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A STUDY TO DETERMINE THE CORRELATION BETWEEN CONTINUITY OF CARE AND PATIENT MEDICATION COMPLIANCE

A Graduate Research Project
Submitted to the Faculty of Baylor University
in Partial Fulfillment of the
Requirements for the Degree
of
Master of Health Administration

by

Captain(P) Leon Woodley, MSC

August 1984

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This study examined medication noncompliance patterns to determine a relationship between continuity of care and compliance. This study found a ten percent noncompliance rate among the patients researched. The author found the noncompliance rate to be very favorable compared to the range reported in the literature. The author also found a significant difference between those patients given a continuity of care through a family practice clinic versus a general outpatient clininc.

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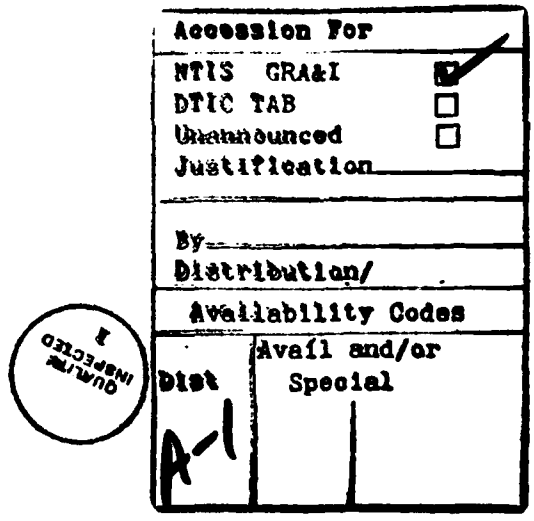

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I. INTRODUCTION

A. Development of the Problem

Americans have 750 million prescriptions filled each year.[1] Physicians prescribe medications to treat every ailment from aches and pains to complex cardiac conditions. There is an alarmingly wide gap between the regimen recommended by the physician and that adhered to by the patient. This failure to comply with medical recommendations results in a waste of health resources, frustration to the health care provider, and possible hazards to the patient's health.[2]

An initial awareness of the magnitude of the problem of noncompliance comes with the reading of research findings in the area. An investigation of 134 outpatients who received 380 prescriptions for a wide range of diseases found that only 22 percent of the prescriptions were being taken properly and 31 percent were being misused in a manner that posed a serious threat to the patient's health.[3] Earlier studies and reviews reveal differing degrees of successful patient compliance. Other noncompliance estimates have been: Davis 30-35 percent; Blackwell 25-50 percent; and Stimson 19-72 percent.[4] Marston[5] reported a range 8-96 percent. The median levels of noncompliance have been estimated at 47 percent (Sackett)[6] and 43 percent (Marston).[7] The American Medical Association estimates that of the millions of prescriptions filled each year, 40 percent of those prescriptions may not help their users because the medications are not taken correctly.[8]

The problem of patient noncompliance with drug regimens is not confined by socioeconomic groups or categories of diseases. The reasons patients fail

to follow their physician's advice are varied. Many times the patients receive inadequate instructions. Sometimes they are confused by the instructions they do receive. They may not be aware of allergies, interaction with other medications, or even how foods affect the way their medication works. They may stop using the medication as soon as they feel better or because it does not produce immediate results instead of completing the entire treatment program.

The phenomenology of compliance is riddled with contradictions, and when we review our own prior perceptions of its determinants or those of newcomers to the field, it is clear that compliance is one of the least understood yet most guessed-about topics in health care.[9] Much of the literature is devoted to factors which reduce health care compliance. These factors revolve around four main areas in determining specific drug compliance behaviors: the physician, the patient, the clinical setting, and psychosocial factors, i.e., support groups, knowledge, etc. Yet despite thorough investigations of these factors associated with different degrees of successful patient compliance, no single factor offers a panacea.

Experts from the various fields of medicine have endorsed continuity of care to improve the quality of care and patient satisfaction. A more general perception is that this continuous relationship with a personal health care provider would also improve compliance with the medicine regimen.[10] When an individual selects a personal physician, he seeks more than competent medical treatment. He perceives a special physician-patient interaction. The patient expects the physician to introduce himself, explore his worries and expectations, answer all his questions, avoid unexplained medical jargon, engage in some nonmedical talk, and be friendly rather than businesslike.

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The world of socialized medicine as exemplified in Military Treatment Facilities is characterized by a large population, low personnel staffing levels, and dedication to the mission of conserving the fighting strength of the ACTIVE force. In the process of offering competent medical care to as many beneficiaries as the limited time and personnel resources allow and establishing priority based on the medical mission, the military physician has acquired the image of an impersonal health care provider.

Silas B. Hays Army Community Hospital affords personal patient-physician interaction to a substantial number of its military beneficiaries. Care is provided by panels of single physicians interrrupted only by reassignment of either beneficiary or physician. The Family Practice Service emphasizes continuing and total health care for all members of the family through a Family Physician. It plans and provides a comprehensive plan of care for patients including monitoring and maintenance, counseling and guidance and health education and disease prevention. The Family Practice Service assures continuity of health care through interdisciplinary consultation and referrals. Patients are seen on an appointment-only basis.

This type of personalized service cannot be offered to everyone in the Silas B. Hays catchment area. Those beneficiaries not selected for Family Practice Services are provided health care through the General Outpatient Clinic (GOC). The GOC is the initial mode of entry to the hospital for all patients other than Family Practice, emergencies, and those active duty personnel seen at the Troop Medical Clinics. The GOC also provides follow-up general medical care for its patients and makes appropriate referrals to specialty clinics. The GOC operates on a walk-in, first come-first served basis.

These beneficiaries have half a million prescriptions filled each year. In creating clinics with low continuity of care are we contributing to the waste of health care resources? Dropping out of drug regimens or taking prescription drugs incorrectly result in adverse drug reactions, prolonged illness, and higher health care cost.

Continuity of care with a personal health care provider has been endorsed by experts from family practice, pediatrics, and internal medicine. Yet it remains a controversial concept. The purpose of this paper is to explore the beneficiaries' opportunity to establish an ongoing personal relationship with a physician in the military health care delivery system. The underlying assumption is that a continuous relationship with this health care provider improves the incidence of patient medication compliance.

B. Statement of the Problem

The problem is to determine if continuity of care affects the incidence of patient medication compliance. The task is to test for significant differences in the amount of noncompliance in prescription drug regimens due to the level of continuity of care of patients seen in the Family Practice Service as compared to the patients seen in the General Outpatient Clinic. Inherent in the problem statement are the problems of defining compliance and continuity of care, and selecting a measurement for each. These factors will be explained further in considering factors which will influence the method of research and the solution offered.

C. Objectives, Criteria, Assumptions and Limitations

Objectives

Objective One: Design the test. Unique methodologic problems are to be addressed in the research methodology. However, the preliminary design of the test answers the basic questions of "who, what, when, where, and how".

Who: A representative sample of the population at risk was selected who met the following requirements:

1. The subject was a beneficiary of the Uniformed Health Services in the Silas B. Hays Army Community Hospital catchment area.

2. The subject had been dispensed prescribed medication within the last six months.

3. The subject received medication regimen through the Family Practice Service or the General Outpatient Clinic.

What: The study was to measure compliance of drug regimens while isolating continuity of care by controlling for socioeconomic and/or demographic factors.

When: The test covered the time period of July 1983 to May 1984. The test sample was selected from those who had received prescriptions in the six months from June to December 1983.

Where: The test was conducted at Silas B. Hays Army Community Hospital, Fort Ord, California. The sample lives within a twenty mile radius with a driving time to the facility of thirty minutes.

How: Each subject and medication prescription was selected and followed through the Computerized Medical Records-Order Entry/Results Reports element of the Computer Stored Ambulatory Record System and the Registration Module of the DOD TRIPAD System.

Objective Two: Determine data to be collected for evaluation. A patient medication questionnaire was developed to answer questions in several areas.

Area 1: Identify demographic characteristics of the sample population.

Area 2: Determine whether subject received adequate written/oral medications instructions.

Area 3: Determine whether the subject understood the medication instructions that were given.

Area 4: Determine whether the subject complied with medication instructions.

Area 5: Determine the amount of health care provided by the subject's primary health care provider.

The questionnaire was mailed to each randomly selected subject. The subject was to complete the questionnaire while remaining anonymous. The questionnaires were color coded to identify subjects in the Family Practice Group and the General Outpatient Group. Through an assessment of the specific questions on compliance and the general responses to the entire questionnaire, a determination of compliance or noncompliance was made.

Objective Three: Evaluate the data. The results of the patient medication questionnaire were studied, analyzed, and compared. By matching certain socio-economic and demographic factors, an attempt was made to eliminate or block the interacting effects these factors had on compliance. The medication compliance rates were determined. Comparisons in the rate of compliance for the variable, continuity of care, was made for the Family Practice Group and the General Outpatient Group. The significant differences in those groups were tested for using hypothesis testing. Using the chi-square statistic concept, the difference between the two population proportions was tested with results evaluated using a .05 level of significance as the cutoff criterion.

Objective Four: Report evaluation and recommendations. The test results will be reported. Items of interest which cannot be explained by statistical inference will be reported with descriptive statistics. Based on any statistically significant findings, a report of the test analysis and recommendations for enhancing patient-physician interaction, thus compliance, will be made.

Criteria

Criterion One: The definition of compliance must be precise, unambiguous, and appropriate. The definition must be clear to all readers.

Criterion Two: An unobtrusive measurement of compliance must be appropriate to the clinical setting. The measurement must allow for appropriate interpretation and replicability in future studies.

Criterion Three: There must be blocking or elimination of other factors which presumably affect compliance such as age, education, instruction comprehension, etc.

Criterion Four: The data collected will be evaluated by comparing the proportion of the Family Practice Service patients and the General Outpatient Clinic patients who are compliant or noncompliant with the degree of continuity of care. Using hypothesis testing, the difference between the population proportions with a level of significance of 0.05 will be the cutoff criterion.

Assumptions

Assumption One: Continuity of care can be isolated and studied.

Assumption Two: Continuity of care differs between the groups.

Assumption Three: Clinical and demographic characteristics of the groups are comparable before the intervention.

Assumption Four: Continuity of care has a high positive correlation with patient medication compliance.

Assumption Five: The medication prescribed was believed to be effective given diagnosis and treatment.

Assumption Six: The loss from analysis of questionnaires not returned by the subjects of the sample groups does not also represent the loss of the least compliant patient. The proportion of the sample subjects who do not return questionnaires is assumed to be normally distributed.

Limitations

Limitation One: The patient medication compliance questionnaire may not be the most accurate tool for measuring compliance. It may be normally expected that patients may lie when asked whether he has complied. However, when the patient's reliability in reporting his own compliance was scientifically investigated, there was little or no evidence to suggest that complying patients misrepresented themselves as noncompliers, nor was there evidence that those who professed noncompliance were lying.[11] Although there may be questions as to its validity, the questionnaire seems adequate in identifying noncompliers in this clinical investigation.

Limitation Two: Pretesting of the subject population is inappropriate and undesirable. Pretesting the subject population would be awkward and likely to be reactive. In order to alleviate the negative connotation of noncompliance and give the subject freedom to respond candidly, anonymity must be kept.

Limitation Three: The accuracy of the questionnaire results depends on patient recall and willingness to be truthful.

Limitation Four: Patients may have been prescribed a variety of different medications and regimens. Patients must be able to identify a specific drug regimen and report compliance or noncompliance to each.

Limitation Five: The final determination of whether the patient intervened in the medication regimen will be determined by the researcher's evaluation of the questionnaire.

D. Other Factors Influencing the Method of Research or Solution Offered

Compliance in health care literature has been used to denote the timely seeking of medical care, keeping appointments, changing lifestyles, or following the advice of ones health care provider. Compliance is a well recognized concept but extremely difficult to define. The way a researcher defines compliance affects the total research effort. Compliance is generally defined as the extent to which a person's behavior (in terms of taking medications, following diets, or executing lifestyle changes) coincides with medical or health advice.[12] The term is used in the context of this paper to denote the specific health behavior of following a prescribed drug regimen. Compliance would be determined to exist if the subjects indicated that they had completed all medication prescribed for an acute condition or continuing on schedule with dosage prescribed for a chronic condition.

The concept of continuity of care is just as difficult to define. Throughout the literature it is defined in many different ways. It can refer to the process from identification and diagnosis of a health problem to its treatment and management. It can refer to follow-up from one physician visit to the next. It can refer to the ongoing care from a person or institution.[13] For the purpose of this paper, the term continuity of care refers to the ongoing relationship between patient and health care provider. This elusive phenomenon of patient-physician interaction will be determined to exist if the subjects indicate that the major portion of their care is provided by the same physician.

The study made no attempt to link a specific disease with a therapeutic regimen. The random selection of the sample subjects produced a multiplicity of

therapeutic drugs. Each drug the subjects identified specifically could, however, be defined by treatment goals and then translated into general disease categories and treatment regimens.

E. Review of the Literature

The literature about compliance is one of the most extensive of the health care topics. A literature search was conducted using the Medical Literature on Line (MEDLINE) file. Articles written between 1960 and 1982 were reviewed. The literature identified covered thousands of articles and over six hundred original studies.

The process of selecting appropriate articles was a monumental task. Fortunately, a similar undertaking had been done by Dietrich and Morton[14] in a literature review regarding the effects of a continuous relationship with a personal health care provider on the quality of health care. Using this as a road map, an extensive review of the original studies conducted prior to 1980 was conducted. Further review was conducted on more current articles.

Relatively few of the studies reported in the literature have attempted to identify the association of continuity of care and medication compliance. The research disclosed only six which defined continuity of care as an ongoing personal relationship between health care provider and patient, and measured the amount of medication compliance. Therefore, these reports are the source for the background information.

Charney et al.[15] studied groups of patients who were prescribed oral penicillin for otitis or streptococcal pharyngitis. The study was done to determine if either the nature of the patient seen or the private practice relationship differentiated those who took the medication from those who did not. Since this was a study of pediatric patients, mothers were responsible to administer the medication. Compliance was determined using a urine collection technique.

The study results showed that 73 percent of patients who saw their usual provider were compliant with medication as compared to 54 percent compliance of patients who saw their provider's colleague. Using the chi-square method, this was found to be significant at the five percent level ($p < .01$).

Becker et al.[16] conducted a study to develop and test empirically a behavior model for predicting mother's compliance with pediatric medical regimens. The subjects were prescribed an oral antibiotic for otitis media. Compliance was examined as a process involving knowledge of the drug, administration schedule, and follow-up appointment and whether the subsequent behavior indicated completion of the latter two. The study found a positive correlation between medication compliance in pediatric acute illness and the mother's perception that the child would be examined by the same pediatrician on subsequent visits to the clinic. The nonparametric Goodman-Kruskal gamma test was used because the study variables were measured on ordinal scales for which parametric statistics were inappropriate.

The study which comes closest to the research design of this research was conducted by Gardis and Markowitz.[17] Two controlled studies were undertaken to evaluate the effectiveness of comprehensive and continuous pediatric care. In the first study, 220 infants of primiparous adolescents were randomly allocated to either a comprehensive care (CC) or traditional care (TC) group. The CC infants received all their medical care from select group of staff specialists. Mothers of the TC infants obtain their care in low continuity settings such as emergency rooms and outpatient clinics. Compliance was determined through interviews with the mothers and abstracts from the child's medical records. The study found no differences between CC and TC infants in completeness of immunization, utilization of medical resources, morbidity or mortality.

In the second study, 73 children on oral penicillin prophylaxis for history of rheumatic fever were studied for compliance with the physicians' recommendations. The patients were stratified for age, sex, and compliance, and randomly allocated to continuous care (CC) or traditional care (TC) groups. The CC group was seen by different physicians. Compliance was determined using the urine collection technique. The study concluded that there were no differences between the CC and TC groups in the proportion of noncompliance or in internal shifts in compliance.

Ettlinger and Freeman[18] conducted a study to test the hypothesis that close identification with a general practitioner leads to better drug compliance. In the study, 119 patients on an anti-microbial drug for a new episode of illness were identified to have received care from two different health centers. Compliance was determined from a home visit interview and pill count. Patients were said to be compliers who answered Yes to the question: "Do you feel that you knew the physician well who prescribed the tablets?" The study concluded that compliance with the prescription was strongly associated with whether the patient thought that he knew the prescribing doctor well.

Boethius[19] conducted a study on hypertensive adult patients. Compliance was determined from the timeliness of the prescription refills. He found that there were fewer gaps in prescription refills among patients who saw fewer different physicians.

Continuity of care has been in the medical literature for a long time. Compliance in association with this arrangement for the delivery of health care

services has rarely been proven empirically. These studies attempted to do this. Although the studies may suffer from some internal/external invalidities, two similarities of the studies are readily apparent. The first three studies dealt with pediatric subjects. The factor examined was the propensity for compliance of the child's mother. The other two studies were conducted in England and Sweden, respectively. Both countries have a varying degree of socialized health care delivery. No previous study has examined the variables of continuity of care and compliance in the area of socialized medicine in the United States as exemplified in Military Treatment Facilities. There is a need for evaluating their effectiveness through carefully designed, randomized, controlled studies in which two or more formats to providing medical care are compared simultaneously.

F. Research Methodology

Study Population

The setting for the study is a 200-plus bed, acute-care military hospital serving an eligible beneficiary population of approximately 90,000 persons. The hospital offers ambulatory patient services in two major types of outpatient clinics. The first clinic, which is the functional component of the Family Practice Residency Program as certified by the American Academy of Family Physicians, provides comprehensive care to include acute illnesses, obstetrics, gynocology, etc. A limited number of patients are assigned to this clinic on a first application basis. The total population is 3,100 families, or approximately 12,400 persons, with distribution based on the following formula: 25 percent retired (older patients) and family members (3/4 enlisted, 1/4 officers). The second clinic is a general outpatient clinic with treatment of acute illness episodes with referrals to other specialists. The clinic operates on a walk-in, first-come, first-served basis. The average clinic visits per month for the Family Practice Clinic (FPC) and the General Outpatient Clinic are 3,100 and 2,800, respectively. The pharmacy dispenses approximately one prescription per visit from these clinics.

Experimental Design

The Post-test Only Control Group Design[20] was used. Its form is as follows:

Experimental Group	R	X	O_1
Control Group	R		O_2

This design is frequently used in experiments with methods for the initial introduction of entirely new subject matter for which pretests in the ordinary

sense are impossible. For example, pretests on believed guilt or innocence would be inappropriate in a study of the effects of lawyers' briefs upon a jury. The design has two weaknesses. The first weakness is not knowing for sure that the experimental and control groups were equal before the differential experimental treatment. In this study, initial biases are assumed to be overcome by adequate randomization. The second weakness is that this design controls for testing as main effect and interaction, but does not measure them. Since such measurements are tangential to the central question of whether or not X did have an effect, this weakness was overcome by further statistical analysis using log-linear models.

Sampling Technique

Randomization of the subject population (those who report to clinic for services) is not possible as a strict measure. A stratified sampling technique was used. All subjects were selected randomly from the data files of the Medical Record-Order Entry/Results Reporting Module of the Computer Stored Ambulatory Records System. A computer program was written to generate a random listing of 250 persons who were prescribed a drug regimen when seen by a physician in the Family Practice Clinic within the previous six months, and a listing of 250 persons who were prescribed a drug regimen by a physician in the General Outpatient Clinic during the same time frame.

Data Collection

The data gathering for the research relied heavily on the Computer Stored Ambulatory Record System. Not only were the samples randomly selected by the computer, but it also generated individual mailing labels for each subject. The system provided a computerized medical record on each patient seen in Family Practice; however, more significantly, it provided a detailed drug

profile of each patient who was dispensed medication through the outpatient pharmacy service.

A patient medication compliance questionnaire was developed by the researcher with the aid of staff physicians and pharmacists. The purpose of the questionnaire was twofold. First, it answered the basic question (with minimal interpretation by the researcher) whether the medication regimen intervention was solely due to the patient. Secondly, it allowed for closer control of certain clinical and demographic factors such as sex, age, education, etc., which may effect compliance and may be interacting with continuity of care. Each subject was asked to complete the medication questionnaire and return it to the researcher.

Statistical Tests

Measurement of the Variables. The patients of the Family Practice Service were considered the experimental (FPC) group and the patients of the General Outpatient Clinic were considered the control (GOC) group. The two groups were assumed to be differing only in the continuity of care which receives a high degree of emphasis in the Family Practice Clinic. Continuity of care was measured by the question of the amount of medical care provided by the subject's primary physician. There were four levels denoted as "always", "most of the time", "seldom", and "never". Whether or not the subject was compliant with a given drug regimen was determined by subject's admission of intervention and the researcher's overall evaluation of the subject's questionnaire.

The population sampled in this study was classified dichotomously and using multiple categories according to two or more characteristics. In the

analysis of cross-classified categorical data, these variables are called response variables--that is, they are free to vary in response to controlled conditions--and explanatory variables--that is, variables that are regarded as fixed, either as in experimentation or because context of the data suggests they play a determining or causal role in the situation under study.[21] Specifically, in this study, the response variable is compliance and the explanatory variables are continuity of care, clinic setting, etc.

The Hypothesis. The hypothesis to be tested is that "compliance" is not associated with the categories "continuity of care" and "clinical setting" against the alternate that they are positively associated. Statistically, we test the null hypothesis:

$$H_o: \quad P_1 = P_2$$

against the alternate hypothesis:

$$H_a: \quad P_1 \neq P_2$$

Tests of Significance. To test the null hypothesis H_o: $P_1 = P_2$, a comparison was made of the results expected if H_o was true with the actual results obtained from the medication questionnaire. The data was initially compared using the Pearson's chi-square (χ^2) method.[22] In dealing with frequency data, χ^2-provided the expected frequencies (E_1) are not too small-can be expressed as:

$$\chi^2 = \sum \frac{(O_i - E_1)^2}{E_i}$$

where O_i stands for the observed frequencies and E_i for the expected frequencies and i runs from 1 to N for the number of cells in the contingency table. If there is close agreement between the O's and the E's, then $\sum (O_1-E_1)^2$ will be

small, which means that the calculated χ^2 will be small. If there is a disparity between some of the O's and E's, $\sum_i (O_1-E_1)^2$ will be large and the calculated value of χ^2 will also be large. Taking into account the degrees of freedom associated with χ^2, a decision can be made. That is, if the computed value of χ^2 exceeded χ^2_{α}, the null hypothesis was rejected at the $\alpha = .05$ level of significance.

To increase the power of the significance test, a discrete multivariate analysis of covaraince was performed. The method used was the LOGLINEAR method.[25] The LOGLINEAR procedure is a general procedure which does model fitting hypothesis testing and parameter estimation for any model that has categorical variables as its major components. The linear model is obtained by taking

$$\phi(\mu) = \log \mu,$$

and given by

$$\log \mu_i = \sum_j a_{ij} \theta_j \quad (i=1, 2, \ldots, t).$$

Two models were used. In the general log-linear model, the (a_{ij}) was restricted to the values 0 and 1, as in the three-way contingency table, and the (θ_j) then represented main effects and interactions of the variables. In the second model, the LOGIT regression, the (a_{ij}) was defined as explanatory variables, and the parameters (θ_j) were then regression coefficients.[24] The specific and procedural dimension of multivariate analysis using log-linear models are too vast to cover in a paper such as this. Readers who desire further study can consult the references on such analysis in the bibliography.

The members of the sample were cross-classified with results arranged in a rectangular table. Such a table is known as a contingency table. The data

was arranged in both two-dimensional (2x2) tables and three-dimensional (2x2x4; 2x2x2) tables. They have the following forms:

(a)

	continuity of care	no continuity of care
compliance	1,1	1,2
noncompliance	2,1	2,2

(b)

	FPC		GOC	
	continuity	no continuity	continuity	no continuity
compliance	1,1,1	1,1,2	1,2,1	1,2,2
noncompliance	2,1,1	2,1,2	2,2,1	2,2,2

The statistical techniques employed in this study were conducted using computer analysis. The statistical analysis package used was the Statistical Package for the Social Sciences (SPSS and SPSS-X). The program was run on the IBM 3033AP.

II. DISCUSSION

A. Results

Complete results were obtained from 468 medical regimens prescribed to 220 patients (questionnaire returns). Compliance with individual drug regimens were counted because on the average, if two drugs were prescribed per patient, a patient may have been in compliance with one drug and noncompliance with the other. There was a total of 145 varieties of drugs prescribed. Of the 468 drug regimens prescribed to the patients, 7.5 percent received no medication instructions; 37.4 percent were not informed about what to expect, i.e., side-effects, foods-liquids avoidance, etc.; and an overwhelming 92.1 percent responded that they understood the medication instructions which they did receive clearly. Survey sheets were coded to identify patients as FPC or GOC. Two hundred forty-six (52.6 percent) drug regimens were written by physicians in the Family Practice Clinic compared to 222 (47.4 percent) written by General Outpatient Clinic physicians.

Patients were categorized as "compliant" if they stated that they had completed the medication for an acute illness episode or continuing on the dosage schedule for medication prescribed for a chronic illness. Continuity of care was determined from the question, "How much of your care was provided by your primary physician?" Two hundred eighteen (46.6 percent) identified their care as being "always" provided by their primary physician; 185 (39.5 percent) responded "most of the time"; 44 (9.4 percent) responded "seldom"; and 21 (4.5 percent) responded "never".

The noncompliance rate was reasonably low for both clinics. Twenty-eight (11.4 percent) patients in the FPC group were noncompliant as compared to 18 (8.1 percent) of the GOC. The overall noncompliant rate was 46 (9.8 percent).

B. Evaluation

Correlations between the response variable "compliance" and the explanatory variables "primary clinic" and "continuity of care" are presented in Tables I - VI.

Table I is compliance and continuity of care expressed as numbers/(%) of patients.

The table shows significance beyond the .05 level. However, the data causes concern. The mathematical derivation of the distribution:

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

assumes that the expected values E_i are large. The proof is valid only on the assumption that the expected values approach infinity.[25] Two (2) out of eight (25 percent) of the valid cells in Table I have expected cell frequency less than 5.0. Since most statisticians warn against the use of the chi-square test when the E-values are less than 5, the results are skeptical. Further methods to overcome this difficulty were employed.

Categories are adjustable and may often be combined or altered without destroying the identity of the information. A process of collapsing[26] across categories within a variable, i.e., combining classification categories was used. The first and second categories, and the third and fourth categories were combined. The arrangement of the data is now shown in Table II. Table II now shows that the significance is below the .05 level. However, the data is clearly approaching that level. There is a significant difference in the comparison of the significance of the overall χ^2, i.e., one is strongly significant and the other is not. There was reason to believe that these

TABLE I

RELATIONSHIP BETWEEN COMPLIANCE AND THE DEGREE OF CONTINUITY OF CARE

CROSSTABULATION OF COMPLI Q25: COMPLIANCE BY CONTIN Q23: HOW MUCH CARE PROVIDED BY PRIMARY D

PAGE 1 OF 1

COMPLI	COUNT / COL PCT	CONTIN A ALWAYS	B MOST OF THE TIME	C SELDOM	D NEVER	ROW TOTAL
N NO		13	22	4	7	46
		6.0	11.9	9.1	33.3	9.8
Y YES		205	163	40	14	422
		94.0	88.1	90.9	66.7	90.2
	COLUMN TOTAL	218	185	44	21	468
		46.6	39.5	9.4	4.5	100.0

2 OUT OF 8 (25.0%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
MINIMUM EXPECTED CELL FREQUENCY = 2.064
CHI SQUARE = 17.68083 WITH 3 DEGREES OF FREEDOM SIGNIFICANCE = 0.0005

TABLE II

RELATIONSHIP BETWEEN COMPLIANCE AND CONTINUITY OF CARE
(Collapsed Table)

COMPLI Q25: COMPLIANCE BY CARE CONTINUITY OF CARE

COMPLI	COUNT / COL PCT	CARE: ALWAYS OR OFTEN A	CARE: SELDOM OR NEVER B	ROW TOTAL
N NO		35	11	46
		8.7	16.9	9.8
Y YES		368	54	422
		91.3	83.1	90.2
	COLUMN TOTAL	403	65	468
		86.1	13.9	100.0

CORRECTED CHI SQUARE = 3.40695 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = 0.0649
RAW CHI SQUARE = 4.28608 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = 0.0384

proportions are heterogeneous but a more detailed analysis was conducted to decide just where the significant differences lay.

The data was examined for the first time in a three dimensional contingency table. The three variables of consideration were "compliance", "continuity of care", and "primary clinic". The same rule which let us collapse within classification categories also let us collapse across a third variable. However, this is true only if the variable collapsed over is independent of at least one of the two other variables. Table III shows that "compliance" has no association with "primary clinic" beyond the .05 percent level of significance. So we were free to pursue more detailed examination of the data.

Table IV breaks down the data into additive components for the FPC and GOC. The chi-square values show that when we compared "compliance" and "continuity of care" while controlling for FPC, there was no association. However, there is a tremendous difference in the data when controlling for GOC. The data in Table IV shows a strong association between "compliance" and "continuity of care" beyond the .05 level of significance ($p=.007$).

In Table V, we have a 2x2x2 table with the variables compliance, primary clinic, and continuity of care (collapsed). If the three variables corresponding to the dimensions of the table are independent, then an analogy with the model of independence in two dimensions can be done with the log-linear model which is reminiscent of analysis-of-variance notation.

The table contains three major sets of information. The first set of information consists of the observed frequencies, the expected frequencies, and three types of residuals. The column labeled CODE contains value labels

TABLE III

RELATIONSHIP BETWEEN COMPLIANCE AND PRIMARY CLINIC

CROSSTABULATION OF COMPLI 025: COMPLIANCE BY CLINIC Q26: PRIMARY CLINIC PAGE 1 OF 1

COMPLI	COUNT / COL PCT	CLINIC FPC F	CLINIC GOC G	ROW TOTAL
N NO		28 / 11.4	18 / 8.1	46 / 9.8
Y YES		218 / 88.6	204 / 91.9	422 / 90.2
	COLUMN TOTAL	246 / 52.6	222 / 47.4	468 / 100.0

CORRECTED CHI SQUARE = 1.06603 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = 0.3018
RAW CHI SQUARE = 1.41131 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = 0.2348

TABLE IV

RELATIONSHIP BETWEEN COMPLIANCE AND CONTINUITY OF CARE CONTROLLING FOR FAMILY PRACTICE CLINIC OR GENERAL OUTPATIENT CLINIC

```
* * * * * * * * * * * * * * * * * * *   C R O S S T A B U L A T I O N   O F  * * * * * * * * * * * * * * * * *
   COMPLI    Q25: COMPLIANCE                                   BY  CARE       CONTINUITY OF CARE
CONTROLLING FOR..
   CLINIC    Q26: PRIMARY CLINIC                               VALUE = F           FPC
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *   PAGE  1 OF  1

                     CARE
          COUNT   I
          COL PCT IALWAYS O SELDOM O   ROW
                  IR OFTEN  R NEVER   TOTAL
                  I   A    I   B    I
COMPLI    --------I--------I--------I
            N     I    26  I     2  I     28
  NO              I  11.3  I  12.5  I   11.4
                 -I--------I--------I
            Y     I   204  I    14  I    218
  YES             I  88.7  I  87.5  I   88.6
                 -I--------I--------I
          COLUMN      230       16       246
           TOTAL     93.5      6.5     100.0

   1 OUT OF     4 ( 25.0%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
MINIMUM EXPECTED CELL FREQUENCY =   1.821
CORRECTED CHI SQUARE =    0.0      WITH 1 DEGREE OF FREEDOM.  SIGNIFICANCE =  1.0000
      RAW CHI SQUARE =    0.02120  WITH 1 DEGREE OF FREEDOM.  SIGNIFICANCE =  0.8842

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SPSS BATCH SYSTEM                                                             02/22/84        PAGE    4

FILE    NONAME    (CREATION DATE = 02/22/84)

* * * * * * * * * * * * * * * * * * *   C R O S S T A B U L A T I O N   O F  * * * * * * * * * * * * * * * * *
   COMPLI    Q25: COMPLIANCE                                   BY  CARE       CONTINUITY OF CARE
CONTROLLING FOR..
   CLINIC    Q26: PRIMARY CLINIC                               VALUE = G           GOC
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *   PAGE  1 OF  1

                     CARE
          COUNT   I
          COL PCT IALWAYS O SELDOM O   ROW
                  IR OFTEN  R NEVER   TOTAL
                  I   A    I   B    I
COMPLI    --------I--------I--------I
            N     I     9  I     9  I     18
  NO              I   5.2  I  18.4  I    8.1
                 -I--------I--------I
            Y     I   164  I    40  I    204
  YES             I  94.8  I  81.6  I   91.9
                 -I--------I--------I
          COLUMN      173       49       222
           TOTAL     77.9     22.1     100.0

   1 OUT OF     4 ( 25.0%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
MINIMUM EXPECTED CELL FREQUENCY =   3.973
CORRECTED CHI SQUARE =    7.20344  WITH 1 DEGREE OF FREEDOM.  SIGNIFICANCE =  0.0073
      RAW CHI SQUARE =    8.88252  WITH 1 DEGREE OF FREEDOM.  SIGNIFICANCE =  0.0029

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
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TABLE V

GENERAL LOG LINEAR MODEL: MAIN EFFECT AND INTERACTION OF COMPLIANCE, CONTINUITY OF CARE, AND CLINIC

* L O G L I N E A R A N A L Y S I S *
* Log Linear Model *

CORRESPONDENCE BETWEEN EFFECTS AND COLUMNS OF DESIGN/MODEL 1

STARTING COLUMN	ENDING COLUMN	EFFECT NAME
1	1	NCOMPLI
2	2	NCONTIN
3	3	NCLINIC
4	4	NCOMPLI BY NCONTIN
5	5	NCOMPLI BY NCLINIC
6	6	NCONTIN BY NCLINIC
7	7	NCOMPLI BY NCONTIN BY NCLINIC

*** ML CONVERGED AT ITERATION 5. THE CONVERGE CRITERION = .00020

OBSERVED, EXPECTED FREQUENCIES AND RESIDUALS

FACTOR	CODE	OBS. COUNT & PCT.	EXP. COUNT & PCT.	RESIDUAL	STD. RESID.	ADJ. RESID.
NCOMPLI	YES					
NCONTIN	CONTINUI					
NCLINIC	FAMILY P	204.00 (43.59)	204.00 (43.59)	.00000	.00000	.00000
NCLINIC	GENERAL	164.00 (35.04)	164.00 (35.04)	.00000	.00000	.00000
NCONTIN	NO CONTI					
NCLINIC	FAMILY P	14.00 (2.99)	14.00 (2.99)	.00000	.00000	.00000
NCLINIC	GENERAL	40.00 (8.55)	40.00 (8.55)	.00000	.00000	.00000
NCOMPLI	NO					
NCONTIN	CONTINUI					
NCLINIC	FAMILY P	26.00 (5.56)	26.00 (5.56)	.00000	.00000	.00000
NCLINIC	GENERAL	9.00 (1.92)	9.00 (1.92)	.00000	.00000	.00000
NCONTIN	NO CONTI					
NCLINIC	FAMILY P	2.00 (.43)	2.00 (.43)	.00000	.00000	.00000
NCLINIC	GENERAL	9.00 (1.92)	9.00 (1.92)	.00000	.00000	.00000

GOODNESS-OF-FIT TEST STATISTICS

LIKELIHOOD RATIO CHI SQUARE = .00000 DF = 0 P = 1.000
PEARSON CHI SQUARE = .00000 DF = 0 P = 1.000

ESTIMATES FOR PARAMETERS

NCOMPLI

PARAMETER	COEFF.	STD. ERR.	Z-VALUE	LOWER 95 CI	UPPER 95 CI

TABLE V (Cont)

* L O G L I N E A R A N A L Y S I S *
* Log Linear Model *

ESTIMATES FOR PARAMETERS (CONT.)

NCONTIN

PARAMETER	COEFF.	STD. ERR.	Z-VALUE	LOWER 95 CI	UPPER 95 CI
2	.8318748713	.11647	7.14266	.60360	1.06015

NCLINIC

PARAMETER	COEFF.	STD. ERR.	Z-VALUE	LOWER 95 CI	UPPER 95 CI
3	-.1593467462	.11647	-1.36819	-.38762	.06893

NCOMPLI BY NCONTIN

PARAMETER	COEFF.	STD. ERR.	Z-VALUE	LOWER 95 CI	UPPER 95 CI
4	.1906375382	.11647	1.63686	-.03764	.41891

NCOMPLI BY NCLINIC

PARAMETER	COEFF.	STD. ERR.	Z-VALUE	LOWER 95 CI	UPPER 95 CI
5	-.0485453934	.11647	-.41682	-.27682	.17973

NCONTIN BY NCLINIC

PARAMETER	COEFF.	STD. ERR.	Z-VALUE	LOWER 95 CI	UPPER 95 CI
6	.4791281278	.11647	4.11390	.25086	.70740

NCOMPLI BY NCONTIN BY NCLINIC

PARAMETER	COEFF.	STD. ERR.	Z-VALUE	LOWER 95 CI	UPPER 95 CI
7	-.1621092052	.11647	-1.39191	-.39038	.06616

identifying the cells. Since this is a saturated model, all residuals are zero. The term "saturated" is used to denote that this model imposes no restrictions.[27] Similarly, the goodness-of-fit statistics, which contain the second set of information, are also zero. The third set of information concerns the parameter estimates. It is comprised of the value of the coefficient, the standard error of the coefficient, the standardized value (labeled Z-Value) of the coefficient, and the 95 percent confidence interval of the coefficient. The standardized value is distributed approximately as a standard normal variate. Thus, only the main effect for continuity of care (NCONTIN) and the interaction effect for continuity of care (NCONTIN) by clinic (NCLINIC) are significant at the .05 level. Again those that are not significant are in agreement with the Pearson's chi-square statistic. Compliance and continuity is approaching significance at the .05 level but not quite there. Likewise, compliance and clinic has no significant association. Lastly, the three way interaction relating all variables are not significant at the .05 level of significance.

The Logit Model can be used with this data even though the marginal totals are not "fixed" because of the interest only in the effects of the explanatory variables (continuity and clinic) on the response variable (compliance).[28] In Table VI, the model is again saturated. The regression-like coefficients were obtained by multiplying the estimates by two. These coefficients were then used to obtain log-odds coefficients. Then their anti-log was obtanied to translate the model into odds rather than log odds. Table VI shows the model coefficients.

TABLE VI

THE LOGIT MODEL: ANOVA-LIKE REGRESSION OF CONTINUITY OF CARE AND CLINIC ON COMPLIANCE

* L O G L I N E A R A N A L Y S I S *
* Logit Model *

CORRESPONDENCE BETWEEN EFFECTS AND COLUMNS OF DESIGN/MODEL 1

STARTING COLUMN	ENDING COLUMN	EFFECT NAME
1	1	NCOMPLI
2	2	NCOMPLI BY NCONTIN
3	3	NCOMPLI BY NCLINIC
4	4	NCOMPLI BY NCONTIN BY NCLINIC

*** ML CONVERGED AT ITERATION 5. THE CONVERGE CRITERION = .00003

OBSERVED, EXPECTED FREQUENCIES AND RESIDUALS

FACTOR	CODE	OBS. COUNT & PCT.	EXP. COUNT & PCT.	RESIDUAL	STD. RESID.	ADJ. RESID.
NCOMPLI	YES					
NCONTIN	CONTINUI					
NCLINIC	FAMILY P	204.00 (88.70)	204.00 (88.70)	.00000	.00000	.00000
NCLINIC	GENERAL	164.00 (94.80)	164.00 (94.80)	.00000	.00000	.00000
NCONTIN	NO CONTI					
NCLINIC	FAMILY P	14.00 (87.50)	14.00 (87.50)	.00000	.00000	.00000
NCLINIC	GENERAL	40.00 (81.63)	40.00 (81.63)	.00000	.00000	.00000
NCOMPLI	NO					
NCONTIN	CONTINUI					
NCLINIC	FAMILY P	26.00 (11.30)	26.00 (11.30)	.00000	.00000	.00000
NCLINIC	GENERAL	9.00 (5.20)	9.00 (5.20)	.00000	.00000	.00000
NCONTIN	NO CONTI					
NCLINIC	FAMILY P	2.00 (12.50)	2.00 (12.50)	.00000	.00000	.00000
NCLINIC	GENERAL	9.00 (18.37)	9.00 (18.37)	.00000	.00000	.00000

GOODNESS-OF-FIT TEST STATISTICS

LIKELIHOOD RATIO CHI SQUARE = .00000 DF = 0 P = 1.000
PEARSON CHI SQUARE = .00000 DF = 0 P = 1.000

ANALYSIS OF DISPERSION

SOURCE OF VARIATION	DISPERSION ENTROPY	DISPERSION CONCENTRATION	DF
DUE TO MODEL	4.459	1.578	
DUE TO RESIDUAL	145.915	81.379	
TOTAL	150.373	82.957	467

MEASURES OF ASSOCIATION

ENTROPY = .029650
CONCENTRATION = .019023

TABLE VI (Cont)

LOG LINEAR ANALYSIS
Logit Model

ESTIMATES FOR PARAMETERS

NCOMPLI

PARAMETER	COEFF.	STD. ERR.	Z-VALUE	LOWER 95 CI	UPPER 95 CI
1	1.0500287914	.11647	9.01578	.82176	1.27830

NCOMPLI BY NCONTIN

PARAMETER	COEFF.	STD. ERR.	Z-VALUE	LOWER 95 CI	UPPER 95 CI
2	.1906375352	.11647	1.63686	-.03764	.41891

NCOMPLI BY NCLINIC

PARAMETER	COEFF.	STD. ERR.	Z-VALUE	LOWER 95 CI	UPPER 95 CI
3	-.0485453904	.11647	-.41682	-.27682	.17973

NCOMPLI BY NCONTIN BY NCLINIC

PARAMETER	COEFF.	STD. ERR.	Z-VALUE	LOWER 95 CI	UPPER 95 CI
4	-.1621092082	.11647	-1.39191	-.39038	.06616

Table A: Model Coefficients

Effect	Coefficient	Coefficient x 2	Anti-Log
Compliance	1.05	2.10	8.166
Compliance by Continuity	.191	.382	1.465
Compliance by Clinic	- .049	.097	1.102
Compliance by Continuity by Clinic	- .162	.324	1.382

The regression-like model[29] implied by the coefficients is:

$$\ln(F_{ij}1/F_{ij}2) = B_o + B(A)_i + B(B)_j + B(AB)_{ij}$$

where F is an expected frequency, and

B_o equals 2.1

$B(A)_i$ equals .382 for i = 1
- .382 for i = 2

$B(B)_j$ equals - .097 for j = 1
.097 for j = 2

$B(AB)_{ij}$ equals - .324 for i = j
.324 for i ne j

To evaluate the model in terms of odds rather than log odds, an anologous multiplicative mode was used giving the anti-log shown in the table as coefficients. That is,

$$(F_{ij}/F_{ij}2) = T \times T(A)_i \times T(B)_j \times T(AB)_{ij}$$

where

T equals 8.166

$T(A)_i$ equals 1.465 for i = 1
1/1.465 for i = 2

$T(B)_j$ equals 1.102 for j = 1
1/1.102 for j = 2

$T(AB)_{ij}$ equals 1.382 for i = j
1/1.382 for i ne j

The odds were then interpreted. For example, consider a person assigned to the Family Practice Clinic who received continuity of care. This person's observed odds of complying with the prescription is 7.849 (88.70/11.30). By comparison

the person assigned to the General Outpatient Clinic and received continuity of care has a greater odds of compliance 18.230 (94.80/5.20). The model decomposes the observed odds for the first person noted into components.

$$7.84 = (8.166)(1.465)(1.102)(1.382)$$

where the effects are interpreted---

8.166 is the mean or overall effect.

1.465 is the continuity effect indicating the net effect of continuity of care versus no continuity of care on the likelihood of compliance. Other things equal, an individual receiving continuity of care has a 1.465 to 1 odds of being compliant.

1.102 is the net effect of clinic on compliance. This indicates that a person seen in the Family Practice Clinic versus the General Outpatient Clinic has about a one to one (1.102 to 1) odds of being compliant.

1.382 is the interaction effect between continuity of care and clinic. The effect is negative. This means that the effect of receiving continuity of care in the Family Practice Clinic is less positive than is indicated by combining the main effect of receiving continuity of care with the main effect of being in the Family Practice Clinic.

C. Interpretation

The overall chi-square value shows that compliance and continuity of care is not associated at the .05 level of significance. However, it is clearly approaching significance ($p < .06$). It could be easy to say that we could not reject the null hypothesis, therefore, concluding that there is no association between the two methods of classification of the members of the population concerned. However, as shown in Table IV, when we control for the variable, primary clinic, a significant difference in the population is apparent. There is virtually no association between compliance and continuity of care for the Family Practice Clinic group. Clearly opposite, is the strong association between compliance and continuity of care in the General Outpatient Clinic group. Although the expected cell frequencies for the FPC are small, there is reason to believe that the chi-square value is valid.

The log linear models are Tables V and VI and give further weight to the phenomenon that compliance is significant only in the General Outpatient Clinic. As shown in Table V, only continuity of care, the pair continuity of care by clinics were significant. The latter simply means that, as expected, the continuity of care is greater in one clinic than the other but did not effect compliance. As shown in Table VI, the odds of compliance are about even when comparing the interaction of the pairwise variables, clinic and compliance. However, the odds for continuity of care and compliance were significant.

The difference may be explained in the concept of continuity of care, the descriptive data, and the researcher's observance of the population concerned. In Table IV, 93.5 percent of the FPC patients reported that they received

care from their primary physician "always" or "most of the time". This compares with 77.9 percent of the GOC patients reporting continuity of care to the same extent in Table V. This latter percentage was indeed larger than the researcher expected. The General Outpatient Clinic was not designed to offer this type of care. The patients themselves had created a "pseudo" continuity of care by asking to see a certain physician even if this meant longer waiting time. This was especially true of the aged population. Although both groups show good continuity of care, there is a significant difference in the concept of continuity of care in the GOC and the FPC. If the GOC patient had a personal patient-physician relationship, it was created by the patient. Consequently, the other physicians in the clinic would not be familiar with the patient or the patient's medical problems. In the FPC continuity of care is offered through a "panel system" composed of six physicians. When the patient's primary physician is not available, one of the other physicians on that particular panel will see the patient. Consequently, the patient may be seen by another physician who is just as familiar and concerned about the patient as the primary physician. Therefore, there would be a significant difference in whether the patient had no continuity of care in the FPC as compared to the GOC. It is concluded that the concept of continuity of care, that patient-physician interaction, is more realistic in the GOC setting where the patient had the freedom--to a certain extent--to choose a personal physician. When that physician was not available, there was indeed a disruption in the continuity of care perceived by that patient.

Viewing the results in this way and in conjunction with the chi-square value in Table V, the results strongly support the hypothesis that compliance with a

prescription is related to the degree of continuity of care offered by the physician. The concept of continuity of care is subjective and may be divided into various components: patient satisfaction, communication between patient and physician, and identification. This research made no attempt to examine the contributory effects of any of these individual components.

III. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

The aim of this research was to test the compliance patterns of our beneficiary population and the appropriateness of our prescriptions. The overall results clearly demonstrates that prescription compliance is not a significant problem within this health care facility. The ten percent noncompliance rate fits well within the 8-96 percent range that has been reported in the literature. The physicians do provide adequate medication instructions with those instructions being complemented by pharmacy labeling. More emphasis needs to be placed on informing the patient of what effects to expect, even if the drug is as common as an aspirin tablet.

The findings of this research suggest that there is a strong association between compliance and continuity of care, especially where there is a definitely discernable difference in the presence or absence of the latter. Compliance may have been affected by factors unrelated to the format of the care. These factors were reasonably controlled by the random allocation of patients to either group. To some extent, the statistical testing also controlled such variables. Thus, within the limitations described, it has been demonstrated that compliance is significantly impacted upon by the availability of continuity of care in an objective, quantifiable measurement such as drug prescription regimens.

B. Recommendations

The paper suggests strongly a case for greater continuity of care to be offered to our beneficiary population. The physician should never take for granted that the instructions given the patient, whether it is understood or not, will be congruent with his expectations. Just as the patient has the responsibility to follow his physician's instructions, it should be the physician's responsibility to know if and how often the patient takes his medication.[30] The physician and patient must establish an atmosphere of trust, openness, and confidence in the physician's abilities for this to be accomplished.

The implication for the military health care delivery system is clear. We must move away from the perceived image of second-class medical care. If continuity of care can have a demonstrable effect on a measurable resource such as prescription drugs, the affect may well carry over to patient satisfaction and quality of care. More clinics need to be reorganized into a family practice/personal physician concept. Troop clinics can still support active duty personnel with referrals to a hospital-based family physician. The Aviation Troop Clinic which supports dependent family members can be another method and/or role model. Further study into personnel and resources implications are needed. However, the feasibility of such a goal attainment suggests it is within our limits.

The implication for the nation's health care delivery system is clear. The nation's health care delivery system is rapidly changing. Pro-competition is the concept of the future. As more and more people are forced into Health Maintenance Organizations (HMOs) and Preferred Providers Organizations (PPOs), an individual's choice will be of little significance. In a system driven

by economic issues, short-term goals will be obtained at the expense of long-term health care provision. A personal health care provider may soon be only an annotation in the chronicles of health care evolution.

FOOTNOTES

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APPENDIX A

Patient Medication Compliance Questionnaire

DEPARTMENT OF THE ARMY
HEADQUARTERS U.S. ARMY MEDICAL DEPARTMENT ACTIVITY (MEDDAC) FORT ORD
FORT ORD, CALIFORNIA 93941

REPLY TO
ATTN OF

HSXT-AR

SUBJECT: Research Project Questionnaire

To Patient of Silas B. Hays Army Community Hospital

1. Although there are numerous demands on your time, will you take a few minutes for a task which may result in the improvement of health conditions such as yours? It should take only three to five minutes of your time.

2. This is part of a research project being conducted at Silas B. Hays Army Community Hospital in order to find the most effective method of providing patient medication instructions. The questionnaire is designed to help you tell us how effectively we gave you information about your various medication(s). All you have to do is to answer each statement as it pertains to you, by marking a cross by the appropriate answer or by a brief statement.

3. Will you cooperate in this investigation by completing the attached questionnaire at your earlist convenience and returning it in the business reply envelope provided for your use? The questionnaire will remain strictly anonymous. For the purpose of this study, we are interested in the effectiveness of medication instructions and not in the names of individual patients. No patient will be identified in the results of the study.

4. Your promptness and attention to this matter is of utmost importance to us. Thank you.

LEON WOODLEY
CPT, MSC
Research Analyst

1. I am a(n):

_____a. active duty military
_____b. dependent of active duty military
_____c. retiree
_____d. dependent of retiree
_____e. other_____

2. I am _____ male _____ female

3. My age is:

_____a. 1-12 years old
_____b. 13-19 years old
_____c. 20-30 years old
_____d. 31-50 years old
_____e. 51 or older

4. My educational level is:

_____a. elementary
_____b. high school
_____c. two-year college
_____d. four year college
_____e. post-graduate

5. I graduated at the educational level listed above.

_____ Yes
_____ No
(If no, list number of years attended.) _____

6. I speak English as a first language.

_____ Yes
_____ No
(If no, list your primary language)_____

7. I received prescription medication instruction(s) orally from:

_____a. no one
_____b. physician
_____c. pharmacist
_____d. other _____

8. I received written prescription medication instruction from:

_____a. physician
_____b. pharmacist
_____c. patient medication instructions
_____d. package inserts
_____e. other _____

9. I was informed about possible:

_____a. drug interactions
_____b. foods/liquids to avoid
_____c. side effects
_____d. allergic reactions
_____e. others _____
_____f. none of the above

10. The prescription medication instructions were:

_____a. clearly understood
_____b. partially understood
_____c. vague
_____d. not understood

11. I was responsible to administer the medication to:

_____a. myself
_____b. my spouse
_____c. my children
_____d. my parents
_____e. others _____

12. I was prescribed the following medication(s):

_____a. _____
_____b. _____
_____c. _____
_____d. _____
_____e. _____

13. I completed the entire plan prescribed for all the medication(s) listed above:

_____ yes _____ no

If "no" list those medication(s) you did not complete

a. _____
b. _____
c. _____
d. _____
e. _____

14. I did not complete the medications listed above because:

_____a. confused by instrucions
_____b. felt better after a few doses of the medication.
_____c. medication did not produce immediate results
_____d. developed an allergic reaction
_____e. other (describe) _____

15. The medication(s) was prescribed to me:

_____a. for the first time
_____b. for a continuing problem

16. I had to return to the physician for the same ailment:

_____ yes _____ no

If "yes", did the physician:

_____a. prescribe the same medication
_____b. increase current medication
_____c. prescribe new medication
_____d. take you off medication
_____e. other (describe) _____

17. The medications were prescribed by:

_____a. my primary physician
_____b. my physician's substitute
_____c. nurse
_____d. others _____.

18. My health care is provided by my primary physician:

_____a. always
_____b. most of the time
_____c. seldom
_____d. never

19. The medication(s) prescribed to me was:

_____a. very effective
_____b. effective
_____c. not effective

APPENDIX B

Computer Coded Input Format

COMPUTER CODE SHEET OF PATIENT MEDICATION COMPLIANCE SURVEY

Code Word/Statement:

1. STATUS - I am a(n):

_____a. active duty military
_____b. dependent of active duty military
_____c. retiree
_____d. dependent of retiree
_____e. other_____

2. SEX - I am _____ male _____ female

3. AGE - My age is:

_____a. 1-12 years old
_____b. 13-19 years old
_____c. 20-30 years old
_____d. 31-50 years old
_____e. 51 or older

4. EDLEV - My educational level is:

_____a. elementary
_____b. high school
_____c. two-year college
_____d. four year college
_____e. post-graduate
_____x. not applicable

5. GRAD - I graduated at the educational level listed above.

_____ Yes
_____ No
_____ Not Applicable

6/7. YRSATT - If no, list number of years attended. (two digit code) _____

8. ENGLAN - I speak English as a first language.

_____ Yes
_____ No

9. OTHLAN - If no, list your primary language _____
Not Applicable _____.

10. ORAINS - I received prescription medication instruction(s) orally from:

_____a. no one
_____b. physician
_____c. pharmacist
_____d. other _____
_____e. physician and pharmacist

11. WRINS - I received written prescription medication instruction from:

_____a. physician
_____b. pharmacist
_____c. patient medication instructions
_____d. package inserts
_____e. package labels
_____f. physician and pharmacist
_____g. physician and PMI
_____h. phar., PMI, & PI
_____i. PMI & PI
_____j. physician & PI
_____k. pharmacist & PMI

12. INFORM - I was informed about possible:

_____a. drug interactions
_____b. foods/liquids to avoid
_____c. side effects
_____d. allergic reactions
_____e. others _____
_____f. none of the above
_____g. all of the above
_____h a and b
_____i. a and c
_____j a and d
_____k. b and c
_____l. b and d
_____m. d and c
_____n. three of the above

13. UNDSTAN - The prescription medication instructions were:

_____a. clearly understood
_____b. partially understood
_____c. vague
_____d. not understood

14. RESPER - I was responsible to administer the medication to:

_____a. myself
_____b. my spouse
_____c. my children
_____d. my parents
_____e. others _____

15. REGCOM - I completed the entire plan prescribed for the medication.

_____ yes _____ no

16 & 17. DRUG - List the medication below. (two digit code)

a. _____

18. REASON - I did not complete the medication listed because:

_____a. confused by instrucions
_____b. felt better after a few doses of the medication.
_____c. medication did not produce immediate results
_____d. developed an allergic reaction
_____e. other (describe) _____
_____f. continuing the regiman on prescribed dosage schedule.
_____g nausea
_____h. produced side effects
_____x. not applicable

19. CONDIT - The medication(s) was prescribed to me:

_____a. for the first time
_____b. for a continuing problem

20. RETVIS - I had to return to the physician for the same ailment:

_____ yes _____ no

21. FOUPVIS - If "yes", did the physician:

_____a. prescribe the same medication
_____b. increase current medication
_____c. prescribe new medication
_____d. take you off medication
_____e. other (describe) _____
_____x. not applicable

22. PRESCR - The medications were prescribed by:

_____a. my primary physician
_____b. my physician's substitute
_____c. nurse
_____d. others _____.

23. CONTIN - My health care is provided by my primary physician:

_____a. always
_____b. most of the time
_____c. seldom
_____d. never

24. EFFECT - The medication(s) prescribed to me was:

_____a. very effective
_____b. effective
_____c. not effective

(25). COMPLI - Compliance: Yes_____ No_____

(26). CLINIC - Primary clinic: GOC____ FPC_____

APPENDIX C

Research Data

```
PAGESIZE      NOEJECT
DATA LIST     FIXED / 1  STATUS   1 (A)       SEX      2    (A)
                         AGE      3 (A)       EDLEV    4    (A)
                         GRAD     5 (A)       YRSATT   6-7
                         ENGLAN   8 (A)       OTHLAN   9    (A)
                         ORAINS  10 (A)       WRINS    11   (A)
                         INFORM  12 (A)       UNDSTAN  13   (A)
                         RESPER  14 (A)       REGCOM   15   (A)
                         DRUG    16-17 (A)    REASON   18   (A)
                         CONDIT  19    (A)    RETVIS   20   (A)
                         FOUP    21    (A)    PRESCR   22   (A)
                         CONTIN  23    (A)    EFFECT   24   (A)
                         COMPLI  25    (A)    CLINIC   26   (A)
                         PATIENT 29-31
VAR LABELS    STATUS  Q1: ACTIVE DUTY STATUS                                /
              SEX     Q2: SEX                                               /
              AGE     Q3: AGE                                               /
              EDLEV   Q4: EDUCATION LEVEL                                   /
              GRAD    Q5: GRADUATED ??                                      /
              YRSATT  Q6: YEARS ATTENDED, IF NOT GRAD                       /
              ENGLAN  Q8: ENGLISH AS A FIRST LANGUAGE                       /
              OTHLAN  Q9: PRIMARY LANGUAGE, IF NOT ENGLISH                  /
              ORAINS  Q10: RECEIVED MEDICATION INSTRUCT ORALLY FROM         /
              WRINS   Q11: RECEIVED MEDICATION INSTRUCT WRITTN FROM         /
              INFORM  Q12: INFORMED ABOUT POSSIBLE...                       /
              UNDSTAN Q13: UNDERSTOOD MEDICATION INSTRUCT ??                /
              RESPER  Q14: ADMINISTERED MEDICATION TO ...                   /
              REGCOM  Q15: COMPLETED PRESCRIBED PLAN                        /
              DRUG    Q16: DRUG                                             /
              REASON  Q18: DID NOT COMPLETE MEDICATION BECAUSE ...          /
              CONDIT  Q19: MEDICATION PRESCRIBED TO ME ....                 /
              RETVIS  Q20: RETURNED TO PHYSICIAN FOR SAME AILMENT ??        /
              FOUP    Q21: IF YES Q20, DID PHYSICIAN ...                    /
              PRESCR  Q22: MEDICATIONS PRESCRIBED BY ...                    /
              CONTIN  Q23: HOW MUCH CARE PROVIDED BY PRIMARY DOCTOR ??      /
              EFFECT  Q24: MEDICATION EFFECTIVENESS ??                      /
              COMPLI  Q25: COMPLIANCE                                       /
              CLINIC  Q26: PRIMARY CLINIC                                   /
              PATIENT PATIENT CODE                                          /
VALUE LABELS  STATUS
                   ('A') ACTIVE DUTY MILITARY
                   ('B') ACTIVE DUTY DEPENDENT
                   ('C') RETIREE
                   ('D') RETIREE DEPENDENT
                   ('E') OTHER                          /
              SEX
                   ('M') MALE
                   ('F') FEMALE                         /
              AGE
                   ('A') 1-12 YEARS OLD
                   ('B') 13-19 YEARS OLD
                   ('C') 20-30 YEARS OLD
                   ('D') 31-50 YEARS OLD
                   ('E') 51 OR OLDER                    /
              EDLEV
                   ('A') ELEMENTARY
                   ('B') HIGH SCHOOL
                   ('C') TWO-YEAR COLLEGE
                   ('D') FOUR YEAR COLLEGE
                   ('E') POST-GRADUATE
                   ('F') NOT APPLICABLE: INFANT     /
              GRAD ENGLAN
                   ('Y') YES
                   ('N') NO
                   ('F') NOT APPLICABLE: INFANT     /
              ORAINS
                   ('A') NO ONE
                   ('B') PHYSICIAN
                   ('C') PHARMACIST
                   ('D') OTHER
                   ('E') PHYSICIAN AND PHARMACIST   /
              WRINS
```

```
                    ('A') PHYSICIAN
                    ('B') PHARMACIST
                    ('C') PATIENT MEDICATION INSTRUCT
                    ('D') PACKAGE INSETS
                    ('E') PACKAGE LABELS
                    ('F') PHYSICIAN AND PHARMACIST
                    ('G') PHYSICIAN AND PMI
                    ('H') PHAR., PMI, & PI
                    ('I') PMI & PI
                    ('J') PHYSICIAN & PI
                    ('K') PHARMACIST & PMI          /
          INFORM
                    ('A') DRUG INTERACTIONS
                    ('B') FOODS OR LIQUIDS TO AVOID
                    ('C') SIDE EFFECTS
                    ('D') ALLERGIC REACTIONS
                    ('E') OTHERS                    /
          CONDIT
                    ('A') FOR THE FIRST TIME
                    ('B') FOR A CONTINUING PROBLEM  /
          CONTIN
                    ('A') ALWAYS
                    ('B') MOST OF THE TIME
                    ('C') SELDOM
                    ('D') NEVER                     /
          EFFECT
                    ('A') VERY EFFECTIVE
                    ('B') EFFECTIVE
                    ('C') NOT EFFECTIVE  /
          COMPLI
                    ('Y') YES
                    ('N') NO   /
          CLINIC
                    ('G') GOC
                    ('F') FPC  /
COMPUTE             CARE=CONTIN
RECODE              CARE ('A','B' = 'A')('C','D'='B')
VAR LABEL           CARE CONTINUITY OF CARE /
VALUE LABELS        CARE ('A') ALWAYS OR OFTEN BY PRIMARY PHYSICIAN
                         ('B') SELDOM OR NEVER BY PRIMARY PHYSICIAN /
PRINT FORMATS       STATUS TO GRAD ENGLAN TO CLINIC CARE (A)
MISSING VALUES      YRSATT (-1) DRUG ('XX')
                    EDLEV GRAD OTHLAN REASON FOUP ('X')
CROSSTABS           TABLES=COMPLI BY CONTIN
STATISTICS          1
OPTIONS             3 5
READ INPUT DATA
CMEEY   YXBHHAANPHFBNXABBYF  001        1
CMEEY   YXBHHAANASFBNXABBYF  001        2
CMEEY   YXBHHAANMTBBNXABBNF  001        3
CMEEY   YXBHHAANACFBNXABBYF  001        4
DFEDNO3YXAEFBAYLPXBYDABAYF   002        5
DFEDNO3YXAEFBANHCGBYDABCNF   002        6
DFEBY   NABBFAANL5CAYEDDCNF  003        7
DFEBY   NABBFAANDCCAYEDDCNF  003        8
BFAAY   YXBDFADNAPBANXBBANF  004        9
BFDDY   YXBAFAANSDCANXA9CNF  005       10
CMECNO3YXBJBAANXXBANXABBNF   006       11
CMDCNO2NBBAFCANHCFBYCCBBYF   007       12
CMDCNO2NBBAFCANVLFBYCCBBYF   007       13
CMDCNO2NBBAFCANIDCAYCABBNF   007       14
CMDCNO2NBBAFCANMCCAYCABBNF   007       15
CMDCNO2NBBAFCANPPCAYCABBNF   007       16
CMDCNO2NBBAFCANSQCAYCABBNF   007       17
BFCEY   YXACFAANUCEBYCABCNF  008       18
BFCEY   YXACFAANLDEBYCABCNF  008       19
BFCEY   YXACFAANHTEBYCABCNF  008       20
BFCEY   YXACFAANKNEBYCBBCNF  008       21
AFCDNO2YXBAFAAYAMXANXAABYF   009       22
AFCDNO2YXBAFAANNGBANXAABNF   009       23
DFECNO2YXBAJAANNTFBYAAABYF   010       24
DFECNO2YXBAJAANAOCBYAAABNF   010       25
```

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DFECNO2YXBAJAANHCCBYAAABNF  010      26
DFECNO2YXBAJAANIDCBYAAABNF  010      27
DFECNO2YXBAJAANIASCBYAAABNF 010      28
CMEENO2YXBNGAANDZFBYCAABYF  011      29
CMEENO2YXBNGAANSLEBYDAABYF  011      30
CMEENO2YXBNGAAYAOXBYAAABYF  011      31
CMEENO2YXBNGAAYIGXBYAAABYF  011      32
CMEENO2YXBNGAAYKFXBYDAABYF  011      33
CMEENO2YXBNGAANHCCBYDAABNF  011      34
CMEENO2YXBNGAANKSEBYDAABNF  011      35
CMEENO2YXBNGAANDLHBYDAABNF  011      36
CMEENO2YXBNGAANADHBYDAABNF  011      37
CMEENO2YXBNGAANMPHBYDAABNF  011      38
CMEENO2YXBNGAANHCHBYDAABNF  011      39
AFDEY   YXACCAAYSDXANXABAYF 012      40
AFDEY   YXACCAAYCLXANXABAYF 012      41
AFDEY   YXAECAAYKNXANXABAYF 012      42
AFDEY   YXAECAANUCDAYCDBCNF 012      43
AFDEY   YXAECAANAXDAYDUBCNF 012      44
DFECNO2NEAAAAAYGVXBYAACBYG  013      45
DFECNO2NEAAAAAIASSBYAACBNG  013      46
DFECNO2NEAAAAAYAMXBYAACBYG  013      47
AFCBY   YXKABAANUCBAYCACBNG 014      48
AFCBY   YXKABAANBCBBYAACBNG 014      49
CMECY   YXKDFAAYXXXANXDDAYG 015      50
CMECY   YXKDFAANRDBANXADANG 015      51
AFCBY   YXBIGAANMTBANXDDCNG 016      52
AFCBY   YXBIGAANNPBANXJDCNG 016      53
AFCBY   YXBIGAANETDBNXJDCNG 016      54
CFDCY   YXBJBAAUAMEANXABBNG 017      55
AFCBY   YXBMAAAYTCXANXABBYG 018      56
AFCBY   YXBMAAANETDANXABBNG 018      57
AFCBY   YXBMAAANRDDANXABBNG 018      58
BFCBY   YXBHFAANXXBANXABANG 019      59
DFEDY   YXBACAAYHCXANXABBYG 020      60
DFEDY   YXBACAANBCHANXABBNG 020      61
CMECN   YXCEFAAYLOXANXAABYG 021      62
DFEDY   YXBACAAYCCXANXABBYG 020      63
CMECN   YXCEFAANMTGANXAACNG 021      64
BFDBY   YXBACAANXXGAYDABBNG 022      65
AMCCNO1YXBAFCAYHCXANXAABYG 023      66
AMCCNO1YXBAFCANCGEAYCAABYG 023      67
CMEBY   YXBAKAAYXXX3YBAAAYG 024      68
CMDCY   YXBBCAAYIDXBYAAAAYG 025      69
CMDCY   YXBBCAAYMPXBYAAAAYG 025      70
CMDCY   YXBBCAAYNBXBYAAAAYG 025      71
CMDCY   YXBBCAAYCGXBYBAAAYG 025      72
DFEBN11YXBAFAAYFMXBYAAABYG  026      73
DFEBN11YXBAFAAYHGXBYAAABYG  026      74
CMEDNO3YXBAFAANHCFBYAAAAYG  027      75
CMEDNO3YXBAFAANIDDEBYEAAAYG 027      76
CMEDNO3YXBAFAANTLFBYEAAAYG  027      77
CMEDNO3YXBAFAANDDFBYEAAAYG  027      78
CMEDNO3YXBAFAANHDFBYEAAAYG  027      79
CMEDNO3YXBAFAAIDCFBYEAAAYG  027      80
CMEBY   YXBAKAANHCFBYAAAAYG 028      81
CMEBY   YXBAKAANIDFBYAAAAYG 028      82
CMEBY   YXBAKAANPCFBYAAAAYG 028      83
CMECY   YXAABAANPCFBYCAABYG 029      84
CMECY   YXAAJAAYZFXBYCAABYG 029      85
CMECY   YXAABAANCPFBYCAABYG 029      86
CMECY   YXAABAANHCFBYCAABYG 029      87
CMECY   YXAABAANTNFBYCAABYG 029      88
BMAAY   YXBAFAEYCMXANXBCBYF 030      89
BMAAY   YXBAFAEYCLXANXBCBYF 030      90
AMCBY   YXCAFAANPSBANXACANG 031      91
BFBBY   NAFHDAAYCMXANXABBYF 032      92
BFDDY   NEBACACNBNFBYADAAYG 033      93
CMEDY   YXGACAAYMTXBYAAAAYG 034      94
DFBCNO1YXBAJAAYHRXBYAAAAYG 035      95
CMECY   YXDAFBAYHCXBYBAABYG 036      96
CMECY   YXDAFBAYCNXBYBAABYG 036      97
```

```
CMECY   YXDAFBAYCLXBYBAABYG  036      98
CMECY   YXDAFBAYCCXPYBAABYG  036      99
CMECY   YXDAFBAYECXBYBAABYG  036     100
CMEDY   YXBANAANMTBBYDAABNG  037     101
DFEAND9YXBAGAAYTPXBYAAAAYG   038     102
DFEAND9YXBAGAAYTBXBYAAAAYG   038     103
DFEAND9YXBAGAAYPNXBYAAAAYG   038     104
DFEAND9YXBAGAAYCDXBYAAAAYG   038     105
DFEAND9YXBAGAAYALXBYAAAAYG   038     106
DFEEY   YXBAIAAYMTXBYAAABYG  039     107
DFEBY   YXBAIAAYPMXBYAAABYG  039     108
DFEBY   YXBAIAAYCDXBYAAABYG  039     109
DFEBY   YXBAIAAYTGXBYCAABYG  039     110
DFEBY   YXBAIAAYGVXBYCAABYG  039     111
BFCBN11YXBCFAANIDFRYAAAAYG   040     112
BFCBN11YXBCFAANHPFBYAAAAYG   040     113
CMECNO2YXBABAAYQTXBYAAAAYG   041     114
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