NAVAL HEALTH RESEARCH CENTER

RATIONALE AND DESIGN FOR A MISHAP COST-REDUCTION MODEL FOR THE NAVY'S OCCUPATIONAL SAFETY AND HEALTH PROGRAM

S. L. Shepherd

E. J. Doyle, Jr.

W. M. Pugh

Report No. 93-37

NAVAL HEALTH RESEARCH CENTER
P. O. BOX 85122
SAN DIEGO, CALIFORNIA 92186 – 5122

NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND
BETHESDA, MARYLAND

RATIONALE AND DESIGN FOR A MISHAP COST-REDUCTION MODEL FOR THE NAVY'S OCCUPATIONAL SAFETY AND HEALTH PROGRAM

Steven L. Shepherd, MPH
Edward J. Doyle, Jr. CAPT, MC, USN
William M. Pugh, MA

Naval Health Research Center
Medical Information Systems and Operations Research Department
P. O. Box 85122
San Diego, CA 92186-5122

Report No. 93-37, supported by the Chief of Naval Operations, Logistics (N-45) and by the Naval Medical Research and Development Command under Work Unit no. 63706N-096.004-6202, Department of the Navy. The views expressed in this article are those of the authors and do not reflect the official policy or position of the Department of the Navy, Department of Defense, or the U.S. Government. Approved for public release, distribution unlimited.

The authors acknowledge the assistance of the following Naval Health Research Center personnel: Mr. Eddie Shaw and Ms. Jennifer Jaeger, for their help in preparing the manuscript's many figures; Mr. David H. Ryman, for help in data preparation and computer programming; and Ms. Bonnie J. LaFleur, for statistical consultation. Our thanks to all.

EXECUTIVE SUMMARY

Problem

Costs to the U.S. Department of the Navy for occupational mishaps suffered by its civilian employees have risen steadily for more than a decade, reaching one-quarter of a billion dollars in 1993. The rate of increase exceeds that expected from inflation alone; however the role played by other factors is unclear. Ample data are available to help identify the reasons for these rising costs. They reside, however, in multiple databases that are incompatible, were designed primarily for administrative purposes, and are maintained by separate organizational entities. Moreover, before they can be used to assess, for instance, the effectiveness of Navywide safety programs, well-recognized difficulties in making comparisons between vastly different types of facilities must be addressed.

Objective

The purpose of this report is to propose a means for using available data sources to identify factors influencing the Department's workers' compensation costs. Particular emphasis is placed on the development of methods for identifying those factors which present opportunities for the reduction or control of costs.

Approach

A design is proposed for a Mishap Cost-Reduction and Quality Assessment Model for the Navy Occupational Safety and Health Program. The proposed Model will be derived from an integrated database built from data obtained from the U.S. Department of Labor's Office of Workers' Compensation Programs (OWCP), the Navy Civilian Personnel Data System, and the Navy Inspector General Oversight Inspection Unit. These sources provide,

respectively, information on the cost and occurrence of individual occupational mishaps at Department of the Navy facilities, on worker demographics, and on facility safety inspections. Analyses will be based on mishaps at the Department's 150 largest facilities.

Results

Naval Health Research Center has obtained the necessary data and begun preparing them for integration into the proposed database. As of 30 June 1991, the 150 facilities to be included in the analyses employed 242,040 civilian workers. These individuals comprise 80 percent of the Department's entire civilian work force as of that date. In the subsequent year (1 July 1991 to 30 June 1992) this "at-risk population" experienced approximately 8,500 mishaps meeting criteria for the definition of an analyzable case (e.g., mishaps resulting in time lost from work). Actuarial projections of the total costs expected to accrue as a result of all mishaps experienced by all Department of the Navy civilian employees during this time period exceed $357 million. Of this amount, approximately 75 percent is likely to be accounted for by mishaps planned for inclusion in the analyses used to build the Model.

Conclusions

While requiring considerable initial effort to manipulate, the available data nonetheless appear remarkably free from keystroke errors and other common problems associated with administrative databases. We conclude that development of the Mishap Cost-Reduction and Quality Assessment Model is feasible using these data and that creation of the Model should proceed as proposed. We conclude further that the Model has great potential for helping both to improve the Navy's Occupational Safety and Health Program, and to reduce and control its costs for occupational injuries and illnesses.

TABLE OF CONTENTS

BACKGROUND

Costs to the U.S. Department of the Navy for occupationally related injuries and illnesses suffered by its civilian workers have increased steadily for at least the last decade, rising from $133 million in 1982 to $242 million in 1992 (Figure 1). Large as they are, these numbers include only "direct" costs (principally the costs of medical care and compensation for lost wages) and do not include such "indirect" costs as lost productivity, replacement employee training, administrative overhead, and the provision of in-house medical care, all of which increase substantially the true total cost of occupational injuries and illnesses.[1,2]

This steady increase in costs, which persists even after adjustment for inflation (Figure 2), constitutes reason enough for the development of better means both to understand the forces driving these upward costs and to identify effective programs to reduce or contain them. Other imperatives apply as well, however. Citing the need to control increasing costs, President Reagan in 1983 set a governmentwide goal of reducing injuries to federal civilian workers by 3 percent per year for five consecutive years.[3] Results for the Navy were less than desired and subsequently the Chief of Naval Operations specified a follow-up goal of reducing the Navy's total injury and illness case rate by 2 percent per year for the five years ending in fiscal year 1993.[4] Beginning in fiscal year 1994, individual facilities will be required to establish their own reduction goals consistent with local needs, constraints, and capabilities.[5 ¶0505, 6] (The Marine Corps' rate- and cost-reduction activities during this period have been conducted without the establishment of formal goals). Despite their differences, all of these efforts require or will require varying degrees of analysis if assessment of their effectiveness is to be maximally informative.

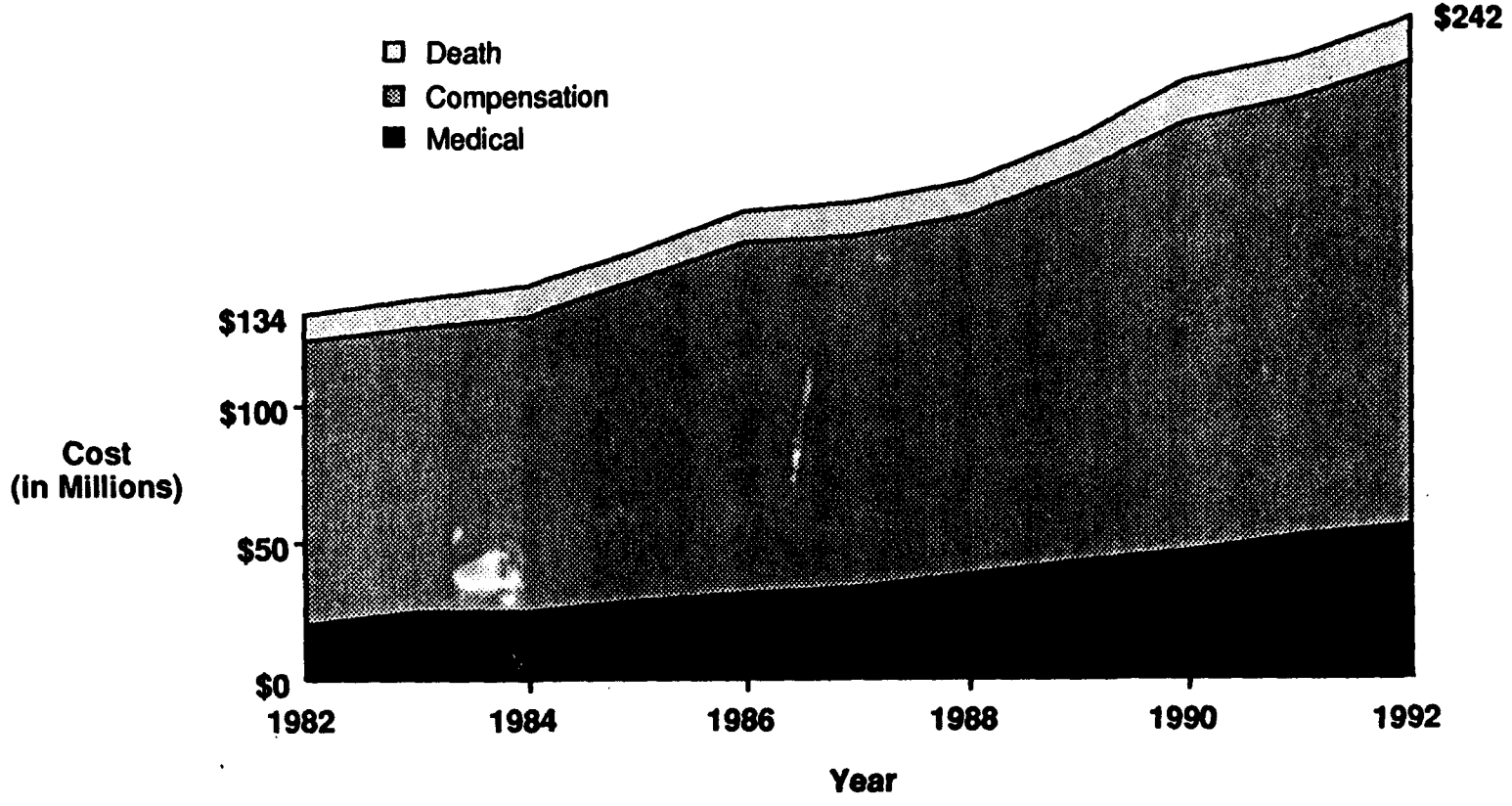


Figure 1: Chargeback costs in nominal dollars, Department of the Navy, chargeback years (1 July - 30 June) 1982-92

Source: Director's Office, Division of Federal Employees' Compensation, Office of Workers' Compensation Programs, Employment Standards Administration, U.S. Department of Labor.

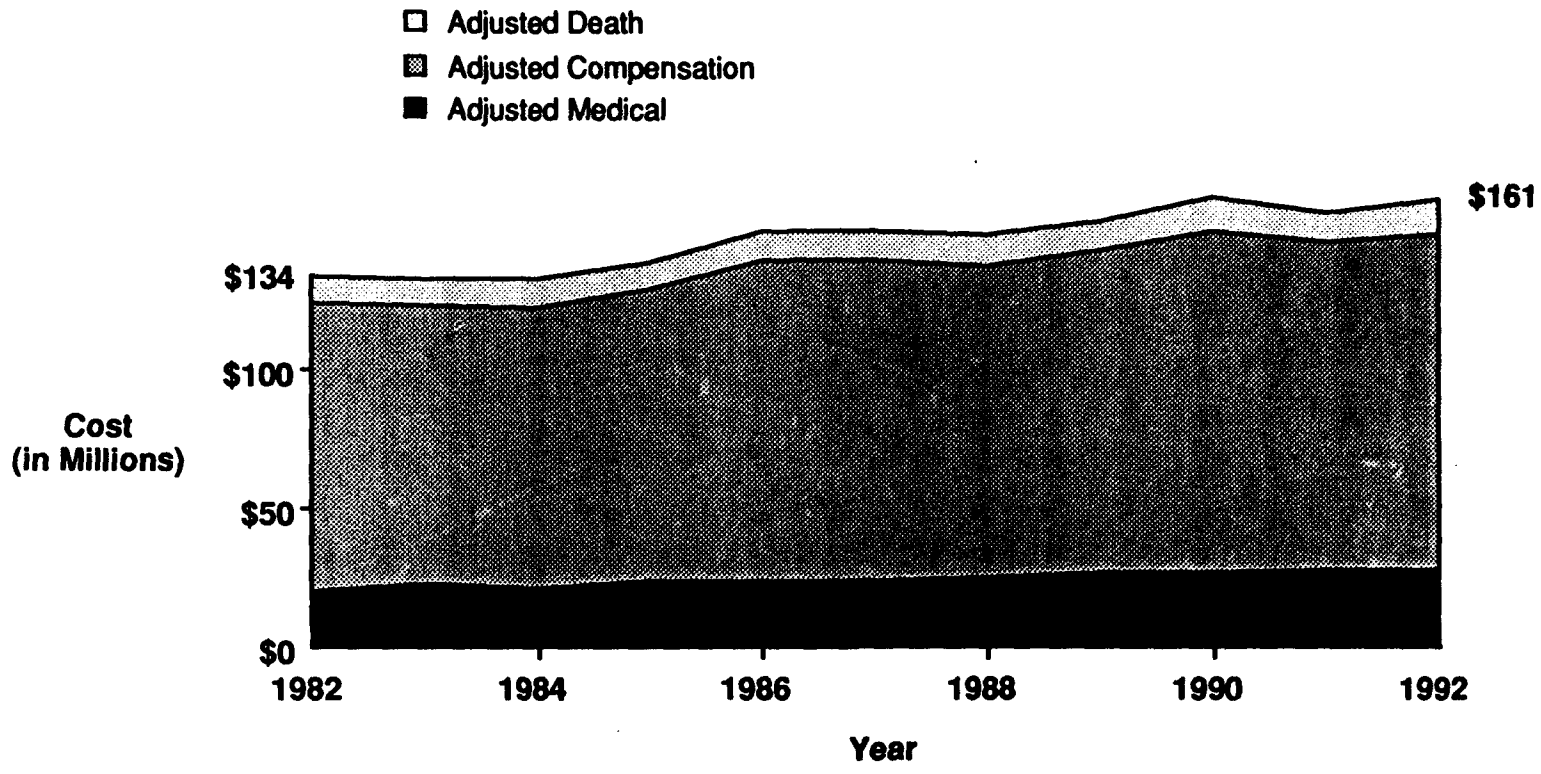


Figure 2: Chargeback costs in 1982 constant dollars, Department of the Navy, chargeback years (1 July - 30 June) 1982-92

Sources: Director's Office, Division of Federal Employees' Compensation, Office of Workers' Compensation Programs, Employment Standards Administration, U.S. Department of Labor.

Death and compensation benefits adjusted by annual federal COLA from FECA form CA-841, Office of Workers' Compensation Program, Employee Standards Administration, U.S. Department of Labor.

Medical benefits adjusted by annual medical care price index, Consumer Price Index Detailed Report, June 1992, and unpublished data, U.S. Bureau of Labor Statistics.

The Federal Employees' Compensation Act

Any employer's expenditures for occupationally related health mishaps* are the result of two interacting elements: the rate of injuries and illnesses occurring in its work force, and the individual costs of those injuries and illnesses. Cost control efforts should address both. Of the two, however, mishap rates have the greatest influence on total cost. As noted by William Hager, president of the National Council on Compensation Insurance, a nonprofit research and rate-making organization for commercial providers of workers' compensation insurance, "The most effective way to control costs is to prevent injuries from arising in the first place."[7] This is likely to be particularly true for the Department of the Navy because its potential to influence injury and illness rates is substantially greater than its potential to influence the costs of personnel mishaps once they have occurred.

Provisions for the care and compensation of federal civilian employees harmed at the workplace are contained in the Federal Employees' Compensation Act of 1916, as amended (5 U.S.C. 8101 *et seq.*). This act grew out of a Progressive Era consensus that industrial accidents were going to be an inevitable corollary of the Industrial Revolution and that rather than forcing injured workers to seek recompense from employers through the litigious finding of fault, the burden of injured workers should be borne by society nonadversarially. It has been described as "one of the most significant social policy statutes predating the Great Depression."[8 p.3] Implementing regulations are contained in the Code of Federal Regulations, Title 20, Chapter 1: *Office of Workers' Compensation Programs, Department of*

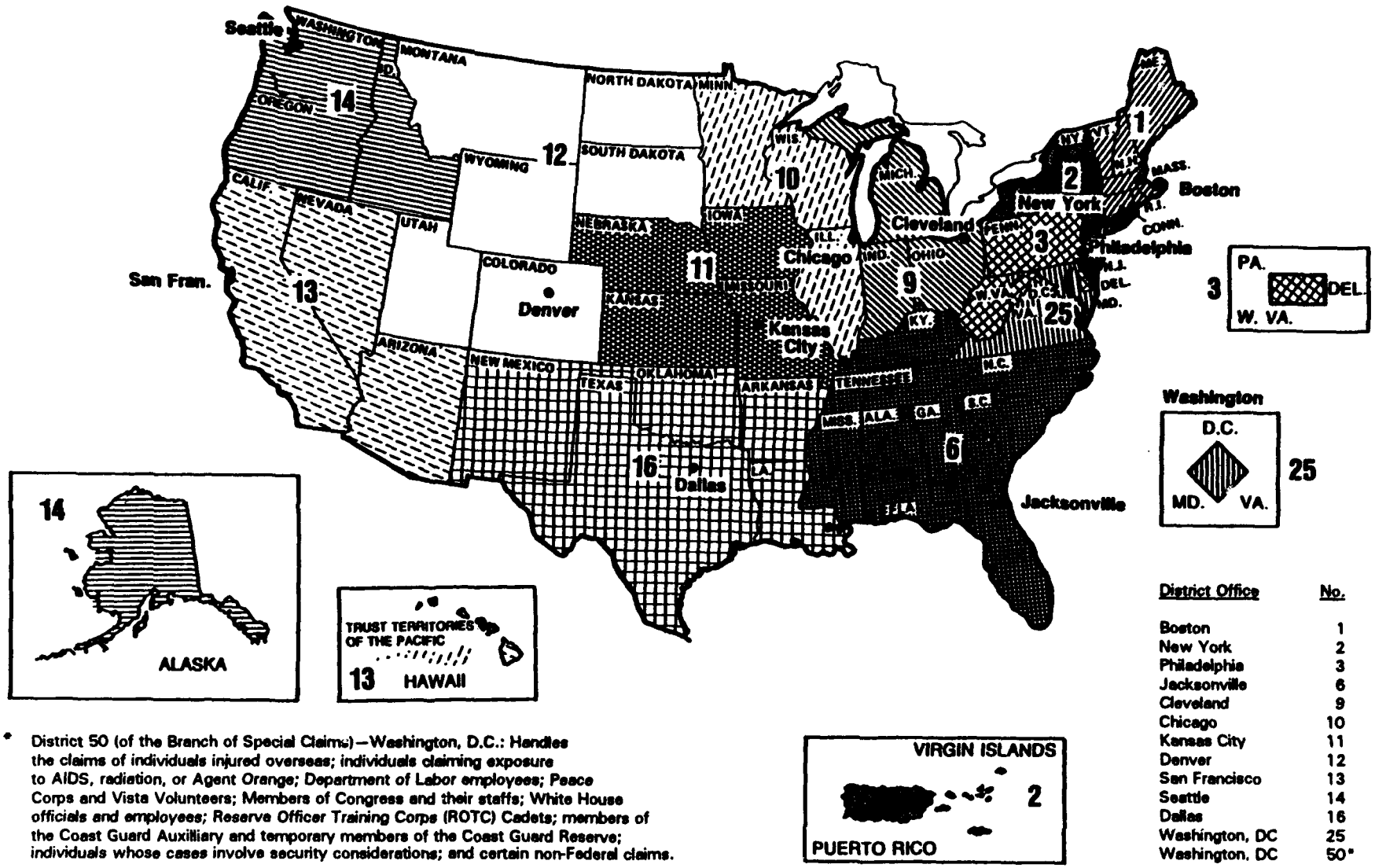
---

* A "mishap" is defined in OPNAVINST 5100.23C ¶1402e as "any unplanned or unexpected event causing personnel injury, occupational illness, death, material loss or damage, or an explosion of any kind whether damage occurs or not." In the current document, "mishap" has been used broadly to refer to any event leading an employee to file a claim for benefits under the Federal Employees' Compensation Act, or as a collective term referring to all work-related injuries and illnesses.

Labor (Parts 1-199), with further guidance provided in the *Federal Personnel Manual*, Chapter 810: *Injury Compensation*.

Authority to administer the Federal Employee's Compensation Act is vested in the Office of Workers' Compensation Programs (OWCP) of the U.S. Department of Labor. OWCP, which administers other federally mandated workers' compensation programs as well (e.g., the Black Lung Benefits Act), is composed of several divisions, among which the Division of Federal Employees' Compensation has responsibility for handling claims originating under the Federal Employees' Compensation Act. The Division, in turn, is comprised of a Branch of Special Claims and 12 district offices, each with jurisdiction for claims arising in its specified geographic area (Figure 3). Claims examiners at the district offices oversee and adjudicate individual claims.

Under the Federal Employees' Compensation Act, the rights, roles, and obligations of injured workers, employing federal agencies (such as the Department of the Navy), and OWCP are precisely delineated. Injured workers have the right to receive compensation for lost wages and to full payment of medical expenses if certain criteria are met (e.g., the claimant is an eligible employee of the federal government and the injury or illness was work-related). The rates of compensation are fixed: For the first 45 days following an injury, payment is at full salary, is subject to taxation, and is paid via the employing agency's payroll as if the worker were still on the job. Thereafter, payment is made by OWCP at two-thirds or three-quarters of an employee's salary (depending on the presence or absence of dependents) and is tax-free. In some cases (called "scheduled awards") compensation will be made for the loss of a body part or its use, and again, the amount of compensation is fixed (although payments may be prorated if the loss is judged to be less



District Office	No.
Boston	1
New York	2
Philadelphia	3
Jacksonville	6
Cleveland	9
Chicago	10
Kansas City	11
Denver	12
San Francisco	13
Seattle	14
Dallas	16
Washington, DC	25
Washington, DC	50*

* District 50 (of the Branch of Special Claims)—Washington, D.C.: Handles the claims of individuals injured overseas; individuals claiming exposure to AIDS, radiation, or Agent Orange; Department of Labor employees; Peace Corps and Vista Volunteers; Members of Congress and their staffs; White House officials and employees; Reserve Officer Training Corps (ROTC) Cadets; members of the Coast Guard Auxilliary and temporary members of the Coast Guard Reserve; individuals whose cases involve security considerations; and certain non-Federal claims.

Figure 3: District office territorial jurisdiction under the Federal Employees' Compensation Act

Source: *Federal Personnel Manual*, Chapter 810: *Injury Compensation*

than 100 percent). Injured federal workers also have the right to choose their own health-care providers and to appeal decisions made by OWCP. In return, they are precluded from obtaining benefits or redress beyond what is provided by the act, they are obligated to submit to OWCP-requested medical evaluations, to return to work as soon as they are able, and to accept assignments or reemployment offers for which they have been deemed medically fit.

Employing agencies may offer medical care at their own facilities, but they cannot insist that these facilities be used. Agencies may challenge, or "controvert," an employee's initial claim to compensation if they believe the claim fails to meet the necessary criteria. And agencies may (and are encouraged to) make offers of "light duty assignment" to injured workers when they have sufficiently recovered. Agencies cannot, however, contest an injured employee's rate of compensation. Nor can they request a hearing before OWCP; in a hearing requested by an employee they are proscribed from questioning the claimant or making any argument (20 CFR 10.135). Indeed, because the Federal Employees' Compensation Act is meant to be nonadversarial, employing agencies are expressly forbidden from "actively participating in the claims adjudication process" (20 CFR 10.140).

OWCP, on the other hand, may review any case at any time. It may require claimants to submit to medical evaluations as frequently as it desires and from health-care providers of its own choosing. And in all cases, OWCP is the final arbiter of entitlement; agencies are entitled to an explanation of OWCP's actions, but must accept its decisions (*Federal Personnel Manual* 810, Subchapter 4-3).

Paperwork and the timeliness of claims processing

Because all affected parties are required to communicate in writing, the filing of an injury or illness claim under the Federal Employees' Compensation Act triggers a complex cascade of paperwork. The key events in this cascade are depicted in Figures 4 and 5, which illustrate the paperwork flow generated by filings for injuries and illnesses, respectively. As one OWCP regional director noted in 1991, the way in which claims are handled, along with the roles of the various participants and the principles for fact-finding and decision-making, is much the same today as it was in 1916.[8] Indeed, the procedure manual for OWCP's claims examiners contains instructions for placing incoming claims materials on a "spindle by punching a hole as near as possible to the center of the document. Material should be aligned at the upper corners. Centered documents are less likely to become ragged at the edges. . . ."[9 Chap. 2-400 ¶2a]

Only a portion of the information generated in this course of events is computerized, and not surprisingly, considerable time can be required to process claims. A "time-lag analysis" conducted by OWCP on claims filed during the period 1 October 1991 to 31 December 1991 revealed that government-wide, 28 percent of the claims filed (32 percent for the Department of the Navy) took more than 45 days from the date of injury to arrive at OWCP.[10] Following receipt, added time still is required for OWCP to adjudicate a claim (that is, accept or deny it for coverage).[11] But regardless of its source, slow claims processing is important in the context of cost control efforts because of its association with increased claims costs.[12, 13]

Figure 4: Paperwork flow for selected forms used in reporting *injuries* to the Office of Workers' Compensation Programs (OWCP)

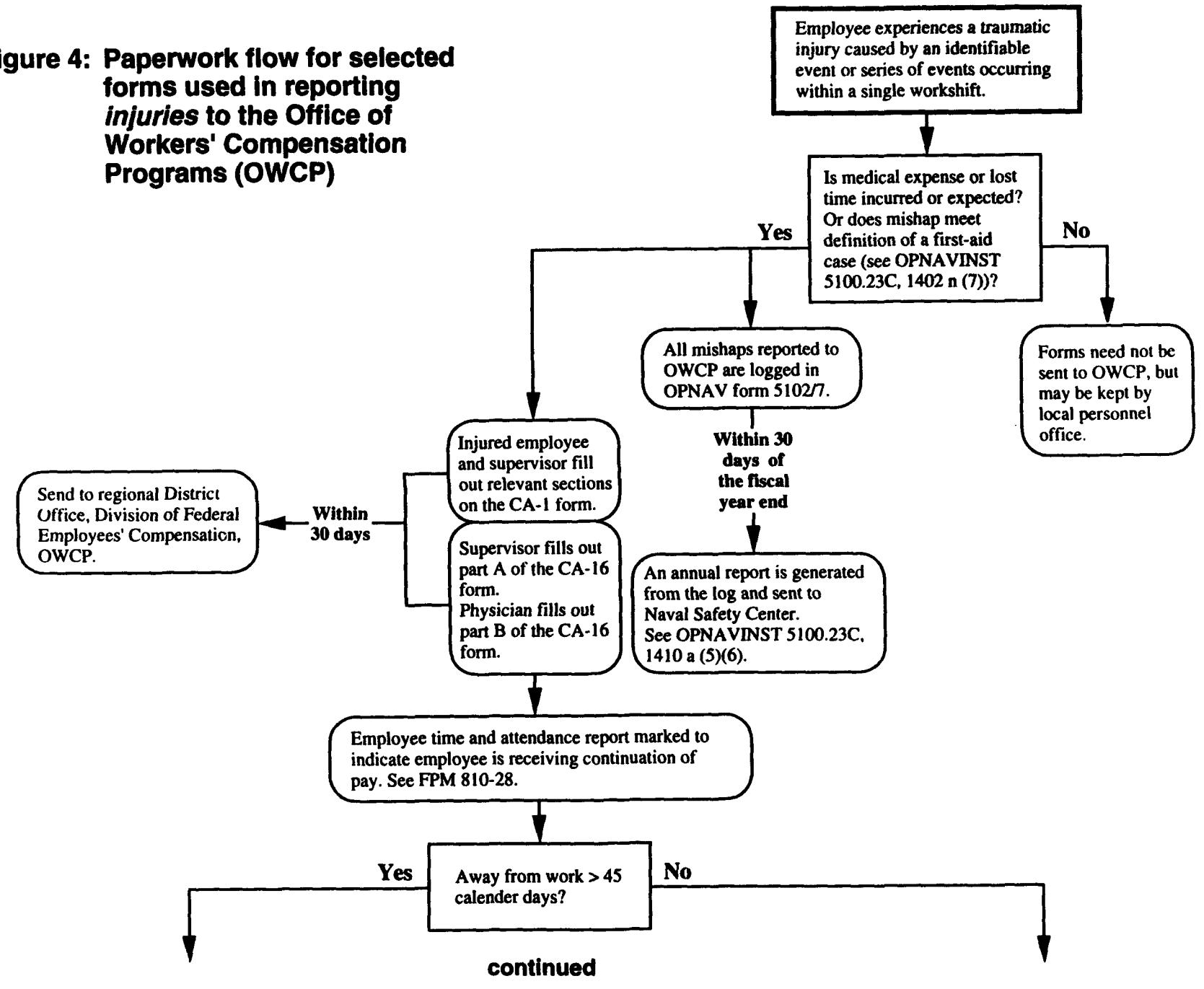


Figure 4: continued

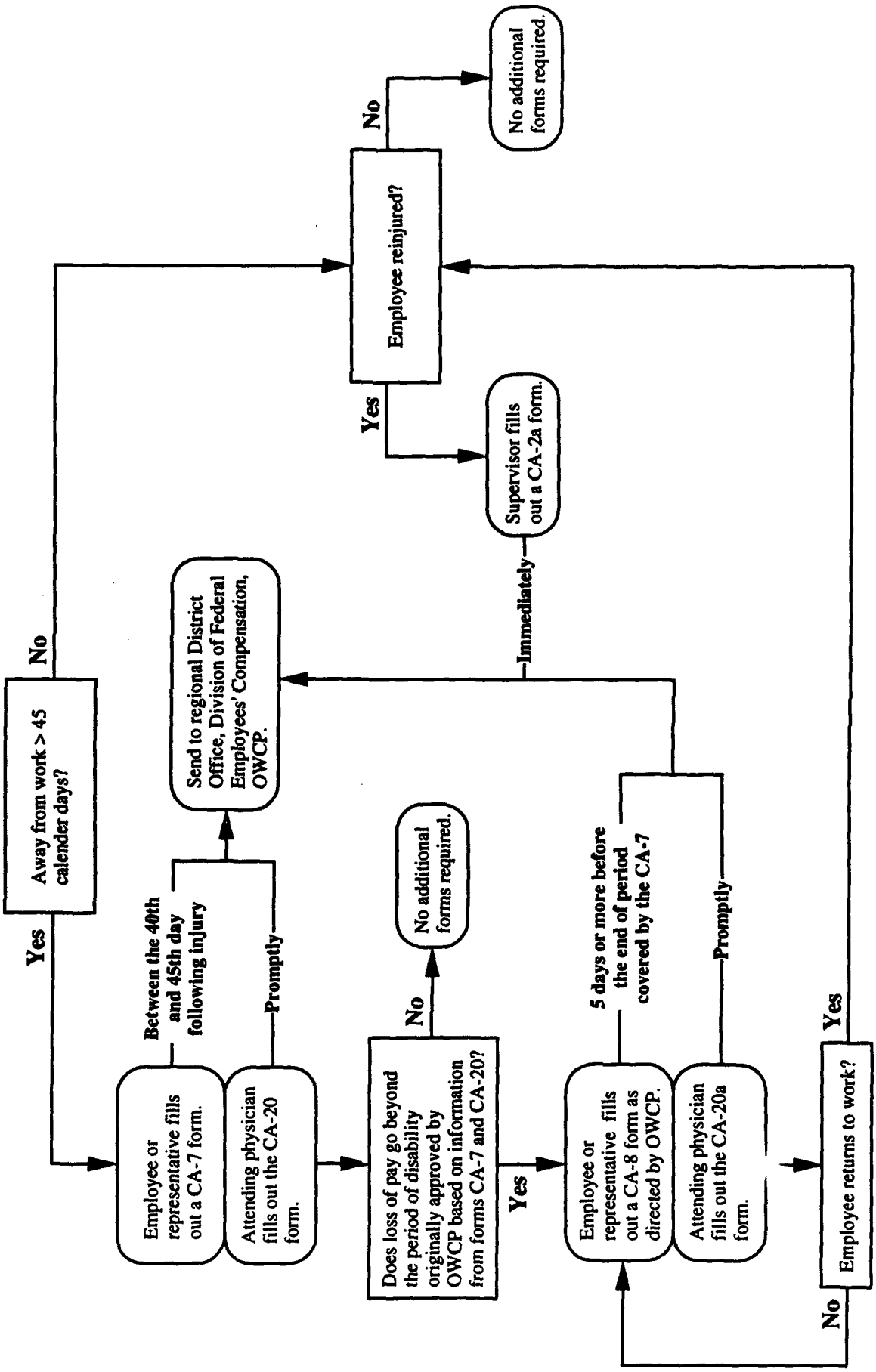
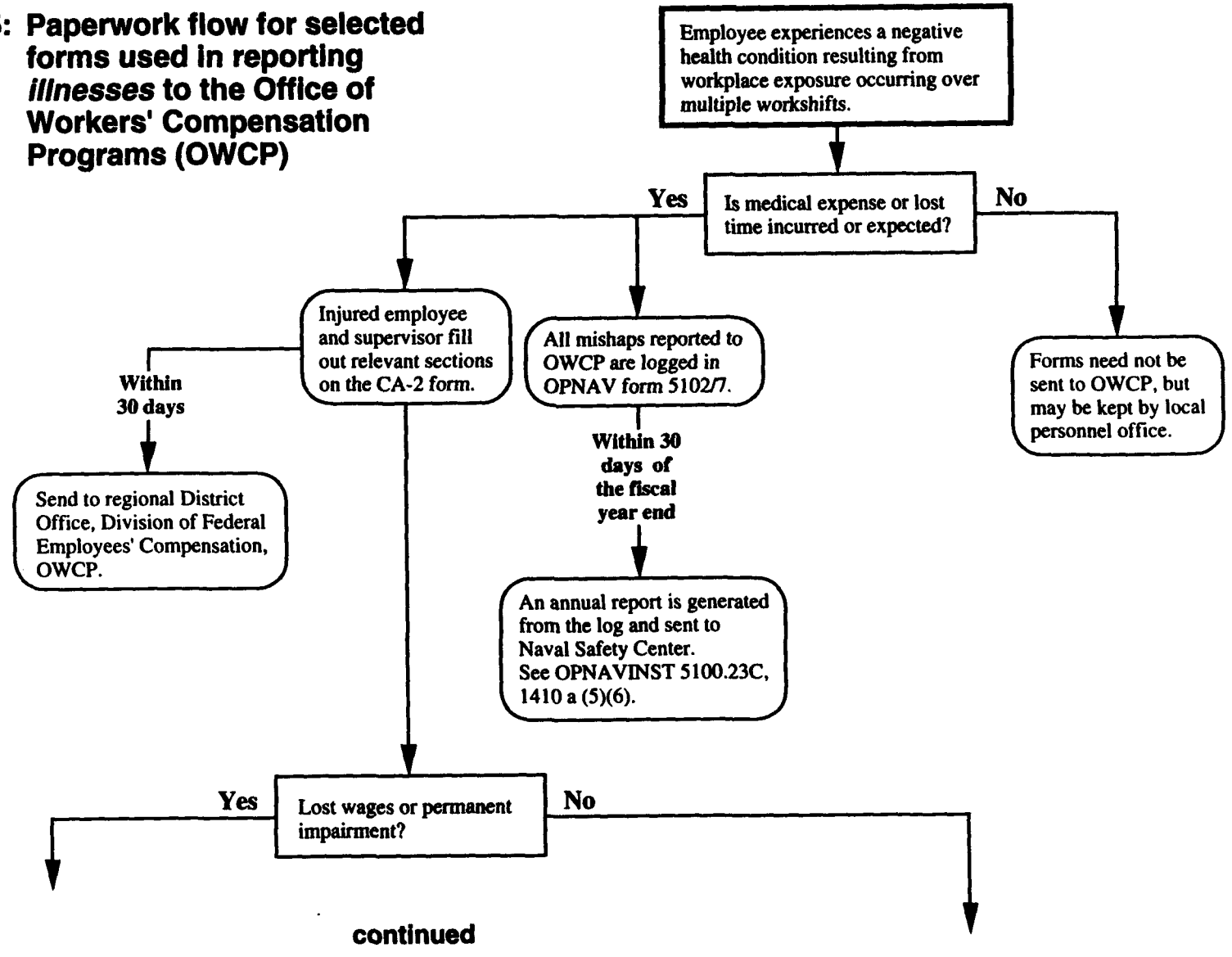
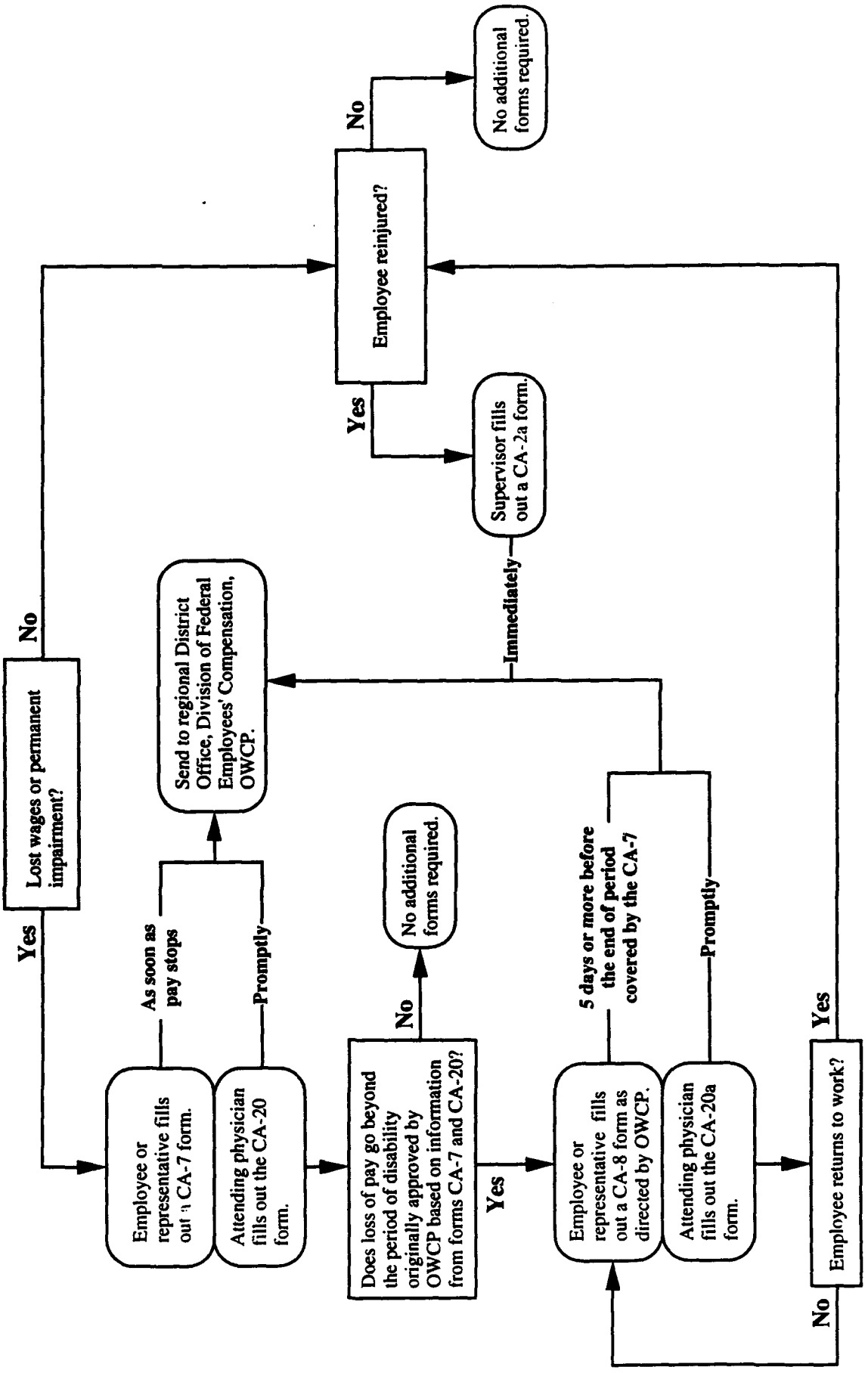


Figure 5: Paperwork flow for selected forms used in reporting *illnesses* to the Office of Workers' Compensation Programs (OWCP)



continued

Figure 5: continued



Chargebacks and the financing of injury and illness claims

The Federal Employees' Compensation Act is financed via the Employees' Compensation Fund. This fund is maintained through chargebacks made by OWCP to the employing federal agencies on whose behalf OWCP has made payments during 12-month periods running from July through June. After OWCP calculates the amount to be charged back to each agency, the agencies include the amount in their budget requests for the next fiscal year; the funds are then deposited in the Employees' Compensation Fund within 30 days after they become available.[14]

The chargeback financing mechanism was first instituted in 1960. Its purpose was to provide federal agencies with an incentive to improve their occupational health and safety performance by making them directly responsible for the costs of work-related injuries and diseases suffered by their workers.[8] In essence, it produced a governmental version of the experience-rating system used by private insurers in which employers with poor safety records and high workers' compensation costs are charged more than employers with good records and low costs.[15]

To further promote accountability, the *Federal Personnel Manual* states that agencies should pay special attention to chargeback billings and "arrange to charge costs to the lowest organizational level practicable in order to make managers more aware of costs" (*FPM* Chapter 810, Subchapter 9-1f.). Accordingly, the Department of Defense Comptroller instituted a policy effective fiscal year 1990 of charging workers' compensation costs (which previously had been centrally paid by each service) back to the individual activity for whom an injured or ill employee had worked. This policy was subsequently reemphasized by the Chief of Naval Operations in a formal instruction noting that the intention of the policy was

"to increase the awareness of local commanders of injury compensation costs incurred at their activities, as well as the impact that their actions can have in reducing future costs."[16] The instruction also reaffirmed the Navy's commitment "to provide a safe work environment."[16]

The Navy Occupational Safety and Health Program

As the preceding discussion makes clear, most of the factors affecting the costs of injuries and illnesses once they have occurred are beyond the control of the Department of the Navy and of individual activities. Payment rates are fixed, selection of health-care providers is in the hands of employees, decision-making powers are held by OWCP exclusively, and the Department has no rights of appeal. However, one cost driver does fall almost completely within the Department's realm of influence: safety.

The Navy's Occupational Safety and Health Program for its civilian work force is detailed in the *Navy Occupational Safety and Health Program Manual.*[5] The *Manual* states policy ("to provide a safe and healthful workplace for all personnel"[5 ¶0104]), assigns responsibilities, prescribes resource allocation and organizational structures, establishes reporting and recordkeeping criteria, and specifies explicit prevention and monitoring programs for a variety of known occupational hazards (e.g., noise and lead exposure). The second edition of the *Manual* was revised substantially seven times in 10 years; the third edition was released in late 1992[5] and represents a sustained effort on the part of the Navy to continually improve its Occupational Safety and Health Program. The Marine Corps' corresponding document is *Marine Corps Order 5100.8E.*[17]

Identifiable expenditures for the program exceeded $179 million in fiscal year 1992; the actual resources devoted were even greater because this total excludes many of the costs of uniformed personnel who provide health or safety services to civilian workers.[6] Implementation of the Navy's Occupational Safety and Health Program is assessed by means of a three-tiered inspection plan including: (1) routine workplace inspections conducted annually (or more often) under authority of activity-level commanding officers, (2) occupational safety and health management evaluations conducted at least every three years at subordinate commands under authority of Echelon 1 and 2 commanders, and (3) comprehensive oversight inspections conducted under the auspices of the Navy Inspector General. The latter are meant "to evaluate all aspects of the Navy Occupational Safety and Health Program"[5 ¶0906a] and are primarily conducted at large, industrialized facilities such as shipyards and aviation depots; results from these inspections are entered into a centralized database maintained by the Navy Inspector General's *Oversight Inspection Unit* and are used in part to help assess the efficacy of the overall program.

RATIONALE FOR A MODEL

Despite the effort and resources devoted to implementing the Navy's Occupational Safety and Health Program and to ensuring adherence to its requirements, costs for occupational mishaps to civilian employees are still increasing (Figures 1 and 2). This poses numerous questions. Is the increase due to rising costs per case? To an increasing rate of cases? Or both?

It is also unclear how well either of these factors is understood. Medical inflation, for instance, has obviously been driving up the cost per case. But has the actual increase exceeded that expected from inflation? And if so, why? As for rates, the Navy's

occupational injury and illness case rate for its civilian workers has reportedly been decreasing since at least fiscal year 1988.[18] This should have been associated with an accompanying reduction in costs (or at least their rate of increase)—but only if those cases from which the rates are compiled are the same as those from which the Navy's workers' compensation bills are generated. Anecdotal reports suggest, however, that minor injuries not associated with compensation costs are reported to OWCP (the source of the data from which the Navy case rates are calculated) with varying degrees of rigor by different activities. Moreover, the bulk of the costs OWCP charges back in any given year are for cases originally occurring many years previously and which were likely to have been unaffected by current trends; for instance, 30 percent of the cases and *73 percent* of the costs on the Department of the Navy's 1990 chargeback bill are for mishaps that originally occurred before 1988. This means the underlying trend for the rates of injuries and illnesses actually driving workers' compensation costs is currently unknown. (*This type of difficulty* in analyzing and interpreting data on occupational injuries and illnesses is far from unique.[19] The U.S. Bureau of Labor Statistics, for instance, appears for years to have been underestimating by a factor as great as nine the rates in private industry of injury and illness-related lost workdays—the Bureau's primary measure of mishap severity—because of flawed methodology.[20])

Equally uncertain are the effects of the Navy's three-tiered occupational safety and health inspections. Initial analyses by our research team suggested that higher scores on the "program" component of the Navy Inspector General Oversight Inspection Unit inspections tended to be associated with lower injury rates.[21] However, subsequent analyses using more sophisticated statistical techniques have called these initial findings into question.[22]

Other researchers have found similarly conflicting results and the issue of whether inspections affect injury rates remains a topic of vigorous debate.[23] Both Viscusi[24] and Ruser and Smith,[25] for instance, found inspections administered by the Occupational Safety and Health Administration (OSHA) to be unrelated to injury rates. Robertson and Keeve, on the other hand, showed that OSHA inspections were associated with injury rates if the data were disaggregated by objective and subjective injuries and if they controlled for the effect of increasing workers' compensation payment rates.[26] OSHA itself obtained similarly inconclusive results when asked to demonstrate the efficacy of the medical surveillance programs it had imposed on industry. After collecting data from more than 7,000 businesses, OSHA's principal analytic approach was to catalog the respondents' medical surveillance programs then relate facets of the programs to a variety of subjective impressions (e.g., perceived effects on employee relations).[27, 28] An attempt was made in the agency's *Draft Final Report* to relate medical surveillance programs to "hard" outcomes (i.e., illness rates). However, the relevant regression results (which showed significant associations of medical surveillance programs with reported illness rates among large manufacturing firms using the most hazardous materials[27]) were excluded from the published report of the study because of problems in the analysis.[28] Private industry appears to be having equal difficulties in the area, for the OSHA survey did find that among a subgroup of companies studied in detail, none had performed quantitative analyses of the effects of their medical surveillance programs on illness or injury rates because most "simply . . . did not know how."[28 p.696]

As these examples illustrate, assessing trends in an organization's costs due to occupational injuries and illnesses, along with the efficacy of its cost control and occupational

safety and health programs, is difficult at best. Without question, the effort can yield both lowered mishap rates and costs.[12,19,29] But meaningful results require access to appropriate databases, experience with the data sets to be used, the informed use of sophisticated analytic techniques, perseverance, and a rational framework for organizing data and guiding their analysis—that is, a model.

Exploiting performance variation among activities

These same requirements apply to the assessment of the various etiologic-specific program components mandated in the *Navy Occupational Safety and Health Program Manual*[5] (e.g., the Hearing Conservation Program). They apply if cost-effectiveness comparisons are to be made between program components ("Does an investment in hearing conservation produce greater or lesser savings than an equal investment in ergonomics?"). And they apply to the assessment of individual activities.

Also required (and indeed, exploited) are individual variations in performance. As Table 1 shows, even among Navy activities similar in nature—in this case, shipyards—there are substantial differences in mishap rates and their associated costs. Fourfold differences exist between shipyards with the highest and lowest mishap rates. Cost per employee varies even more.

This type of variation potentially offers the means of identifying "good" or "bad" performers, but only if competing explanations for the differences in question are first taken into account. Differences in outcome (e.g., mishap rates) may be due to differences in performance (e.g., Occupational Safety and Health Program effectiveness). But they may also be due to factors such as an activity's mission or the composition of its work force. A shipyard, for instance, will have a higher injury rate than an administrative facility, no

Table 1

Incidence Rates and Costs Accrued Through Two Years for Lost-Time Injuries and Illnesses Newly Occurring In Navy Shipyards During the 12 Months Ending 30 June 1992*

Shipyard	Incidence rate (new lost-time cases per 100 full-time employees**)	95% confidence inverval	Mean cost per case (two-year accrued costs***), in dollars	Cost per employee (two-year accrued costs***), in dollars
A	1.91	1.46—2.42	4,933	94
B	4.54	3.83—5.31	1,911	87
C	5.13	4.53—5.77	2,417	124
D	5.37	4.48—6.33	2,042	110
E	6.84	6.15—7.56	2,462	168
F	7.32	6.42—8.29	7,297	534
G	8.08	7.14—9.08	2,216	179
H	8.52	7.25—9.90	5,519	470
overall	5.82	5.61—6.04	3,417	199

* Source: OWCP annual chargeback summary tapes as provided by the Office of Civilian Personnel Management, Department of the Navy.

** Excludes cases filed but not accepted by OWCP

*** Costs shown are the sum of all payments made by OWCP in the original injury year (1 July 1991 to 30 June 1992) plus those made in the single subsequent year for which data were available, i.e., through 30 June 1993.

Under the Federal Employees' Compensation Act, as in private industry, the bulk of all costs are generated by a minority of cases for which payments continue over many years. For this reason, the costs incurred on behalf of a cohort of injured workers in the first few years following their injuries represent only a small portion of the total amount that eventually will be paid. Cost and actuarial studies[1, 30] show that the eventual total cost for a lost-time illness or injury among Department of the Navy civilian employees is approximately nine times the amount paid out the first two years. This means the average projected total cost for the lost-time cases in Table 1 exceeds $30,000. For the eight Navy shipyards, 3,529 such cases occurred in the year shown, which will result in an eventual cost of more than $108 million. This total excludes an additional $3.6 million that was paid directly to injured workers by the shipyards in the form of continuation of pay.[31]

matter how well run the former's occupational safety and health program or how poorly the latter's.

A further example of the importance of taking such factors into account can be seen in Figures 1 and 2, which illustrate trends in the Department of the Navy's direct costs from occupational mishaps during the period 1982 to 1992. Figure 1 shows these costs increasing 82 percent when graphed in current, or "nominal," dollars. This trend appears less worrisome when inflation is taken into account (Figure 2). However, the size of the Department's civilian work force has been decreasing during the period shown (among blue-collar workers, who experience the overwhelming proportion of occupational mishaps, there has been a 25 percent reduction in the Department's work force from 1982 to 1992), and adjusting the data additionally to show costs as if the size of the work force had remained constant would therefore reveal a steeper "real" increase than that shown in Figure 2. (This latter adjustment was not calculated because the requisite data—annual OWCP payments broken down by injury year cohorts and dating back to the year in which the first cohort receiving payment was injured—are not available.)

As this example shows, meaningful data interpretation often depends on finding suitable methods of adjustment. In particular, the need to control for key differences in groups or institutions when making comparisons using statistical models based on administrative- or claims-based data, has been described by Roos et al.[32] They note that testing hypotheses about the relationship between interventions (e.g., safety programs) and outcomes, distinguishing the better of two interventions, or identifying performers with especially good (or especially poor) results all depend on proper adjustments with the right covariates.

AN OCCUPATIONAL MISHAP COST-REDUCTION MODEL FOR THE NAVY

The impetus for using administrative- and claims-based data to help better understand the Navy's escalating workers' compensation costs is contained in a 1991 *Tentative Medical Requirement.*[33] The *Requirement* points out that large quantities of data are routinely generated and stored in the course of implementing and monitoring the Navy's Occupational Safety and Health Program and in the course of paying compensation expenses for workers suffering occupational mishaps. The *Requirement* notes further that the existence of these data represents an opportunity for assessing aspects of the Navy's Occupational Safety and Health Program, but that before this opportunity can be realized the data must be integrated and organized.

Figure 6 presents a proposed Mishap Cost-Reduction and Quality Assessment Model for the Navy Occupational Safety and Health Program. The Model is based on theoretical assumptions and empirical findings from the relevant literature, as well as consideration of what data are currently available from centralized sources. An overview of these data sources is provided below; a detailed description of the specific variables planned for extraction from these sources and incorporation into the Model appears in the Appendix, with the variables grouped into "domains" corresponding to those shown in the Model and categorized by whether they are fixed or modifiable.

The Model in Figure 6 is presented first in overview, then in four parts. The overview (Figure 6) depicts the broad influences on workers' compensation costs proposed in the Model: combinations of risk factors lead to mishaps, combinations of case management factors lead to costs per case, and the two multiplied together (number of cases times cost per case) give overall cost, which can be standardized as cost per employee. The first part

of the Model (Figure 6a) shows the hypothesized relationship for a given facility between those variables that cannot be changed via the Navy's Occupational Safety and Health Program (e.g., the mean age of a facility's work force) and the illness and injury rates which would be "expected" given these unalterable circumstances. Figure 6b shows the hypothesized relationship between those variables which *can* be changed (e.g., safety inspection scores) and residualized injury and illness rates—that is, the difference between a facility's actual and expected rates. Various aspects of a facility's ability to manage its cases and their attendant costs are unalterable; Figure 6c shows these factors and their hypothesized influences. And finally, some aspects of case management are under facilities' control and the proposed relationship between these variables and the difference between a facility's actual and expected costs is shown in Figure 6d. Breakdown of the Model in this fashion allows for the separate analysis, if desired, of explicit safety and health outcomes (i.e., injury and illness rates), of various cost drivers, and of the combined effects of all these factors on overall total costs.

Application of the Model to a hypothetical example

Figure 7 presents a decision-making algorithm showing how the costs of occupational injuries and illnesses at an individual facility might be analyzed through application of the Model. Such an application can be further illustrated with a hypothetical example.

A particular facility with 1,000 civilian employees, for instance, might report 100 occupational mishaps in a year, with an eventual projected cost for these cases of $1 million, or $1,000 per employee. In contrast, suppose the per-employee cost for occupational mishaps Navywide is $250. Obviously, the facility's per-employee cost exceeds that of the Navy as a whole. Suppose, however, that blue-collar workers comprise 50 percent of the

Overview

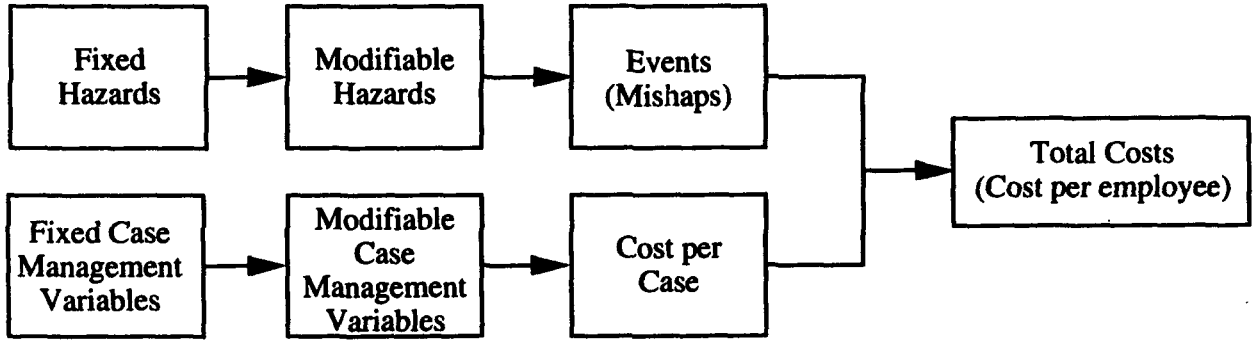


Figure 6: Mishap Cost-Reduction and Quality Assessment Model for the Navy Occupational Safety and Health Program

Relationship of fixed hazard variables to expected mishap rates

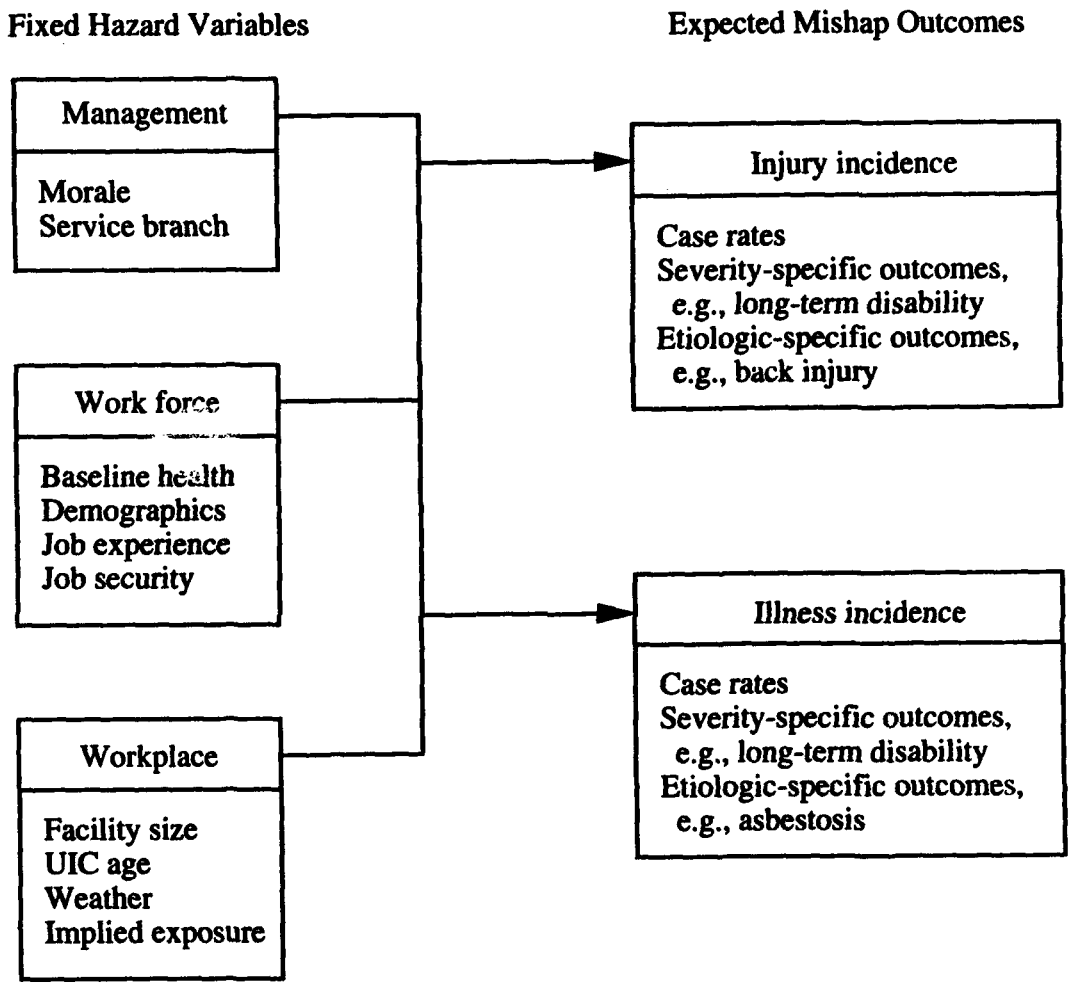


Figure 6a: Mishap Cost-Reduction and Quality Assessment Model for the Navy Occupational Safety and Health Program

Note: Specific variable definitions are provided in the Appendix.

Relationship of modifiable hazard variables to residualized mishap rates

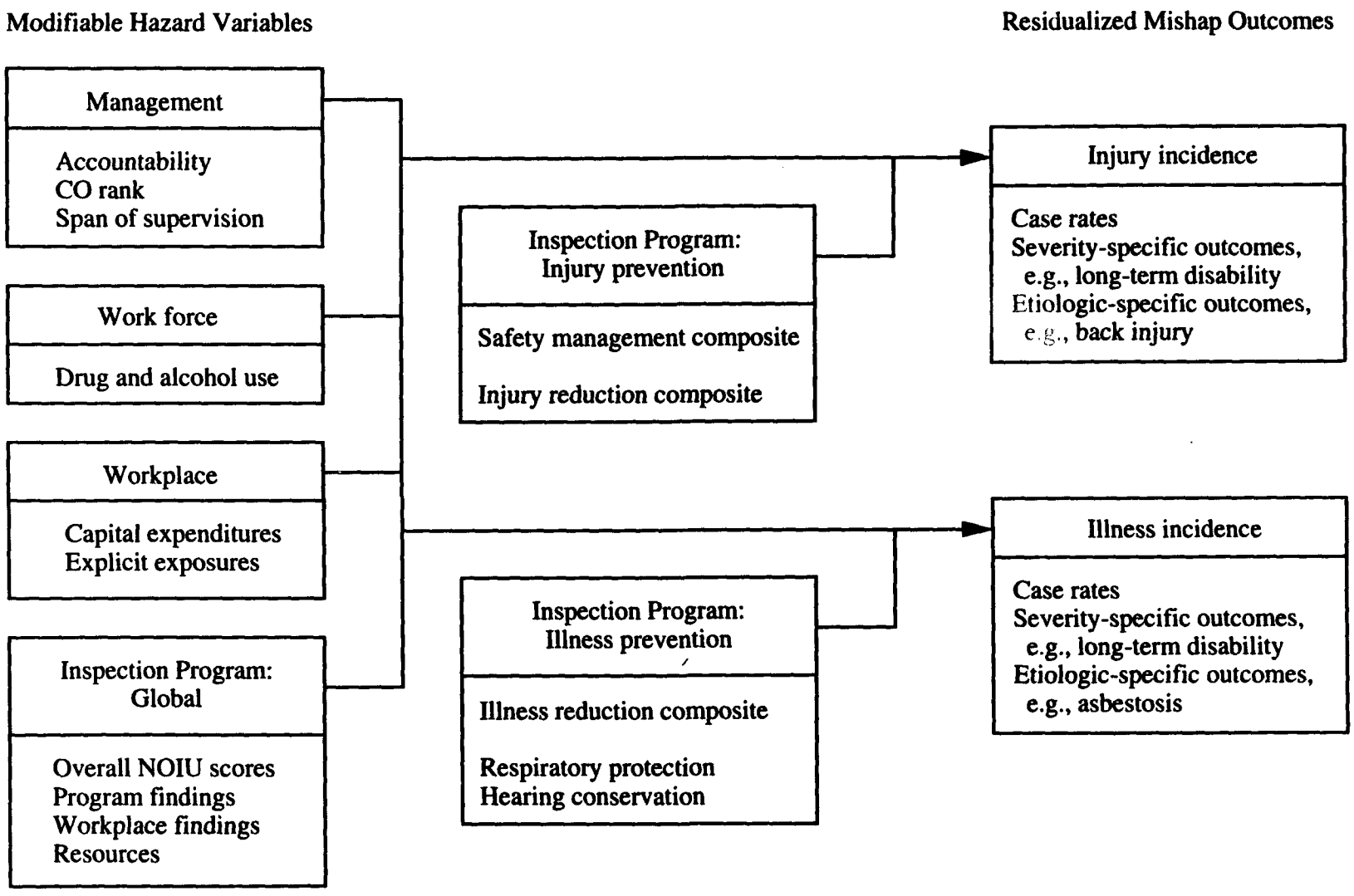


Figure 6b: Mishap Cost-Reduction and Quality Assessment Model for the Navy Occupational Safety and Health Program

Note: Specific variable definitions are provided in the Appendix.

Relationship of fixed case management variables to expected cost per case

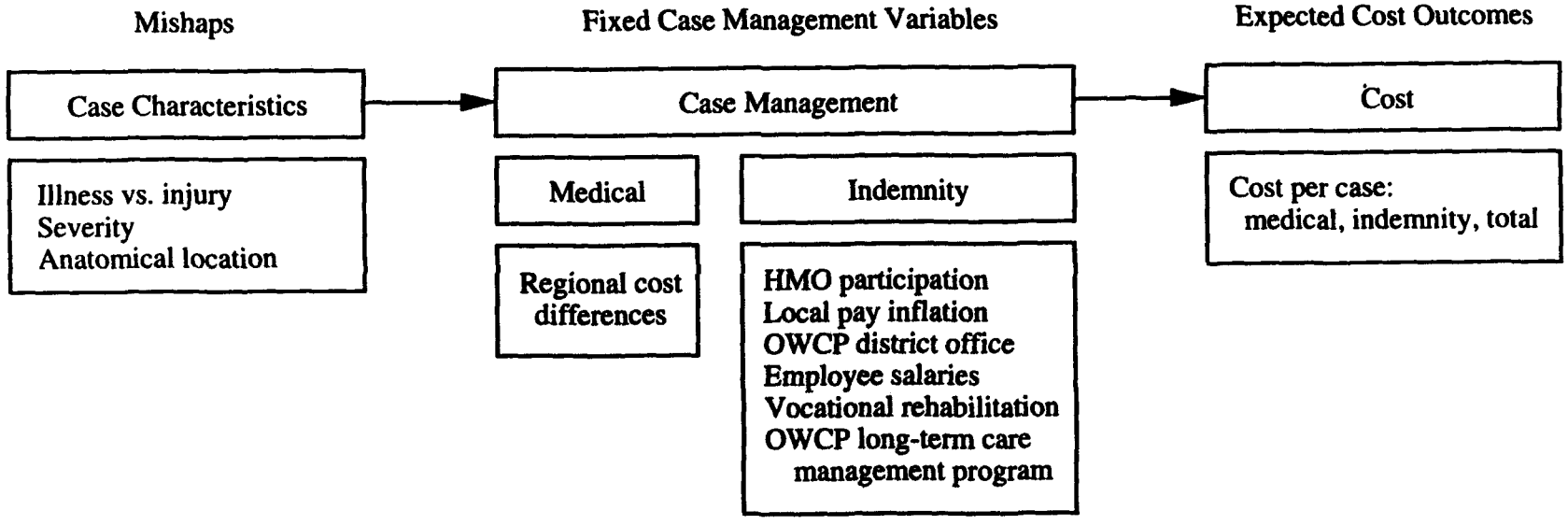


Figure 6c: Mishap Cost-Reduction and Quality Assessment Model for the Navy Occupational Safety and Health Program

Note: Specific variable definitions are provided in the Appendix.

Relationship of modifiable case management variables to residualized cost per case

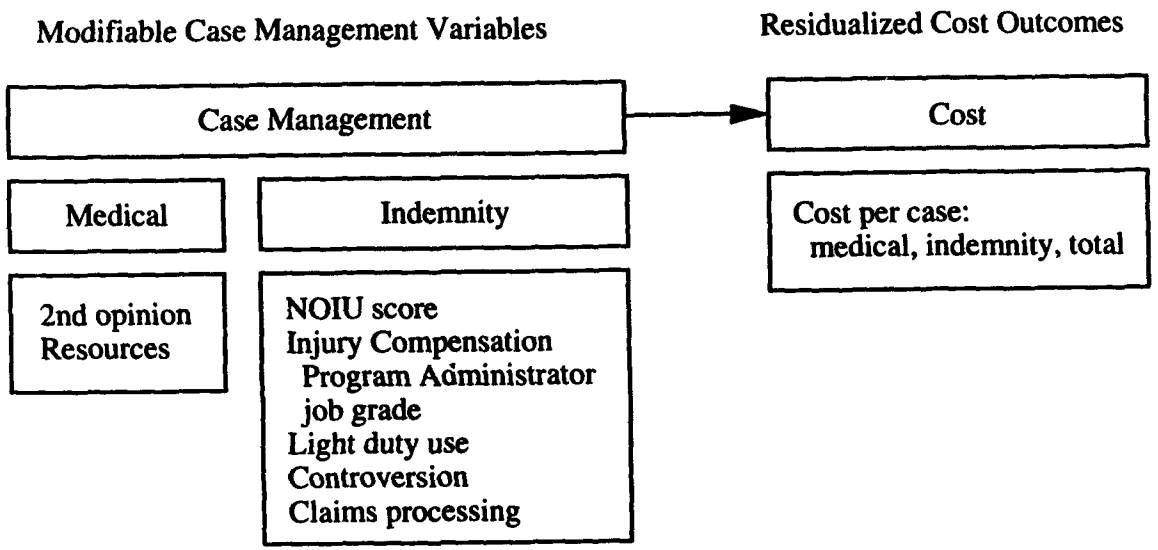


Figure 6d: Mishap Cost-Reduction and Quality Assessment Model for the Navy Occupational Safety and Health Program

Note: Specific variable definitions are provided in the Appendix.

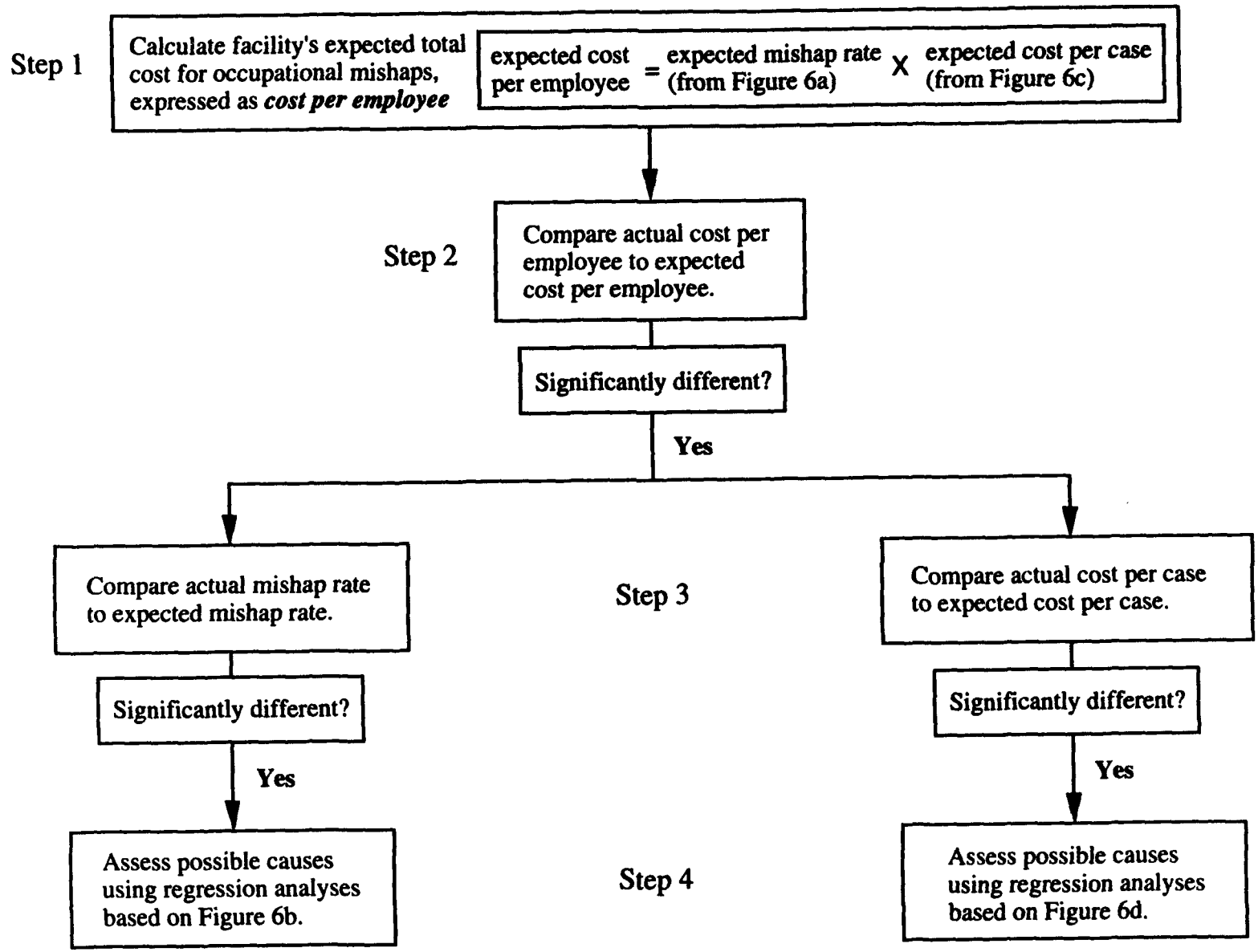


Figure 7: Algorithm for application of the Mishap Cost-Reduction and Quality Assessment Model to the analysis of occupational mishaps at an individual facility

facility's work force and that it is located in an expensive urban area where medical costs are 150 percent of the national average. Are the facility's costs still excessive? And if so, why?

Step 1 in the algorithm calls for using the Model to begin answering these questions by calculating, as shown in Figures 6a and 6c, the rate of mishaps and the cost per case that would be "expected" given circumstances of the facility that cannot be changed. In this case, doing so might indicate an expected mishap rate, given the high percentage of blue-collar workers, of 7 per 100 (as opposed to the observed 10 per 100) and an expected cost per case, given the area's high cost of medical services, of $10,500. Together, these expected figures yield an expected cost per employee for the facility of $735 (70 expected cases times an expected $10,500 cost per case / 10,000 employees). In Step 2, a one-sample t-test would be used to determine if the difference between the facility's expected $735 cost per employee and its actual $1,000 cost per employee was statistically significant.

Step 3 assumes this difference is significant and that it is important to know why. (Higher-than-expected rates? Higher-than-expected costs per case? Or both?) Each of these questions can be addressed statistically (using a one-sample test for proportions for the rate difference and a one-sample t-test for the difference in cost per case). In this hypothetical example, this facility's cost per case is actually *less* than would be expected given the prevailing high cost of medical services in its locale. Its mishap rate, however, is significantly greater than expected, even given the facility's large proportion of blue-collar workers. Step 4 calls for examining the possible reasons for this excess through the use of regression analyses based on Figure 6b of the Model; for instance, this facility might be found to have an inadequate safety program.

DATA SOURCES AND STUDY SAMPLE

Inevitably, data collected for claims or other administrative purposes have various quirks and shortcomings when used for research purposes. These have been commented on by previous researchers[19, 34]—some of whom have found themselves completely thwarted in their attempts to make use of such data[35]—and can include such problems as erratic case classification, incomplete records, coding errors, and limitations or idiosyncracies in one data set that preclude or limit the use of another.

Our research team has performed an overview of the potential Navy data sources available for use in the Mishap Cost-Reduction Model and our initial findings have been consistent with the experiences of these early workers. For instance, the only source of case-level cost and mishap data is OWCP, to which events are reported for the payment of compensation claims. The data from OWCP, whose chargeback year runs from 1 July to 30 June, include a code identifying an injured worker's employing activity; using this code and denominator data from the Department of the Navy's Office of Civilian Personnel Management, it is possible to calculate event rates for individual activities. To establish the reliability of these data, it would be useful to correlate them with rate data independently collected by the Naval Safety Center.[5] However, the case reporting criteria used by the two organizations are not always consistent, the Safety Center does not collect individual-level data, and the time frame for its data collection corresponds to that of the federal fiscal year (1 October to 30 September). This means it is not possible to correlate data from these two sources and that given the necessity of using the first, the second is of limited value. Similar problems became apparent with other data sources containing otherwise potentially useful information.

Figure 8 shows the data sources planned for use in the Model and the time periods from which data will be extracted. To help strengthen the causal plausibility of the Model's results, independent (i.e., predictor) variables are being extracted from data entries no later than 30 June 1991; dependent (outcome) variables are being extracted from data entries occurring on or after 1 July 1991. Additional comments on the planned data sources are provided below.

Office of Civilian Personnel Management: Study sample

The Policy Analysis and Information Branch, Office of Civilian Personnel Management, Department of the Navy, publishes routine reports on various demographic aspects of the Department's civilian work force. Data from the Office's report of 30 June 1991 were used to identify the 150 Department of the Navy facilities having the largest U.S. citizen civilian work forces as of that date.[36] These 150 facilities, identified by Unit Identification Codes, are listed in Table 2. The Model relies on variables (listed in the Appendix) generated from data describing these facilities.

To minimize the effect of potential cultural differences, four facilities in Guam and Puerto Rico that would have qualified based on size were excluded from the sample. Although comprising less than 10 percent of the Department's 1,544 facilities employing civilian workers on 30 June 1991, the 150 facilities selected nonetheless employed 80 percent of all civilians working for the Department at that time. Most of the Department's workers' compensation costs are generated by its large industrial facilities (e.g., shipyards and aviation rework and repair depots), and all of these facilities are included in the sample. Also shown in Table 2 is the percentage of each facility's work force comprised of blue-collar workers, which previous work has shown is related to injury and illness rates.[22]

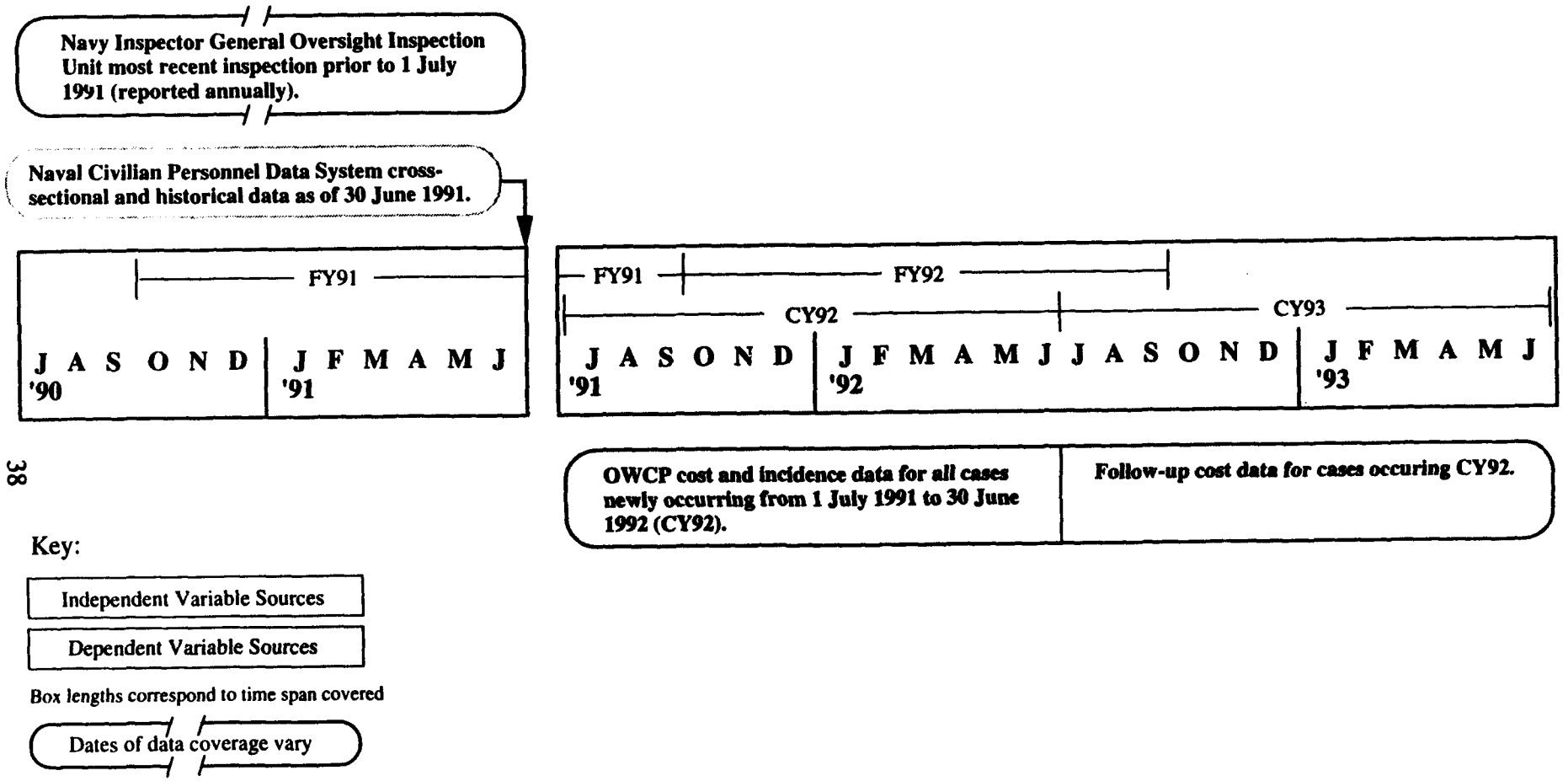


Figure 8: Mishap Cost-Reduction and Quality Assessment Model for the Navy Occupational Safety and Health Program: Planned dates of data coverage

Table 2

Department of the Navy Facilities Employing Civilians: Largest 150 Facilities as of 30 June 1991, in Descending Order by Work Force Size

Unit Identification Code and facility description		Location	Pop.	Percent blue-collar
00251	PUGET SOUND NAVSHIPYD	Bremerton, WA	11470	64.21
00181	NORFOLK NAVSHIPYD	Portsmouth, VA	11369	69.74
00191	NAVSHIPYD	Charleston, SC	7501	66.00
00102	NAVSHIPYD	Portsmouth, NH	7054	60.80
00221	NAVSHIPYD	Mare Island, CA	7032	61.02
00151	NAVSHIPYD	Philadelphia, PA	6925	74.11
00311	NAVSHIPYD	Pearl Harbor, HI	5332	67.99
60530	NAVWPNSCEN	China Lake, CA	5239	6.68
60921	NAVSWC	Dahlgren, MD	5156	9.41
65887	NAVAVNDEPOT	Norfolk, VA	4385	63.15
65888	NAVAVNDEPOT	North Island, CA	4375	56.27
63126	COMPACMISTESTCEN	Point Mugu, CA	4272	12.59
00164	NAVWPNSUPPCEN	Crane, IN	4031	16.08
60258	NAVSHIPYD	Long Beach, CA	3965	73.90
65885	NAVAVNDEPOT NAS	Alameda, CA	3930	63.72
65889	NAVAVNDEPOT	Pensacola, FL	3775	66.38
00163	NAVAVIONICCEN	Indianapolis, IN	3539	25.49
00253	NAVUSEAWARENGSTA	Keyport, WA	3532	40.97
66604	NUSC	Newport, RI	3434	5.07
00104	SPCC	Mechanicsburg, PA	3350	4.99
00173	NRL	Washington, DC	3226	8.59
65886	NAVAVNDEPOT	Jacksonville, FL	3199	61.96
65923	NAVAVNDEPOT	Cherry Point, NC	3071	65.29
66001	NAVOCEANSYSCEN	San Diego, CA	3012	1.83
00421	NAVAIRTESTCEN	Pax River, MD	2917	7.30
00174	NORORDSTA	Indian Head, MD	2808	28.95
42192	NAVSEA-OPER SUPP FLD	Washington, DC	2777	0
62381	MSC	Bayonne, NJ	2759	83.18

Table 2, continued:

Department of the Navy Facilities Employing Civilians: Largest 150 Facilities as of 30 June 1991, in Descending Order by Work Force Size

Unit Identification Code and facility description		Location	Pop.	Percent blue-collar
00167	DTNSRDC	Betheada, MD	2688	12.17
00189	NSC	Norfolk, VA	2672	52.69
62269	NAVAIRDEVCEN	Warminster, PA	2614	6.92
67004	MCLB	Albany, GA	2572	39.58
00197	NAVORDSTA	Louisville, KY	2528	53.44
62383	MSC PAC AREA	Oakland, CA	2405	84.78
63394	NAVSHIPWPNSYSENGSTA	Port Hueneme, CA	2377	0.97
00383	ASO	Philadelphia, PA	2332	8.10
68335	NAVAIRENGCEN	Lakehurst, NJ	2298	18.36
63387	PWC	San Diego, CA	2290	60.04
00187	PWC	Norfolk, VA	2143	69.81
67001	MCB	Camp Lejeune, NC	2133	40.74
42191	NAVAIR-OPER SUPP FLD	Washington, DC	1906	0
62204	MCLB	Barstow, CA	1786	65.12
65540	NAVSSES	Philadelphia, PA	1730	12.31
00109	WPNSTA	Yorktown, VA	1623	45.84
00161	USNA	Annapolis, MD	1502	38.35
00146	MCAS	Cherry Point, NC	1412	43.34
60701	WPNSTA	Seal Beach , CA	1346	35.74
00367	FLEMATSUPPO	Mechanicsburg, PA	1345	0
62583	CBC	Port Hueneme, CA	1316	26.98
68378	PWC	San Francisco, CA	1307	64.65
62755	PWC	Pearl Harbor, HI	1294	56.96
00681	MCB	Camp Pendleton, CA	1288	50.93
61331	NAVCOASTSYSCEN	Panama city, FL	1284	10.12
60036	WPNSTA	Concord, CA	1270	51.26
00259	NAVHOSP	San Diego, CA	1262	18.30

Table 2, continued:

Department of the Navy Facilities Employing Civilians: Largest 150 Facilities as of 30 June 1991, in Descending Order by Work Force Size

Unit Identification Code and facility description		Location	Pop.	Percent blue-collar
00183	NAVHOSP	Portsmouth, VA	1215	8.40
61339	NAVTRASYSCEN	Orlando, FL	1195	1.00
68381	NAVSEA PMO	Washington, DC	1191	0
00244	NSC	San Diego, CA	1172	42.49
00264	MCCDC	Quantico, VA	1172	40.02
68438	TRIREFFAC BANGFOR	Bremerton, WA	1139	65.94
00168	NAVMEDCOM NATCAPREG	Bethesda, MD	1120	20.45
64267	NAVWARFARE ASSMT CTR	Corona, CA	1084	1.01
62474	WESTNAVFACENGCOM	San Bruno, CA	1064	0.38
00193	WPNSTA	Charleston, SC	1050	48.10
00612	NSC	Charleston, SC	976	27.56
44466	TRIREFFAC	Kings Bay, GA	971	62.31
62980	COMNAVMILPERSCOM	Washington, DC	960	1.35
00027	MANAGEMENT HDQTRS MC	Washington, DC	958	0.10
68322	NAVEDTRAPRODEVCEN	Pensacola, FL	954	2.62
62306	NACOCEANO	Stennis Space Ctr, MS	946	0.42
62271	NAVPGSCOL	Monterey, CA	854	12.30
00228	NSC	Oakland, CA	853	12.66
42200	NAVELEX PO	Arlington, VA	822	0
64281	NAVSEA NORFOLK DET	Norfolk, VA	818	0
62467	SOUTHNAVFACENGCOM	Charleston, SC	817	0.12
62470	LANTNAVFACENGCOM	Norfolk, VA	796	0
60478	WPNSTA	Earle Colts Neck, NJ	756	43.92
62472	NAVFACENGCOMNORDIV	Philadelphia, PA	750	0.27
00246	NAS NO ISLE	San Diego, CA	735	25.17
60050	MCAS EL TORO	Santa Anna, CA	727	41.40
62376	NAVAIRPROPCEN	Trenton, NJ	716	39.80

Table 2, continued:

Department of the Navy Facilities Employing Civilians: Largest 150 Facilities as of 30 June 1991, in Descending Order by Work Force Size

Unit Identification Code and facility description		Location	Pop.	Percent blue-collar
00171	COMNAVDIST	Washington, DC	701	37.23
00619	NAVHOSP	Oakland, CA	701	17.83
00406	NSC PUGET SOUND	Bremerton, WA	672	24.85
65114	PWC	Pensacola, FL	664	70.18
68166	NISC	Suitland, MD	628	1.43
63042	NAS	Lemoore, CA	604	36.59
65584	NAVELEXSYSENGCEN	San Diego, CA	601	6.66
00216	NAS	Corpus Christi, TX	596	37.75
65912	NAVSEACENLANT	Portsmouth, VA	596	0.84
00129	SUB BASE	New London, CT	593	40.98
62661	NETC	Newport, RI	593	41.48
65913	NAVSEACENPAC	San Diego, CA	593	1.01
62849	NAESU	Philadelphia, PA	590	0
65113	PWC	Great Lakes, IL	580	70.69
62813	NAVSTA	Pearl Harbor, HI	561	7.66
00604	NSC	Pearl Harbor, HI	561	36.90
00207	NAS	Jacksonville, FL	557	15.08
62678	SUPSHIP C/R USN	Portsmouth, VA	540	28.70
63285	NAVINVESTSERCMD	Washington, DC	534	0
62791	SUPSHIP C/R	San Diego, CA	532	28.01
67399	MCAGCC	Twentynine Palms, CA	511	33.07
62477	CHESNAVFACENGCOM	Washington, DC	509	0
60259	NAS MIRAMAR	San Diego, CA	509	42.44
00232	NAVHOSP	Jacksonville, FL	503	14.71
63408	NAVMTO	Norfolk, VA	489	24.74
62793	SUPSHIP C/R	Newport News, VA	488	0.61
68711	SWNNAVFACENGCOM	San Diego, CA	488	0

Table 2, continued:

Department of the Navy Facilities Employing Civilians: Largest 150 Facilities as of 30 June 1991, in Descending Order by Work Force Size

Unit Identification Code and facility description		Location	Pop.	Percent blue-collar
00014	OCNR	Washington, DC	485	0.21
60191	NAS OCEANA	Virginia Beach, VA	482	34.23
68462	NORDA	Bay St. Louis, MS	473	0
68836	NSC	Jacksonville, FL	468	16.45
00025	COMNAVFACENGCOMHQ	Washington, DC	464	0.22
61414	NAVPHIBASE	Little Creek, VA	464	44.18
00204	NAS	Pensacola, FL	458	13.32
62604	CBC	Gulfport, MS	457	46.61
61463	NAVBASE	Norfolk, VA	456	0
00620	NAS	Whidbey Island, WA	451	9.98
00019	COMNAVAIRSYSCOM	Arlington, VA	438	0.46
00024	NAVSEA HG	Washington, DC	433	2.31
67439	MARCORSUPACT	Kansas City, MO	431	1.62
62789	SUPSHIP C/R	Groton, CT	422	1.42
62795	SUPSHIP C/R	Pascagoula, MS	418	8.37
65580	NAVELEXSYSENGCEN	Portsmouth, VA	417	0.24
00213	NAS	Key West, FL	417	38.85
00030	DIRSSPO	Washington, DC	409	0
68346	NAVAIR PMO	Washington, DC	404	0
68094	NRMC	Camp Pendleton, CA	399	23.06
65928	NTC	Orlando, FL	399	35.59
65538	NAVSEALOGSUPENGACT	Mechanicsburg, PA	399	0
60200	NAS	Cecil field, FL	396	11.11
68084	NAVHOSP	Charleston, SC	393	5.60
60957	FAADCPAC	San Diego, CA	388	0
68305	NAVCIVENGRLAB CBC	Port Hueneme, CA	386	6.22
47039	OFC NAVOPER	Arlington, VA	377	0

Table 2, continued:

Department of the Navy Facilities Employing Civilians: Largest 150 Facilities as of 30 June 1991, in Descending Order by Work Force Size

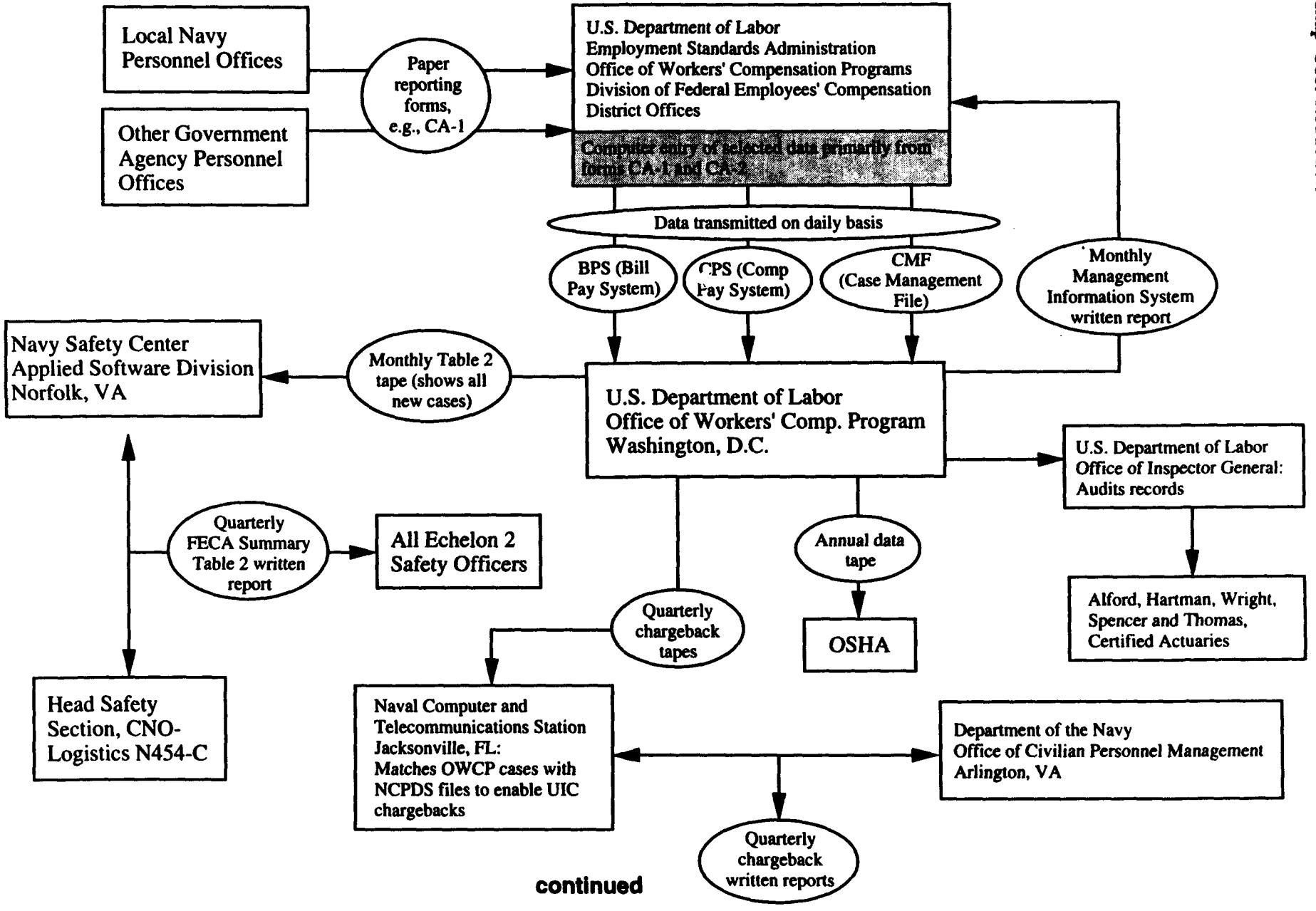
Unit Identification Code and facility description		Location	Pop.	Percent blue-collar
63028	POMFLANT	Charleston, SC	376	53.19
62742	PACNAVFACENGCOM	Pearl Harbor, HI	375	0
68860	NAVSUPCEN	Pensacola, FL	370	34.86
60951	FAADCLANT	Norfolk, VA	366	0
00236	NAS	Alameda, CA	363	29.20
00318	MCAS	Kanehoe Bay, HI	358	54.19
65236	NAVELEXSYSENGCEN	Charleston, SC	357	0
00296	NAS	Moffett Field, CA	357	35.85
65980	NAVELEXSYSENGACT	St. Inigoes, MD	354	1.69
68093	NAVHOSP	Camp Lejeune, NC	350	18.57
62767	NAVAIRTECHSERFAC	Philadelphia, PA	347	0.29
67854	MCRDAC	Washington, DC	342	3.22
42237	SUB BASE	Kings Bay, GA	340	10.29
68057	NARDAC	Norfolk, VA	338	0.59
	TOTAL		242,040	37.95

Office of Workers' Compensation Programs: Outcome variables

A vast stream of paper flows to OWCP (Figures 4 and 5). So that OWCP can comply with various statutory reporting requirements—in particular that it notify federal agencies as to the individual employees for whom expenses have been incurred and for which the agencies will be charged (*Federal Personnel Manual*, Chapter 810, Subchapter 9-2c)—some of this information is transferred to computer and is therefore available for analysis. These data include date of injury (or first reporting of illness), cause and nature of the injury or illness, and medical and compensation expenses—all of which are key outcome variables in the Model. Social security numbers are used to keep track of the individual data records. Of particular value is a code indicating whether the injury or illness resulted in time lost from work. Because these cases *must* be reported to OWCP, and because they are, in practice, virtually synonymous with lost workday cases, this code provides a means for selecting uniformly reported and classified cases across facilities as well as for generating case rates directly comparable to those calculated by independent sources such as the National Council on Compensation Insurance[37] and the Bureau of Labor Statistics.[38]

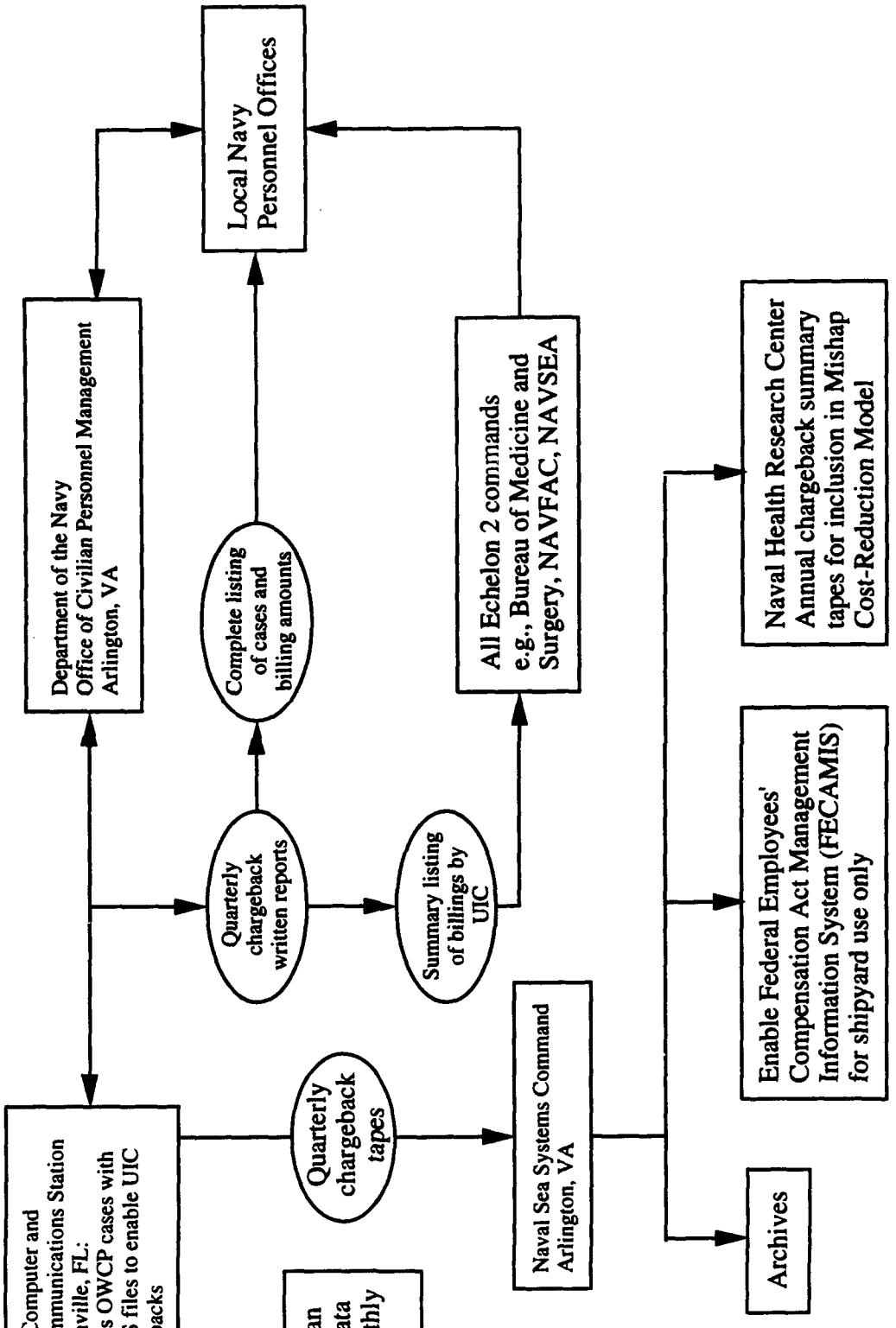
Figure 9 shows the route data take as they are collected and distributed by OWCP. In brief, paper forms originating from personnel offices throughout the federal government are sent to one of the 12 OWCP district offices. There, selected data elements are entered into computers and transmitted daily to a centralized data processing center, which in turn, sorts and separates case records by federal agency. Upon receipt of these taped data for its employees, the Department of the Navy then matches the OWCP files with individual personnel files from the Naval Civilian Personnel Data System to verify the employing activity for injured workers, thereby enabling chargebacks to the correct activity as per

Figure 9: Flow of Navy-related OWCP data



continued

Figure 9: continued



instruction.[16] Once processed in this manner, various paper reports and taped copies of the data are distributed as shown in Figure 9.

For every claim filed, the taped data available from OWCP includes 74 data fields arrayed as a single record approximately 428 characters in length. Because some of these fields are no longer used or have other idiosyncracies, and because no comprehensive data dictionary is available from OWCP, Naval Health Research Center has prepared a detailed and thorough codebook describing OWCP's taped data.[39] Use of this codebook will allow precise selection of cases according to well-understood criteria.

As mentioned, OWCP creates a data record for every claim it receives. Not all claims received, however, meet the criteria for a compensable occupational injury or illness (*Federal Personnel Manual* 810, Subchapter 3); some are filed for injuries incurred away from work and some for incidents that do not result in injury. Claims not accepted by OWCP are identifiable in the database and will be excluded from use in the Model.

As shown in Figure 8, the Model will be based on data from cases newly occurring between 1 July 1991 and 30 June 1992 (OWCP's 1992 chargeback year). Experience with previous OWCP data sets[1] suggests that only 80 percent of the total number of claims eventually to be reported to OWCP for occurrences during this period, will have been reported in time to appear on OWCP's year-end tape for the 1992 chargeback year. Within another year, however, the identified portion of the cohort will have risen to 98 percent (the remainder will be reported in subsequent years). Accordingly, OWCP's 1993 year-end tape will be reviewed for cases newly occurring between 1 July 1991 and 30 June 1992 but not previously reported, and these cases will be included among those eligible for inclusion in the Model.

Of the approximately 19,500 injuries and illnesses occurring between 1 July 1991 and 30 June 1992 and reported to OWCP through the end of its 1993 chargeback year, roughly 8,500 are expected to meet the added criteria of: (1) adjudicated as accepted by OWCP, (2) involving some amount of lost time, and (3) occurring at one of the 150 facilities listed in Table 2. Data for the Model's outcome variables will be derived from these cases.

The outcome variables will be of two types, as shown in Figure 6. The first consists of standard epidemiologic measures of injury and illness incidence,[29, 38] e.g., overall lost-time case rate (expressed as events per 100 full-time employees), severity-specific case rates (counting, for instance, only cases involving 45 days or more of disability), or rates of mishaps due to specific etiologies (back injury or hearing loss, for example). After statistical adjustment as dictated by the Model, statistically significant differences in these variables will identify facilities that are performing better or worse than expected with respect to a given predictor variable of concern (e.g., safety inspection score).

The second type of outcome variable consists of cost variables, primarily cost per case and cost per employee. The latter is a particularly useful comparative measure because it is affected not only by mishap severity and case management (more severe and less well-managed cases both drive up costs), but also by incidence; two facilities can have the same mean cost per case but one with a higher mishap rate will also have a higher cost per employee. As with incidence, both cost per case and cost per employee can be examined with respect to specific outcomes of interest (e.g., mean cost per back injury).

Regardless of the measure used, the ultimate cost attributable to the mishaps occurring in any given year takes years to become apparent. This latency occurs partly for the same reason that it takes time for the true incidence to become known: mishaps that are reported

late are also late in generating costs. But primarily it occurs because workers' compensation costs follow what is known in the insurance industry as a "long tail" pattern of development[40]: a single case can generate payments for years and leave its ultimate cost unknown for decades. During the 1992 chargeback year, for instance, OWCP paid over $1 million for 62 mishaps that originally occurred prior to July 1961. Conversely, of the $242 million paid out in the 1992 chargeback year, only $14.5 million (or 6 percent) was for cases newly occurring that year.

While the full cost of these new 1992 cases will not be known for many years, actuarial methods have been developed that enable predictions of future costs based on past payment histories.[40, 41, 42] Figure 10 uses results from actuarial analyses of payments dating back to 1961 and made by OWCP on behalf of the Department of the Navy to show how the initial expenses for the cases newly occurring in 1992 are expected to grow over time, reaching $357 million in cumulative expenses after 30 years.[30] As shown in Figure 8, the Model will incorporate cost data for these new 1992 cases as they have accrued through the end of the 1993 chargeback year (by which time $42 million in payments had been made). While this plan represents a necessary compromise between the competing goals of data recency, completeness, and compatibility, it is also apparent that this approach means the Model will be based on less than 15 percent of the total expected costs attributable to these mishaps. Accordingly, methods will be explored whereby actuarial projections can be used to estimate the ultimate costs of the individual mishaps providing data for use in the Model; the suitability of using such projections on individual cases, as well as on within-facility collections of cases, will also be explored. Alternatively, actuarial projections might best be used *after* the Model has been applied; once a particular facility, for instance, has

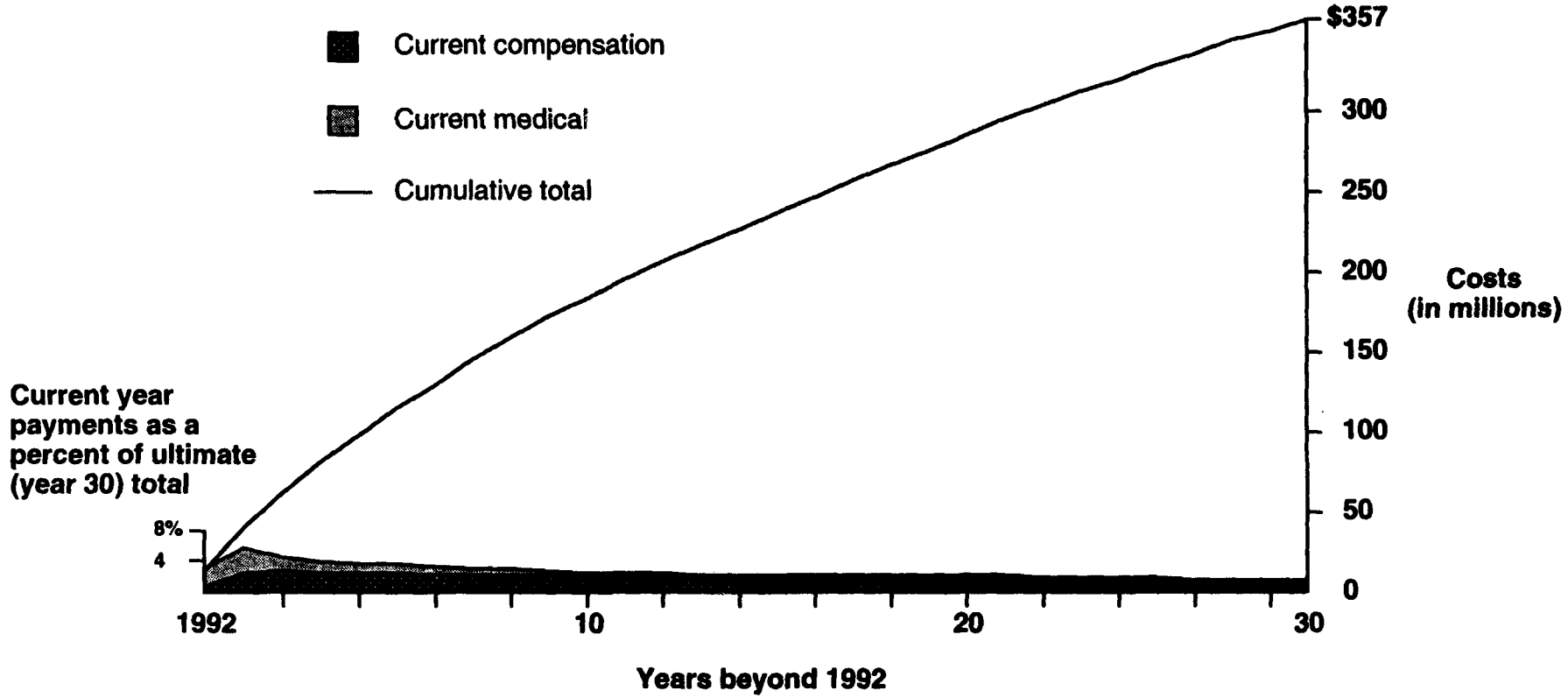


Figure 10: Actuarial projections of eventual Department of the Navy costs for occupational mishaps occurring during chargeback year 1992 (1 July 1991 - 30 June 1992)

Source: Actuarial model created by Towers Perrin, St. Louis, MO, using data from the Office of Workers' Compensation Programs, Employment Standards Administration, U.S. Department of Labor, as supplied by Naval Health Research Center (reference 30); incorporates first-year medical payments of $11.3 million, first-year compensation payments of $3.1 million, second-year medical payments of $16 million, and second-year compensation payments of $11.4 million.

been found to have significantly higher than expected costs, the ultimate value of this discrepancy could then be calculated using actuarial techniques.

Naval Civilian Personnel Data System: Control variables and denominator counts

The Model calls for a number of control (i.e., "fixed") variables to permit adjustments between facilities with different work force demographics. Data for this purpose are available from the Naval Civilian Personnel Data System, which collects 1,500 characters of coded information on every civilian employed by the Department of the Navy. As with OWCP, not all of this information is captured at a central location, the data take a circuitous route (Figure 11) during which they are sometimes "massaged" and manipulated, and not everything entered is permanently stored. Nonetheless, substantial amounts of data are retained. These are contained on a monthly "status" file depicting the current status of all Department employees with respect to some 200 data fields, and on a "dynamic" file prepared monthly and containing data on all employees for whom some change in status has occurred in the prior month (e.g., a promotion or change of duty station). Both files are arrayed as a single record per individual and all records contain social security numbers, thereby permitting linkage with each other as well as with records from OWCP.

Again as with OWCP, no comprehensive data dictionary is available for the Naval Civilian Personnel Data System. Naval Health Research Center has therefore reviewed the data fields and prepared a thorough codebook describing the subset of variables planned for initial inclusion in the Model.[43] This subset includes approximately 30 data fields containing information such as age, ethnicity, gender, occupation, and educational achievement (details are provided in the Appendix).

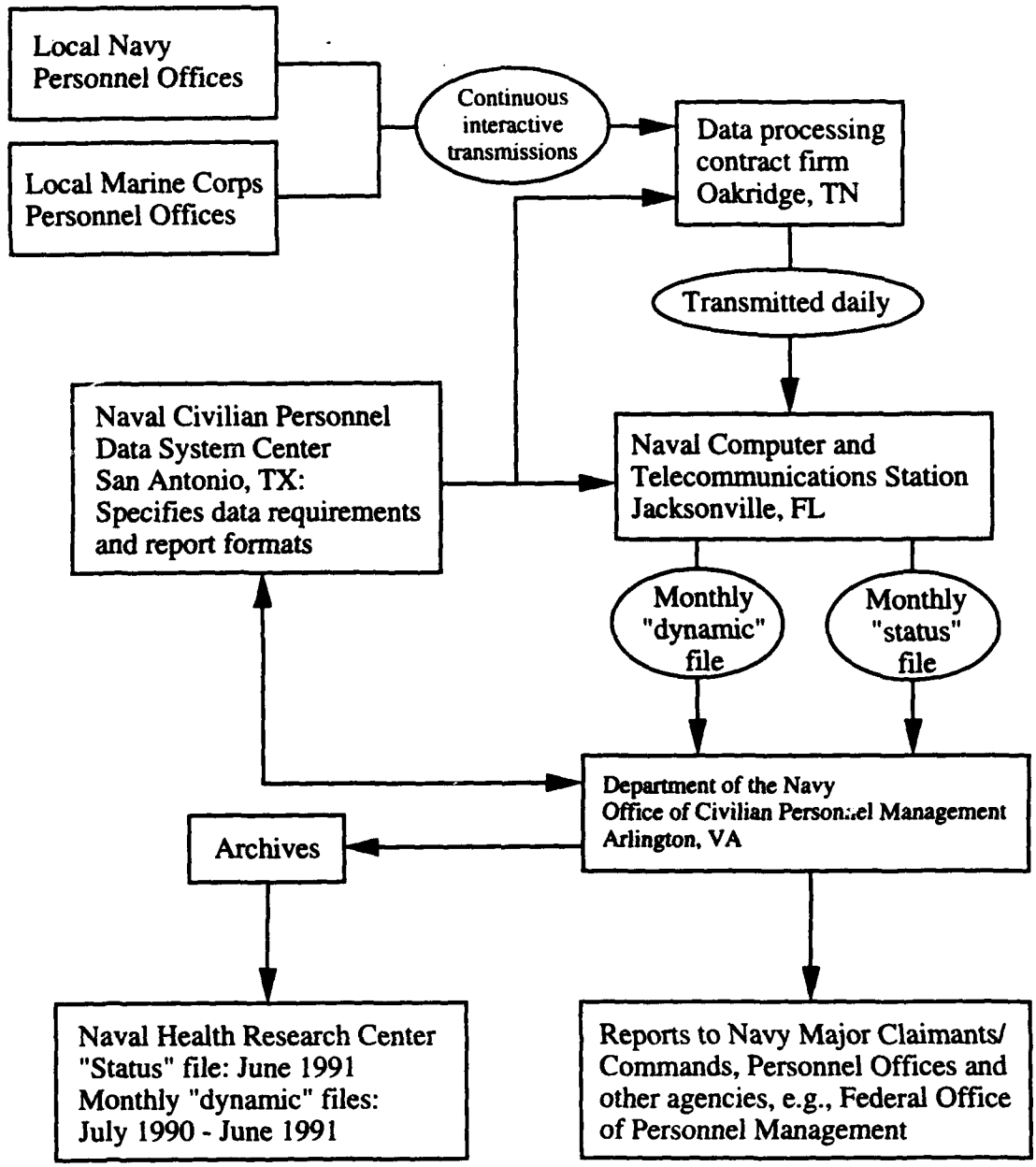


Figure 11: Flow of data through the Naval Civilian Personnel Data System

Data will be extracted from taped files provided by the Navy Office of Civilian Personnel Management, which controls the Naval Civilian Personnel Data System. These tapes will include the "status" file for 30 June 1991 and the 12 "dynamic" files for the 12-month period ending June 1991. These latter files will provide information such as the percentage of a facility's work force receiving promotions during the prior year; the two sets of files together will permit a comprehensive description of the work force as it existed on 30 June 1991 at each of the 150 facilities in the sample.

Navy Inspector General Oversight Inspection Unit: Predictor variables

One of the Model's central purposes is to permit meaningful assessments of various Navy occupational safety and health programs as they are applied across facilities. Among these is the inspection program conducted by the Navy Inspector General Oversight Inspection Unit. These inspections are carried out following a prescribed protocol,[44] and with scheduling priority accorded to those facilities "determined to have the most severe safety and health problems."[5 ¶0906b] Individual items are assessed and scored, collapsed into subcomponents (e.g., Hearing Conservation Program compliance), then collapsed again into two broad assessment categories: "program" and "workplace." The program score rates organizational compliance with requirements such as the existence of specified committees and published policies, whereas the workplace score evaluates more traditional workplace safety criteria.

By 30 June 1991, 85 of the 150 facilities in the sample had been inspected at least once. (Several had been inspected more than once, and in these cases the most recent scores will be used). Another five had been inspected prior to 30 September 1991. Because the oversight inspections are generally scheduled and announced well in advance, and because

organizations tend to prepare for such events ahead of time,[45] it is likely that inspections occurring during these three months remain indicative of conditions as they existed at these facilities as of 30 June 1991; accordingly, these later inspections will be used as well, yielding a total of 90 facilities for which scores are available for incorporation in the Model. These scores have been entered into a database, of which copies have been provided to the Naval Health Research Center. Variables planned for use in the Model are described in the Appendix.

PLAN OF ANALYSIS AND MODEL BUILDING

After extraction from the described sources, data will be integrated into a single database, with individual-level data linked by social security number and facility-level data linked by Department of the Navy Unit Identification Code number. Analysis will then proceed in stages. Throughout, candidate predictor variables showing no significant association with the dependent variable under analysis will be dropped from further consideration, with the goal of producing the leanest, most parsimonious model possible.[46]

The strategy for determining facility-level "expected mishap rates," as indicated in Figure 6a, will be similar to that used by Robertson and Keeve.[26] The first step will be to ascertain mishap rates by occupational category using combined data from all 150 facilities in the sample. (Among the 240,000 civilian employees at these 150 facilities there are approximately 620 uniquely coded occupations.[43] To achieve statistical stability, occupations represented by only a small number of subjects will be consolidated into broader established groupings, for instance Department of the Navy Occupational Levels.[43]) These rates will then be applied to each individual within an occupational category to determine his or her expected number of mishaps based solely on the general hazard level of that individual's

occupation.[26] The difference between an individual's actual and expected number of mishaps will then be regressed onto the available demographic variables, yielding a fitted equation that will be used to calculate for each individual the number of mishaps that would be predicted after controlling for his or her occupation and given his or her age and other similar factors. The results from these two steps will then be combined to produce, for each individual in the sample, an expected number of mishaps given the person's job, age, gender, etc. Within each facility, these individual-level expected numbers will be summed to generate an expected number of mishaps given the occupations and demography of a facility's entire work force. The difference between this number and the facility's actual mishap rate will be regressed onto the remaining facility-level variables shown in Figure 6a (e.g., weather exposure) to produce a fitted equation that will be used to predict a facility's rate of mishaps over and above that attributable to the occupational and demographic characteristics of its work force. Finally, the quantities from these last two steps will be summed to produce, for each facility in the sample, an expected number of mishaps given its mission, location, work force composition, and other factors that cannot be changed via the Navy's Occupational Safety and Health Program.

At this stage, each facility's actual rate of mishaps will be compared statistically to its expected rate of mishaps (using the normal approximation to the binomial distribution). Facilities having rates significantly higher (or lower) than expected will be identified. Regression of the difference between facilities' actual and expected rates onto the variables in Figure 6b will in turn suggest the degree to which factors that are "modifiable" and under a facility's control (e.g., safety program performance) influence or are responsible for mishap rates above or below that which is expected.

The cost analyses depicted in Figures 6c and 6d will be handled in a similar fashion. Using individual-level data from all subjects in the sample, case costs will be regressed onto those mishap characteristics which best define its likely costs (e.g., the severity of the mishap),[1] plus those variables hypothesized as influencing costs but outside a facility's control (e.g., regional variation in the price of medical services). The resulting fitted equation will permit calculation of predicted (or "expected") individual case costs. The difference between actual costs and these expected costs will then be used as the dependent variable in a second regression designed to determine the influence on excess costs of those variables amenable to change (Figure 6d). For each facility, a mean difference between individual actual and expected costs will be calculated; means significantly higher than zero will indicate facilities whose costs per case are excessively high for reasons attributable to case management practices at the facility itself.

APPLICATIONS

As proposed, the Mishap Cost-Reduction and Quality Assessment Model offers myriad applications. Fundamentally, it offers the opportunity to identify sources of the Department of the Navy's rising costs for occupational injuries and illnesses and to thereby permit the concentration of resources in those areas offering the best opportunities for the reduction or control of these costs. Broadly speaking, these potential opportunity areas have been conceptualized a priori as involving some aspect either of the rate of occupational mishaps or of their individual costs.

Rates will be analyzable at a variety of levels and for different purposes. The Model will facilitate evaluation of the overall effectiveness of the Navy Occupational Safety and Health Program by making it possible to determine whether more vigorous program

implementation is associated with lower mishap rates Navywide. Model-guided analysis of rates associated with specific etiologies (e.g., back strain) will also make it possible to assess individual program components (e.g., the Ergonomics Program) and identify those that may be less effective than desired as currently implemented.

More narrowly, the Model will enable assessment of individual facilities. It will permit, for instance, the identification of facilities whose mishap rates are excessively high because of shortcomings in their safety programs. In addition, the Model will encourage and facilitate the exploration of "What if?" scenarios. For instance, what if facility A had a work force with the demographic composition of facility B? What would its mishap rate look like? Or, what if a facility increased the amount of safety training provided to its workers? Would its mishap rate decrease?

Similar questions will be amenable to analysis with respect to cost. For instance, what if the policy were changed so that Injury Compensation Program Administrators were required at facilities with annual compensation costs in excess of $500,000 rather than the current $1 million?[16] Would the savings justify the expense?

Finally, the database underlying the Model has applications beyond those directly related to derivation of the Model. For instance, it could be used to generate Navywide mishap rates by occupation, which offers the potential for identifying high-risk occupations and perhaps the subsequent development of occupation-specific safety programs. Similarly, the database offers the potential for the development of algorithms enabling Injury Compensation Program Administrators and others to identify at the earliest possible moment those mishaps with the potential for generating the greatest costs (e.g., lost-time traumatic

injuries of the back among workers over age 45), thereby increasing the prospects of effective early intervention.

CONCLUSIONS AND RECOMMENDATIONS

We conclude that development of the Mishap Cost-Reduction and Quality Assessment Model is feasible using the available data. We conclude further that the Model has great potential for helping both to improve the Navy's Occupational Safety and Health Program, and to reduce and control its costs for occupational injuries and illnesses. Our principal recommendation, therefore, is that development of the Model proceed as proposed. Implementing this recommendation will establish the Navy as a leader among federal agencies working to address a problem identified recently in a report to the President by the Secretary of Labor, namely that within federal occupational safety and health programs there is "little basic research into causal factors of mishaps or hazard recognition, evaluation and control methods."[47]

The following secondary recommendations are based on our initial work with a wide variety of information sources with a potential bearing on the development of a maximally informative Model for understanding contributors to the occurrence and cost of occupational mishaps within the Navy:

- Estimating the total future costs attributable to a current occupational mishap is the only way to develop an accurate perception of the true cost of newly occurring injuries and illnesses—and the value of their prevention—and the Department of the Navy's (and OWCP's) capability to estimate these costs needs to be strengthened considerably. This capability should be developed in concert with professional actuaries experienced in the field of workers' compensation.[30] Ultimately, the ability should be developed to project costs at

both the facility level and at the individual case level (using such attributes as the anatomical location and severity of injury).

- The current Navy policy of charging workers' compensation costs back to individual facilities for the purpose of increasing local commanders' awareness of the costs of unsafe working conditions is philosophically sound.[16] Because, however, 95 percent of the costs charged back in any given year are attributable to mishaps that occurred in prior years, the effect of a facility's current safety efforts on its current bill is almost negligible. Accordingly, we recommend that accounting procedures be explored whereby facilities, rather than being charged for expenses deriving from liabilities incurred years ago, could instead be charged each year for the full projected costs of the mishaps occurring in that year. Such an approach would be consistent with the requirement that private insurers set aside each year sufficient reserves to meet the full liability created by that year's new cases.[40]

- The database from which the Model is to be derived should be maintained and enhanced as new data become available. This applies not only to data from those sources discussed in this document and currently planned for inclusion in the database, but to potential new data sources as well. Candidates for such future incorporation include, but are not limited to:

  - Standardized industrial hygiene and exposure data from the Consolidated Industrial Hygiene Laboratories[48]
  - Naval Facilities Engineering Command's listing of projects receiving centrally managed hazard abatement funds[5 ¶1206]
  - Navy Occupational Safety and Health Program annual per-facility cost data reported to the Chief of Naval Operations (N-45)[5 ¶1303]

- Facility-level annual safety training data, as reported to the Naval Civilian Personnel Data System Center
- Occupational health service provider performance indicator data from the Bureau of Medicine and Surgery[49]

• A critical variable used by the Bureau of Labor Statistics[38] and others in injury epidemiology[20] for measuring mishap severity is workdays lost due to individual injuries or illnesses. OWCP, however, does not record this information, nor is it available from other Navy sources. The U.S. Air Force has developed a procedure for routinely merging data from OWCP and local Air Force personnel offices with its centralized headquarters civilian personnel file to provide readily this and other useful cost-control information (e.g., continuation of pay and light duty start- and stop-date data). We recommend that the Department of the Navy consider instituting a similar procedure.

• In addition to the just-mentioned capability of the Air Force, other federal agencies have developed systems for rapidly reviewing, analyzing, and managing their occupational mishap rates and costs. Preeminent among these is the U.S. Postal Service, which over many years has developed and refined a computerized National Accident Reporting System and a computerized Workers' Compensation Information System. The first of these systems produces timely, comprehensive reports on newly occurring injury statistics, allowing quick identification of potentially hazardous situations. The second alerts local Postal Service compensation specialists to the appearance of a new claim *within 10 days* of its filing with OWCP. Given that their Navy counterparts may not receive this same information for months (Figure 9, page 46) and that the savings to be gained from reacting quickly to new

case filings are potentially huge,[12, 13] we recommend that the Department of the Navy evaluate these systems and consider their adoption.

- Finally, the Safety and Occupational Health Branch, Chief of Naval Operations, has repeatedly recommended that the OWCP database be thoroughly revamped.[50] We agree completely with this recommendation. The database, upon which billions of dollars in chargebacks are based, is archaic and difficult to use. No codebook is available from OWCP. The starting and stopping point for OWCP's "year" is at odds with the fiscal year used by rest of the federal government, necessitating constant manipulations of the data if comparisons to other available information are to be made. The financial accounting uses for which the database is designed are short- rather than long-term. And the medical and epidemiological coding schemes used in the database are unconventional, rudimentary, and inconsistent. Improving the quality of this information should substantially strengthen efforts by the Department of the Navy (and other federal agencies) to control the costs of occupational mishaps and to improve worker health and safety.

REFERENCES

1. Doyle EJ, White MR, Fitzgerald RB, & Pugh WM (1993). *Costs for civilians at selected Department of the Navy facilities due to the Federal Employees' Compensation Act* (Report No. 93-6). San Diego, CA: Naval Health Research Center.

2. Walsh DC (1991). Costs of illness in the workplace. In: Green GM, & Baker F, Eds. *Work, Health, and Productivity.* New York, NY: Oxford University Press.

3. Reagan R (1983). *Memorandum for heads of departments and agencies. Subject: Federal occupational safety and health.* Washington, DC: The White House, 11 October.

4. Chief of Naval Operations (1988). Presidential injury/illness reduction goal results for FY-88. *5100 Letter Ser 454C/8U586963.* Washington, DC: Department of the Navy, 15 December.

5. Chief of Naval Operations (1992). OPNAVINST 5100.23C: *Navy Occupational Safety and Health Program Manual.* Washington, DC: Department of the Navy, 2 November.

6. Maish C (1993). *Personal communication.* Arlington, VA: Head, Safety Section; Safety and Occupational Health Branch; Environmental Protection, Safety, and Occupational Health Division; Chief of Naval Operations, Logistics (N-45), 31 August.

7. Hager WD (1993). Workers' compensation 1993: workers at risk—business at risk. *NCCI Digest* 8(1):1-14.

8. Nordlund WJ (1991). The Federal Employees' Compensation Act. *Monthly Labor Review* 114:3-14.

9. Office of Workers' Compensation Programs, Employment Standards Administration, U.S. Department of Labor (1991). *Federal (FECA) Procedure Manual Part 2 - Claims.*

10. Division of Federal Employees' Compensation, Office of Workers' Compensation Programs, Employment Standards Administration, U.S. Department of Labor (1992). *Agency FECA Injury Reporting Time-Lags Analysis: Cases Received From Oct. 01, 1991 Thru Dec. 31, 1991.* Washington, DC: 1 January.

11. Office of Inspector General, U.S. Department of Labor (1987). *Timeliness of FECA Claims Processing* (Report No. 02-5-074-04-431). Washington, DC: 31 August.

12. Johnson & Higgins (1992). *Survey on Workers' Compensation 1992.* Chicago, IL.

13. National Council on Compensation Insurance (1993). Delays in reporting can increase claims by 50%, Kemper finds. *Cost Containment & Reform Activity Report* November; 3(5):6. Boca Raton, FL.

14. Office of Inspector General, U.S. Department of Labor (April 1992). *Audit Guide: Federal Employees' Compensation Act, PCIE Employing Agency Project.* Philadelphia, PA.

15. National Council on Compensation Insurance (1993). Injury Prevention. In: *1993 Issues Report.* Boca Raton, FL.

16. Chief of Naval Operations (1990). OPNAVINST 12810.1: *Federal Employees' Compensation Act (FECA) Program.* Washington, DC: Department of the Navy, 26 January.

17. Commandant of the Marine Corps (1979). MCO 5100.8E: *Marine Corps Ground Occupational Safety and Health Program.* Washington, DC: Department of the Navy, 6 February.

18. Chief of Naval Operations (1993). Performance in meeting occupational injury and illness reduction goals for the first half of fiscal year 1993. *5100 Letter* Ser 454C/3U594120. Washington, DC: Department of the Navy, 9 June.

19. Glendon AI (1991). Accident data analysis. *J Health Saf* 7:5-24.

20. Oleinick A, Guire KE, Hawthorne VM, et al. (1993). Current methods of estimating severity for occupational injuries and illnesses: data from the 1986 Michigan comprehensive compensable injury and illness database. *Am J Ind Med* 23:231-52.

21. Linnville S, Doyle EJ, & Pugh WM (1993). Do quality Navy occupational safety and health programs prevent injuries? Poster presentation: *34th Navy Occupational Health and Preventive Medicine Workshop.* Norfolk, VA: 27 February-4 March.

22. Doyle EJ, Linnville S, & Lindell M (1993). *Are occupational safety and health inspection scores associated with injury rates?* (Report, in preparation). San Diego, CA: Naval Health Research Center.

23. Moore MJ (1993). Incentives vs. regulations: why should we save workers' comp? *Safe Workplace* 1(2):20-2.

24. Viscusi WK (1979). The impact of occupational safety and health regulation. *Bell J Econ* 10:117-40.

25. Ruser JW, & Smith RS (1991). Reestimating OSHA's effects: have the data changed? *J Hum Resour* 26:212-35.

26. Robertson LS, & Keeve JP (1983). Worker injuries: the effects of workers' compensation and OSHA inspections. *J Health Polit Policy Law* 8:581-97.

27. Office of Regulatory Analysis, Directorate of Policy, Occupational Safety and Health Administration, U.S. Department of Labor (1993). *Description and Evaluation of Medical Surveillance Programs in General Industry and Construction: Final Draft Report.* Washington, DC: Occupational Safety and Health Administration, February.

28. Conway H, Simmons J, & Talbert T (1993). Effects of occupational medical surveillance programs as perceived by respondents to the Occupational Safety and Health Administration's 1990-1991 survey. *J Occup Med* 35:687-97.

29. Robertson LS (1992). *Injury Epidemiology.* New York: Oxford University Press.

30. Miccolis JA (1993). *NAVOSH Mishap Cost-Reduction Model* (unpublished). St. Louis, MO: Towers Perrin, 17 December.

31. Defense Finance Accounting Service (July-September 1991, October-December 1991, January-March 1992, April 1992). *Continuation of Pay Report for Disabling Job-Related Traumatic Injuries Sustained by Federal Employees.* Cleveland, OH.

32. Roos LL, Sharp SM, Cohen MM, & Wajda A (1989). Risk adjustment in claim-based research: the search for efficient approaches. *J Clin Epidemiol* 42:1193-206.

33. Chief of Naval Operations (1991). Proposed tentative medical requirement. *5100 Letter* Ser 454/0037. Washington DC: Department of the Navy, 21 March.

34. Bright RA, Avorn J, & Everitt DE (1989). Medicaid data as a resource for epidemiologic studies: strengths and limitations. *J Clin Epidemiol* 42:937-45.

35. Walsh DC, Connor E, Tracey LV, Goldberg GA, & Egdahl RH (1990). Posthospital convalescence and return to work. *Health Affairs* 8(3):76-90.

36. Policy Analysis and Information Branch, OCPM Policy Support Center, Office of Civilian Personnel Management, Department of the Navy (1991). *Monthly Statistics: Data as of 30 June 1991: Full-Time U.S. Citizen Civilian Employees.* Arlington, VA: Office of Civilian Personnel Management, 30 June.

37. National Council on Compensation Insurance (1993). *Classification Codes and Statistical Codes for Workers' Compensation and Employers' Liability Insurance.* Boca Raton, FL.

38. Bureau of Labor Statistics, U.S. Department of Labor (1992). *Occupational Injuries and Illnesses in the United States by Industry, 1990.* Washington, DC: Bureau of Labor Statistics, April.

39. Shaw E, & Shepherd SL (1993). *Office of Workers' Compensation Programs (OWCP) Data Codebook* (Report No. 93-34). San Diego, CA: Naval Health Research Center.

40. National Council on Compensation Insurance (1992). *Providing for Future Claim Payments—The Role of Loss Reserves.* Boca Raton, FL.

41. National Council on Compensation Insurance (1993). *Annual Statistical Bulletin.* Boca Raton, FL.

42. Wyatt Company (1991). *Actuarial Valuation of the Panama Canal Compensation Fund.* Washington, DC: 6 November.

43. Jaeger J (1993). *Mishap Cost-Reduction Project-Specific Naval Civilian Personnel Data System (NCPDS) Codebook* (unpublished). San Diego, CA: Naval Health Research Center.

44. Navy Inspector General Oversight Inspection Unit (1992). *Navy Occupational Safety and Health Program Evaluation Guide for Shore Activities* (NAVSAFECEN PUB 5100/1 (10/92)). Norfolk, VA: Naval Safety Center, October.

45. Oliver C (1991). Strategic responses to institutional processes. *Acad Manage Rev* 16:145-79.

46. Gauch, HG (1993). Prediction, parsimony and noise. *Am Sci* 81:468-78.

47. Secretary of Labor (1993). *The Secretary of Labor's Report to the President on Federal Department and Agency Occupational Safety and Health Program Activity: Fiscal Year 1991.* Washington, DC: Office of Federal Agency Programs, Occupational Safety and Health Administration, Department of Labor, 8 September.

48. Commanding Officer (1993). Industrial Hygiene Data Capture. *6290 Letter Ser 3333/0765.* Norfolk, VA: Navy Environmental Health Center, Department of the Navy, 17 February.

49. Chief, Bureau of Medicine and Surgery (1992). BUMEDINST 6260.29: *Occupational Health and Preventive Medicine (OH/PM) Indicators.* Washington, DC: Bureau of Medicine and Surgery, Department of the Navy, 1 September.

50. Chief of Naval Operations (1993). Report to the Occupational Safety and Health Administration on the U.S. Navy Occupational Safety and Health Program for Fiscal Year 1992. *5100 Letter Ser N454C/3U593700.* Washington, DC: Department of the Navy, 13 January.

APPENDIX

VARIABLES PLANNED FOR CONSIDERATION

IN THE MISHAP COST-REDUCTION MODEL

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
1. accountability: civilian managers	management	OSH Performance Procedures percentage score from NOIU inspection	y	NOIU	this score (from Section 4 in the Evaluation Guide) is comprised of two "yes" or "no" items; better measures may be available
2. accountability: commanding officer's remaining length of stay at time of NOIU inspection	management	months remaining in UIC commanding officer's tour of duty at time of NOIU inspection	y	†	COs have often moved to new duty stations before the possible effects of poor scores become apparent
3. accountability: military performance evaluations	management	†	y	†	OPNAVINST 5100.23C states that military performance evaluations should recognize OSH activities; where is this information recorded? Whose evaluations should be considered?
4. rank of commanding officer	management	numerical rank as of 30 June 1991	y	†	
5. rank/grade of safety director	management	numerical rank/grade as of 30 June 1991	y	†	

† Specific measure or data source remains to be identified.

Acronyms:

DIN: Data Identification Number
NAVFAC: Naval Facilities Engineering Command
NAVOSH: Navy Occupational Safety and Health
NCPDS: Naval Civilian Personnel Data System
NOIU: Navy Inspector General Oversight Inspection Unit
OSH: Occupational Safety and Health
OWCP: Office of Workers' Compensation Programs
UIC: Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
6. ratio of rank to age of commanding officer	management	ratio of numerical rank to age in years as of 30 June 1991	y	†	assumes better officers are sooner to rise in rank and that better overall management is associated with reduced injury risk
7. ratio of rank/grade to age of safety director	management	ratio of numerical rank to age in years, as of 30 June 1991	y	†	assumes better managers are sooner to rise in rank/grade and that better overall management is associated with reduced injury risk
8. span of supervision	management	ratio of workers to supervisors	y	NCPDS	may be prescribed in our sample and hence lack statistical variability
9. supervisory performance ratings	management	mean performance rating (ordinal variable coded 1 to 5) for supervisors only	n	NCPDS	higher ratings should reflect better morale and therefore may be associated with lower injury rates
10. service branch	management	dichotomous measure: Navy vs. Marine Corps Command	n	UIC listing	

† Specific measure or data source remains to be identified.

Acronyms:

DIN: Data Identification Number
NAVFAC: Naval Facilities Engineering Command
NAVOSH: Navy Occupational Safety and Health
NCPDS: Naval Civilian Personnel Data System
NOIU: Navy Inspector General Oversight Inspection Unit
OSH: Occupational Safety and Health
OWCP: Office of Workers' Compensation Programs
UIC: Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
11. morale: awards	management	percent of UIC's work force *receiving a performance-based* cash award or bonus during preceding year	n	NCPDS	see the NCPDS HM DIN series for range of award codes; HM1 or HM5A may contain an indication of ***safety awards*** given, which ***might be of value as a variable in its own right***
12. morale: disciplinary actions	management	percent of UIC's work force subject to disciplinary action during preceding year	n	NCPDS	see the NCPDS Q5 DIN series for range of codes
13. morale: promotions	management	*percent of UIC's work force* receiving promotions during preceding year	n	NCPDS	conceivably, there would be higher morale in a UIC with more employees receiving promotions; higher morale should be associated with lower injury and illness rates
14. morale: performance ratings	management	ordinal variable coded 1 to 5; UIC work force's mean, median, mode, or some recoded percentage breakdown	n	NCPDS	higher ratings should reflect better morale and therefore may be associated with lower injury rates

† Specific measure or data source remains to be identified.

Acronyms:

DIN:	Data Identification Number	NOIU:	Navy Inspector General Oversight Inspection Unit
NAVFAC:	Naval Facilities Engineering Command	OSH:	Occupational Safety and Health
NAVOSH:	Navy Occupational Safety and Health	OWCP:	Office of Workers' Compensation Programs
NCPDS:	Naval Civilian Personnel Data System	UIC:	Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
15. morale: turnover rate	management	ratio of total employees on payroll during year to average number of employment positions	†	NCPDS	may require annual compilation of monthly data; may not be meaningful given hiring freeze and trend towards hiring "contractors"; Office of Personnel Management has a formal calculation for measuring turnover
16. baseline health: physical handicaps	work force	percent of UIC's work force with a physical handicap	n	NCPDS	all handicaps are self-reported
17. demographics: educational attainment	work force	highest academic attainment levels	n	NCPDS	NCPDS uses a categorical, quasi-ordinal coding scheme for this data; "17," for instance, refers to the attainment of a master's degree, not 17 years of education, and a mean constructed from these data could be misleading
18. demographics: race/ethnicity	work force	composition of UIC's work force using categories from NCPDS coding	n	NCPDS	example coding is E: white non-Hispanic; can be recoded as desired
19. demographics: gender	work force	gender distribution of UIC's work force	n	NCPDS	

† Specific measure or data source remains to be identified.

Acronyms:

DIN: Data Identification Number
NAVFAC: Naval Facilities Engineering Command
NAVOSH: Navy Occupational Safety and Health
NCPDS: Naval Civilian Personnel Data System
NOIU: Navy Inspector General Oversight Inspection Unit
OSH: Occupational Safety and Health
OWCP: Office of Workers' Compensation Programs
UIC: Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
20. demographics: mean age	work force	mean age of UIC's work force, in years	n	NCPDS	computed by subtracting birthdates from 30 June 1991
21. job security	work force	*dichotomous yes or no:* reduction in force announced for UIC?	*n*	†	measure should identify UIC's included in base-closing acts passed prior to 1 July 1991
22. implied exposure: specific employee occupations	workplace	percent of UIC's work force engaged in specific occupations	n	NCPDS	possible way of rating the inherent danger of a workplace; a variety of NCPDS variables are available for this information, e.g., occupational series codes, DONOL Codes for occupational families, PATCOB codes (occupations classified by professional, administrative, technical, etc.), and wage grade vs. general schedule (i.e., blue- vs. white-collar) pay plan status

† Specific measure or data source remains to be identified.

Acronyms:

DIN: Data Identification Number
NAVFAC: Naval Facilities Engineering Command
NAVOSH: Navy Occupational Safety and Health
NCPDS: Naval Civilian Personnel Data System
NOIU: Navy Inspector General Oversight Inspection Unit
OSH: Occupational Safety and Health
OWCP: Office of Workers' Compensation Programs
UIC: Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
23. implied exposure: Navy job category ratings	workplace	percent of UIC's work force in job hazard categories A, B, & C	n	†	alternative way to rate the inherent danger of a workplace; note that the A, B, & C ratings in OPNAVINST 5100.23C ¶0303c, Appendix 3-A do not categorize facilities per se, but refer rather to numbers of workers in various job hazard categories; this variable is most likely related to injuries and not illnesses.
24. implied exposure: annual wages	workplace	UIC work force's mean annual wage	n	NCPDS	alternative way to rate the inherent danger of a workplace; provides a potential continuous variable; ***this measure also is related to indemnity costs, since a higher paid work force will receive higher compensation for the same injuries***
25. implied exposure: facility hazard value	workplace	NOIU facility hazard value	n	NOIU	alternative way to rate the inherent danger of a workplace; NOIU inspectors rank facilities on their perceived inherent hazardousness; scores range from 0.5 (low hazard) to 4.5 (high hazard)

† Specific measure or data source remains to be identified.

Acronyms:

DIN: Data Identification Number
NAVFAC: Naval Facilities Engineering Command
NAVOSH: Navy Occupational Safety and Health
NCPDS: Naval Civilian Personnel Data System
NOIU: Navy Inspector General Oversight Inspection Unit
OSH: Occupational Safety and Health
OWCP: Office of Workers' Compensation Programs
UIC: Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
26. facility size	workplace	total number of employees at facility	n	NCPDS	prior research has shown an inverse relationship between facility size and injury incidence
27. facility age	workplace	years elapsed from facility's commissioning	n	†	NAVFAC may be possible source; this measure should assess how up-to-date or well-maintained the facilities and equipment are to which employees are exposed; alternatives include date of last major renovation or new building or mean age of all buildings
28. capital expenditures	workplace	total expenditures for capital improvements per employee over last five years	y	†	another possible measure of how up-to-date or well-maintained the facilities and equipment are to which employees are exposed; NAVFAC may be possible source
29. weather exposure	workplace	*Places Rated Almanac* weather index	n	*Places Rated Almanac*	this composite variable combines humidity, and daily, seasonal, and monthly temperature variability; scores for UICs in Model range from 362 to 910

† Specific measure or data source remains to be identified.

Acronyms:

DIN: Data Identification Number
NAVFAC: Naval Facilities Engineering Command
NAVOSH: Navy Occupational Safety and Health
NCPDS: Naval Civilian Personnel Data System
NOIU: Navy Inspector General Oversight Inspection Unit
OSH: Occupational Safety and Health
OWCP: Office of Workers' Compensation Programs
UIC: Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
30. explicit exposure: employee overtime or mean length of work week	workplace	hours worked per employee per week	y	†	two concepts need to be addressed, one is quantity of exposure, the other is "work intensity"; because intensity is not really measured by overtime, alternatives need to be explored (for instance, payments for supplies, standardized by number of employees)
31. NOIU scores: overall NAVOSH rating	OSH program	overall composite percentage score	y	NOIU	could be used in conjunction with specific NOIU subcomponents
32. NOIU scores: program findings	OSH program	percentage score	y	NOIU	could be used in conjunction with other NOIU component scores
33. NOIU scores: workplace findings	OSH program	percentage score	y	NOIU	could be used in conjunction with other NOIU component scores
34. resources: hazard abatement expenditures	OSH program	dollars per employee per year	y	†	NAVFAC and CNO-Logistics N-45 may be possible sources; note that local expenditures are reported to CNO via OPNAVINST 5100.23C Appendix 13-A, whereas centrally managed costs are reported via NAVFAC

† Specific measure or data source remains to be identified.

Acronyms:

DIN: Data Identification Number
NAVFAC: Naval Facilities Engineering Command
NAVOSH: Navy Occupational Safety and Health
NCPDS: Naval Civilian Personnel Data System
NOIU: Navy Inspector General Oversight Inspection Unit
OSH: Occupational Safety and Health
OWCP: Office of Workers' Compensation Programs
UIC: Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
35. resources: industrial hygiene staff size	OSH program	ratio of total industrial hygiene staff per employee	y	†	CNO-Logistics N-45 may be possible source; may be so prescribed (as per OPNAVINST 5100.23C ¶0303c) as to be invariate; consider as an alternative the safety and occupational health professional personnel line item expenditures from the OPNAVINST 5100.23C Appendix 13-A form reported annually to CNO-Logistics N-45
36. resources: OSH staff size	OSH program	ratio per employee of total OSH staff (doctors, safety personnel, inspectors, etc.)	y	†	CNO-Logistics N-45 may be possible source; may be so prescribed (as per OPNAVINST 5100.23C ¶0303c) as to be invariate; consider as an alternative the safety and occupational health professional personnel line item expenditures from the OPNAVINST 5100.23C Appendix 13-A form reported annually to CNO-Logistics N-45

† Specific measure or data source remains to be identified.

Acronyms:

DIN: Data Identification Number
NAVFAC: Naval Facilities Engineering Command
NAVOSH: Navy Occupational Safety and Health
NCPDS: Naval Civilian Personnel Data System
NOIU: Navy Inspector General Oversight Inspection Unit
OSH: Occupational Safety and Health
OWCP: Office of Workers' Compensation Programs
UIC: Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
37. NOIU scores: safety-management composite	OSH program	percentage score	y	NOIU	weighted composite to be derived from the following 11 individual item scores: OSH Office Organization, OSH Performance Eval, OSH Inspection Prog, NAVOSH Deficiency Abatement, OSH Training, Employee Reports, Mishap Investigation, OSH Policy, Project Review Program, Navy Awards, Hazardous Material Control
38. NOIU scores: illness-reduction composite	OSH program	percentage score	y	NOIU	weighted composite to be derived from the following 5 individual item scores: industrial hygiene, medical surveillance, asbestos, hearing, respiratory protection; should only to be used in modeling illness-related outcomes
39. NOIU scores: injury-reduction composite	OSH program	percentage score	y	NOIU	weighted composite to be derived from the following 4 individual item scores: back injury prevention, gas-free engineering, sight conservation, respiratory protection; should only be used in modeling injury-related outcomes

† Specific measure or data source remains to be identified.

Acronyms:

DIN: Data Identification Number
NAVFAC: Naval Facilities Engineering Command
NAVOSH: Navy Occupational Safety and Health
NCPDS: Naval Civilian Personnel Data System
NOIU: Navy Inspector General Oversight Inspection Unit
OSH: Occupational Safety and Health
OWCP: Office of Workers' Compensation Programs
UIC: Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
40. NOIU scores: respiratory composite	OSH program	percentage score	y	NOIU	weighted composite to be derived from combination of gas-free engineering and respiratory protection program scores; should only to be used in modeling of outcomes related to diseases acquired through respiratory exposures
41. NOIU scores: back-injury-reduction score	OSH program	percentage score of Back Injury Prevention and Control Program	y	NOIU	should only to be used in modeling of back-injury-related outcomes
42. NOIU scores: Hearing Conservation Program	OSH program	percentage score of Hearing Conservation Program	y	NOIU	should only to be used in modeling of hearing-related outcomes

† Specific measure or data source remains to be identified.

Acronyms:

DIN:	*Data Identification Number*	NOIU:	Navy Inspector General Oversight Inspection Unit
NAVFAC:	Naval Facilities Engineering Command	OSH:	Occupational Safety and Health
NAVOSH:	Navy Occupational Safety and Health	OWCP:	Office of Workers' Compensation Programs
NCPDS:	Naval Civilian Personnel Data System	UIC:	Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
43. claims processing time	case management: indemnity	elapsed time in days from date of injury to OWCP adjudication date	†	OWCP	there are two major components to claims processing time: length of time from injury to claim receipt at OWCP office (which measures UIC handling time), and length of time from claim receipt to claim adjudication (which measures OWCP handling time); it may be useful to code and analyze each of these separately
44. FECA Program score from NOIU inspection	case management: indemnity	percentage score	y	NOIU	
45. government first care provider	case management: indemnity	percent of ill or injured workers who obtain their initial medical care from a government (as opposed to private) provider		†	
46. HMO participation	case management: indemnity	percent of employees in capitated payment HMO	n	NCPDS	this variable can also be included in medical costs domain

† Specific measure or data source remains to be identified.

Acronyms:

DIN: Data Identification Number
NAVFAC: Naval Facilities Engineering Command
NAVOSH: Navy Occupational Safety and Health
NCPDS: Naval Civilian Personnel Data System
NOIU: Navy Inspector General Oversight Inspection Unit
OSH: Occupational Safety and Health
OWCP: Office of Workers' Compensation Programs
UIC: Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
47. Injury Compensation Program Administrator: job grade	case *management:* indemnity	grade (and step) of ICPA, if *existent*, as of 30 June 1991	y	†	OPNAVINST 12810.1 indicates ICPAs should be professionals appointed "at a level commensurate with cost/risk *liability of the program"; facilities* attaching greater importance to Federal Employees' Compensation Act (FECA) cost control will presumably recruit higher caliber personnel for this position; alternative is ratio of ICPA grade to mean GS grade in geographic region.
48. intensity of UIC's cost containment/claims management efforts	case management: indemnity		y	†	no candidate measure as yet; the frequency with which UICs access the FECA Management Information System (FECAMIS) would be an ideal candidate; however, FECAMIS is only available in shipyards
49. local pay differential	case management: *indemnity*	dichotomous yes or no: is UIC affected by civil service 8% *pay differential* for employees in SF, NY, or LA?	n	NCPDS	geographic salary adjustment based on the location of the UIC; applies to a UIC's entire white-collar work force; note that blue-collar pay rates can vary throughout the country

† Specific measure or data source remains to be identified.

Acronyms:

DIN:	Data Identification Number	NOIU:	Navy Inspector General Oversight Inspection Unit
NAVFAC:	Naval Facilities Engineering Command	OSH:	Occupational Safety and Health
NAVOSH:	Navy Occupational Safety and Health	OWCP:	Office of Workers' Compensation Programs
NCPDS:	Naval Civilian Personnel Data System	UIC:	Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
50. OWCP District Office	case management: indemnity	dummy variable for OWCP District Office code handling UIC claims	n	OWCP	see Figure 3 in text for map of areas covered by each district
51. OWCP long-term case management program	case management: indemnity	dichotomous yes or no: is UIC's OWCP District Office engaged in OWCP long-term case management program?	n	OWCP	this program began in 1992 in four OWCP offices; may be premature to detect an effect
52. rate of "light duty" duty assignment	case management: indemnity	percent of employees filing a CA1 or CA2 who are given "light duty" assignments	y	†	NCPDS may be best source of these data; note that the Air Force enters and maintains this information in its computerized headquarters "CW" personnel records
53. rate of claims controversion	case management: indemnity	percent of claims controverted, by UIC	y	OWCP	
54. rate of injured (or ill) workers' return to work	case management: indemnity	percent of UIC's workers filing a CA1 or CA2 who return to work	y	OWCP	

† Specific measure or data source remains to be identified.

Acronyms:

DIN: Data Identification Number
NAVFAC: Naval Facilities Engineering Command
NAVOSH: Navy Occupational Safety and Health
NCPDS: Naval Civilian Personnel Data System
NOIU: Navy Inspector General Oversight Inspection Unit
OSH: Occupational Safety and Health
OWCP: Office of Workers' Compensation Programs
UIC: Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
55. vocational rehab: success rate	case management: indemnity	percent of all eligible cases for which vocational rehabilitation is initiated and successfully results in job placement	y	OWCP	this code needs to be read from subject's last (most recent) record in the file; note that as per *Federal Personnel Manual* Chapter 810 ¶8-5, vocational rehab is only provided to "permanently disabled employees"
56. vocational rehab: mean days elapsed before initiation of rehabilitation efforts	case management: indemnity	for all workers receiving rehabilitation, mean days elapsed from date of injury (or reported illness) to initiation of rehabilitation efforts	y	OWCP	see notes from variable 55
57. vocational rehab: mean days elapsed before rehabilitated workers' return to work	case management: indemnity	for all rehabilitated workers who return to work, mean days elapsed from date of injury (or reported illness) to return to work	y	OWCP	see notes from variable 55
58. HMO participation	case management: medical	percent of employees in capitated payment HMO	n	NCPDS	this variable can also be included in indemnity costs domain

† Specific measure or data source remains to be identified.

Acronyms:

DIN: Data Identification Number
NAVFAC: Naval Facilities Engineering Command
NAVOSH: Navy Occupational Safety and Health
NCPDS: Naval Civilian Personnel Data System
NOIU: Navy Inspector General Oversight Inspection Unit
OSH: Occupational Safety and Health
OWCP: Office of Workers' Compensation Programs
UIC: Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
59. regional medical cost differential	case management: *medical*	*Places Rated Almanac* medical care cost index	n	*Places Rated Almanac*	this index measures percent variation from national norm in health-care prices by metropolitan statistical area; note that a similar measure prepared by the American Chamber of Commerce Researchers Association and included in the *Statistical Abstract of the United States* is highly correlated with the *Places Rated* index ($r = .815$; $p < .001$)
60. resources: available medical personnel	case management: medical	ratio per employee of total available medical personnel at UIC (or accessible contiguous UIC)	y	†	the measure should include all docs, nurses, technicians, etc.; need to include or consider civilian, military, and contract care providers, as well as part-time providers; the issue of multiple UICs served by a single clinic needs to be addressed; physician and nursing staff levels may be so prescribed (as per OPNAVINST 5100.23C ¶0303c) as to be invariate

† Specific measure or data source remains to be identified.

Acronyms:

DIN: Data Identification Number
NAVFAC: Naval Facilities Engineering Command
NAVOSH: Navy Occupational Safety and Health
NCPDS: Naval Civilian Personnel Data System
NOIU: Navy Inspector General Oversight Inspection Unit
OSH: Occupational Safety and Health
OWCP: Office of Workers' Compensation Programs
UIC: Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
61. resources: medical facility on-site	case management: medical	dichotomous yes or no: presence at UIC (or accessible contiguous UIC) of medical facilities?	y	†	
62. resources: nurse on-site	case management: medical	dichotomous yes or no: presence at UIC (or accessible contiguous UIC) of one or more full-time nurse?	y	†	need to consider availability of civilian, military, and contract care providers
63. resources: physician on-site	case management: medical	dichotomous yes or no: presence at UIC (or accessible contiguous UIC) of one or more full-time physicians?	y	†	need to consider availability of civilian, military, and contract care providers
64. resources: total expenditures for provision of medical care	case management: medical	dollars per employee per year	y	†	should include salaries for all medical personnel (docs, nurses, technicians, etc.), equipment, outside contractors, etc.; for multiple UICs served by a single clinic, expenses should be allocated on a per-person basis to each UIC served

† Specific measure or data source remains to be identified.

Acronyms:

DIN: Data Identification Number
NAVFAC: Naval Facilities Engineering Command
NAVOSH: Navy Occupational Safety and Health
NCPDS: Naval Civilian Personnel Data System
NOIU: Navy Inspector General Oversight Inspection Unit
OSH: Occupational Safety and Health
OWCP: Office of Workers' Compensation Programs
UIC: Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
65. incidence: lost-time case rate	outcome	total accepted lost-time cases *per 100 employees*	na	OWCP and NCPDS	cases included in calculating rates must meet all case definition criteria (e.g., OWCP adjudication status equals accepted); fatalities to be included
66. incidence: case-specific or etiologic-specific case rates	outcome	total *accepted cases meeting* specified criteria per 100 employees	na	OWCP	these cases can be defined as desired; e.g., injury cases only (excluding illnesses), long-term disability cases (those, say, involving more than 45 lost workdays), or those involving back injuries only (as identified by OWCP's nature of injury codes); generally, these cases should always be subsets of the overall set of lost-time cases used for variable 65

† Specific measure or data source remains to be identified.

Acronyms:

DIN: Data Identification Number
NAVFAC: Naval Facilities Engineering Command
NAVOSH: Navy Occupational Safety and Health
NCPDS: Naval Civilian Personnel Data System
NOIU: Navy Inspector General Oversight Inspection Unit
OSH: Occupational Safety and Health
OWCP: Office of Workers' Compensation Programs
UIC: Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
67. cost: indemnity cost per lost-time case	outcome	mean indemnity payments for accepted lost-time cases	na	OWCP	this can be calculated variously as the sum of first year payments only, as the sum of all payments made to date, or as the sum of all past payments and all projected future payments; this variable can also be calculated as including or excluding payments for continuation of pay; preferable method is to include continuation of pay and all projected payments
68. cost: medical cost per lost-time case	outcome	mean medical payments for accepted lost-time cases	na	OWCP	should include all medical and medically related costs (e.g., physical rehab); notes from variable 67 also apply
69. cost: total cost per lost-time case	outcome	mean total cost for all accepted lost-time cases	na	OWCP	calculated as the sum of all medical and indemnity payments divided by number of accepted lost-time cases; notes from variable 67 also apply

† Specific measure or data source remains to be identified.

Acronyms:

DIN: Data Identification Number
NAVFAC: Naval Facilities Engineering Command
NAVOSH: Navy Occupational Safety and Health
NCPDS: Naval Civilian Personnel Data System
NOIU: Navy Inspector General Oversight Inspection Unit
OSH: Occupational Safety and Health
OWCP: Office of Workers' Compensation Programs
UIC: Unit Identification Code; here, often synonymous with facility

Variables Planned for Consideration in the Mishap Cost-Reduction Model

(variants of most measures could be formulated for use at either the individual- or facility-level)

Variable	*Domain*	*Proposed Measure*	*Modifiable by NAVOSH?*	*Source*	*Notes*
70. cost: cost per employee	outcome	per employee payments for accepted lost-time cases	na	OWCP	calculated as total costs for all accepted lost-time cases divided by total number of full-time employees as of 30 June 1991; notes from variable 67 apply
71. index: combined incidence and cost	outcome	(total costs times number of lost-time cases) divided by number of employees squared	na		a proposed index reflecting both *rates and severity/case* management efforts (better case management and less severe cases both produce lower costs); the relative rankings by UIC produced by this index roughly correspond to cost per employee (variable 70), however its properties are somewhat different; e.g., if population and costs are held constant, this index will move in concert with any change in rates, whereas cost per employee would not change at all under the same circumstances

† Specific measure or data source remains to be identified.

Acronyms:

DIN: *Data Identification Number*
NAVFAC: Naval Facilities Engineering Command
NAVOSH: Navy Occupational Safety and Health
NCPDS: Naval Civilian Personnel Data System
NOIU: Navy Inspector General Oversight Inspection Unit
OSH: Occupational Safety and Health
OWCP: Office of Workers' Compensation Programs
UIC: Unit Identification Code; here, often synonymous with facility

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATE COVERED
	January 1994	Interim: June - Dec 1993

4. TITLE AND SUBTITLE
Rationale and Design For a Mishap Cost-Reduction Model For the Navy's Occupational Safety and Health Program

5. FUNDING NUMBERS
Program Element: 63706N
Work Unit Number: M0096.004-6202

6. AUTHOR(S) Steven L. Shepherd, Edward J. Doyle, Jr., William M. Pugh

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Naval Health Research Center
P. O. Box 85122
San Diego, CA 92186-5122

8. PERFORMING ORGANIZATION
Report No. 93-37

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Naval Medical Research and Development Command
National Naval Medical Center
Building 1, Tower 2
Bethesda, MD 20889-5044

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

Costs to the Department of the Navy for occupational mishaps suffered by its civilian employees reached $250 million in 1993. Data are available to help identify the reasons for these rising costs. However, they reside in multiple databases maintained by separate organizations.

This report proposes a means for using available data to identify factors influencing the Department's workers' compensation costs. Emphasis is placed on the development of methods for identifying those factors which present opportunities for the reduction or control of costs.

A design is proposed for a Mishap Cost-Reduction and Quality Assessment Model for the Navy Occupational Safety and Health Program. The proposed Model will be derived from an integrated database built from data obtained from the Office of Workers' Compensation Programs, the Navy Civilian Personnel Data System, and the Navy Inspector General. These sources provide information on the cost and occurrence of occupational mishaps at Department facilities, on worker demographics, and on safety inspections. Analyses will be based on mishaps that occurred at the Department's 150 largest facilities during the period of 1 July 1991 to 30 June 1992. Actuarial projections of the total costs expected to accrue as a result of these mishaps exceed $357 million.

14. SUBJECT TERMS
Workers' Compensation
Occupational Health
Injury Epidemiology
Occupational Safety
Health Economics

15. NUMBER OF PAGES
89

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	Unlimited