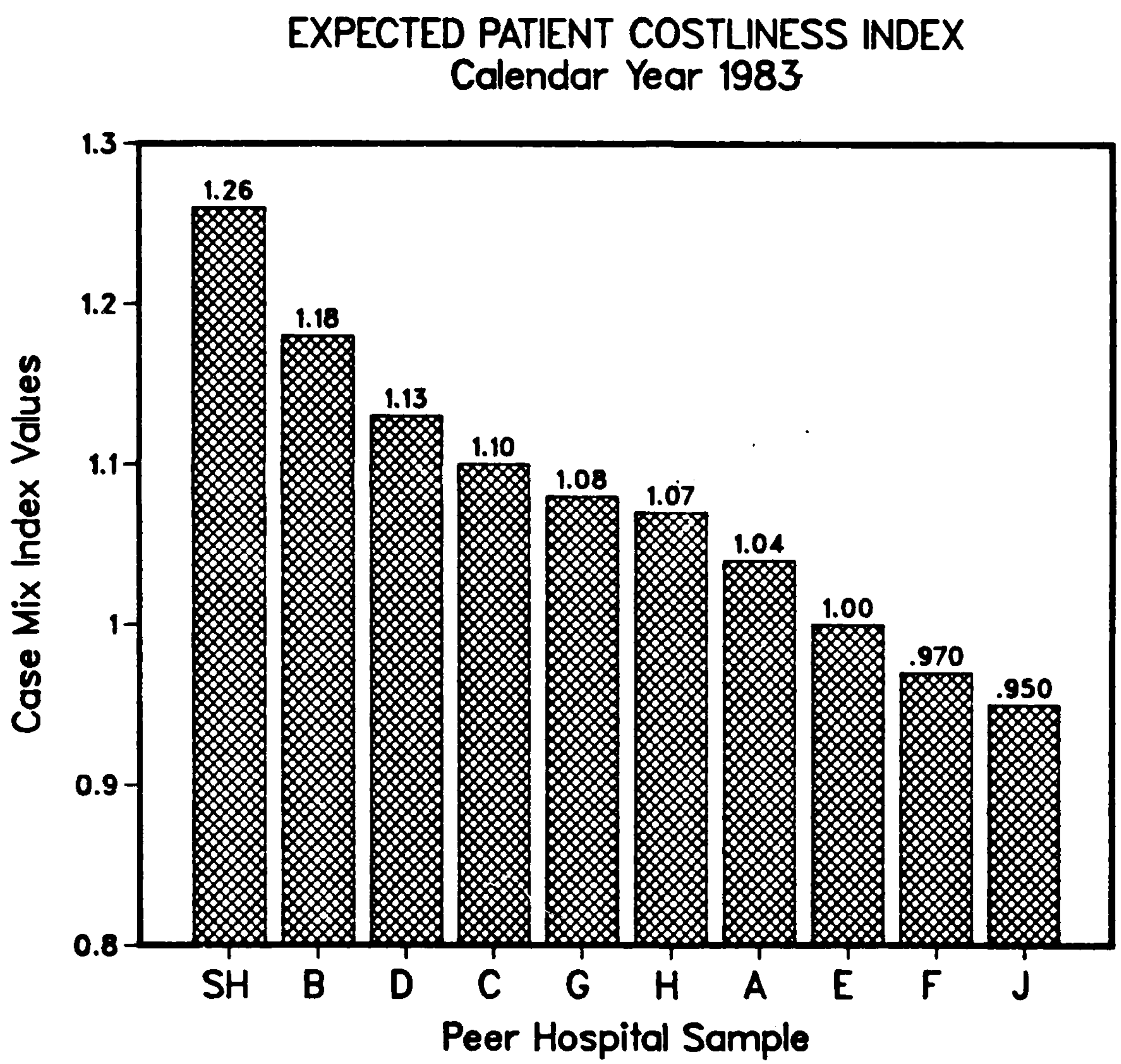
Physician Management

Utilization Control

Reimbursement Appeals

US ARMY MEDICAL TREATMENT FACILITIES VS. PAS HOSPITALS
Expected Acute Care Nursing Need Index by Fiscal Period
1 October 1980 — 30 September 1983
Group III.




EXPECTED PATIENT COSTLINESS INDEX
Calendar Year 1983
Case Mix Index Values
1.3
1.2
1.1
1
0.9
0.8
1.26
1.18
1.13
1.10
1.08
1.07
1.04
1.00
.970
.950
SH
B
D
C
G
H
A
E
F
J
Peer Hospital Sample

FACTORS AFFECTING DRG PROFITABILITY

A. DRG Phenomenon

1. Research Methodology

   a. Purpose: To identify impact of billing data on DRG profitability.

   b. Approach:

      (1) DRG profit and loss statements from case mix system at CPHA

      (2) Use of nine hospitals, over 20,000 cases

      (3) Medicare only

2. "Profitability" Defined

   a. Profit = Reimbursement - Cost

   b. Reimbursement is Medicare payment for the DRG

   c. Cost is cost of covered services

3. Potential Problems in DRG Rates

   a. Use of billing data instead of medical record data

   b. Incomplete data for

      (1) Multiple procedures (Cardiac Caths)

      (2) Comorbidities - Conditions brought into hospital by patient

      (3) Complications - Conditions developed at the hospital

   c. 80% of hospitals increased case-mix index with medical record data

   d. Impact may be creation of "winners' and "losers"

4. Comorbidity/Complications (C.C.) Adjustments

   a. 2,800 diagnoses identified as C.C. resulting in one extra day's stay in 75% of cases

   b. DRGs recognized that C.C. cases would consume more resources

   c. Equated geriatric cases to C.C. (e.g., over 70 = respiratory failure)

   d. No identification of impact of multiple comorbidities, e.g., respiratory failure, kidney failure, other body systems failure

   e. Original DRGs used LOS rather than cost to identify C.C. relevance

   f. 208 DRGs use C.C. to define DRG

COMPARISON OF PROFITABILITY OF COMORBID/COMPLICATED V.S. NONCOMORBID DRG PAIRS

	Number of Cases	Number of DRGs	Number of DRGs Where Profitability Was Greater	Number Where Range Profitability Was Greater	% Day Outliers	% Cost Outliers
Comorbid/ Complicated DRGs	7,518	104	22	59	5.0%	1.1%
Noncomorbid/ Complicated DRGS	1,458	104	50	26	2.2%	0.1%
	8,976	208				
Total Cases In Sample	20,113					

Conclusion: Complicated/Comorbid DRGs are less profitable, have more outliers, and are greater business risks.

THREE DRGs WHERE COMORBIDITIES GIVE LESS MONEY THAN NONCOMORBID DRGs

	WEIGHT	REIMBURSEMENT
168 Mouth OP w/C.C.	.8631	2,589
169 Moutn OP w/o C.C.	.8992	2,698
	Difference	(109)
403 Lymphoma, Leukemia w/C.C.	1.1715	3,515
404 Lymphoma, Leukemia w/o C.C.	1.1787	3,536
	Difference	(21)
452 Complications of Treatment w/C.C.	.8492	2,548
453 Complications of Treatment w/o C.C.	.9020	2,706
	Difference	(158)

DRGs WHICH PAY MORE FOR LESS

DRG rates were statistically derived view of physician behavior and patient condition

Will not necessarily provide incentives for doing more work

TWO DRGs WHICH PAY MORE FOR DOING LESS

DRG 411 History of Cancer, No Endoscopy

Weight .7221

Approximate
Reimbursement $2,166

DRG 412 History of Cancer With Endoscopy

Weight .3400

Approximate
Reimbursement $1,020

By doing Endoscopy, Hospital loses $1,146

B. Patient Condition

1. Sicker patients require more resources
2. DRG payment does not take condition of patient into account.
3. Therefore, hospitals treating sicker patients will probably not fare as well as hospitals treating patients who aren't as ill.

C. Physician Practice

1. Assumption: Given uniform patients, physicians who treat cases more efficiently with most appropriate mix of resources will be more profitable.
2. Translation:
   a. Minimize testing
   b. Shorten length of stay
   c. Develop more efficient mix of diagnostic and treatment protocols
   d. Review drug usage

D. Impact of Coding on DRG Profitablity

1. Need for accurate coding
2. Need for specificity
3. Need to watch for Comorbidity/Complications
4. Need to identify all relevant diagnoses

E. Accounting Practices

F. Base Rate Determination

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PERFORMANCE MEASUREMENT --- WHERE CHAMPUS FITS

LTC Joseph C. H. Smith, MSC, USAF
Dianne K. Reyer

INTRODUCTION

The purpose of this presentation is to provide you with some sense of the impact of the performance measure used in the Direct Care System on CHAMPUS, and to provide a set of objectives for developing a performance measure which would meet the needs of OCHAMPUS.

NATURE OF THE SYSTEM

CHAMPUS: The Office of the Civilian Health and Medical Program of the Uniformed Services (OCHAMPUS) is a worldwide program that provides financial assistance to eligible beneficiaries for health care received from civilian sources. The CHAMPUS eligible population consists of active duty dependents, retirees and their dependents, and surviving dependents of deceased members of the services. CHAMPUS eligibility for retirees and their dependents is terminated upon attaining eligibility for MEDICARE. CHAMPUS, however, is not a total health benefit program. It was designed to augment medical services available through the military treatment system. This results in a two-part health benefit delivery system with many adverse incentives and unique problems.

Health Benefit Delivery: This two-part system must provide a health benefit to the entire beneficiary population. The direct care part of the system provides the total health benefit to active duty beneficiaries, and provides care on a space available basis to the remaining beneficiaries. In the event that the direct care system cannot provide care to the active duty member, or in the event of required emergency care, the Direct Care System must buy the care from the private sector, or from other government agencies such as the VA. On the other hand, if care cannot be provided to other beneficiaries, the beneficiaries may be sent to receive care from civilian sources under CHAMPUS. Non-active duty beneficiaries may choose to receive outpatient care under CHAMPUS without first going to an MTF, and if they live outside an MTF catchment, they may choose CHAMPUS for inpatient care also.

In summary, only the active duty beneficiary is guaranteed his total health benefit from a single source. All other beneficiaries must rely on available space in the Direct Care System, and use CHAMPUS otherwise. Both the Direct Care System and CHAMPUS must purchase care from the private sector.

Financing: The split between the two systems is further exacerbated by the fact that each piece has a separate appropriation, and can only spend its respective budgets in certain ways. CHAMPUS generally can only use CHAMPUS funds to purchase care from civilian sources. The funds cannot buy care in other Federal facilities, nor can the funds be transferred to the Direct Care System to expand in-house capability. Because of this separate funding, care rendered in the Direct Care System is free from the CHAMPUS perspective, and care rendered under CHAMPUS is free from the Direct Care System perspective. For care provided under the CHAMPUS program, the beneficiary generally shares in the cost of that care. The fact that the beneficiary shares in the cost complicates the problem since bringing the care in-house may result in increased cost to the government.

Another complication in the financing arena is other health insurance. CHAMPUS is second pay to all other health insurance except supplemental plans. This means that if the beneficiary has other health insurance, the other insurance must pay first, and CHAMPUS will, to a certain extent, pay the remaining bill. This process is known as coordination of benefits (COB), and again reduces the government's liability for health care costs. The Direct Care System does no coordination of benefits at this time; however, there are proposals before Congress which would require the Direct Care System to coordinate benefits.

PERFORMANCE MEASURES

Defined: As used in this paper, performance measures are values which represent the output or ratios of outputs from and inputs to a system. For example, the number of admissions per beneficiary per year would be a performance measure for the Direct Care System. Another example would be the number of outpatient visits per physician per year. On the other hand, the number of physicians in the system would not be considered a performance measure, but rather a measure of resources or input to the system. However, it is clear that if one is to discuss ratios of outputs and inputs as performance measures, one is vitally concerned with the measurement of inputs in order to develop performance measures.

Objectives: The primary reasons for developing performance measures, and going to the trouble of collecting and storing the measurements, is to be able to manage the system better. Performance measurements as discussed here are to be used to compare the performance of one facility with another, and to compare the performance of the MHSS with other health care delivery systems. Furthermore, they are to be used as the basis for budgeting and resource allocation. The purpose of this paper is to provide objectives for performance measures for the MHSS which would meet the needs of OCHAMPUS. The proposed list of objectives is:

(1) The performance measures must be able to be implemented. The ideal measures of performance in the medical system are likely to involve such intangibles as health status and beneficiary satisfaction. While these attributes are desirable, it is extremely difficult to develop reliable or valid

approaches to measuring these variables, and measures which are developed are likely to be very costly to collect. One must accept compromises in order that we can actually do the required measurement.

(2) The performance measures must establish an incentive structure which promotes the choice of treatment plans which is most cost effective to the government. Under the current system of using the Composite Work Unit (CWU) as the primary measure of system output, the incentive is to provide more care. The incentive in the fee-for-service system in the private sector has been blamed to a large extent for the high increases in the cost of health care in this country, and is the primary system affecting the utilization of CHAMPUS. For example, the Military Health Services System (MHSS), the combined CHAMPUS and Direct Care System, produces 1,084,535 admissions per year, and 7,102,163 hospital days per year. This level of output is impressive; however, it is probably significantly more output than is really necessary to provide a high quality health benefit to our population. Specifically, if one projects annual utilization for our population enrolled in a Kaiser type health maintenance organization, One gets a requirement for only 665,840 admissions and 3,343,556 hospital days. That means that we are providing 60% more admissions than really necessary, and more than double the number of required hospital days.

(3) The performance measures must provide the incentive for the system to rearrange itself in order to improve the overall efficiency. Under the current system of separate budgets, if the MTF Commander is faced with the choice of spending $25,000 from his supplemental funds, or sending the patient to CHAMPUS for a government cost of $30,000 from the CHAMPUS budget, he is most likely to choose the CHAMPUS option. A performance measure by itself cannot solve this problem, but it could serve to make people more aware of the problem, and promote the appropriate changes.

(4) The performance measures should consider all inputs into the system, and all outputs from the system. They should allow one to look at the various segments of the system, or at the system as a whole. Certainly the cost of CHAMPUS is an input to the system, and the care delivered under CHAMPUS is an output from the system. Both should be considered when looking at the total system. At the same time, the Direct Care System has multiple missions. It must be prepared for mobilization, it must provide a health benefit, and it must support the requirements of the line. Some activities of the MTF may support all three missions, while other activities may support one mission and detract from another. The output in support of the separate missions should all contribute to system output, and still should remain separable.

(5) The value of the performance measure associated with a unit of output should be proportional to the quantity of resources normally required to generate the output. For example, a hospital day would probably be worth more than an outpatient visit, and a day in an intensive care unit should be worth more than a regular hospital day.

(6) The performance measures should promote effective Coordination of Benefits (COB). This requirement is difficult since the amount of potential COB recovery is different in different areas; however, COB does reduce total cost to the government and should be encouraged.

(7) The performance measures should promote high quality output. An outpatient visit which does not effectively solve a problem should not be as valuable as one which does solve the probler In a similar manner, a records system which provides for continuity of care -- records access -- when an MTF patient receives care under CHAMPUS should result in higher quality, more effective care. One would hope that the performance measures would promote such a system to the extent it is worthwhile.

(8) The performance measures should allow us to compare the performance of our health benefit delivery system with other health benefit delivery systems. Even though there is no other health benefit delivery system which is truly comparable to ours, we must be able to look at our performance and compare it with other systems. We may be providing six outpatient visits per eligible beneficiary per year compared with about four visits per member per year for a Kaiser, but it may be that we are counting telephone consultations as visits while Kaiser is not. Or, we may be counting immunizations as a visit, and we must provide significantly more immunizations per year because of line requirements to have shot records always current.

(9) The performance measures should be adaptable to the changing world. The CWU has remained static for a number of years while the practice of medicine has changed significantly. It is very difficult to get such a measurement changed; therefore, rather than being a management tool, the measurement can become the master. The proposed Health Care Unit (HCU) is tied to the Uniform Chart of Accounts (UCA) so that as the UCA adapts to account for the resources, the output measure changes.

SUMMARY

We are faced with a health care delivery system which is split into two separate parts, and which has numerous competing missions. With the current performance measures, major portions of the system are completely ignored, and it is not possible to measure our performance in the health benefits arena against the performance of other health benefit delivery systems. The result is an inability to support required programs, and the creation of incentives which increase government costs. In this presentation, we have developed a set of objectives for performance measures which, if satisfied, will meet our needs. The next steps in the process are to develop criteria for each objective, and give appropriate weights to each criteria.

HOSPITAL CASE MIX:
CURRENT RESEARCH EFFORTS BY THE NAVY MEDICAL DEPARTMENT

CDR Karen A. Rieder, NC, USN

INTRODUCTION

During the past three years, the Health Care Services Research Department at the Naval School of Health Sciences, Bethesda Maryland, has been conducting ongoing research in hospital case mix to answer the following questions:

1. How does the Diagnosis Related Groups (DRG) classification scheme compare to the patient grouping strategies normally used by the Navy?

2. Can DRGs be used as an analysis tool for monitoring hospital performance and for allocating resources within the Navy?

3. Are DRGs a valid patient grouping method for the Navy Medical Department, or are there additional variables, some of which may be unique to military settings, that will help explain differences among facilities in relation to length of stay?

The Navy's interest in DRGs developed as an attempt to help explain the considerable variation in length of stay data across Navy hospitals. The commonly used workload measures, such as admissions, outpatient visits, occupied bed days, and the Composite Work Unit provided minimal insight into the reason for these variations. Therefore, the frequently accepted explanation that differences in hospital case mix are a major cause of these variations was examined.

Grouping Strategy

To ascertain the efficacy of DRGs as a patient grouping strategy, their ability to account for variation in length of stay was compared to four alternative grouping techniques. These techniques are common classification methods used by the Navy to group patients and include either (1) major diagnosis class, (2) disease subcategory, (3) three digit diagnosis code, or (4) disease subcategory subdivided by surgery and complications.

To test DRGs as an alternative patient grouping method, it was necessary to convert the diagnosis and surgery codes used by the Navy to the codes required to assign a patient to a DRG. The Research Department staff completed a computer edit which replaced each ICD-9 (International Classification of Diseases, 9th Revision)[7] diagnosis code and ICPM (International Classification of Procedures in Medicine)[8] surgery code with an appropriate ICD9-CM (Clinical Modification)[1] code. This procedure was not designed to provide an exact mapping between the two systems but ensured that patient records were assigned to the correct DRG. Ninety percent of the 1980 inpatient records were assigned to a DRG: the other 10% had ICD-9 codes that were so vague they could not be converted, or the charts had incomplete data. The total sample consisted of approximately 188,000 inpatient records. As an aside, the 1982 inpatient records were recently converted using a revised conversion process. This time, 98% of the records were assigned to a DRG. This computer bridge has been shared with the Army and is currently being validated through a contract with the Commission on Professional and Hospital Activities (CPHA).

Findings indicated that DRGs explained significantly more of the total variation in length of stay for patients at naval hospitals than the other currently used grouping techniques. As indicated in Table 1, DRGs accounted for about 25% of the variation in patient length of stay, which was more than any of the comparison methods tested. Using a F-test,[4] this difference was found to be statistically significant. Perhaps more importantly, DRGs required that the sample be subdivided into 445 groups whereas grouping the sample by principal diagnosis code required 905 groups. This smaller number has definite benefits for hospital utilization review since there are fewer patient groups to monitor.

However, we also found that DRGs were able to explain less than 25% of the total variation in contrast to the New Jersey study findings which accounted for 43% of the variation in length of stay.[5] Therefore, DRGs are a better method

Table 1

PERCENTAGE OF VARIATION IN LENGTH OF STAY
EXPLAINED BY SELECTED PATIENT GROUPING METHODS
NAVAL HOSPITALS, CY 1980

Patient Grouping Method	Number of Groups	Percent of variation explained
Comparison methods		
Major diagnostic class	18	5.1
Disease subcategory	118	15.5
Disease subcategory by subcategory and complications	451	20.8
Three digit diagnosis code	905	21.4
DRGs	445	24.5

for explaining variation in LOS data than the methods normally used by the Navy to classify patients, but they explain less variation than in the civilian community.

Hospital Performance

To evaluate the use of DRGs to monitor hospital performance, two studies have been conducted. One used length of stay as the dependent variable while the second looked at convalescent leave days.

The length of stay (LOS) study was undertaken to demonstrate how the DRG methodology could be used as an analysis tool to investigate very practical management and quality assurance questions. Evaluating differences in length of stay is difficult because length of treatment can be dramatically affected by many factors, such as diagnosis, disease severity, hospital characteristics, as well as administrative policies and procedures, and individual physician practice. The ability to identify comparable groups of patients is especially important because naval hospitals are so diverse with respect to location, teaching status, and workload (Table 2). Therefore, in order to conduct utilization review, one must be able to identify and have access to length of stay data for specific groups of patients that are comparable across all the hospitals being studied.

Table 2

LOCATION, TEACHING STATUS, AND WORKLOAD
NAVAL HOSPITAL, FY 1980

Teaching Status	Number
Residency Teaching Hospitals	4
Family Practice Teaching Hospitals	5
Non-teaching Hospitals	26
Total	35
Location	**Number**
United States	24
Outside U.S., ashore	11
Total	35
Workload	**Range**
Admissions	95 to 31143
Daily average number of patients occupying beds	1 to 499
Average length of stay (days)	2 to 9

To do this, LOS data from matched hospitals were adjusted to determine to what extent variations could be accounted for by patient case mix. The results indicated that case mix differences explained some, but not all, of the differences in total LOS between similar facilities. In fact, for specific DRGs, average length of stay at one facility was over twice as long as that for the comparison hospitals.

These results could be interpreted in at least two alternative ways. First, at those facilities with longer lengths of stay, administrative policies and procedures could be contributing to the unexplained variance. If this explanation is correct, medical audits could be conducted to identify specific problem areas where policy changes could help realign a facility's average length of stay data with its peers. The second interpretation is that DRGs do not adequately account for differences in patient case mix among naval hospitals. One could argue that patients at some hospitals require more medical attention than patients at another facility. For example, DRGs do not account for progression or stage of disease, a fact well discussed in the recent literature.[2] Perhaps the "outlier" facility had a higher proportion of patients at a more serious stage of illness who required in-creased treatment time.

The second study using DRGs to monitor hospital performance compared the four patient grouping methods for their ability to explain differences in convalescent leave (CL) among active duty Navy and Marine Corps personnel. The assumption made was that patients within a DRG tend to require the same amount of convalescent leave.

For 15,791 dispositions during 1980, results indicated that the greatest amount of variation in convalescent leave - 40.9% - was accounted for by the DRG methodology (Table 3), and that 10 DRGs generated 41% of the CL days for active duty personnel. Although DRGs accounted for a slightly higher percentage of the variance than three digit diagnosis codes (40.9% versus 40.1%), this difference was not statistically significant. However, DRGs were able to explain this slightly higher variance by dividing the population into fewer groups (350 groups for DRGs versus 634 groups for three digit diagnosis codes). This lower number of groups is desirable because it is much easier for a manager to monitor fewer patient groupings.

Table 3

PERCENTAGE OF VARIATION IN RECOMMENDED CONVALESCENT LEAVE DAYS ACCOUNTED FOR BY SELECTED PATIENT GROUPING METHODS FOR ACTIVE DUTY NAVY AND MARINE CORPS PERSONNEL, CY 1980

Patient Grouping Method	Number of Groups	Percent of variation explained
Major diagnostic class	22	20.9
Disease subcategory	112	28.4
Disease subcategory by subcategory and complications	376	36.4
Three digit diagnosis code	634	40.1
DRGs	350	40.9

The remainder of the study estimated the potential savings in lost work time that could result by reducing CL days for those DRGs that exceed the average amount recommended by all naval facilities. This was calculated from a formula that delineated the number of dispositions within the selected DRG at a specific hospital and the average number of convalescent leave days granted by all facilities for that DRG.

In order to develop a patient grouping method based on DRGs that would optimally account for differences in convalescent leave among active duty Navy and Marine Corps personnel, one should consider at least two further steps. The first strategy is to recategorize variables used by the DRGs developers into groups that are more appropriate to the active duty population in terms of age. Secondly, certain DRGs may also be combined, thus reducing the total number of groups needed to account for differences in convalescent leave. For example, DRGs 159-162 are used to group patients over age 17 who required surgical repair of a hernia. For these four DRGs the mean convalescent leave days ranged from 15.7 to 17.3. Since there is very little difference in convalescent leave among these DRGs, they could be collapsed into one group.

The results of these two studies demonstrate that DRGs can be used to monitor not only length of stay but that patient groupings based on DRGs may also be homogeneous with respect to other variables, such as convalescent leave.

The next question becomes how can this system impact on resource allocation?

Allocate Resources

Though a case mix index based on length of stay is appropriate for use in utilization review, one based on relative costs per patient case is desirable to make resource allocation decisions. Yet, at the present time, Navy medical accounting systems do not allow for detailed cost determinations. Hospital and clinic reimbursement are based on the Composite Work Unit (CWU) which does not account for differences in patients treated i.e., case mix. Our FY 85 research efforts will be directed towards the application of case mix methodology to the allocation of resources to Navy medical facilities. During this study we will identify, compare, and evaluate the implications of allocating resources using various techniques that account for patient case mix. Resource allocation systems developed by civilian researchers and the Veterans Administration will be studied for their possible application to the Navy Health Care System.

Unique Military Variables

As a result of our studies we have found that DRGs, although better than other currently used grouping methods, explained less variation in patient length of stay for naval hospitals than that reported by civilian researchers. This is partly due to the fact that current Navy diagnosis and surgery codes are less precise than the codes used by the DRGs. But to evaluate whether the current DRGs are a valid grouping method for the Navy, we have completed two further studies.

First, we explored whether other factors already coded on the Navy discharge abstract data base significantly contributed to length of stay variance in naval hospitals. Second, we investigated differences in severity of illness within a DRG as one possible explanatory variable using a nursing patient classification system, which provided an estimate of the daily nursing care hours each patient requires. If one accepts the assumption that more severely ill patients require increased nursing care, patient classification may serve as an estimate of patient disease severity within DRGs and is data already being collected by all of our hospitals for estimating staffing levels. The results of both of these studies will be presented at a future session.

In conclusion, the studies conducted by the Research Department have demonstrated that DRGs are a preferred grouping strategy which could assist military program managers to monitor hospital performance and to allocate resources. The findings also suggests that some modifications of the DRG grouping could be necessary to increase its applicability for the military setting.

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THE AMEDD PERFORMANCE MEASUREMENT STUDY

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BACKGROUND AND PURPOSE

In 1982 the US Army Health Services Command (HSC) Productivity Study staff surveyed a cross-section of Army Medical Department (AMEDD) health care administrators and providers to assess satisfaction with the extent to which the traditional measure of patient care workload, the Medical Care Composite Unit (MCCU), represented accurately the major patient care output of Army Medical Treatment Facilities (MTF). It was determined that the MCCU was no longer adequate for use in measures of system performance needed for resource justification and resource allocation, nor individual performance including productivity and quality assurance. It was apparent that the MCCU did not give appropriate credit for the increased sophistication of ambulatory medicine, the added requirements of quality assurance activities, nor many non-patient care functions to include readiness and training. Therefore, the Army Surgeon General directed HSC to conduct a study with the following purpose:

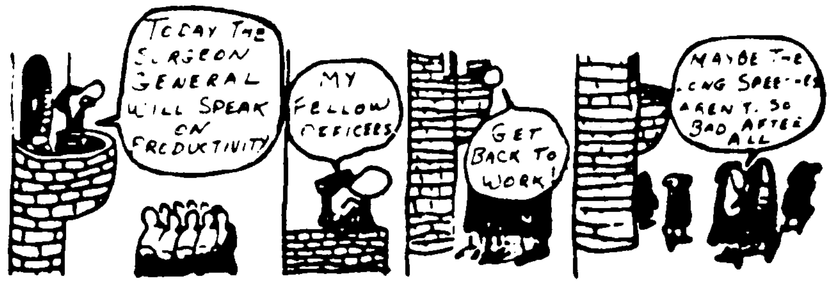
> To evaluate current measures of AMEDD health care system performance and, as required, develop better measures and workload data capture systems which accurately reflect actual resource utilization.

SYSTEMS APPROACH TO PRODUCTIVITY MEASUREMENT

To develop a system of performance measurement, it was necessary to devise a framework within which to consider productivity and performance measurement. Of course, one philosophy of productivity improvement is that given in Figure 1. However, in our approach we consider productivity to be a systemic concept concerning the conversion of inputs to outputs by the system under consideration. This concept can best be applied to the hospital setting utilizing a systems approach as depicted in Figure 2. The "raw" inputs to the hospital, labor,

Figure 1

PRODUCTIVITY PHILOSOPHY

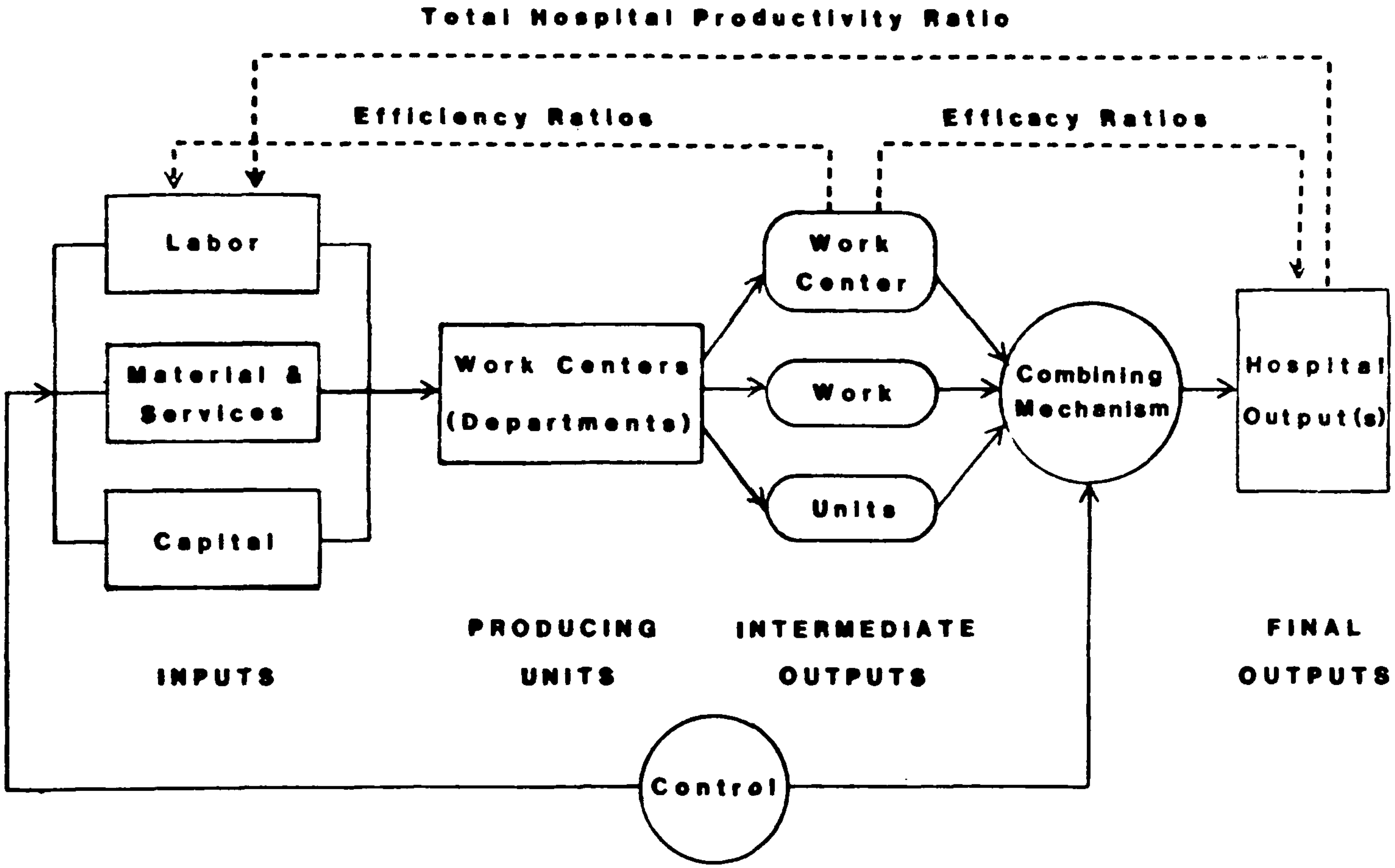


materials and services, and captial can now be identified consistently across all military hospitals and allocated to various workcenters, departments or "producing units" under the Uniform Chart of Accounts (UCA). The work centers or departments produce what might be called "intermediate outputs" such as laboratory tests, radiology studies, prescriptions, nursing manhours of care, and patient days. Notice that patient days are considered only intermediate products in this model, a major difference from the MCCU approach. All of these intermediate products are ordered and combined by the professional component of care into final products. Ideally, these final products would be such esoteric outputs as change in health status, medical and patient or community education, or medical readiness. However, in the absence of satisfactory measures for such output, we usually choose some measure of care provided or services delivered as the final product. As indicated earlier, the MCCU, which has been the traditional measure of final product, is not a very good one. This idea will be expanded in the next section.

By separating the process of health care delivery into the above components, two very important ideas can be introduced. The performance of the producing units may be measured by looking at what might be called "efficiency ratios"

Figure 2

SYSTEMS MODEL OF HOSPITAL PRODUCTIVITY



such as lab tests per manhour, nursing hours per bed day, or cost per prescription. The performance of the professional combining mechanism may be evaluated by determining "efficacy ratios" which compare how effectively and appropriately the intermediate products have been ordered and utilized to produce the final product. As will be seen later, it is very important to distinguish between these two related but different components of productivity. It may be that each of the support departments in a given hospital may be the most efficient in, say, a region. That is, the laboratory may have the lowest cost per weighted procedure, the radiology department may have the greatest output per manhour, etc. But, the lab tests and radiology films may have been ordered in far too great a quantity for the severity level and case mix of the final patient product of the hospital. This may be true conceptually, but it will continue to be impossible to detect until a measure of hospital output is developed that is sensitive to real differences in case mix.

NEED FOR IMPROVED MEASURES OF OUTPUT

The MCCU has been utilized as a measure of hospital output since about 1957. During this period it has been virtually unchanged, although the practice of medicine has changed dramatically. The MCCU, or Composite Work Unit (CWU) as it is known in the other services, is defined as follows:

$$MCCU = (10 \times ADM) + (10 \times LB) + OBD + (0.3 \times OPV)$$

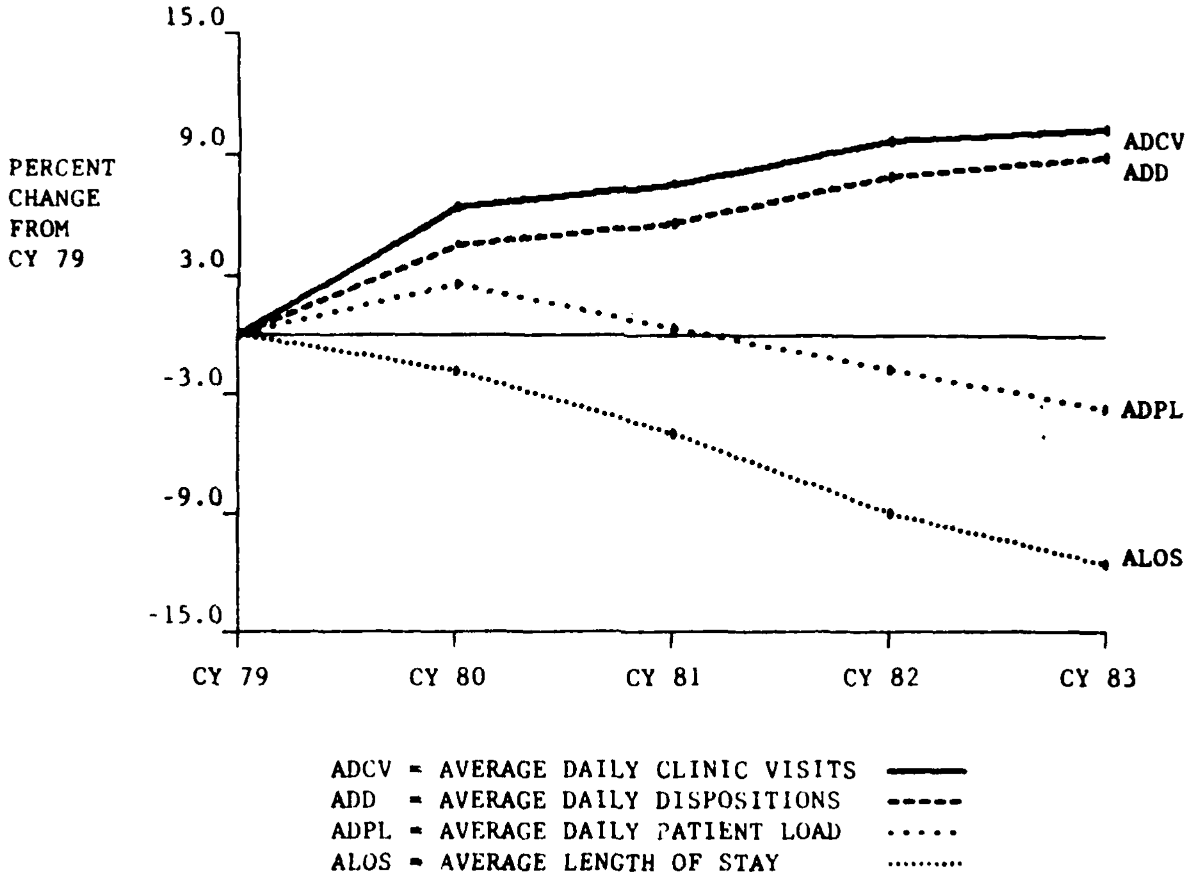
where,
ADM = Number of Admissions
LB = Number of Live Births
OBD = Number of Occupied Bed Days
OPV = Number of Outpatient Visits.

Several problems with the MCCU are well known. First is the fact that a major component of the MCCU is clearly an intermediate product rather than a final product. Figure 3 clearly shows the impact of this shortcoming. In the sense of performance assessment, clinic visits and inpatient dispositions can be considered as final products which contribute to our mission--providing patient

Figure 3

MCCU COMPONENT TRENDS

(1979 - 1983)



SOURCE: IPDS Worldwide Database. All patients including transfers.

care. However, patient days are intermediate products which are not an "end" but a "means to an end," the end being treated patients. Changing patterns of utilization, medical practice, and technological advances have very significantly reduced the average length of patient stay and, therefore, average daily patient load or beds occupied. This has resulted in a leveling off of the MCCU. The reduced patient stays are clearly shorter at the end of the stay rather than the beginning. This means fewer less costly "hotel services" are being provided but the intensity of resources applied to the actual acute days of care has increased. Certainly there is no less involvement of physicians, support staff assets, and other resources that are more costly than those associated with hotel services in producing the complete patient stay. A preferred measure of output would be based on the "case" and the "episode" rather than the patient day to indicate greater productivity when fewer days are provided to treat the same or increased numbers of patients with acceptable quality of care.

A second major problem with the MCCU is the relative value of inpatient versus outpatient care given by the weights on admissions, bed days, and clinic visits. It is easy to see from the formula that, given the average length of stay for Army patients worldwide is about six days, the typical admission generates 16 MCCUs. Since the weight on a clinic visit is only 0.3, the equivalent "substitution rate" is 53:1. That is, a physician would have to see 53 patients in the ambulatory setting to generate the equivalent workload in MCCUs of a single inpatient stay. Thus, when resources are allocated on the basis of the number of MCCUs generated, even when good medical judgement would dictate treating, say, a vasectomy as an outpatient case, the "logical" course of action is to admit. Similarly, when an "extra" day in the hospital results in one more MCCU with its associated resources, the tendancy may be to "keep the patient a little longer" than is really medically necessary. Clearly, the last few days of care are not very expensive for the hospital in most cases. This is an excellent example of how the measurement tool prescribes practice.

Figure 4 depicts a third major problem with the MCCU, its inability to

Figure 4

WORKLOAD MEASUREMENT

INPATIENT A: 45 year old male presents with chief complaint of crushing substernal chest pain. Admitted to CCU, Diagnosis: AMI. Third day develops cardiogenic shock, undergoes emergency cardiac catheterization and open heart surgery (CABG). Dies on sixth hospital day.

Est Cost $50,000 MCCU = 16

INPATIENT B: 45 year old male presents with chief complaint of crushing substernal chest pain. Admitted to CCU. Evaluation reveals no evidence of cardiac diagnosis but reflux esophagitis on barium swallow. Transferred to ward on third day. Treated with antacids and discharged sixth hospital day.

Est Cost $5,000 MCCU = 16

INPATIENT C: 16 year old active duty male presents with sore throat and fever. Unable to eat and care for himself in barracks. Unit has gone to field. Admitted and treated with rest, fluids, and aspirin. Discharged on sixth hospital day.

Est Cost $1,500 MCCU = 16

OUTPATIENT A: 30 year old female presents with 2 cm lump in right breast for outpatient breast biopsy. Diagnosis: nonmalignant lesion.

Est Cost $800 MCCU = 0.3

OUTPATIENT B: 79 year old male with weakness in left leg of questionable duration. CAT scan reveals old infarct with no new lesion. No treatment given.

Est Cost $400 MCCU = 0.3

OUTPATIENT C: 19 year old active duty male returns three days post emergency room visit for scalp laceration. Sutures not yet ready to be removed. Return in two days.

Est Cost $25 MCCU = 0.3

distinguish between different types of inpatients or different types of outpatients. This figure contains descriptions of three inpatients and three outpatients, a very rough estimate of the equivalent civilian cost of care, and the number of MCCUs the patient would generate. These examples again demonstrate how the MCCU provides no incentives to treat patients on an outpatient basis nor to reduce the length of stay for less severe cases. The measure, in essence, has dictated how the care is delivered.

In an attempt to satisfy some of the criticisms of the MCCU, and at the same time develop an output measure based on data available under UCA, the Office of the Assistant Secretary of Defense for Health Affairs (OASD[HA]) contracted Vector Research, Inc., of Ann Arbor, Michigan, to develop the Health Care Unit (HCU). Using FY 82 UCA cost and workload data in regression analysis, the standardized weights depicted in Figure 5 for the two-digit UCA accounts were developed.

The HCU is certainly a move in the right direction. It separates Medical inpatients from Surgical inpatients and Family Practice clinic visits from Orthopedic clinic visits. Yet, each Medical admission is given the same amount of workload credit except for length of stay and Outpatients B and C in Figure 4 would still record the same amount of resource use in terms of HCUs. It is likely that the subdivision at the two-digit UCA level is not sufficiently fine to determine real case mix differences. Research needs to be done, however, to determine if extending the HCU concept to the third or fourth digit level might be sufficient for output measurement. In addition, the current HCU weights only decrease the equivalent substitution rate of outpatient care for inpatient care from 53:1 to about 40:1 on the average.

Of course, as is being thoroughly discussed in other areas of this conference, Diagnosis Related Groups (DRGs) are being considered as a basis for the management, assessment, and measurement of inpatient workload. If we can couple

Figure 5

REFINED HCU WEIGHTS

HCU Clinical Area		Disposition Weight	OBD Weight	Visit Weight	Dental Proc Weight
Medical	(AA)	.097	.137		
Surgical	(AB)	.319	.154		
OB/GYN	(AC)	.216	.148		
Pediatric	(AD)	.121	.120		
Orthopedic	(AE)	.604	.078		
Psychiatric	(AF)	.330	.107		
Medical	(BA)			.022	
Surgical	(BB)			.028	
OB/GYN	(BC)			.021	
Pediatric	(BD)			.017	
Orthopedic	(BE)			.028	
Psychiatric	(BF)			.026	
Family Practice	(BG)			.021	
Primary Care	(BH)			.021	
Emergency	(BI)			.027	
Flight	(BJ)			.030	
Underseas	(BK)			.015	
Dental Service	(CA)				.005
Dental Lab	(CB/CC)				.002

this with the corresponding concept in the outpatient area, i.e., Ambulatory Visit Groups (AVGs), we would have the basis for a weighted measure of patient care output. The weights as signed to the various categories of inpatient and outpatient care would be based on the relative resource requirements of typical cases in each category. For research purposes, the logical place to start is, similar to what the Veteran's Administration (VA) has done, to use the Medicare weights published by the Health Care Financing Administration (HCFA). Other weights are available from the VA and the State of New Jersey but the services should also investigate developing a unique set of weights for military medical care.

EFFICIENCY VERSUS EFFICACY

As mentioned previously, the systems approach to performance or productivity measurement described in Figure 2, coupled with an output measure based on, for example, weighted DRGs and AVGs, which is sensitive to the expected resource requirements of the actual case mix of the patient population, would allow the analysis of the efficiency versus efficacy of resource utilization. The fundamental relationship which relates these two components to some total measure of hospital productivity may be represented as follows.

$$\frac{\text{WORK UNITS}}{\text{TOTAL INPUT}} \times \frac{\text{TOTAL OUTPUT}}{\text{WORK UNITS}} = \frac{\text{TOTAL OUTPUT}}{\text{TOTAL INPUT}}$$

The first ratio above is an "efficiency ratio" which is a measure of how much intermediate product of a work center is generated per unit of total input measured, usually, in dollars. The second ratio is really the reciprocal of a productivity-type ratio and is here called an "efficacy ratio". This ratio relates the work units produced by the work centers to the total output of the hospital and, thus, measures how well the intermediate products, e.g., lab tests and x-rays, have been utilized in producing the case mix treated by the hospital. The final ratio is the common expression of a "total productivity ratio" in that it relates total output to total input. The meaningfulness of these ratios is totally dependent upon the appropriateness of the measure of total output. Again, historically this has been the MCCU.

In Figure 6 an example is provided using current UCA data to illustrate these concepts. In this example, the HCU is used as the measure of final product since it does begin to distinguish case mix although not nearly to the degree necessary for such analysis. This data is taken from actual UCA reports of three similarly sized Army MTF. The work units (intermediate products) in each of the ancillary areas (work centers) are standard weighted units. "Cost

Figure 6

EFFICIENCY VS EFFICACY OF ANCILLARY SUPPORT

(1) HOSPITAL	(2) ANCILLARY SERVICE	(3) COST PER WORK UNIT	(4) WORK UNITS PER HCU	(5) ANCILLARY COST PER HCU
A	Pharm	$ 4.78	32.0	$ 152.96
	Path	0.50	220.7	110.35
	Rad	2.74	21.2	58.09
B	Pharm	$ 5.31	33.8	$ 179.48
	Path	0.57	299.4	170.66
	Rad	3.64	18.7	67.91
C	Pharm	$ 7.10	35.5	$ 252.05
	Path	1.12	185.7	207.98
	Rad	4.12	13.2	54.43

per work unit," Column (3) consists of "efficiency" ratios for the ancillary support departments of the three facilities. Notice the wide range of values. It would appear, on the surface, that Hospital A is much more efficient than Hospital C. Indeed, since these values are the only ones that appear on an actual UCA report, Hospital C might be asked to explain these figures. For each of the MTF, the HCU was calculated and the weighted work units per HCU displayed in Column (4) as our "efficacy" measure. Notice again the wide variation in facilities with similar size and, it turns out, mission. If the measure of final output, the HCU in this case, really did adjust for differences in case mix of the patient workload, then these differences in efficacy could be examined to determine if policies surrounding professional medical care delivery were responsible. As was indicated in Dr. Horn's presentation, physicians could be educated as to differences in their practice patterns. The final column of the display indicates the overall impact of these differences. These "ancillary cost per HCU" ratios in Column (5) measure the overall "total productivity" of the ancillary departments and are the product of Column (3) times Column (4) as was suggested in the fundamental relationship given earlier. It can be seen, for example, that even though the Radiology Service at Hospital C appeared to be the most inefficient, the fact that the physicians there are using less costly radiology studies even after adjusting for case mix (as much as the HCU will allow), results in the greatest overall productivity in treating final products, i.e., lower ancillary cost per HCU.

In summary, the ability to separate the performance of individuals, clinics, hospitals, regions, or commands into components as described above, is very desirable for management purposes. It would allow the monitoring of productivity from the individual to the command level while targeting the appropriate deficiency when performance is not as desired. It would also allow the setting of standards of performance for efficiency, efficacy, and overall productivity in a way that could be related to the actual case mix of the hospitals' patient populations. Finally, it would prevent the organizational dysfunction associated with having to "explain to higher headquarters" seemingly poor performance which may be a function of the measures utilized for evaluation rather than the efficiency or efficacy of actual performance.

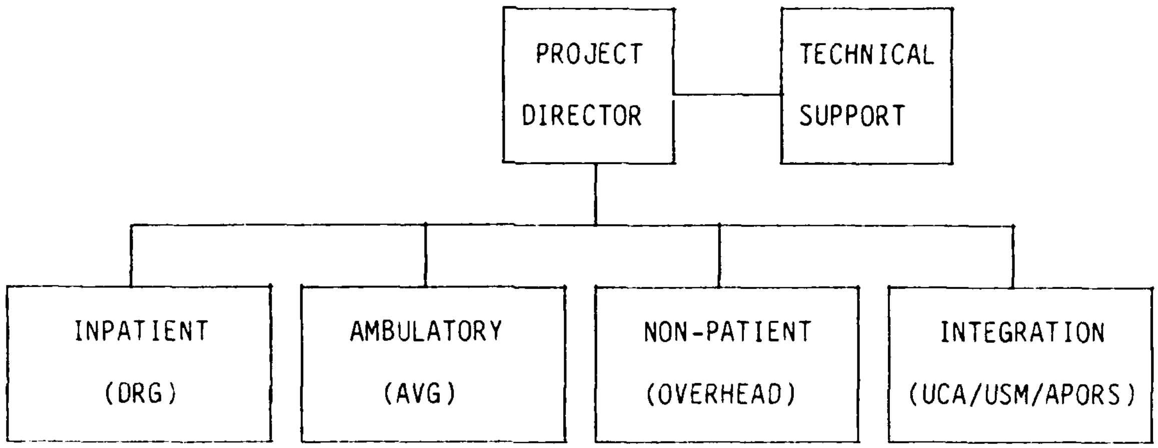
ORGANIZATION OF STUDY EFFORT

US Army Health Care Studies and Clinical Investigation Activity (HCSCIA), under the guidance of the Chief of Staff, HSC, has organized the Performance Measurement Study into four major categories as shown in Figure 7. Although the details of work being done under each of these headings are provided elsewhere in this article and these proceedings, major activities are summarized here for convenience.

INPATIENT CARE: Adapting Medicare Diagnosis Related Groups to AMEDD performance monitoring. Work to this point has involved solving problems associated

Figure 7

AMEDD PERFORMANCE MEASUREMENT STUDY (PMS)



with converting IPDS ICD-9 data to the Medicare DRGs which are defined in terms of *ICD-9-CM coded patient records. Coordination* is being made with Air Force and Navy researchers to develop best possible and consistent DRG assignments. Activities are being coordinated with the Patient Administration Systems and Biostatistical Activity to facilitate introducing DRG based analysis potential to MTF commanders.

AMBULATORY CARE: Establishing an Ambulatory Care Data Base (ACDB) to capture previously non-existant diagnostic and resource use data in the ambulatory setting. Currently mark sense forms are being developed and hardware leased to expand the Redstone ACDB project to five additional sites. A major problem was solved when the Assistant Secretary of the Army (Financial Management) approved a sole source contract effort to lease equipment, develop software, and design forms in support of the ACDB. The ACDB will reside in the Fort Detrick Data Processing Center.

NON-PATIENT CARE: Including the impact of training, readiness, mobilization, and quality assurance efforts on the ability of providers and the MTFs to deliver direct patient care. Data capture methods which are compatible with the ACDB and Uniform Staffing Methodologies (USM) data collection efforts are currently being explored.

SYSTEMS INTEGRATION: Relating PMS efforts to other ongoing studies and projects such as UCA, USM, and Army Performance Oriented Reviews and Standards (APORS). A Performance Measurement Data Base is being integrated at the Fort Detrick Data Processing Center to support all elements of the project. Current efforts are directed toward determining the relationship between UCA costs at the workcenter level and DRG based case mix indices.

TRI-SERVICE COOPERATION

Realizing that a unilateral effort by the AMEDD to replace traditional workload measures in budget defense at DOD and before the Congress might be counter productive, The Surgeon General directed the PMS study group to attempt a Tri-Service effort. The first step in this attempt is this Tri-Service Performance Measurement Conference with representatives from the Army, Navy, Air Force, Veterans Administration, and the Office of the Assistant Secretary of Defense (Health Affairs). The final AMEDD PMS staff will be assembled by 31 October 1984 and the project should produce significant interim results by 30 September 1985. Continued coordination with the Navy and Air Force efforts will be accomplished throughout the study, as will contacts with OASD(HA) and OCHAMPUS.

AMBULATORY CARE DATA BASE

LTC Terry R. Misener, ANC, USA

INTRODUCTION

Purpose

Recognizing the need for an Ambulatory Care Database (ACDB), The Army Surgeon General tasked the Health Care Studies Division (HCSD), Health Care Studies & Clinical Investigation Activity (HCSCIA), to examine the feasibility of implementing such a study. The study proposed to answer two questions: (1) Is it possible to capture the necessary information for an ambulatory database? (i.e., will health care providers complete encounter forms in addition to entries they are required to make in the outpatient medical record). (2) What types of reports can be generated from the data gathered?

Background

Although reports to document Army outpatient workload are generated on a recurring basis the reliability of the data and their usefulness has been questioned. The outpatient's individual health record contains routine information expected in any outpatient treatment setting. However, obtaining aggregate data, auditing a random set of outpatient records, documenting individual health care providers' practice profiles, or carrying out epidemiological research, has not been possible. A literature search was conducted to include a review of the development of standardized diagnostic codes, data systems, methods of data collection, and medical information management.

LIMITATIONS

Resource constraints included both time and personnel. The data collection phase of the study was to be completed by the end of the 3D QTR FY 83. No full-time employees could be added for the study, i.e., required personnel were within the HCSD, the MEDDAC where the study was to be carried out, and from shared data processing staff.

Prior studies demonstrated that the data gathering tool needed to be provider centered. Any table look-ups required by the provider should be kept to a minimum, and providers must feel the project to be symbiotic, i.e., they would gain something in return for their efforts. To be most effective, the data encounter form was not to exceed one page (8 ½ x 11).

METHODOLOGY

Overview

A six month project was undertaken to collect outpatient encounter information (including demographic data, workload, and diagnoses) at Fox Army Hospital, Redstone Arsenal, Huntsville, Alabama (1 Nov 82 - 31 Mar 83). The 10,000 - 13,000 patients seen each month, the clerical staff, and primary care providers all assisted in completing a "mark sense" data capture form.

The hardware selected was the National Computer Systems (NCS) Sentry 7001 Table-Top Optical Mark Sense Reader, with tape drive and transport printer attached. This equipment was compatible with hardware existing within HSC. NCS forms with an individual lithocode printed on each form facilitated merging or finding records easily. NCS was the only vendor known to provide this feature.

A two-sided, single page, multicolor (purple and red) encounter form was designed (see Appendix 1). The face validity of the form was assured by the investigators after consultation with other health care providers, public health professionals, and providers at Redstone.

Overall Army needs mandated that diagnostic information be a priority element in the database. The International Classification of Health Problems in Primary Care (ICHPPC-2) was selected (truncations of the ICD-9 classification. The codes were simple to use, and had previously been utilized in the Army

Family Practice Database. The encounter form allowed space for only 250 of the possible 371 diagnoses. The remaining diagnoses not on the menu could be found in a preprinted index and then entered in spaces provided. Along with the demographics, the diagnostic information provides the core of the epidemiological data. These same data gave the MEDDAC the ability to carry out peer review and retrospective chart audits in a reliable and objective manner.

Procedures

After a one day pilot test of the instrument at Fort Hood, Texas, minor form design and instruction sheet changes were made. A major change, suggested and incorporated, was to request able patients to complete their portion of the form. Staff training at Redstone began two weeks prior to the collection of data.

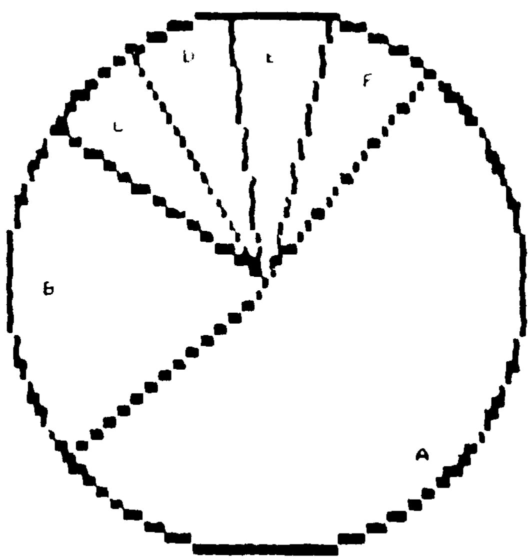
Prior to the implementation of the study, code numbers were assigned to each care provider and each clinic. Separate instruction sheets were prepared for patients, clerical staff, and care providers.

Patients were instructed to complete their portion of the demographic-type data which was checked for completeness and accuracy by the clerical staff who entered the clinic identifier, family member prefix (to identify household status of the patient), appointment status, and time in. The remainder of the form was completed by the providers. The clerical staff monitored completeness and entered the time out of the clinic. The provider had to select one of 371 diagnostic codes as the primary reason for seeing a patient on a particular visit. Additionally, the providers were allowed to select up to five secondary diagnoses germane to a particular visit (a secondary diagnosis was not required).

The patient portion of the form required about two minutes to complete; the provider data required about 30 seconds (after providers became familiar with frequently used diagnoses). Clerical staff required about 30 seconds to check and complete each form. After the encounter forms were completed and checked for errors in the clinic, they were taken to a central point in the Administrative Department of the MEDDAC, where one of three trained persons processed the records. Error-free and corrected forms were read by the scanner and output onto seven inch magnetic tape. Tapes were transferred to Fort Sam Houston, Texas, for processing, analysis, and report generation.

FINDINGS

The major study question was: will providers complete the encounter forms as requested? With approximately 60,000 records in the database, it has been demonstrated that personnel will complete the encounter forms. All primary provider visits included in the Medical Summary 302 Feeder Reports were counted in the study. Visits to physicians accounted for 53% of the total encounters; 47% were credited to other providers (Figure 1).



PROVIDER PERCENTAGES FOR TOTAL VISITS
For Entire Redstone Dataset

	LABEL	VALUE	%
A	Physicians	31181.0000	52.95
B	Nurses	12153.0000	20.64
C	Physical Therapy	3994.00000	6.[illegible]
D	PAs	3773.00000	6.4[illegible]
E	Corpsmen	3566.00000	6.06
F	Other	4223.00000	7.1[illegible]

Figure 1

The second study question was: what reports can be generated from the acquired data? Reports can be partitioned into three major categories: 1) provider profiles, 2) reports useful to management, and 3) special reports not generated on a recurring basis. The number of reports possible are limited only by the user's imagination.

DISCUSSION

Primary care providers received profile reports of their practice on a monthly basis. The report included the following information:

- a list and frequency of all primary diagnoses
- procedures reported
- patient demographic data
- beneficiary status of patients
- number and types of physical examinations
- average time patients spent in the clinic

Monthly aggregate reports useful to management were prepared and included:

- number of patients seen in each clinic
- number of forms completed by each provider
- information for the Medical Summary Report
- MED 302 Service Branch Total
- MED 302 Service Branch Total/OH and TMC
- number of exams chaperoned per clinic
- students from other countries

Twenty diagnostic groups accounted for 77.9% of the diagnoses made during November, 75.4% in December, 76.6% in February, 78.9% in March, and 77.1% of the total diagnoses.

To address reliability of data captured, the investigators randomly selected 30 encounter forms and compared the entries against the outpatient charts for the same encounter. The information on the encounter forms compared identically in 100% of the cases.

A major concern of the hospital staff was fear that the total encounters reflected by the study would be fewer than the M[illegible] based on the Medical Summary 302 count. If the MEDDAC were to use the encounter system to replace all Medical Summary 302 feeder reports, would the activity be penalized? During the training phase this concern was alleviated, when one clinic, which had counted 78 patient encounters on the MED 302 feeder report the previous day, ran their encounter forms and found 120 encounters documented, an increase of 54%. A major strength of the encounter system is that the counts or visits are completely auditable; i.e., charts can be pulled to compare encounter forms to actual patient visits. This information is more difficult to extract from Medical Summary 302 feeder reports.

Near the end of the study period, care providers and clerical personnel participated in a survey to measure their opinions of the encounter form and suggestions (additions/deletions) to increase its effectiveness. Twenty percent of the care providers indicated they would like to receive the practice profile report on a continuing basis. When asked if use of the form should be adopted Army-wide, 21% said yes because they felt the form would give good estimates of workload; 68% said no, their reasons focused on additional time spent in filling out the form, which caused them to see two to four less patients per day; 11% had no opinion. (Arguments regarding fewer patients seen were felt to be artifacts not validated by administrative data, i.e., clinic hours, backlogs, or number of patients seen, were not affected.) Forty-seven percent felt information gained by completing the form was of value to them, while 53% felt it was of no value; 58% felt it was of value to Fox Army Hospital and the Army while 26% felt it was not; and 16% had no opinion. Only 10% said they preferred not to use the form at all. Most receptionists responded that the form was easy to use and agreed that the elements were in the most logical sequence; 90% felt the form captured all information required for report generation such as the MED Summary Report 302.

Several lessons have been learned from the study:

(1) No one page form can meet the needs of every clinic. It is suggested that further study be undertaken to develop several forms for use by different

specialties (e.g., pediatrics, obstetrics, occupational medicine, walk-in clinic, etc.).

(2) Several providers found the ICHPPC-2 diagnostic codes to be too general for their needs. This may be a result of the physicians' experience with the ICD-9 codes for inpatient diagnoses. This area bears further exploration.

(3) Time to fill out encounter forms would be greatly decreased if a registration system were developed to hold the patients' basic demographic data for call up.

(4) The need for trained and dedicated personnel to manage the project and to process encounter forms is obvious. It is not envisioned that added personnel would be required, but that a realignment of duties may be necessary as the system would greatly decrease the MED Summary 302 clerk's workload.

SUMMARY/CONCLUSIONS

The overall objectives of the study have been met.

(1) The elements to be collected for an ambulatory care database were identified. A significant number could be standardized across MTFs; however, the need for site specific variables is recognized.

(2) The majority of care providers will complete their portion of the encounter form.

(3) A single encounter form for all clinics is not acceptable.

(4) Data collected can be audited and provide an objective and valid ambulatory peer review and quality assurance mechanism.

(5) Provider and clerical staff satisfaction was surveyed.

(6) A comparison of encounters from the ACDB and the MED Summary 302 was accomplished.

(7) The number of reports that can be developed from the data are limited only by the users' imagination. The MED Summary 302 can be captured from the data elements.

(8) The OMR method of data capture was shown to be efficient and cost effective.

(9) Problems needing resolution in future use of an ACDB were identified.

(10) The need for command emphasis, at the highest levels, is obvious. Failure to fill out the form properly must be viewed as negatively as falsification of patient records.

RECOMMENDATION

We recommend that this inexpensive and reliable data collection methodology be tested at more sites for eventual implementation. The method is highly practical because it will interface with any system or mainframe conceptualized or planned at this time. It provides an excellent interim system until the Composite Health Care System (CHCS) is implemented. Finally, it can continue to be used in areas where a CHCS is not practical or planned, e.g., a field environment.

PLANS

It is the plan of the Army as a part of the Performance Measurement Study to implement the methodology of the Ambulatory Care Data Base Study to capture data for the ambulatory portion of the study. Data will be captured for a twelve month period of time at six medical activities for all outpatient encounters. The sites to be used are still under consideration; however, they will be chosen to represent a variety of configurations (i.e., facilities, types of troop units supported and with varying numbers of beneficiaries supported). In addition to providing data on approximately four million encounters, it will afford the opportunity to implement the lessons learned in the Redstone experience.

The study group will continue to maintain a liaison with the Yale group to insure that the elements captured will afford a comparable data set. At the same time, elements will be included to integrate several other database such as the UCA data.

Finally, since the Army's database will eventually serve several purposes, provider oriented elements will also be captured for such purposes as certification and specialty board requirements. Because of these requirements, it is mandatory that a diagnostic coding system such as ICD-9-CM be considered and that several encounter forms be developed, perhaps as many as one for each specialty service. Work with specialty consultants is under way at this time to make this determination.

Appendix 2 provides a conceptual model of the package that is planned for installation at each study site in addition to the mainframe support for the overall data analysis.

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NCS Trans-Optic EB01 11825 32?

OUTPATIENT ENCOUNTER FORM (TEST)

163

USE NO. 2 PENCIL ONLY

CLINIC | FMP | [illegible] YEAR MONTH | PATIENT'S INITIALS

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

PATIENT STATUS

INPATIENT
OUTPATIENT

APPOINTMENT STATUS

UNSCHEDULED
SCHEDULED
MISSED APPT
LATE TO APPT
OTHER

SEX

MALE
FEMALE

ETHNICITY

HISPANIC ORIGIN
NOT HISPANIC ORIGIN

RACE

BLACK
WHITE
AM INDIAN ALASKAN NATIVE
ASIAN PACIFIC ISLANDER
OTHER

SPONSOR SSAN

STATUS

ACTIVE DUTY
DEPN AD
RETIRED
DEPN RET DECD
OR
FED EMPLOYEE
CIV EMERGENCY
STU OTHER COUNTRY
OR
OTHER (ask clerk for help)

BRANCH OF SERVICE: ARMY, [illegible], NAVY, MARINE

FOR CLERK'S USE ONLY

IF STUDENT FROM OTHER COUNTRY: [illegible], GREECE, INDONESIA, [illegible], KENYA, KOREA, KUWAIT, MOROCCO, PHILIPPINES, SAUDIA ARABIA, SINGAPORE, TAIWAN, [illegible], YEMEN, OTHER

ACTIVE DUTY ARMY: OFFICER, WARRANT OFF, ENLISTED

DEPENDENTS AND RETIREES DO NOT USE

CIVILIAN OCC SERIES | PAY GRADE | [illegible] NUMBER

PAY GRADE | IF ARMY-DUTY MOS/SSI | UNIT

UNIT: STU 4, STU 5, STU 6, STU 7, STU 8, A CO, B CO, HHC, OTHER

TODAY'S DATE

DAY | MONTH | YEAR

JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC

TIME IN | TIME OUT

BOTTOM SECTION TO BE FILLED OUT BY PROVIDER

INITIAL VISIT FOR THIS PROBLEM? [illegible] NO

#1 CARE PROVIDER | #2 CARE PROVIDER

PROCEDURES

ADVICE HEALTH INSTR
ANTIBIOTIC
AUDIOMETRY
BIOPSY
BLOOD PRESSURE
CAST APPLICATION
CAST REMOVAL
DIAPHRAGM FITTING
DIETARY COUNSELLING
DRESSING CHANGE
EAR IRRIGATION
EKG
EKG ORDER FORM
ENDOMETRIAL BIOPSY
HEARING CONS.
HEMOCCULT
HOME VISIT
I & D
IMMUNIZATIONS
INJECTION OBSERV
[illegible]
KOH PREP WET MOUNT
LETTERS FORMS
LIQUID NITROGEN
MANIPULATION
MINOR SURGERY
MYRINGOTOMY
NASAL SMEAR
OB WORKUP
OT SERVICES
PATIENT CONSULTATION
PHYS THERAPY
PREG DETERMINATION
[illegible]
[illegible]
[illegible]
[illegible]
SPINAL [illegible]
SPIROMETRY
[illegible]
STOOL GUIAC
STREP [illegible]
SUTURE
SUTURE REMOVAL
TELE CONSULT
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
OTHER PROCEDURES

REFERRED TO

ALLERGY
COMM HEALTH NURSE
AUDIOLOGY
CARDIOLOGY
DENTAL
DERMATOLOGY
DIETICIAN
ENT
ER
FAMILY PRACTICE
GYNECOLOGY
INTERNAL MED
NEUROLOGY
OB CHAMPUS
OCC THERAPY
ONCOLOGY
OPTHALMOLOGY
ORTHOPEDIC
PEDIATRICS
PHYS THERAPY
PODIATRY
PRIVATE PHYSICIAN
PSYCHIATRY
RHEUMATOLOGY
SOCIAL WORK
SURGERY
UROLOGY
OTHER

JOB RELATED DIAGNOSIS

YES NO

DISPOSITION

HOME [illegible]
RETURN TO CLINIC
CONSULT
CHAMPUS REFERRAL
ADMITTED
QUARTERS
[illegible]

EXAMS

CHAPERONED

YES NO

DO NOT WRITE IN THIS AREA

033012

ICHPPC-2
DIAGNOSES

MARK ONLY PERTINENT DIAGNOSES FOR THIS VISIT

EAR DISEASES (continued)
7324 WAX IN EAR

CIRCULATORY SYSTEM DISEASES

HEART DISEASES
410 AC MYOCARD INFARCT SUBAC ISCHEMIA
412 CHRONIC ISCHEMIC HEART DISEASE
428 HEART FAILURE
4273 ATRIAL FIBRILLATION OR FLUTTER
4270 PAROXYSMAL TACHYCARDIA
4278 ECTOPIC BEATS ALL TYPES

BLOOD PRESSURE PROBLEMS
HYPERTENSION

VASCULAR SYSTEM DISEASES
TRANSIENT CEREBRAL ISCHEMIA
OTHER CEREBROVASCULAR DISEASE
ATHEROSCLEROSIS EXCL HEART & BRAIN
PHLEBITIS & THROMBOPHLEBITIS
VARICOSE VEINS OF LEGS
455 HEMORRHOIDS
459 OTHER PERIPHERAL VESSEL DISEASES

RESPIRATORY SYSTEM DISEASES
465 ACUTE TONSILLITIS & QUINSY
474 HYPERTROPH CHRON INFECT TONSIL/ADEN
464 LARYNGITIS & TRACHEITIS ACUTE
466 BRONCHITIS & BRONCHIOLITIS ACUTE
487 INFLUENZA
486 PNEUMONIA
PLEURISY ALL TYPES EXC TUBERCUL
491 BRONCHITIS CHRONIC & BRONCHIECTASIS
492 EMPHYSEMA & COPD
493 ASTHMA
477 HAY FEVER

DIGESTIVE SYSTEM DISEASES
MOUTH TONGUE SALIVARY GLAND DISEA
ESOPHAGEAL DISEASES
DUODENAL ULCER W WO COMPLICATIONS
OTHER PEPTIC ULCER
OTHER STOMACH & DUODEN DIS DISORD
APPENDICITIS ALL TYPES
550 INGUINAL HERNIA W WO OBSTRUCTION
HIATUS DIAPHRAGM HERNIA
553 OTHER HERNIAS
DIVERTICULAR DISEASE OF INTESTINE
IRRITABLE BOWEL SYNDR INTEST DISOR NEC
CHRONIC ENTERITIS ULCERATIVE COLITIS
5640 CONSTIPATION
ANAL FISSURE FISTULA ABSCESS
PROCTITIS RECTAL & ANAL PAIN NOS
HEMATEMESIS MELENA GI HEMORRHAGE
CIRRHOSIS & OTHER LIVER DISEASES
574 GALLBLADDER & BILIARY TRACT DISEASE

GENITOURINARY SYSTEM DISEASES
URINARY SYSTEM DISEASES
MALE GENITAL ORGAN DISEASES
BENIGN
HYDROCELE
FEMALE GENITAL ORGAN DISEASES

FEMALE GENITAL ORGAN DISEASES (continued)
PREMENSTRUAL TENSION SYNDROME
NON PSYCH VAGINISMUS & DYSPAREUNIA
OTHER FEMALE GENITAL ORGAN DISEASES

FERTILITY PROBLEMS
STERILITY & REDUCED FERTILITY

SKIN, SUBCUTANEOUS TISSUE DISEASES
684 IMPETIGO
OTHER INFECTIONS SKIN SUBCUTANEOUS
690 SEBORRHEIC DERMATITIS
ECZEMA & ALLERGIC DERMATITIS
692 CONTACT & OTHER DERMATITIS NEC
DIAPER RASH
6963 PITYRIASIS ROSEA
6961 PSORIASIS W WO ARTHROPATHY
PRURITUS & RELATED CONDITIONS
CORNS & CALLOSITIES
SEBACEOUS CYST
INGROWN TOENAIL & NAIL DISEASE NEC
704 ALOPECIA & OTHER HAIR DISEASES
7061 ACNE
707 CHRONIC SKIN ULCER
708 URTICARIA

MUSCULOSKELETAL, CONNECTIVE TISSUE DISORDERS
ARTHRITIS & ARTHROSIS
RHEUMATOID ARTHRIT & ALLIED CONDITION
OSTEOARTHRITIS & ALLIED CONDITIONS
TRAUMATIC ARTHRITIS
PAIN OR STIFFNESS IN JOINT
SWELLING OR EFFUSION OF JOINT
ARTHRITIS NEC DIFF CONN TISS DIS

NONARTICULAR RHEUMATISM
SHOULDER SYNDROMES
OTHER BURSITIS & SYNOVITIS
OTHER NONARTICULAR RHEUMATISM
7295 PAIN & OTHER LIMB SYMPTOMS

VERTEBRAL COLUMN SYNDROMES
CERVICAL SPINE SYNDROMES
721 OSTEOARTHRITIS OF SPINE
7242 BACK PAIN W/O RADIATING SYMPTOMS
7244 BACK PAIN WITH RADIATING SYMPTOMS

OTHER MUSCULOSKEL CONNECT TISSUE DISORDER
OSTEOCHONDROSIS
7330 OSTEOPOROSIS
CHRONIC INTERNAL KNEE DERANGEMENT

SIGN, SYMPTOM, ILL DEFINED COND
CENTRAL & PERIPHERAL NERVOUS SYSTEM
CONVULSIONS
ABNORMAL INVOLUNTARY MOVEMENT
7804 DIZZINESS & GIDDINESS
DISTURBANCE OF SPEECH
HEADACHE
DISTURBANCE OF SENSATION

CARDIOVASCULAR & LYMPHATIC SYSTEM
PALPITATIONS
NOT INFECTED

RESPIRATORY SYSTEM

GASTROINTESTINAL SYSTEM & ABDOMEN
NAUSEA VOMITING

GENITOURINARY SYSTEM

GENITOURINARY SYSTEM (continued)

GENERAL SIGNS & SYMPTOMS
UNEXPLAINED ABNORMAL RESULTS
HEMATOLOGICAL ABNORMALITY NEC
ABNORMAL UNEXPLAINED BIOCHEM TEST
NON SPECIFIC ABNORMAL
OTHER UNEXPLAINED ABNORMAL RESULTS

INJURIES & ADVERSE EFFECTS
ACUTE DAMAGE
SPRAIN STRAIN

OTHER TRAUMA
850 CONCUSSION & INTRACRANIAL INJURY
INSECT BITE & STING
918 ABRASION SCRATCH BLISTER
BRUISE CONTUSION CRUSHING
949 BURNS & SCALDS
FOREIGN BODY IN TISSUE
930 FOREIGN BODY IN EYE
939 FOREIGN BODY ENTERING THRU ORIFICE
908 LATE EFFECT OF TRAUMA
OTHER INJURIES TRAUMA

ADVERSE EFFECTS
OVERDOSE MEDICINE ACCID OR DELIBERATE
ADVERSE EFFECT MED PROPER DOSE
ADVERSE EFFECT CHEMICALS
998 SURGERY & MEDICAL CARE COMPLICATION
994 ADVERSE EFFECT PHYSICAL FACTORS

SUPPLEMENTARY CLASSIFICATION
GENERAL CONTRACEPTIVE GUIDANCE
INTRAUTERINE DEVICE
MARITAL PROBLEM
MEDICAL EXAM
V620 OCCUPATIONAL PROBLEM
V25 OTHER CONTRACEPTIVE METHODS

ADDITIONAL DX
(if not listed in columns above)
PRIMARY DX | SECONDARY DX

INFECTIVE & PARASITIC DISEASES
INTESTINAL INFECTIOUS DISEASE
SCARLET FEV ERYSIPELAS
DERMATOPHYTOSIS & DERMATOMYCOSIS
PINWORMS HELMINTH NEC
OTHER INFESTATIONS
ACARIASES
OTHER INFECT PARASITIC DISEASES NEC

NEOPLASMS
BENIGN NEOPLASMS

ENDOCRINE NUTRITIONAL METABOLIC
NODULE
HYPOTHYROIDISM MYXEDEMA CRETINISM
METABOLIC DISORDERS
OTHER ENDOCR NUTRITN METABOL DISORD

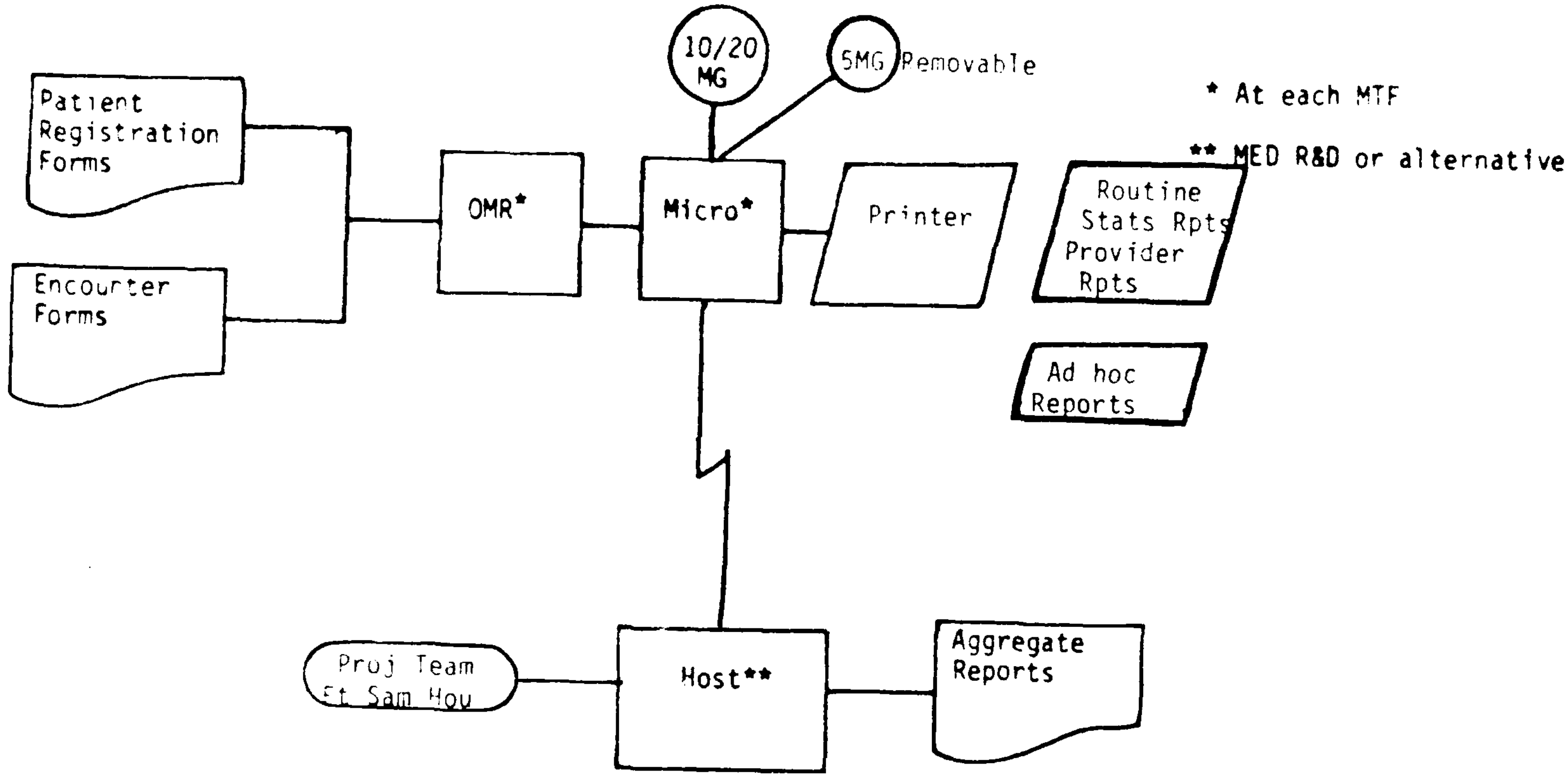
BLOOD DISEASES
ANEMIA
HEMOLYTIC ANEMIAS
OTHER BLOOD BLOOD FORMING ORGAN DISOR NEC

MENTAL DISORDERS
ALCOHOL DRUG INDUCED
HYPOCHONDRIAC DISORDER
MENTAL PSYCHOTIC DISORDERS
SLEEP DISORDERS
ALCOHOLIC PSYCHOSIS
ADDICTION
CHARACTER DISORDERS
OTHER MENTAL & PSYCHOLOGICAL DISORDER

NERVOUS SYSTEM, SENSE ORGAN DISEASES
MIGRAINE

DO NOT WRITE IN THIS AREA

AMBULATORY CARE DATABASE CONCEPT



Files	Record Length (MTF)	Record Length (Host)
1. Registration File	55	150
2. Encounter Record		
Outpatient	90	
PM/OCC.HLTH	95	

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THE DEFECTIVE MCCU AND ITS PROMOTION OF INEFFICIENCY

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Over the past 20 plus years, the Army Medical Department (AMEDD) has tied its monetary wagon to the Medical Care Composite Unit (MCCU). Twenty years ago the MCCU was a new, innovative and, eventually, an accepted abstract quantity measurement of the medical care provided in Army Medical Treatment Facilities (MTFs). This composite work measurement formula incorporated accepted elements of hospital care (admissions, beds occupied, live births and clinic visits) and gave them a relative weight based on resources consumed by each element.

The MCCU eventually became the bench mark or reference point. Each MTF could compare itself against previous performances and other similarly organized and physically structured MTFs. This reference point became a unit for cost comparison and eventually the basis for allocation and retraction of monetary resources for medical care at all Army MTFs. The more admissions, beds occupied, live births and clinic visits an organization could accomplish -- the more resources would be forth coming.

Unfortunately, the MCCU formula fails to incorporate a measurement of the ancillary services (i.e., radiology, pathology and pharmacy) utilized in the treatment of patients and of the manhours consumed in educating the care providers. It also fails to incorporate a sufficiently weighted measurement of hours consumed in educating potential patients in preventive care measures. As a result of the above failures, the MCCU provides no incentive to provide the most effective and efficient care to the patients. The emphasis of the MCCU is on a partial list of work units, not on the end products. The MCCU formula was based on the assumptions that objective diagnostic testing would not advance, that care providers would not fall victim to preservation of their resource base, and that the health care system would not change focus.

Over the past 20 years, the health care system has changed its focus from providing primarily inpatient care to emphasizing preventive care and outpatient treatment. The force for this change in focus was derived from the fact that preventive care and/or outpatient treatment was much less costly and much more effective and efficient than providing inpatient health care. Outpatient care precludes costly nursing care, while providing positive psychological incentives for the patients to recover and return/contine to be a productive member of society.

In the effort to provide more unattended specific care to the patient on an outpatient basis, more objective diagnostic tests were developed, as well as, more effective and safer pharmaceutical products. As a result of the emphasis on outpatient care and the normal advancement of medical science, we have witnessed a quantum leap in types and sophistication of diagnostic tests and pharmaceutical items provided our medical staff. As a result, our medical staffs are demonstrating a greater diagnostic dependence on objective testing. Over the past 10 years, the Fort Knox MEDDAC Pathology Service has increased its testing capability by approximately 25 additional tests; the Radiology Service has incorporated advanced radiological techniques which were not available 10 years ago (Table 1); while the pharmaceutical utilization has burgeoned with a more than mildly escalating cost per pharmacy procedure.

This increase in the availability of new objective diagnostic testing in radiology and pathology has resulted in the care provider's increased use of such procedures per patient. Increased procedures per patient has resulted in an increase in cost of treatment per patient. The MCCU measurement does not reflect the additional work being accomplished within a medical treatment facility as a result of the increased use of diagnostic procedures.

As a matter of fact, in reviewing the pathology procedures accomplished at Fort Knox MEDDAC over the past eight years, we find a dramatic procedure

Table 1

RADIOLOGY DIAGNOSTIC TESTS

PROCEDURES	PROJECTED ANNUAL REQUIREMENTS
Routine Exams	
Head Neck	5,000
Chest Ribs	22,000
Abdomen	5,000
Spine Pelvis	3,400
Extremities and Pelvimetries	11,000
Fluoroscopy Exams	
Upper GI	1,800
Barium Enema	720
Small Bowell Follow Through	65
Other (Gall Bladders, Pacemaker Insertions)	105
Special Procedures	
IV Pyelograms	720
Operative Cholangiogram	60
Tomogram	240
T-Tube Cholangiogram	20
Arthogram	50
Histosalpingogram	40
Angiography	30
Voiding Cystourethrograms	100
Venogram	30
Myelography	30
Other (Sinogram, Kidney, Cyst, Retrograde, Laryngogram, Lymphangigram, Bronchogram, or other special procedures as requested by staff physicians)	50
New Tests	
Ultrasound	2,340
Xeromammogram	900
CT Scan	500
Linear Accelerater	

decrease in 1980 with an increase in MCCUs. What happened? In 1980 automation was realized in the laboratory. New equipment reduced the CAP pathology procedure count. The automated equipment performed more tests in less time and with less cost than the manual system. The fact that more procedures were accomplished without a commensurate increase in cost per MCCU, could lead one to believe the MCCU is an adequate measurement for distributing resources. Such is not the case. The adequacy of funding for the future years occurred in spite of the MCCU formula. The adequacy of funding occurred as a result of an equipment change -- a quirk of fate -- rather than the adequacy of the work measurement unit or any trends it may have indicated.

A review of average daily pathology procedures, identified in Figure 1, indicate procedures are increasing as the average daily MCCUs, displayed in Figure 2, are decreasing. This review would indicate that the quantity of procedures performed per patient is increasing. Carried one step further, we should conclude that without additional technical advancement in pathological testing equipment economies, we can expect the trend toward more objective diagnosis to increase patient treatment costs significantly.

In the area of radiology service we find a similar situation (See Figure 3). New applications of old technology and new technologies (e.g., ultra sound and Computer Aided Tomography scans) have resulted in more expensive tests and in many cases more tests per patient. The MCCU, however, does not incorporate these diagnostic test procedures in its composite formula. As a result, the use of new radiological tests penalizes the MTF by consuming more resources than provided by the MCCU justification. In effect the MTF reduces their future available resources if the use of the new radiology services reduces treatment time for inpatients or precludes future outpatient visits, which would in turn justify future resources. (Additional outpatient visits or inpatient days would have increased MCCUs, thereby justifing more future resources.)

Of all the increases in ancillary services the pharmacy procedure has displayed the most dramatic increase at Fort Knox MEDDAC (see Figure 4). From 1970 to 1984 pharmacy procedures have increased from 1.70 to 3.41 procedures

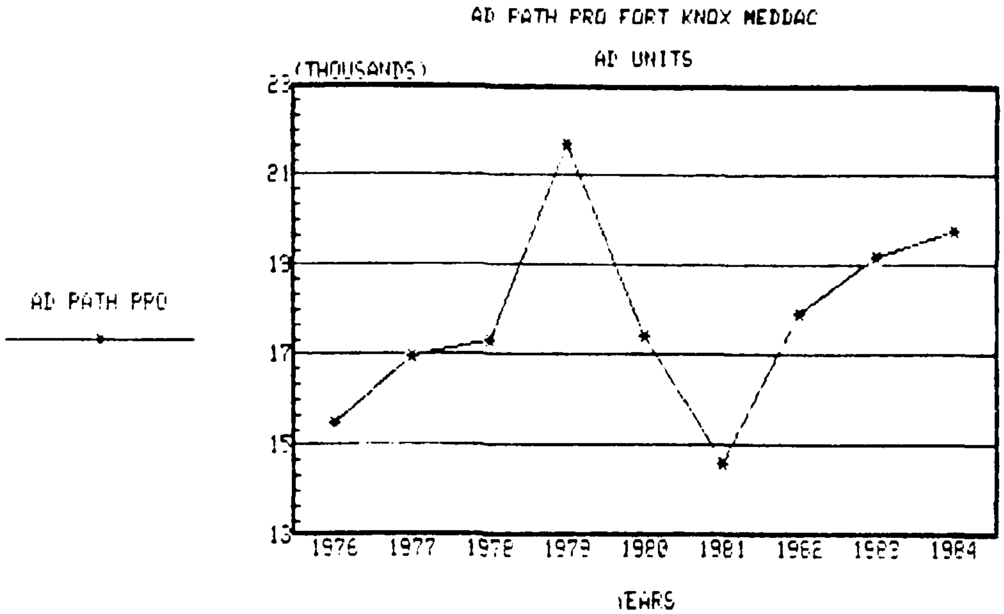

Figure 1

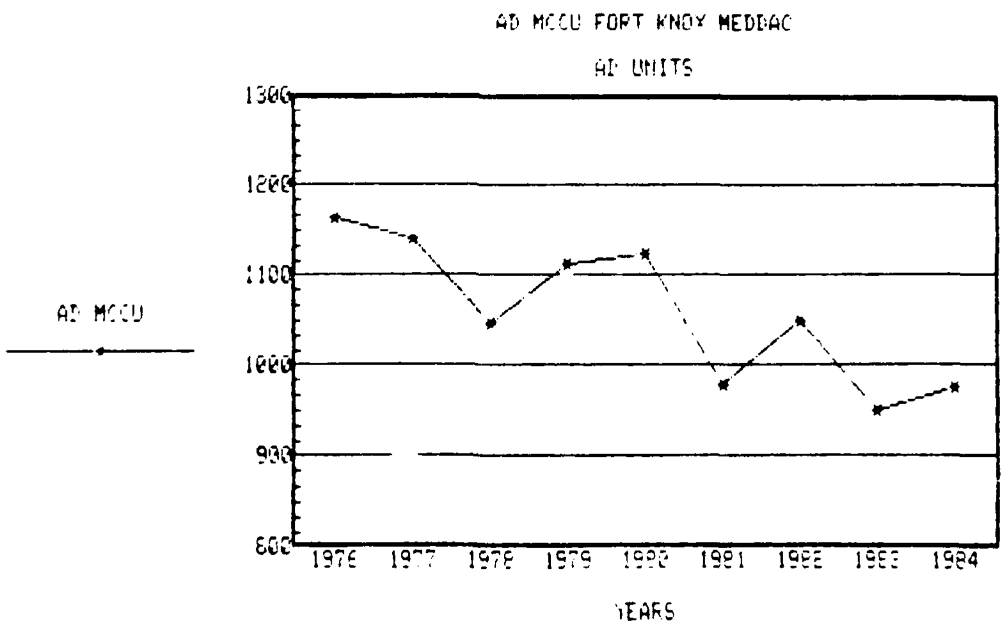

Figure 2

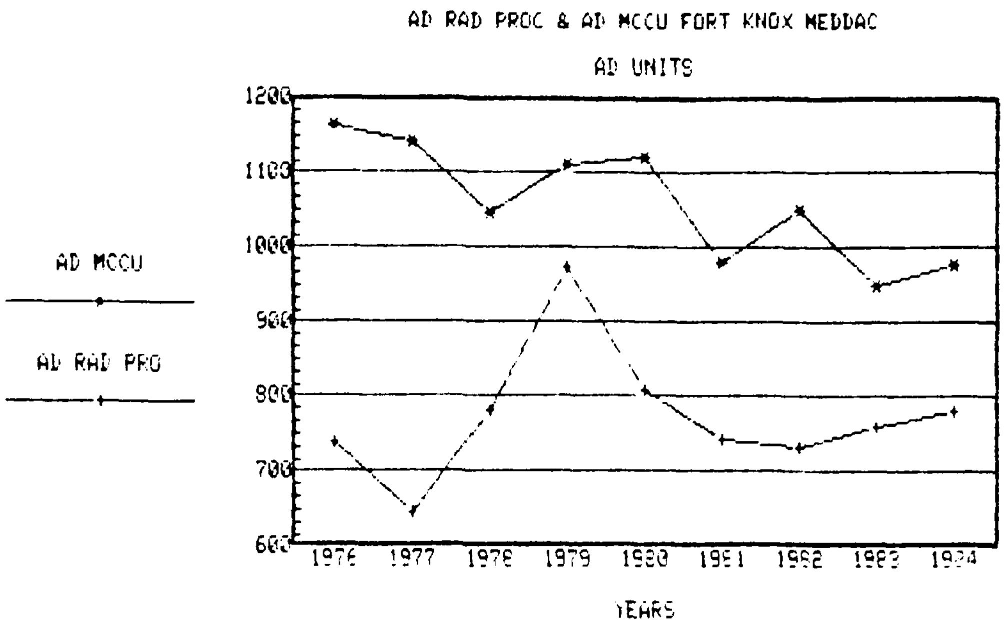

Figure 3

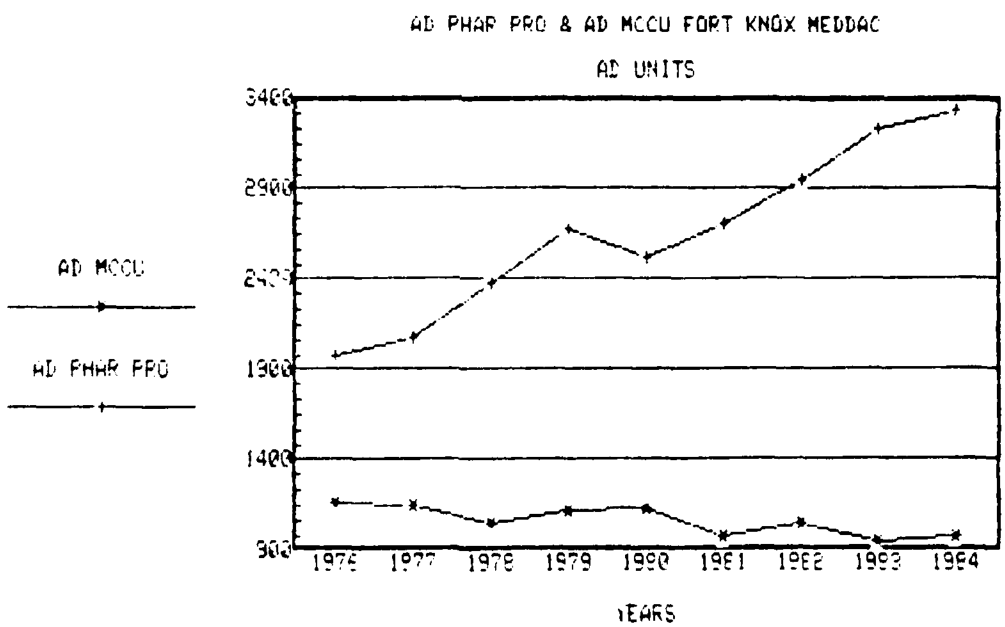

Figure 4

per MCCU. Has the increase in use of pharmaceuticals been beneficial to the patient? Did it reduce recovery time? Did this increase benefit anyone? It is impossible to determine by evaluating the MCCU. The only certain determination is that the consumption rate of resources has increased. New high tech pharmaceuticals are more expensive than they were 10 years ago and the number of pharmacy procedures per MCCUs has increased.

As a result of the MCCU's failure to incorporate the effect of the evolution from subjective to objective diagnosis, the care providers have become aware of the significance of outpatient treatment versus inpatient treatment. The care providers have become acutely aware that an inpatient visit will generate on the average 14-15 MCCUs compared to an outpatient visit which equates to .3 MCCU. The provider of care is quick to note that if extensive or sophisticated (expensive) diagnostic testing is required, it makes sense to admit the patient rather than provide the tests and care on an outpatient basis. The admission would justify more future resources (Ft Knox cost of $82.31 per AD MCCU i.e. $24.69 per outpatient vs $1152.34 per inpatient). Examples of diagnostic tests and treatments which can be performed on an outpatient basis but were at one time performed on an inpatient basis are found in Table 2.

The care provider's knowledge of the effect of MCCU production on the availability of resources may not cause conscious admission of a true outpatient by a care provider. But, at a minimum, it will persuade the care provider to err to his advantage. The net effect of admitting a patient who could remain an outpatient costs the government resources that were not a necessary expenditure (food, nursing staff, military training, or service time, etc.).

The failure of the MCCU formula to incorporate in some fashion the health care provider's manhours expended on continuing health education (CHE) distorts

Table 2

EXAMPLES OF OUTPATIENT/INPATIENT DIAGNOSTIC TESTS AND TREATMENT

1. Internal Medicine Clinic
   a. Protoscopy
   b. Upper GI
   c. Barium Enema
   d. Endoscopy
   e. Colonoscopy
2. Ortho Clinic
   a. Nerve Block
   b. Mylograms
   c. Arthroscopy
3. Urology Clinic
   a. Vasectomy Treatment
   b. Circumcision Treatment
   c. Stone Basket
   d. Plyograms
4. Opthomology Clinic
   a. Laser Optics Treatment
5. OB/GYN Clinic
   a. D&C Treatment
   b. NST (None Stress Test)
   c. OCT (Oxitocen Challenge Test)
   d. Scope Tubal

the measurement of care provided. The care provider has two primary tasks to perform: treating patients and upgrading his knowledge of the most effective and efficient treatment methods and modalities. Failure to acquire this additional knowledge will eventually effect the quality and quantity of the care he provides.

Acquiring CHE knowledge is in direct conflict with treating patients. When the care provider is receiving this training he is not treating patients. He is a resource provided to treat patients, but is not doing so. In fact, the present system of distributing resources based on the MCCUs penalizes the MTF for allowing the care provider time off from treating patients to receive CHE. The average FY 83 CHE physician or physician assistant training experience removed the practitioner from the direct care work force for a total of six days each. Six days of patient treatment for each of our 66 practitioners were lost -- over one year of direct patient care!

An argument against including a weighted measurement for ancillary services and care provider education in the formulation of the MCCU could hinge on the fact that these areas are supportive of patient treatment and are not direct contact situations. Whereas, all the elements presently included in the MCCU formulation are direct contact situtations. The inclusion of these supportive services would cause the care provider to use diagnostic testing excessively, over prescribe pharmaceuticals, and spend inordinate amounts of time receiving additional training rather than treating patients.

If the care provider stood to personally gain by over testing and/or over prescribing, the argument may be valid. However, military care providers gain nothing personally. The only entity that could gain by excessive use of supportive services would be the organization. The incentive/pressure to do so would be far less than the present pressure to admit every patient possible. The present pressure is caused by the lack of sufficient resources to support true patient requirements and the associated required diagnostic testing and pharmaceutical items. If correct and adequate resources were identified and provided by the MCCU resource justificaion system, less manipulation of work units would be the order of the day. The excessive education of care providers gained by sacrificing patient treatment time could be prevented by limiting the number of hours or days of CHE training time a care provider could have per year.

The effect of failing to sufficiently weight the event of educating potential patients in preventive care defeats the concept of preventive care.

Preventive care education is based on the premise that it is much more efficient to prevent injury or disease by educating high risk persons, rather than treating the injury or disease. The MCCU formula provides a .3 weight to a preventive care session outside of the MTF regardless of the size or the duration of the class.

At the Fort Knox MEDDAC during May 1984, 2,894 potential patients were provided Fitness & Injury Prevention Classes in 41 presentations. Credit for the work accomplished was 12.3 MCCU. Each presentation was approximately 50 minutes long, not including the care provider's travel time. If the care provider had remained in the MTF and treated one patient every 40 minutes, he would have surely achieved more MCCUs for the same period of time, especially if a few of the patients were admitted.

The failure of the MCCU to incorporate adequate measurement of ancillary services consumed, care provider education experienced, and preventive care classes conducted, highlights the severe limitation of the MCCU measurement unit. The measurement unit must at least count those fuctions that are continually changing (e.g., radiology) and promote/support the most efficient concept of providing health care. At its best, the MCCU is a gross, incomplete, and misleading measurement of work accomplished in a MTF. In a nutshell, the MCCU does not promote efficient or effective use of resources. The MCCU as it is used in the distribution of resources promotes excessive and wasteful use of resources. A more effective work measurement/work costing system is direly needed if the MTFs are to become effective and efficient.

NOTE: Workload data upon which this presentation was based is shown in Table 3.

Table 3

FORT KNOX MEDDAC STATISTICS

	1976	1977	1978	1979	1980	1981	1982	1983	1984
AD MCCU	1,161.5	1,140.6	1,045.5	1,111.4	1,121.7	978.2	1,048.7	948.7	975.0
AD BEDS OCC	231.5	208.4	149.8	163.5	151.7	117.1	131.4	131.0	143.3
AD CLINIC VS	1,836.6	1,780.6	1,878.9	1,919.8	2,096.6	1,843.7	1,918.9	1,569.1	1,467.5
AD RAD PRO	738.0	645.6	780.1	973.0	808.2	740.1	731.9	757.9	778.8
AD PHAR PRO	1,970.0	2,072.6	2,377.2	2,669.0	2,516.2	2,698.6	2,940.5	3,223.5	3,327.7
AD PATH PRO	15,460.0	16,930.4	17,271.9	21,663.0	17,388.5	14,578.1	17,932.9	19,191.9	19,756.4
INPAT MCCU	610.6	606.4	481.8	535.5	492.7	445.1	472.8	478.0	535.0
CL VS % MCCU	47.4	46.8	53.9	51.8	56.1	56.5	54.9	49.6	45.2
CL VS MCCU	550.9	534.2	563.7	575.9	629.0	533.1	575.7	470.7	440.2

NOTE: 1984 figures are estimates

SOURCE: HQ, [illegible] Army Health Services Command, Command Performance Summary

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NURSING PRODUCTIVITY AS MEASURED BY THE NAVY WORKLOAD MANAGEMENT SYSTEM

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Introduction

One of the most difficult problems facing directors of nursing service is the determination of nurse staffing requirements. Traditionally, staffing needs were based upon daily inpatient census, and staffing standards were set on a ratio of hours of care per 24 hour patient day. For example, 3.5 hours of care per patient day may be used with staffing levels generally set high to ensure adequate coverage during peak loads (DHEW, 1973). Another major shortcoming was the assumption that nursing care requirements would be the same for every patient. The result was a continuous imbalance of workload. Although supervisors did make daily staffing reassignments based upon their judgement and experience, these changes were viewed as subjective and frequently resulted in charges of unfairness or favoritism. Therefore, studies were undertaken to find a more objective method of determining staffing requirements. One technique that is widely used today is a Patient Classification System (PCS). Under this method, staffing requirements are based upon the acuity levels of patients. A Patient Classification System refers to the "identification and classification of patients into care groups or categories, and to the quantification of these categories as a measure of the nursing effort required" (Giovenetti, 1979, p.4). Abdellah and Levine (1979) have identified two types of Patient Classification Systems. The first type, "prototype evaluation," matches patients to a standard profile or stereotype for each category. The second and most common type, "factor evaluation," utilizes critical indicators or descriptors of direct care requirements to separately rate the care requirements for each patient. Each factor earns a score. The scores are then summed with the total score designating a patient's category.

Patient Classification Systems were not widely implemented in hospitals until the Joint Commission on Accreditation of Hospitals revised Nursing Service Standard III in 1980. The standard states that:

> The nursing department/service shall define, implement, and maintain a system for determining patient requirements for nursing care on the basis of demonstrated patient needs, appropriate nursing intervention, and priority of care. (JCAH, 1980, p. 118)

With this mandate, Patient Classification Systems have gained popularity.

The Navy Workload Management System

The development of the Navy Workload Management System (WMS) which includes a patient classification tool was initially undertaken at the request of the Navy Surgeon General (SGO, 1979) and reinforced by the mandate from the Joint Commission on the Accreditation of Hospitals. This development was part of an ongoing three year research project which examined the utility of a Patient Classification System as the basis for nurse staffing decisions within the Navy Medical Department. What evolved was a WMS for nursing which is designed to accurately determine staffing requirements based on inpatient nursing workload. This system provides a useful means for establishing appropriate baseline staff and for allocating personnel to meet daily fluctuations in workload.

Figure 1 delineates how the Workload Management System operates. The process begins with the classification of patients into categories of care. The hours of nursing care required and the recommended number and mix of personnel needed to meet these requirements are then calculated based on the number of patients in each category. The actual number and mix of personnel assigned is then compared with the recommended staffing to determine if staffing levels are above, below, or within the recommendations. If staffing levels for the workload to be accomplished differ from recommended levels, staffing can be adjusted to balance the variation.

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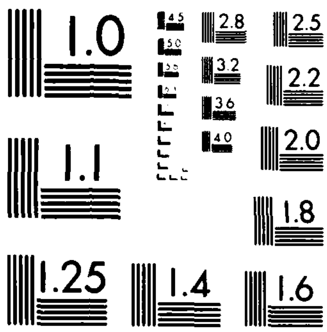

MICROCOPY RESOLUTION TEST CHART
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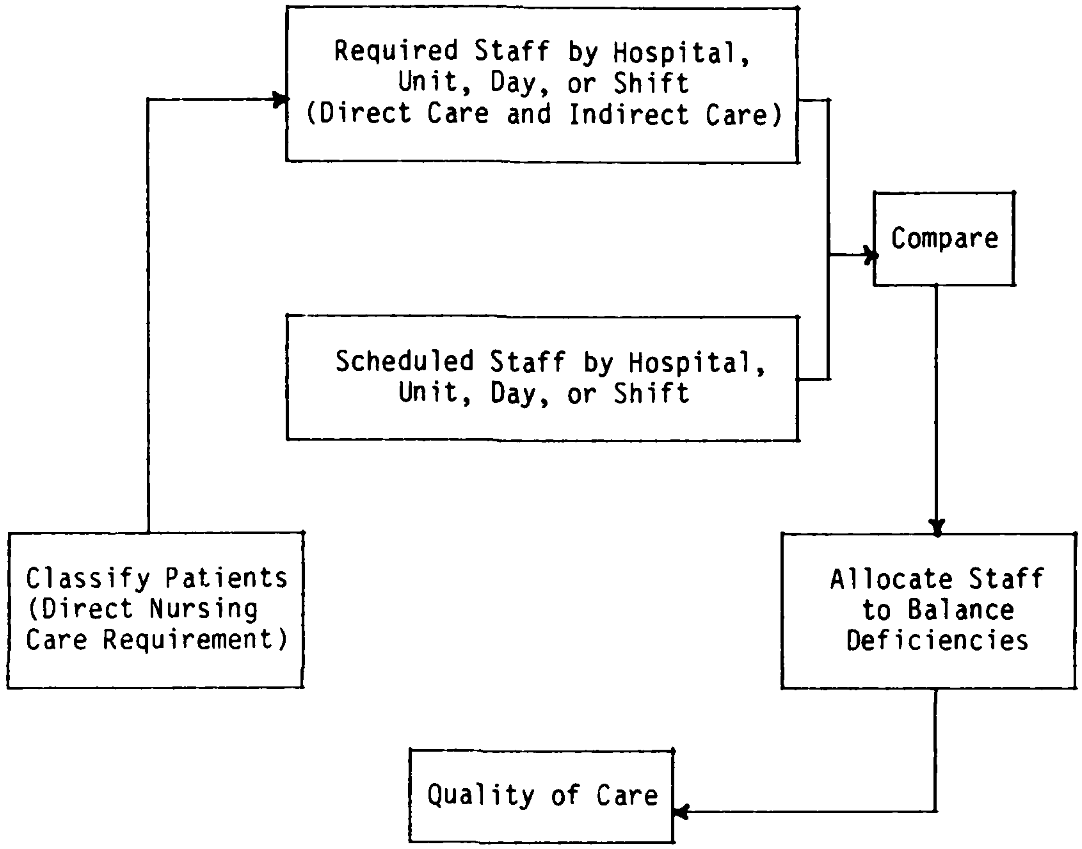
Figure 1

DYNAMICS OF THE WORKLOAD MANAGEMENT SYSTEM



In short, the Workload Management System encompasses an integrated process of: (1) assessment and classification of patients; (2) allocation, assignment and scheduling of nursing personnel; and, (3) an evaluation or monitoring of care given.

In order to give a clear understanding of the workload management process, it is essential to review both the classification and staffing phases of the system. This can be done by defining the terms which form the foundation of the system and describing the reports used.

Patient Classification of Direct Care Activities

The system begins with the classification of all patients on a daily basis. This is the grouping of patients according to some assessment of their nursing care requirements over a specified period of time for the purpose of determining the number of nurses required to provide that care. This grouping is done with a tool which delineates critical indicators of care, those activities that have the greatest impact on direct care time.

The Critical Indicator Guidesheet is the basis of the Patient Classification System. This guidesheet lists multiple patient care activities, each with an associated point value that indicates the amount of time needed to perform the activity. Each point is worth 7½ minutes of direct nursing care time. Nurses use this guidesheet as a tool to classify each patient on a unit. The Critical Indicator Sheet is divided into factors which are a group of critical indicators that cover one specific domain of activities. They include nine areas: vital signs, monitoring, activities of daily living, feeding, treatments, respiratory therapy, IV therapy, teaching/emotional support, and continuous care. All of these are direct care activities which are defined as those actions that take place in the presence of the patient and/or family. The activities are observable, behavioral, and include the following: placement of equipment at bedside, explanation of procedure to patient, preparation of patient, performance of task, removal of equipment from area, recording, assessment/observation, and teaching. In the current system these direct care activities are calibrated as taking 35 percent of the total nursing care time.

The specific number of points assigned to each activity has been based upon documented time and motion studies. To standardize the point value for each critical indicator, the Navy utilized the results obtained in a Nursing Care Hour Standards Study completed by the Army in 1981. LTC Susan Sherrod, a nurse researcher at the Health Care Studies Division of the Academy of Health Sciences, conducted a four-year time and motion study in which 37,000 observations were made to derive mean times for 357 direct nursing care activities at nine hospitals for all levels of nursing staff. These time measurements were utilized to determine minimal essential mean tasking times for all specified direct nursing care activities. In addition, a methodology for determining care provider numbers and mix for various specialty areas was developed.

In adopting the time values, an assumption was made that direct nursing care given by Navy personnel would require the same amount of time as with Army personnel. This assumption was tested for several activities and found to be valid. Since the Sherrod study has been cited as having the most comprehensive and best documented task list to be found anywhere in nursing literature (US Army, 1982), the Navy has a high level of confidence in using the point values assigned to each critical indicator.

The operational definitions for these critical indicator activities have been developed and published in the form of guidelines. These guidelines have been incorporated into an educational workbook that is used as an interpretive text for the definition of each critical indicator and its application during the direct care of patients. For example, one of the activities on the critical indicator sheet is "blood pressure, manual". The operational definition states:

> includes time to place equipment at bedside, place cuff around extremity, position stethoscope, measure blood pressure, remove cuff, record results, and remove equipment from area.

Based on the number of activities and the total amount of points assigned for each critical indicator factor, a patient can fall into one of six categories of care. Category is defined as the representative grouping of patients according to their nursing care requirements. A Category I patient requires minimal care while a Category VI requires intensive care.

Therefore, a nurse classifies each patient using a critical indicator sheet and the results are tabulated on the Patient Classification Worksheet. This worksheet lists each patient on a unit, the total points or time their nursing care requires, and the category of care based on the points awarded to the patient. This form also provides a summary of the number of patients in each category on that nursing unit. The summary from this worksheet becomes the working basis for determining staffing requirements.

Accounting for Indirect Care Activities

Since the Patient Classification System only addresses direct care activities, a mechanism has been incorporated into the system for indirect care activities. Indirect care is defined as all nursing activities done away from the patient in preparation for or completion of care, as well as those activities directed toward general unit management. To address these factors, indirect care time and special allowances have been incorporated into the nursing care hour requirements for each of the six patient care categories. Indirect care time takes approximately 55 to 65 percent of the total nursing care time. Indirect care time is subdivided into the following four categories: indirect care - 30%; unpredicted needs - 15%; teaching hospital allowance - 10%; and semi-private room allowance - 20%.

In summary, the nursing care hour requirements determined by using this system include direct care time, indirect care time and special allowances in order to account for the significant variations between patient care activities, nursing units and medical facilities. The next step is to translate these activities into staffing numbers.

Staffing Methodology

The patient care coordinator for each clinical area receives the Patient Classification Worksheet and reviews it for accuracy. In order to ascertain the amount of nursing care required for a specific group of patients who may run the continuum from Category I to VI, the supervisor calculates the nursing care hour requirements. This consists of calculating the number of hours of nursing care time required for each category of patient based upon an assessment of their direct and indirect nursing care requirements. It is operationalized via six pre-calculated Nursing Care Hour Requirement Charts which incorporate two factors: type of unit (open, semi-private room, nursery, or light care), and type of facility (teaching vs. non-teaching hospitals).

These nursing care hour requirements are then translated into personnel requirements using an eight hour workshift per employee as the standard. Personnel requirements are the number and mix of RNs and NRNs required to care for the patient workload on a unit. This is operationalized via two charts: acute care and intensive care. The acute care chart allocates a 40% RN to 60% NRN personnel mix and distributes 45% of this staff to the day shift, 35% to the evening shift, and 20% to the night shift. In contrast, the intensive care chart utilizes a 60% RN to 40% NRN personnel mix which is evenly distributed across each shift.

The classification data and the recommended number and mix of personnel are recorded on the daily summary sheet. The Workload Management Summary Sheet identifies on a daily basis the number of patients in each category on a nursing unit, the recommended staffing for each shift, the actual staff scheduled on each shift, and any variance between the recommended and actual staffing. Any changes to the schedule are recorded on this form so that the number of personnel who actually worked on each shift is documented.

The last instrument used is the Monthly Staffing Summary Graph. This is designed as a tool to identify trends in workload and staffing distribution problems on units for each shift. The graphic display will document the recommended daily requirements as compared to the actual scheduled staff and what the staffing looked like after changes have been made.

Reliability Testing

In order for the patient classification process to generate accurate and useable information, an inter-rater reliability monitoring system must be used on a regular basis. Inter-rater reliability refers to the consistency or stability of measurement of the patient classification instrument from user to user. Reliability is evaluated by having two individuals classify the same patient independently on Patient Classification Worksheets. This information is then used to compute an index of equivalence or agreement by factors and by category between classifiers.

The purpose of the reliability testing is: (1) to measure the Percentage of agreement among nurses in selecting patient classification categories and factors; (2) to identify the need for updating classification skills and/or revising patient classification categories and decision rules; and, (3) to routinely monitor the patient classification process to assure that all nursing personnel continue to use the process in the manner intended. In order to do this testing an independent, expert classifier appointed by nursing administration must conduct the reliability testing. It should be done routinely (approximately monthly) on all nursing units involved in patient classification and efforts made to maintain a minimum of 80% agreement in patient categories and factors among classifiers. If the percent of agreement by category is below 80%, efforts should focus on discussions with unit classifiers to determine the reasons for disagreement. Corrective action must be taken to increase inter-rater reliability.

To reiterate, ongoing reliability testing is crucial to validating the accuracy of the data forwarded from each facility. When one considers that, based on this information, major decisions will be made at both the hospital and headquarters levels, the importance of this process is self-evident.

Criteria for System Performance

In order for the WMS to perform effectively the following system performance criteria should be met:

1. Comprehensiveness - The system should classify inpatients according to levels of required nursing care and determine the amount of nursing time required to care for these patients. It should apply to all inpatients at all Navy hospitals and should account for both direct and indirect care. In this way, the system should produce a series of daily and monthly reports that are useful both in the operation of the hospital and in the planning and budgeting of resources. The reports should be timely and provide information on actual patient days, actual nurse staffing, and nurse workload by patient category, by shift, by ward, and by personnel category.

In order to do this, that same definition of patient classes should be used throughout the Navy. The definition should he simple to understand and the procedures for using the tool speedy and reliable.

2. Validity - The system should also measure what it purports to measure. The validity of the patient categories and the times for direct care should be assessed on a Navy-wide basis using expert opinions and objective data.

3. Reliability - Unsystematic variation between raters, between hospitals and wards, and overtime, must be maintained at a reasonable level. The reliability of the Workload Management System should be assessed at each hospital monthly. To ensure this, an implementation plan should include training and orientation for all personnel, as well as assignment of responsibility for various phases of the system at each hospital.

4. Usefulness - The Workload Management System should be a valid management tool for identifying patient workload and assigning appropriate staff. It should retrospectively document what has been done for the patient and prospectively identify what nursing care will be needed for the following shifts.

To complete the Workload Management System Project, an evaluative study was begun in February 1984 to assess its validity and reliability (Rieder, 1983). Over a period of six months, on-site visits were planned to six CONUS hospitals randomly selected based upon size. Visits to five sites have thus far been completed. Interrater reliability was tested by comparing scores awarded by a nurse expert to scores assigned by the nurse classifying patients on the same nursing units. Initial reliability results have been greater than .80. Other data was collected by administering questionnaires which measure charge nurses' perceptions of staffing adequacy and staff nurses' perceptions of direct and indirect nursing care given under various staffing patterns.

Throughout this project, close collaboration has been maintained with the Army Nursing Research Department, Walter Reed Army Medical Center, Washington, D. C. The Army has field tested the WMS at five Army Military Treatment Facilities. Based on their findings, the WMS will be implemented at all facilities in October 1984. In addition, the Army has recently completed a work sampling study of indirect nursing care at nine hospitals (U. S. Army, 1983). Results from this study will be valuable in determining if the Navy Nursing Care Hour Requirement Charts need to be revised.

Benefits of the System

The benefits to the Navy of a reliable Workload Management System are multiple. At the local hospital level, the information can be used to adjust staff assignments, to compare workload on different units, and to justify requests for numbers and skill level of nursing personnel. The Naval Medical Command could use the information for facility planning of beds and units, for health care program planning, and for identifying trends in patient needs based on seasonal, geographical and historical data. The Navy Military Personnel Command could utilize the data for allocating nursing billets between hospitals. This data could also he valuable as an addendum to the Uniform Staffing Methodology and Uniform Chart of Accounts information since complexity of patient care requirements within work centers is pertinent to measuring, justifying, and allocating resources.

Summary

In summary, nurse staffing in the past has been based on historical data related to the number of beds occupied in a clinical area. Over the years, the nature and volume of our workload has been significantly altered by increasingly complex technology, specialization, emphasis on health teaching, personalization of service to patients and ongoing evaluation of personnel performance and patient care. No longer can staffing be managed on the basis of patient census alone, and we have the added impetus of the JCAH 1980 Nursing Standard. To this end, the Navy Medical Department has developed a valid and reliable system that enables patients to be categorized according to required nursing care and provides guidelines for effective allocation and utilization of nursing resources.

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HOMOGENEITY OF DRGs FOR NAVY INPATIENT DATA:
A Critical Analysis

Terrence L. Kay

Our interest in case mix methodology resulted from a desire to use DRGs as a tool to account for differences in average length of patient stay among naval hospitals. The initial approach, which began shortly after Yale r[illegible]ed the ICD9-CM DRGs, was to compare DRGs with other patient grouping t[illegible]iques that were commonly used by the Navy, such as patient categories based [illegible]e diagnosis code.

We found that DRGs explained more variation in length of stay than any of tne comparison methods. DRGs were only slightly better than the three digit diagnosis codes, but required about one-half the number of groups in which to categorize the patient population as do the diagnosis codes. It is much easier for a manager to monitor 467 DRG groups rather than groups based on over 1,000 three digit codes.

We were concerned, however, with what was thought to be a relatively low proportion of explained variance in length of stay using DRGs. To increase the explained variance, patients with unusually long or short lengths of stay were removed from the data. The results are summarized in Table 1.

Each method of removing outliers has helped to explain more variance in length of stay, especially the Yale trim points technique. The Yale trim points include cut points for both abnormally short and long lengths of stay, whereas the HCFA cut points are for abnormally long lengths of stay only. Note that using the long length of stay reduced the effect of outlier cases for untrimmed data.

Next, the individual DRGs were reviewed to ascertain which ones possessed large amounts of unexplained variance. The statistic used to identify these

Table 1

EXPLAINED VARIATION IN LENGTH OF STAY
BY SELECTED RECORDS, 1982

Selection Criteria	Number of Records	Percent Variation Explained	
		Length of Stay	Log Length of Stay
All Records	196,916	23	29
Exclude Transfer (in or out)	185,704	26	32
HCFA Trim Points	191,131	31	31
Yale Trim Points	183,115	41	40

DRGs was the coefficient of variation, which is simply the ratio of the standard deviation of the length of stay, divided by the mean length of stay, and expressed as a percentage. The lower this ratio, the lower the amount of variation existing in the sample being studied and the more homogeneous the DRG grouping. A coefficient of variation of 70% was arbitrarily chosen as a cutoff point to flag potential problem DRGs.

The coefficient of variation tended to be large across a majority of the DRGs. Table 2 displays only the results for the first ten DRGs, but these results are typical of what was found for most of the case mix groupings. We initially looked at the obvious reasons for this variability, again removing transfers and using log length of stay, but the results indicated that most of the DRGs were candidates for further analysis.

From the first phase of this study we concluded that DRGs were better tha other patient grouping methods. The fact that they accounted for only about

Table 2

COEFFICIENT OF VARIATION FOR DRGs 1-10

DRG Number	Description	Number of Cases	Coefficient of Variation
1	Craniotomy age $\geq$ 18 except for trauma	112	86.3
2	Craniotomy for trauma age $\geq$ 18	23	77.5
3	Craniotomy age < 18	34	91.9
4	Spinal procedures	141	118.8
5	Extracranial vascular procedures	140	125.1
6	Carpal tunnel release	0	-
7	Periph & cranial nerve & other nerv syst proc age $\geq$ 70 and/or C.C.	36	155.1
8	Periph & cranial nerve & other nerv syst proc age < 70 w/o C.C.	457	194.6
9	Spinal disorders & injuries	53	158.7
10	Nervous System neoplasms age $\geq$ 70 and/or C.C.	42	90.7

quarter of the total variance in length of stay suggested that there must be other variables to explore. To identify these other factors, our research has progressed in two directions. First, variables that were already available on the Inpatient Data System were examined to see if they would explain additional variance in length of stay. These included patient related variables (age, race, sex, number of medical diagnoses and procedures, admission and discharge status), hospital characteristics (size, location, and teaching status), and military unique variables (military status, length of service, and pre-existence of condition prior to entry). Second, a pilot test was conducted to determine whether differences in length of stay within DRGs could be accounted for by disease severity, a concept which was operationalized by using patient acuity levels. Patient acuity was measured by the patient classification tool which is part of the Nursing Workload Management System discussed in the presentation by CDR Rieder.

The procedure adopted to study the effect of variables from the Inpatient Data System was similar to that used by the Yale researchers who developed the original DRGs. Each DRG was analyzed to see if any of the selected variables from the inpatient record could explain additional variance in length of stay. Therefore, an attempt was made to further subdivide each DRG.

Each DRG was split into subgroups based upon the results of a stepwise multiple regression analysis into which the inpatient variables of interest were entered. The criteria used for terminating the splitting process was as follows:

(1) statistical significance of the split was not attained using $p < .05$;

(2) less than one percent of additional variance in length of stay was explained by further split;

(3) the group to be split contained fewer than 100 cases;

(4) splitting would result in a subgroup with fewer than 10 cases;

(5) the difference in the average length of stay for split groups was less than one-half of a day; and,

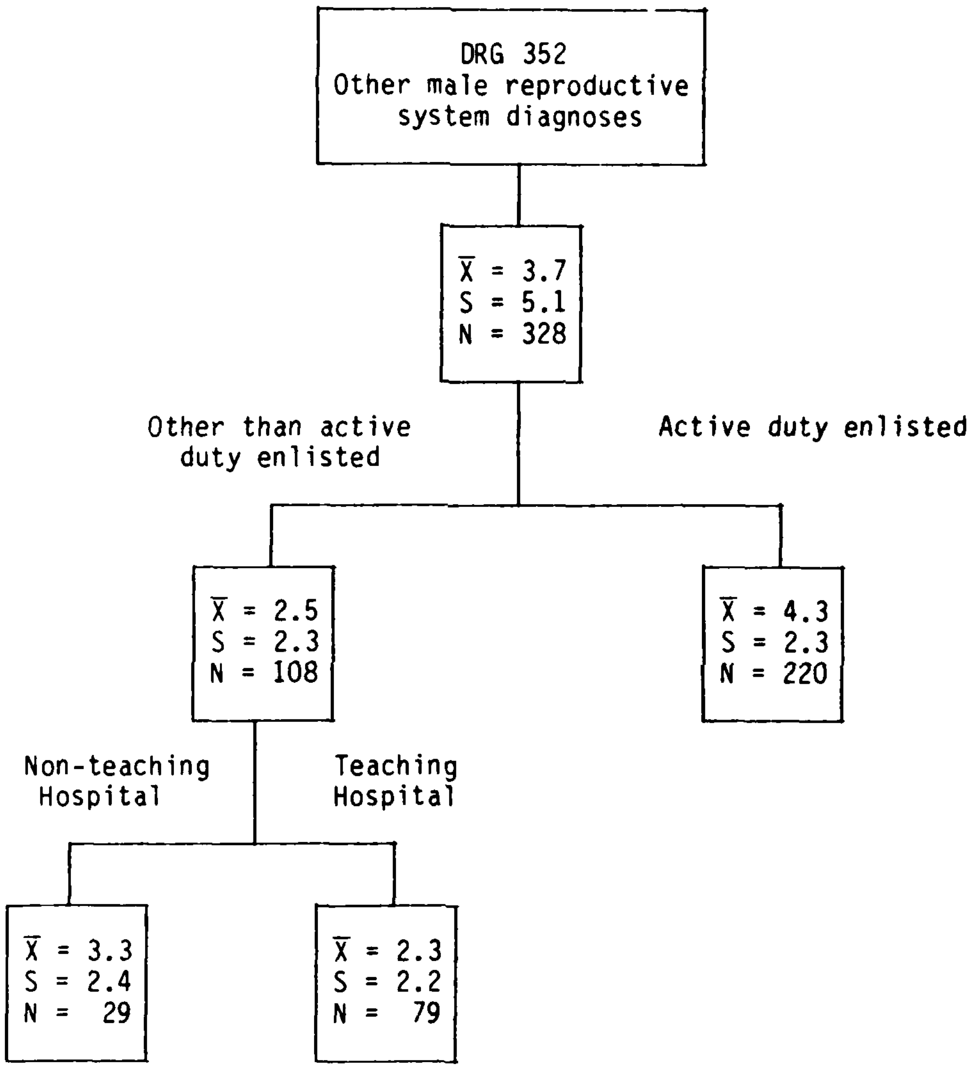
(6) splitting according to statistical criteria resulted in uninterpretable subgroups (e.g., age groups or number of procedures).

This procedure is best illustrated with an example.

Table 3 shows the splitting process for one selected DRG. The total sample was first subdivided on the basis of active duty enlisted status. Active duty

Table 3

SUBGROUPS FOR DRG 352 USING 1980 DATA

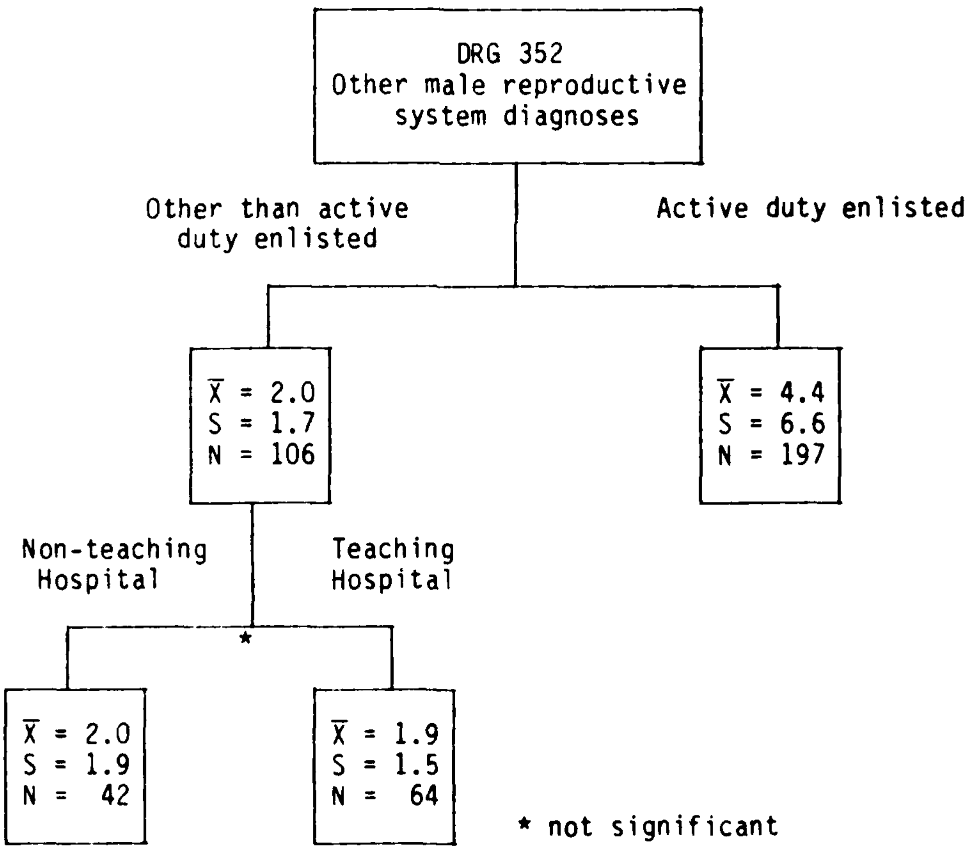


enlisted patients stayed about two days longer than other patients. Second, the DRG was further split on the basis of whether the hospital was a teaching institution or not. In this case, there was one day's difference in length of stay between the two groups of hospitals, with the teaching hospitals having the shorter stay. This finding was somewhat unusual since teaching hospitals tend to have longer lengths of stay than non-teaching hospitals.

Using 1980 data, this subgrouping procedure was repeated for each DRG with over 100 cases. To check the consistency of the results, we tested the significance of each split found for 1980 data by using 1982 data. We reasoned that the most important factors would be significant for more than one time period. Again, using the results for DRG 352 as an example, we found that 1982 average length of stay data for enlisted personnel was significantly greater than for the other patients (See Table 4). However, there was no dif-

Table 4

SUBGROUPS FOR DRG 352 USING 1982 DATA



ference found between teaching and non-teaching hospitals in this specific DRG. Therefore, only the subgroups based on enlisted status were retained in this DRG. The results of this splitting process for all the DRGs are summarized in Table 5.

Table 5

VALIDATION OF 1980 DRG SUBGROUPINGS USING 1982 DATA

1980	
DRGs (out of a possible 467)	456
Additional groupings	674
Total	1,130
1982	
DRGs (out of a possible 467)	456
1980 subgroups significant during 1982	345*
Total	801

* 332 significant at <.05; 13 signifiant at <.075 and means, s.d.s were quite different.

Of the 674 additional groupings found for 1980, 332 were also significant ($p < .05$) for 1982. An additional 13 groups had probability levels of .06 or .07. Since the means of these subgroups were quite different, they were retained. Two-thirds of the additional splits retained in 1982 were accounted for by the five factors listed in Table 6.

The primary factors were number of diagnoses and number of procedures. These two factors are often used as proxies for disease severity which is less than ideal because of the potential for abuse. If a hospital's performance rating or funds are dependent upon the number of coded diagnoses or procedures, there may be an incentive to document extra codes in a patient's record. Concomitantly, the longer a patient stays in the hospital, the more likely that additional medical problems will be identified which warrant additional procedures. As might be expected, transfer status was also a significant factor; patients transferred from one facility to another tend to stay longer than

Table 6

VARIABLES USED TO FORM DRG SUBGROUPS 1982

Variable	Number of Subgroups	Percent
Number of diagnoses	65	18.8
Number of procedures	62	18.0
Admitted by transfer	39	11.3
Active duty enlisted status	37	10.7
Large teaching hospital	31	9.0
Other	111	32.2
Total	345	100.0

direct admissions. A military unique factor that was a significant variable was active duty enlisted status; enlisted patients tend to stay one or two days longer than other patients. Another important variable was the characteristics of the hospital at which the patient was treated. Patients treated at large teaching hospitals tend to have a longer length of stay than patients treated at other hospitals.

Overall, the additional variation explained by these extra subgroups is not dramatic. The 345 additional subgroups increased the variance explained from about 23% to about 30%. These additional subgroups, however, can be useful in at least two ways. One option is to modify the DRGs for military use by adding these additional subgroups. If this option is selected some labeling convention would be necessary so that the data can be collapsed back to the original DRG level. This would be essential for comparing Navy data with that from civilian hospitals or from the other military services. Another alternative is to simply use the DRGs as they have been defined by their developers, but when unexpected differences among specific hospitals emerge a manager would refer to the subgroups for possible explanation.

As stated earlier, this further subgrouping of DRGs was one of two attempts to account for additional variance in length of stay. A more recent effort has been to explore the possibility of using a nursing patient classification tool as an estimate of disease severity. Our logic was that the more seriously ill the patient, the more nursing care that patient would require. Since Dr. Susan Horn has demonstrated that disease severity is a major contributor to patient length of stay, we decided to see if this relationship with length of stay would hold for required nursing care. Since patient classification data is already being collected for staffing purposes, this data was readily available, and additional coders to review patient charts were not needed.

The hospitals included in this pilot study were selected from a subgroup of those participating in the Nursing Workload Management System field study. Data from each selected hospital were obtained for September through November 1983. This was the earliest time period for which we had both patient classification data and matching inpatient data. The DRGs studied (See Table 7) were selected from among those DRGs which had relatively large amounts of variability in length of stay.

The matching of patient class data with inpatient data was done manually, using admission and discharge dates and each patient's last name. So far, we have only matched about 425 records and have just begun data analysis. Our preliminary findings have not been what was expected. We had anticipated that there would be a strong correlation between the average patient classification and the patient length of stay, but so far this has not been found.

The type of problem we encountered can be illustrated with an example using DRG 243, Medical Back Problems. It was expected that patient classification data would be useful for differentiating between those patients just

Table 7

DRGs SELECTED FOR PATIENT CLASSIFICATION STUDY

DRG Number	DRG Description	1980 Values		1982 Values	
		LOS X	LOS S.D.	LOS X	LOS S.D.
25	Seizure and headache, age 18-69 without complications/comorbidity	5.1	6.0	5.6	8.1
82	Respiratory neoplasms	10.0	11.3	10.5	12.3
133	Atherosclerosis, age < 70, without complications/comorbidity	4.6	5.7	4.7	6.6
169	Procedures on the mouth, age < 70	6.7	6.9	5.9	5.5
231	Local excision and removal of internal fixative devices except hip and femur	6.0	8.4	5.1	9.0
243	Medical back problems	10.5	9.2	7.3	8.5
254	Fractures, sprains, strains, and dislocations of upper arm, lower leg, except foot, age 18-69, without complications/comorbidity	5.0	7.8	3.7	5.4
324	Urinary stones	3.0	5.2	2.7	2.5
421	Viral illness, age ≥ 18	4.4	4.2	3.9	3.4
450	Toxic effects of drugs, age 18-69, without complications/comorbidity	2.9	5.7	2.5	3.9

receiving a few tests and requiring little care versus seriously ill, immobilized patients, requiring significant care. The assumption was that the seriously ill patient would both require more nursing care and have a longer length of stay. For our very small sample, this relationship did not materialize. Patients with low average patient classifications actually tended to stay somewhat longer than patients with higher average classifications. (See Table 8).

Table 8

AVERAGE LENGTH OF STAY BY AVERAGE NURSE PATIENT CATEGORY, SAMPLE OF RECORDS FROM SEPTEMBER THROUGH NOVEMBER 1983

DRG 243 (Medical Back Problems)

Average Nurse Patient Class	Number of Cases	Average Length of Stay
1 - 1.5	73	6.8
1.51 - 2.5	61	5.7
2.51 - 3.5	1	14.0
Total Sample	135	6.4

At this point, we can only speculate on why this has occurred. One possible explanation is that nursing care hour requirements for seriously ill patients with long lengths of stay tend to be concentrated during the first few days of hospitalization. Following this short period of high intensity nursing care, these patients require a lower level of nursing care during the remainder of their stay. This lower level of nursing care required during the latter part of the patient stay deflates the value of the average patient classification for these patients. For such patients, the average classification may be an inadequate measure to express the level of care required. A more promising approach may be to analyze the patient classification data using only the first few days of admission, or to use as a dependent variable the maximum class at which a patient was rated. We also plan to look at the nursing care time required by the patient rather than just the patient classification category. A typical problem with using patient classification data to account for length of stay can be illustrated by comparing data from two patients in DRG 243. Patient A stayed 10 days and was rated as a Class I for every day following the day of admission. Patient B stayed two days and was a Class II for both days. There is no positive correlation in this example between patient class and length of stay. Unfortunately, such examples are fairly easy to find. To see if the differences in length of stay for these two patients could be explained by factors other than severity, all available data from the Navy Inpatient Data System was examined. The findings revealed nothing obvious. Both patients were assigned to the same DRG and had the following characteristics:

a. both were direct admissions to the same hospital;

b. both were male enlisted personnel -

   Patient A is an E4, age 26,
   Patient B is an E7, age 31;

c. both had only one diagnosis code, and the code was very similar -

   Patient A (Diagnosis Code 7222)
   Patient B (Diagnosis Code 7221); and,

d. neither had any major or minor procedures listed on the record.

At this point, the easiest way to identify significant factors not accounted for by DRGs may be to pinpoint such patients and then examine their medical records.

Since the Army researchers plan to use patient classification data in a similar way, we will be very interested in their findings. It should be emphasized that we have not addressed the importance of patient classification data for other purposes, especially in accounting for differences in hospital costs. Since nursing care accounts for 50% of all hospital costs, this variable must be explored further.

Based upon the New Jersey results we thought that DRGs were not as useful for explaining length of stay differences between Navy hospitals as they appeared to be for the civilian community. DRGs explained less than 25% of the variation in Navy data, whereas New Jersey results showed over 40% variance explained. A recent conversation with Dr. Susan Horn indicated that the Navy finding may actually be in line with those of most civilian hospitals. Dr. Horn stated that the civilian hospitals in which she has conducted research have explained between 25-30% of the variance in length of stay using DRGs. In her opinion, by modifying DRGs to account for enlisted personnel and patient transfers (factors which tend to be more) important for the Navy than for most civilian hospitals), we could equal or exceed the variance explained by DRGs in most civilian hospitals.

We plan to continue our search for important factors contributing to length of stay, especially those that may be unique to the military. After the Army and the Air Force have had the opportunity to address the issue of additional DRG subgroups, it would seem wise for the three Services to scrutinize each DRG to see if agreement on specific subgroups can be achieved. The identification of and agreement on a standardized unit of measure is an essential step towards monitoring and comparing hospital productivity.

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CASE MIX AND DATA QUALITY

MAJ Lawrence M. Leahy, MSC, USA

INTRODUCTION

When a military hospital discovers that its planned budget exceeds allowed budget guidance, the hospital commander may argue that the hospital is entitled to budget adjustment because of the type of patients treated and the services provided. This arguement, which has been supported by econometric and hospital cost studies conducted in the late 60's and early 70's, has recently begun to gain acceptance by higher headquarters. The motivation for this attention derives from a number of sources: decrease in medical workload, increase in technology, and dissatisfaction with the Medical Care Composite Unit (MCCU).

The Army Surgeon General and the Commander, US Army Health Services Command (HSC), are considering development of an expanded case mix approach to measure productivity in the Army health care system because of dissatisfaction with the MCCU. HSC is evaluating the use of Diagnosis Related Groups (DRGs) as part of this approach. While a DRG system has the potential to benefit the military health care sector, there is a need to evaluate the accuracy of the medical record system which will be used to develop the use of DRGs or any other case mix method.

RELIABILIY OF DATA

Independent support for the need to evaluate the reliability of the input data to case mix comes from many sources.[1] However, the initial impetus came from studies conducted by the Institute of Medicine (IOM), which assessed the reliability of information abstracted from patients' medical records.[2] While the studies were conducted separately, their major objective was the same--to determine the reliability of selected informational items. Items assessed were date of hospital admission, date of discharge, sex, date of birth or age, source of payment, principal diagnosis, admitting diagnosis, other diagnoses, principal and other procedures, race, marital status, and disposition.[3,4] Although previous studies have been conducted on quality of medical records, the IOM studies are unique for the following reasons:

1. They were national in scope.
2. They involved an independent examination of the medical record by someone other than the individual initially completing the abstract.
3. Conclusions were derived from a thorough review of the medical records.[5]

The first study "concentrated on data derived from hospital discharge abstracts processed by private abstract services" which covered about 65 percent of all discharges from short-stay general hospitals. Based on the sampling plan and a weighted analysis, data were generalized nationally to all 1974 discharges for Medicare and Medicaid patients who were treated in hospitals subscribing to the participating abstract services or the larger hospitals with internal data systems. The second study evaluated the data from Medicare claims submitted by hospitals to fiscal intermediaries and eventually to the Health Care Financing Administration (HCFA). The Medicare study results were applied to "all Medicare beneficiaries age 65 and over, who were discharged from hospitals during 1974."[6] The final IOM study focused on data collected by the National Hospital Discharge Survey (NHDS), a voluntary survey that yielded statistics on utilization of all general and special non-federal, short-stay hospitals in the United States.[7] Because the methods of the NHDS study were similar to the previous two IOM studies, the results could be applicable to all NHDS data collected in 1977.

In all three studies the non-medical data reliability was of a high level. However, reliability of diagnositic information was questioned by all three studies (Tables 1 and 2) and elicited "serious reservations about the adequacy

Table 1

DISCREPANCIES BETWEEN THE IOM FIELD TEAM AND ORIGINAL DATA SOURCE (PRIVATE ABSTRACT OR MEDICARE RECORD) FOR SELECTED DATA ITEMS

Data Item	Weighted Percent With No Discrepancy Medicare Record	Private Abstract
Admission Date	99.5%	99.7%
Discharge Date	99.3	99.2
Date of Birth/Age	-	-
Sex	99.4	99.1
Payment Source	-	98.1
Principal Diagnoses (4)	57.2	65.2
Additional Diagnoses	74.5	-
Principal Procedures	78.9	73.2

Source: L. K. Demlo, P. M. Campbell, and S. S. Brown, "Reliability of Information Abstracted from Patients' Medical Records" Medical Care 16 (December 1978) p. 999, Table 1.

Table 2

ADEQUACY OF THE FACE SHEET FOR ABSTRACTING NHDS DATA (WEIGHTED PERCENT)

Data Item	Adequate	Insufficient	Inaccurate	Total
Admission Date	98.8%	0.8%	0.4%	100.0%
Discharge Date	99.2	0.6	0.2	100.0
Date of Birth/Age	96.9	0.8	2.3	100.0
Sex	97.4	1.0	1.6	100.0
Race	91.7	1.0	7.3	100.0
Marital Status	95.8	0.2	4.0	100.0
Principal Expected Source Payment	97.7	0.4	1.9	100.0
Additional Expected Source Payment	95.9	0.1	4.0	100.0
Patient Disposition	24.8	2.0	63.2	100.0
Principal Diagnosis	47.3	49.3	3.4	100.0
Principal Procedure	5.9	90.6	3.0	100.0

Source: L.K. Demlo and P. M. Campbell, "Improving Hospital Discharge Data: Lessons From the National Hospital Discharge Survey" Medical Care 19 (October 1981) p. 1037, Table 8.

of existing hospital discharge information".[8,9] Because these three studies were conducted during the time period when four-digit coding of diagnoses was standard, the evaluators believed there would be more concern about the reliability of hospital discharge data when a five-digit coding scheme was utilized.[10]

Since the IOM studies of the reliability of discharge data found high error rates, additional studies were conducted by Richard F. Corn, Cynthia Barnard, and Truman Esmond, and H. P. Doremus and Elana M. Michenzi. Corn's research was sponsored by the National Center for Health Statistics and was an assessment of the state of quality control procedures utilized by abstracting services. Using a combination of letters, telephone calls and personal interviews, information was gathered on quality control procedures reportedly followed by private abstracting services, HDS, and HCFA in its 20 percent Medicare sample. In studying procedures utilized in preparation and processing of either an abstract or claim form, Corn's study team raised four significant points:

1. Each of the three major national sources of hospital discharge data... need improvement, particularly in the verification of abstracted information, error correction, and training programs.

2. Validity of the (HDS) data may be limited because the abstractor is instructed to refer only to the face sheet of the medical record.

3. Quality control procedures of the Medicare system are limited and vary across the country.

4. Steps should be taken to improve the quality of discharge data in view of the importance of accurate data.[11]

The study conducted by Barnard and Esmond had three areas of focus: the ambiguity inherent in use of diagnosis and procedure coding schemes and their applicability; the source of Medicare bill data and its relevance to DRG assignment; financial and case mix implications of discrepancies between billing data and medical records data. Using a random 50 percent sample of Medicare inpatients discharged from Rush-Presbyterian-St. Luke's Medical Center during the year beginning 1 May 1979, Barnard and Esmond compared concurrently determined discharge data with retrospectively determined discharge data.[12] In comparing the two types of discharge data, the study showed that "in 53 percent of the cases...the retrospectively coded diagnosis had not been cross-coded at all on a concurrent basis."[13] (Table 3) When applying this coding difference to the DRG payment process, the study showed that "reimbursement based on concurrent data, with case mix and local wage index as the sole determinant of payment amount, would have averaged $600 less than reimbursement based on retrospective data."[14] (Table 4) In analyzing their research data, Barnard and Esmond were quite emphatic in the use of concurrent data as a case mix data base. Specifically, they observe, "the data upon which the Health Care Financing Administration plans to construct its new reimbursement mechanism may be inappropriate for that use...the current case mix based on Diagnosis Related Groups cannot be used to measure resource use and therefore will not accurately predict reimbursement needs."[15]

Additional support for Barnard and Esmond's hypothesis concerning the reliability of the HCFA data base has been provided by Doremus and Michenzi who compared data from the MEDPAR File, the original medical record discharge order, and a reabstracted record. Based on the authors' comparison, an analysis was made of each item's effect upon DRG classification and the Medicare reimbursement ceiling for University Hospitals of Cleveland. Study results show:

1. In 47.7 percent of the cases studied the principal diagnosis code was different in the HCFA data base than in the patient's original medical record discharge order.

2. A comparison of the principal diagnosis code on the original discharge order with the code on the reabstracted record revealed a different code in 32.1 percent of the cases studied. (Table 5)

3. The variation in diagnostic and surgical information between the HCFA data base and information found in the original discharge order resulted in a different DRG classification for 61.1 percent of the patients in the study.

Table 3

MATCHING RETROSPECTIVE PRINCIPAL AND SECONDARY CODES TO CONCURRENT CODES

	Principal Diagnosis	Secondary Diagnosis	Principal Procedure	Secondary Procedure
Retrospective code matches concurrent (%)	35.05	4.77	31.32	5.34
Retrospective principal as concurrent secondary or	6.38	6.45	4.43	6.96
vice versa (%)	2.82	2.41	.54	.40
No retrospective code found (%)	2.62	41.60	15.83	40.19
Retrospective code not in concurrent (%)	53.12	44.76	47.88	47.11
Total	100.00	100.00	100.00	100.00

NOTE: Rounded numbers may not add to 100%

Source: C. Barnard and T. Esmond. *"DRG-Based Reimbursement: The Use of* Concurrent and Retrospective Clinical Data" Medical Care 19: (November 1981), p. 1077, Table 2.

Table 4

DISCREPANCIES IN RETROSPECTIVE VERSUS CONCURRENT DRGs

	No. of Cases	%
Retrospective DRG same as concurrent	684	22.984
Retrospective DRG differs from concurrent	2292	77.016

Source: C. Barnard and T. Esmond, "DRG-Based Reimbursement: The Use of Concurrent and Retrospective Clinical Data" Medical Care 19 (November 1981): 1078, Table 3.

Table 5

DIAGNOSTIC DATA DISCREPANCIES BETWEEN THE HEALTH CARE FINANCE ADMINISTRATION (HCFA) RECORD, ORIGINAL DISCHARGE ORDER, AND REABSTRACTED RECORD

	HCFA Record Compared With Original Discharge Order		Original Discharge Order Compared With Reabstracted Record	
Data Item	Number	%	Number	%
Disagreement on principal diagnositc code (all digits -ICDA-8)	125	47.7	84	32.1
Case with indication of one additional diagnosis on at least one record	159	61.0	201	76.7
Disagreement on first listed additional diagnosis when both records show an additional diagnosis/diagnoses	0	0	77	38.3
Cases with indication of additional diagnosis on only one record	159	100.0	54	26.9
Cases with no indication of additional diagnosis on either record	103	39.3	61	23.3

Source: H. D. Doremus and E. M. Michenzi, "Data Quality : An Illustration of its Potential Impact Upon a Diagnosis Related Group's Case Mix Index and Reimbursement" Medical Care (October 1983): p. 100, Table 1.

4. In 37 percent of the cases studied the DRG classification differed when classification was compared based on diagnostic and surgical information from the original discharge order and the reabstracted record.

5. Using data from the HCFA data base for case mix reimbursement would lead to a significantly understated level of Medicare reimbursement.

The results of the study demonstrated that there is inaccurate, incomplete recording of diagnostic and surgical information in the medical record, which reinforced the findings of Barnard and Esmond's study and brought out the requirement for additional research on data quality.[16]

THE DARNALL ARMY COMMUNITY HOSPITAL STUDY

The foregoing studies tend to suggest that data on discharge abstracts may be inappropirate for use in developing a case mix system and that further research on data quality is necessary prior to implementing any case mix system. A study on data quality has recently been initiated at Darnall Army Community Hospital (DACH), which is a 250-bed academic community hospital located at Fort Hood, Texas.

Objectives of the Study

The study is comparing concurrently determined diagnostic data with medical records retrospectively determined diagnostic data. The goal is to evaluate the extent to which concurrently collected data can be substituted for retrospective diagnosis. Because the study is being used as a Graduate Research Project, it is also determining reasons for discrepancies and determining specific recommendations to decrease the discrepancy rate.

Data and Method

Data were obtained from DACH's Patient Administration Division for patient dispositions during January 1984. The data elements obtained were patient number, principal diagnosis (concurrent and retrospective), additional diagnoses, sex, principal service utilized, and beneficiary category. To accurately assess the difference between concurrent and retrospective diagnostic data, all patients admitted for delivery, newborns, absent sick, carded for record, and medical board patients were eliminated from the study.

Study Results

Administrative information (sex, principal service, and beneficiary category) was highly reliable in our study. However, there was much less reliability for clinical data. The principal retrospective diagnosis was coded principal in concurrent diagnosis in 72 percent of the cases. In 20 percent of the cases the concurrent code was matched by an additional retrospective diagnosis. Thus, the retrospective coded diagnosis had not been coded on a concurrent basis in eight percent of the cases. (Table 6)

Table 6

MATCHING RETROSPECTIVE PRINCIPAL AND ADDITIONAL DIAGNOSIS TO CONCURRENT DIAGNOSIS

Retrospective diagnosis matches concurrent diagnosis (%)	72.0
Retrospective additional diagnosis matches concurrent diagnosis (%)	20.0
Retrospective diagnosis does not match concurrent diagnosis (%)	8.0
Total	100.0

Tentative Conclusions

While our preliminary study results show a discrepancy rate less than that found in other studies previously referenced, there is a sufficient problem indication which questions the reliability of patient data. It is difficult to make a general statement about the quality of medical records data throughout Health Services Command because our data is preliminary and our patient population is quite unique. However, prior to constructing a new case mix budgetary system, there is a need for additional research. We are continuing the current study and upon completion will attempt to identify the causes for data discrepancy. Also, given the results of our study, HSC and OTSG need to take steps to ensure that their data base represents complete and accurate diagnostic data.

FOOTNOTES

[1]Siemon, James E. "Case Mix and Data Quality." Topics in Health Record Management 2 (June 1982): 19-20.

[2]Corn, Richard F. "Quality Control of Hospital Discharge Data." Medical Care 18 (April 1980): 416.

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[7]Demlo, "Improving Hospital Discharge Data," p. 1030.

[8]Demlo, "Reliability of Information," p. 998.

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[11]Corn, "Quality Control of Hospital Discharge Data," pp. 417-426.

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INPATIENT PERFORMANCE MEASUREMENT UPDATE: DATA CONVERSION AND INITIAL CASE MIX ACCOUNTING

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INTRODUCTION

The Patient Administration Systems and Biostatistics Activity (PAS&BA) has been performing hospital profile analyses in one form or another for many years. The analyses have been performed using the Individual Patient Data System (IPDS) data which are centrally maintained by the Health Care System Support Activity (HCCSA) at Fort Sam Houston, Texas. Although PAS&BA depends on HCSSA for computer processing, many general retrieval programs have been written by statisticians assigned to the activity. General retrieval programs form the basis for a full range of information retrieval and biostatistical analysis capabilities covering both descriptive and inferential techniques. Retrieval techniques have primarily been employed to support hospital information requirements. The various programs are used to provide hospitals with a wide range of products which include: lists of inpatient records by primary diagnoses helpful in evaluating a hospital's case mix; length of stay data by diagnositc code groups for internal utilization review and monitoring; and comparative length of stay studies intended to help Medical Treatment Facilities (MTF) profile their data within peer groups.

Fundamental to many of the IPDS based analyses of hospitals has been the issue of determining which hospitals could be labelled "similar" to the hospital under examination. The issue of determining which hospitals were, in fact, similar to others was given only limited examination until two years ago when it became apparent that MTF were requesting more analyses focusing on normative/comparative length of stay issues within peer group hospitals. The most common criteria for grouping hospitals were those created by resources management staff. Other groups were defined by type of population supported or mission, e.g., Training and Doctrine Command (TRADOC) posts which have high trainee hospitalization rates or tertiary, acute care facilities which treat a high proportion of retirees and their dependents. Groupings were also formed on the basis of bed size, dispositions and total patient days. None of these groupings were sufficiently sensitive to case mix variations, and the resulting analyses using diagnostic data for length of stay studies produced relatively large unexplained variations within each group. The desire to improve the homogeneity of the groups led PAS&BA to initiate research in two areas. The first area was to investigate the availability of some type of patient classification technique that would be better than using hospital structural criteria as a proxy for case mix and secondly, to employ an appropriate patient classification technique in order to understand the impact of case mix on quality assurance and utilization review issues among MTF. Both of these pursuits have been encompassed within the scope of the Army Medical Department (AMEDD) Performance Measurement Study (PMS) along with other important issues helpful in explaining hospital and health system performance.

As a point of departure, a study was generated to explore the changes in case mix and length of stay over the last ten years among AMEDD inpatient data. This analysis was done using International Classification of Diseases, Ninth Revision (ICD-9) code groups to help define case mix. The analysis of the IPDS data base and related resource measures from the Medical Summary Reporting System indicated that if our workload performance measures were more sensitive to the type of disposition and clinic visit and less dependent upon bed day measures, the workload picture for the AMEDD would be brighter. Length of stay among AMEDD MTF has steadily declined during the last five years (FY79-83). This conclusion was reached after categorizing patient data by a number of the variables found in the basic Individual Patient Data System (IPDS) inpatient record. The pattern of decreased length of stay parallels the pattern in the civilian sector. One might conclude that an emphasis on bed-day-type measures does not provide the proper incentives for MTF Commanders to utilize their resources properly. In fact, variations in length of stay among MTF for the same disease, controlling for age and sex, frequently leave the conclusion that the variant length of stay (LOS) was due largely to local command policy or other professional perogatives. Moreover, the emphasis on establishing an effective ambulatory care delivery system demands an alternative to the current outpatient weighting system. The outpatient weighting system, like the inpatient weights, are not sensitive to the type of case and thus fail to reflect the actual resources and provider time expended in the delivery of care.

The IPDS review revealed that our MTF are hospitalizing more patients in older age groups and that these older patients are becoming increasingly prevalent in IPDS over time (See Figure 1). In a related examination, viewing IPDS in terms of the beneficiary category of patients hospitalized, patients defined as "other" (for the purposes of this analysis, "other" category accumulated all patient beneficiary categories not accounted for as active duty military or dependents of active duty military) represented an increasingly significant proportion of the inpatient data over the duration of the study (See Figure 2). Using some of the initial IPDS-DRG data, a correlation was computed with the case mix index and the percent of "other" patients. For FY 82, the MTFs were grouped in three categories; MEDCENs, large MTF and small MTF. The medical centers demonstrated a nearly linear relationship between case mix index and the percent of "other" patient category data. The coefficient of determination was calculated to be .955 (See Figure 3 and 4).

An examination of selected elements of the Medical Care Composite Unit (MCCU) or Composite Work Unit (CWU) demonstrated that MTFs have actually increased workload. Both the number of patients dispositioned and outpatient

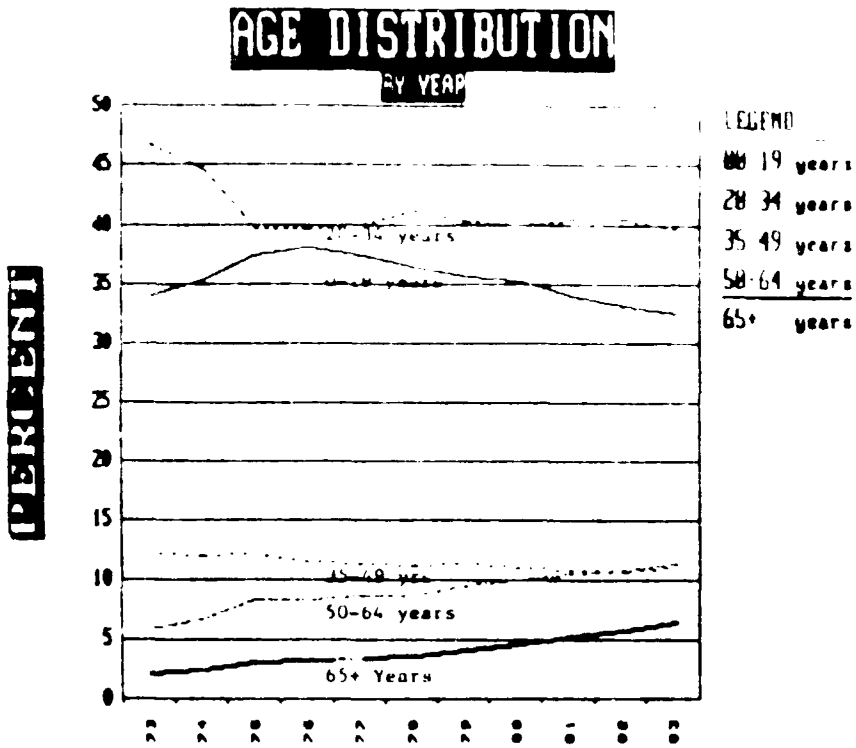


Table portrays percent of all inpatient dispositions from US Army hospitals by age groups.

SOURCE: Individual Patient Data System (IPDS)

Figure 2

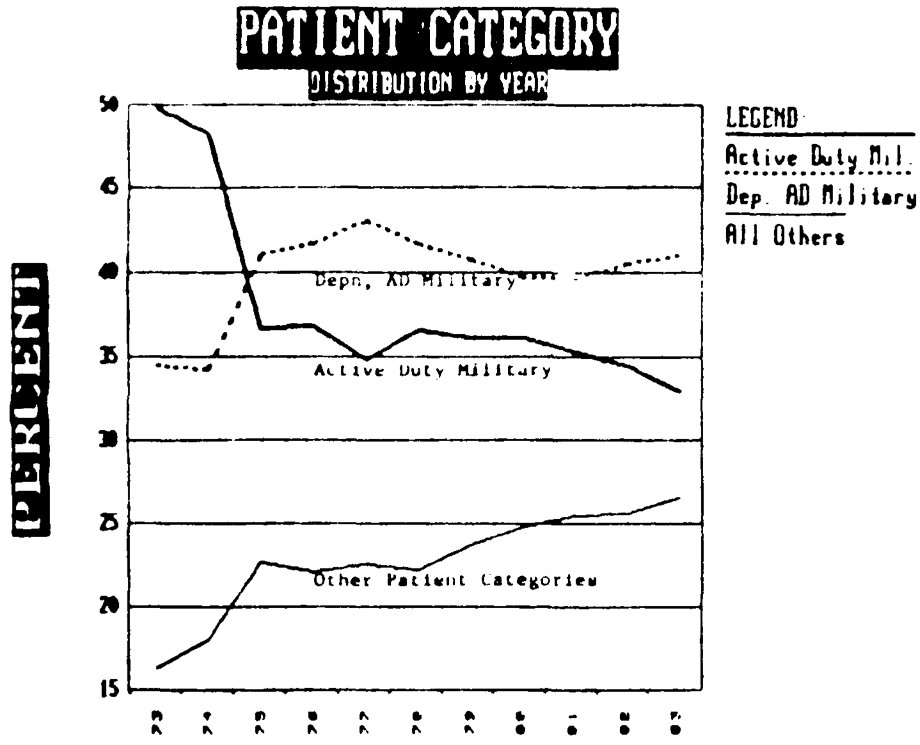


Table portrays percent of all inpatient dispositions from US Army hospitals by patient category.

SOURCE: Individual Patient Data System (IPDS)

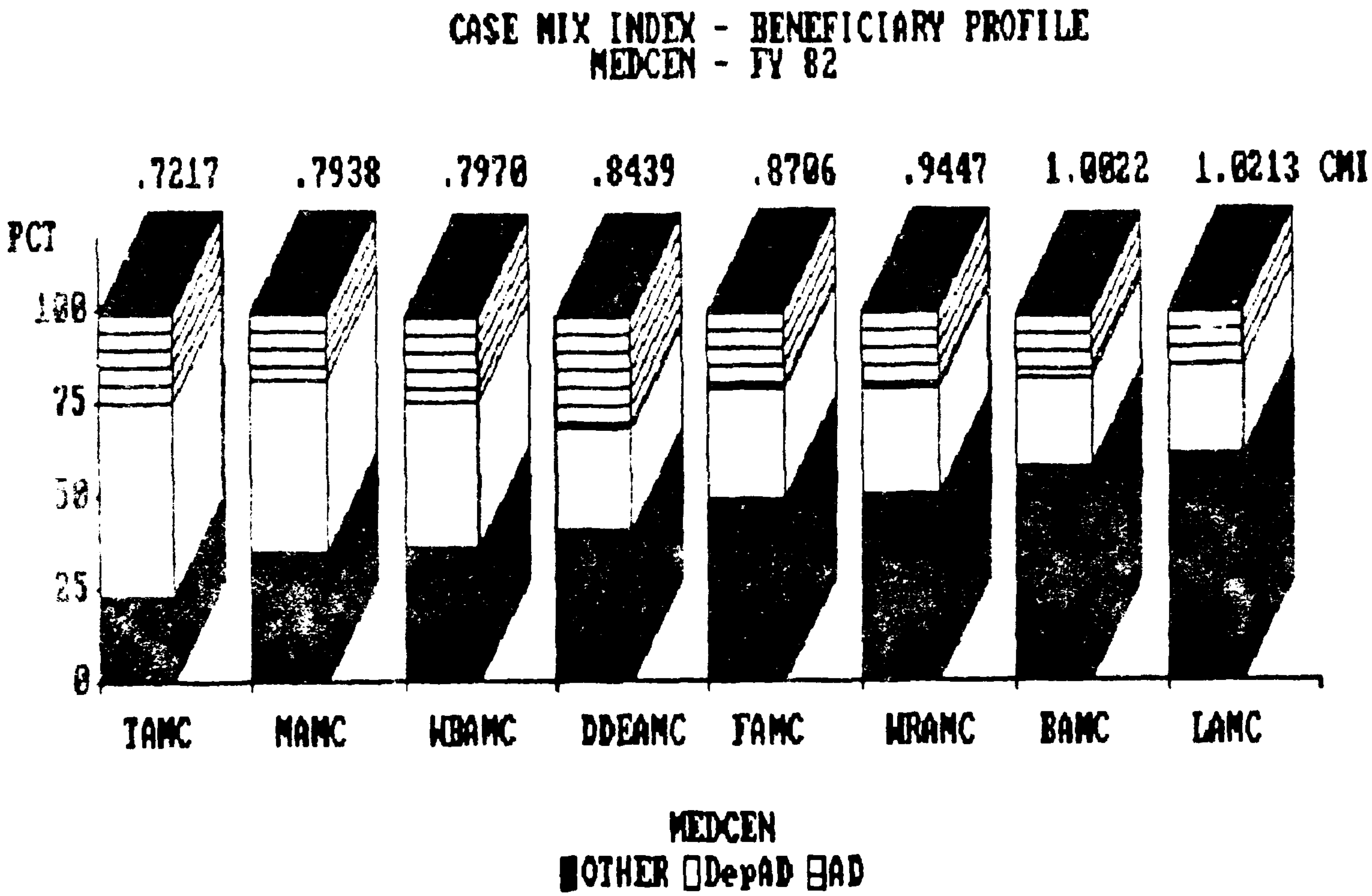
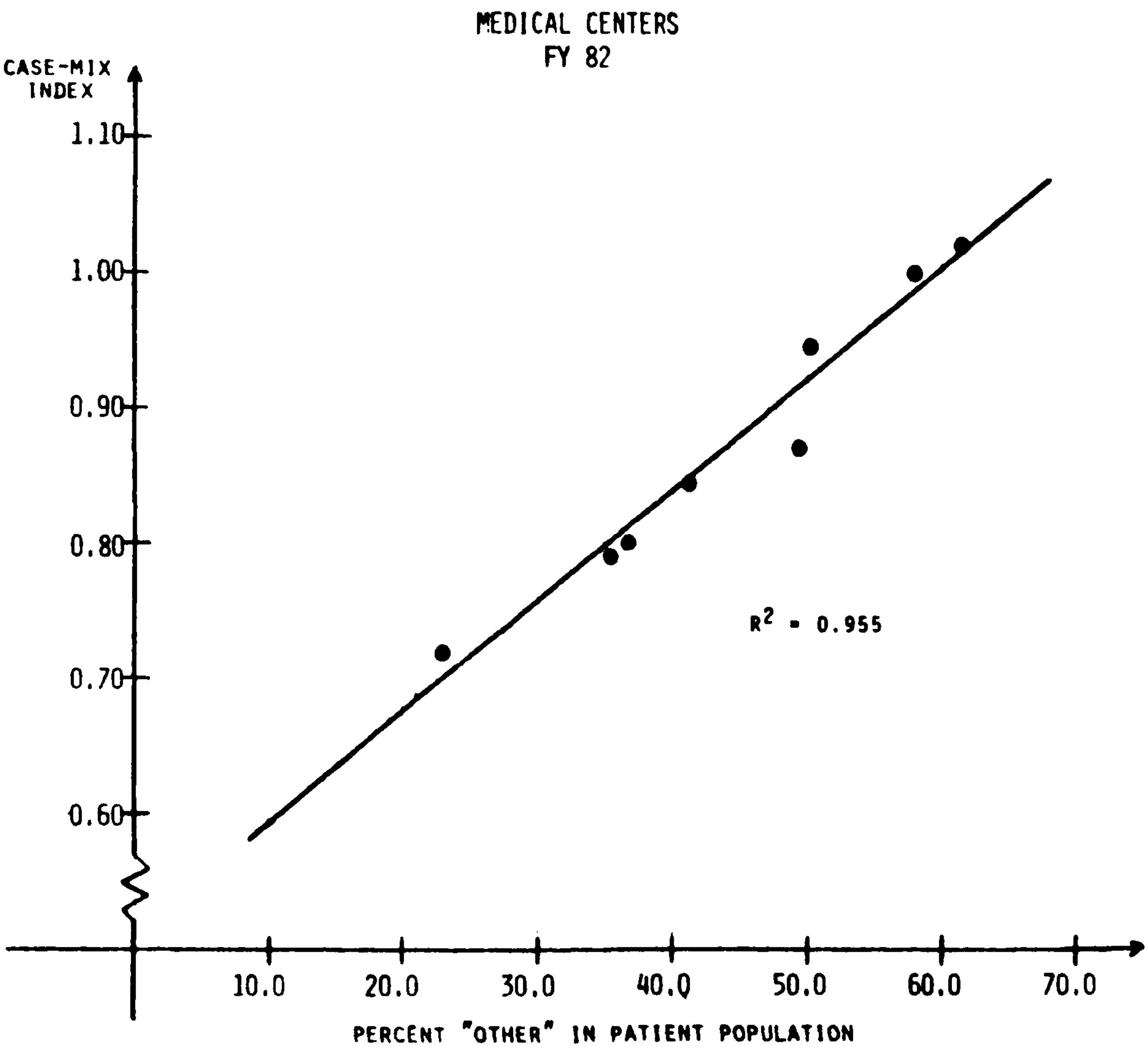

CASE MIX INDEX - BENEFICIARY PROFILE
MEDCEN - FY 82
.7217
.7938
.7970
.8439
.8706
.9447
1.0022
1.0213 CMI
PCT
100
75
50
25
0
TAMC
MAMC
WBAMC
DDEAMC
FAMC
WRAMC
BAMC
LAMC
MEDCEN
OTHER DepAD AD

Figure 3

Figure 4

CMI VERSUS PERCENT "OTHER" IN POPULATION



encounters/visits have shown consistent growth overtime. Perhaps as a result of increased production vis-a-vis dispositioned patients and increased ambulatory care efforts, the average length of stay has dropped signficantly with a corresponding decline in average daily patient load. As observed by Joyce Hutchins, the statistician who developed the IPDS trend analysis, using the MCCU/CWU measure, it would appear that AMEDD MTF are being penalized for being more efficient.

Several points were found to be indicative of a trend in IPDS over the CY 79-83 period indicating changes in case mix/case complexity length of stay:

Key Points with Respect to Length of Stay

* An increase in the number and percent of female patients treated coupled with their consistently shorter LOS.
* An increase in the number of cases and percents of dispositions accumulated to OB/GYN and Pediatric clinic services combined.
* A decrease in the number and percent of injury cases and their typically longer lengths of stay.
* A decrease in dispositions for failure to meet medical procurement standards (these cases are primarily handled on an outpatient basis now).

Key Points with Respect to Increasing Complexity

* There are more diagnoses being coded per IPDS record.
* There has been a slight increase in the number of deaths among inpatients .
* The number and percent of inpatients treated who are fifty years of age and older has increased.
* The number and percent of active duty military patients has decreased.
* Average length of stay has increased progressively by age group. Similarly, the number of diagnoses and procedures coded per record also increased with the older age groups.
* While hospital stays for lower enlisted have decreased, average length of stay for more senior ranks increased.

Having analyzed the IPDS data and related resource measures from a traditional perspective, the PMS study efforts began examining the applicability of of the Diagnosis Related Groups to AMEDD inpatient Data. This effort caused the study to address a major nosological issue. The DRGs currently used by HHS, HCFA were formed using codes documented in the International Classification of Diseases, Ninth Revision with Clinical Modification (ICD-9-CM). The civilian hospital industry and the Veterans Administration adopted this coding classification system in 1979. Conversely, the three Services elected to use the ICD-9 and International Classification of Procedures in Medicine (ICPM) for diagnoses and procedures, respectively. The Services implemented ICD-9 and ICPM coding in calendar year 1980. Therefore, the first problem encountered in the study effort was, "how to convert our AMEDD data to the coding system (ICD-9-CM) that was compatable with the Health Systems International Grouper." The "grouper" is the software used to assign individual patient records to one of the 470 DRGs. Before examining the initial products of our DRG/case mix analyses, we will review the methodology used to convert and group Army inpatient data.

CONVERSION AND GROUPING OF ARMY INPATIENT DATA

Measuring performance in inpatient care is very difficult without some benchmark of comparison. Since the Department of Defense medical departments use ICD-9 and ICPM for their medical coding and civilian and Veterans Administration health care facilities code by ICD-9-CM, it is very difficult for the services to make comparisons other than with other military hospitals. It was recognized that some type of diagnoses grouping for performance measurement was necessary. Two major efforts have been made in this direction. The first effort was directed at finding an appropriate and acceptable method for converting ICD-9 and ICPM diagnoses and surgical procedures into ICD-9-CM. If such a map were possible, then that would enable Army hospitals not only to compare their data with nonmilitary medical treatment facilities, but also to use certain state-of-the-art grouping techniques to facilitate case mix measurement. The code conversion map used in the study group's initial efforts was one developed by Mr. Kay, from the Naval School of Health Sciences (NSHS) in conjunction with the December 1981 version Health Systems International Grouper Program for assigning records to Diagnoses Related Groups (DRGs).

A DRG data base was created for the study group using the last three fiscal years (FY 81-FY 83) of inpatient records from US Army hospitals Worldwide. This amounted to approximately 1.2 million records. The records of active duty Army personnel treated in civilian hospitals for their entire period of hospitalization were not included in this data base; neither were incomplete records, i.e., records with clinical data missing, nor Carded for Record Only (CRO) records. The Army inpatient record is 240 characters in length. It contains the usual demographic data found on most hospital abstracts, such as sex, age, and race, along with up to eight diagnoses and eight different surgical procedures. Certain data elements unique to DOD or Army are collected, such as convalescent leave days, supplemental care days, external cause of injury and underlying cause of separation for disability separations. Individual Patient Data System (IPDS) records are edited extensively before being added to the data base. Consistency checks are made between fields, as well as quality-type edits. Age or sex-related diagnoses are verified. Admission, disposition data sequencing and computations of days fields (bed, sick, convalescent leave, supplemental care, cooperative care, other) are checked. By the time a record is through the editing process, it is error-free as much as is possible with machine editing. This data base was used as input to a FORTRAN program that essentially copied the 240 characters of the IPDS record and added an additional 112 characters, making the DRG record 352 characters in length

The ICD-9 diagnoses and ICPM procedures were converted to ICD-9-CM codes using the Navy map mentioned above. This map contained approximately 170 diagnosis codes and 650 procedure codes. In the conversion program, if an equivalent code were not found in the map, then a 0 was added to the diagnosis to make a 5-digit ICD-9-CM diagnosis code. If an equivalent code were not found in the procedure map, then that particular procedure was not converted. Those converted diagnosis and procedure codes were then output onto the new record. The program also converted age to a 3-character field, sex to a numeric 1-character field, and the IPDS disposition (or discharge) to a 1-digit numeric code. In an effort to render the best possible conversion map, it was learned that The Health Systems Management Group, School of Organization and Management, Yale University were doing a similar conversion for international comparisons using DRGs. In January, communication began with the Yale staff and a contract was negotiated with Commission on Professional and Hospital Activities (CPHA) for nosological expertise and recommendations on the map. In March, Mr. Terry Kay from NSHS, LTC Cecere, M.D., and COL Rosenberg, M.D. of the PMS, and the authors met and corrected recognizable deficiencies in the procedure map. Suggestions and recommendations were received from Yale University (for both diagnoses and procedures) and CPHA (for procedures only). In many cases Yale and CPHA recommendations were different. Some of their suggestions were integrated into the map; others are still being evaluated. Changes from the 81 Grouper to the 83 Grouper program improved the grouping substantially. Some changes corrected errors in the 81 program logic, while others improved the groupings. A summary of the changes implemented with 1983 Grouper are as follows:

a. Thirteen procedure codes were changed from "OR" to "NON-OR."

b. Five procedure codes were changed from "NON-OR" to "OR."

c. Procedure codes were added to additional DRGs as indicated in Table 1.

Table 1

PROCEDURE CODE CHANGES FROM 81 TO 83 GROUPER

MDC	# PROCEDURE CODES ADDED	DRG ADDED TO
01	38	7-8
05	20	120
06	2	154-156
06	1	152-153
06	1	157-158
07	1	193-194
08	1	213
08	1	226-227
08	7	233-234
09	1	267
09	3	269-270
10	1	292-293
11	1	303-305
13	3	360
13	3	363-364
14	1	375
14	1	381
16	1	394
21	16	442-443
22	37	459

d. Some diagnosis codes were changed between MDCs:

2 diagnosis codes previously assigned to DRG 469 were added to MDC 15.

1 diagnosis code was added to MDC 14.

e. The grouper program was corrected to allow Newborns with no secondary diagnosis to be assigned to DRG 391, Normal newborns.

f. The surgical DRG hierarchy for MDCs 6 and 8 was changed.

g. Two hundred sixty-nine codes were added to the complications/comorbidity list, and 46 codes were eliminated from the list. One hundred fifty-one of the codes added were nature of injury codes.

h. The coding of discharge status was changed to the UB-82 convention, using the same categories of discharges but changing the codes to two-digit codes.

i. Detailed listings of the changes are found in Appendix H to the Manual, The Revised ICD-9-CM Diagnosis Related Groups (DRGs).

Use of the 83 version of the Grouper began in mid-April 1984. In analyzing the newly grouped data, the distinction desired between types of hospitals was not achieved. A change was made to the conversion program to not convert procedures that had been performed at another hospital (on transfer records). This slightly improved the differentiation between types of hospitals. CPHA recommendations included the mapping of all "class 1" procedures, which they define as surgery. Some of these had been included in the previous conversion map used, and some had not. About the beginning of May the map was expanded to include verbatim addition of the CPHA recommendations concerning procedures. This change seemed to improve the groupings by DRG more than any other single modification up to that point. Evaluation of Yale recommendations for the diagnosis and procedure maps still remains to be done. Also, CPHA is expected to submit their recommendations for the diagnosis map in the near future providing the capstone event for this major area. It is hoped that a satisfactory map can be derived that will successfully and accurately assign records to the DRG they would have been grouped to had the data been originally coded by the ICD-9-CM classification.

Once the "best map" has been attained, analysis will be made as to the accuracy of that map. Table 2 shows changes to the first few DRGs through the various mapping and grouper changes. One Air Force site has coded a sample of primary inpatient records using ICD-9-CM, and has coded the same records using ICD-9 and ICPM. Plans for future work with Wilford Hall Air Force Medical Center in analyzing the results of this dual coding experiment should aid in validation of the diagnosis and procedure maps. All through the mapping process, case mix indices (CMIs) have been computed using the HCFA weights as computed for Medicare, the 1982 Schedule of Reimbursement used for New Jersey and the 1984 reimbursement schedule for the Veterans Administration hospitals (Nashville). CMIs using each of these weighting systems were computed for a sample of records from the FY 81 file (3,859 records), then later for each of the three fiscal years (FY 81-FY 83). Each iteration of the map seemed to

Table 2

EFFECT OF CHANGES ON FY 83 DRG FREQUENCY

DRG	81 GROUPER	83 GROUPER	83 GROUPER EXCL SURG AT OTHER MTF	83 GROUPER EXCL SURG AT OTHER MTF INCL CLASS 1
001	256	256	236	251
002	134	134	85	85
003	128	128	126	127
004	110	110	87	88
005	242	242	241	241
006	0	0	0	1028
007	133	140	131	54
008	1227	1273	1268	310
009	135	137	158	158
010	101	101	104	104
011	133	133	140	140
012	457	461	463	456
013	336	338	338	338
014	1078	1088	1102	1103
015	699	699	701	699
016	80	82	83	76
017	185	186	186	174
018	148	142	144	146
019	918	928	934	933
020	831	832	833	833
021	448	448	448	449
022	6	6	6	6
023	54	54	54	55
024	408	369	369	373
025	2150	2193	2194	2190
026	1061	1060	1062	1062
027	0	0	0	0
028	534	598	654	668
029	1883	1947	1977	1975
030	876	889	891	893

improve the CMI, with the exception of the Yale recommendations. Using their map exclusively produced the lowest set of MTF CMIs of all the CMIs computed. Table 3 shows the changes in CMI through some of the various mappings using Medicare weights.

Another type of map developed was an ICD-9 conversion to CPHA's "List A Groups". This was done by Army to be used for conversion of IPDS data to List A

Table 3

EFFECT OF CHANGES ON FY 83
ADJUSTED CASE MIX INDEX

MTF	81 GROUPER	83 GROUPER	83 GROUPER EXCL SURG AT OTHER MTF	83 GROUPER EXCL SURG AT OTHER MTF W/MOD MAP
LETTERMAN AMC	1.0285	1.0295	1.0264	1.0669
BROOKE AMC	1.0108	1.0143	1.0106	1.0483
WALTER REED AMC	0.9673	0.9668	0.9625	0.9935
FITZSIMONS AMC	0.8830	0.8810	0.8795	0.9059
EISENHOWER AMC	0.8924	0.8960	0.8627	0.8955
WM BEAUMONT AMC	0.8099	0.8081	0.7970	0.8093
REDSTONE ARSENAL	0.8251	0.8072	0.7981	0.7968
FT MEADE	0.8072	0.7957	0.7927	0.7962
FT DEVENS	0.7987	0.7901	0.7830	0.7852
MADIGAN AMC	0.7696	0.7689	0.7643	0.7742
TRIPLER AMC	0.7416	0.7440	0.7368	0.7589
FT EUSTIS	0.7518	0.7474	0.7430	0.7479
LANDSTUHL, GE	0.7239	0.7223	0.7223	0.7461
FT MONMOUTH	0.7475	0.7501	0.7478	0.7455
SEOUL, KOREA	0.7522	0.7422	0.7411	0.7370
FT BRAGG	0.7258	0.7262	0.7229	0.7232
FT DIX	0.7232	0.7244	0.7228	0.7229
FT MCCLELLAN	0.7258	0.7226	0.7213	0.7206
FT BEN HARRISON	0.7489	0.7214	0.7169	0.7169
FT LEE	0.7244	0.7163	0.7124	0.7151
FT BENNING	0.7216	0.7207	0.7119	0.7146
GORGAS, CZ	0.7078	0.7077	0.7068	0.7110
FT LEAVENWORTH	0.7199	0.7190	0.7073	0.7107
FT IRWIN	0.6943	0.6898	0.6898	0.6886
FT STEWART	0.6744	0.6771	0.6745	0.6818
FT JACKSON	0.6786	0.6809	0.6800	0.6801
FT LEONARD WOOD	0.6845	0.6839	0.6799	0.6789
WEST POINT	0.6684	0.6677	0.6677	0.6771
AUGSBURG, GE	0.6751	0.6755	0.6731	0.6751
FT KNOX	0.6809	0.6744	0.6694	0.6702
FT HUACHUCA	0.6790	0.6722	0.6720	0.6700
FT POLK	0.6633	0.6658	0.6631	0.6630
FT CARSON	0.6635	0.6643	0.6632	0.6623
FT ORD	0.6602	0.6618	0.6598	0.6607
FT RUCKER	0.6649	0.6599	0.6599	0.6563
FT CAMPBELL	0.6599	0.6581	0.6524	0.6552
FT HOOD	0.6613	0.6577	0.6552	0.6550
FRANKFURT, GE	0.6536	0.6535	0.6521	0.6515
FT SILL	0.6513	0.6529	0.6451	0.6497
FT RILEY	0.6427	0.6451	0.6429	0.6456

Table 3 (continued)

EFFECT OF CHANGES ON FY 83
ADJUSTED CASE MIX INDEX

MTF	81 GROUPER	83 GROUPER	83 GROUPER EXCL SURG AT OTHER MTF	83 GROUPER EXCL SURG AT OTHER MTF W/MOD MAP
BAD CANNSTATT, GE	0.6419	0.6391	0.6373	0.6449
WUERZBURG, GE	0.6423	0.6383	0.6335	0.6338
BREMERHAVEN, GE	0.6309	0.6232	0.6140	0.6297
ALASKA	0.6258	0.6250	0.6238	0.6244
NUERNBERG, GE	0.6361	0.6222	0.6212	0.6234
VICENZA, IT	0.6107	0.6157	0.6113	0.6113
SHAPE, BELGIUM	0.6186	0.6114	0.6088	0.6105
LEGHORN, IT	0.6427	0.5981	0.5974	0.6043
FT BELVOIR	0.5980	0.5984	0.5984	0.5977
HEIDELBERG, GE	0.5910	0.5900	0.5890	0.5889
BERLIN, GE	0.5838	0.5835	0.5774	0.5807

Groups for a second analysis employing another case mix measure referred to as the Resource Need Index (RNI). The RNI is a CPHA measure that addresses expected resource variation based on case mix. With this "List A" map, the Army has gained the ability to compare AMEDD data with CPHA's national normative data. CPHA's data is from a large sample of Professional Activities Study (PAS) hospitals and reports LOS by List A Groups. The variables included within List A Groups are: whether or not surgery was performed, presence or absence of secondary diagnosis, and five age groups. The variance and percentiles (5th, 10th, 75th, 90th, 95th, and 99th) are also reported. Since 1980 when DOD began coding from ICD-9 and civilian hospitals were using ICD-9-CM, very little comparison could be made between DOD and their civilian counterparts. A map from ICD-9 to List A Groups now gives DOD that capability of comparison, and the Army expects to do more in this area of analysis.

INITIAL CASE MIX ACCOUNTING

The current edition of Diagnosis Related Groups establishes twenty-three Major Diagnostic Categories (MDCs). Table 4 provides an english description of each MDC. The MDCs were formed by physician panels as the first step toward insuring that the DRGs would be clinically coherent. The diagnoses in each MDC correspond to a single organ system or etiology and in general are associated with a particular medical specialty. MDCs 14 and 15 contain the greatest amount of Army data representing Pregnancy, Childbirth and the Puerperium and Newborns and Other Neonates with Conditions Originating in the Perinatal Period, respectively. A graphic presentation of the frequency of AMEDD inpatient data by Major Diagnostic Category for FY 1983 is at Figure 5. Correspondingly, a review of the top twenty Diagnoses Related Groups shows that DRGs 391 and 373, representing Normal Newborns and Vaginal Delivery without Complicating Diagnoses, respectively, have the highest frequency (See Figure 6). It should be noted that the MDC frequency graphic includes data for MDC 24. MDC 24 is not an actual MDC, as described above, but instead reflects the data assigned to DRGs 469 and 470 which are, in effect, catch-all DRGs where data did not fit the delineation of DRGs 1 through 468.

Case mix information has been created using HCFA established relative weight units for fiscal years 1981-1983. Case mix data prepared for these proceedings represent FY 1983 data. Figures 7, 8, and 9 display MTF Case Mix Indexes for the three types of MTF groups commonly known within the US Army Health Services command as MEDCENS (Medical Centers), Large MTF and Small/Medium MTF. The following definitions may be helpful in explaining the concept associated with case mix. Case Mix is defined as the relative proportion of cases that fall into mutually exclusive case types (e.g., DRGs). Case Mix Measures are calculated by application of a set of weights to the number of patients falling into each case type within a hospital. Each case type (e.g., DRG)

Table 4

LISTING OF TWENTY-THREE MAJOR DIAGNOSTIC CATEGORIES

Major Diagnostic Cateogry Number	Major Diagnostic Category English Description
01	Diseases and Disorders of the Nervous System
02	Diseases and Disorders of the Eye
03	Diseases and Disorders of the Ear, Nose and Throat
04	Diseases and Disorders of the Respiratory System
05	Diseases and Disorders of the Circulatory System
06	Diseases and Disorders of the Digestive System
07	Disease and Disorders of the Hepatobiliary System and Pancreas
08	Disease and Disorders of the Musculoskeletal System and Connective Tissue
09	Disease and Disorders of the Skin, Subcutaneous Tissue and Breast
10	Endocrine, Nutritional, and Metabolic Diseases and Disorders
11	Diseases and Disorders of the Kidney and Urinary Tract
12	Diseases and Disorders of the Male Reproductive System
13	Diseases and Disorders of the Female Reproductive System
14	Pregnancy, Childbirth and the Puerperium
15	Newborns and Other Neonates with Conditions Originating in the Perinatal Period
16	Diseases and Disorders of the Blood and Blood-forming Organs and Immunological Disorders
17	Myeloproliferative Diseases and Disorders and Poorly Differentiated Neoplasms
18	Infectious and Parasitic Diseases (Systemic or Unspecified Sites)
19	Mental Diseases and Disorders
20	Substance Use and Substance Induced Organic Mental Disorders
21	Injuries, Poisonings and Toxic Effects of Drugs
22	Burns
23	Factors Influencing Health Status and Contacts with Health Services

FREQUENCY OF MAJOR DIAGNOSTIC CATEGORIES
FY 83

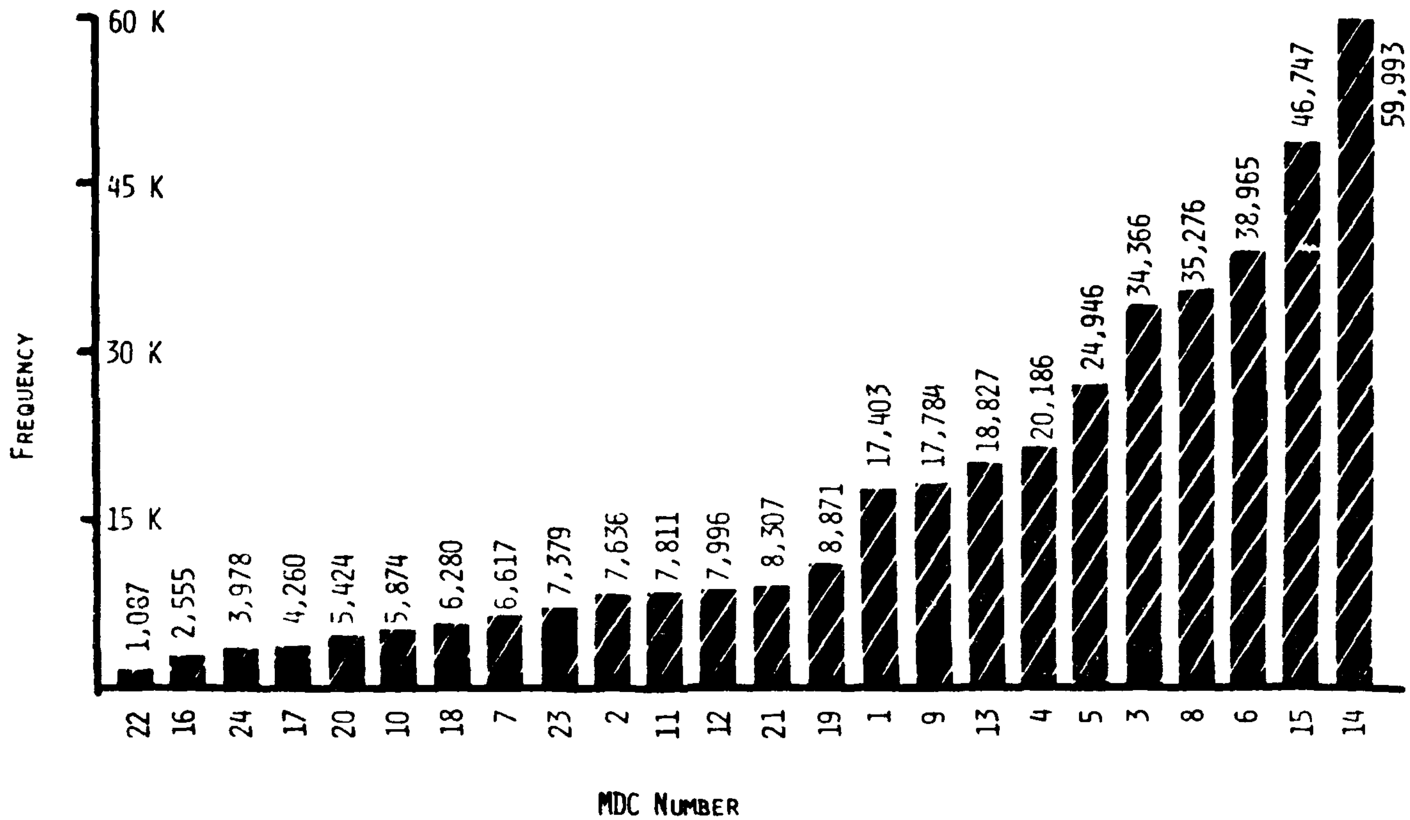


Figure 5

FREQUENCY OF DIAGNOSTIC RELATED GROUPS

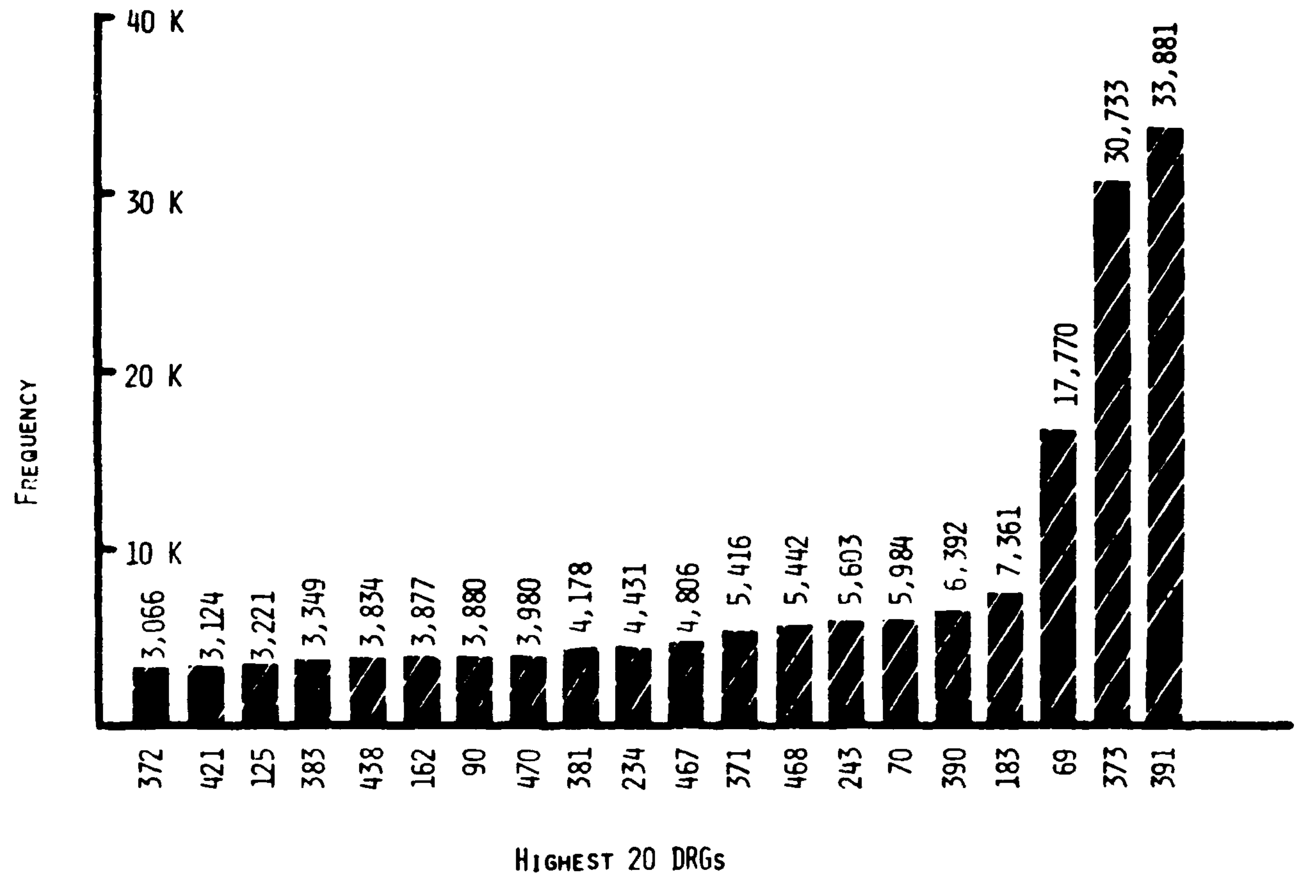


Figure 6

CASE MIX INDEX FOR MEDCENS

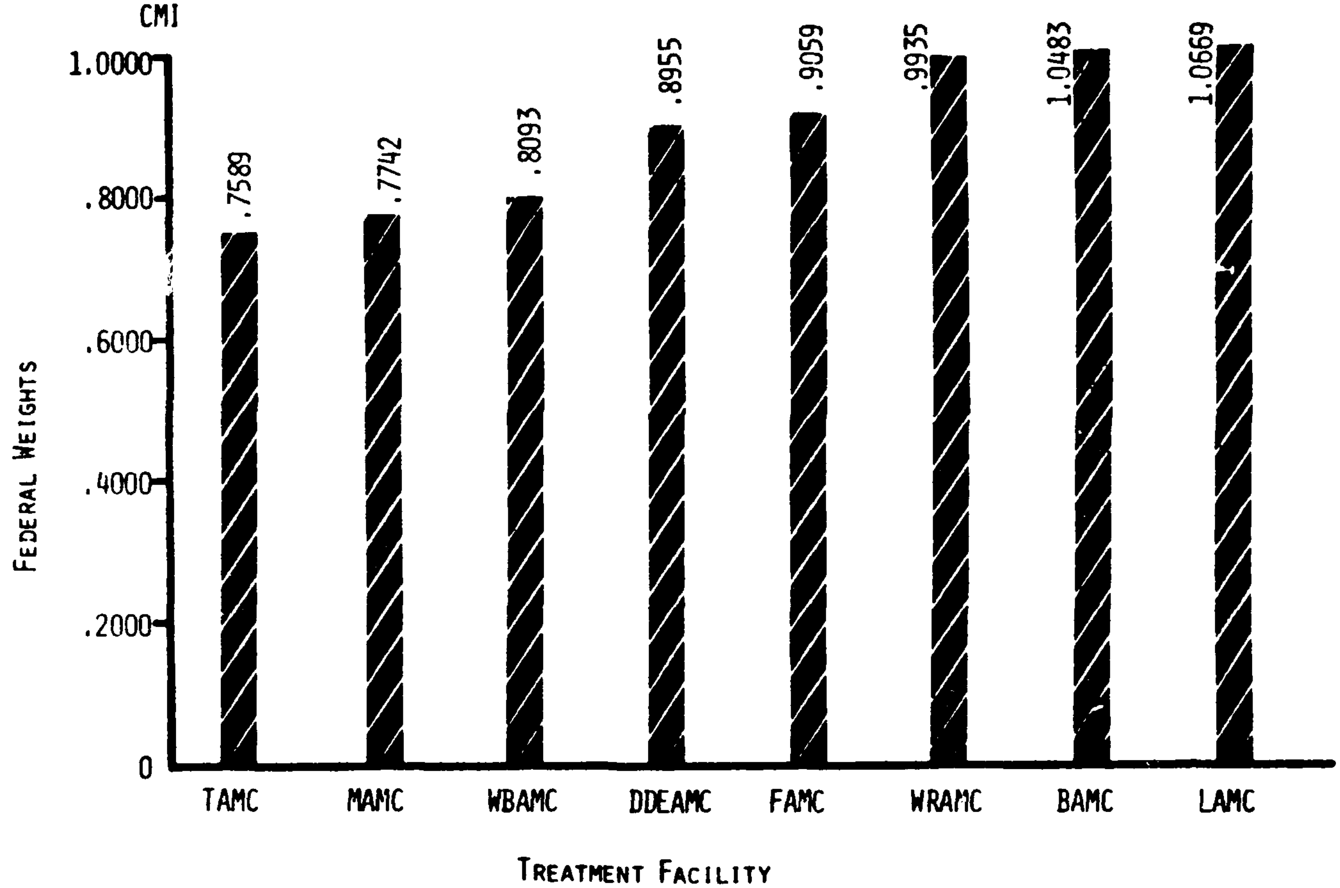


Figure 7

CASE MIX INDEX FOR LARGE MEDDACS

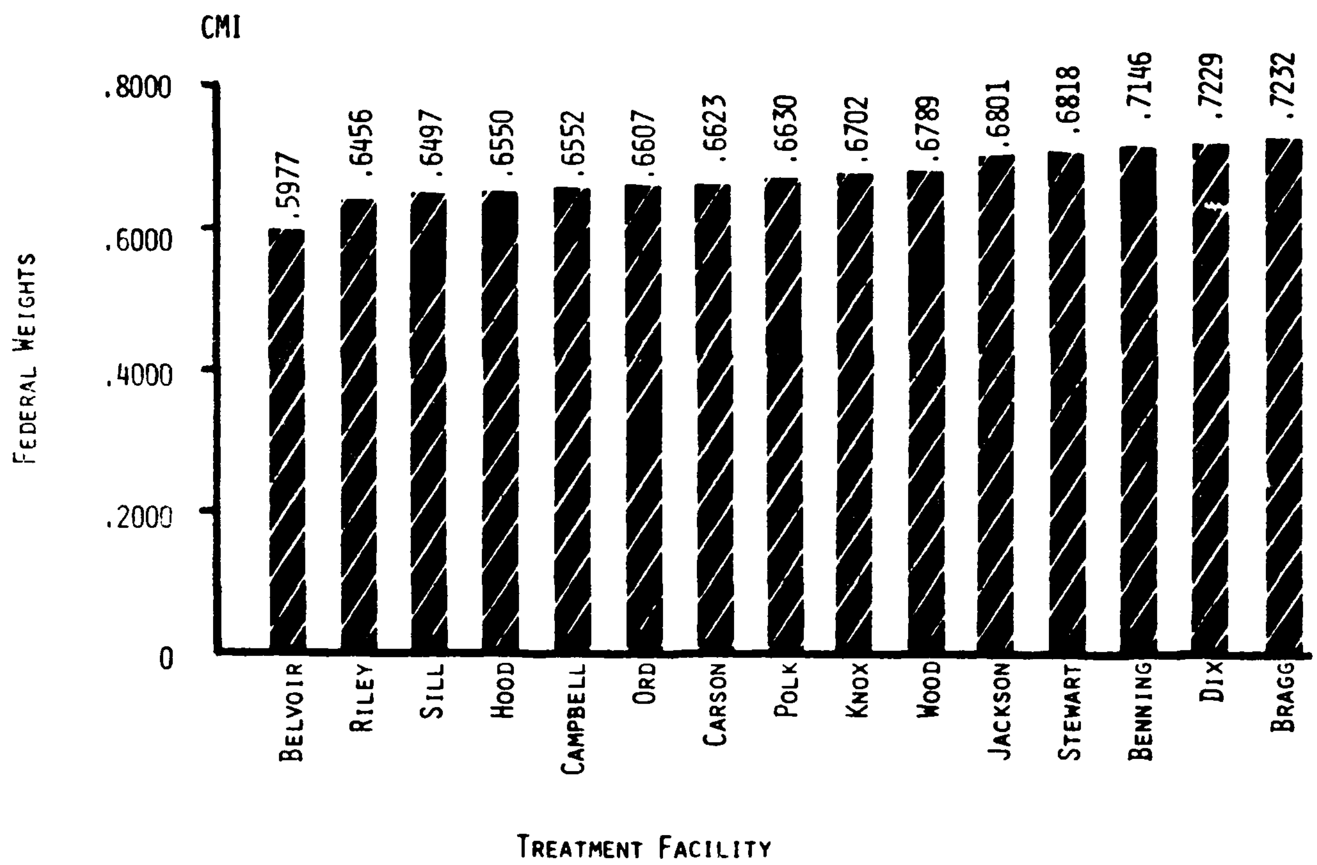


Figure 8

CASE MIX INDEX FOR SMALL MEDDACS

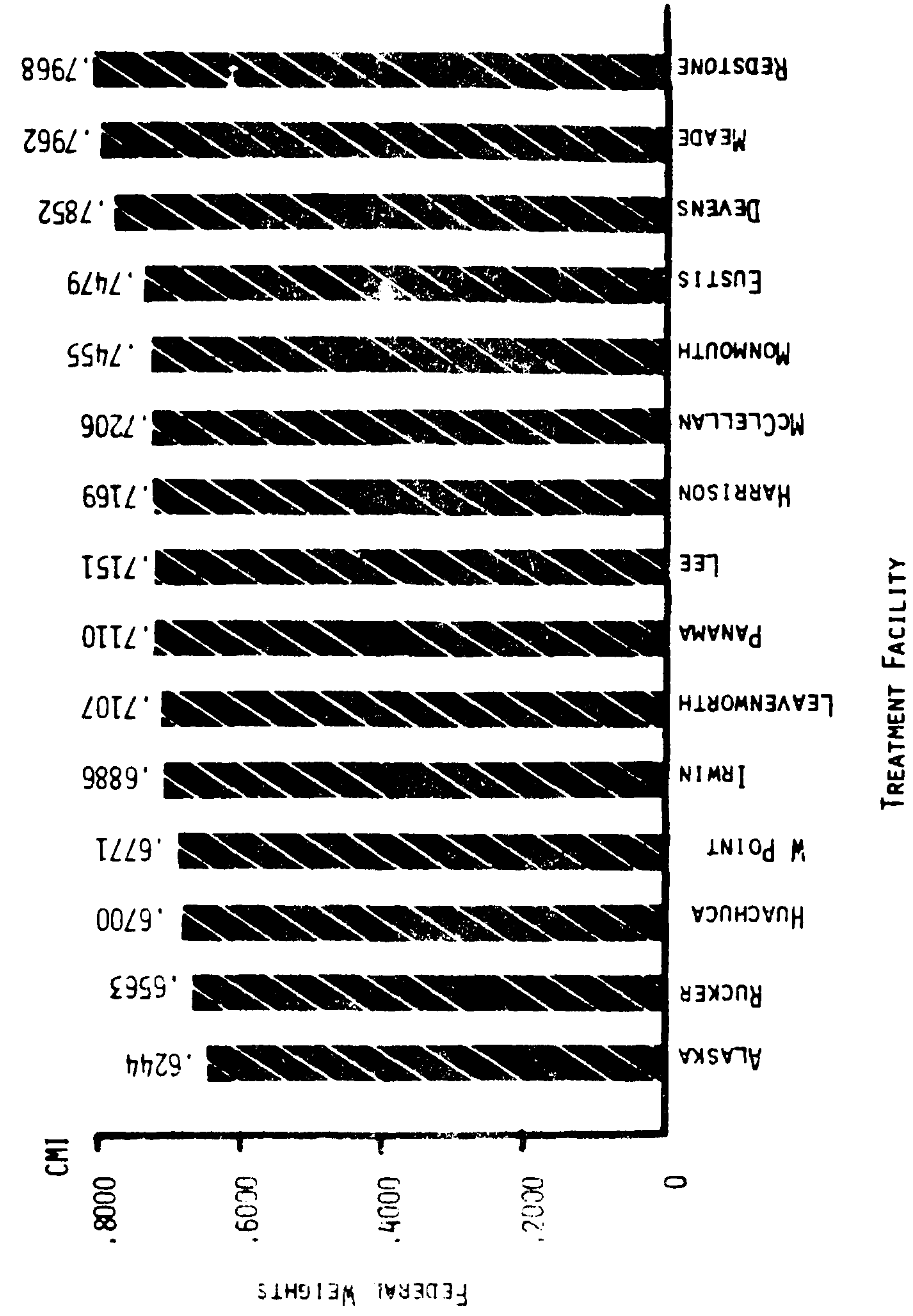


Figure 9

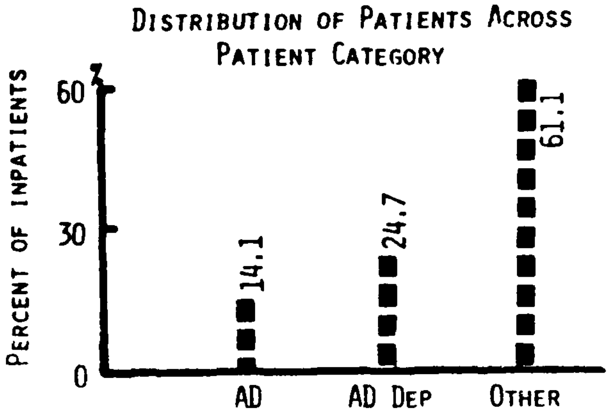
receives a distinct weight, constant for all hospitals, that represents the relative hospital resource utilization of an average or ideal case that falls into that case type. In this case, the weights employed were those published by HCFA. The relative weight products are summed and divided by the total frequency of patient dispositions. The quotient results in a case mix index. The dimension of complexity that is estimated in any given case mix measure is determined by the set of weights that is used to estimate the relative expected patient resource consumption. Yet without validation of these weights to AMEDD data, they should be considered preliminary and subject to further study.

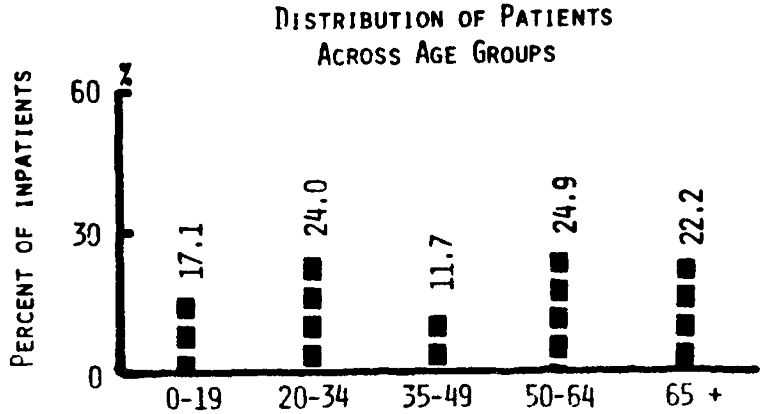
Notwithstanding, health services researchers have demonstrated that case mix usually accounts for the major variations in hospital costs and performance. The contribution these studies have made to understanding hospital organizational behavior led PAS&BA and the AMEDD Performance Measurement Study to examine the utility of case mix measurement data in explaining AMEDD MTF Performance.

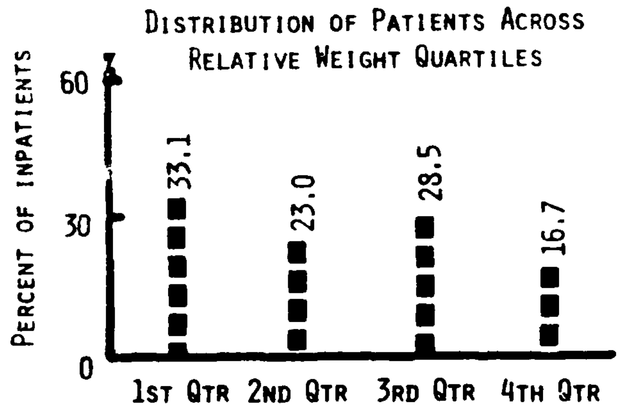
The case mix reports that have been developed thus far primarily reflect the distribution of hospital data across DRGs and provide a summary report that describes inpatients, the relative weight distribution, and the case mix index. The following text portrays the key elements of the summary report and suggested interpretation. The narrative is illuminated by graphic displays drawn from data from two medical centers (MEDCENs) and two primary care hospitals (MEDDACs) (See Figures 10-13). The section concludes with a complete copy of an actual hospital DRG/Case Mix profile report (Table 5).

There are two case mix index figures provided in the attached displays, the unadjusted and the adjusted. The adjusted case mix is the more valuable of the two indexes in that patient records assigned to DRGs 469 and 470 have been eliminated. These were eliminated because the relative weight value for each is 0.0. Civilian hospitals with data in these DRGs would review these

LETTERMAN ARMY MEDICAL CENTER - FY 83







THIS MTF HAD PATIENTS ASSIGNED TO 419 OF 470 DIAGNOSIS RELATED GROUPS.

CASE MIX INDEX AS COMPUTED USING WEIGHTS PUBLISHED IN 1 SEP 83 FEDERAL REGISTER:

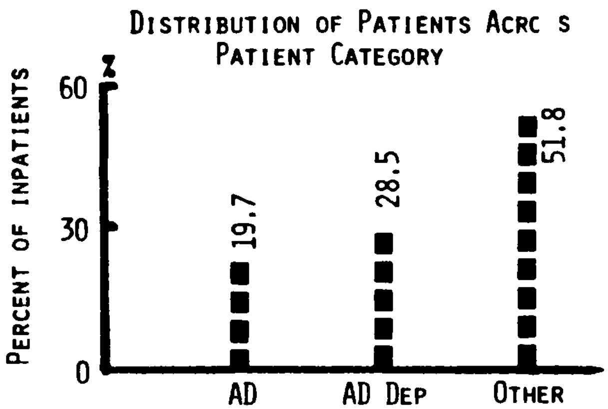
ADJUSTED (FOR DATA IN 469, 470)	1.0264
UNADJUSTED	1.0132

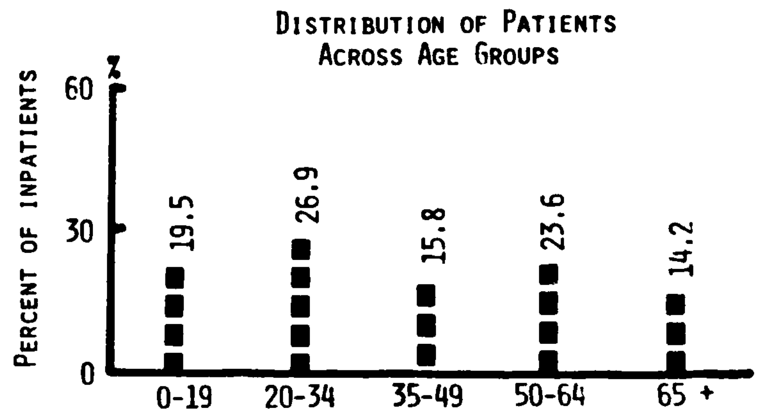
SOURCE: INDIVIDUAL PATIENT DATA SYSTEM (IPDS)

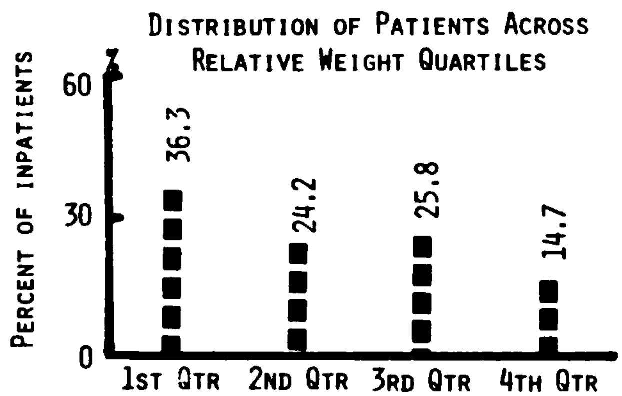
NUMBER OF IPDS DISPOSITIONS USED FOR THIS REPORT: 10,025

Figure 10

WALTER REED ARMY MEDICAL CENTER - FY 83







THIS MTF HAD PATIENTS ASSIGNED TO 441 OF 470 DIAGNOSIS RELATED GROUPS.

CASE MIX INDEX AS COMPUTED USING WEIGHTS PUBLISHED IN 1 SEP 83 FEDERAL REGISTER:

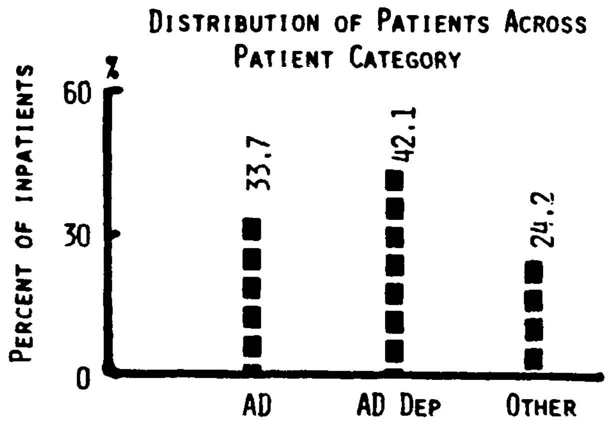
ADJUSTED (FOR DATA IN 469, 470)	0.9625
UNADJUSTED	0.9539

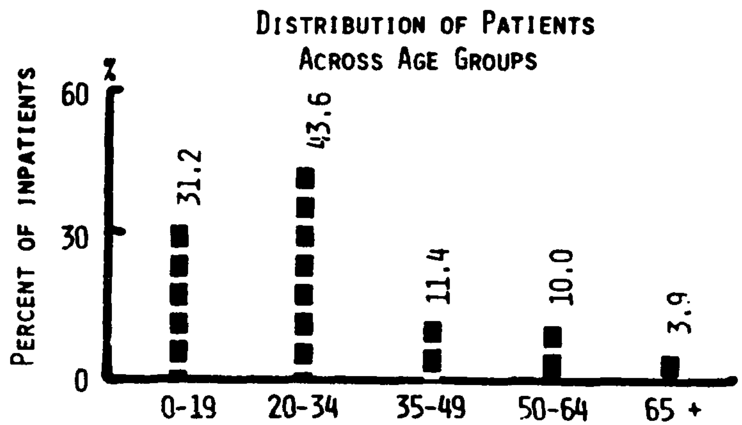
SOURCE: INDIVIDUAL PATIENT DATA SYSTEM (IPDS)

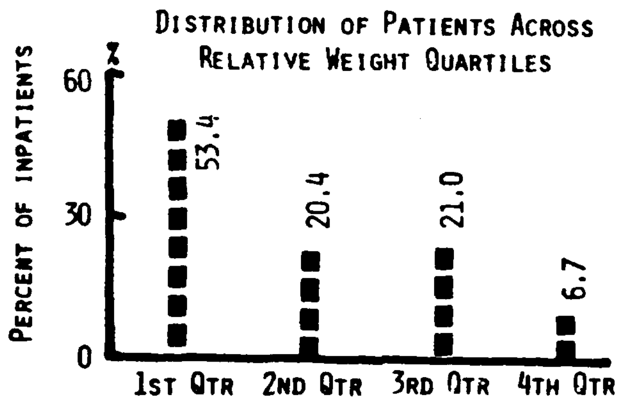
NUMBER OF IPDS DISPOSITIONS USED FOR THIS REPORT: 20,185

Figure 11

FORT BRAGG MEDDAC - FY 83







THIS MTF HAD PATIENTS ASSIGNED TO 412 OF 470 DIAGNOSIS RELATED GROUPS.

CASE MIX INDEX AS COMPUTED USING WEIGHTS PUBLISHED IN 1 SEP 83 FEDERAL REGISTER:

ADJUSTED (FOR DATA IN 469, 470)	0.7229
UNADJUSTED	0.7123

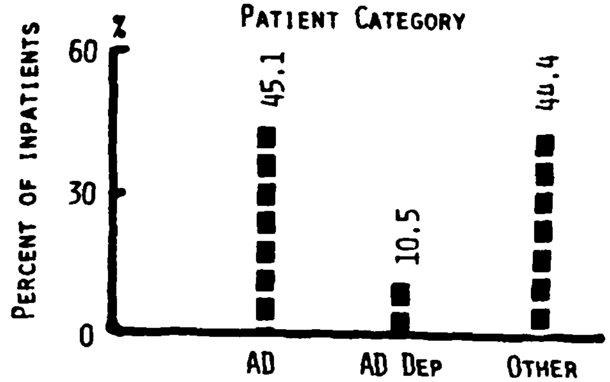
SOURCE: INDIVIDUAL PATIENT DATA SYSTEM (IPDS)

NUMBER OF IPDS DISPOSITIONS USED FOR THIS REPORT: 14,383

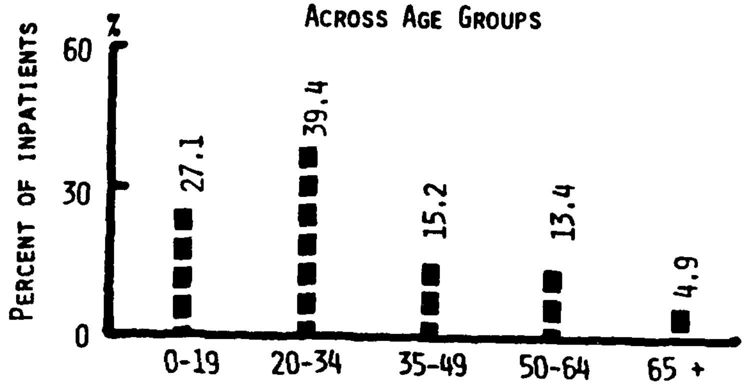
Figure 12

FORT LEE MEDDAC - FY 83

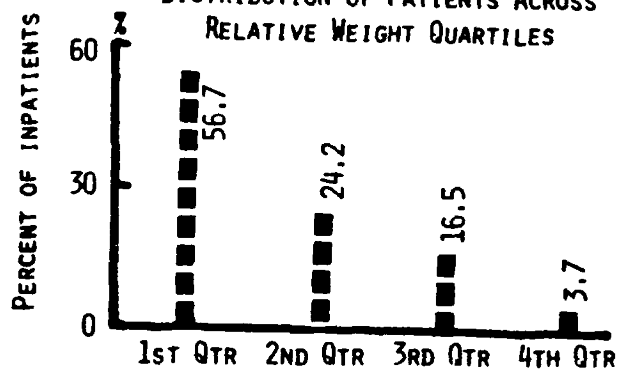
Distribution of Patients Across Patient Category



Distribution of Patients Across Age Groups



Distribution of Patients Across Relative Weight Quartiles



This MTF had patients assigned to 260 of 470 Diagnosis Related Groups.

Case Mix Index as computed using weights published in 1 Sep 83 Federal Register:

Adjusted (for data in 469, 470)	0.7124
Unadjusted	0.7048

SOURCE: Individual Patient Data System (IPDS)

Number of IPDS dispositions used for this report: 3,985

Figure 13

records in hopes of having them regrouped to more definitive DRGs. Therefore, we have computed the adjusted case mix index without using records assigned to DRG 469 or 470. The "total count adjusted for DRG cells 469 and 470" reveals the number of IPDS dispositions assigned to DRGs 1 through 468. This count states the number of records included in the calculation of the "adjusted" case mix index. The distribution of patients across Relative Weights Quartiles describes the MTF workload in terms of "relative weight quartiles" by reporting the count and per cent of workload developed by quartile. This chart reflects the Health Care Financing Administration (HCFA) established relative weights sorted and arranged by quartiles with the 1st quartile reflecting the DRG with the lowest relative weight value through the DRG with a relative weight value of 0.6291 and so on for each quartile. This module may be used to explain the high or low value of the case mix index by displaying the concentration of dispositions in DRGs with low or high value relative weights. As an example, if 60% of a hospital's data fell into the first quartile, it would seem reasonable to expect a fairly low case mix index which may be further interpreted to mean a relatively low average case complexity for the hospital. Conversely, a higher case mix index could be anticipated if an MTF had a relatively even distribution of data across each of the relative weight quartiles. The patient category distribution module describes an MTF in terms of general patient beneficiary categories using IPDS data elements. This adds to the interpretation of the case mix index value by alluding to the types of diseases or injuries one could anticipate based upon the activity level or demographic features frequently associated with a given segment of the MTF catchment area population.

The age graphic displays some critical features of an MTF's inpatient population by showing the data by category with the respective percent of data attributed to each age cell. This further facilitates explanation of the case mix index. In general, the younger the population represented in the inpatient data, the less complex the diseases and injuries treated. Conversely, the greater the percent of patients in the older age cells, the higher the case mix index because of the presence of complicating and/or comorbid conditions.

A hospital is considered to have treated patients with an average case complexity when the case mix index is 1.00. This figure represents the average case mix index for hospitals in the private sector based on calculations made from 1981 cost and billing data published in the 1 September 1983 Federal Register. (FR 48: 171). Specific average case mix indexes by hospital classification group appear in Table 3b FR 48 page 39871. The average case mix complexity figures should not be considered as a viable comparison to AMEDD MTF for several reasons: 1) our CMIs reflect all patient categories (i.e., not just Medicare eligible patients); 2) because of our mission, AMEDD MTF treat a young active duty population as the first priority for care; and, 3) the nuances of patient classification coupled with preliminary status of the coding conversion process could tend to misdirect or malassign AMEDD patient data causing the DRG assignment to be adversely affected.

Pearson correlation coefficients computed across each of the three relative weight systems previously discussed resulted in the following: HCFA weights and NJ average cost per DRG data from the 1982 Schedule of Reimbursement produced an r value of 0.9828. The HCFA correlation with the VA (Nashville) costs per DRG resulted in an r value of 0.8964. New Jersey weights correlated with the VA (Nashville) weights produced an r value of 0.9265. Based upon the close relationship between the relative weights and the potential comparability with civilian hospitals, the PMS DRG effort chose to focus on the HCFA relative weights for case mix accounting.

DIRECTION OF FUTURE RESEARCH

An area with great potential to explain and perhaps predict resource consumption is the development of linkages between UCA at the 3 digit level (e.g., AAA) and IPDS clinic service. Reports with mean clinic service case mix indexes have demonstrated variation within MTF across clinic services as well as across MTF for the same clinic service.

The resolution of nosological issues will remain at the forefront of our research until we obtain closure vis-a-vis the "best" map. The effectiveness and appropriateness of converting ICD-9/ICPM data to ICD-9-CM is central to gaining an accurate DRG assignment. A supplementary research issue will be the evaluation and incorporation of the Wilford Hall AFMC direct ICD-9-CM coding test for a stratified sample of that facility's data. The goal in this area is to compare the DRG assignment of records converted from ICD-9 to ICD-9-CM and those coded directly to ICD-9-CM.

Other areas that are planned for investigation include: 1) the use of the Autogrp system to reevaluate and possibly re-construct DRGs or patient groups unique to the AMEDD. 2) Introduce disease staging to explain variation further either within MDC or within DRG. 3) Evaluate the contribution patient acuity data may make in explaining variations within DRGs.

LENGTH OF STAY BY DIAGNOSIS RELATED GROUP

FT JACKSON, SC
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Table 5

DRG	TITLE	FREQ	MIN	MAX	MEAN LENGTH OF STAY THIS MTF	MEAN LENGTH OF STAY GROUP	STANDARD DEVIATION THIS MTF	STANDARD DEVIATION GROUP
005	EXTRACRANIAL VASCULAR PROCEDURES	13	5	37	10.5	14.5	9.6	14.2
006	CARPAL TUNNEL RELEASE	25	1	8	3.1	3.2	1.6	4.2
008	PERIPH + CRANIAL NERVE + OTHER NERV SYST PROC AGE<70 W/O C.C.	7	2	7	4.3	5.8	2.1	7.5
011	NERVOUS SYSTEM NEOPLASMS AGE <70 W/O C.C.	1	1	1	1.0	7.1	-	-
012	DEGENERATIVE NERVOUS SYSTEM DISORDERS	6	1	10	4.2	7.3	3.4	7.6
013	MULTIPLE SCLEROSIS + CEREBELLAR ATAXIA	3	1	56	20.3	14.9	30.9	29.0
014	SPECIFIC CEREBROVASCULAR DISORDERS EXCEPT TIA	31	1	156	16.8	13.9	29.5	17.1
015	TRANSIENT ISCHEMIC ATTACKS	20	1	16	3.5	4.5	3.6	3.9
016	NONSPECIFIC CEREBROVASCULAR DISORDERS WITH C.C.	1	9	9	9.0	14.4	-	-
017	NONSPECIFIC CEREBROVASCULAR DISORDERS W/O C.C.	1	3	3	3.0	6.8	-	-
018	CRANIAL + PERIPHERAL NERVE DISORDERS AGE >69 AND/OR C.C.	2	1	16	8.5	16.4	10.6	30.7
019	CRANIAL + PERIPHERAL NERVE DISORDERS AGE <70 W/O C.C.	25	2	38	7.6	5.7	9.9	8.1
020	NERVOUS SYSTEM INFECTION EXCEPT VIRAL MENINGITIS	41	1	18	7.3	7.4	3.2	5.2
021	VIRAL MENINGITIS	13	2	35	7.7	4.9	8.5	4.7
023	NONTRAUMATIC STUPOR + COMA	1	4	4	4.0	6.6	-	-
024	SEIZURE + HEADACHE AGE >69 AND/OR C.C.	9	1	35	7.8	6.9	10.5	9.4
025	SEIZURE + HEADACHE AGE 18-69 W/O C.C.	53	1	29	5.7	5.3	6.4	6.5
026	SEIZURE + HEADACHE AGE 0-17	20	1	8	2.7	2.7	1.9	2.3
028	TRAUMATIC STUPOR + COMA, COMA <1 HR AGE >69 AND/OR C.C.	2	1	5	3.0	5.1	2.8	12.8
029	TRAUMATIC STUPOR + COMA <1 HR AGE 18-69 W/O C.C.	13	1	8	2.4	2.2	2.1	2.7
030	TRAUMATIC STUPOR + COMA <1 HR AGE 0-17	13	1	6	2.2	1.6	1.7	1.8
031	CONCUSSION AGE >65 AND/OR C.C.	4	1	6	3.3	3.4	2.2	3.4
032	CONCUSSION AGE 18-69 W/O C.C.	10	1	8	2.7	2.1	1.9	2.1
033	CONCUSSION AGE 0-17	6	1	3	1.7	1.5	0.8	1.3
034	OTHER DISORDERS OF NERVOUS SYSTEM AGE >69 AND/OR C.C.	1	4	4	4.0	7.9	-	-
035	OTHER DISORDERS OF NERVOUS SYSTEM AGE <70 W/O C.C.	4	1	12	5.3	5.2	4.7	5.4
037	ORBITAL PROCEDURES	5	1	12	5.6	4.3	4.4	3.7
039	LENS PROCEDURES	54	2	11	4.5	3.8	2.1	2.4
040	EXTRAOCULAR PROCEDURES EXCEPT ORBIT AGE >17	23	1	7	2.7	2.5	1.4	2.3
041	EXTRAOCULAR PROCEDURES EXCEPT ORBIT AGE 0-17	5	1	6	2.0	1.8	2.2	0.9
042	INTRAOCULAR PROCEDURES EXCEPT RETINA, IRIS + LENS	5	2	13	7.8	4.8	4.3	3.6
043	HYPHEMA	10	1	18	3.9	4.4	5.0	3.6
044	ACUTE MAJOR EYE INFECTIONS	2	4	7	5.5	6.5	2.1	5.9
045	NEUROLOGICAL EYE DISORDERS	11	1	26	7.8	5.7	7.6	5.6
046	OTHER DISORDERS OF THE EYE AGE >17 WITH C.C.	6	1	8	4.3	5.0	2.7	5.2
047	OTHER DISORDERS OF THE EYE AGE >17 W/O C.C.	58	1	9	3.0	3.1	2.1	3.1
048	OTHER DISORDERS OF THE EYE AGE 0-17	22	1	8	2.4	2.1	2.2	2.0
050	SIALOADENECTOMY	1	3	3	3.0	5.9	-	-
051	SALIVARY GLAND PROCEDURES EXCEPT SIALOADENECTOMY	1	3	3	3.0	4.8	-	-
054	SINUS + MASTOID PROCEDURES AGE 0-17	1	7	7	7.0	5.1	-	-
055	MISCELLANEOUS EAR, NOSE + THROAT PROCEDURES	1	1	1	1.0	2.4	-	-
057	T+A PROC EXCEPT TONSILLECTOMY +/OR ADENOIDECTOMY AGE >17	8	2	10	4.9	5.9	2.7	21.1
058	T+A PROC EXCEPT TONSILLECTOMY +/OR ADENOIDECTOMY AGE 0-17	1	4	4	4.0	3.6	-	-
059	TONSILLECTOMY AND/OR ADENOIDECTOMY ONLY AGE >17	17	2	10	4.3	3.4	2.1	2.1
060	TONSILLECTOMY AND/OR ADENOIDECTOMY ONLY AGE 0-17	14	1	4	2.4	2.2	0.9	0.8
063	OTHER EAR, NOSE + THROAT O.R. PROCEDURES	4	2	12	6.0	6.1	4.9	13.5
064	EAR,NOSE + THROAT MALIGNANCY	2	1	2	1.5	11.9	0.7	22.5
065	DYSEQUILIBRIUM	5	2	6	4.2	4.6	1.6	7.4
066	EPISTAXIS	7	1	3	2.0	3.3	0.8	2.1

LENGTH OF STAY BY DIAGNOSIS RELATED GROUP

FT JACKSON, SC
PERIOD OF REPORT: FY 83

Table 5

DRG	TITLE	FREQ	MIN	MAX	MEAN THIS MTF	MEAN GROUP	STANDARD DEVIATION THIS MTF	STANDARD DEVIATION GROUP
067	EPIGLOTTITIS	1	4	4	4.0	4.4	-	-
068	OTITIS MEDIA + URI AGE >69 AND/OR C.C.	92	1	48	4.3	4.1	5.2	3.4
069	OTITIS MEDIA + URI AGE 18-65 W/O C.C.	3372	1	24	3.0	2.9	1.6	1.7
070	OTITIS MEDIA + URI AGE 0-17	488	1	9	3.1	2.4	1.6	1.8
071	LARYNGOTRACHEITIS	3	4	5	4.3	2.1	0.6	1.6
072	NASAL TRAUMA + DEFORMITY	1	1	1	1.0	2.9	-	-
073	OTHER EAR, NOSE + THROAT DIAGNOSES AGE >17	14	1	6	2.6	3.5	1.4	4.1
074	OTHER EAR, NOSE + THROAT DIAGNOSES AGE 0-17	1	1	1	1.0	1.8	-	-
075	MAJOR CHEST PROCEDURES	9	1	43	22.7	16.7	13.0	10.2
076	O.R. PROC ON THE RESP SYSTEM EXCEPT MAJOR CHEST WITH C.C.	6	2	56	21.2	17.8	20.4	17.9
077	O.R. PROC ON THE RESP SYSTEM EXCEPT MAJOR CHEST W/O C.C.	5	2	24	10.0	7.8	9.3	7.1
078	PULMONARY EMBOLISM	9	1	16	9.6	11.0	5.2	6.9
080	RESPIRATORY INFECTIONS + INFLAMMATIONS AGE 18-69 W/O C.C.	3	2	16	10.7	11.7	7.6	10.6
081	RESPIRATORY INFECTIONS + INFLAMMATIONS AGE 0-17	2	1	1	1.0	7.9	-	-
082	RESPIRATORY NEOPLASMS	21	1	101	15.0	10.9	22.2	13.7
085	PLEURAL EFFUSION AGE >69 AND/OR C.C.	1	12	12	12.0	8.7	-	-
086	PLEURAL EFFUSION AGE <70 W/O C.C.	2	7	7	7.0	7.0	-	-
087	PULMONARY EDEMA + RESPIRATORY FAILURE	1	16	16	16.0	12.2	-	-
088	CHRONIC OBSTRUCTIVE PULMONARY DISEASE	38	1	27	7.1	7.4	6.1	7.5
089	SIMPLE PNEUMONIA + PLEURISY AGE >69 AND/OR C.C.	20	3	20	6.8	9.0	4.3	8.4
090	SIMPLE PNEUMONIA + PLEURISY AGE 18-69 W/O C.C.	341	1	18	3.7	4.1	1.9	2.7
091	SIMPLE PNEUMONIA + PLEURISY AGE 0-17	47	1	7	3.5	3.4	1.6	2.2
092	INTERSTITIAL LUNG DISEASE AGE >69 AND/OR C.C.	1	60	60	60.0	10.8	-	-
093	INTERSTITIAL LUNG DISEASE AGE <70 W/O C.C.	13	2	15	5.5	5.2	4.1	4.7
095	PNEUMOTHORAX AGE <70 W/O C.C.	7	3	11	5.4	6.6	2.8	5.0
096	BRONCHITIS + ASTHMA AGE >69 AND/OR C.C	14	2	21	8.1	6.3	6.8	6.1
097	BRONCHITIS + ASTHMA AGE 18-69 W/O C.C.	152	1	18	3.7	3.9	2.2	3.1
098	BRONCHITIS + ASTHMA AGE 0-17	40	1	7	3.3	2.9	1.5	1.7
099	RESPIRATORY SIGNS + SYMPTOMS AGE >69 AND/OR C.C.	2	2	5	3.5	8.5	2.1	9.8
100	RESPIRATORY SIGNS + SYMPTOMS AGE <70 W/O C.C.	9	1	11	3.9	3.7	3.4	3.8
101	OTHER RESPIRATORY DIAGNOSES AGE >69 AND/OR C.C.	9	2	20	10.0	7.4	7.7	7.2
102	OTHER RESPIRATORY DIAGNOSES AGE <70	9	1	10	4.2	3.8	3.2	3.4
110	MAJOR RECONSTRUCTIVE VASCULAR PROCEDURES AGE >65 AND/OR C.C.	1	10	10	10.0	45.0	-	-
112	VASOLLAR PROCEDURES EXCEPT MAJOR RECONSTRUCTION	9	8	26	15.0	10.4	5.7	8.9
114	UPPER LIMB + TOE AMPUTATION FOR CIRC SYSTEM DISORDERS	1	13	13	13.0	11.6	-	-
116	PERMANENT CARDIAC PACEMAKER IMPLANT W/O AMI OR CHF	1	4	4	4.0	7.8	-	-
119	VEIN LIGATION + STRIPPING	6	5	38	11.2	6.0	13.2	6.9
121	CIRCULATORY DISORDERS WITH AMI + C.V. COMP. DISCH. ALIVE	4	1	23	8.8	14.6	10.1	10.1
122	CIRCULATORY DISORDERS WITH AMI W/O C.V. COMP. DISCH. ALIVE	45	1	26	9.6	11.1	5.9	5.0
123	CIRCULATORY DISORDERS WITH AMI, EXPIRED	7	1	18	3.9	5.3	6.3	9.2
127	HEART FAILURE + SHOCK	21	2	32	7.9	7.4	6.5	7.4
128	DEEP VEIN THROMBOPHLEBITIS	16	2	20	9.7	9.9	4.7	5.0
129	CARDIAC ARREST	3	1	24	9.0	7.0	13.0	9.8
130	PERIPHERAL VASCULAR DISORDERS AGE >69 AND/OR C.C.	2	3	4	3.5	11.5	0.7	16.9
131	PERIPHERAL VASCULAR DISORDERS AGE <70 W/O C.C.	16	1	29	9.1	6.2	8.9	7.5
132	ATHEROSCLEROSIS AGE >69 AND/OR C.C.	37	1	12	3.8	5.4	2.7	5.8
133	ATHEROSCLEROSIS AGE <70 W/O C.C.	12	1	8	3.2	5.1	2.4	8.4
134	HYPERTENSION	24	1	18	4.3	4.8	4.3	4.7
135	CARDIAC CONGENITAL + VALVULAR DISORDERS AGE >69 AND/OR C.C.	1	1	1	1.0	[illegible]	-	-

LENGTH OF STAY BY DIAGNOSIS RELATED GROUP

FT JACKSON, SC
PERIOD OF REPORT: FY 83

Table 5

DRG	TITLE	FREQ	MIN	MAX	MEAN THIS MTF	MEAN GROUP	STANDARD DEVIATION THIS MTF	STANDARD DEVIATION GROUP
136	CARDIAC CONGENITAL + VALVULAR DISORDERS AGE 18-69 W/O C.C.	2	11	13	12.0	6.1	1.4	18.2
138	CARDIAC ARRHYTHMIA + CONDUCTION DISORDERS AGE >69 AND/OR C.C.	21	1	13	3.8	5.0	3.0	5.3
139	CARDIAC ARRHYTHMIA + CONDUCTION DISORDERS AGE <70 W/O C.C.	35	1	17	3.0	3.0	3.5	3.1
140	ANGINA PECTORIS	27	1	9	4.2	3.8	2.3	2.8
141	SYNCOPE + COLLAPSE AGE >69 AND/OR C.C.	6	1	5	2.3	3.2	1.8	2.9
142	SYNCOPE + COLLAPSE AGE <70 W/O C.C.	16	1	5	1.8	3.7	1.2	4.6
143	CHEST PAIN	102	1	27	2.5	2.9	3.1	2.5
144	OTHER CIRCULATORY DIAGNOSES WITH C.C.	8	1	26	7.8	9.7	9.0	11.6
145	OTHER CIRCULATORY DIAGNOSES W/O C.C.	15	1	8	3.2	4.0	2.2	3.5
146	RECTAL RESECTION AGE >69 AND/OR C.C.	2	10	27	18.5	23.0	12.0	8.9
147	RECTAL RESECTION AGE <70 W/O C.C.	3	11	22	15.7	16.2	5.7	8.9
148	MAJOR SMALL + LARGE BOWEL PROCEDURES AGE >69 AND/OR C.C.	14	14	121	30.9	22.7	28.8	17.8
149	MAJOR SMALL + LARGE BOWEL PROCEDURES AGE <70 W/O C.C.	11	3	21	9.3	13.9	4.9	7.1
151	PERITONEAL ADHESIOLYSIS AGE <70 W/O C.C.	1	12	12	12.0	9.4	-	-
152	MINOR SMALL + LARGE BOWEL PROCEDURES AGE >69 AND/OR C.C.	2	5	18	11.5	10.0	9.2	9.7
153	MINOR SMALL + LARGE BOWEL PROCEDURES AGE <70 W/O C.C.	13	1	27	8.1	6.5	6.3	6.3
154	STOMACH, ESOPHAGEAL + DUODENAL PROCEDURES AGE >69 AND/OR C.C.	4	7	57	28.8	22.0	22.2	19.9
155	STOMACH, ESOPHAGEAL + DUODENAL PROCEDURES AGE 18-69 W/O C.C.	6	7	38	16.8	8.9	11.8	9.7
156	STOMACH, ESOPHAGEAL + DUODENAL PROCEDURES AGE 0-17	2	3	3	3.0	4.6	-	-
157	ANAL PROCEDURES AGE >69 AND/OR C.C.	6	2	17	8.3	7.4	5.1	5.5
158	ANAL PROCEDURES AGE <70 W/O C.C.	38	1	41	6.2	5.3	7.3	4.1
159	HERNIA PROCEDURES EXCEPT INGUINAL + FEMORAL AGE >69 AND/OR C.C.	5	7	15	9.6	10.0	3.4	8.4
160	HERNIA PROCEDURES EXCEPT INGUINAL + FEMORAL AGE 18-69 W/O C.C.	11	4	10	6.6	5.4	1.8	3.8
161	INGUINAL + FEMORAL HERNIA PROCEDURES AGE >69 AND/OR C.C.	12	6	12	8.0	7.9	2.2	5.7
162	INGUINAL + FEMORAL HERNIA PROCEDURES AGE 18-69 W/O C.C.	82	3	19	7.2	5.2	2.6	2.6
163	HERNIA PROCEDURES AGE 0-17	23	2	11	3.3	2.3	2.2	2.0
164	APPENDECTOMY WITH COMPLICATED PRINC. DIAG AGE>69 AND/OR C.C.	2	8	15	11.5	15.3	4.9	9.2
165	APPENDECTOMY WITH COMPLICATED PRINC. DIAG AGE <70 W/O C.C.	7	6	29	14.7	9.5	9.2	5.4
166	APPENDECTOMY W/O COMPLICATED PRINC. DIAG AGE >69 AND/OR C.C.	5	4	14	8.4	9.4	3.8	6.2
167	APPENDECTOMY W/O COMPLICATED PRINC. DIAG AGE <70 W/O C.C.	45	2	15	6.2	4.7	2.5	2.4
168	PROCEDURES ON THE MOUTH AGE >69 AND/OR C.C.	6	2	27	8.2	15.3	9.4	24.3
169	PROCEDURES ON THE MOUTH AGE <70 W/O C.C.	14	1	52	12.9	7.6	15.0	11.6
170	OTHER DIGESTIVE SYSTEM PROCEDURES AGE >69 AND/OR C.C.	4	2	6	4.5	8.6	1.9	12.9
171	OTHER DIGESTIVE SYSTEM PROCEDURES AGE <70 W/O C.C.	22	1	22	6.0	4.4	5.1	5.5
172	DIGESTIVE MALIGNANCY AGE >69 AND/OR C.C.	4	6	42	27.8	15.2	16.8	19.0
173	DIGESTIVE MALIGNANCY AGE <70 W/O C.C.	2	3	13	8.0	5.0	7.1	4.5
174	G.I. HEMORRHAGE AGE >69 AND/OR C.C.	10	1	17	5.8	6.6	5.7	6.1
175	G.I. HEMORRHAGE AGE <70 W/O C.C.	27	1	20	5.5	4.4	3.8	4.5
177	UNCOMPLICATED PEPTIC ULCER >69 AND/OR C.C.	1	8	8	8.0	6.8	-	-
178	UNCOMPLICATED PEPTIC ULCER <70 W/O C.C.	11	1	12	6.4	4.5	3.4	4.8
179	INFLAMMATORY BOWEL DISEASE	5	2	14	7.2	7.1	4.8	7.2
181	G.I. OBSTRUCTION AGE <70 W/O C.C.	7	1	15	5.9	5.0	6.2	5.7
182	ESOPHAGITIS,GASTROENT.+ MISC. DIGEST. DIS AGE >69 +/OR C.C.	27	1	16	7.6	5.6	4.2	6.0
183	ESOPHAGITIS,GASTROENT.+ MISC. DIGEST. DIS AGE 18-69 W/O C.C.	334	1	38	3.8	3.4	3.4	3.4
184	ESOPHAGITIS, GASTROENTERITIS + MISC. DIGEST. DISORDERS AGE 0-17	78	1	11	2.7	2.8	1.7	2.1
185	DENTAL + ORAL DIS, EXC EXTRACTIONS + RESTORATIONS,AGE >17	13	1	41	10.7	8.5	12.2	11.4
186	DENTAL + ORAL DIS, EXC EXTRACTIONS + RESTORATIONS,AGE 0-17	1	3	3	3.0	2.4	-	-
187	DENTAL EXTRACTIONS + RESTORATIONS	32	1	52	4.3	2.2	8.8	4.7
188	OTHER DIGESTIVE SYSTEM DIAGNOSES AGE >69 AND/OR C.C.	7	2	20	7.3	5.4	6.2	6.7

LENGTH OF STAY BY DIAGNOSIS RELATED GROUP

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Table 5

DRG	TITLE	FREQ	MIN	MAX	LENGTH OF STAY MEAN THIS MTF	MEAN GROUP	STANDARD DEVIATION THIS MTF	STANDARD DEVIATION GROUP
189	OTHER DIGESTIVE SYSTEM DIAGNOSES AGE 18-69 W/O C.C.	30	1	15	4.9	3.2	3.7	4.0
190	OTHER DIGESTIVE SYSTEM DIAGNOSES AGE 0-17	4	1	3	1.8	1.9	1.0	2.1
191	MAJOR PANCREAS, LIVER + SHUNT PROCEDURES	4	17	40	27.3	31.3	9.8	24.8
194	BILIARY TRACT PROC EXC TOT CHOLECYSTECTOMY AGE <70 W/O C.C.	1	6	6	6.0	10.7	-	-
195	TOTAL CHOLECYSTECTOMY WITH C.D.E. AGE >69 AND/OR C.C.	2	27	30	28.5	18.1	2.1	11.6
197	TOTAL CHOLECYSTECTOMY W/O C.D.E. AGE >69 AND/OR C.C.	9	5	30	11.9	11.3	8.4	8.9
198	TOTAL CHOLECYSTECTOMY W/O C.D.E. AGE <70 W/O C.C.	47	5	44	9.5	7.4	7.1	3.8
200	HEPATOBILIARY DIAGNOSTIC PROCEDURE FOR NON-MALIGNANCY	3	8	35	17.3	10.3	15.3	13.4
202	CIRRHOSIS + ALCOHOLIC HAPATITIS	10	2	49	14.5	12.3	14.8	13.5
203	MALIGNANCY OF HEPATOBILIARY SYSTEM OR PANCREAS	1	56	56	56.0	8.6	-	-
204	DISORDERS OF PANCREAS EXCEPT MALIGNANCY	20	2	12	7.0	6.7	2.6	4.6
205	DISORDERS OF LIVER EXC MALIG,CIRR,ALC HEPA AGE >69 AND/OR C.C.	3	6	11	8.7	9.7	2.5	10.3
206	DISORDERS OF LIVER EXC MALIG,CIRR,ALC HEPA AGE <70 W/O C.C.	19	1	21	8.3	7.4	5.7	6.9
207	DISORDERS OF THE BILIARY TRACT AGE >69 AND/OR C.C.	4	5	13	8.5	7.1	3.7	6.9
208	DISORDERS OF THE BILIARY TRACT AGE <70 W/O C.C.	18	1	13	6.4	4.3	3.6	3.0
213	AMPUTATIONS FOR MUSCULOSKELETAL SYSTEM + CONN. TISSUE DISORDERS	1	34	34	34.0	8.5	-	-
216	BIOPSIES OF MUSCULOSKELETAL SYSTEM + CONNECTIVE TISSUE	1	6	6	6.0	11.1	-	-
217	WND DEBRID + SKN GRFT EXC HAND,FOR MUSCKELETAL + CONN.TISS.DIS	6	2	28	14.0	15.7	11.0	24.9
219	LOWER EXTREM + HUMER PROC EXC HIP,FOOT,FEMUR AGE 18-69 W/O C.C.	3	2	10	6.3	6.4	4.0	8.3
221	KNEE PROCEDURES AGE >69 AND/OR C.C.	1	12	12	12.0	23.5	-	-
222	KNEE PROCEDURES AGE <70 W/O C.C.	41	4	55	13.3	9.2	11.4	11.8
224	UPPER EXTREMITY PROC EXC HUMERUS + HAND AGE <70 W/O C.C.	8	3	14	6.9	7.7	3.8	7.6
225	FOOT PROCEDURES	46	2	50	4.3	4.0	7.1	5.0
226	SOFT TISSUE PROCEDURES AGE >69 AND/OR C.C.	2	5	6	5.5	13.5	0.7	14.9
227	SOFT TISSUE PROCEDURES AGE <70 W/O C.C.	27	2	17	4.9	6.6	3.3	7.3
228	GANGLION (HAND) PROCEDURES	8	1	4	2.0	2.4	1.2	1.6
229	HAND PROCEDURES EXCEPT GANGLION	25	1	25	6.2	5.8	5.4	11.4
231	LOCAL EXCISION + REMOVAL OF INT FIX DEVICES EXCEPT HIP + FEMUR	30	1	70	8.9	7.0	17.0	11.7
232	ARTHROSCOPY	16	2	12	4.9	6.4	2.6	8.0
233	OTHER MUSCULOSKELET SYS + CONN TISS O.R. PROC AGE >69 +/OR C.C.	9	3	79	24.4	20.9	22.1	17.3
234	OTHER MUSCULOSKELET SYS + CONN TISS O.R. PROC AGE <70 W/O C.C.	79	1	64	10.0	8.8	11.5	9.8
235	FRACTURES OF FEMUR	1	44	44	44.0	16.6	-	-
236	FRACTURES OF HIP + PELVIS	2	8	19	13.5	15.1	7.8	12.9
237	SPRAINS, STRAINS, + DISLOCATIONS OF HIP, PELVIS + THIGH	3	2	8	5.3	5.9	3.1	8.6
238	OSTEOMYELITIS	12	1	32	7.3	6.5	9.0	8.4
239	PATHOLOGICAL FRACTURES + MUSCULOSKELETAL + CONN.TISS.MALIGNANCY	5	1	4	2.2	10.3	1.3	15.6
240	CONNECTIVE TISSUE DISORDERS AGE >69 AND/OR C.C.	2	4	5	4.5	9.2	0.7	6.7
241	CONNECTIVE TISSUE DISORDERS AGE <70 W/O C.C.	5	3	10	6.6	8.4	2.6	14.5
242	SEPTIC ARTHRITIS	2	2	41	22.5	12.3	29.0	10.9
243	MEDICAL BACK PROBLEMS	104	1	53	6.4	7.9	7.0	10.5
244	BONE DISEASES + SEPTIC ARTHROPATHY AGE >69 AND/OR C.C.	2	10	10	10.0	12.3	-	-
245	BONE DISEASES + SEPTIC ARTHROPATHY AGE <70 W/O C.C.	6	1	9	4.0	6.6	2.8	8.2
246	NON-SPECIFIC ARTHROPATHIES	1	10	10	10.0	6.9	-	-
247	SIGNS + SYMPTOMS OF MUSCULOSKELETAL SYSTEM + CONN TISSUE	13	2	21	6.9	6.1	6.0	6.5
248	TENDONITIS, MYOSITIS + BURSITIS	21	1	24	8.2	5.4	6.8	5.5
250	FX,SPRNS,STRNS + DISL OF FOREARM,HAND,FOOT AGE >69 +/OR C.C.	2	2	28	15.0	10.2	18.4	17.4
251	FX,SPRNS,STRNS + DISL OF FOREARM,HAND,FOOT AGE 18-69 W/O C.C.	24	1	37	5.8	4.5	8.7	5.5
252	FX,SPRNS,STRNS + DISL OF FOREARM,HAND,FOOT AGE 0-17	6	1	5	3.2	2.0	1.7	2.9
253	FX,SPRNS,STRNS + DISL OF UPARM,LOWLEG EX FOOT AGE >69 +/OR C.C.	2	11	11	11.0	9.4	-	-

LENGTH OF STAY BY DIAGNOSIS RELATED GROUP

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Table 5

DRG	TITLE	FREQ	MIN	MAX	LENGTH OF STAY: MEAN THIS MTF	LENGTH OF STAY: MEAN GROUP	LENGTH OF STAY: STANDARD DEVIATION THIS MTF	LENGTH OF STAY: STANDARD DEVIATION GROUP
254	FX,SPRNS,STRNS + DISL OF UPARM,LOWLEG EX FOOT AGE 18-69 W/O C.C.	48	1	36	6.6	6.3	7.0	9.8
255	FX,SPRNS,STRNS + DISL OF UPARM,LOWLEG EX FOOT AGE 0-17	5	1	4	2.2	2.7	1.6	2.4
256	OTHER DIAGNOSES OF MUSCULOSKELETAL SYSTEM + CONNECTIVE TISSUE	13	1	21	7.6	7.1	5.6	13.6
257	TOTAL MASTECTOMY FOR MALIGNANCY AGE >69 AND/OR C.C.	2	8	11	9.5	13.3	2.1	7.8
258	TOTAL MASTECTOMY FOR MALIGNANCY AGE <70 W/O C.C.	7	2	12	9.0	11.0	3.4	4.5
260	SUBTOTAL MASTECTOMY FOR MALIGNANCY AGE <70	1	7	7	7.0	3.0	-	-
261	BREAST PROC FOR NON-MALIG EXCEPT BIOPSY + LOC EXC	4	2	8	4.5	7.6	2.5	6.6
262	BREAST BIOPSY + LOCAL EXCISION FOR NON-MALIGNANCY	39	1	15	3.7	2.7	3.3	2.3
264	SKIN GRAFTS FOR SKIN ULCER OR CELLULITIS AGE <70 W/O C.C.	1	31	31	31.0	14.8	-	-
265	SKIN GRAFTS EXCEPT FOR SKIN ULCER OR CELLULITIS WITH C.C.	2	2	41	21.5	13.3	27.6	9.5
266	SKIN GRAFTS EXCEPT FOR SKIN ULCER OR CELLULITIS W/O C.C.	4	2	14	7.5	9.5	4.9	9.8
267	PERIANAL + PILONICAL PROCEDURES	6	3	9	5.8	7.3	2.1	7.8
268	SKIN,SUBCUTANEOUSTISSUE + BREAST PLASTIC PROCEDURES	1	7	7	7.0	3.7	-	-
269	OTHER SKIN, SUBCUT TISS + BREAST O.R. PROC AGE >69 +/OR C.C.	5	5	19	10.0	10.2	6.2	20.2
270	OTH SKIN, SUBCUT TISS + BREAST O.R. PROC AGE <70 W/O C.C.	111	1	23	5.8	4.4	4.3	4.8
271	SKIN ULCERS	4	7	24	15.5	15.6	7.0	15.6
272	MAJOR SKIN DISORDERS AGE >69 AND/OR C.C.	3	10	31	22.0	13.8	10.8	18.0
273	MAJOR SKIN DISORDERS AGE <70 W/O C.C.	10	3	42	10.4	7.3	11.6	8.0
274	MALIGNANT BREAST DISORDERS AGE >69 AND/OR C.C.	2	1	4	2.5	15.6	2.1	23.7
275	MALIGNANT BREAST DISORDERS AGE <70 W/O C.C.	1	1	1	1.0	5.5	-	-
276	NON-MALIGNANT BREAST DISORDERS	2	4	10	7.0	3.2	4.2	2.5
277	CELLULITIS AGE >69 AND/OR C.C.	18	3	16	6.7	7.6	3.1	6.4
278	CELLULITIS AGE 18-69 W/O C.C.	158	1	15	4.3	4.8	2.5	3.7
279	CELLULITIS AGE 0-17	18	1	22	4.9	4.0	4.6	3.2
280	TRAUMA TO THE SKIN, SUBCUT TISS + BREAST AGE >69 +/OR C.C.	6	2	26	9.0	4.5	8.7	8.2
281	TRAUMA TO THE SKIN, SUBCUT TISS + BREAST AGE 18-69 W/O C.C.	65	1	19	4.2	4.2	3.4	5.6
282	TRAUMA TO THE SKIN, SUBOUT TISS + BREAST AGE 0-17	15	1	11	3.5	2.6	3.4	2.6
283	MINOR SKIN DISORDERS AGE >69 AND/OR C.C.	8	1	9	3.8	5.2	2.8	5.2
284	MINOR SKIN DISORDERS AGE <70 W/O C.C.	55	1	11	3.5	4.2	2.1	5.6
285	AMPUTATIONS FOR ENDOCRINE,NUTRITIONAL + METABOLIC DISORDERS	1	12	12	12.0	36.4	-	-
287	SKIN GRAFTS + WOUND DEBRIDE FOR ENDOC,NUTRIT + METAB DISORDERS	1	34	34	34.0	33.8	-	-
289	PARATHYROID PROCEDURES	1	3	3	3.0	4.0	-	-
290	THYROID PROCEDURES	8	3	11	5.8	5.7	2.6	3.2
294	DIABETES AGE =>36	33	1	29	7.7	7.7	5.8	9.3
295	DIABETES AGE 0-35	10	1	20	5.0	5.4	5.7	4.4
296	NUTRITIONAL + MISC. METABOLIC DISORDERS AGE >69 AND/OR C.C.	5	3	30	10.4	8.5	11.1	10.3
297	NUTRITIONAL + MISC. METABOLIC DISORDERS AGE 18-69 W/O C.C.	13	1	15	5.8	10.2	5.1	10.7
298	NUTRITIONAL + MISC. METABOLIC DISORDERS AGE 0-17	12	3	37	9.1	5.3	9.5	4.6
299	INBORN ERRORS OF METABOLISM	2	1	2	1.5	4.4	0.7	5.5
300	ENDOCRINE DISORDERS AGE >69 AND/OR C.C.	3	1	50	22.7	9.5	25.0	10.4
301	ENDOCRINE DISORDERS AGE <70 W/O C.C.	8	1	22	13.1	6.6	7.7	6.7
303	KIDNEY,URETER + MAJOR BLADDER PROCEDURE FOR NEOPLASM	1	15	15	15.0	18.1	-	-
304	KIDNEY,URETER + MAJ BLDRPROC FOR NON-MALIG AGE >69 +/OR C.C.	3	5	11	8.3	15.2	3.1	11.6
305	KIDNEY,URETER + MAJ BLDR PROC FOR NON-MALIG <70 W/O C.C.	6	11	64	21.0	11.1	21.1	8.8
30[illegible]	[illegible]INOR BLADDER PROCEDURES AGE <70 W/O C.C.	8	2	21	6.3	4.9	6.2	3.9
[illegible]	[illegible]RANSURETHRAL PROCEDURES AGE >69 AND/OR C.C.	3	2	4	2.7	6.0	1.2	5.6
[illegible]	TRANSURETHRAL PROCEDURES AGE <70 W/O C.C.	18	2	11	4.8	4.6	2.6	4.7
31[illegible]	[illegible]RETHRAL PROCEDURES, AGE 18-69 W/O C.C.	2	2	5	3.5	6.5	2.1	5.4
3[illegible]	URETHRAL PROCEDURES, AGE 0-17	2	1	5	3.0	1.6	2.8	1.9

LENGTH OF STAY BY DIAGNOSIS RELATED GROUP

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Table 5

DRG	TITLE	FREQ	MIN	MAX	LENGTH OF STAY: MEAN THIS MTF	LENGTH OF STAY: MEAN GROUP	LENGTH OF STAY: STANDARD DEVIATION THIS MTF	LENGTH OF STAY: STANDARD DEVIATION GROUP
316	RENAL FAILURE W/O DIALYSIS	2	3	37	20.0	8.5	24.0	10.9
318	KIDNEY + URINARY TRACT NEOPLASMS AGE >69 AND/OR C.C.	2	11	68	39.5	12.1	40.3	16.6
320	KIDNEY + URINARY TRACT INFECTIONS AGE >69 AND/OR C.C.	7	1	30	9.3	9.0	9.7	12.0
321	KIDNEY + URINARY TRACT INFECTIONS AGE 18-69 W/O C.C.	32	1	23	4.7	4.0	3.9	2.6
322	KIDNEY + URINARY TRACTINFECTIONS AGE 0-17	14	1	7	3.9	3.7	1.6	2.5
323	URINARY STONES AGE >69 AND/OR C.C.	2	3	3	3.0	3.9	-	-
324	URINARY STONES AGE <70 W/O C.C.	30	1	9	3.6	3.0	2.7	2.7
325	KIDNEY + URINARY TRACT SIGNS +SYMPTOMS AGE>69 AND/OR C.C.	2	5	5	5.0	5.5	-	-
326	KIDNEY + URINARY TRACT SIGNS + SYMPTOMS AGE 18-69 W/O C.C.	5	2	10	4.2	3.6	3.3	3.0
327	KIDNEY + URINARY TRACT SIGNS + SYMPTOMS AGE 0-17	1	1	1	1.0	2.8	-	-
329	URETHRAL STRICTURE AGE 18-69 W/O C.C.	1	7	7	7.0	3.1	-	-
331	OTHER KIDNEY + URINARY TRACT DIAGNOSES AGE >69 AND/OR C.C.	2	2	3	2.5	10.1	0.7	10.5
332	OTHER KIDNEY + URINARY TRACT DIAGNOSES AGE 18-69 W/O C.C.	13	1	24	5.2	5.3	6.0	4.9
333	OTHER KIDNEY + URINARY TRACT DIAGNOSES AGE 0-17	2	2	3	2.5	2.0	0.7	2.0
336	TRANSURETHRAL PROSTATECTOMY AGE >69 AND/OR C.C.	6	4	7	5.5	8.7	1.2	5.1
337	TRANSURETHRAL PROSTATECTOMY AGE <70 W/O C.C.	18	4	22	6.4	6.1	4.3	3.3
338	TESTES PROCEDURES, FOR MALIGNANCY	1	3	3	3.0	9.1	-	-
339	TESTES PROCEDURES, NON-MALIGNANT AGE >17	22	2	13	4.6	4.4	3.1	3.1
340	TESTES PROCEDURES, NON-MALIGNANT AGE 0-17	15	1	4	2.2	2.0	0.7	1.1
342	CIRCUMCISION AGE >17	1	1	1	1.0	2.7	-	-
343	CIRCUMCISION AGE 0-17	3	1	2	1.7	1.3	0.6	0.6
344	OTHER MALE REPRODUCTIVE SYSTEM O.R. PROCEDURES FOR MALIGNANCY	1	2	2	2.0	10.0	-	-
345	OTHER MALE REPRODUCTIVE SYSTEM O.R. PROC EXCEPT FOR MALIG	3	3	10	5.3	3.3	4.0	2.8
346	MALIGNANCY, MALE REPRODUCTIVE SYSTEM, AGE >69 AND/OR C.C.	1	7	7	7.0	12.1	-	-
347	MALIGNANCY, MALE REPRODUCTIVE SYSTEM, AGE <70 W/O C.C.	2	2	5	3.5	6.7	2.1	11.0
348	BENIGN PROSTATIC HYPERTROPHY AGE >69 AND/OR C.C.	2	2	16	9.0	5.3	9.9	4.4
349	BENIGN PROSTATIC HYPERTROPHY AGE <70 W/O C.C.	6	2	3	2.2	2.7	0.4	2.4
350	INFLAMMATION OF THE MALE REPRODUCTIVE SYSTEM	40	1	10	3.5	4.8	2.3	3.7
352	OTHER MALE REPRODUCTIVE SYSTEM DIAGNOSES	6	1	4	2.2	3.2	1.2	3.2
354	NON-RADICAL HYSTERECTOMY AGE >69 AND/OR C.C.	25	5	12	7.6	8.3	2.1	4.9
355	NON-RADICAL HYSTERECTOMY AGE <70 W/O C.C.	71	4	17	6.2	6.3	1.9	2.1
356	FEMALE REPRODUCTIVE SYSTEM RECONSTRUCTIVE PROCEDURES	17	4	13	5.8	6.8	2.5	3.2
357	UTERUS + ADENEXA PROCEDURES, FOR MALIGNANCY	2	6	9	7.5	8.0	2.1	5.9
358	UTERUS + ADENEXA PROC FOR NON-MALIGNANCY EXCEPT TUBAL INTERRUPT	36	2	11	5.4	5.5	2.1	3.0
359	TUBAL INTERRUPTION FOR NON-MALIGNANCY	27	1	6	2.5	2.8	1.0	1.4
360	VAGINA, CERVIC + VULVA PROCEDURES	22	1	13	4.1	2.6	3.2	1.9
361	LAPAROSCOPY + ENDOSCOPY (FEMALE) EXCEPT TUBAL INTERRUPTION	29	1	29	3.6	2.7	5.2	[illegible]
362	LAPAROSCOPIC TUBAL INTERRUPTION	45	1	4	2.0	2.0	0.7	0.8
363	D+C,CONIZATION + RADIO-IMPLNT, FOR MALIGNANCY	5	2	2	2.0	2.7	-	-
364	D+C,CONIZATION EXCEPT FOR MALIGNANCY	57	1	7	2.3	2.2	1.2	1.2
365	OTHER FEMALE REPRODUCTIVE SYSTEM O.R. PROCEDURES		4	13	6.5	5.6	4.2	3.3
366	MALIGNANCY, FEMALE REPRODUCTIVE SYSTEM AGE >69 AND/OR C.C.	6	5	48	17.7	8.[illegible]	16.6	[illegible]
367	MALIGNANCY, FEMALE REPRODUCTIVE SYSTEM AGE <70 W/O C.C.	1	6	[illegible]	6.0	4.4	-	
368	INFECTIONS, FEMALE REPRODUCTIVE SYSTEM	71	1	[illegible]	4.7	4.5	[illegible]	[illegible]
369	MENSTRUAL + OTHER FEMALE REPRODUCTIVE SYSTEM DISORDERS	69	1	16	3.0	2.3	[illegible]	[illegible]
370	CESAREAN SECTION WITH C.C.	26	4	15	[illegible]	6.9	[illegible]	4.6
371	CESAREAN SECTION W/O C.C.	83	[illegible]	49	5.5	5.4	[illegible]	[illegible]
372	VAGINAL DELIVERY WITH COMPLICATING DIAGNOSES	39		18	4.4	[illegible]	[illegible]	4.4
373	VAGINAL DELIVERY W/O COMPLICATING DIAGNOSES	386	[illegible]	9	3.3	[illegible]	[illegible]	[illegible]

LENGTH OF STAY BY DIAGNOSIS RELATED GROUP

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Table 5

DRG	TITLE	FREQ	LENGTH OF STAY MIN	MAX	MEAN THIS MTF	MEAN GROUP	STANDARD DEVIATION THIS MTF	STANDARD DEVIATION GROUP
374	VAGINAL DELIVERY WITH STERILIZATION AND/OR D+C	45	2	7	3.5	3.4	0.8	1.5
375	VAGINAL DELIVERY WITH O.R. PROC EXCEPT STERIL AND/OR D+C	3	5	8	6.3	3.9	1.5	2.0
376	POSTPARTUM DIAGNOSES W/O O.R. PROCEDURE	11	1	7	4.4	3.5	2.3	2.2
377	POSTPARTUM DIAGNOSES WITH O.R. PROCEDURE	3	1	3	1.7	3.0	1.2	2.7
378	ECTOPIC PREGNANCY	17	4	16	6.8	5.3	3.5	3.0
379	THREATENED ABORTION	43	1	6	1.8	2.5	1.4	3.5
380	ABORTION W/O D+C	6	1	2	1.2	2.1	0.4	2.4
381	ABORTION WITH D+C	48	1	10	1.8	1.4	1.6	1.1
383	OTHER ANTEPARTUM DIAGNOSES WITH MEDICAL COMPLICATIONS	50	1	15	3.2	3.5	2.4	3.0
384	OTHER ANTEPARTUM DIAGNOSES W/O MEDICAL COMPLICATIONS	41	1	25	2.8	2.3	4.1	3.6
385	NEONATES, DIED OR TRANSFERRED	2	1	1	1.0	1.5	-	-
386	EXTREME IMMATURITY, NEONATE	5	1	14	4.4	7.1	5.6	12.3
387	PREMATURITY WITH MAJOR PROBLEMS	1	11	11	11.0	7.6	-	-
388	PREMATURITY W/O MAJOR PROBLEMS	7	10	28	20.0	5.2	8.6	4.7
389	FULL TERM NEONATE WITH MAJOR PROBLEMS	64	1	14	4.2	4.4	3.1	3.6
390	NEONATES WITH OTHER SIGNIFICANT PROBLEMS	231	1	8	3.3	3.4	0.9	2.5
391	NORMAL NEWBORNS	304	1	11	3.4	3.2	1.0	1.2
394	OTHER O.R. PROCEDURES OF THE BLOOD + BLOOD FORMING ORGANS	4	1	13	5.3	5.9	5.3	8.4
395	RED BLOOD CELL DISORDERS AGE >17	13	1	39	11.5	5.6	12.3	9.5
396	RED BLOOD CELL DISORDERS AGE 0-17	3	2	6	3.7	3.5	2.1	3.2
397	COAGULATION DISORDERS	4	3	8	5.0	5.9	2.2	11.1
398	RETICULOENDOTHELIAL + IMMUNITY DISORDERS AGE >69 AND/OR C.C.	2	5	31	18.0	6.8	18.4	6.7
399	RETICULOENDOTHELIAL + IMMUNITY DISORDERS AGE <70 W/O C.C.	6	1	19	5.2	4.4	6.9	3.6
400	LYMPHOMA OR LEUKEMIA WITH MAJOR O.R. PROCEDURE	1	18	18	18.0	14.0	-	-
403	LYMPHOMA OR LEUKEMIA AGE >69 AND/OR C.C.	1	11	11	11.0	9.4	-	-
404	LYMPHOMA OR LEUKEMIA AGE 18-69 W/O C.C.	3	1	15	8.0	5.4	7.0	9.1
409	RADIOTHERAPY	1	53	53	53.0	12.9	-	-
410	CHEMOTHERAPY	18	1	11	1.8	3.0	2.4	3.3
414	OTHR MYELOPROLIF DISORD OR POORLY DIFF NEOPL DX AGE<70 W/O C.C.	3	2	26	12.0	5.6	12.5	7.4
415	O.R. PROCEDURE FOR INFECTIONS + PARASITIC DISEASES	6	3	58	19.7	11.0	19.9	10.4
416	SEPTECEMIA AGE >17	3	8	12	10.0	16.6	2.0	20.0
417	SEPTECEMIA AGE 0-17	1	7	7	7.0	5.1	-	-
418	POSTOPERATIVE + POST-TRAUMATIC INFECTIONS	5	3	9	5.0	7.0	2.3	8.8
420	FEVER OF UNKNOWN ORIGIN AGE 18-69 W/O C.C.	4	1	4	2.0	5.8	1.4	4.7
421	VIRAL ILLNESS AGE >17	283	1	21	3.5	3.5	2.0	2.8
422	VIRAL ILLNESS + FEVER OF UNKNOWN ORIGIN AGE 0-17	52	1	5	2.4	2.7	1.1	1.7
423	OTHER INFECTIOUS + PARASITIC DISEASES DIAGNOSES	9	1	12	4.1	5.9	3.4	7.2
424	O.R. PROCEDURES WITH PRINCIPAL DIAGNOSIS OF MENTAL ILLNESS	1	5	5	5.0	18.2	-	-
425	ACUTE ADJUST REACT + DISTURBANCES OF PSYCHOSOCIAL DYSFUNCTION	10	1	25	6.9	5.4	7.2	7.0
426	DEPRESSIVE NEUROSES	23	1	58	13.9	7.2	16.9	10.4
427	NEUROSES EXCEPT DEPRESSIVE	23	1	14	5.7	5.9	4.1	8.7
428	DISORDERS OF PERSONALITY + IMPULSE CONTROL	203	1	32	4.3	6.3	5.1	8.3
429	ORGANIC DISTURBANCES + MENTAL RETARDATION	3	1	6	4.3	11.9	2.9	13.9
430	PSYCHOSES	33	1	56	13.6	14.8	12.5	16.3
432	OTHER DIAGNOSES OF MENTAL DISORDERS	2	2	17	9.5	4.7	10.6	5.1
433	SUBSTANCE USE + SUBST INDUCED ORGANIC MENTAL DISORDERS, LEFT AMA	1	3	3	3.0	1.7	-	-
435	DRUG USE EXCEPT DEPENDENCE	2	1	5	3.0	4.8	2.8	7.5
437	ALCOHOL USE EXCEPT DEPENDENCE	5	1	7	2.8	3.1	2.5	3.3
438	ALCOHOL + SUBSTANCE INDUCED ORGANIC MENTAL SYNDROME	27	1	33	9.0	7.5	7.6	7.4

LENGTH OF STAY BY DIAGNOSIS RELATED GROUP

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Table 5

DRG	TITLE	FREQ	MIN	MAX	MEAN THIS MTF	MEAN GROUP	STANDARD DEVIATION THIS MTF	STANDARD DEVIATION GROUP
439	SKIN GRAFTS FOR INJURIES	2	46	52	49.0	24.5	4.2	32.0
440	WOUND DEBRIGEMENTS FOR INJURIES	1	1	1	1.0	11.6	-	-
441	HAND PROCEDURES FOR INJURIES	4	2	16	9.0	9.9	7.0	14.3
442	OTHER O.R. PROCEDURES FOR INJURIES AGE >69 AND/OR C.C.	2	2	3	2.5	20.3	0.7	29.3
443	OTHER O.R. PROCEDURES FOR INJURIES AGE <70 W/O C.C.	13	1	102	13.1	6.8	27.0	8.9
444	MULTIPLE TRAUMA AGE >69 AND/OR C.C.	2	2	3	2.5	7.3	0.7	10.8
445	MULTIPLE TRAUMA AGE 18-69 W/O C.C.	29	1	17	5.2	5.0	3.6	5.4
446	MULTIPLE TRAUMA AGE 0-17	7	1	8	4.1	2.9	2.9	2.8
447	ALLERGIC REACTIONS AGE >17	1	2	2	2.0	2.1	-	-
448	ALLERGIC REACTIONS AGE 0-17	1	3	3	3.0	2.6	-	-
449	TOXIC EFFECTS OF DRUGS AGE >69 AND/OR C.C.	8	2	14	7.4	5.6	5.1	7.1
450	TOXIC EFFECTS OF DRUGS AGE 18-69 W/O C.C.	42	1	9	2.0	2.8	1.9	3.8
451	TOXIC EFFECTS OF DRUGS AGE 0-17	25	1	5	1.7	1.8	1.2	2.2
452	COMPLICATIONS OF TREATMENT AGE >69 AND/OR C.C.	4	2	8	5.3	6.6	2.5	5.0
453	COMPLICATIONS OF TREATMENT AGE <70 W/O C.C.	29	1	12	3.1	2.8	3.3	2.6
454	OTHER INJURIES, POISONINGS + TOXIC EFFDIAG AGE >69 AND/OR C.C.	2	1	2	1.5	4.5	0.7	5.5
455	OTHER INJURIES, POISONINGS + TOXIC EFF DIAG AGE <70 W/O C.C.	36	1	11	2.3	2.8	2.0	4.0
459	NON-EXTENSIVE BURNS WITH WOUND DEBRIDEMENT + OTHER O.R. PROC	4	5	18	10.8	12.9	5.4	13.1
460	NON-EXTENSIVE BURNS W/O O.R. PROCEDURE	10	2	67	12.1	6.8	19.7	7.4
461	O.R. PROC WITH DIAGNOSES OF OTHER CONTACT WITH HEALTH SERVICES	11	1	19	6.5	4.0	5.9	4.0
463	SIGNS + SYMPTOMS WITH C.C.	2	2	11	6.5	9.7	6.4	11.2
464	SIGNS + SYMPTOMS W/O C.C.	14	1	17	4.6	4.9	4.3	6.3
466	AFTERCARE W/O HISTORY OF MALIGNANCY AS SECONDARY DX	4	2	4	3.5	3.2	1.0	7.2
467	OTHER FACTORS INFLUENCING HEALTH STATUS	79	1	10	2.2	1.7	1.8	2.6
468	UNRELATED OR PROCEDURE	111	1	137	10.5	7.8	17.4	12.3
469	PRIM DX INVALID AS DISCHARGE DIAGNOSIS	54	1	44	3.6	2.9	5.9	4.6
470	UNGROUPABLE	73	1	62	10.6	7.3	13.9	11.8
	TOTAL	11572						

LENGTH OF STAY BY DIAGNOSIS RELATED GROUP

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Table 5

NOTE: DATA EXCLUDE CRO, ABSENT SICK CASES, RECORDS WITH CLINICAL DATA MISSING, DISABILITY SEPARATIONS, AND RECORDS WITH ZERO BED DAYS. TRANSFER DISPOSITIONS ARE ALSO EXCLUDED FROM THE MEDDAC REPORTS.
THE GROUP MEAN AND STANDARD DEVIATION PRESENTED ARE FOR THE GROUP TO WHICH THIS HOSPITAL BELONGS: IE, HSC MEDCEN, OVERSEAS MEDCEN, HSC MEDDAC, OR OVERSEAS MEDDAC.
SOURCE: INDIVIDUAL PATIENT DATA SYSTEM (IPDS)

PREPARED BY:
DEPARTMENT OF THE ARMY
US ARMY PATIENT ADMINISTRATION SYSTEMS
AND BIOSTATISTICS ACTIVITY
FT SAM HOUSTON, TX 78234
DATE PREPARED: 12 OCT 84

RELATIVE WEIGHT PRODUCTS BY DIAGNOSIS RELATED GROUP

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Table 5

DRG	TITLE	FREQUENCY	RELATIVE WEIGHT	RELATIVE WEIGHT PRODUCTS
005	EXTRACRANIAL VASCULAR PROCEDURES	13	1.6780	21.8140
006	CARPAL TUNNEL RELEASE	25	0.3993	9.9825
008	PERIPH + CRANIAL NERVE + OTHER NERV SYST PROC AGE<70 W/O C.C.	7	0.7239	5.0673
010	NERVOUS SYSTEM NEOPLASMS AGE >69 AND/OR C.C.	2	1.3087	2.6174
011	NERVOUS SYSTEM NEOPLASMS AGE <70 W/O C.C.	4	1.2545	5.0180
012	DEGENERATIVE NERVOUS SYSTEM DISORDERS	6	1.1136	6.6816
013	MULTIPLE SCLEROSIS + CEREBELLAR ATAXIA	5	1.0150	5.0750
014	SPECIFIC CEREBROVASCULAR DISORDERS EXCEPT TIA	33	1.3527	44.6391
015	TRANSIENT ISCHEMIC ATTACKS	20	0.6673	13.3460
016	NONSPECIFIC CEREBROVASCULAR DISORDERS WITH C.C.	1	0.8592	0.8592
017	NONSPECIFIC CEREBROVASCULAR DISORDERS W/O C.C.	1	0.8392	0.8392
018	CRANIAL + PERIPHERAL NERVE DISORDERS AGE >69 AND/OR C.C.	2	0.7915	1.5830
019	CRANIAL + PERIPHERAL NERVE DISORDERS AGE <70 W/O C.C.	34	0.6975	23.7150
020	NERVOUS SYSTEM INFECTION EXCEPT VIRAL MENINGITIS	43	1.3141	56.5063
021	VIRAL MENINGITIS	13	0.6301	8.1913
023	NONTRAUMATIC STUPOR + COMA	1	1.1568	1.1568
024	SEIZURE + HEADACHE AGE >69 AND/OR C.C.	9	0.7279	6.5511
025	SEIZURE + HEADACHE AGE 18-69 W/O C.C.	55	0.6392	35.1560
026	SEIZURE + HEADACHE AGE 0-17	21	0.4349	9.1329
028	TRAUMATIC STUPOR + COMA, COMA <1 HR AGE >69 AND/OR C.C.	4	1.0701	4.2804
029	TRAUMATIC STUPOR + COMA <1 HR AGE 18-69 W/O C.C.	13	0.7175	9.3275
030	TRAUMATIC STUPOR + COMA <1 HR AGE 0-17	13	0.3576	4.6488
031	CONCUSSION AGE >65 AND/OR C.C.	4	0.6051	2.4204
032	CONCUSSION AGE 18-69 W/O C.C.	10	0.4519	4.5190
033	CONCUSSION AGE 0-17	6	0.2483	1.4898
034	OTHER DISORDERS OF NERVOUS SYSTEM AGE >69 AND/OR C.C.	1	0.9927	0.9927
035	OTHER DISORDERS OF NERVOUS SYSTEM AGE <70 W/O C.C.	6	0.8460	5.0760
037	ORBITAL PROCEDURES	6	0.5630	3.3780
039	LENS PROCEDURES	54	0.5010	27.0540
040	EXTRAOCULAR PROCEDURES EXCEPT ORBIT AGE >17	23	0.3977	9.1471
041	EXTRAOCULAR PROCEDURES EXCEPT ORBIT AGE 0-17	5	0.3695	1.8475
042	INTRAOCULAR PROCEDURES EXCEPT RETINA, IRIS + LENS	5	0.5906	2.9530
043	HYPHEMA	10	0.3828	3.8280
044	ACUTE MAJOR EYE INFECTIONS	2	0.6298	1.2596
045	NEUROLOGICAL EYE DISORDERS	18	0.5641	10.1538
046	OTHER DISORDERS OF THE EYE AGE >17 WITH C.C.	9	0.5964	5.3676
047	OTHER DISORDERS OF THE EYE AGE >17 W/O C.C.	74	0.5064	37.4736
048	OTHER DISORDERS OF THE EYE AGE 0-17	27	0.4060	10.9620
050	SIALOADENECTOMY	1	0.7160	0.7160
051	SALIVARY GLAND PROCEDURES EXCEPT SIALOADENECTOMY	1	0.6702	0.6702
054	SINUS + MASTOID PROCEDURES AGE 0-17	1	0.6961	0.6961
055	MISCELLANEOUS EAR, NOSE + THROAT PROCEDURES	1	0.4153	0.4153
057	T+A PROC EXCEPT TONSILLECTOMY +/OR ADENOIDECTOMY AGE >17	8	0.5251	4.2008
058	T+A PROC EXCEPT TONSILLECTOMY +/OR ADENOIDECTOMY AGE 0-17	1	0.3130	0.3130
059	TONSILLECTOMY AND/OR ADENOIDECTOMY ONLY AGE >17	17	0.3147	5.3499
060	TONSILLECTOMY AND/OR ADENOIDECTOMY ONLY AGE 0-17	14	0.2643	3.7002
063	OTHER EAR, NOSE + THROAT O.R. PROCEDURES	4	1.1090	4.4360
064	EAR, NOSE + THROAT MALIGNANCY	6	1.0812	6.4872
065	DYSEQUILIBRIUM	5	0.4857	2.4285

RELATIVE WEIGHT PRODUCTS BY DIAGNOSIS RELATED GROUP

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Table 5

DRG	TITLE	FREQUENCY	RELATIVE WEIGHT	RELATIVE WEIGHT PRODUCTS
066	EPISTAXIS	9	0.4116	3.7044
067	EPIGLOTTITIS	1	0.6762	0.6762
068	OTITIS MEDIA + URI AGE >69 AND/OR C.C.	93	0.6289	58.4877
069	OTITIS MEDIA + URI AGE 18-65 W/O C.C.	3374	0.5417	1827.6958
070	OTITIS MEDIA + URI AGE 0-17	488	0.3697	180.4136
071	LARYNGOTRACHEITIS	3	0.3589	1.0767
072	NASAL TRAUMA + DEFORMITY	1	0.4857	0.4857
073	OTHER EAR, NOSE + THROAT DIAGNOSES AGE >17	19	0.5217	9.9123
074	OTHER EAR, NOSE + THROAT DIAGNOSES AGE 0-17	1	0.3463	0.3463
075	MAJOR CHEST PROCEDURES	9	2.6044	23.4396
076	O.R. PROC ON THE RESP SYSTEM EXCEPT MAJOR CHEST WITH C.C.	7	1.8734	13.1138
077	O.R. PROC ON THE RESP SYSTEM EXCEPT MAJOR CHEST W/O C.C.	7	1.8178	12.7246
078	PULMONARY EMBOLISM	9	1.4095	12.6855
080	RESPIRATORY INFECTIONS + INFLAMMATIONS AGE 18-69 W/O C.C.	3	1.7445	5.2335
081	RESPIRATORY INFECTIONS + INFLAMMATIONS AGE 0-17	2	0.8743	1.7486
082	RESPIRATORY NEOPLASMS	25	1.1400	28.5000
085	PLEURAL EFFUSION AGE >69 AND/OR C.C.	1	1.1461	1.1461
086	PLEURAL EFFUSION AGE <70 W/O C.C.	2	1.1217	2.2434
087	PULMONARY EDEMA + RESPIRATORY FAILURE	1	1.5529	1.5529
088	CHRONIC OBSTRUCTIVE PULMONARY DISEASE	39	1.0412	40.6068
089	SIMPLE PNEUMONIA + PLEURISY AGE >69 AND/OR C.C.	20	1.1029	22.0580
090	SIMPLE PNEUMONIA + PLEURISY AGE 18-69 W/O C.C.	341	0.9849	335.8509
091	SIMPLE PNEUMONIA + PLEURISY AGE 0-17	47	0.5131	24.1157
092	INTERSTITIAL LUNG DISEASE AGE >69 AND/OR C.C.	1	1.0370	1.0370
093	INTERSTITIAL LUNG DISEASE AGE <70 W/O C.C.	14	0.9724	13.6136
095	PNEUMOTHORAX AGE <70 W/O C.C.	7	1.1252	7.8764
096	BRONCHITIS + ASTHMA AGE >69 AND/OR C.C	15	0.7996	11.9940
097	BRONCHITIS + ASTHMA AGE 18-69 W/O C.C.	153	0.7256	111.0168
098	BRONCHITIS + ASTHMA AGE 0-17	40	0.4275	17.1000
099	RESPIRATORY SIGNS + SYMPTOMS AGE >69 AND/OR C.C.	2	0.8035	1.6070
100	RESPIRATORY SIGNS + SYMPTOMS AGE <70 W/O C.C.	9	0.7730	6.9570
101	OTHER RESPIRATORY DIAGNOSES AGE >69 AND/OR C.C.	10	0.9035	9.0350
102	OTHER RESPIRATORY DIAGNOSES AGE <70	10	0.9024	9.0240
110	MAJOR RECONSTRUCTIVE VASCULAR PROCEDURES AGE >65 AND/OR C.C.	1	2.9328	2.9328
112	VASOLLAR PROCEDURES EXCEPT MAJOR RECONSTRUCTION	9	2.3500	21.1500
114	UPPER LIMB + TOE AMPUTATION FOR CIRC SYSTEM DISORDERS	1	2.1067	2.1067
116	PERMANENT CARDIAC PACEMAKER IMPLANT W/O AMI OR CHF	1	2.8665	2.8665
119	VEIN LIGATION + STRIPPING	6	1.0610	6.3660
121	CIRCULATORY DISORDERS WITH AMI + C.V. COMP. DISCH. ALIVE	6	1.8648	11.1888
122	CIRCULATORY DISORDERS WITH AMI W/O C.V. COMP. DISCH. ALIVE	46	1.3651	62.7946
123	CIRCULATORY DISORDERS WITH AMI, EXPIRED	7	1.1360	7.9520
127	HEART FAILURE + SHOCK	21	1.0408	21.8568
128	DEEP VEIN THROMBOPHLEBITIS	16	0.8639	13.8224
129	CARDIAC ARREST	3	1.5506	4.6518
130	PERIPHERAL VASCULAR DISORDERS AGE >69 AND/OR C.C.	4	0.9645	3.8580
131	PERIPHERAL VASCULAR DISORDERS AGE <70 W/O C.C.	17	0.9491	16.1347
132	ATHEROSCLEROSIS AGE >69 AND/OR C.C.	45	0.9182	41.31[illegible]
133	ATHEROSCLEROSIS AGE <70 W/O C.C.	18	0.8599	15.4782
134	HYPERTENSION	24	0.7049	16.9176

RELATIVE WEIGHT PRODUCTS BY DIAGNOSIS RELATED GROUP

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Table 5

DRG	TITLE	FREQUENCY	RELATIVE WEIGHT	RELATIVE WEIGHT PRODUCTS
135	CARDIAC CONGENITAL + VALVULAR DISORDERS AGE >69 AND/OR C.C.	1	0.9922	0.9922
136	CARDIAC CONGENITAL + VALVULAR DISORDERS AGE 18-69 W/O C.C.	3	0.9674	2.9022
138	CARDIAC ARRHYTHMIA + CONDUCTION DISORDERS AGE >69 AND/OR C.C.	22	0.9297	20.4534
139	CARDIAC ARRHYTHMIA + CONDUCTION DISORDERS AGE <70 W/O C.C.	35	0.8303	29.0605
140	ANGINA PECTORIS	29	0.7548	21.8892
141	SYNCOPE + COLLAPSE AGE >69 AND/OR C.C.	6	0.6475	3.8850
142	SYNCOPE + COLLAPSE AGE <70 W/O C.C.	17	0.5680	9.6560
143	CHEST PAIN	102	0.6814	69.5028
144	OTHER CIRCULATORY DIAGNOSES WITH C.C.	9	1.1267	10.1403
145	OTHER CIRCULATORY DIAGNOSES W/O C.C.	15	1.0020	15.0300
146	RECTAL RESECTION AGE >69 AND/OR C.C.	2	2.7082	5.4164
147	RECTAL RESECTION AGE <70 W/O C.C.	3	2.5087	7.5261
148	MAJOR SMALL + LARGE BOWEL PROCEDURES AGE >69 AND/OR C.C.	14	2.5493	35.6902
149	MAJOR SMALL + LARGE BOWEL PROCEDURES AGE <70 W/O C.C.	11	2.2154	24.3694
151	PERITONEAL ADHESIOLYSIS AGE <70 W/O C.C.	1	2.0274	2.0274
152	MINOR SMALL + LARGE BOWEL PROCEDURES AGE >69 AND/OR C.C.	3	1.4851	4.4553
153	MINOR SMALL + LARGE BOWEL PROCEDURES AGE <70 W/O C.C.	13	1.2599	16.3787
154	STOMACH, ESOPHAGEAL + DUODENAL PROCEDURES AGE >69 AND/OR C.C.	4	2.6901	10.7604
155	STOMACH, ESOPHAGEAL + DUODENAL PROCEDURES AGE 18-69 W/O C.C.	6	2.3336	14.0016
156	STOMACH, ESOPHAGEAL + DUODENAL PROCEDURES AGE 0-17	2	0.8470	1.6940
157	ANAL PROCEDURES AGE >69 AND/OR C.C.	6	0.7985	4.7910
158	ANAL PROCEDURES AGE <70 W/O C.C.	38	0.6408	24.3504
159	HERNIA PROCEDURES EXCEPT INGUINAL + FEMORAL AGE >69 AND/OR C.C.	5	0.9297	4.6485
160	HERNIA PROCEDURES EXCEPT INGUINAL + FEMORAL AGE 18-69 W/O C.C.	11	0.7676	8.4436
161	INGUINAL + FEMORAL HERNIA PROCEDURES AGE >69 AND/OR C.C.	12	0.7068	8.4816
162	INGUINAL + FEMORAL HERNIA PROCEDURES AGE 18-69 W/O C.C.	82	0.5854	48.0028
163	HERNIA PROCEDURES AGE 0-17	23	0.4358	10.0234
164	APPENDECTOMY WITH COMPLICATED PRINC. DIAG AGE>69 AND/OR C.C.	2	1.8320	3.6640
165	APPENDECTOMY WITH COMPLICATED PRINC. DIAG AGE <70 W/O C.C.	7	1.6154	11.3078
166	APPENDECTOMY W/O COMPLICATED PRINC. DIAG AGE >69 AND/OR C.C.	5	1.4328	7.1640
167	APPENDECTOMY W/O COMPLICATED PRINC. DIAG AGE <70 W/O C.C.	45	1.0818	48.6810
168	PROCEDURES ON THE MOUTH AGE >69 AND/OR C.C.	6	0.8631	5.1786
169	PROCEDURES ON THE MOUTH AGE <70 W/O C.C.	14	0.8992	12.5888
170	OTHER DIGESTIVE SYSTEM PROCEDURES AGE >69 AND/OR C.C.	4	2.6602	10.6408
171	OTHER DIGESTIVE SYSTEM PROCEDURES AGE <70 W/O C.C.	23	2.3976	55.1448
172	DIGESTIVE MALIGNANCY AGE >69 AND/OR C.C.	5	1.2268	6.1340
173	DIGESTIVE MALIGNANCY AGE <70 W/O C.C.	3	1.0517	3.1551
174	G.I. HEMORRHAGE AGE >69 AND/OR C.C.	10	0.9281	9.2810
175	G.I. HEMORRHAGE AGE <70 W/O C.C.	28	0.8236	23.0608
177	UNCOMPLICATED PEPTIC ULCER >69 AND/OR C.C.	1	0.7422	0.7422
178	UNCOMPLICATED PEPTIC ULCER <70 W/O C.C.	11	0.6141	6.7551
179	INFLAMMATORY BOWEL DISEASE	5	1.0153	5.0765
181	G.I. OBSTRUCTION AGE <70 W/O C.C.	7	0.7845	5.4915
182	ESOPHAGITIS,GASTROENT.+ MISC. DIGEST. DIS AGE >69 +/OR C.C.	28	0.6185	17.3180
183	ESOPHAGITIS,GASTROENT.+ MISC. DIGEST. DIS AGE 18-69 W/O C.C.	335	0.5652	189.3420
184	ESOPHAGITIS, GASTROENTERITIS + MISC. DIGEST. DISORDERS AGE 0-17	79	0.3822	30.1938
185	DENTAL + ORAL DIS. EXC EXTRACTIONS + RESTORATIONS,AGE >17	16	0.6681	10.6896
186	DENTAL + ORAL DIS. EXC EXTRACTIONS + RESTORATIONS,AGE 0-17	1	0.4155	0.4155
187	DENTAL EXTRACTIONS + RESTORATIONS	32	0.3990	12.7680

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DRG	TITLE	FREQUENCY	RELATIVE WEIGHT	RELATIVE WEIGHT PRODUCTS
188	OTHER DIGESTIVE SYSTEM DIAGNOSES AGE >69 AND/OR C.C.	8	0.7444	5.9552
189	OTHER DIGESTIVE SYSTEM DIAGNOSES AGE 18-69 W/O C.C.	32	0.6576	21.0432
190	OTHER DIGESTIVE SYSTEM DIAGNOSES AGE 0-17	5	0.3379	1.6895
191	MAJOR PANCREAS, LIVER + SHUNT PROCEDURES	4	4.1791	16.7164
194	BILIARY TRACT PROC EXC TOT CHOLECYSTECTOMY AGE <70 W/O C.C.	1	1.9881	1.9881
195	TOTAL CHOLECYSTECTOMY WITH C.D.E. AGE >69 AND/OR C.C.	2	2.1690	4.3380
197	TOTAL CHOLECYSTECTOMY W/O C.D.E. AGE >69 AND/OR C.C.	10	1.4868	14.8680
198	TOTAL CHOLECYSTECTOMY W/O C.D.E. AGE <70 W/O C.C.	47	1.2752	59.9344
200	HEPATOBILIARY DIAGNOSTIC PROCEDURE FOR NON-MALIGNANCY	3	2.5818	7.7454
202	CIRRHOSIS + ALCOHOLIC HAPATITIS	10	1.1965	11.9650
203	MALIGNANCY OF HEPATOBILIARY SYSTEM OR PANCREAS	2	1.0937	2.1874
204	DISORDERS OF PANCREAS EXCEPT MALIGNANCY	22	0.9682	21.3004
205	DISORDERS OF LIVER EXC MALIG,CIRR,ALC HEPA AGE >69 AND/OR C.C.	5	1.0822	5.4110
206	DISORDERS OF LIVER EXC MALIG,CIRR,ALC HEPA AGE <70 W/O C.C.	20	0.9247	18.4940
207	DISORDERS OF THE BILIARY TRACT AGE >69 AND/OR C.C.	4	0.8492	3.3968
208	DISORDERS OF THE BILIARY TRACT AGE <70 W/O C.C.	19	0.7315	13.8985
213	AMPUTATIONS FOR MUSCULOSKELETAL SYSTEM + CONN. TISSUE DISORDERS	2	2.1315	4.2630
216	BIOPSIES OF MUSCULOSKELETAL SYSTEM + CONNECTIVE TISSUE	1	1.5596	1.5596
217	WND DEBR + SKN GRFT EXC HAND,FOR MUSCKELETAL + CONN.TISS.DIS	6	2.2824	13.6944
219	LOWER EXTREM + HUMER PROC EXC HIP,FOOT,FEMUR AGE 18-69 W/O C.C.	3	1.0790	3.2370
221	KNEE PROCEDURES AGE >69 AND/OR C.C.	1	1.2727	1.2727
222	KNEE PROCEDURES AGE <70 W/O C.C.	44	0.9897	43.5468
224	UPPER EXTREMITY PROC EXC HUMERUS + HAND AGE <70 W/O C.C.	8	0.8952	7.1616
225	FOOT PROCEDURES	46	0.6476	29.7896
226	SOFT TISSUE PROCEDURES AGE >69 AND/OR C.C.	2	0.7984	1.5968
227	SOFT TISSUE PROCEDURES AGE <70 W/O C.C.	27	0.6337	17.1099
228	GANGLION (HAND) PROCEDURES	8	0.3626	2.9008
229	HAND PROCEDURES EXCEPT GANGLION	25	0.5998	14.9950
231	LOCAL EXCISION + REMOVAL OF INT FIX DEVICES EXCEPT HIP + FEMUR	31	0.9519	29.5089
232	ARTHROSCOPY	17	0.6063	10.3071
233	OTHER MUSCULOSKELET SYS + CONN TISS O.R. PROC AGE >69 +/OR C.C.	11	1.7737	19.5107
234	OTHER MUSCULOSKELET SYS + CONN TISS O.R. PROC AGE <70 W/O C.C.	83	1.2454	103.3682
235	FRACTURES OF FEMUR	2	1.7586	3.5172
236	FRACTURES OF HIP + PELVIS	3	1.3855	4.1565
237	SPRAINS, STRAINS, + DISLOCATIONS OF HIP, PELVIS + THIGH	3	0.7929	2.3787
238	OSTEOMYELITIS	12	1.5511	18.6132
239	PATHOLOGICAL FRACTURES + MUSCULOSKELETAL + CONN.TISS.MALIGNANCY	7	1.0979	7.6853
240	CONNECTIVE TISSUE DISORDERS AGE >69 AND/OR C.C.	2	0.9709	1.9418
241	CONNECTIVE TISSUE DISORDERS AGE <70 W/O C.C.	5	0.9048	4.5240
242	SEPTIC ARTHRITIS	2	1.5880	3.1760
243	MEDICAL BACK PROBLEMS	120	0.7551	90.6120
244	BONE DISEASES + SEPTIC ARTHROPATHY AGE >69 AND/OR C.C.	3	0.7792	2.3376
245	BONE DISEASES + SEPTIC ARTHROPATHY AGE <70 W/O C.C.	8	0.7177	5.7416
246	NON-SPECIFIC ARTHROPATHIES	1	0.7147	0.7147
247	SIGNS + SYMPTOMS OF MUSCULOSKELETAL SYSTEM + CONN TISSUE	19	0.6559	12.4621
249	TENDONITIS, MYOSITIS + BURSITIS	31	0.6136	19.0216
250	FX,SPRNS,STRNS + DISL OF FOREARM,HAND,FOOT AGE >69 +/OR C.C.	2	0.7428	1.4856
251	FX,SPRNS,STRNS + DISL OF FOREARM,HAND,FOOT AGE 18-69 W/O C.C.	27	0.5964	16.1028
252	FX,SPRNS,STRNS + DISL OF FOREARM,HAND,FOOT AGE 0-17	6	0.3533	2.1198

RELATIVE WEIGHT PRODUCTS BY DIAGNOSIS RELATED GROUP

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DRG	TITLE	FREQUENCY	RELATIVE WEIGHT	RELATIVE WEIGHT PRODUCTS
253	FX,SPRNS,STRNS + DISL OF UPARM,LOWLEG EX FOOT AGE >69 +/OR C.C.	2	0.7466	1.4932
254	FX,SPRNS,STRNS + DISL OF UPARM,LOWLEG EX FOOT AGE 18-69 W/O C.C.	59	0.6258	36.9222
255	FX,SPRNS,STRNS + DISL OF UPARM,LOWLEG EX FOOT AGE 0-17	5	0.4687	2.3435
256	OTHER DIAGNOSES OF MUSCULOSKELETAL SYSTEM + CONNECTIVE TISSUE	17	0.8706	14.8002
257	TOTAL MASTECTOMY FOR MALIGNANCY AGE >69 AND/OR C.C.	2	1.1085	2.2170
258	TOTAL MASTECTOMY FOR MALIGNANCY AGE <70 W/O C.C.	7	1.0729	7.5103
259	SUBTOTAL MASTECTOMY FOR MALIGNANCY AGE >69 AND/OR C.C.	1	1.0141	1.0141
260	SUBTOTAL MASTECTOMY FOR MALIGNANCY AGE <70	1	0.9325	0.9325
261	BREAST PROC FOR NON-MALIG EXCEPT BIOPSY + LOC EXC	4	0.7329	2.9316
262	BREAST BIOPSY + LOCAL EXCISION FOR NON-MALIGNANCY	39	0.4617	18.0063
264	SKIN GRAFTS FOR SKIN ULCER OR CELLULITIS AGE <70 W/O C.C.	1	2.2031	2.2031
265	SKIN GRAFTS EXCEPT FOR SKIN ULCER OR CELLULITIS WITH C.C.	2	1.4959	2.9918
266	SKIN GRAFTS EXCEPT FOR SKIN ULCER OR CELLULITIS W/O C.C.	4	0.9485	3.7940
267	PERIANAL + PILONICAL PROCEDURES	6	0.6113	3.6678
268	SKIN,SUBCUTANEOUSTISSUE + BREAST PLASTIC PROCEDURES	1	0.5388	0.5388
269	OTHER SKIN, SUBCUT TISS + BREAST O.R. PROC AGE >69 +/OR C.C.	5	0.9947	4.9735
270	OTH SKIN, SUBCUT TISS + BREAST O.R. PROC AGE <70 W/O C.C.	111	0.8123	90.1653
271	SKIN ULCERS	5	1.3802	6.9010
272	MAJOR SKIN DISORDERS AGE >69 AND/OR C.C.	3	0.8620	2.5860
273	MAJOR SKIN DISORDERS AGE <70 W/O C.C.	10	0.8286	8.2860
274	MALIGNANT BREAST DISORDERS AGE >69 AND/OR C.C.	2	1.0108	2.0216
275	MALIGNANT BREAST DISORDERS AGE <70 W/O C.C.	1	0.9014	0.9014
276	NON-MALIGNANT BREAST DISORDERS	2	0.6066	1.2132
277	CELLULITIS AGE >69 AND/OR C.C.	18	0.8863	15.9534
278	CELLULITIS AGE 18-69 W/O C.C.	158	0.8096	127.9168
279	CELLULITIS AGE 0-17	18	0.4789	8.6202
280	TRAUMA TO THE SKIN, SUBCUT TISS + BREAST AGE >69 +/OR C.C.	7	0.6201	4.3407
281	TRAUMA TO THE SKIN, SUBCUT TISS + BREAST AGE 18-69 W/O C.C.	65	0.5377	34.9505
282	TRAUMA TO THE SKIN, SUBOUT TISS + BREAST AGE 0-17	15	0.3460	5.1900
283	MINOR SKIN DISORDERS AGE >69 AND/OR C.C.	8	0.6394	5.1152
284	MINOR SKIN DISORDERS AGE <70 W/O C.C.	57	0.5971	34.0347
285	AMPUTATIONS FOR ENDOCRINE,NUTRITIONAL + METABOLIC DISORDERS	1	2.8658	2.8658
287	SKIN GRAFTS + WOUND DEBRIDE FOR ENDOC,NUTRIT + METAB DISORDERS	1	2.8143	2.8143
289	PARATHYROID PROCEDURES	1	1.3736	1.3736
290	THYROID PROCEDURES	8	0.8549	6.8392
294	DIABETES AGE =>36	35	0.8087	28.3045
295	DIABETES AGE 0-35	14	0.7457	10.4398
296	NUTRITIONAL + MISC. METABOLIC DISORDERS AGE >69 AND/OR C.C.	5	0.8979	4.4895
297	NUTRITIONAL + MISC. METABOLIC DISORDERS AGE 18-69 W/O C.C.	13	0.7923	10.2999
298	NUTRITIONAL + MISC. METABOLIC DISORDERS AGE 0-17	13	0.7538	9.7994
299	INBORN ERRORS OF METABOLISM	3	0.9407	2.8221
300	ENDOCRINE DISORDERS AGE >69 AND/OR C.C.	[illegible]	0.9731	2.9193
301	ENDOCRINE DISORDERS AGE <70 W/O C.C.	10	0.8143	8.1430
303	KIDNEY,URETER + MAJOR BLADDER PROCEDURE FOR NEOPLASM	1	2.5397	2.5397
304	KIDNEY,URETER + MAJ BLDRPROC FOR NON-MALIG AGE >69 +/OR C.C.	3	1.7952	5.3856
305	KIDNEY,URETER + MAJ BLDR PROC FOR NON-MALIG <70 W/O C.C.	6	1.7043	10.2258
309	MINOR BLADDER PROCEDURES AGE <70 W/O C.C.	8	0.9290	7.4320
310	TRANSURETHRAL PROCEDURES AGE >69 AND/OR C.C.	3	0.7071	2.1213
311	TRANSURETHRAL PROCEDURES AGE <70 W/O C.C.	18	0.5871	10.5678

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313	URETHRAL PROCEDURES, AGE 18-69 W/O C.C.	2	0.6897	1.3794
314	URETHRAL PROCEDURES, AGE 0-17	2	0.4368	0.8736
315	OTHER KIDNEY + URINARY TRACT O.R. PROCEDURES	1	2.4884	2.4884
316	RENAL FAILURE W/O DIALYSIS	3	1.3314	3.9942
318	KIDNEY + URINARY TRACT NEOPLASMS AGE >69 AND/OR C.C.	2	0.9142	1.8284
320	KIDNEY + URINARY TRACT INFECTIONS AGE >69 AND/OR C.C.	7	0.8123	5.6861
321	KIDNEY + URINARY TRACT INFECTIONS AGE 18-69 W/O C.C.	33	0.6803	22.4499
322	KIDNEY + URINARY TRACTINFECTIONS AGE 0-17	14	0.4553	6.3742
323	URINARY STONES AGE >69 AND/OR C.C.	2	0.7131	1.4262
324	URINARY STONES AGE <70 W/O C.C.	30	0.5472	16.4160
325	KIDNEY + URINARY TRACT SIGNS +SYMPTOMS AGE>69 AND/OR C.C.	3	0.7247	2.1741
326	KIDNEY + URINARY TRACT SIGNS + SYMPTOMS AGE 18-69 W/O C.C.	6	0.5875	3.5250
327	KIDNEY + URINARY TRACT SIGNS + SYMPTOMS AGE 0-17	1	0.5027	0.5027
329	URETHRAL STRICTURE AGE 18-69 W/O C.C.	1	0.5326	0.5326
331	OTHER KIDNEY + URINARY TRACT DIAGNOSES AGE >69 AND/OR C.C.	3	0.8919	2.6757
332	OTHER KIDNEY + URINARY TRACT DIAGNOSES AGE 18-69 W/O C.C.	16	0.7763	12.4208
333	OTHER KIDNEY + URINARY TRACT DIAGNOSES AGE 0-17	3	0.5146	1.5438
336	TRANSURETHRAL PROSTATECTOMY AGE >69 AND/OR C.C.	6	1.0079	6.0474
337	TRANSURETHRAL PROSTATECTOMY AGE <70 W/O C.C.	18	0.8491	15.2838
338	TESTES PROCEDURES, FOR MALIGNANCY	1	0.9096	0.9096
339	TESTES PROCEDURES, NON-MALIGNANT AGE >17	22	0.6093	13.4046
340	TESTES PROCEDURES, NON-MALIGNANT AGE 0-17	15	0.4381	6.5715
342	CIRCUMCISION AGE >17	1	0.4228	0.4228
343	CIRCUMCISION AGE 0-17	3	0.3828	1.1484
344	OTHER MALE REPRODUCTIVE SYSTEM O.R. PROCEDURES FOR MALIGNANCY	1	1.1204	1.1204
345	OTHER MALE REPRODUCTIVE SYSTEM O.R. PROC EXCEPT FOR MALIG	3	0.8334	2.5002
346	MALIGNANCY, MALE REPRODUCTIVE SYSTEM, AGE >69 AND/OR C.C.	1	0.9395	0.9395
347	MALIGNANCY, MALE REPRODUCTIVE SYSTEM, AGE <70 W/O C.C.	2	0.8304	1.6608
348	BENIGN PROSTATIC HYPERTROPHY AGE >69 AND/OR C.C.	2	0.8864	1.7728
349	BENIGN PROSTATIC HYPERTROPHY AGE <70 W/O C.C.	6	0.6998	4.1988
350	INFLAMMATION OF THE MALE REPRODUCTIVE SYSTEM	40	0.6096	24.3840
352	OTHER MALE REPRODUCTIVE SYSTEM DIAGNOSES	7	0.6385	4.4695
354	NON-RADICAL HYSTERECTOMY AGE >69 AND/OR C.C.	25	1.1108	27.7700
355	NON-RADICAL HYSTERECTOMY AGE <70 W/O C.C.	71	1.0156	72.1076
356	FEMALE REPRODUCTIVE SYSTEM RECONSTRUCTIVE PROCEDURES	17	0.8460	14.3820
357	UTERUS + ADENEXA PROCEDURES, FOR MALIGNANCY	2	1.9188	3.8376
358	UTERUS + ADENEXA PROC FOR NON-MALIGNANCY EXCEPT TUBAL INTERRUPT	36	1.0890	39.2040
359	TUBAL INTERRUPTION FOR NON-MALIGNANCY	27	0.4279	11.5533
360	VAGINA, CERVIC + VULVA PROCEDURES	22	0.5985	13.1670
361	LAPAROSCOPY + ENDOSCOPY (FEMALE) EXCEPT TUBAL INTERRUPTION	29	0.4864	14.1056
362	LAPAROSCOPIC TUBAL INTERRUPTION	45	0.3126	14.0670
363	D+C,CONIZATION + RADIO-IMPLNT, FOR MALIGNANCY	6	0.6516	3.9096
364	D+C,CONIZATION EXCEPT FOR MALIGNANCY	57	0.4028	22.9596
365	OTHER FEMALE REPRODUCTIVE SYSTEM O.R. PROCEDURES	4	1.7965	7.1860
366	MALIGNANCY, FEMALE REPRODUCTIVE SYSTEM AGE >69 AND/OR C.C.	6	0.8444	5.0664
367	MALIGNANCY, FEMALE REPRODUCTIVE SYSTEM AGE <70 W/O C.C.	1	0.5786	0.5786
368	INFECTIONS, FEMALE REPRODUCTIVE SYSTEM	71	0.7944	56.4024
369	MENSTRUAL + OTHER FEMALE REPRODUCTIVE SYSTEM DISORDERS	69	0.6959	48.0171
370	CESAREAN SECTION W C.C.	26	0.9912	25.7712

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DRG	TITLE	FREQUENCY	RELATIVE WEIGHT	RELATIVE WEIGHT PRODUCTS
371	CESAREAN SECTION W/O C.C.	83	0.7535	62.5405
372	VAGINAL DELIVERY WITH COMPLICATING DIAGNOSES	39	0.5534	21.5826
373	VAGINAL DELIVERY W/O COMPLICATING DIAGNOSES	388	0.4063	157.6444
374	VAGINAL DELIVERY WITH STERILIZATION AND/OR D+C	45	0.5492	24.7140
375	VAGINAL DELIVERY WITH O.R. PROC EXCEPT STERIL AND/OR D+C	3	0.6889	2.0667
376	POSTPARTUM DIAGNOSES W/O O.R. PROCEDURE	11	0.4158	4.5738
377	POSTPARTUM DIAGNOSES WITH O.R. PROCEDURE	3	0.4761	1.4283
378	ECTOPIC PREGNANCY	17	0.8094	13.7598
379	THREATENED ABORTION	43	0.3169	13.6267
380	ABORTION W/O D+C	6	0.2705	1.6230
381	ABORTION WITH D+C	48	0.3602	17.2896
383	OTHER ANTEPARTUM DIAGNOSES WITH MEDICAL COMPLICATIONS	50	0.4317	21.5850
384	OTHER ANTEPARTUM DIAGNOSES W/O MEDICAL COMPLICATIONS	41	0.3245	13.3045
385	NEONATES, DIED OR TRANSFERRED	3	0.6883	2.0649
386	EXTREME IMMATURITY, NEONATE	5	3.6863	18.4315
387	PREMATURITY WITH MAJOR PROBLEMS	1	1.8459	1.8459
388	PREMATURITY W/O MAJOR PROBLEMS	7	1.1693	8.1851
389	FULL TERM NEONATE WITH MAJOR PROBLEMS	64	0.5482	35.0848
390	NEONATES WITH OTHER SIGNIFICANT PROBLEMS	231	0.3523	81.3813
391	NORMAL NEWBORNS	304	0.2241	68.1264
394	OTHER O.R. PROCEDURES OF THE BLOOD + BLOOD FORMING ORGANS	4	1.1146	4.4584
395	RED BLOOD CELL DISORDERS AGE >17	13	0.7839	10.1907
396	RED BLOOD CELL DISORDERS AGE 0-17	4	0.6295	2.5180
397	COAGULATION DISORDERS	6	0.9863	5.9178
398	RETICULOENDOTHELIAL + IMMUNITY DISORDERS AGE >69 AND/OR C.C.	2	0.8900	1.7800
399	RETICULOENDOTHELIAL + IMMUNITY DISORDERS AGE <70 W/O C.C.	7	0.8459	5.9213
400	LYMPHOMA OR LEUKEMIA WITH MAJOR O.R. PROCEDURE	1	2.8272	2.8272
403	LYMPHOMA OR LEUKEMIA AGE >69 AND/OR C.C.	5	1.1715	5.8575
404	LYMPHOMA OR LEUKEMIA AGE 18-69 W/O C.C.	8	1.1787	9.4296
409	RADIOTHERAPY	2	0.8134	1.6268
410	CHEMOTHERAPY	19	0.3527	6.7013
414	OTHR MYELOPROLIF DISORD OR POORLY DIFF NEOPL DX AGE<70 W/O C.C.	3	1.0359	3.1077
415	O.R. PROCEDURE FOR INFECTIONS + PARASITIC DISEASES	6	3.0027	18.0162
416	SEPTECEMIA AGE >17	3	1.5504	4.6512
417	SEPTECEMIA AGE 0-17	1	0.7152	0.7152
418	POSTOPERATIVE + POST-TRAUMATIC INFECTIONS	5	0.9968	4.9840
420	FEVER OF UNKNOWN ORIGIN AGE 18-69 W/O C.C.	4	0.8022	3.2088
421	VIRAL ILLNESS AGE >17	283	0.6045	171.0735
422	VIRAL ILLNESS + FEVER OF UNKNOWN ORIGIN AGE 0-17	52	0.4360	22.6720
423	OTHER INFECTIOUS + PARASITIC DISEASES DIAGNOSES	9	1.2107	10.8963
424	O.R. PROCEDURES WITH PRINCIPAL DIAGNOSIS OF MENTAL ILLNESS	1	2.1938	2.1938
425	ACUTE ADJUST REACT + DISTURBANCES OF PSYCHOSOCIAL DYSFUNCTION	10	0.6812	6.8120
426	DEPRESSIVE NEUROSES	23	0.9495	21.8385
427	NEUROSES EXCEPT DEPRESSIVE	24	0.7678	18.4272
428	DISORDERS OF PERSONALITY + IMPULSE CONTROL	203	0.9741	197.7423
429	ORGANIC DISTURBANCES + MENTAL RETARDATION	3	0.9523	2.8569
430	PSYCHOSES	97	1.0934	106.0598
432	OTHER DIAGNOSES OF MENTAL DISORDERS	3	1.0525	3.1575
433	SUBSTANCE USE + SUBST INDUCED ORGANIC MENTAL DISORDERS, LEFT AMA	1	0.4457	0.4457

RELATIVE WEIGHT

DRG	TITLE	FREQUENCY	RELATIVE WEIGHT	RELATIVE WEIGHT PRODUCTS
436	DRUG USE EXCEPT DEPENDENCE	2	1.0738	2.1476
437	ALCOHOL USE EXCEPT DEPENDENCE	6	0.6183	3.7098
438	ALCOHOL + SUBSTANCE INDUCED ORGANIC MENTAL SYNDROME	34	0.8420	28.6280
439	SKIN GRAFTS FOR INJURIES	2	1.8219	3.6438
440	WOUND DEBRIGEMENTS FOR INJURIES	1	1.4807	1.4807
441	HAND PROCEDURES FOR INJURIES	4	0.7180	2.6720
442	OTHER O.R. PROCEDURES FOR INJURIES AGE >69 AND/OR C.C.	2	1.9026	3.8052
443	OTHER O.R. PROCEDURES FOR INJURIES AGE <70 W/O C.C.	13	1.5211	19.7743
444	MULTIPLE TRAUMA AGE >69 AND/OR C.C.	2	0.8830	1.7660
445	MULTIPLE TRAUMA AGE 18 69 W/O C.C.	38	0.7530	28.6140
446	MULTIPLE TRAUMA AGE 0-17	7	0.4846	3.3922
447	ALLERGIC REACTIONS AGE >17	1	0.4785	0.4785
448	ALLERGIC REACTIONS AGE 0-17	1	0.3505	0.3505
449	TOXIC EFFECTS OF DRUGS AGE >69 AND/OR C.C.	8	0.7331	5.8648
450	TOXIC EFFECTS OF DRUGS AGE 18-69 W/O C.C.	42	0.5957	25.0194
451	TOXIC EFFECTS OF DRUGS AGE 0-17	25	0.2912	7.2800
452	COMPLICATIONS OF TREATMENT AGE >69 AND/OR C.C.	4	0.8492	3.3968
453	COMPLICATIONS OF TREATMENT AGE <70 W/O C.C.	29	0.9020	26.1580
454	OTHER INJURIES, POISONINGS + TOXIC EFFDIAG AGE >69 AND/OR C.C.	2	0.8224	1.6448
455	OTHER INJURIES, POISONINGS + TOXIC EFF DIAG AGE <70 W/O C.C.	36	0.6165	22.2660
456	NON-EXTENSIVE BURNS WITH WOUND DEBRIDEMENT + OTHER O.R. PROC	4	2.7568	11.0272
460	NON-EXTENSIVE BURNS W/O O.R. PROCEDURE	10	1.4225	14.2250
461	O.R. PROC WITH DIAGNOSES OF OTHER CONTACT WITH HEALTH SERVICES	11	1.6507	18.1577
463	SIGNS + SYMPTOMS WITH C.C.	2	0.7702	1.5404
464	SIGNS + SYMPTOMS W/O C.C.	14	0.7322	10.2508
465	AFTERCARE WITH HISTORY OF MALIGNANCY AS SECONDARY DX	1	0.2071	0.2071
466	AFTERCARE W/O HISTORY OF MALIGNANCY AS SECONDARY DX	7	0.6377	4.4639
467	OTHER FACTORS INFLUENCING HEALTH STATUS	80	0.9799	78.3920
468	UNRELATED OR PROCEDURE	114	2.1037	239.8218
469	PRIM DX INVALID AS DISCHARGE DIAGNOSIS	54	0.0	0.0
470	UNGROUPABLE	125	0.0	0.0
	TOTAL	11964		8015.1607

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RELATIVE WEIGHT PRODUCTS BY DIAGNOSIS RELATED GROUP

FT JACKSON, SC
PERIOD OF REPORT: FY 83

Table 5

NOTE: DATA EXCLUDE CRO, ABSENT SICK CASES, AND RECORDS WITH CLINICAL DATA MISSING.

SOURCE: INDIVIDUAL PATIENT DATA SYSTEM (IPDS)

PREPARED BY:
DEPARTMENT OF THE ARMY
US ARMY PATIENT ADMINISTRATION SYSTEMS
AND BIOSTATISTICS ACTIVITY
FT SAM HOUSTON, TX 78234
DATE PREPARED: 12 OCT 84

CASE MIX (UNADJUSTED)	0.6699
NUMBER OF NON-EMPTY DRG CELLS (UNADJUSTED)	374
TOTAL COUNT ADJUSTED FOR DRG CELLS 469 AND 470	11785
CASE MIX INDEX (ADJUSTED)	0.6801

QUARTILE	RELATIVE WEIGHT RANGES	COUNT	PERCENT WORKLOAD
1ST	LT 0.6291	7695	65.3
2ND	0.6291-0.8858	1962	16.6
3RD	0.8858-1.3637	1845	15.7
4TH	GT 1.3637	462	3.9

	COUNT	PERCENT
ACTIVE DUTY MILITARY	5180	43.3
DEPENDENTS ACTIVE DUTY MILITARY	2089	17.5
RETIRED MILITARY, DEPENDENTS RETIRED/DECEASED MILITARY	2372	19.8
ALL OTHER TYPE BENEFICIARIES	2323	19.4

	MALE		FEMALE		TOTAL	
	COUNT	PERCENT	COUNT	PERCENT		
AGE 0-17	3599	30.1	1675	14.0	5274	44.1
AGE 18-34	2224	18.6	2171	18.1	4395	36.7
AGE 35-49	361	3.0	441	3.7	802	6.7
AGE 50-64	614	5.1	410	3.4	1024	8.6
AGE GT 64	263	2.2	206	1.7	469	3.9
TOTAL	7061	59.0	4903	41.0	11964	

NOTE: DATA EXCLUDE CRO, ABSENT SICK CASES, AND RECORDS WITH CLINICAL DATA MISSING.

SOURCE: INDIVIDUAL PATIENT DATA SYSTEM (IPDS)

PREPARED BY:
DEPARTMENT OF THE ARMY
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AND BIOSTATISTICS ACTIVITY
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DATE PREPARED: 12 OCT 84

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THE RELATIONSHIP BETWEEN INPATIENT SERVICE COST AND CASE-COMPLEXITY AT WILFORD HALL USAF MEDICAL CENTER

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INTRODUCTION

This study was conducted at Wilford Hall USAF Medical Center (WHMC) to examine the relationship between complexity of case mix and cost of providing patient care at a military medical facility. WHMC, located at Lackland Air Force Base, San Antonio Texas, is the largest medical center in the Air Force and its patient population represents a wide diversity in complexity of case mix. Facility size and case-complexity made WHMC ideal for examining the relationship between cost and case-complexity.

Sixteen major inpatient services were selected for study and the relationship between service case-complexity and cost of providing inpatient care was examined. Costs were derived using Uniform Chart of Accounts (UCA) data. Since UCA is the cost accounting method for all Department of Defense (DoD) medical facilities it is important to examine if the cost of providing patient care is sensitive to changes in case-complexity. UCA's ability to reflect changes in case-complexity has future implications for use as a budgeting tool sensitive to case-complexity, as well as for evaluating the efficiency of providing patient care based on cost per unit of output.

METHODOLOGY

Sample Selection

The sample consisted of 1323 patient records sampled from 16 services which reflected the major inpatient services at WHMC for FY 82. The only major service not sampled was obstetrics. Unique military codes added to the diagnosis codes within this service made sample selection difficult.

The source for the sample was the Medical Administrative Management System Revised (MAMSR). MAMSR was the automated patient registration system used by selected Air Force medical facilities during the study period. This system included individual patient information with regard to: (1) service of discharge; (2) diagnoses and procedures; (3) length of stay; (4) beneficiary type; (5) patient referral status; and (6) treating physician. Using historical MAMSR data, two stage proportional sampling was used. Initially, a target sample size of 1330 cases was established. Sample size was based on service diagnostic variability as well as the cost estimate for recoding records.

In the first stage, the number of records to be sampled from each of the sixteen services was determined using the following formula:

$$\frac{\text{Number of Dispositions in Service}_i}{\text{Total Dispositions of Study Services}} \times \text{Target Sample Size}$$

Where: Service_i = Each of the 16 services analyzed.

In the second stage the number of individual diagnoses to be sampled from each service was determined using the following formula:

$$\frac{\text{Number of Diagnosis}_j \text{ in Service}_i}{\text{Total Dispositions in Service}_i} \times \text{Service}_i \text{ Sample Size}$$

Where: Diagnosis_j = each diagnosis in Service_i.

After the number of cases required for each diagnosis within a service was determined, the cases were randomly selected from each diagnosis.

Case-Complexity

Upon completion of the sample selection, the 1323 patient records were retrieved. The records were then manually recoded from ICD-9 (ICD-9 is currently used by DoD) to ICD-9-CM codes. To insure accuracy of recoding, each record was reviewed by a supervisor. After conversion to ICD-9-CM codes, Health Systems International (HSI) DRG Grouper Tape (August 1983 edition) was used to obtain the DRG classification.

All but 59 records were successfully grouped to DRG. Failure to group these 59 records was due to a programming error in age computation for patients under one year of age. Once age corrections were made these remaining records were manually grouped using the HSI Revised ICD-9-CM DRG Manual.

DRGs were then assigned complexity weights using Relative Weighting Factors from the Health Care Financing Administration (HCFA) 1981 survey of 5853 hospitals nationwide.[1] Each weight factor in this survey reflects the individual DRG mean patient charge relative to the mean charge for all DRGs. Mean case-complexity for each service was determined by averaging the weight factors of the DRGs within each service.

Facility Service Costs

Cost data were derived from the DoD Uniform Chart of Accounts (UCA). UCA is an automated costing methodology which distributes costs to final accounts within the hospital. These final accounts include clinical services, outpatient clinics, dental services and special programs. In UCA, total costs are comprised of direct costs and indirect costs. Direct costs are those costs, such as salary costs and certain supply costs that can be directly assigned to a final account. Indirect costs are assigned using a step-down purification process which distributes ancillary and support costs to the final accounts they serve.

Support costs include the costs of equipment depreciation, administrative support overhead (to include base support, such as police and fire protection, etc.) and custodial support services. These costs are distributed to the

1./See, Federal Register, Vol. 48, No. 171, pp. 39876 to 39886, September 1, 1983.

respective final accounts based on a step-down assignment factor specific to that support function (e.g., square footage, pounds of linen processed, etc.)

Ancillary costs include the costs of certain medical services such as laboratory, radiology, pharmacy and rehabilitative services. These costs are distributed to final accounts based on weighted procedures provided to the final account. Weighted procedures are specific to the ancillary service (e.g., weighted laboratory values and pharmacy prescriptions, etc.).[2]

UCA costs were derived for each of the sixteen services using FY 82 UCA Unit Detail Cost Reports and Computation Summaries. The following service mean costs were derived by dividing respective annual costs by total annual workload: (1) Total mean cost per patient day; (2) Total mean cost per disposition; (3) Support mean cost per patient day; (4) Support mean cost per disposition; (5) Ancillary mean cost per patient day; and, (6) Ancillary mean cost per disposition.

ANALYSIS

Descriptive Statistics

Table 1 includes total, support and ancillary cost per day, cost per disposition, and the mean case-complexity for each of the 16 services studied. Service mean case-complexity at WHMC ranged from .460 for Opthalmology to 2.074 for Cardiothoracic Surgery. Service mean total cost per bed day ranged from $143.60 for Neurology to $386.27 for Cardiology. Service mean total cost per disposition ranged from $1716.59 for Neurology to $4155.41 for Psychiatry.

Descriptive statistics for the study sample are presented in Table 2. There were 254 unique DRGs for the study sample with an mean case-complexity score of .9836. The study sample had a mean age of 36.98 years, 61% were married and

2./For more information, see Department of Defense Uniform Chart of Accounts for Fixed Military Medical and Dental Treatment Facilities, DoD Pub. 6010.10-M, July 1979.

Table 1

SERVICE MEAN CASE-COMPLEXITY AND
MEAN COSTS FOR WILFORD HALL USAF MEDICAL CENTER

Service	Mean Case Complexity	Total Costs Per Bed Day	Support Costs Per Bed Day	Ancillary Costs Per Bed Day	Total Cost Per Disposition	Support Cost Per Disposition	Ancillary Cost Per Disposition
Internal Medicine	.829	233.49	23.43	126.26	2316.83	232.52	1254.42
Cardioloy	1.797	386.27	52.99	116.33	3732.82	512.06	1124.21
Neurology	.881	134.60	32.00	66.47	1716.59	408.16	847.71
Oncology	1.262	186.39	25.38	65.68	3521.60	479.46	1240.98
General Surgery	.945	253.42	25.36	170.89	2670.81	267.26	1801.04
Cardiothoracic Surgery	2.074	267.50	18.35	185.30	3785.46	259.73	2622.20
Neurosurgery	1.200	142.19	18.17	79.96	2665.20	340.64	1498.72
Opthalmology	.565	246.64	31.95	96.19	1979.07	256.34	771.83
Otorhinolaryngology	.460	296.84	27.90	155.25	2061.08	193.74	1077.98
Plastic Surgery	.622	276.18	24.47	147.17	2386.56	211.46	1271.76

Table 1 (continued)

SERVICE MEAN CASE-COMPLEXITY AND
MEAN COSTS FOR WILFORD HALL USAF MEDICAL CENTER

Service	Mean Case Complexity	Total Costs Per Bed Day	Support Costs Per Bed Day	Ancillary Costs Per Bed Day	Total Cost Per Disposition	Support Cost Per Disposition	Ancillary Cost Per Disposition
Urology	.980	259.93	26.56	137.59	2188.57	223.65	1158.54
Gynecology	.915	305.10	29.84	157.89	2156.77	210.95	1116.14
Pediatrics	.860	311.37	31.74	74.13	2047.35	208.76	487.43
Nursery	.678	370.09	55.34	75.94	2571.23	384.47	527.62
Orthopedics	1.028	195.94	25.50	86.69	2900.71	377.46	1283.44
Psychiatry	.932	221.52	71.82	29.21	4155.41	1347.31	547.94

Table 2

DESCRIPTIVE STATISTICS OF STUDY POPULATION
(N = 1323)

Services Examined	16
Unique DRGs	254
Mean Case-Complexity	.9836
Mean Age	36.98 years
Gender	59.4% male
Marital Status	61.0% married
Beneficiary Status	33.5% active duty
	25.0% retired
	41.6% dependent
Discharge Status	98.4% discharged home
	.6% transferred
	1.1% died

[illegible]% were active duty. Almost the entire study sample was discharged to home [illegible] duty (98.4%).[3]

Correlation of Service Cost and Case-Complexity

During initial data analysis it was determined that psychiatry departed markedly from the remaining services, particularly when [illegible] and case-complexity were examined. As a result all [illegible] 16 services and again when psychiatry was excluded. In addition, when examining the distributions of the cost factors, several [illegible] significant coefficients of skewness indicating [illegible] findings suggested bed day and disposition costs [illegible]

[3] [illegible] Statistical Software, 1981, used to conduct analyses.

assumptions. Consequently all cost variables were log-transformed and correlational analysis was performed for both unlogged costs and log-transformed costs.

Correlations between service mean total, support and ancillary costs per bed day and mean service case-complexity are presented in Table 3. Correlations between service mean total, support and ancillary costs per disposition and mean service case-complexity are presented in Table 4.

Table 3

CORRELATION OF SERVICE MEAN CASE-COMPLEXITY AND MEAN COST PER BED DAY[1]

Type of Cost	All Services (N = 16)		Psychiatry Excluded (N = 15)	
	Costs Unlogged	Costs Logged	Costs Unlogged	Costs Logged
Total Costs	.04	.00	.03	.00
Support Costs	-.06	-.15	-.04	-.15
Ancillary Costs	.17	.12	.17	.13

[1]All correlations are non-significant.

There were no significant correlations between service mean case-complexity and service mean total, support, and ancillary costs per bed day (see Table 3). This lack of relationship persisted when costs were log-transformed as well as when psychiatry was excluded.

In contrast to the lack of relationship between service mean cost per bed day and case-complexity, there were statistically significant, strong positive relationships between service mean costs per disposition and service mean case-complexity (see Table 4).[4] The correlation between mean total

4./The algorithm used to test statistical significance of correlation coefficients can be found in Snedecor, G.W. and Cochran, W.G., Statistical Methods. Ames, Iowa. Iowa State University Press, 1980, p. 185.

Table 4

CORRELATION OF SERVICE MEAN CASE-COMPLEXITY
AND MEAN COST PER DISPOSITION

Type of Cost	All Services (N = 16)		Psychiatry Excluded (N = 15)	
	Costs Unlogged	Costs Logged	Costs Unlogged	Costs Logged
Total Costs	[illegible]	.6[illegible]	.85***	.80***
Support Costs	.12	.2	.45	.45
Ancillary Costs	.63**	.54*	.65**	.57*

* $p \leq .05$ ** $p \leq .01$ *** $p \leq .001$

cost per disposition and mean case-complexity was r = .69 and when psychiatry was excluded the correlation increased to r = .85. The correlation between mean ancillary cost per disposition and mean case-complexity was also strong (r = .63). When psychiatry was excluded and ancillary costs per disposition and mean case-complexity were again examined there was negligible change in the positive relationship (r = .65). Although service mean support cost per disposition did demonstrate a mild positive relationship with mean case-complexity (r = .12), this relationship was not statistically significant. Excluding psychiatry did increase this correlation to r = .45, but this relationship remained non-significant. Log-transforming cost factors did not improve correlations.

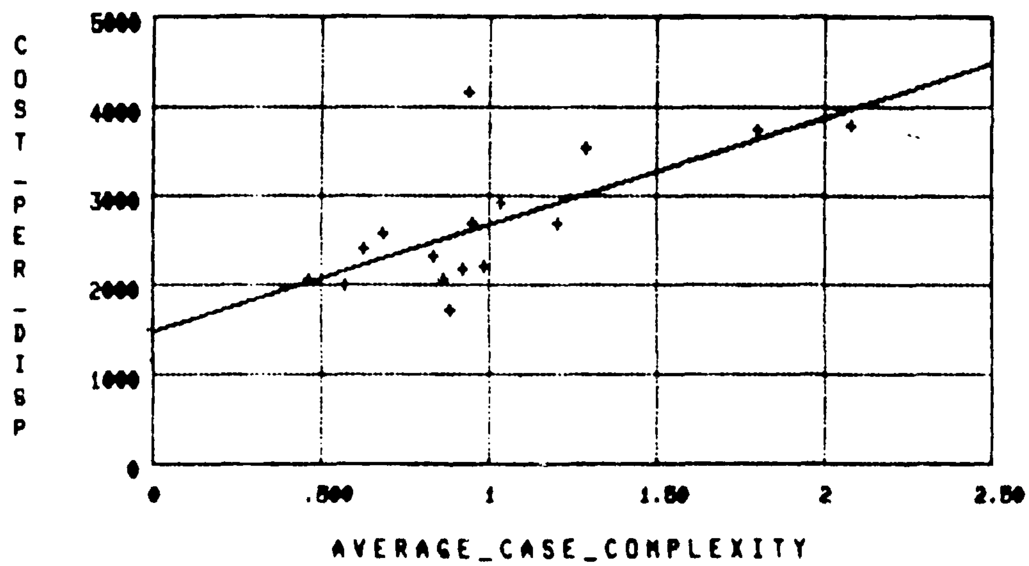
Prediction of Service Mean Cost per Disposition

Prediction equations were calculated for service mean total cost per disposition using service mean case-complexity. Ordinary least squares regression analysis was used to derive prediction equations. Since there was no improvement in correlations when cost factors were log-transformed, prediction equations were performed only for unlogged costs. Equations were derived using all services (Table 5) and again when psychiatry was excluded (Table 7). Included in Tables 5 and 7 are graphical data displays with calculated least squares lines. Residuals are plotted against predicted values for the analysis using all services (Table 6) and again when psychiatry was excluded (Table 8).

Table 5

PREDICTION OF SERVICE MEAN TOTAL COST PER DISPOSITION
BY MEAN CASE-COMPLEXITY

All Services (N = 16)



	Coefficient
Intercept	1469.57
Complexity	1205.31

Overall F Ratio = 12.93 $p \leq .01$ $r^2 = .48$

When using all services, 48% of the variance in service mean total cost per disposition was explained by mean case-complexity. When psychiatry was

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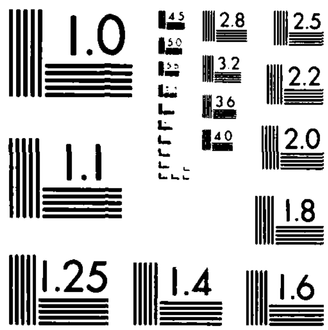
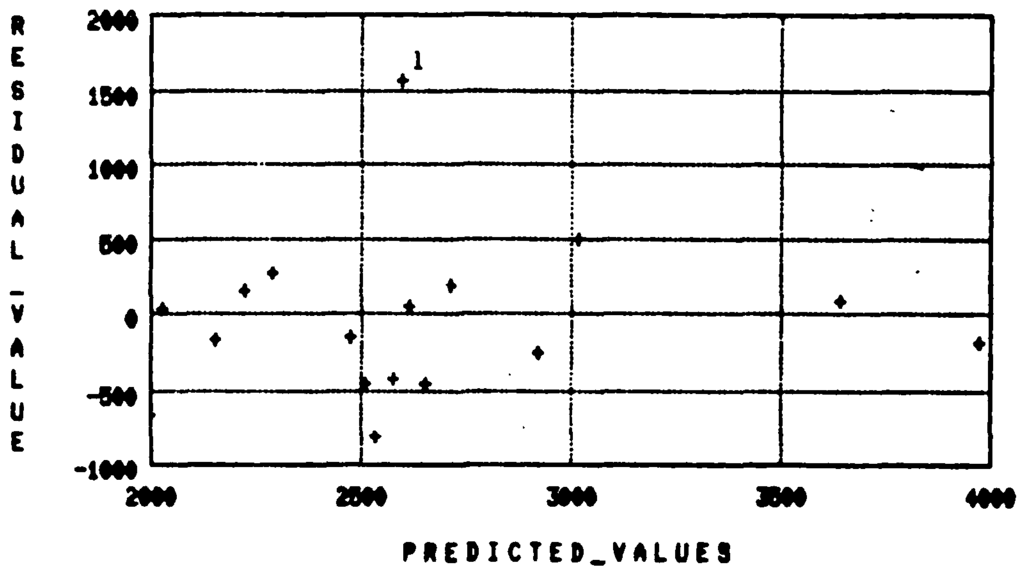


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

Table 6

PLOT OF PREDICTED MEAN COST PER DISPOSITION RESIDUALS
WITH PREDICTED MEAN COSTS

All Services (N = 16)



Serial Correlation of Residuals = .04

[1] Psychiatry predicted cost residual > 2 Standard Deviations from the mean.

excluded service mean case-complexity explained 72% of the variance in mean total cost per disposition.

Examination of plotted residuals both when all services were used (Table 6) and when psychiatry was excluded (Table 8) supported the use of linear regression analysis. In both cases residuals were not correlated.

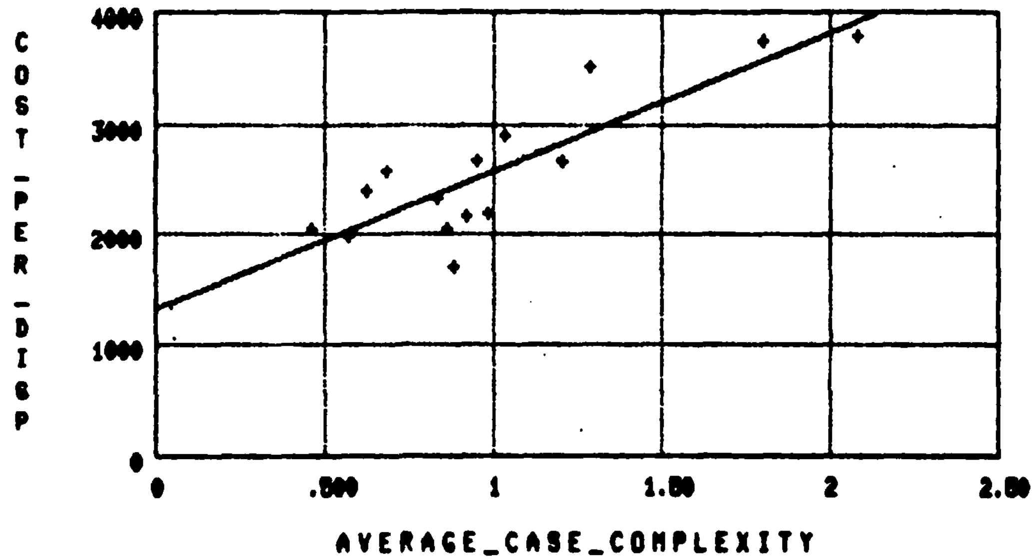
Length of Stay Comparisons Between HCFA and WHMC.

A comparative analysis was made between HCFA length of stay and WHMC length of stay. The analysis was performed because of the marked differences found when correlating service mean cost per bed day as opposed to mean cost per disposition and mean case-complexity (see Tables 9 and 10).

Table 7

PREDICTION OF SREVICE MEAN TOTAL COST PER DISPOSITION BY MEAN CASE-COMPLEXITY

Psychiatry Excluded (N = 15)



	Coefficient
Intercept	1321.39
Complexity	1248.99

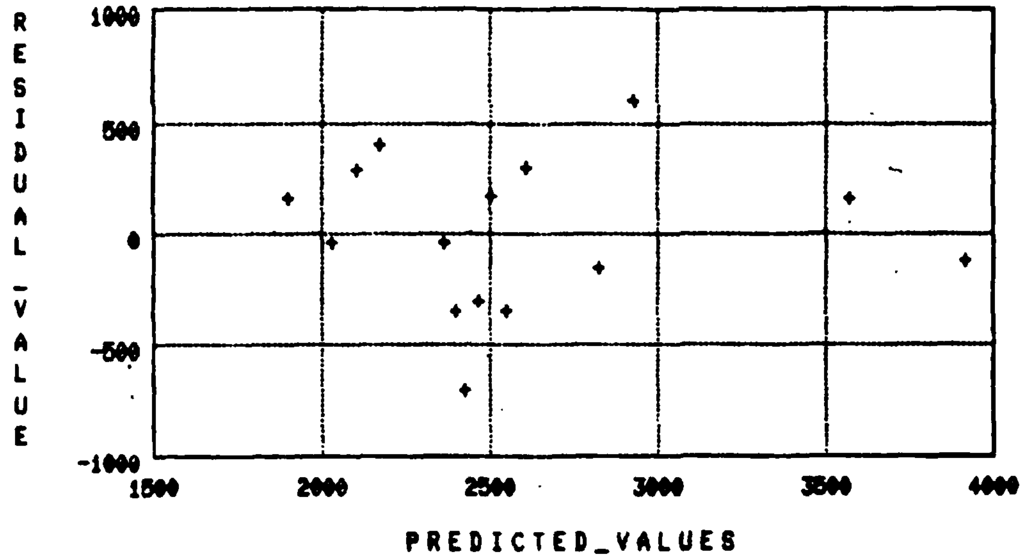
Overall F Ratio = 33.10 $p \leq .0001$ $r^2 = .72$

For each service the actual mean length of stay was computed. Secondly, for each of the 254 DRGs represented in the study population, the HCFA geometric mean length of stay was substituted for the actual length of stay for that DRG. Service mean length of stay was then recomputed. Service mean length of stay data are presented in Table 9 along with service mean case-complexity. Services have been ranked by case-complexity to assist review. A paired t-test was performed to determine if the difference between WHMC actual mean length of stay and HCFA mean length of stay was statistically

Table 8

PLOT OF PREDICTED MEAN COST PER DISPOSITION RESIDUALS
WITH PREDICTED MEAN COSTS

Psychiatry Excluded (N = 15)



Serial Correlation of Residuals = -.19

significant. As Table 9 indicates the difference in length of stay was statistically significant.

Correlations were computed between service mean case-complexity when using WHMC service actual mean length of stay and when using service HCFA DRG mean length of stay (see Table 10). In addition, the difference between WHMC and HCFA service mean length of stay was correlated with service mean case-complexity. The correlation between WHMC actual length of stay and case-complexity was r = .57. Excluding psychiatry substantially increased this correlation (r = .83). As anticipated HCFA mean length of stay demonstrated a strong correlation (r = .81). The exclusion of psychiatry did not improve this relationship. When correlating the difference between WHMC and HCFA

Table 9

COMPARISON OF WHMC SERVICE ACTUAL MEAN LENGTH OF STAY AND HCFA ADJUSTED MEAN LENGTH OF STAY

Service	Mean Case Complexity	WHMC Actual Mean Length of Stay	WHMC HCFA Adjusted Mean Length of Stay
Otorhino-laryngology	.460	3.868	2.958
Ophthalmology	.565	6.556	3.590
Plastic Surgery	.622	5.889	3.822
Nursery	.678	5.182	4.336
Internal Medicine	.829	8.217	6.223
Pediatrics	.860	6.280	5.123
Neurology	.881	12.395	7.100
Gynecology	.915	8.753	6.819
Psychiatry	.932	27.017	8.473
General Surgery	.945	7.066	6.853
Urology	.980	8.071	6.879
Orthopedics	1.028	16.868	7.590
Neurosurgery	1.200	11.982	9.646
Oncology	1.282	15.465	8.023
Cardiology	1.797	14.256	7.912
Cardiothoracic Surgery	2.074	19.093	10.121
Mean Difference = 4.46 Days*			

*$p \leq .01$

Table 10

CORRELATION OF SERVCE MEAN LENGTH OF STAY WITH MEAN CASE-COMPLEXITY

	All Services (N = 16)	Psychiatry Excluded (N = 15)
WHMC Service Mean Length of Stay and WHMC Service Complexity	.57*	.83***
HCFA DRG Geometric Mean Length of and WHMC Service Complexity	.81***	.84***
Difference between WHMC and HCFA Mean Length of Stay and WHMC Service Complexity	.39	.69**

* $p \leq .05$ ** $p \leq .01$ *** $p \leq .001$

mean length of stay and mean case-complexity, a mild positive correlation resulted (r = .39), but the correlation was not statistically significant. Excluding psychiatry served to strengthen the observed relationship (r = .69). This correlation was now statistically significant. In other words, as service case-complexity increased the difference between WHMC mean length of stay and HCFA mean length of stay also increased.

DISCUSSION AND IMPLICATIONS

There was no observed relationship between service mean cost per bed day and service mean case-complexity. In services with higher complexity, the patient days in those services distributed costs over longer periods of hospitalization. In other words, the major cost of hospitalizaton typically occurred in the first few days of hospitalization and was progressively diluted.

When psychiatry was excluded, both service total and ancillary mean cost per disposition demonstrated a strong positive correlation with service mean case-complexity. Service mean cost per disposition more accurately reflected the major costs of hospitalization, since the dilution affect of a longer period of hospitalization was removed. The lack of relationship demonstrated between service mean support cost and mean case-complexity was not unexpected. Consumption of support costs by a service (e.g., pounds of laundry used, consumption of utilities, etc.) tends to be influenced more by overall uitilization rather than the type of patient treated.

The actual service mean length of stay for psychiatry at WHMC departed markedly from the HCFA mean length of stay. Patients participating in the Alcohol Rehabilitation Program at WHMC must remain as inpatients for specified lengths of stay as required by DoD regulations. For example, for DRG 436, Alcohol and Substance Induced Organic Mental Syndrome, and DRG 438, Alcohol Dependence, the HCFA mean lengths of stay are 8.1 and 6.9 days respectively. For WHMC, the length of stay for DRG 436 was 36.5 days and for DRG 438 the length of stay was 25.3 days. Due to the prescribed lengths of stay for the above program, cost per disposition was markedly affected, decreasing the number of dispositions for this service. This resulted in an elevated mean cost per disposition. Study data suggest that when using a case-complexity system based upon the experience of civilian hospitals, consideration must be given to unique DoD requirements affecting treatment patterns in psychiatric services.

The positive correlation between the difference of WHMC and HCFA service mean length of stay and mean case-complexity may have been accounted for by such factors as the teaching mission and military discharge processing requirements of WHMC. This suggests that further analysis and possible adjustment for factors such as military teaching requirements would be necessary prior to implementing a case-complexity based cost accounting system.

Study findings indicated that service mean cost per disposition more accurately reflected the resources required to provide medical care based upon case complexity, suggesting that allocating resources to military medical treatment facilities under a case-complexity system using mean cost per bed day would be inappropriate and may be counter productive. In other words, if medical treatment facilities were allocated resources based on case-complexity, allocation of resources based on disposition cost would stimulate efficiency; whereas, resource allocation based on cost per bed day could have the opposite effect. This relationship is illustrated in Table 11. These two hypothetical hospitals

Table 11

COMPARISON OF DISPOSITON AND BED DAY COSTS
FOR TWO COMPARABLE HOSPITALS

Hospital A	Hospital B
Aggregate Case-Complexity Index: .9836	Aggregate Case-Complexity Index: .9836
Total Expense: $100,000.00	Total Expenses: $100,000.00
Total Dispositions: 60	Total Dispositions: 50
Total Bed Days: 600	Total Bed Days: 750
Mean Length of Stay: 10 days	Mean Length of stay: 15 days
Mean Cost per Disposition: $1,666.66	Mean Cost per Disposition: $2,000.00
Mean Cost per Bed Day: $166.66	Mean Cost per Bed Day; $133.33

have identical mean case-complexity, have the same total expenses, but Hospital A treated more patients (i.e., a greater number of dispositions). However, the average length of stay in Hospital B is 50% higher than in Hospital A (15 days as compared to 10 days). Although the cost per disposition is less in Hospital A ($1,666.66 as compared to $2,000.00 in Hospital B), Hospital B has a lower cost per patient day ($133.33 as compared to $166.66 in Hospital A), as well as a greater number of patient days. Current allocation of inpatient resources within DoD is predicted upon the number of bed days. In addition, one performance measure of military medical treatment facilities is cost per patient day. Although Hospital A is more efficient from the perspective of lost productivity, (i.e., absence from the work place as a result of the shorter length of stay), under current methods of evaluation Hospital B would be considered more efficient.

UCA costs were sensitive to service differences in case-complexity when the cost per disposition was used. The results of this study indicated that in the future, if military medical treatment facilities were allocated resources based on cost per disposition rather than cost per bed day, this method of resource allocation would more appropriately reflect the case-complexity of the facility. If cost per disposition rather than cost per bed day was used as a measure of productivity there would be greater incentives for cost minimization.

PRODUCTIVITY MEASUREMENT AT THE FORT ORD MEDDAC

LTC C.H. Moore, MSC, USA

A narrative of LTC Moore's presentation was not available for publication. However, we wanted to include at least an outline of his very fine and well-received presentation in these proceedings.

SEVEN STEPS TO WORKLOAD AND PRODUCTIVITY MANAGEMENT AT MEDDAC FORT ORD

<u>STEP 1</u>: DETERMINE WORK TO BE DONE

Agreement between workcenter and top management on the amount of work to be done (e.g., clinic visits, pages typed, issues processed).

<u>STEP 2</u>: ESTABLISH PRODUCTIVITY OBJECTIVES

Agreement on the number of personnel to do the work, establishing a workcenter productivity bench mark.

<u>STEP 3</u>: RECORD WORK AND TIME

Accurately and honestly record work accomplished.

<u>STEP 4</u>: MEASURE WORK AND PRODUCTIVITY

Measure actual work done against expected work
and
Measure actual productivity against expected productivity.

<u>STEP 5</u>: ANALYZE RESULTS

WHEN ACTUAL WORK ACCOMPLISHED IS	AND, ACTUAL PRODUCTIVITY IS	THEN WE ARE LIKELY TO
same as expected	same as expected	move on to next activity.
	higher than expected	reward; look for more work or consider reducing authorizations.
	lower than expected	question work count and manpower requirements; criticize if indicated.

STEP 5: (continued)

WHEN ACTUAL WORK ACCOMPLISHED IS	AND, ACTUAL PRODUCTIVITY IS	THEN WE ARE LIKELY TO
greater than expected	same as expected	question work count and investigate any policy and procedural changes in workcenter.
	higher than expected	reward; increase resources.
	lower than expected	question work count and investigate any policy and procedural changes in workcenter.
less than expected	same as expected	conduct on-site audit of reported work hours; look for more work or consider reducing authorizations.
	higher than expected	conduct on-site audit of both reported work hours and workload.
	lower than expected	criticize or adjust authorizations.

STEP 6: TAKE ACTION

Take management action if necessary.

Take leadership action:

-- stimulate people
-- remove obstacles
-- improve procedures and policies
-- discipline

Adjust resources

-- manpower allocations
-- fund hirelag and temporary positions
-- buy equipment
-- alter facilities
-- redesignate space

STEP 7: FOLLOW UP

Review problem workcenters monthly to determine if the corrective management actions selected are producing expected results.

WHY THIS SYSTEM WORKS

- o COMMAND EMPHASIS
- o DCA AND DCCS ARE RESULTS ORIENTED
- o THE WORKCENTER MANAGER IS PERSONALLY INVOLVED IN THE PROCESS
- o WE TAKE CORRECTIVE ACTION PROMPTLY
- o WE REALLOCATE RESOURCES QUICKLY
- o WE FOLLOW UP

PROVIDING CARE

1. KNOW POPULATION SUPPORTED AND BASIC DEMOGRAPHIC CHARACTERIST ᶜᶜ
2. EPIDEMIOLOGICAL CHARACTERISTICS (PRESENT AND PAST UTILIZATION)
3. PROJECT (ESTIMATE) AN APPROPRIATE LEVEL OF UTILIZATION
4. PROVIDE EFFECTIVE AND EFFICIENT QUALITY HEALTH CARE WITHIN AVAILABLE RESOURCES
5. MANAGE WELL

   BE EFFECTIVE

   BE EFFICIENT

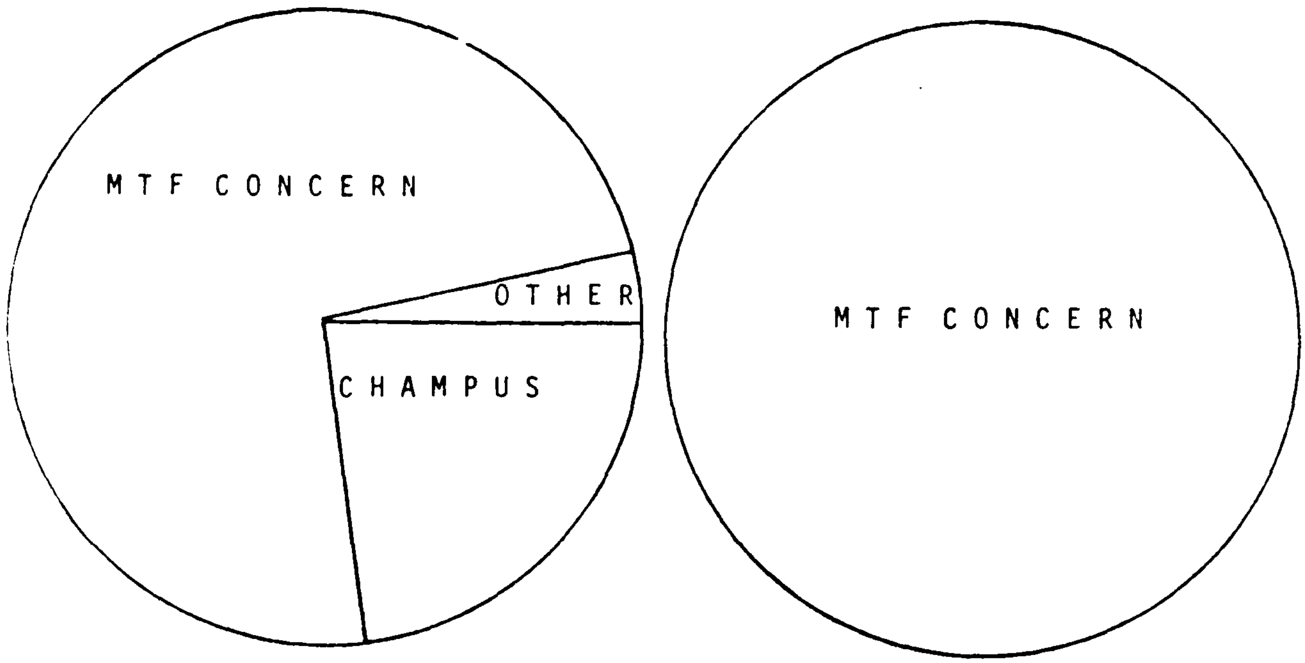
   -- UNIT COSTS LOW

   -- LABOR PRODUCTIVITY HIGH

PROPOSITION

THAT WITH THE NECESSARY INCENTIVES, RESOURCE MANAGEMENT FLEXIBILITIES, AND AN INTEGRATED COST AND UTILIZATION DATA BASE, THE MTF CAN FOCUS ON A "TOTAL SYSTEM" APPROACH TO EFFECTIVELY AND EFFICIENTLY SATISFY DOD HEALTH CARE DELIVERY REQUIREMENTS.

PROPOSITION (continued)



BEFORE AFTER

THE PREDOMINANTLY "INTERNAL INSTITUTIONAL" APPROACH WE USE TODAY WILL DISAPPEAR.

WHAT IS NECESSARY?

INCENTIVE AT MTF

- The point of health care delivery, mobilization responding and disaster planning.

RESOURCE FLEXIBILITY

- The commander's capability to capitalize on opportunities and correct problems fast.

INTEGRATED COST AND UTILIZATION DATA BASE

- Only way the MTF can view DOD financed direct care, CHAMPUS and other health care collectively

INCENTIVES

1. Make MTFs responsible for full range of DOD costs to induce interest in all DOD funded care.

2. Allow MTFs to participate with the patient in choosing whether care will be provided by direct care, supplemental care, CHAMPUS, or other federal facilities.

3. Encourage prospective thinking at MTF level by asking commanders:

   a. To target their own system utilization indicies to develop a basis for determining their own effectiveness.

   b. To obtain internal involvement and agreement among department chiefs on productivity and cost goals so there is a basis to measure their own efficiency. Then alter resource request procedures to allow commanders to prospectively state clinical initiatives.

RESOURCE FLEXIBILITY

1. Raise floor on investment equipment purchases to allow more O&M procurement. Urge Defense and Congress to provide for co-mingling of CHAMPUS and Military Department O&M funds. This allows commanders to make advantageous trade-offs.

2. Support reemerging congressional interest in making Operations and Maintenance two year appropriations. This allows commanders to attain their objectives in a continuous process, rather than executing disconnected annual budget segments.

3. Integrate processes by which MTFs fill military personnel requirements and prepare operating budgets. This allows MTFs to advance prospective initiatives which will be fully supported or fully nixed. No more imbalance between military personnel availability and funds to accomplish programs.

4. Urge Congress to remove civilian end strength limitations. Failing that, civilian positions funded on reimbursable basis, i.e., from CHAMPUS funds, not to be counted against end strength limitations.

INTEGRATED COST AND UTILIZATION (WORKLOAD) DATA BASE

1. Use data already available. MTFs have enough data collection activities now.

2. Insure collateral systems can understand each other without translators, e.g., CHAMPUS inpatient coding and Army IPDS coding. Only way MTFs can "see" their catchment areas.

3. Management reports derived from this data base must be clear, simple, and understood by both providers and lower level supervisors - we're trying to provide timely information to clinical decision makers, not justify the need for management and quantitative analysts.

SUMMARY

1. MTFs can do reasonably well at managing internal productivity with today's data. Simple techniques are effective.

2. The proposition is that with incentives, more flexibility in resource management, and a fully integrated cost and utilization data base, commanders can focus their attention on all DOD funded health care within their catchment area.

3. If this is so, then we can expand our interest from institutional MTF management and productivity, to system management and system productivity within the catchment area.

4. We need concensus among the military departments that this is worth doing and both OSD and Congressional support to accomplish it.

DEVELOPMENT OF A NONPATIENT CARE MODEL FOR THE PERFORMANCE MEASUREMENT STUDY

CPT(P) James M. King, MSC, USA
MAJ Donald E. O'Brien, MSC, USA
A.D. Mangelsdorff, Ph.D.

Presently, measurement of the work performed by the military health care system is restricted to those activities that can be directly related to patient care through the Medical Care Composite Unit. This creates a problem when one attempts to measure the actual work performed by providers in this setting, because individual provider data are not now collected in a fashion which makes them either easily retrievable or compatible with other data sources. In addition many of the activities performed by these providers are mandated by their roles as health care providers in a military setting, but do not fall under the rubric of patient care activities. Thus, we feel that a number of activities can be identified which are critical to the adequate performance of the health care provider role in the military environment, but which do not involve patient care.

Currently, the Army accounts for time spent by medical personnel in a variety of other than patient care activites through an 11% nonavailability factor. This factor, which is discussed in the Staffing Guide for U.S. Army Medical Department Activities (1974), combines such diverse activities as PCS processing, leave, and sick time with other than patient care activities for all grades and occupational specialties. Regardless of a person's grade, specialty, job title, or SSI, this nonavailability factor is constant. On the face of it, such an approach would seem to oversimplify the situation. Indeed, studies by Parker and Mayotte (1979), Alexander and Mangelsdorff (1980), Misener and Frelin (1983), and King, O'Brien, and Mangelsdorff (1983a and 1983b) have shown that time spent at other than patient care activities varies by grade, facility, and facility type. Other researchers (Langwell and Deane, 1980; Spaulding, Shelly, Domine, Martin, and St. Claire, 1983) have found that data systems to efficiently track this sort of activity are not yet available in the civilian sector.

We decided to focus this portion of the Performance Measurement Study on military unique activites, committees, clinical investigation, and training/teaching, as these areas have received the least attention under existing workload accounting systems (DOD Pam. 6010.10-M, 1979; DOD Pam. 6010.11-M, 1982; DA Pam. 40-XX, Draft). The Uniform Chart of Accounts Personnel Utilization System (UCAPERS), which is currently undergoing implementation, appears to be a substantial improvement over the existing systems, but it still relies upon labor-intensive manual keying for data entry (Federal Data Systems Corporation, 1983). The clinical investigation and training/teaching areas have received explicit recognition in the Veterans Administration model, as described by Thomas, Berki, Wyszewianski, and Ashcraft (1983), but the committee function is almost always lumped into overhead costs in all systems. The military unique activities are not captured in a fashion which is compatible with other aspects of the Performance Measurement Study. To the maximum extent possible, we propose that our study be compatible with Uniform Chart of Accounts (UCA), Uniform Staffing Methodologies (USM), and UCAPERS in coding, definitions of terms, and with the Ambulatory Care Data Base (ACDB) portion of the Performance Measurement Study (PMS) in terms of test sites. These data will be input and manipulated either through the ACDB hardware using the optical mark reader technology, or within the context of UCAPERS. The data element lists and forms designs have been, and will continue to be, developed in consultation with clinical and administrative professionals working in medical treatment facilities.

We are proposing a two level system of data capture. The first level will involve the capture of data related to group activities. This level will identify the numbers of participants by categories, and will identify the type of activity accomplished. The type of activity will be explicitly related to a UCA/USM fourth level code as described in the Health Services Command UCA/USM Standard Fourth Level Coding FY 84 manual (1983). The following figures are intended to present desired data elements, rather than final forms designs. Figure 1 contains the data elements related to the clinical investigation mission and to the committee function. Figure 2 contains the data elements related to the military training and readiness mission of a medical treatment facility. Figure 3 displays a listing of those elements needed to account for the time spent in nursing education and training. Figure 4 shows the data elements which might be captured on the types of personnel involved in a particular activity. These data would be used in conjunction with the data elements displayed in Figures 1 and 2. Figure 5 is an example of the data which might be collected on rostered additional duties.

The second level of data capture will be keyed to specific individuals. For the purposes of this study, data would be collected from individuals who have provider codes for the Ambulatory Care Data Base portion of the Performance Measurement Study. They will be asked to indicate, on a periodic basis, the amount of their time spent in specific activities, each of which is related to a specific UCA/USM fourth level code. Examples of the types of data elements which are required are shown in Figure 6. It may prove feasible to collect these data through more frequent USM or UCAPERS Clinician Surveys, or through the UCAPERS Clinician Utilization Worksheet, if appropriate changes can be incorporated into these systems (DOD Pam. 6010.11-M, 1982; DA Pam. 40-XX, Draft; Federal Data Systems Corporation, 1983) at the various study sites for the Ambulatory Care Data Base portion of the Performance Measurement Study. This linkage is crucial if data from all portions of the Performance Measurement

ADMINISTRATIVE DATA SHEET

		0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
DEPT #		0 1 2 3 4 5 6 7 8 9

DATE	DAY		0 1 2 3
			0 1 2 3 4 5 6 7 8 9
	MO		0 1
			0 1 2 3 4 5 6 7 8 9
	YR		0 1 2 3 4 5 6 7 8 9
			0 1 2 3 4 5 6 7 8 9

Meeting

Advan Acquis Pl Comm	o	Linen Manag	o
APC/EMC	o	Mater Stand Comm	o
Auto Guid Coun	o	Med Care Eval	o
Awards Board	o	MED Case	o
Blood Donor Prog	o	Prog Meeting	o
Blood Trans Comm	o	Med Lib	o
Can Care Comm	o	Multidisc Canc Conf.	o
CHEP	o	OPSEC Comm	o
CPR Comm	o	Pt Care Eval	o
CPCMT	o	Rabies Advis Bd.	o
Cl Inves Comm	o	Radi Control Comm	o
Cred Comm	o	Safety and Health Comm	o
Emp Trg Dev Comm	o	Sen NCO Coun	o
Enlist Acad Eval	o	Sexual Asslt Mang Grp	o
EOP Aff Actions	o	Space Util/Mast. Plan Bd.	o
EEO Advis Comm	o	Sp Care Unit Comm	o
Exec Com	o	TAB	o
Health Consumer	o	Tissue Comm	o
Hosp Educ	o	Utiliz and Review	o
Human Use Comm	o	Other 1	o
Infec Control	o	Other 2	o
Lab Anim Use Rev	o	Other 3	o
Lab Supp Comm	o	Other 4	o

Time

Hours		$\frac{1}{2}$	$\frac{1}{4}$
☐			
1	o	o	o
2	o		
3	o		
4	o		

Department Meetings

Admin	o
QAP	o
Training	o
Other 1	o
Other 2	o

Figure 1

Military Training Record

		0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
DEPT #		0 1 2 3 4 5 6 7 8 9

		0 1 2 3
	DAY	0 1 2 3 4 5 6 7 8 9
DATE		0 1
	MO	0 1 2 3 4 5 6 7 8 9
	YR	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9

Training

Alcol-Drug Absue	o	CTT	o
Hague-Geneva Con	o	CETT	o
Mil Jus	o	Wpms Qual	o
SAEDA	o	Other 1	o
Terror Awar	o	Other 2	o
Code of Cond	o	Other 3	o
Phys Fitness	o		
Stand of Cond	o		
SQT	o		
NCODP	o		
Profis	o		

Time

Hours				$\frac{1}{2}$	$\frac{1}{4}$
□		□		o	o
0	0	0	0		
1	o	1	o		
2	o	2	o		
		3	o		
		4	o		
		5	o		
		6	o		
		7	o		
		8	o		
		9	o		

Figure 2

NURSING EDUCATION/TRAINING RECORD

			0 1 2 3 4 5 6 7 8 9
			0 1 2 3 4 5 6 7 8 9
DEPT #			0 1 2 3 4 5 6 7 8 9

DATE	DAY		0 1 2 3
			0 1 2 3 4 5 6 7 8 9
	MO		0 1
			0 1 2 3 4 5 6 7 8 9
	YR		0 1 2 3 4 5 6 7 8 9
			0 1 2 3 4 5 6 7 8 9

<u>Type Training</u>

Basic Cardiac Life Support	O
Specialty Care Courses - LVNs	O
NETS DN Orientation	O
Critical Care Course	O
Chemotherapy Course - RNs LVNs	O
91B Hospital Orientation Course	O
Basic EKG Interpretation	O
Wardmaster Orientation Course	O
Basic Cardiac Life Support Instructor Course	O
Special Educational Programs	O
Intravenous Therapy	O
Pharmacy Math Testing /Class	O
Unit Inservice Coordinators Workshop	O
Unit Inservice Programs	O
Other #1	O
Other #2	O
Other #3	O

Attending

Mil Nurses	04-06	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
	01-03	0 1 2 3 4 5 6 7 8 9
Civ RN		0 1 2 3 4 5 6 7 8 9
	11-13	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
	06-10	0 1 2 3 4 5 6 7 8 9
Civ LVNs		0 1 2 3 4 5 6 7 8 9
	06-09	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
	03-05	0 1 2 3 4 5 6 7 8 9
EM		0 1 2 3 4 5 6 7 8 9
	E7-E9	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
	E4-E6	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
	E1-E3	0 1 2 3 4 5 6 7 8 9

Figure 3

Attending Category	Grade	Number
		0 1 2 3 4 5 6 7 8 9
MC	05-06	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
	03-04	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
Civ Phys	11-15	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
ANC	04-06	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
	01-03	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
AMSC	04-06	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
	01-03	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
CVN PT, OT, DIET	11-13	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
	06-10	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
VC	04-06	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
	01-03	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
Cvn Vet	11-13	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
Cvn Nurses	11-13	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
	06-10	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
MSC (68)	04-06	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
	01-03	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
MSC (67)	04-06	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
	01-03	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
PA	W1-W4	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
Other Civ	12-15	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
	06-11	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
	03-05	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
EM	E7-E9	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
	E4-E6	0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9
	E1-E3	0 1 2 3 4 5 6 7 8 9

Figure 4

DUTY ROSTER

DEPT #

	0 1 2 3 4 5 6 7 8 9
	0 1 2 3 4 5 6 7 8 9
	0 1 2 3 4 5 6 7 8 9

PROVIDER NUMBER:

	0 1 2 3 4 5 6 7 8
	0 1 2 3 4 5 6 7 3
	0 1 2 3 4 5 6 7 8
	0 1 2 3 4 5 6 7 8

DATE

DAY		0 1 2 3
		0 1 2 3 4 5 6 7 8 9
MO		0 1
		0 1 2 3 4 5 6 7 8 9
YR		0 1 2 3 4 5 6 7 8 9
		0 1 2 3 4 5 6 7 8 9

Duty

MOD/POD	o
SDO/AOD	o
NCOD	o
CQ	o
Asst CQ	o
Driver	o
Other 1	o
Other 2	o
Other 3	o

Grade

06	o	E9	o
05	o	E8	o
04	o	E7	o
03	o	E6	o
02	o	E5	o
01	o	E4	o
W4	o	E3	o
W3	o	E2	o
W2	o	E1	o
W1	o		

Time

Hours				½	¼
☐		☐		o	o
0	o	0	o		
1	o	1	o		
2	o	2	o		
		3	o		
		4	o		
		5	o		
		6	o		
		7	o		
		8	o		
		9	o		

SSI

1st Number	0	1	2	3	4	5	6	7	8	9
	o	o	o	o	o	o	o	o	o	o
2nd Number	0	1	2	3	4	5	6	7	8	9
	o	o	o	o	o	o	o	o	o	o

Letter	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
	R	S	T	U	V	W	X	Y	Z								
	o	o	o	o	o	o	o	o	o								

Figure 5

PROVIDER TIME SHEET

PROVIDER NUMBER:

	0 1 2 3 4 5 6 7 8 9
	0 1 2 3 4 5 6 7 8 9
	0 1 2 3 4 5 6 7 8 9
	0 1 2 3 4 5 6 7 8 9

Week	MO	Year
1 2 3 4 5	1 1	1 1
	2 2	2 2
	3 3	3 3
	4 4	4 4
	5 5	5 5
	6 6	6 6
	7 7	7 7
	8 8	8 8
	9 9	9 9

Hours Per Activity Per Day

ACTIVITY	S	M	TU	W	TH	F	S
Medical Training/ Teaching	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789
Mil Mand Training	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789
Profis	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789
Clinical Investi-gation	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789
Pt. Care Mtg	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789
CME	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789
In-Patient Care 1	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789
In-Patient Care 2	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789
Out-Patient Care 1	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789
Out-Patient Care 2	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789
Consul-tation	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789
Commit-tees	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789
Addi-tional	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789
Other	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	012 0123456789	0123456789

Figure 6

Study are to be available on a reasonable sample of medical treatment facilities.

Using these sorts of inputs, we hope to develop a provider utilization model, as outlined in Figure 7. We will account for provider time as follows: Non-available time (NAT) will be defined as leave, sick, and permanent change of station travel; Available time (AT) will be determined by totaling patient care time (PCT), consisting of inpatient and outpatient care, and nonpatient care time (NPCT), consisting of the readiness, clinical investigation, committees, teaching/training, and other activities outlined above. Theoretical total time will be defined as the sum of AT and NAT. We hope to use the providers PCT productivity, as documented by the other sections of the Performance Measurement Study, to develop a weighting system for NPCT activities which will allow us to attach explicit values to these activities.

The present approach has the advantage of directly acknowledging the value of these various NPCT activities, to include readiness, required training, additional duties, physical training, clinical investigation, and teaching/training. It recognizes that they are an integral part of the mission of the military medical treatment facility, and it gives explicit credit for their accomplishment. Our approach assumes that time spent in NPCT activities is as productive, in the context of the Military Health Care System, as time spent in PCT activities. It is our intention to incorporate indices of the quality of the NPCT activities into our measures as they become available. The present concept is in agreement with the efficiency - efficacy model of performance measurement discussed by LTC Coventry elsewhere in these proceedings. As a bi-product of our study, we believe that the outputs of our data collection process, using the optical mark reader method of data input, will enable the facilities to produce the currently required input for UCA, USM, and UCAPERS in a more cost effective and timely manner than would be possible with manual keying of input. In the

PROVIDER TIME ALLOCATION

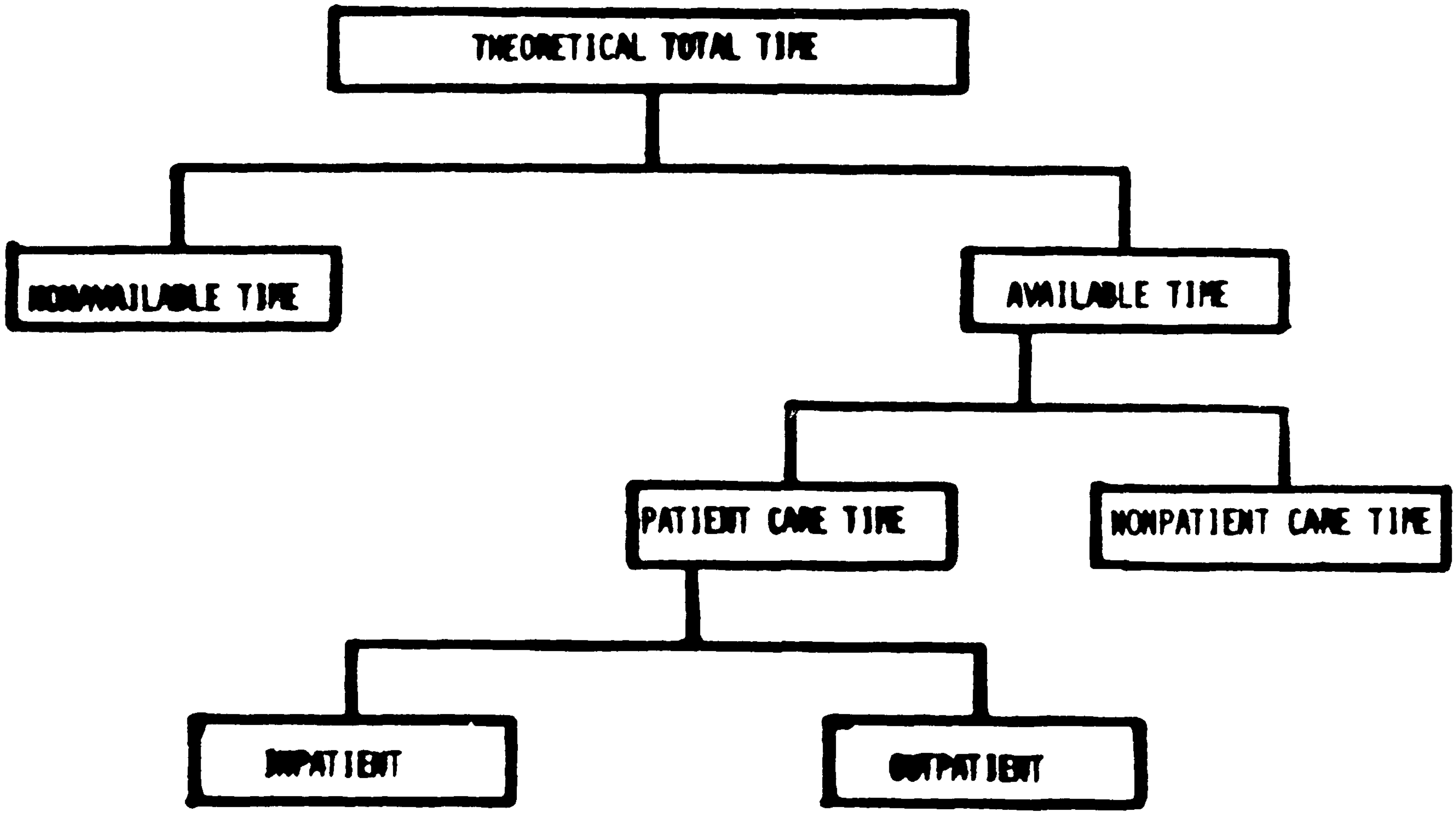


Figure 7

event that we work through UCAPERS, we will avoid any redundancy of data collection efforts within the facilities. These data, in conjunction with the data collection and processing methodologies proposed, will make it possible for the facilities themselves to produce reports which will enable all levels of management within the AMEDD to gain a more complete understanding of the demands placed upon their facilities by NPCT missions, to prioritize these NPCT missions in relation to other facility missions, and to document the outputs generated to satisfy these mission demands. These capabilities are not now fully realized in any existing or proposed AMEDD or DOD data system.

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PRODUCTIVITY MEASUREMENT AT US GENERAL LEONARD WOOD ARMY COMMUNITY HOSPITAL

MAJ John Abshire, MSC, USA

Productivity measurement at the General Leonard Wood Army Community Hospital as it relates to reporting the accomplishments of the physicians is a relatively new issue. Within the last nine months there has been a concerted effort at the hospital to measure productivity. Why do we want to measure productivity? Our overriding concern in this effort has been the goal of MAXIMIZING ACCESS OF PATIENTS TO QUALITY CARE. We already do this in many ways. We have Central Appointment System (CAS), increased telephone lines, call monitors, and mini-manpower surveys. We monitor no-show rates, hold Community Health Care Board meetings, and we measure the productivity of providers. Quality and Quantity--how do we maximize these two pieces of a very large health care puzzle which seems to be changing. At the present time we have what we feel is a very good Quality Assurance Program at the hospital. What we hope to achieve is to develop an accurate and timely measure of productivity that will allow our managers to determine if the tradeoffs for quality are acceptable in relation to the availability of care; or if, in fact, we are putting so much effort into quality care that we are defeating ourselves (and potentially reducing our resources) by denying or delaying the quantity of care to too many beneficiaries for too long.

PHYSICIAN PRODUCTIVITY REPORT

What we have devised is a tool to begin to address the productivity piece of the puzzle [illegible] manage it. Instituting a productivity [illegible] had to be [illegible] carefully [illegible] a good selling job accomplished in order to gain the [illegible] of the staff. [illegible] we had convinced the Command [illegible], [illegible] Clinical Services that we could provide them a tool [illegible], the rest [illegible]. After several revisions we finally arrived at what we call the Physicians' Productivity Report. In a way this title may be misinterpreted to be a measure of the productivity of each individual physician. However, it does not directly measure individual productivity but measures productivity on a department or clinic basis. This report addresses only physicians and nurse clinicians who produce MCCU workload.

The report is produced by the second Friday of each month utilizing the data from the previous month. The report is presented to the Utilization Review Committee and a copy provided each department and clinic chief. The report is produced manually and once all the input data is collected it takes approximately one manday to complete the report. Input data for the report comes from the following sources:

a. MED 302 Report

b. Manpower Availability Report

c. Clinician Surveys

d. DA Pam 570-557 (Staffing Guide for Army Medical Department Activities)

The productivity report is presented in two parts, the first (Figure 1) being the breakout of hours spent in each clinic area as reported on the clinician surveys. The total hours are reported on the Manpower Availability Report. The percentage reported on the clinician surveys are applied to the total hours and the hours for each clinic are reflected on the report for each physician. The hours in each clinic area are totaled. The next item of information presented is the clinic visits associated with physicians in each clinic area, and average daily beds occupied. The clinic visits and occupied beds come from the MED 302 Report. The total hours in each clinic area are divided into the clinic visits and visits per hour are reported. The staffing guide criteria (DA Pam 570-557) for that clinic is reflected on the report. And finally an analysis of the month's productivity, or access to quality care, is compared to the staffing guide.

Figure 1

WORKCENTER: MEDICAL CLINIC HOURS SPENT IN SPECIALITY DATE: 30 APRIL 1984

PHYSICIAN	BEDS INPATIENT	CLINICS INT MED	CARD	GASTRO	NEUR	TOTAL CLINIC HOURS	TOTAL HOURS
DACUS	34	135				135	169
LOONEY	59	136				136	195
DEVERA	104	104				104	208
WEISSMAN	64	43	106			149	213
MCQUEEN	50	42		66	8	116	166
MUGGLEBURG	29	114				114	143
HARRINGTON	30	59	29		29	117	147
GMO's	(17)						(17)
TOTAL	387	633	135	66	37	871	1258
WORKLOAD: *CLINIC VISITS		1349	100	107	30	1586	

OCC BEDS (DA AVG) 67.8 (Includes 39 DA AVG ARD)

VISITS PER HOUR		2.1	.7	1.6	.8	1.8	

STAFFING GUIDE CRITERIA: Int Med, Cardio & Gastro = 300 visits per physician.
Int Med = 1 physician per each 30 occupied beds.

*Physicians workload only.

Percentage of time in each speciality is furnished by the physicians on the clinician survey.

ANALYSIS:
5.3 physicians justified by clinic visits.
2.3 physicians justified by occupied beds.
7.6 physicians justified.
7 physicians assigned.

Dr. Dacus 2 days leave
Dr. Looney 5 days TDY
Dr. Harrington 5 days leave
Dr. Muggleburg 6 days TDY

As you can see in the Medical Clinic we have maximized productivity as measured by the staffing standard. But we have not really determined if each provider is achieving his potential and providing maximum access to quality care or if some other provider carrying a greater amount of the workload.

The second part of the report is a graph which reflects the trends of the past months (Figure 2). As you can see, there has generally been an increase in productivity. After close scrutiny of the report by the department or clinic chief and armed with the knowledge of the capabilities of his physicians, he can determine who is or is not being fully productive. Figures 3 through 8 provide examples of this analysis for three additional clinics.

Since we initiated this report the following positive aspects have been realized:

a. Department Chiefs have up-to-date status of department productivity which they can use to evaluate physician capabilities.

b. Informs department chiefs of impact of workload (productivity) on staffing.

c. Provides a mechanism for Cdr/DCCS to identify problems or to shift resources.

d. Provides a mechanism to generate peer pressure.

e. Identifies workload trends.

f. Provides backup information for manpower surveys.

g. Provides a mechanism to identify need to update clinician surveys.

The following actions have been taken as a result of the information provided:

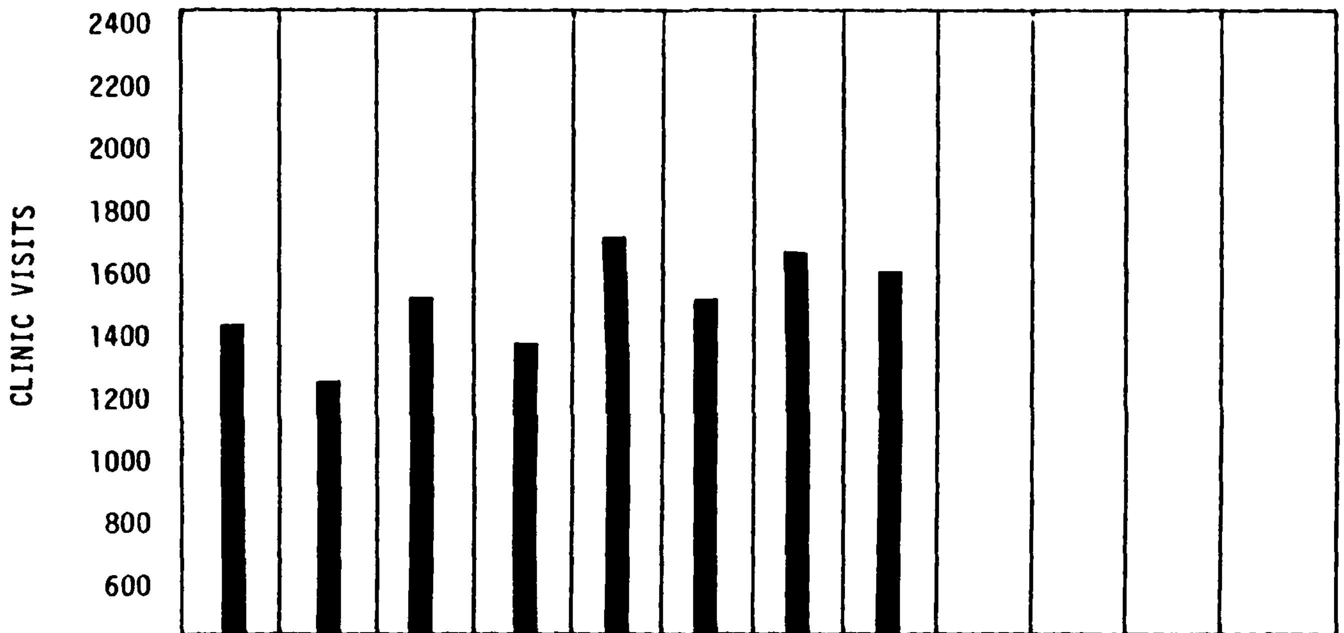
a. Productivity has increased and we have provided better access of patients to quality care.

b. Used in MEDDAC mini-manpower surveys we shift resources to improve support and patient care.

c. Problem areas in certain clinics have been identified for management resolution.

Figure 2

MEDICAL CLINIC



MONTH	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
PHY ASSGN	8	8	8	8	7	7	7	7				
PHY JUSTIFIED	6.3	5.1	6.0	5.5	7.2	7.6	9.1	7.6				
PHY JUSTIFIED FOR INPNT	1.5	.9	1.0	1.1	1.5	2.7	3.6	2.3				

Figure 3

WORKCENTER: PEDIATRIC CLINIC HOURS SPENT IN SPECIALITY DATE: 30 APRIL 1984

PHYSICIAN	BEDS INPATIENT	CLINICS PEDS	CLINICS WELL BABY	CLINICS ADMIN	TOTAL CLINIC HOURS	TOTAL HOURS
KNOWLES	56	84	19	28	103	187
MARCILLE	25	124	16		140	165
BAUGH	59	92	17		109	168
HOWELL	51	102	17		119	170
TOTAL	191	402	69	28	471	690
WORKLOAD:						
*CLINIC VISITS		1336	88		1424	
OCC BEDS (DA AVG)	10.6					
VISITS PER HOUR		3.3	1.3		3.0	

STAFFING GUIDE
CRITERIA: 3 physicians per 1300 clinic visits.
1 physician per each 30 occupied beds.

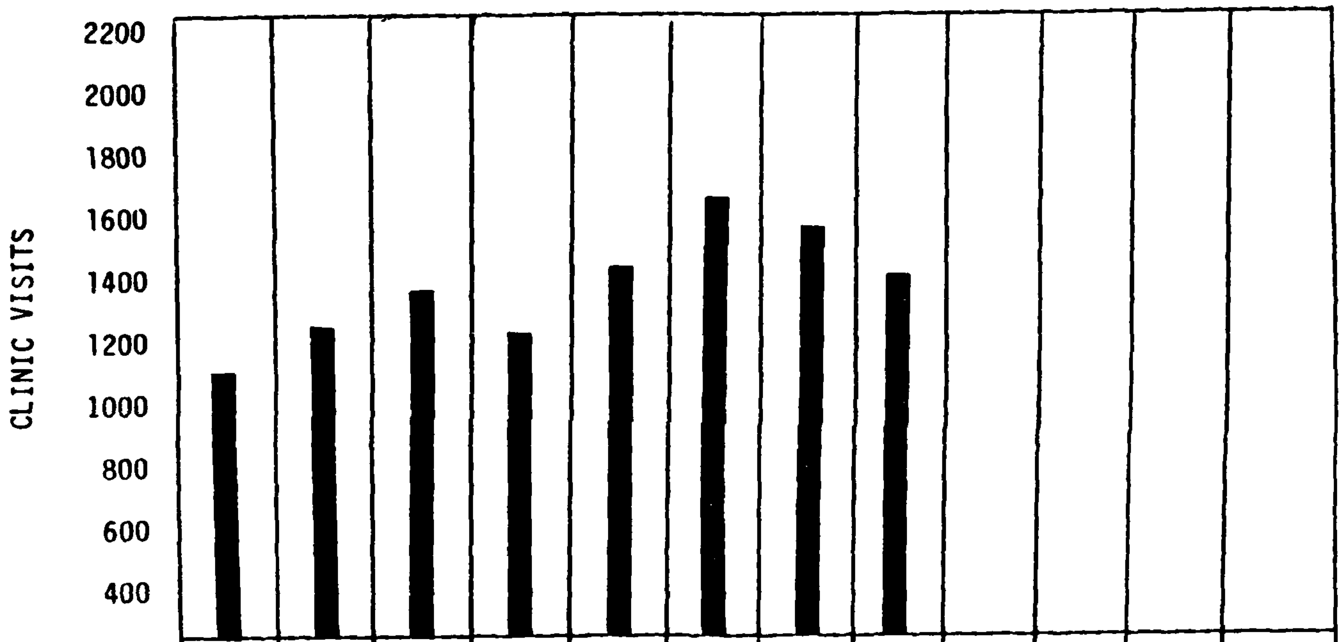
*Physicians workload only.

Percentage of time in each speciality is furnished by the physicians on the clinician survey.

ANALYSIS: 3.3 physicians justified by clinic visits.
.4 physicians justified by occupied beds.
3.7 physicians justified.
4 physicians assigned.

Figure 4

PEDIATRIC CLINIC



MONTH	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
PHY ASSGN	3	4	4	4	4	4	4	4				
PHY JUSTIFIED	3.2	3.8	4.0	3.8	4.3	5.0	3.8	3.7				

Figure 5

WORKCENTER: ORTHOPEDIC CLINIC

DATE: 30 APRIL 1984

HOURS SPENT IN SPECIALITY

PHYSICIAN	BEDS INPATIENT	CLINICS ORTHO CLINIC	*ADMIN	MUSCUL	CAST CL	TOTAL CLINIC HOURS	TOTAL HOURS
HENDERSON	84	84	32	10		84	210
POLLACK	33	190				190	223
BACON	119	86			11	86	216
TOTAL	236	360	32	10	11	360	649

WORKLOAD:
*CLINIC VISITS 1268

OCC BEDS (DA AVG) 26.4

VISITS PER HOUR 3.5

STAFFING GUIDE
CRITERIA: 350 visits per physician.
1 physician per each 30 occupied beds.

Percentage of time in each speciality is furnished by the physicians on the clinican survey.

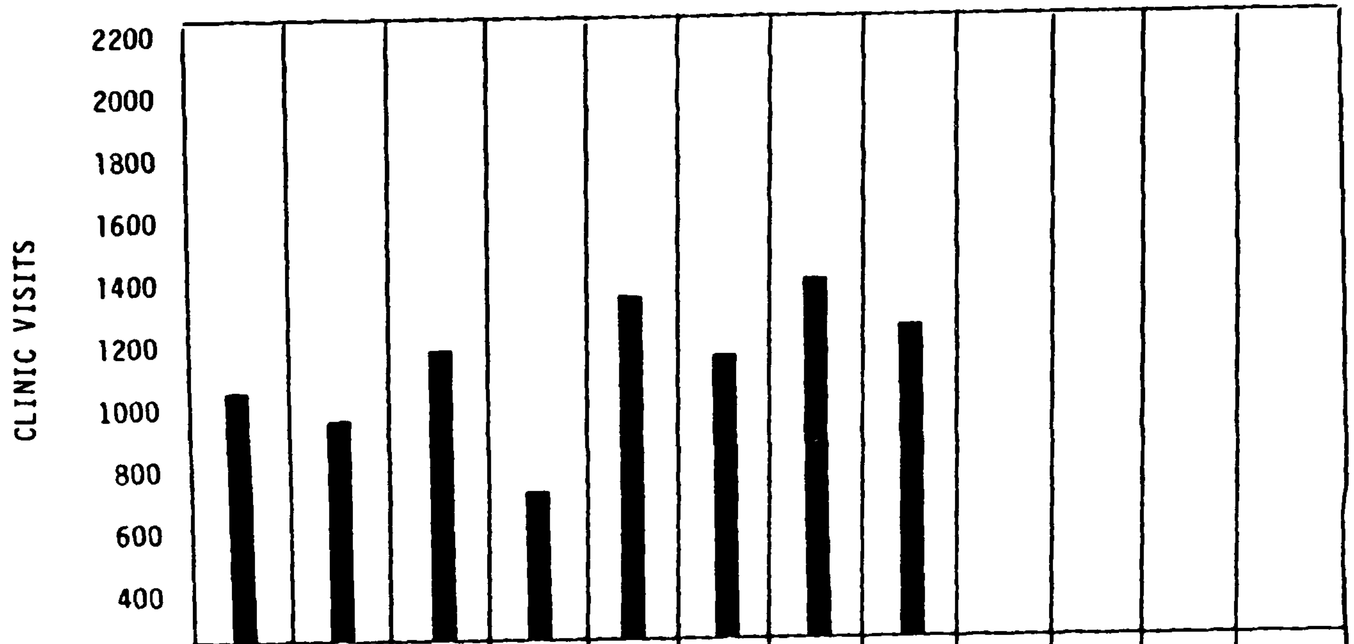
ANALYSIS: 3.6 physicians justified by clinic visits.
.9 physician justified by occupied beds.
4.5 physicians justified.
3 physicians assigned.

PA students workload is included, his hours are excluded.

*C, Clinic is spending 15% of his time reviewing records for OT, PT, Podiatry, PA students, and the Ortho OJT Physician.

Figure 6

ORTHOPEDIC CLINIC



MONTH	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
PHY ASSGN	3	3	3	3	3	3	3	3				
PHY JUSTIFIED	3.3	3.2	3.7	2.4	3.8	3.6	4.9	4.5				
PHY JUSTIFIED FOR INPNT	1.0	1.0	1.2	.7	.9	1.0	1.0	.9				

Figure 7

WORKCENTER: ACC DATE: 30 APRIL 1984

HOURS SPENT IN SPECIALITY

PHYSICIANS	ACC	ER	PE	AMOS CONSOL	ARDS	TOTAL CL HOURS	TOTAL HOURS
CRAWFORD							0
FELDMAN	25	15		124	8	25	172
KAHN	163	1			9	156	173
NELSON	57		10			57	67
ARJONA	168					168	168
PA'S	248					248	248
TOTAL	413/248	16	10	124	17	413/248	580/248

WORKLOAD:
*CLINIC VISITS 1134 = physicians 722 = PA (Total ACC vists 2750).

VISITS PER HOUR 2.7 = physician 2.9 = PA.

STAFFING GUIDE
CRITERIA: 750 visits per physician.

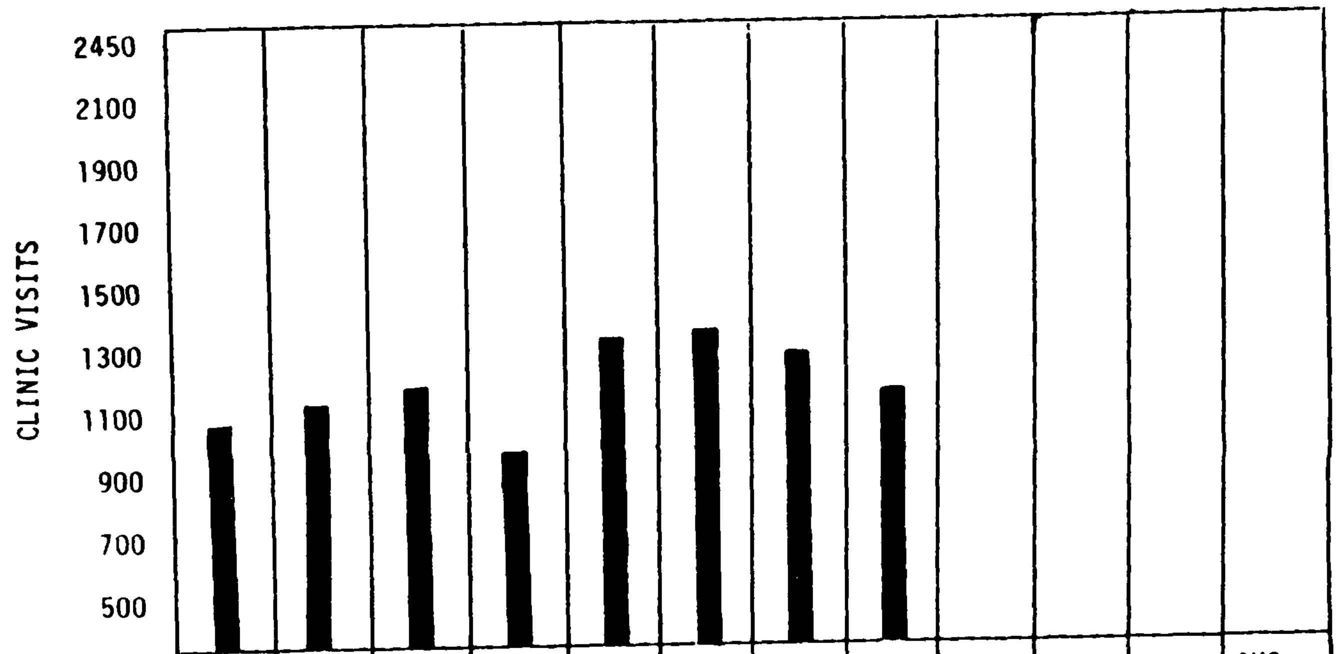
ANALYSIS: 1.5 physician justified by clinic visits.
5 physicians assigned.

Dr. Crawford - 30 days maternity leave.
Dr. Nelson - 13 days leave.

1.0 MM worked in areas other than ACC.
1.6 MM was leave.

Figure 8

ACC CLINIC



MONTH	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
PHY ASSGN	5	5	5	5	5	5	5	5				
PHY JUSTIFIED	2.1	2.3	2.4	1.9	2.6	2.7	1.7	1.5				

Shortcomings of the report are:

a. Does not break out workload by physician.

b. Concentrates only on MCCU producing physicians.

c. Efforts of support physicians, i.e., Radiologist, Pathologist, PM are not reflected.

OUTPATIENT PRODUCTIVITY REPORT

When we addressed the issue of productivity we quickly recognized that the Central Appointment Section (CAS) must be a vital link in the chain. The CAS contribution to the productivity puzzle has been what we call the Outpatient Productivity Report (Figures 9 and 10). Utilizing this report the department and clinic chiefs have a good mechanism for evaluating productivity as it relates to outpatient care. The Outpatient Productivity Report is produced each week, but one major problem we hope to resolve is that with limited resources, the report is not produced in a timely manner. The 14-18 May report was produced on 4 June. Hopefully, with automation and refinement of the reporting system we can produce a more timely report.

The report lists each provider, MC, PA, nurse clinician, MSC, by name and provides hours of authorized absences for each health care provider, CAS appointed hours, clinic scheduled hours (primarily for ward rounds, meetings, etc., walk-in patients, etc.). It reflects the number of walk-in patients, the number of clinic appointed patients and CAS appointed patients. The total patients are then divided by the number of days that the providers are in the clinic.

This report provides the manager, department and clinic chief, with the actual workload or productivity of each provider each week. If the manager evaluates the data over an extended period he may be able to evaluate negative trends and institute corrective action where appropriate.

Figure 9

CLINIC	AUTH ABS IN HRS	CAS APT HRS	CLINIC SCH HRS	WALK-IN PNTS	CLINIC APPT PTS	CAS APPT PTS	TOTAL PTS	AVERAGE PER DAY
Occ Therapy								
Jansen	3 mtg	0	37	12	23	0	35	8
Clausen		0	40	0	5	0	5	1
Oedekoven	3 1/2 mtg	0	36 1/2	28	14	0	42	9
Peterson	2 mtg	0	38	0	32	0	32	7
		% of schedule patients scheduled by CAS - 0 %						
Ophthalmology								
Physician								
Peterson	16 LV	5 1/2	18 1/2	19	53	11	83	
		% of scheduled patients scheduled by CAS - 17 %						
Comments:	Dr. Peterson's schedule showed him on leave 17 and 18 May. He came in on 17 May and saw patients.							
Optometry								
Physician								
Brunk		19 1/2	20 1/2	2	0	27	29	6
Clements	16 Rec Sta	6 1/2	17 1/2	4	0	19	23	8
Langeliers		27	13	5	0	46	51	10
Neujhar	16 Rec Sta	13	10	2	0	22	24	8
		% of appointed patients scheduled by CAS - 100%						
Orthopedics								
Physician								
Bacon	16 LV	12	12	13	0	24	37	12
Henderson	4 CT	12	24	19	0	40	59	13
Pollack	4 CT	18	19	106	0	44	150	33
PA								
Craft		0	40	86	0	0	86	17
		% of appointed patients scheduled by CAS - 100%						

Figure 10

DEPARTMENT OF SURGERY OUTPATIENT PRODUCTIVITY REPORT

81% of appointed patients scheduled by CAS — 14-18 MAY 1984

CLINIC	AUTH ABS IN HRS	CAS APT HRS	CLINIC SCH HRS	WALK-IN PNTS	CLINIC APPT PTS	CAS APPT PTS	TOTAL PTS	AVERAGE PER DAY
Audio								
Physician								
Monk		32	8	3	0	15	18	5
Comments		% of appointed patients scheduled by CAS - 100%						
ENT								
Physician								
Baumann	4 CT	7 1/2	28 1/2	21	49	15	85	19
PA								
Chaffins	0	0	0	0	0	0	0	0
Comments		% of appointed patients schedule by CAS - 23%						
OB-Gyn								
Physician								
Acosta	4 CT	8	28	13	5	33	51	11
Neese	4 CT	6	30	52	6	27	85	19
Sigel		6	10	2	11	74	87	44
Webber	4 CT	2	34	60	0	21	81	18
NC								
Darden	40 LV	0	0	0	0	0	0	0
PA								
Wettstein	32 ACC	4	4	0	0	13	13	13
Comments		% of appointed patients scheduled by CAS - 88%						

We have pursued the possibility of combining the Outpatient Productivity Report and the Physician Productivity Report, but because of varying reporting periods and the difficulty of producing the Outpatient Productivity Report in a timely manner we could not combine them. However, if we could we could possibly produce a report which ties individual productivity to departmental staffing criteria or self imposed goals, we could produce greater peer pressure, and a methodology for comparing the productivity of the physician who sees patients with complex problems versus a physician who sees acute respiratory disease, and relating all this to quality.

MILITARY AVAILABILITY REPORT

The impact of nonavailable time and military duties on assigned hours has long been a concern of the MEDDAC in relation to mission accomplishment and maximizing access of patients to quality care. The emphasis on readiness and supporting the global mission has required involvement in field training exercises, CTT, PT programs, and other related duties, has taken personnel away from their duties. In the near future the MEDDAC will undergo a manpower survey. In an effort to determine the impact of the nonavailable time and military duties we have analyzed the utilization of the military personnel on three wards, four support branches, and six clinics. The first two quarters of fiscal year 84 were evaluated. The data for the analysis was collected from the Uniform Staffing Methodology (USM) report. We have collected this military unique time since March 1982. The information reflected in Figure 11 lists the workcenter, the available hours, the hours assigned, the hours nonavailable, and hours of military duty for the first and second quarters. In all areas the hours nonavailable exceeded the 11% nonavailability factor prescribed in the current staffing guide criteria and in many instances the percentage of time devoted to military duties exceeded the 11% factor. In summary, the percentage of military

Figure 11

MILITARY MANPOWER AVAILABILITY

1ST AND 2ND QUARTERS FY84

WORKCENTER	HOURS AVAIL	HOURS ASSIGNED	HOURS NON AVAIL	HOURS MILITARY DUTY
SUPPORT				
CSD/Amb Spt Div				
1ST QTR	3396	3752	700	276
2ND QTR	3428	3664	640	243
Pharmacy				
1ST QTR	5252	5702	1385	861
2ND QTR	5959	7567	1110	462
Pathology				
1ST QTR	11424	14069	3270	2688
2ND QTR	11895	13734	2340	1290
Nutrition Care Div				
1ST QTR	4093	4452	835	544
2ND QTR	3997	4296	535	413

Figure 11 (continued)

MILITARY MANPOWER AVAILABILITY

1ST AND 2ND QUARTERS FY84

WORKCENTER	% OF HOURS NON AVAIL TO HRS AVAIL	% OF HOURS MIL DUTY TO HRS AVAIL	% OF HOURS NON AVAIL TO HRS ASSGN	% OF HOURS MIL DUTY TO HRS ASSGN
SUPPORT				
CSD/Amb Spt Div				
1ST QTR	20.6	8.1	18.7	7.4
2ND QTR	18.7	7.1	17.5	6.6
Pharmacy				
1ST QTR	26.4	16.4	24.3	15.1
2ND QTR	18.6	7.7	14.7	6.1
Pathology				
1ST QTR	28.6	23.5	23.2	19.1
2ND QTR	19.7	10.8	17.0	9.4
Nutrition Care Div				
1ST QTR	20.4	13.3	18.8	12.2
2ND QTR	13.4	10.3	12.5	9.6

Figure 11 (continued)

MILITARY MANPOWER AVAILABILITY

1ST AND 2ND QUARTERS FY84

WORKCENTER	HOURS AVAIL	HOURS ASSIGNED	HOURS NON AVAIL	HOURS MILITARY DUTY
CLINICS				
TMC #4				
1ST QTR	1841	2880	948	424
2ND QTR	2263	2480	391	160
TMC #6				
1ST QTR	1523	4056	637	380
2ND QTR	1954	3896	582	220
Orthopedic				
1ST QTR	3037	2928	365	359
2ND QTR	2523	2520	300	1
Internal Med				
1ST QTR	4002	4752	1162	611
2ND QTR	4816	4725	703	83
ACC				
1ST QTR	5168	4312	898	700
2ND QTR	4345	4154	827	129
Physical Therapy				
1ST QTR	2347	3712	1001	750
2ND QTR	3054	4032	1017	384

Figure 11 (continued)

MILITARY MANPOWER AVAILABILITY

1ST AND 2ND QUARTERS FY84

WORKCENTER	% OF HOURS NON AVAIL TO HRS AVAIL	% OF HOURS MIL DUTY TO HRS AVAIL	% OF HOURS NON AVAIL TO HRS ASSGN	% OF HOURS MIL DUTY TO HRS ASSGN
CLINICS				
TMC #4				
1ST QTR	51.5	23.0	32.9	14.7
2ND QTR	17.3	7.1	15.8	6.5
TMC #6				
1ST QTR	41.8	25.0	15.7	9.4
2ND QTR	29.8	11.3	14.9	5.6
Orthopedic				
1ST QTR	12.0	11.8	12.5	12.3
2ND QTR	11.9	0	11.9	0
Internal Med				
1ST QTR	29.0	15.3	24.5	12.9
2ND QTR	14.6	1.7	14.8	1.8
ACC				
1ST QTR	17.4	13.5	20.8	16.2
2ND QTR	19.0	3.0	19.9	3.1
Physical Therapy				
1ST QTR	42.7	32.0	27.0	20.2
2ND QTR	33.3	12.6	25.2	9.5

Figure 11 (continued)

MILITARY MANPOWER AVAILABILITY

1ST AND 2ND QUARTERS FY84

WORKCENTER	HOURS AVAIL	HOURS ASSIGNED	HOURS NON AVAIL	HOURS MILITARY DUTY
WARD				
6C Ortho				
1ST QTR	6584	7976	1564	911
2ND QTR	7727	7784	997	361
5C Gen Medicine				
1ST QTR	6642	7328	1327	668
2ND QTR	8559	8448	940	336
4 A/B ARD				
1ST QTR	5559	7612	1752	952
2ND QTR	6990	7544	914	232

Figure 11 (continued)

MILITARY MANPOWER AVAILABILITY

1ST AND 2ND QUARTERS FY84

WORKCENTER	% OF HOURS NON AVAIL TO HRS AVAIL	% OF HOURS MIL DUTY TO HRS AVAIL	% OF HOURS NON AVAIL TO HRS ASSGN	% OF HOURS MIL DUTY TO HRS ASSGN
WARD				
6C Ortho				
1ST QTR	23.8	13.8	19.6	11.4
2ND QTR	12.9	4.7	12.8	4.6
5C Gen Medicine				
1ST QTR	20.0	10.1	18.1	9.1
2ND QTR	11.0	3.9	11.1	4.0
4A/B ARD				
1ST QTR	31.5	17.1	23.0	12.5
2ND QTR	13.1	3.3	12.1	3.1

duties is requiring more and more time and reducing the availability of these personnel to support the health care mission.

SUMMARY

In summation what we want to develop is a methodology to analyze and evaluate the potential for each provider to provide quality care at maximum productivity. We need to know how productive each provider is in doing what (diagnosis), and then be able to audit some of what he is doing in terms of quality.

A DATA BASED QUALITY ASSURANCE PROGRAM

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Accurate, timely, and appropriate data are the cornerstones of any Quality Assurance Program (QAP). Modern automatic data processing systems have made it possible for program managers to obtain data necessary for the enlightened management of hospital programs. This paper will present a model of a multihospital QAP for a Major Medical Command (MEDCOM.)

The plan suggesed here departs from the traditional concept of the role of the MEDCOM in that it recommends that the MEDCOM conduct a QAP by actively monitoring the care being given in its facilities, and that it abandon the outdated concept that MEDCOMs should only monitor the Quality Assurance Plans of subordinate activities. Only by realizing the implications of this distinction and following through with the logical staffing, tasking, and organization of a Quality Assurance Division will modern and operationally sound QAPs come into existence in our MEDCOMs.

MEDCOM QUALITY ASSURANCE DIVISION

In our proposed schema each MEDCOM would have QA Division (QAD), charged with monitoring the level of medical care provided by the command's subordinate medical treatment facilities. This QAD would be responsible for regularly reporting its findings to the MEDCOM Commander.

The QAD should ideally be divided into two separate sections. The first section should be a Patient Care Evaluation Branch (PCEB), and the second section, a Quality Assurance Support Branch (QASB). The QASB would concern itself with the many administrative duties required of a QAD. It is with the functions and operations of the PCEB that the remainder of the paper will concern itself.

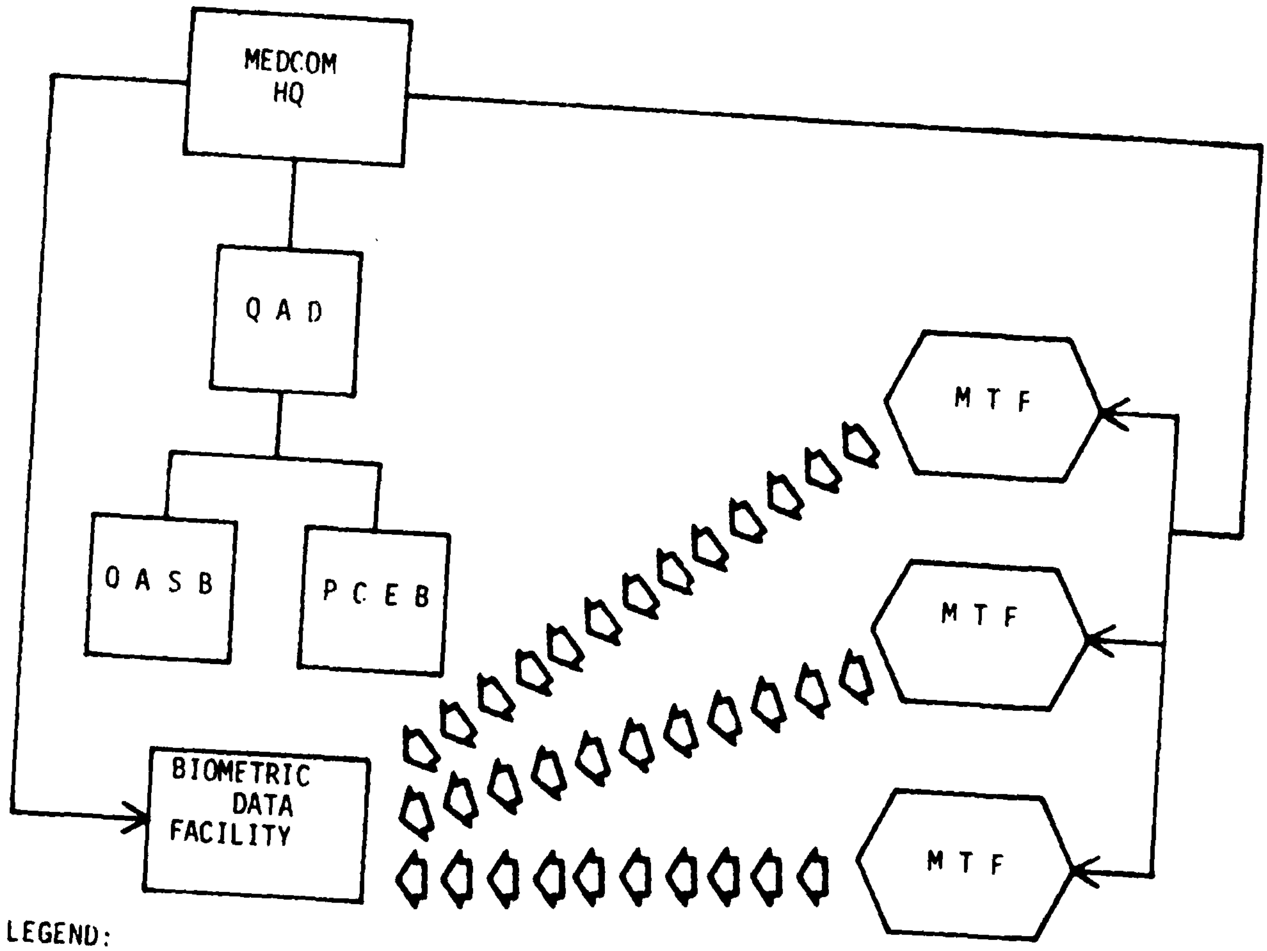
As a minimum the PCEB must have a Biometric Data Analyst (BDA) and a Patient Care Evaluation Physician (PCEP) assigned, having the following qualifications and duties: The Biometric Data Analyst should have experience as a hospital PAD officer or as a clinical practitioner and administrator in one of the ancillary care specialties. He must be able to request, analyze, and interpret data appropriate to the mission of the PECB, using appropriate data analysis procedures. The Patient Care Evaluation Physician should have a well rounded background in clinical medicine, and be familiar with automated data management techniques.

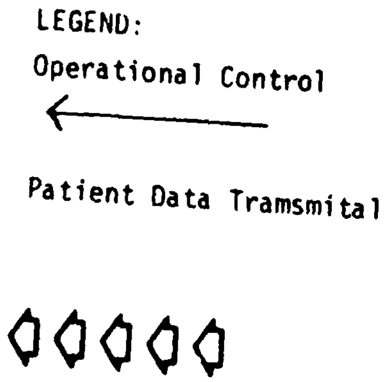
Both of these officers would be expected to make recommendations to the MEDCOM Commander and the Commander of the Biometric Data Facility regarding the appropriateness of the data being collected by the patient data systems, and the technical aspects of the data collection, editing, input, and retrieval systems as they impact on the ability of the PCEB to effectively monitor the MEDCOM QAP.

THE QUALITY ASSURANCE DATA ANALYSIS SYSTEM

The QA Data Analysis System is characterized in Figures 1 and 2. Figure 1 shows the MEDCOM/MTF Command Structure and indicates that the MTFs submit data on patients treated at their facilities to a data holding facility at regular intervals in accordance with existing regulations. The model, as presented here, is equally applicable to the Biostatistics Activity of any service and to any of the Major Medical Commands. Although the activities now deal solely with inpatient data, the schema outlined here will also apply to outpatient data when these are introduced into the system at a later date.

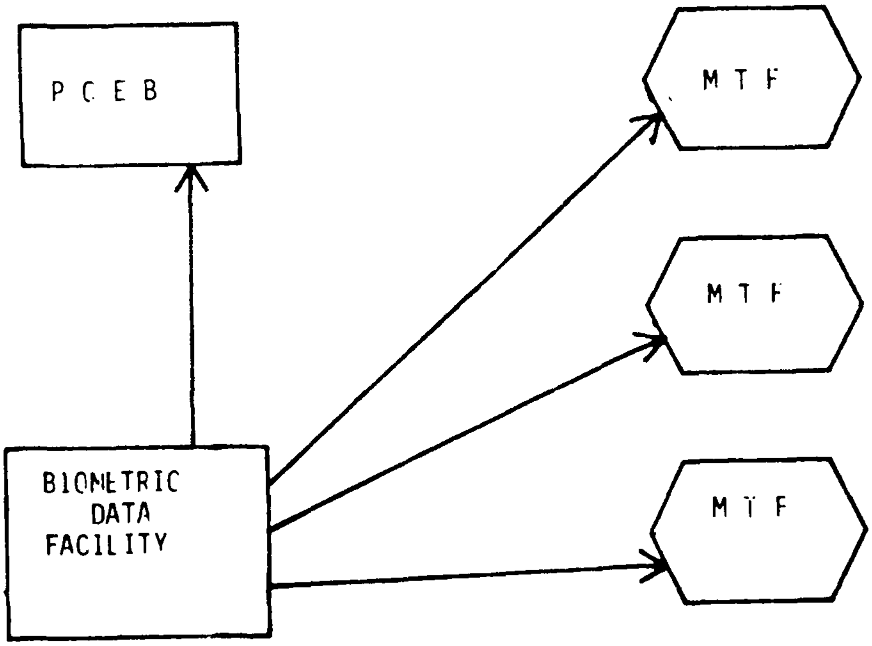
Figure 2 indicates that the Biometric Data Facility (BDF) compiles and edits the data reported by the MTFs and issues reports based on that data to the MTFs and to the PCEB. Both the MTFs and the PCEB have the ability to request special





MEDCOM/MTF Command Patient Data Reporting System

Figure 1



LEGEND:

Reports

Biometric Data Facility Reports to MTFs and PCEB

Figure 2

reports from the BDF to obtain data on patient care that relates to their particular mission. Examples of some standard reports that could be generated by the Biometrics Data Facility are shown in Table 1.

Table 1

EXAMPLES OF BDF REPORTS

1. Reports to the individual MTF:

   a. Inpatient:

      (1) Number of patients by service by DRG.
      (2) Mean LOS by DRG plus criterion LOS.
      (3) Number of cases with signal events.
      (4) Number of cases with multiple major surgical procedures by DRG by provider.
      (5) Number of patients readmitted within a specified time period after discharge by DRG by provider.

   b. Outpatient:

      (1) Number of patients seen by clinic/service.
      (2) Number of patients returning for the same complaint within a specified time period and subsequently admitted.

2. Reports to PCEB:

   a. Inpatient:

      (1) Number of patients by MTF by DRG.
      (2) Mean LOS by DRG by MTF plus criterion LOS.
      (3) Number of cases with signal events by MTF.
      (4) Number of cases with multiple major surgical procedures by DRG by MTF.
      (5) Number of patients readmitted within a specified time period after discharge by DRG by MTF.

   b. Outpatient:

      (1) Number of patients seen by MTF.
      (2) Number of patients returning for the same complaint within a specified time period and subsequently admitted by MTF.

For each quality of care indicator reported, there will also be a corresponding accepted standard of care to which that indicator can be compared. MTFs will be grouped in categories that allow realistic comparison of their performance. For example, data on MEDCENS, and large, medium, and small hospials will be presented separately, and norms could be based on civilian or military data.

Because many variables are available for analysis, the projected standard monthly reports would cover only a small portion of the data available through the BDF. Therefore, the PCEB would regularly request special reports that investigated in-depth one or more data items available in the Individual Patient Data System. For example, the PCEB might decide to investigate care given to patients in DRG #000 for the month of May 1984. The PCEB would then request descriptive statistics for DRG #000 for the month of May 1984, by MTF, from the BDF. The BDF would make a data run and forward the report to PCEB. In this report MTFs *would be identified by code number* only. This report would include all MTFs that had patients categorized in DRG #000 during May 1984. The PCEB would analyze the data to see if either the system as a whole, or any individual MTFs, showed indications of significant deviations from established norms. (The norms might be system wide, national, regional, or based on comparable MTFs.) If no deviations were found, the analysis of this DRG could stop at this point. However, if any MTF is found to have a mean LOS greater than some predetermined criteria, the PCEB would continue the investigation.

The next step of the PCEB would be to look at the DRG by clinical service in the hospital(s) with the above average LOS. The PCEB would request a report from the BDF showing the DRG for the MTF in question by clinical services, LOS, patient category (e.g., AD, Ret), by age group, and by sex. At this point it is quite conceivable that the data would present a clear picture of the majority of patients falling well within the accepted LOS for the DRG, with only one, or a very few, outliers whose longer LOS can be easily explained by the other categories of information.

If the PCEB was satisfied that it had adequately explained the variant data for the DRG in question, the analysis would terminate at this point. If there was still a question about a particular case, or group of cases, the PCEB could request a printout of the individual case by discharge abstract from the BDF. The PCEB would study this abstract to see if the information contained therein answered their questions. If so, the analysis would terminate. If the PCEB could find no adequate explanation of the extended LOS for the DRG, it would have the option of contacting the MTF commander for further information on the case or cases in question.

In future years, software could be developed by the PCEB and the BDF which focused on selected diagnoses or DRGs. Critical values for LOS would be established and the data generated automatically when aberrations occurred. This type of development is more sophisticated, but would relieve the PCEB of much burdensome data analysis in its day to day operations. This step would also facilitate the ability of the BDF to provide critical and timely information to the MTFs and to their patient care mission.

A similar situation would exist in regard to the reports sent to the commanders of the MTFs. They would receive only a small portion of the data available in the BDF data base. However, the MTFs then could also request special reports about their own facilities, which would allow them to investigate suspected problem areas in detail.

The above process would provide the MEDCOM Commander with a modern quantitative tool for both determining the quality of care provided in the command, and for making decisions as to the allocation of resources in order to achieve the desired level of patient care. It would also provide the MTF commanders with new tools to appraise the relative effectiveness of their facility in providing quality care to the patients they serve.

EFFECTS OF THE SYSTEM

The process described above presents a system to macroscopically monitor the quality of care being delivered in a MEDCOM. Although conceptually simple, it relies on three essential factors to be successful: (1) command support; (2) trained personnel; and, (3) a sophisticated and flexible data collection, analysis, and distribution system.

The true value of such a system will be realized if it can be developed to the point where patterns of suboptimal care can be detected prior to the occurrence of crises in patient care, and if the detection of such patterns can activate the resources of the health care system to correct the deficiencies.

In this system, the importance of Biometrics Activity to the command will increase immeasureably, for it will be constantly called upon to act as a vital link between the MTFs and the MEDCOM Commander.

This monitoring system is compatible with JCAH requirements. It assumes a functioning, locally controlled QAP, and it assumes the continuation of the substructure of committees and peer review in each MTF. For, only if local efforts are successful, can quality care emerge throughout the command.

A feature key to the successful use of this system would be the positive recognition of successful local QAPs. This must include the commitment of the MEDCOM Commander to intervene at an early stage to improve areas of patient care <u>before</u> serious problems occur. However, if this system is used only to discover "mistakes" and place blame, then it will become a hinderance rather than a help to delivery of quality patient care.

If used in a positive manner, this system has the potential for recognizing MTF commanders whose facilities deliver exceptional patient care. This would add another dimension to the evaluation of a commander's ability to manage a medical facility, and would improve the procedures for selecting such individuals for higher level command and administration positions.

This system will not prevent cases of provider malpratice, nor lapses in care that occur despite the best efforts of direct care providers. What the system can do is prevent institutionalized subpar performance. Once a pattern of such performance is recognized, corrective action to alleviate the problem is mandated at the level of recognition (e.g., MEDCOM level), where the marshalling of resources is possible.

By having direct access to information on the quality of patient care being delivered in the command, the MEDCOM Commander will be able to manage his resources in the most appropriate manner. He will be able to manage by using recent patient care data, rather than by relying on last year's outmoded physical plant evaluation, or outdated budget and personnel estimates.

Finally, the implementation of the system suggested here would create a mechanism by which the MEDCOM could readily investigate a number of questions pertinent to the broader issues of QA in the MEDCOM system. For example this system would lend itself to: (1) The development of software to automate the credentialing process. The credentials of all providers could be contained in a central data base. Each record would indicate the procedures that the provider is credentialed to perform, whether the procedure could be performed independently or with supervision, whether the procedure is time relational (i.e., needs current training or periodic retraining), and the date and location of the last credentialing committee action. (2) The development of software to include the Risk Management Program in the QAP. Also, biometric data could be compared with litigation claim data, by malpractice data, by MTF, by clinic service and by provider. (3) The development of an automated index that rates the effect of Facility obsolescence on the quality of patient care. (4) The development of an automated system for identifying equipment in each MTF which is essential to quality patient care. The list should identify manufacture, model number, age, purchase cost, yearly repair cost, and percentage of "down" time. This information would be available system wide in a convenient and readily accessible form and could be used by providers contemplating the purchase of new medical equipment. (5) The development of an automated system to report the occurrence of critical staff-patient ratios in each facility work center. (6) The QA data generated by the Data Based QAP could be used as part of a multivariate analysis of the Health Care Delivery System. For example, outcome factors could be compared against staff-patient ratios, staff training levels, facility ratings, IG and JCAH inspection ratings, and cost per patient, in order to develop data based management indicators.

The model suggested here would bring about a true multihospital QAP for the Uniformed Services. This model may seem radical to some. However, it is not radical to the civilian medical community. Already, articles have appeared in print espousing the same ideas, and the Sisters of Mercy Hospital Corporation are already embarked on a three year study of multihospital quality assurance. Moreover, the Department of Defense is pressuring the services to improve their QA programs. Thus, it will only be a matter of time before the services are forced to begin multihospital QAPs.

At present, we are in a position to be ahead of the rest of the nation and to institute a multihospital QAP to meet the needs of the uniformed services. The trained personnel are available, the automated systems are available, and the blueprint is available. All that is necessary is for the pieces to be brought together to begin a truly effective and modern multihospital QAP.

APPENDIX A

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APPENDIX B

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APPENDIX C

Group Sessions

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TRI-SERVICE PERFORMANCE MEASUREMENT CONFERENCE

Information for Group Sessions

Guidelines for All Groups

1. Identify the major issues involved in each topic area.
2. Determine what specific questions must be answered.
3. Determine the status of Service projects/activities/interest in this area.
4. Suggest what types of studies must be done.
5. Recommend how labor should be divided between/within the Services and DOD.
6. Suggest how we can foster Tri-Service cooperation in this area.
7. Relate the group activity to what we've heard at the conference thus far.
8. Answer the specific questions provided below to the extent possible.
9. Prepare to report the results of group activity during the final conference session on Friday morning.

Group Topics

A1. PATIENT CLASSIFICATION SCHEMES FOR MILITARY DATA (Wednesday Night)

1. Are DRGs the way to go based on what we've seen?
2. What military unique variables must be included?
3. What additional splits might be made?
4. How might we "regroup" to reduce the number of Military Diagnosis Related Groups (MDRGs)?
5. Do we start over or can we modify existing DRGs?
6. What is the impact of ICD9 versus ICD9-CM coding issues on DRGs?
7. What is the current status of coding "maps"?
8. Should we recommend a switch to ICD9-CM?

A2. RELATIVE WEIGHT DETERMINATION FOR MDRGs (Thursday Night)

1. How can we incorporate severity of illness, patient acuity, nursing intensity, or disease staging into classification and weighting?
2. How can MDRGs be tied-in with UCA for work load accounting?

A2. RELATIVE WEIGHT DETERMINATION FOR MDRG (Continued)

3. What should be the basis for relative weight assignment?

4. Should there be a single set of weights for DOD?

5. How should we handle "mission clusters" in weight determination? (Mission Clusters are the "product lines" our facilities have to produce by mission which may involve types of care with very low civilian relative resource use weights but which are very important to Congress.)

B. CONCEPTUAL APPROACHES TO PRODUCTIVITY MEASUREMENT (Wednesday and Thursday)

1. Does efficacy/efficiency make sense as a basis for monitoring two distinctly different types of performance?

2. Should we replace the Composite Work Unit (CWU OR MCCU)?

3. How do we include the quality component in performance measurement?

4. What types of measures do we need for internal Service resource allocation?

5. What types of measures do we need for external budget defense before Congress?

6. Who should set individual provider and clinic/facility/system performance standards for quantity and quality of work load?

7. What information on individual and subsystem performance is required at the facility, command, and higher levels? (i.e., what measures and types of reports are required for decision makers at various levels?)

C. PERFORMANCE MEASUREMENT IN NON-PATIENT CARE ACTIVITIES (Wednesday and Thursday)

1. How do we currently measure overhead/readiness/mobilization/training work load in medical treatment facilities?

2. What activities should we measure under the heading of "non-patient care?"

3. How can such work load measurement fit in with the UCA?

4. How can the relative weighting of indirect versus direct patient care be determined?

5. Should any proposed system track individual or "department" performance in this area?

6. Are currently utilized "nonavailability factors" adequate?

7. How can such work load be incorporated into the manpower requirement or authorization process?

D. AMBULATORY CARE DATA CAPTURE (Wednesday and Thursday)

1. What specific data elements should be included in an Ambulatory Care Data Base (ACDB)?

2. What level of detail in coding diagnoses and procedures and capturing provider and resource use information is required?

3. Is the basic unit of observation for an ACDB the visit or the episode?

4. What is the best method for data capture?

5. What is the potential impact of proposed data capture methods on the local facility?

6. How can an ACDB tie-in to UCA and TRIMIS systems?

7. What should be the basis for developing a set of Ambulatory Patient Clusters (APC)?

8. Must the same coding system be used for both inpatient and ambulatory patient data collection?

9. How could an ACDB become the basis for an Automated Quality Assurance System?

Suggested Group Assignments (*Co-Chairpersons)

A1. PATIENT CLASSIFICATION SCHEMES FOR MILITARY DATA

A2. RELATIVE WEIGHT DETERMINATION FOR MDRGs

LTC Arnt	Mr. Kay
Ms. Austin	Ms. Lindsay
*MAJ Baker	Mr. Pasternack
CPT Fye	*CDR Rieder
Ms. Glover	Ms. Scott
MAJ Heckert	LTC Vorpohl

B. CONCEPTUAL APPROACHES TO PRODUCTIVITY MEASUREMENT

MAJ Crutchfield	CPT Patterson
*COL Fields	Mr. Rushdi
LTC Miller	LTC Smith
LTC Moore	LCDR Tompkins
CAPT Morin	LTC Vago
*CPT Optenberg	

C. PERFORMANCE MEASUREMENT IN NON-PATIENT CARE ACTIVITIES

MAJ Abshire	*LCDR Ford
Ms. Bateman	*CPT King
CPT Bigelow	MAJ O'Brien
MAJ Borders	Dr. Mangelsdorff
Mr. Davenport	

D. AMBULATORY CARE DATA CAPTURE

LCDR Boyer	CPT Morreale
MAJ Clement	Mr. Pasternack
MAJ Evans	*CAPT Pleet
MAJ Leahy	COL Rosenberg
*LTC Misener	COL Young

*Co-Chairpersons are responsible for assisting the Organizational Effectiveness (O.E.) facilitators in directing the attention of the group to the suggested activities and not necessarily for providing expert input to the subject area. They are also responsible for assuring the group is ready to "report out" on Friday morning.

TRI-SERVICE PERFORMANCE CONFERENCE

Results of Group Sessions

GROUP A1: PATIENT CLASSIFICATION SCHEMES FOR MILITARY DATA

1. Are DRGs the way to go based on what we've seen?

   a. Yes, but they must be tailored to fit the military situation.

   b. We will need additional instruments or measures as we go.

   c. DRGs do not adequately account for severity of illness.

   d. The time is very ripe to proceed with DRG analysis.

   e. We must develop standards and times for nursing care.

2. What military unique variables must be included?

   a. Disability separation.

   b. Convalescent leave.

   c. Transfers in or out.

   d. Age of patient or length of service.

   e. Patient categories to include enlisted versus officer status.

3. What additional splits might be made?

   a. We don't know now but some will be necessary.

   b. We will know more as analysis concerning question 2 progresses.

4. How might we "regroup" to reduce the number of Military Diagnosis Related Groups (MDRGs)?

   a. Group does not wish to answer at this time.

   b. Left to each service's discretion.

5. Do we start over or can we modify existing DRGs?

   (see previous answers)

6. What is the impact of ICD-9 versus ICD-9-CM coding issues on DRGs?

   a. Preliminary results seem to indicate great significance.

   b. To be determined by ongoing studies.

7. What is the current status of coding "maps"?

    a. Several versions under various states of evaluation/revision.

    b. Will eventually need to have a single map for all DOD to use.

8. Should we recommend a switch to ICD-9-CM?

    a. Not should we but when can we?

    b. Need to conduct a study (decision paper) of advantages, disadvantages, quality of coding, life cycle costs, etc.

    c. Link efforts to Wilford Hall study.

    d. There are more than performance measurement reasons to recommend considering ICD-9-CM.

GROUP A2: RELATIVE WEIGHT DETERMINATION FOR MDRGs

1. How can we incorporate severity of illness, patient acuity, nursing intensity, or disease staging into classification and weighting?

    a. Only after very careful study.

    b. Severity of Illness: appears meaningful; needs to be tested; would have data availability problems for the services.

    c. Patient Acuity/Nursing Intensity: As current implementations continue to take place validate and incorporate into DRG analyses.

    d. Disease Staging: Army will pursue with SysteMetrics software.

2. How can MDRGs be tied in with UCA for workload accounting?

    a. Investigate TRIPAD (Army, Navy).

    b. Army and Navy review Wilford Hall process.

    c. Air Force replicate process at other facilities.

3. What should be the basis for relative weight assignment?

    a. As an interim measure all services should use the HCFA weights with updates as they become available.

    b. Each service can explore modifications independently.

    c. Eventually tie into UCA cost analysis.

4. Should there be a single set of weights for DOD?

    Yes.

5. How should we handle "Mission Clusters" in weight determination? (Mission Clusters are the "Product Lines" our facilities have to produce by mission which may involve types of care with very low civilian relative weights but which are very important to Congress as part of the readiness or benefit missions.)

   The group did not think it wise to consider this concept at this time. We should stick with the same weights as HCFA for now and explain our differences in some other manner besides weights. We need external comparability at this time.

GROUP B: CONCEPTUAL APPROACHES TO PRODUCTIVITY MEASUREMENT

1. Does efficacy/efficiency make sense as a basis for monitoring two distinctly different types of performance?

   Yes, but not sure how to implement at this time.

2. Should we replace the composite work unit (CWU or MCCU)?

   Unanimous agreement that status quo is inadequate.

3. How do we include the quality component in performance measurement?

   Not sufficient time to address during this conference.

4. What types of measures do we need for internal service resource allocation?

   a. DRGs will be the main basis for measurement, to be augmented by other measures to be developed.

   b. Ultimate goal: Resource allocation based on DRGs interfaced with UCA/USM, with provisions for other measures as they emerge.

5. What types of measures do we need for external budget defense before Congress?

   Same measures will be used for internal and external budget defense to the extent possible.

6. Who should set individual provider and clinic/facility/system performance standards for quantity and quality of workload?

   Standards will result from normative data produced under the DRG system. All Levels of command can utilize these norms in setting standards to augment existing quality assurance programs.

7. What information on individual and subsystem performance is required at the facility, command, and higher levels?

   Not addressed.

8. Additional question discussed. How can we continue the contacts made and discussions begun at this conference?

   a. Information briefings should be presented to each service Surgeon General.

   b. Some type of formal information sharing structure will be created.

   c. Quarterly "mini-conferences" should be held for key workers from each service on selected topics to review progress and plans.

   d. Formal division of labor at this early stage is not recommended.

GROUP C: PERFORMANCE MEASUREMENT IN NON-PATIENT CARE ACTIVITIES

1. How do we currently measure overhead/readiness/mobilization/training workload in medical treatment facilities?

   a. Uniform Staffing Methodology/Uniform Chart of Accounts.

   b. Cost Accounts Codes/Army Management Structure.

   c. Uniform Chart of Accounts Personnel System (UCAPERS).

2. What activities should we measure under the heading of "Non-patient Care"?

   a. All administrative overhead.

   b. E and F accounts within UCA as applicable.

   c. Continuing Medical Education.

   d. Committees and reporting.

   e. Clinical Investigations and research.

   f. Local travel.

   g. Command and control.

   h. Liaison duties.

3. How can such workload measurements fit in with UCA?

   a. Make the UCA accounts compatible with USM.

   b. Flesh out both the UCA and USM in non-patient care activities. Must have fully automated UCA/USM and local command emphasis.

4. How can the relative weighting of indirect versus direct patient care be determined?

   The weighting is implicit in the expanded reporting process.

5. Should any proposed system track individual or "Department" performance in this area?

   Individual will allow us to capture at all levels.

6. Are currently utilized "Nonavailability factors" adequate?

   No.

7. How can such workload be incorporated into the manpower requirement or authorization process?

   a. These activities better describe the mission requirements and as such can be incorporated into manpower staffing standards.

   b. The comparison of requirements to authorizations can be done more realistically.

ASSUMPTIONS/LIMITATIONS

A. While military readiness falls within UCA it is understood that medical readiness usually falls within direct patient care.

B. Non-patient care activities are not homogeneous.

C. We are addressing only human patient care providers.

RECOMMENDATIONS

A. A standardized profiling system at the provider level within all services to include a coordinated, uniform implementation program.

B. A Tri-Service Task Force to study the comparability of data.

C. Each service should contribute an equitable data base to a Tri-service Performance Measurement effort.

D. Increase ancillary services (e.g., pharmacy, lab, preventive medicine, occupational health, radiology, dietary, vet, etc.) involvement in future performance measurement activities.

STATUS OF SERVICE PROJECTS/ACTIVITIES

A. Monthly reporting system on personnel utilization in contingency operations (Navy).

B. APURS/MSSS, UCAPERS, Performance Measurement Study (Army).

C. PRISM - Productivity/efficiency model using weighted units (Air Force).

GROUP D: AMBULATORY CARE DATA CAPTURE

1. What specific data elements should be included in an Ambulatory Care Data Base (ACDB)?

   a. Demographics.

   b. Diagnoses.

   c. Procedures.

   d. Examinations.

   e. Time spent (patient with provider).

   f. Who sees patient (provider registration)

2. What level of detail in coding diagnoses and procedures and capturing provider and resource use information is required?

   6-Byte field.

3. Is the basic unit of observation for an ACDB the visit or the episode?

   Visit. In the future we may be called to look more at episodes of care. Data is not available to do so at this time.

4. What is the best method for data capture?

   Forms presented by the Army as they "bulldozed" this concept through the work group.

5. What is the potential impact of proposed data capture methods on the local facility?

   a. Cost.

   b. Learning curve.

   c. Command emphasis essential.

   d. Physician acceptance.

   e. Logistics.

   f. Data security.

6. How can an ACDB tie into UCA and TRIMIS systems?

   By workcenter as well as visit count. Patients tied in by SSN.

7. What should be the basis for developing a set of Ambulatory Patient Clusters (APCs)?

   Long-term experience with the system.

8. Must the same coding system be used for both inpatient and ambulatory patient data collection?

   Preferably use the same coding system for both - continuity.

9. Could an ACDB become the basis for an automated quality assurance system?

   A partial yes.

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APPENDIX D

Conference Evaluation

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TRI-SERVICE PERFORMANCE MEASUREMENT CONFERENCE

Conference Evaluation

Please indicate the extent to which you agree or disagree with the following statements.	STRONGLY DISAGREE	DISAGREE	UNDECIDED	AGREE	STRONGLY AGREE
1. The advance notice I received concerning the purpose of the conference was sufficient for me to prepare myself as a participant.	03%	14%	03%	45%	35%
2. The facilities (condominiums, meeting rooms, etc.) were adequate and provided an environment that enhanced the exchange of information.			03%	21%	76%
3. The food served was good in both quantity and quality.	03%	14%	45%	38%	
4. The administrative support (e.g., conference staff, break periods, transportation, etc.) were adequate.		03%	10%	25%	62%
5. The recreational facilities enabled me to participate in adequate physical activity during the conference.		07%	10%	35%	48%
6. The civilian guest speakers provided up-to-date information which can be effectively used by developers of performance measures in the military health care environment.				21%	79%
7. The Service projects update provided adequate information on the status of performance measurement activities in the Army, Navy, and Air Force.				28%	72%
8. The military speakers provided information which will be useful to me in my future involvement with performance measurement.			03%	31%	66%
9. The group sessions were well-structured and allowed a free exchange of information on important topics. (Group # ______)			07%	34%	59%
10. The group sessions reports on Friday morning provided sufficient information on the accomplishments of the groups.			52%	24%	24%

(Please see other side.)

Conference Evaluation (continued)

Please indicate the extent to which you agree or disagree with the following statements.	STRONGLY DISAGREE	DISAGREE	UNDECIDED	AGREE	STRONGL AGREE
11. This conference should facilitate future Tri-Service cooperation leading toward unified approaches to performance measurement.			07%	10%	83%
12. My purposes for attending this conference were fulfilled.				34%	66%

13. The thing I liked best about this conference was: amount and quality of information; civilian presentations; excellent facilities; format and selection of attendees; level of exchange; meeting other service members; military stance; on schedule; tri-service interaction; well organized; work groups; DOD and interservice activities update.

14. The thing I liked least about this conference was: evening sessions; excessive attention to statistical processes; food; gravy; inability to attend all sessions; lack of free time; lack of handouts for presentations; lack of preparation time; lack of mixed room assignments (need to integrate services); lack of racquetball facilities; long presentations without breaks; tight schedule on Thursday; lack of gathering places to sit around and talk

15. Additional comments: "best conference I ever attended"; "need more balance among the services in presentations"; "need more advance notice for preparation to attend"; "civilian guest speakers were great"; "would have enjoyed less formal structure and more time to interact with representatives from other services".

SERVICE IDENTIFICATION (Optional) - Circle One

Military:	ARMY	NAVY	AIR FORCE
Civilian Emp:	ARMY	NAVY	AIR FORCE

APPENDIX E

Fetter Articles

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Planning, Budgeting, and Controlling—One Look at the Future: Case-Mix Cost Accounting

John D. Thompson, Richard F. Averill and Robert B. Fetter

This paper outlines the system for cost accounting and managerial control which is an extension of the usually accepted departmental costing systems and takes as its units the 383 Diagnosis Related Groups (DRGs) considered to be the hospital's products. It is held that such an approach offers hospital managers a more powerful, analytic, budgeting, and cost-finding tool and offers the opportunity to involve the medical staff in the issues of how their practice patterns are affecting hospital costs.

Whatever may be the exact role of the government in controlling the costs of hospital care, one factor is clear: the government will substitute some form of prospective reimbursement for the present form of retrospectively adjusted payment based on "reasonable cost." It makes little difference from a management viewpoint whether this reimbursement is negotiated with third party payers, including the various levels of government, or whether the rate is set by government, be it state, regional [1], or federal [2]. Prospective reimbursement in any form requires the health care manager to prepare budgets which can provide comparisons between actual experience and projected estimates which are accurate enough to provide managerial control over costs and revenue during the period covered by the prospective rate. Further, these budgets, based on past experience, must be sufficiently sensitive to permit meaningful variance analyses when there is no agreement on a high order in these comparisons of actual and projected costs.

Many hospital managers, according to Holder [3], cannot generate such a budget at this stage in the development of the art of hospital financial management. The purpose of this paper is to present a new approach to cost finding and budgeting which satisfies the requirements of accuracy and sensitivity of management's financial information and which, further, is based on the costing and budgeting system used by most hospitals today. This extension of the present system is directly aimed at Enthoven's [4] "key issue in health care costs," which is to "motivate physicians to use hospital and other

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resources economically." Further, it attempts to develop one approach to the design of a system which satisfies Griffith's [5] requirement that the system "document the relationship between medical and administrative decisions."

One important objective of hospital costing and budgeting systems is the understanding and control of hospital costs. Costs here are defined as "hospital expenses: a) specifically classified by a standard chart of accounts; b) allocated directly or distributed according to a uniform method of apportionment, and c) transformed into unit costs by dividing them by consistently defined and generally accepted units of service" [6]. Traditionally, the organizational settings in which cost control has proved most successful are those which have dealt with the provision of well-defined products or services with a predictable set of associated costs. The process of cost control in such settings basically entails monitoring resource and cost consumption during the production process in order to insure agreement with expected levels. The provision of different combinations of products or services results in differing levels of total resource and cost requirements.

The fundamental problem which must be solved, if effective resource and cost control is to be achieved within hospitals, is to define in a precise and manageable way the services provided by hospitals. It is not a useful observation simply to say that hospitals provide "patient care." What hospitals provide is patient care of various kinds and intensities over various durations based on the needs of the patients they treat. The total patients treated can be classified, based on selected clinical and demographic characteristics, into patient classes which consume the resources of the hospital in a similar manner. This would provide a categorization of the services provided by a hospital and establish a product definition. Such a definition of hospital services allows the resources utilized and the costs incurred to be related directly to the types of patients the hospital treats. In other words, the relationship between the case mix of the hospital, the resources it consumes, and the costs it incurs, is established.

The Yale University Center for Health Studies has developed such a patient classification scheme. Through a classification technology [7,8], 383 mutually exclusive and exhaustive patient classes have been evolved and are currently undergoing testing and evaluation as a basis for utilization review, prospective reimbursement [9], and hospital budgeting systems [10–13]. This patient classification unit is referred to as a Diagnostic Related Group (DRG). There are three basic properties of the DRG patient classification scheme: 1) there are a manageable number of patient classes—a total of 383 DRGs; 2) each DRG is medically meaningful, i.e., there is an underlying patient care process which, in the main, follows the accepted practices of a specific field of medicine; and 3) the DRGs demonstrate a statistically stable distribution of resource use within the universe of patients treated by the hospital. Thus, the DRGs provide a means of establishing a hospital case mix by determining the relative number of patients discharged within each diagnosis-related group.

Since it is theorized that variations in resource consumption and costs across different hospitals are basically caused by differences in case mix, differences in treatment patterns for similar cases, or varying degrees of institutional inefficiencies, the DRGs, originally developed to assist in the rational implementation of utilization review were soon adapted to provide a meaningful unit of comparison between the consumption of resources and the costs of care between different institutions. Within a single institution, DRGs provide a means of controlling for the different types of patients in order to isolate different modes of treatment, institutional inefficiencies, and the effect on costs of changes in the volume of various patient classes treated. Like most service organizations, hospitals have little direct control over the type of patients they treat. To a certain extent, the type of patients the hospital treats depends upon the clinical specialties of its staff and the availability of special types of facilities, but a hospital treats the patients who require care and, thus, is prone to random fluctuations in case mix which it cannot control. However, hospitals are unique among service organizations in that the management lacks direct control over the consumption of the institution's resources, even within these classes. That is the responsibility of the physicians.

Case-Mix Accounting

In order to meet the demands for financial information, hospitals typically have in operation two distinct accounting systems. Through established accounting procedures, the hospital's financial accounting system can determine its financial condition. The *balance sheet, income statement and* funds flow statement provide a means of determining the hospital's financial and cash position at any point in time or across any time period.

Hospitals also maintain a managerial accounting system to provide financial information for internal management purposes. Traditionally, hospital managerial accounting has been responsibility oriented at the departmental level. The hospital's managerial accounting system provides the financial information necessary for department heads to plan and run their departments. Thus, the department heads of nursing, medical records, laboratory, etc., are responsible for the financial integrity of their own departments. As a set of managerial tools to fix responsibility at the department level, this managerial accounting system must be maintained.

Two other uses of departmental accounts are central to the main concern of case-mix accounting and should also be mentioned. Most measurements of productivity, for example, manpower minutes per meal or direct cost per radiological examination, are derived from departmental accounts. One method used in estimating fixed and variable costs preliminary to the DRG type of analysis may be the departmental aggregate of each expense account [12]. Since each department contains a different proportion of many of these accounts, every cost center ends up with a different fixed variable cost ratio. However, departmental finances deal with patients in the aggregate and not on an individual basis. Thus, departmental managerial accounting has typically lacked an integrated view of the financial responsibility and implications of treating individual patients.

Since the care of patients is the basic service of a hospital, the goal of case-mix cost accounting is to provide a *complete financial picture of the costs* of treating individual patients grouped into similar classes based on use of resources. Under the traditional organization structure of a hospital, there is no department delegated the specific responsibility of assuring that individual patients are financially well managed. The individual physician is *the one who coordinates the various* hospital services and departments in order to provide effective patient care. A case-mix cost accounting system will provide an integrated picture of the *financial consequences of providing* this care to individual patients.

Any comprehensive model for hospital management must address the requirement of five distinct financial functions. It is felt that the future application of case-mix cost accounting will permit new insights into 1) cost finding, 2) cost projection, 3) cost control, 4) charging policies, and 5) reimbursement policies.

Cost Determination and Budgeting of the DRGs

Figure 1 shows the process, for an individual hospital, of determining the cost of treating patients in each of the DRGs. In the financial accounting system there will be a chart of accounts which contains the historical financial information of the hospital. Each account corresponds to an amount of money that was spent or received for a specific purpose. The number and type of accounts will vary among hospitals depending on the services each hospital offers. If a collection of hospitals is to be analyzed through a case-mix cost accounting approach, it is necessary to standardize the individual hospital chart of accounts into a uniform chart of accounts which will allow the individual components of the DRG cost to be comparable across hospitals.

The types of accounts in a typical hospital chart of accounts are categorized into six distinct areas: 1) outpatient accounts, 2) nonpatient care related overhead accounts, 3) patient care related overhead accounts, 4) room, board, and other routine (here called hotel) accounts; 5) nursing accounts; and 6) ancillary accounts.

Figure 2 shows a typical chart of accounts partitioned into the six major hospital service areas. The DRGs currently encompass only the inpatient population, and the hospital outpatient costs are not included in the DRG costs.

Overhead accounts are costs incurred by the hospital in its general operation, but are either not related or only indirectly related to the provision of inpatient care. Depreciation and interest charges are examples of overhead costs which are not related to patient care and, therefore, not included in selected applications of DRG cost data, although they can be considered in cost finding at the individual hospital level.

Two of these accounts alone (depreciation expense and interest expense) *comprised*, on the average, 5.43 percent of total operating costs in Connecticut's hospitals in fiscal year 1976. Furthermore, there was substantial variation in this percentage among these hospitals, from a high of 13.62 percent to a low of 2.48 percent of total operating expenses [14]. This variation is not significantly correlated with case-mix intensity.

Nonpatient care related overhead was included in the cost data for three of the five financial functions mentioned earlier, i.e., 1) cost finding, 4) charging policies, and 5) reimbursement policies. These classifications of accounts were not included in cost projections (budgeting) and are, therefore, absent from the cost control data used in the budget reconciliation since they are treated separately in the budgeting process.

Other overhead accounts, such as housekeeping or laundry, are indirectly related to the provision of patient care and are included in all DRG costs. In other words, the definition of the overhead accounts, which are considered as patient care related versus nonpatient care related, can vary depending upon the use to which the case-mix cost accounting system is put. The remaining three types of accounts, i.e., hotel and other general services, nursing, and

Figure 1:
Overview of the Method for Determining the Cost of Treating Patients in Each DRG

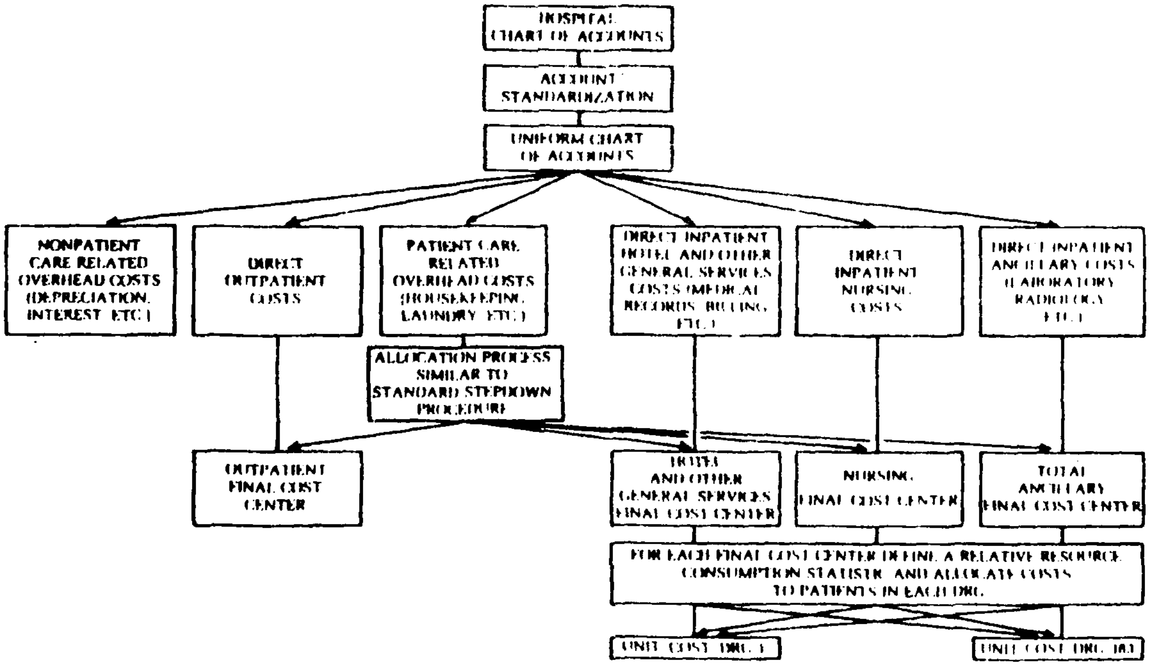
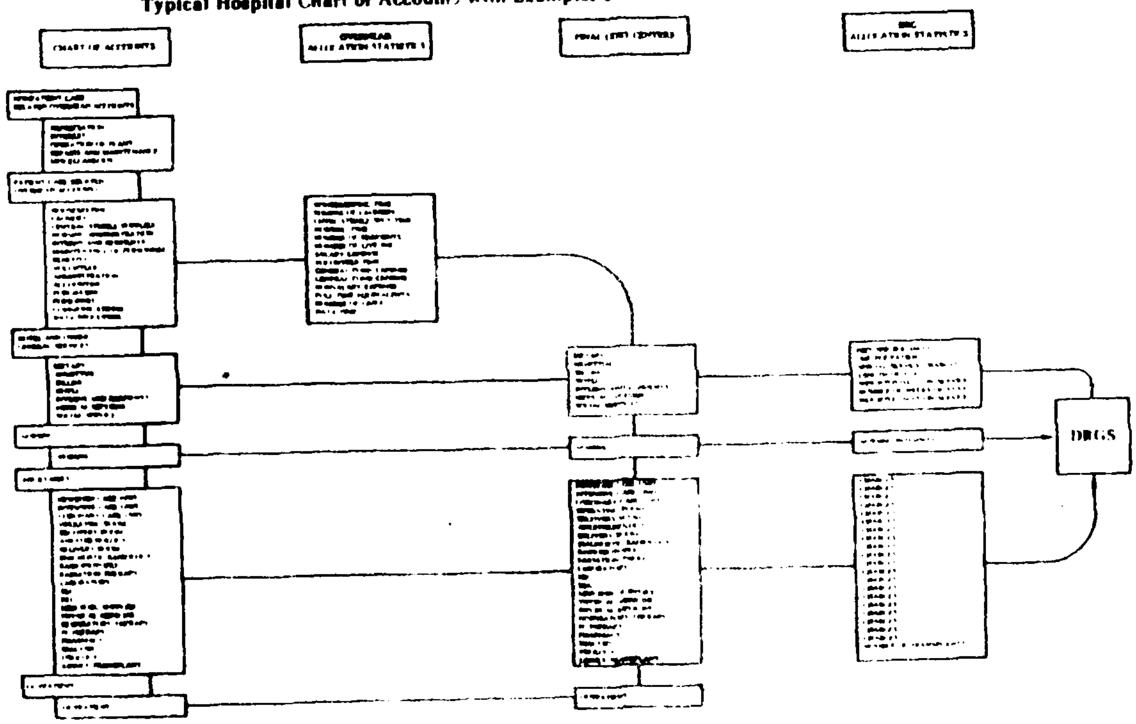


Figure 2:
Typical Hospital Chart of Accounts with Examples of the Overhead and DRG Allocation Statistics



ancillary services can all be directly related to patient care. These three types of accounts, with the addition of the outpatient account, will be referred to as final cost centers since the services associated with these accounts can be directly related to individual patients, allowing their costs to be apportioned to each patient. Many of the final cost centers will correspond closely to the responsibility centers in the hospital's managerial [illegible] system.

The Cost-Finding Process

The [illegible] services [illegible] represent a disaggregation of the basic "room and board" or "routine services" care [illegible] currently assumed to each patient [illegible] length of stay. [illegible] although this [illegible] necessary in order [illegible] more [illegible] the consumption of these resources by patients in the different DRGs. For example, it is not appropriate to levy these costs per patient day uniformly to patients with open heart surgery and to patients with [illegible] upper respiratory infection. Each of these services should have its costs allocated to patients on a more precise basis.

The patient care related overhead services cannot be directly levied as [illegible] to patients. The costs of the [illegible] care related overhead services must therefore be recovered through the final cost centers. As shown in Figure 1, the [illegible] patient care related overhead services are apportioned to the final cost centers through an allocation process similar to the standard hospital accounting stepdown procedure. Figure 2 provides an example of the allocation statistics which can be used as the basis for this allocation.

The overhead allocation process is circular in nature, with the overhead accounts being allocated simultaneously to each other before ultimately being allocated to the final cost centers. The standard stepdown method only approximates this circular behavior and thus does not preserve the identity of the original source of every dollar allocated to the final cost centers. In order to deal precisely with the circular nature of the allocation process, a special allocation algorithm was developed which generates a set of linear equations whose solution provides the identifiable fraction of each account allocated to each final cost center [12].

The direct costs of each final cost center and the portions of the cost of the patient care related overhead accounts allocated to each final cost center represent the total cost of providing the service associated with each final cost center. As shown in Figure 1, an allocation statistic is associated with each final cost center and used as the basis of apportioning the costs to the patients in each of the DRGs. Figure 2 indicates the allocation statistic used for each of the final cost centers. The cost of admitting is allocated to patients by dividing the total cost of the admitting final cost center by the number of discharges in the period and allocating a uniform cost per case. Billing costs are allocated to patients based on the dollar amount billed for all ancillary services, since this measure closely approximates the transactions volume required for the bill and is easily obtained from the patient record.

An analysis of the type of meals and the relative cost of each meal type has resulted in the development of a per diem dietary weight for each of the DRGs. The product of a patient's length of stay and the appropriate dietary weight provides a measure of the relative consumption of dietary resources. By normalizing this dietary measure across all patients, the costs of the

dietary final cost center can be allocated to the individual patients. Most other hotel services are allocated to patients based on a uniform per diem.

The cost of medical records is allocated to patients based on the number of weeks of stay. The relative medical records workload per patient was found to increase in a stepwise fashion with each additional week of stay. For the house staff and social services final cost centers, the number of residents or social workers assigned to each hospital service is known, as well as the hospital service on which each patient received his or her care. Weights for each hospital service can be developed based on the relative number of residents or social workers assigned to each service. The product of the patient's length of stay on each service times the weight for that service provides a measure of the relative consumption of house staff and social service resources.

For the nursing final cost center, 25 nursing activities were defined and the number of minutes of nursing time required for each of these activities determined [13]. A study was performed in which the number of these activities performed for each patient was recorded for each nursing shift. From this data, a per diem nursing weight for each DRG was developed. By normalizing the product of a patient's length of stay and the appropriate nursing weight across all patients, the cost of nursing can be allocated to the individual patient.

Finally, the cost of each of the ancillary service final cost centers is allocated based on the normalized charges levied for each of the ancillary services. The practice of hospitals in measuring and charging for minutes of operating room time, relative laboratory units consumed, relative radiology units consumed, etc., all based on standard measures of differential resource requirements, make the individual relative ancillary service charges an effective basis for the allocation of costs to the patient classes [10].

While all of the allocation statistics possess some defects, they are designed to reflect more equitably the quantity of an institution's resources consumed by the patients in each DRG. As better allocation statistics become readily available, they can easily be incorporated into the methodology.

Cost Finding and Analysis

Series of management reports can be derived from case-mix cost accounting which will permit management to identify those factors which seem to be operative in explaining the differences between historical costs, i.e., cost variations from year to year. Four such examples are given (Tables [illegible]) to illustrate the kinds of insights that can be gained by management by analyzing the behavior of these DRGs. They illustrate the application of this information both to cost explanation and to rate setting and reimbursement policies.

These management reports consist of a summary and a detailed report of [illegible] changes in costs by each DRG [illegible] various cost centers. The second [illegible], DRG [illegible] (Table [illegible]) [illegible] and [illegible] Cor[illegible] the [illegible] both types of reports. Since the purpose of such reports is the internal management, all costs, including [illegible] are allocated to the DRGs.

It is obvious on examination of the first example, DRG 262 (Table [illegible]), [illegible] with Complications with Caesarean Section, that the reason for the large cost increase is a substantial change in volume. A review of the related DRGs, i.e., Caesareans without Complications

Table 1:
DRG 282 Delivery with Complications with Caesarean Section

	Volume & Cost 1975	Volume & Cost 1976	Difference	Percent Change
Number of Patients	255	329	74	29.02%
Number of Bed-Days	1,75[illegible]	2,200	448	25.5[illegible]
Average Length of Stay	6.8[illegible]	6.6[illegible]	−0.18	−2.62
Total Cost	$293,889.3[illegible]	$404,309.50	$110,420.19	37.57
Cost per Case (Unit)	1,152.[illegible]	1,228.90	76.39	6.63
Cost per Day	167.[illegible]	183.8[illegible]	16.09	9.59
Total Charges	344,0[illegible]2.94	470,027.54	125,974.60	36.61
Average Charges per Case	1,349.23	1,428.66	79.43	5.89
Ratio Costs/Charges	0.85[illegible]20	0.86013	—	—

	Total	Accounted for by Volume	Accounted for by Unit Cost	Unexplained Interaction
Cost Change	$110,420.19	$85,2[illegible].50	$19,481.23	$5,653.46
Percent of Total	—	7[illegible].24	17.64	5.12

and Normal Deliveries reveals fewer [illegible] cases resulting in a shift in the [illegible] of deliveries at the hospital. Wh[illegible] er the increase in Caesareans is due [illegible] more frequent intervention in response to some of the new fetal monitoring techniques is not known at this time but this new trend will have to be tracked.

The actual difference in the unit costs over the two periods was only 6.63 percent and a review of the cost centers indicates that the main contributors to these increases were in hotel, operating room, anesthesia, laboratory, and medical-surgical supply costs. Nursing costs, which make up about 35 percent of the total cost of the DRG, actually declined. The financial implications of this volume change to the hospital ($85,286 in total costs) illustrate the fairly dramatic influence changes in volume of selected DRGs can have on a hospital's financial picture, both at the cost and charge level.

The next example, DRG 131 (Table 2), Arrhythmia and Slowed Conduction with the Insertion of Heart Device, illustrates the role of technology on cost. As far as volume of patients treated is concerned, this is a fairly stable DRG, there being a difference of only two patients between the two years. In spite of this close agreement, there was a $175,042 (64.6 percent) difference in the total cost experience for this DRG. Table 3 examines this by each cost center and indicates differences in the way patients were treated in the hospital during the two years.

This change in the detailed treatment pattern for DRG 131 resulted in a longer length of stay and a consequent increase in nursing costs. More of these patients received their postoperative care in the intensive care unit rather than the coronary care unit. Laboratory costs increased for this DRG far more than the average of all DRGs for this period. The most notable increase in dollars, if not percentage, is the cost of the device itself, which is reflected in the medical-surgical supplies cost. The exact reason for this $1,184 change per case must be identified in any cost [illegible]ntrol examination.

Table 2:
DRG 131. Arrhythmia and Slowed Conduction with Insertion of Heart Device

	Volume & Cost 1975	Volume & Cost 1976	Difference	Percent
Number of Patients	69	71	2	2.90%
Number of Bed-Days	629	833	204	32.43
Average Length of Stay	9.11	11.73	2.62	28.76
Total Cost	$271,037.87	$446,079.66	$175,041.82	64.58
Cost per Case (Unit)	3,928.09	6,282.81	2,354.72	59.95
Cost per Day	431.21	535.42	104.21	24.17
Total Charges	269,103.87	370,307.90	101,204.03	37.61
Average Charges per Case	3,900.06	5,215.60	1,315.54	33.73
Ratio Costs/Charges	1.00719	1.20462	—	—

	Total	Accounted for by Volume	Accounted for by Unit Cost	Unexplained Interaction
Cost Change	$175,041.81	$7,056.17	$162,470.72	$4,709.48
Percent of Total	—	4.49	92.82	2.69

Table 3:
DRG 131 Arrhythmia & Slowed Conduction with Insertion of Heart Device

Final Cost Center	Unit Cost 1975	Unit Cost 1976	Difference	Percent Change
1 Dietary	$ 56.28	$ 72.95	$ 16.67	29.60%
2 Admitting	20.45	23.43	2.98	14.60
3 Billing	139.46	209.72	70.26	50.40
4 Hotel	117.23	167.21	49.98	42.60
5 Nursing	516.84	630.50	113.66	22.00
6 House Staff	53.23	68.98	15.75	29.60
7 Medical Records	14.57	23.33	8.76	60.10
8 Social Services	11.03	16.54	5.51	50.00
9 Newborn Intensive Care	—	—	—	—
10 Intensive Care	9.36	208.03	198.67	2,122.50
11 Coronary Care	305.92	288.01	−17.91	−5.90
12 Operating Room	176.11	206.05	29.94	17.00
13 Recovery Room	5.20	11.43	6.23	119.80
14 Anesthesia	129.88	162.42	32.54	25.10
15 Delivery Room	—	—	—	—
16 Diagnostic Radiology	128.89	210.41	81.52	63.30
17 Radioisotopes	4.90	10.37	5.47	111.60
18 Radiotherapy	—	2.34	2.34	—
19 Laboratory	198.11	473.44	275.37	139.00
20 EKG, EEG	38.66	45.28	6.62	17.10
21 Med-Surg Supplies	1,782.37	2,966.98	1,184.61	66.50
22 Physical Medicine	9.42	22.57	13.15	139.60
23 Respiratory Therapy	30.65	110.69	80.04	261.10
24 IV Therapy	28.30	49.49	21.19	74.90
25 Pharmacy	85.49	213.88	128.39	150.20
26 Renal Dialysis	23.60	39.77	16.17	68.50
27 Renal Transplant	—	—	—	—
28 Urology	—	—	—	—
29 Emergency Room	10.06	13.59	3.53	35.10
30 Clinics	2.12	2.54	.42	19.80
31 Outpatient	—	—	—	—
32 Miscellaneous	29.95	32.87	2.92	9.80

The last DRG illustrated is 321 (Table 4): Immaturity, Hyaline Membrane Disease or Conditions of Infancy with Secondary Diagnoses. A review of the statistics also reveals a 9 percent increase in length of stay for this case [illegible] controlled [illegible] the [illegible] between the 1975 and 1977 [illegible] explain all of the in[illegible] [illegible] perinatal [illegible] the most [illegible] was due to the fact that the patients treated in this fiscal year were [illegible] than those [illegible] [illegible] these DRGs [illegible] [illegible] perinatal intensive care [illegible] [illegible] volume of comm[illegible] [illegible] perinatal [illegible] case mix affects [illegible] the costs of operating the unit. [illegible] more disturbing finding is the [illegible] unfavorable [illegible] reimbursement [illegible] based on the ratio of costs to charges. This is particularly true if the hospital were [illegible] on a cost or charge basis, whichever is less. It is obvious from [illegible] the charges for the [illegible] perinatal intensive care unit have not [illegible] to reflect costs, leaving [illegible] dangerous [illegible] [illegible] charges [illegible] control.

The three examples cited, though [illegible] the kinds of analyses which [illegible] out at the specific DRG level, do not indicate the wide [illegible] in costs over all DRGs. The DRG [illegible] unit costs in the [illegible] is typically varied by more than a hundred fold. The following DRG costs illustrate this variation:

DRG	Typical 1976 Unit Cost
127 Ischemic Heart Disease Ex[cep]t Acute Myocardial Infarction with Shunt or Other Major Operation	$5,9[illegible]4
187 Gastric and Peptic Ulcer w[ith] Gastric Resection or Other Major Operation with a Secondary Diagnosis	$ 362
[illegible] Otitis Media, Chronic Mastoiditis or Otosclerosis without [illegible] Operation	$ [illegible]
[illegible] False Labor without any Operation	$ [illegible]

Even within a specific diagnostic area the DRGs provide a high degree of cost discrimination. For example, patients with a primary diagnosis of urinary calculus encompass four DRGs with the following typical 1976 unit costs:

Urinary Calculus DRG	Typical 1976 Unit Cost
239 Without an Operation or Secondary Diagnosis	$ [illegible]
240 Without an Operation with a Secondary Diagnosis	$ [illegible]
241 With Minor Operation such as Cystoscopy or Catheter to Kidney	$1,[illegible]
242 With Major Operation such as Nephrotomy [illegible] or Ureterotomy	$ [illegible]

[illegible] even within this narrow diagnostic area, the unit costs across DRGs varied by nearly a factor of six. It [illegible] that if cost finding and cost explanation in hospitals are to be carried out with any rigor, it must be accomplished at the DRG level.

Hospital Budgeting

The full case-mix cost accounting approach, consisting of cost control and cost projection (budget formulation), has been applied in one test hospital. The unit costs (i.e., average cost per patient) in each DRG were

determined in the initial year. In order to establish the following year's budget [15] by DRGs, it was necessary to 1) project the hospital's case mix, and 2) apply the appropriate anticipated personnel and material inflation factors. In these projections, nonpatient care related overhead (a portion of fixed costs) was removed from the cost data. Deviations from the budget due to case mix could then be detected and the established unit costs [illegible]. This portion of overhead amounted to 11.4 percent of hospital's [illegible] costs for inpatient services.

Although experience in projecting and budgeting is very limited at this stage of development, two or three characteristics emerged from [illegible]. The first is related to the reliability of volume projections [illegible] the number of patients treated within each DRG. The second accounts for the relative importance in the cost projections of relatively few DRGs.

When budgeted and actual volumes across DRGs were compared, the following observations resulted. Overall, the hospital treated some 35,729 inpatients in fiscal year 1976, or 82 patients less than projected. The budgeted median size of a DRG was 46 patients while the actual median size was 47 patients. A review of the frequency distributions on patient volume by DRG indicates that 257 DRGs (or [illegible] percent) experienced a positive or negative volume change of less than [illegible] patients. More than 85 percent [illegible] DRGs fell within a volume change of less than 20 patients.

As historical data on the volume fluctuation of these DRGs is gathered, more accurate predictions can be drawn. It must be remembered [illegible] the present projections [illegible] the basis of just one year of historical data. Of particular [illegible] finding that a [illegible] with an absolute volume change of [illegible] or more patients were related to births, babies, and young children. We are all familiar with the downward trends in some [illegible] and outpatient [illegible]

Table 4:
DRG 321: Immaturity, Hyaline Membrane Disease, Other Major Diseases or Conditions of Infancy with Secondary Diagnosis

	Volume & Cost 1975	Volume & Cost 1977	Difference	Percent Change
Number of Patients	215	[illegible]	-14	-6.[illegible]%
Number of Bed-Days	2,409	2,[illegible]	52	2.16
Average Length of Stay	1[illegible].[illegible]3	[illegible].18	1.03	[illegible]
Total Cost	[illegible]	$553,36[illegible]	[illegible]	[illegible]
Cost per Patient	[illegible],738.00	[illegible]	$[illegible]	[illegible]
Cost per Day	13[illegible].58	[illegible]	[illegible]	[illegible]
Total Charges	354,[illegible]8.56	[illegible]	4[illegible]	[illegible]
Average [illegible] Case	[illegible]	1,[illegible]	[illegible]	[illegible]
Ratio: Costs/Charges	[illegible]	[illegible]	—	—

	Total	Accounted for by Volume	Accounted for by Unit Cost	Unexplained Interaction
Cost Change	$1[illegible]	$[illegible]	$209,[illegible]	$[illegible]
Percent of Total	—	[illegible].46	122.29	[illegible]

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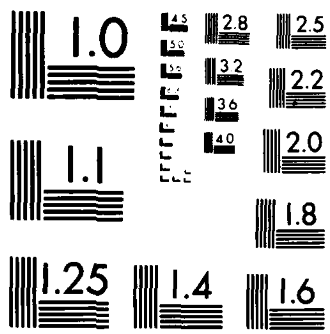

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

others, of these conditions. Close investigation of future projections will have to be considered.

Overall, 70 percent of the DRGs were budgeted too low, while only 30 percent were budgeted too high. This reflects the fact that costs increased at a faster rate than anticipated.

Another finding was the contribution of relatively few DRGs to the total financial picture. There were 12 DRGs with unit costs above $5,000, and although they represent 3.5 percent of all DRGs and 144 patients (3.20 percent of all patients treated), they accounted for 20 percent ($10,107,710) of total expenditures in fiscal year 1976.

A comparison of the budget forecast for fiscal year 1976 with the cost comparison between fiscal years 1975 and 1976 is somewhat clouded because of the different cost base used in the two exercises. The cost comparison included all costs, while the budget projections excluded nonpatient care related overhead. The basic data on the three examples are included in Table 5, along with the data for all DRGs. Although there is some improvement in predicting changes in cost by using the budgeted projections, much more must be done if these budgets are to become more useful management tools for cost control than simple year by year cost comparisons.

Conclusions

One could say that this future extension of financial management in the area of planning, budgeting, and cost control is just an exercise in flummery. Purists might hold that the cost allocation system for hospitals is altogether too shaky to allow for further extensions beyond departmental costing. Classical economists would buttress this criticism with their general caveat concerning the difficulty of pricing single products in a multiproduct firm.

It is not held that allocation of patient care related overhead is perfect as yet. Further refinements of the allocation process should allow a more equitable distribution of this rather sizeable block of expenses. However, it is held that a very valuable management tool for the future is being developed and

Table 5:
Volume & Cost Comparison & Budget Reconciliation on Volume & Cost per Case

	Volume							
	All DRGs Number of Patients		DRG 282 Number of Patients		DRG 131 Number of Patients		DRG 321 Number of Patients	
Fiscal Year 1975	35.691	—	255	—	69	—	216	—
Projected 1976	—	36.549	—	272	—	69	—	232
Fiscal Year 1976	35.729	35.729	329	329	71	71	202	202
Percent Change	0.11	-2.24	29.02	20.96	2.90	2.90	-6.48	-12.93

	Cost per Case							
	All DRGs		DRG 282		DRG 131		DRG 321	
	Cost Comparison	Budget Reconciliation	Cost Comparison	Budget Reconciliation	Cost Comparison	Budget Reconciliation	Cost Comparison	Budget Reconciliation
Fiscal Year 1975	$1.422	—	$1.153	—	$3.928	—	$1.766	—
Projected 1976	—	$1.307	—	$1.060	—	$3.712	—	$1.812
Fiscal Year 1976	$1.598	$1.416	$1.228	$1.127	$6.283	$5.554	$2.730	$2.479
Percent Change	12.38	8.34	6.50	6.32	59.95	49.62	54.63	36.81

that determining cost and revenue in terms of the diagnostic mix of the hospital has enormous implications, both at the level of the individual hospital and for reimbursement patterns and cost comparisons across hospitals. There can be little invocation of cost controls at the state or regional level without valid comparisons across hospitals which correct for case mix [16].

If we will return to the three concerns expressed at the beginning of this paper, i.e., the inability of hospitals to identify a product, the absolute necessity of influencing physician behavior, and the ability to link medical and administrative decisions, it is held that a case-mix cost accounting system does address these issues.

Implications of changes in product or diagnostic mix can clearly be identified and planned under this system. The implications of actual or proposed changes in diagnostic mix can be estimated. Whether these changes be additive or negative changes, or additive in some areas and negative in others, makes little difference, all can be approached by the same methodology. The financial implications of these changes and their consumption of specific resources by type and kind can be understood. This can only be done if one can generate from the total population a series of describable "patient products" which use similar resources.

The implications of changing or different patterns of medical practice can be identified. It is felt that these implications can be stated in terms which both physicians and administrators can understand. The implications of the way physicians allocate resources and the consequences of that allocation process on the administrator's concern with the finances of the hospital can now be explained in terms more meaningful to the physician than nursing costs per day or raw food costs per meal. Whether this will result in a change in the behavior of either is another question, but the main problem now is that we can test whether or not the increased information and subsequent education can change the physician's allocation behavior or that of administration. Our existing departmental costing mechanisms do not permit the physician to make the connection between pounds of laundry per day and the way he is treating certain patients, and, up until now, this inability has too often been termed irresponsibility by those managing the hospital. What is needed is a way to enter into a new era of understanding costs by both management and medical staff at the hospital level.

More importantly, the case-mix accounting approach supplies a basic link between financial management, utilization review, and quality measurement. When dollars (operating or capital) and end results can be related to populations, then an integrated health services management system may, for the first time, be possible. When the three mandated control systems now in place—the PSROs for utilization, the HSAs for community planning, and the various state commissions for cost control—and the hospitals themselves are using the same patient related unit and a common data base on the way these units behave, perhaps the intractable problem of soaring hospital costs can be understood and approached.

Therein, lies the future.

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The Application of Diagnostic Specific Cost Profiles to Cost and Reimbursement Control in Hospitals

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A system has been developed to generate hospital budgets based on the types of patients served. Several hundred classes of patients are defined according to clinical attributes such as diagnoses and surgical procedures, and for each class a profile of resources consumed is determined. The class definitions are based both on homogeneity of patient care processes as well as resource consumption. These profiles are expressed as revenues generated by charging departments and as costs both direct and indirect for all services. A methodology has been developed to associate all indirect costs with their source for each service included in the profile. From a forecast of patient load by class, budgets can be computed from the cost profiles and revenues determined from the charging profiles. Further analysis thus can include the effect of changes in case mix as well as changes in patient care processes. The effect on revenues of different reimbursement mechanisms can also be projected as a function of the case mix. The system is currently being implemented for demonstration and evaluation at the Yale-New Haven Hospital.

INTRODUCTION

In order to construct a budgeting and cost control system in the hospital setting, it is necessary to describe the activities of the hospital in terms of the inputs necessary to produce any required set of outputs. Using the activity analysis framework means essentially viewing the hospital as producing well-defined products (services) whose quantity, quality, and cost can be monitored. In order for a product definition to be useful, it cannot be ambiguous within any institution and should provide some basis for comparison among institutions.

Thus to say that a hospital produces "patient care" is not a useful observation

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One would have to specify precisely and unambiguously the dimensions of such care and the quantities of resources consumed along each dimension for a well-defined episode of care. This means that all episodes would have to be classified such that within any class the care provided was along the same dimensions and the amounts of each resource could be predicted at least on a statistical basis.

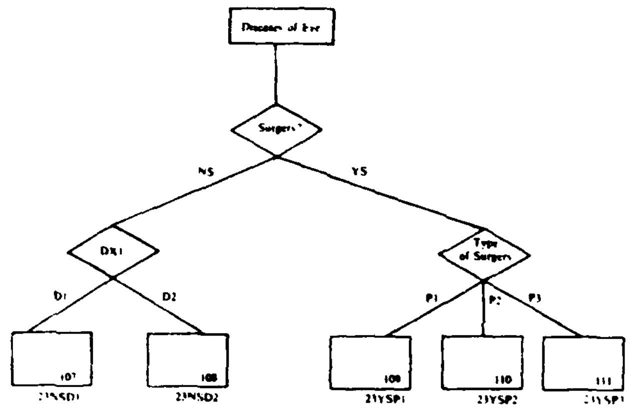

Figure 1 Diagnostic category 23: HICDA2

23 Diseases of eye
D1 DX1
3749 Cataract nos
3787 Uveal tract disease nec
3742 Senile cataract
3600 Conjunctivitis
3730 Convergent strabismus
3782 Eyelid disease nec
3759 Glaucoma nec and nos
3731 Divergent strabismus
3640 Iritis
3739 Strabismus nos
3789 Eyeball and orbit dis nec
3700 Myopia
3752 Secondary glaucoma
3732 Vertical strabismus
3680 Lacrimal inflammation

D2 DX1
3690 Orbital abscess
3770 Retinal vascular lesion
3670 Optic and retinal inflammation
3733 3, 4, 6 cran nerve palsy
3750 Primary acute glaucoma
3630 Keratitis with ulcer
3669 Uveal tract inflam nec
3620 Hordeolum
3776 Optic nerve disease nec
3751 Primary chronic glaucoma
3660 Uveitis
3639 Keratitis nos
3774 Retinal disease nec
3775 Papilledema
3760 Detachment of retina
3661 Chorioretinitis

P1 OPER1
101 Ocular muscle resection
102 Ocular muscle advancement
156 Cataract extraction nec
097 Excision lesion eyelid
122 Excision of pterygium
094 Entropion–ectropion op
083 Manipulation lacrim pass
153 Discission lens capsule
087 Dacryocystorhinostomy
095 Eyelid prosis correction
149 Sclera-iris op nec

P2 OPER1
154 Intracap lens extraction
136 Iridectomy
155 Extracap lens extraction
174 Removal of eyeball

P3 OPER2
164 Retinal repair nec
161 Scleral buckling
125 Corneal transplant
162 Scler buckling and implant
173 Evisceral ocular content
171 Orbitotomy

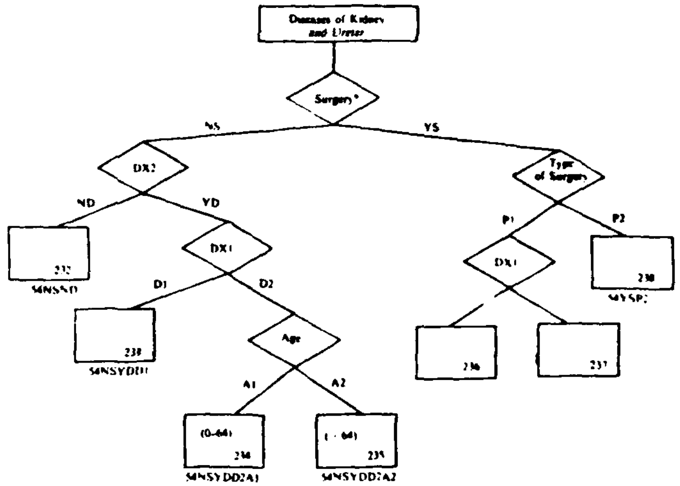

Figure 2 Diagnostic category 54: HICDA2

54 Diseases of kidney and ureter
D1 DX1
5901 Acute pyelonephritis
5830 Glomerulonephritis nos
5938 Hydroureter
5937 Vesico-ureteral reflux

D2 DX1
5852 Chronic renal failure
5902 Pyelonephritis nos
5900 Chronic pyelonephritis
5859 Renal failure nos
5820 Chronic glomerulonephritis
5935 Renal disease nec
5810 Nephrotic syndrom
5851 Acute renal failure nec
5869 Functional renal disorder nec
5934 Solitary cyst of kidney
5910 Hydronephrosis
5936 Ureteral obstruction

P1 OPER1
925 Cystourethroscopy
585 Urethral dilation
598 Urethral catheterization
550 Percutaneous renal puncture
923 Proctosigmoidoscopy
885 Excision skin lesion
584 Urethrolysis

P1D1 DX1
5901 Acute pyelonephritis
5936 Ureteral obstruction
5937 Vesico-ureteral reflux
5939 Ureteral disease nec
5830 Glomerulonephritis nos
5938 Hydroureter
5933 Nephroptosis

P1D2 DX1
5852 Chronic renal failure
5902 Pyelonephritis nos
5900 Chronic pyelonephritis
5910 Hydronephrosis
5859 Renal failure nos
5934 Solitary cyst of kidney
5935 Renal disease nec
5810 Nephrotic syndrome
5820 Chronic glomerulonephritis
5851 Acute renal failure nec
5869 Functional renal disorder nec

P2 OPER1
555 Total nephrectomy
553 Excision renal lesion
567 Ureteral anastomosis nec
556 Kidney transplant
558 Renal repair plastic nec
554 Partial nephrectomy
551 Nephrotomy & nephrostomy
394 Prev vessel op revision
380 Angiotomy
568 Ureterorrhaphy
602 Transureth prostatectomy
552 Pyelotomy & pyelostomy
572 Cystostomy
562 Ureterotomy
399 Vessel operation nec
571 Tur excision bladder lesion

It is reasonable to suppose that there are such classes (normal delivery without complications, for example), but to assert that all or even a very large proportion of episodes of acute care in short-term general hospitals can be decribed by a manageable set of such classes seems heroic to say the least. It is, however, to deal with just this task that efforts at the Yale Center for the Study of Health Services have been directed over the past several years. Through a classification technology,[1] a product definition embracing for any hospital 300–400 such classes has been evolved and is currently undergoing testing and evaluation as the basis for a cost and reimbursement control system.[2,3]

Examples of such results are shown in Figures 1 and 2 for some common diagnoses. For most hospitals where such partitioning has been attempted, results in terms of grouping strategy are remarkably consistent (the statistics are usually very different, however), and the number of groups necessary to define a patient population is less than 400.[4,5]

The grouping process has been tested in a number of settings institutionally and regionally, and for quite large data bases gives reliable and reproducible results in terms of available measures of resource consumption. The same group definitions have been tested over a wide variety of institutions and predict resource consumption with the same precision although (a) some groups do not appear in some settings, and (b) the statistics of resource consumption within groups are often quite different. Only at the study hospital, however, have we obtained a large data base (3 years of patient records) of approximately 105,000 episodes, which record demographic and diagnostic items as well as charges rendered in 23 distinct categories (see Table 1). Since the relationship between costs and charges can be well defined for any hospital service center, this information can, as will be shown, form the basis for developing a cost profile for each class of patients.

It is, however, necessary in our view to disaggregate the basic room and board charge rendered currently to each patient based on his or her length of stay to more precisely reflect the consumption of services as a function of class of patients. It is not appropriate to levy these charges per patient day uniformly to those recovering from open-heart surgery and those with acute sinusitis. Thus, we identified eight additional service dimensions and associated measures of such service in which to disaggregate room and board charges (see Table 2). Thus, admitting would be charged based on dividing the service department's costs by the number of discharges in the period and levying a uniform cost/case. Nursing services, however, would be charged by assigning minutes/day of such care required based on the state of health of the patient. The hospital produces a record each day and for each patient of the relative intensity of such care required. By normalizing these measures to the total nursing hours available, the cost per case can be determined. Seven different meal types and their costs were determined and assigned to the stay of each patient class. The number of hospital residents and interns assigned to each service is known as well as the service on which each type of patient received his or her care. The measure employed was to allocate such costs uniformly to days spent on that service. Billing costs are allocated to patients based on the dollar amount billed for all special services, since this measure most closely approximates the transaction volume required for the bill and is easily obtained from the record. Finally, the medical records cost was apportioned based on a number derived from the group average length of stay (los) according to the formula (1 + [los/7]). This amounts to a fixed cost plus a variable component depending on

Table 1. Revised Chart of Accounts

I	*Support service centers*		
1	Depreciation	10	Nursing administration
2	Benefits	11	Intern and resident
3	Data processing	12	Operation of plant
4	Communications	13	Interest
5	Personnel	14	Repairs and maintenance
6	Purchasing	15	Administration
7	Volunteer	16	Accounting
8	Maintenance of personnel	17	Housekeeping
9	CSS	18	Laundry
II	*Final cost centers*		
A	Inpatient service cost centers		
i	"Room and board" centers		
19	Dietary	23	Nursing
20	Admitting	24	Hospital medical
21	Billing	25	Medical records
22	Hotel	26	Social service
ii	Charging centers		
27	nbscu	39	EKG
28	Intensive care unit	40	Med-surg supplies
29	Coronary care unit	41	Physical medicine
30	Operating room	42	Respiratory therapy
31	Recovery room	43	Peritoneal dialysis
32	Anesthesiology	44	IV therapy
33	Delivery	45	Cardiac special
34	Diagnostic radiology	46	Pharmaceutical
35	Radioisotopes	47	Renal dialysis
36	Radiation therapy	47a	Kidney transplant
37	Laboratory	48	Urology
38	eeg		
B	Cost centers unrelated to inpatient care		
49	Outpatient	50b	Real estate, property taxed
49a	ER	50c	Research
49b	Prepared childbirth	50d	Fund raising
49c	Clinics	50e	Ambulance service
49d	Private referred	50f	Patient guest meals
49e	Home care	50g	Pay cafeteria
49f	Renal dialysis — chronic	50h	Coffee and gift shops
49g	Home training dialysis	50i	Barber shop
49h	Home training supplies	50j	Canteen
50	Miscellaneous — nonpatient care related accounts	50k	Miscellaneous
50a	Public relations	50l	TV rental

the weeks or fractions thereof spent by the patient in the hospital. This function is felt by most to very closely approximate the relative workload per patient in this department.

Admittedly, all of these measures possess defects at some level, but they are designed to reflect more equitably the manner in which different types of patients consume different quantities of the institution's resources. As concerns charges other than

Table 2. Allocation of Costs from Final Cost Centers to Diagnostic Related Groups

Final cost center	Method of allocation
1 Dietary	Diet specific days
2 Admitting	Cost per case
3 Billing	Total special service charges
4 Hotel	Patient days
5 Nursing	Nursing intensity — days
6 Hospital medical	Residents/service by days
7 Medical records	1 + [los/7]
8 Social service	Sum of a product of patient days on service and a service index
9 nbscu	Charges
10 icu	Charges
11 ccu	Charges
12 OR	Charges
13 RR	Charges
14 Anesthesiology	Charges
15 Delivery	Charges
16 Diagnostic radiology	Charges
17 Radioisotopes	Charges
18 Radiation therapy	Charges
19 Lab	Charges
20 EEG-EKG	Charges
21 Med-surg supplies	Charges
22 Physical medicine	Charges
23 Respiratory therapy	Charges
24 IV therapy	Charges
25 Pharmaceuticals	Charges
26 Dialysis	Charges
27 Urology	Charges
28 Outpatient	—
29 Miscellaneous	—
30 Kidney transplant	Number of cases

those for basic room and board, the practice of the hospital measuring and charging for minutes of OR time, relative laboratory units consumed, relative radiology units, and the like all based on standard measures of differential resources required makes these measures much more definitive in predicting costs.

THE COST ALLOCATION PROCESS

In Connecticut, the site of this study, there is a uniform accounting and reporting system employed by all hospitals. We can identify 81 accounting entities that incur direct expenses, and of these we can select the 31 of Table 1, which constitute the absorbing subset (final cost centers) to which all costs must be allocated. For those support departments that do not render direct patient care services, a basis for allocating costs to service departments must be found, and this is defined in Table 3. All of these statistics are routinely kept and provide the basic input to the allocation process.

Table 3. Measures for Allocation of Support Service Centers to Final Service Centers

Cost	Measure
Depreciation	Depreciation
Benefits	Salary expense
Data processing	Data time
Communications	Number of lines
Personnel	Full time equivalents
Purchasing	Nonsalary expense
Volunteer	Volunteer time
Maintenance of personnel	Number of live-ins
CSS	CSS time
Nursing administration	Nursing time
Intern and resident	Residents
Operation of plant	Floor area
Interest	Floor area
Repairs and maintenance	Floor area
Administration	General fund expense
Accounting	General fund expense
Housekeeping	Housekeeping time
Laundry	Pounds of laundry

Since allocations may be circular, and since we wished to preserve the identity of the source of every dollar allocated ultimately to each service *department, a special* algorithm for this allocation was developed. This is detailed in the Appendix and generates a set of linear equations whose solution for unit values of the original accounts gives a table of values in which each element (p_{ik}) is the fraction of account i that is allocated to service center k. This result is constant as long as the statistics of allocation (Table 3) remain constant, and it can be used to allocate any account values simply by multiplication. The usual step-down method will not suffice in this application since it is too costly computationally when one preserves the identity of the source accounts in the final allocations.

THE GENERATION OF GROUP-SPECIFIC COST PROFILES

Once the p_{ik} have been determined (see Appendix), the amount of each account (a_i) to be allocated to each final cost center can be determined by

$$c_{ik} = a_i \, p_{ik}$$

Since some or all of the costs included in accounts or service centers may not be a function of the number of patients in each group, we define

h_{ik} = fraction of costs in final cost center k from account i that are DRG related ($0 \le h_{ik} \le 1$)

Any of the h_{ik} could be zero because the service center does not serve patients in

DRGs (e.g., k = outpatient), because account i is not a function of case mix (e.g., i = depreciation), or some combination of these.

If we define non-DRG costs as "fixed," then we can define

$$c^f_{ik} = (1 - h_{ik})\, c_{ik}$$

$$c^v_{ik} = h_{ik}\, c_{ik}$$

in which

c^f_{ik} = "fixed" costs from account i to center k

c^v_{ik} = "variable" costs from account i to center k

Computation of Fixed Cost

For each final cost center and each account, we also define a function $y_{ik}(\cdot)$, which predicts fixed costs from exogeneous factors such as wage rates, supply prices, and the like and

$$\hat{c}^f_{ik} = y_{ik}\,(c^f_{ik})$$

provides a prediction of the fixed costs. If $h_{ik} = 0$, then

$$\hat{c}_{ik} = \hat{c}^f_{ik}$$

without consideration of case mix.

Computation of Variable Cost

For each DRG, there are a number of measures, l, which reflect the services delivered, e.g., charges, bed-days, admissions, and the like. Let

t_{lj} = value of measure l for the DRG_j

Then for each final cost center, k, we calculate

s_{kj} = service intensity for center k and DRG_j

as a weighted sum of the basic measures

$$s_{kj} = \sum_l w_{kl} t_{lj}$$

The weights, w_{kl}, might in some cases be derived from the c_{ik} values. For example, the service intensity for interns and residents could be calculated by using as weights total salaries of interns and residents in service k with the t_{lj}, the total bed days spent by DRG_j on that service.

The fraction of service k required by DRG_j is calculated as

$$r_{kj} = \frac{s_{kj}}{\sum_j s_{kj}}$$

so that $\sum_j r_{kj} = 1$ for each k. Then assuming that the variable costs c^v_{ik} are proportional to the service intensity, that part of c^v_{ik} associated with each DRG_j is

$$c^v_{ikj} = r_{kj} c^v_{ik}$$

Then the unit variable cost per patient for each final cost center–account combination is

$$v_{ikj} = \frac{c^v_{ikj}}{n_j}$$

in which n_j is the number of patients in group j.

Assuming that fixed costs can also be apportioned to each DRG_j by the service intensity to produce a total unit cost, per patient this can be calculated by

$$u_{ikj} = \frac{r_{kj} c_{ik}}{n_j}$$

In order, however, to predict account values as a function of the n_j, it is only necessary to calculate the marginals of the v_{ikj}, that is,

$$v_{ij} = \sum_k v_{ikj} = \frac{\sum_k c^v_{ik} r_{kj}}{n_j}$$

and

$$v_{kj} = \sum_i v_{ikj} = \frac{r_{kj} \sum_i c^v_{ik}}{n_j}$$

These essentially are the row and column totals of a matrix of costs for each DRG by account i and final cost center k. Then a forecast of case mix, $\hat{n}_j$, can be used to predict

$$\hat{c}_k = \sum_i \hat{c}^f_{ik} + \sum_j \hat{n}_j v_{kj}$$

and

$$\hat{a}_i = \sum_k \hat{c}^f_{ik} + \sum_j \hat{n}_j v_{ij}$$

if the v_{ikj} are calculated then

$$\hat{c}_{ik} = \hat{c}^f_{ik} + \sum_j \hat{n}_j v_{ikj}$$

and

$$\hat{c}_k = \sum_i \hat{c}_{ik}$$

$$\hat{a}_i = \sum_k \hat{c}_{ik}$$

So knowing the case mix enables estimation of the cost in each final cost center and then in each account. In either case, the prediction of account values, $\hat{a}_i$, provides a set of budget values based on any previous account values and a projected case mix. Further, the unit cost values provide a means for assessing and controlling the effect of case mix on costs.

The resulting account values can be presented to the support departments together with the data used in their development for review and modification based on factors other than case mix and controllable and noncontrollable elements in the operation of the department. The usual budgetary procedures will result in final values for these accounts, which can then be employed to produce the cost profiles to be applied to each patient class for the coming budget period.

COST AND REIMBURSEMENT CONTROL

These profiles can be used in two distinct ways. First, deviations from the original budget or deviation from other comparable institutions can be explained as a function of case mix. For example, if the institution treated some number of patients in the various classes different from those on which the budget was based, the difference could be explained in part by differences in case mix. This clinical dimension must be added to hospital budgeting and cost control systems if cost containment is to become an attainable goal. Further, costs incurred by different institutions for the same classes of patients can be compared *in terms of the differences in process* along comparable dimensions of resources consumed. Of course, control would imply that any differences be rationalized in terms of differing levels of efficiency and/or effectiveness in the patient-care process or differences in outcome. In any case, evaluation of such differences can be made since *one is comparing cases* that have been judged comparable on the basis of their clinical attributes.

The second use of such profiles is in the area of reimbursement. The payer can devise a formula by which the elements comprising the total cost profile will be reimbursed to the hospital and simply pay based on the n_j. Each case would generate revenue according to the expected value along each dimension of service. If the hospital were able to improve the effectiveness along any particular dimension, then an incentive scheme based on such improvements could easily be devised.

The important point to be made concerning reimbursement can be exemplified in a number of ways. It is not appropriate, for example, to compare the cost of treating a patient of a given class in hospital A against that in hospital B and merely to observe that in B the cost is higher. First, the dimensions along which it is higher and/or lower should be observed. Second, the source of the difference should be traceable back to its source. If hospital B has an old and inefficient heating plant while A's is new and efficient, B's costs will be higher, but this system will show that the higher cost is due to the allocation from the plant operation account. A reimbursing agency could decide on a standard for this portion of any institution's cost penalizing the inefficient institution, rewarding the most efficient, and thus providing incentive for the improvement of the plant.

CONCLUSIONS AND RECOMMENDATIONS

We believe that the control of the processes of patient care in terms of quality and cost are inextricably linked and rest upon understanding the patient management process as it is applied appropriately to unique classes of patients. It is not sufficient to deal with utilization review and quality of care as a process separable from the expenditure of manpower, facilities, and equipment in delivering that care. The system envisaged here attempts to establish and use the essential link on a macro level in approaching the problem of controlling such resource consumption according to medically meaningful criteria.

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APPENDIX

Cost Allocation Model

$i \in$ set of m_1 accounts used for budgeting (as, for example, in Table 1). $j \in$ set of m_2 patient groups (DRGs); $k \in$ set of m_3 final cost centers (such as "final cost centers" in Table 1). f_{ik} = fraction of account i allocated to final cost center k. $g_{ii'}$ = fraction of account i allocated to account i'.

In the above, the "accounts" include both "support" and "final" cost centers in our chart of accounts (see Table 1). We required $\Sigma_k f_{ik} + \Sigma_{i'} g_{ii'} = 1$ for each i.

Calculation of p_{ik} from f_{ik} and $g_{ii'}$

Let F be the $m_1 \times m_3$ matrix $|f_{ik}|$, G be the $m_1 \times m_1$ matrix $|g_{ii'}|$, I_3 be the $m_3 \times m_3$ identity matrix, and, ϕ be an $m_3 \times m_1$ matrix of zeros. Then the $(m_3 + m_1) \times (m_3 + m_1)$ matrix

$$B = \begin{pmatrix} I_3 & \phi \\ F & G \end{pmatrix}$$

gives the allocation profile from the $m_3 + m_1$ final cost centers and accounts to themselves. Let A^0 be the $1 \times (m_3 + m_1)$ vector

$$(\underbrace{0, \ldots, 0}_{m_3 \text{ times}}, a_1, \ldots, a_{m_1})$$

giving the initial levels allocated to the final cost centers and accounts; then

$$A^1 = A^0 B$$

is a vector of available amounts for cost centers and accounts after one application of the allocation profile. If the last m_1 elements of A^1 were zero, then no further allocation would be necessary. In general, however, these elements are nonzero and the allocation must be performed repeatedly to eliminate them. Thus we have

$$A^2 = A^1 B = A^0 B B = A^0 B^2$$

$$A^3 = A^2 B = A^0 B^2 B = A^0 B^3$$

or, in general,

$$A^n = A^0 B^n$$

where B^n represents the multiplication of B by itself n times.

Proof. The requirement that

$$\sum_k f_{ik} + \Sigma g_{ii'} = 1 \text{ each } i$$

makes A a Markov matrix. Further, a requirement that no set of accounts allocate only to themselves, i.e.,

$$\sum_{i \in Z} g_{ii} < 1 \text{ for all } i \in Z$$

ensures that B is the matrix of an absorbing Markov process.

From the theory of finite Markov chains, we have that

$$B^* = \lim_{n \to \infty} B^n$$

exists, and that

$$A^* = A' B^*$$

is a vector with the last m_i elements zero (meaning all amounts have been allocated to the cost centers), and

$$B^* = \begin{pmatrix} I_k & 0 \\ P & 0 \end{pmatrix}$$

where the $m_i \times m_k$ matrix $P = \{p_{ik}\}$ is given by

$$P = (I - G)^{-1} F$$

where I_i is the $m_i \times m_i$ identity matrix.

Given f_{ik} and $g_{ii'}$, the p_{ik} can be found by solving the following set of simultaneous linear equations

$$p_{ik} - \sum g_{ii'} p_{i'k} = f_{ik} \quad \text{for all } i, k \qquad \text{(A 1)}$$

In practice, account allocations are expressed in dollar amounts rather than normalized fractions, i.e., we are given

F_{ik} = dollars allocated from account i to cost center k
$G_{ii'}$ = dollars allocated from account i to account i'

and

$$\sum_k F_{ik} + \sum_{i'} G_{ii'} = T_i$$

where

T_i = dollars in account i

We could compute

$$f_{ik} = F_{ik}/T_i$$

and

$$g_{ii'} = G_{ii'}/T_i$$

Instead we use these numbers directly by multiplying each equation in (A 1) by T_i and solve

$$T_i p_{ik} - \sum G_{ii'} p_{i'k} = F_{ik} \quad \text{for all } i, k$$

These constraints are sufficient to imply that

$$\sum_k p_{ik} = 1$$

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