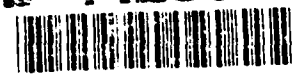

NAVAL HEALTH RESEARCH CENTER

COSTS FOR DEPARTMENT OF THE NAVY CIVILIANS DUE TO THE FEDERAL EMPLOYEES' COMPENSATION ACT: HOW MUCH DOES A CASE COST?

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Report No. 93-6

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EXECUTIVE SUMMARY

Problem

The annual bill from the Office of Workers' Compensation Programs (OWCP) to the Department of the Navy for costs resulting from work-related injuries and illnesses among its civilian employees has been rising for over a decade, reaching $250 million in 1993. This growth in payments has caused concern about future expenditure levels, as well as about the effectiveness of current mishap prevention and cost-control programs. But despite these concerns, fundamental information needed to assess the economic value of these programs has been lacking. For instance, the average cost of a new injury or illness is not known.

Objective

Our purpose was to find a means for projecting the total future costs arising from a cohort of new injuries and illnesses, thereby making it possible to answer the question "What does a case cost?" We also sought to develop a method for classifying groups of cases with substantially different costs and to do so using information available early in a case's history, thereby facilitating the early prediction of cases with high potential costs.

Approach

We obtained OWCP's end-of-year computerized case records for the Department of the Navy for 1990, '91, '92, and '93. From these, cohort files were created, each containing records only of those people newly hurt within a given year. For cohorts whose mishaps occurred prior to 1990, 4-year partial payment histories could be reconstructed; for the 1990 and later cohorts, complete inception-to-date histories were constructed.

Using these data an actuarial consulting firm created a model capable of projecting through 32 years the cumulative costs that will accrue for a new cohort of injury and illnesses cases. From the model we projected cumulative costs for the 1990 cohort and then allocated this total among five categories of mishaps, using as the basis for our allocations the actual costs paid to members of each classification group through 1993. Costs per case were then calculated within each category.

Results

Through the end of 1993, $89 million had been spent on 22,546 cases involving injuries or illnesses newly occurring in 1990. An additional $302 million in expenses are predicted by the model for years 5-32, yielding a total predicted cost through 32 years of $391 million for this one cohort. Using this predicted total, the average cost of a case newly occurring in 1990 and accepted for coverage by OWCP will be $18,632. Among the five mishap classification categories, the average cost for an accepted case ranged from $2,406 for an injury involving between 1 and 45 days of lost time, to $166,716 for an injury involving more than 45 days of lost time.

Conclusions and Recommendations

Using actuarial methods to estimate per-case costs of newly occurring injuries and illnesses provides estimates that are far higher—and "truer"—than any previously available. While the annual cost per Department of the Navy employee for events newly occurring in 1990 through 1993 appears to be holding steady, the total cost predicted to accrue from events in these 4 years is nearly $1.5 billion. Refinement of these methods needs to continue and their implications for policy need to be considered.

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INTRODUCTION

Provisions for the care and compensation of civilian federal employees harmed at the workplace are contained in the Federal Employees' Compensation Act (FECA). First passed in 1916, FECA requires the federal government to pay all medical expenses incurred by its employees who sustain bona fide work-related injuries or illnesses and to replace most of their lost wages. The act is administered by the Office of Workers' Compensation Programs (OWCP), Employment Standards Administration, U.S. Department of Labor.[1]

OWCP makes payments directly to injured or ill individuals and their medical providers, and then "charges back" to the federal agency for whom the individual worked the amount paid by OWCP on the agency's behalf. Between 1986 and 1991, OWCP's annual chargebacks to the Department of the Navy rose from $171 million to $227 million.[2] During the same period, the sum of these annual chargebacks for all federal agencies combined increased from $1.07 billion to $1.52 billion—an annual increase of 7.8 percent.[3]

In contrast, the amount paid by private U.S. businesses (including those who are self-insured) for workers' compensation insurance premiums increased during this period at an annual rate of 10 percent, reaching $44.4 billion in 1991.[4,5] This greater rate of growth is difficult to reconcile with a history of cost-control efforts so aggressive in the private sector as to have frequently included the achievement of legislative reform.[6] One explanation, however, may lie in the different way costs are counted in the two systems.

By law, private insurers in all 50 states are required to estimate the cost of workers' compensation cases (which, in turn, dictate the cost of premiums that will be charged) on a *pre-funded,*[7] or *accrual,*[8] basis, the key feature of which is that the full projected cost of a new injury or illness is estimated at the time at which it occurs and that this cost is then treated as a liability attributable to the year in which the injury or illness occurs. Conceptually, the method is similar to the "incidence approach" referred to by some health economists.[9] Its underlying rationale is that sufficient reserves should be set aside when a worker is injured to ensure that all future benefits can be paid without regard to an insurer's future solvency or continuation in business. The principal alternative to this system is the *cash*, or *pay-as-you-go*, method[7,8] (also referred to as the "prevalence approach"[9]), in which the cost for an injury or illness is attributed to the year in which payment is made rather than

to the year in which the event occurred. This is the accounting method used by OWCP and similar governmental agencies, for whom the continued availability of funds is not in doubt.

Under the accrual method a worker who experiences in 1994 a disabling injury expected to result in payments totaling $500,000 spread over 20 years will generate for his insurer a liability in 1994 of $500,000 (ignoring discounts for future value). Under the pay-as-you-go method, however, this injury will be treated as having a cost in 1994 equal only to the actual amount paid that year, say $25,000. While neither accounting system is distinctly superior in all circumstances, the accrual method most clearly relates accidents and exposures with the costs to which they give rise. It is, note Fahs et al., the method of choice for evaluating the impact of injury or illness prevention programs.[9] For example, the "true" cost of the aforementioned hypothetical injury is readily recognized as $500,000 using accrual accounting methods, and a safety or other prevention program that managed to avert this injury could be valued accordingly. In contrast, use of the pay-as-you-go method obscures the true cost of a given injury or illness (and the attendant value of its prevention) because payments for new and old cases are intermixed without distinction.

Figure 1 shows the effect of this intermixing. The Figure is derived from OWCP's 1990 end-of-year chargeback records for the Department of the Navy (OWCP's accounting year runs from 1 July to 30 June; the 1990 chargeback year therefore encompasses the period 1 July 1989 to 30 June 1990). The Department's chargeback bill for that year was $219 million; approximately 46,000 records are on the tape, each representing an individual for whom a claim for an occupational injury or illness was filed or for whom a payment was made for a claim filed previously. A rudimentary calculation—$219 million divided by 46,000 cases—suggests that an average case that year cost $4,800. However, sorting these cases by the year in which their mishaps originally occurred, as in Figure 1, reveals that while cases originating in 1990 comprised 40 percent of the total number of cases, they generated only 7 percent of the payments; all remaining payments were made for cases originating in preceding years—including over $1 million paid for 72 cases whose injuries occurred in 1961 or earlier.

Clearly, the pay-as-you-go data shown in Figure 1 could not be used to determine the economic worth of a prevention program established in 1990. Even if such a program had prevented all new injuries and illnesses that year, the Department would still have faced a

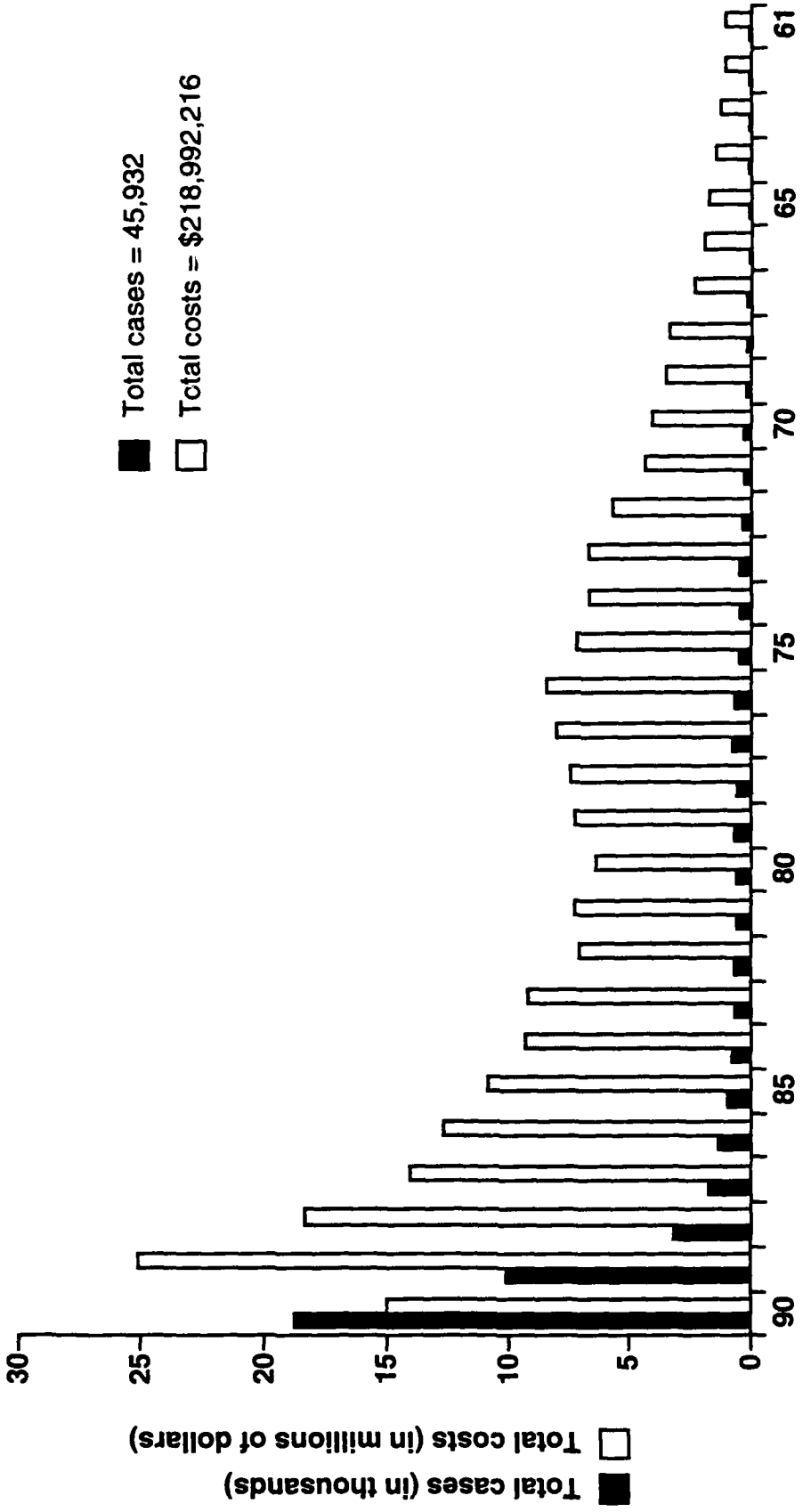

Figure 1: Case counts and costs, by year of original occurrence, for all Department of the Navy cases appearing on the Office of Workers' Compensation Programs' (OWCP) 1990 end-of-year chargeback tape

chargeback bill of $204 million. Nor can the data answer the question "What did a case cost?" if by that is meant "What did an average new case that year cost and what was the value of its prevention?" Using the Figure and looking at just the cases newly occurring in 1990 suggests a cost per case of $800 ($15 million paid divided by 18,700 cases); yet some of these cases will generate payments for years to come (as have the 72 cases from 1961) and the ultimate cost of these cases is unknowable from the data in Figure 1.

Nonetheless, pay-as-you-go accounting data of the sort used in Figure 1 have been routinely used within the Department of the Navy and the federal government to generate cost-per-case estimates and to inform policy. Table 1, for example, shows various estimates of the mean cost of an occupational injury or illness calculated using routinely reported figures from OWCP. The mere size of the differences between these estimates raises questions about their accuracy. In addition, however, the accounting methods used to produce these estimates all share the feature of allocating to newly occurring cases costs that are predominately generated by established, older cases. In other words, the costs being counted are by and large not associated with the cases currently being created.

The same problem appears in a recent annual report on federal agency occupational safety and health programs submitted to the President.[3] The report includes end-of-year chargeback totals for all major federal agencies and, again, makes no distinction between the occurrence of new cases and payments made as the result of established cases. In fact, the report treats the two as closely linked, stating, for instance, that "in 1988 an increase in total cases led to a cost rate increase of 7 percent."[3 p. 5] Yet this is not plausible. Given the data in Figure 1, a 7-percent increase in the total amount paid would have required a doubling of the number of new cases from the preceding year. Similarly, current Navy policy seeks to reduce workers' compensation costs in part by making local commanders responsible for their activities' chargeback bills.[10] However well intentioned, such a policy clearly cannot have its intended effect when the bill received by a commander is almost entirely the result of injuries and illnesses that occurred during his predecessors' commands.

Because, as Secretary of Labor Robert Reich has noted, good policy requires good data,[11] our purpose was to develop and apply a method of calculating the true cost of new injuries and illnesses experienced by Department of the Navy civilian employees using accrual accounting methods. Secondarily, our purpose was to begin to develop a

Table 1

Estimated Average Cost for an Occupational Injury or Illness Experienced by a Federal Civilian Employee Calculated From Pay-As-You-Go Accounting Data

Agency	Data source	Dates covered	Cases		Costs	
			Specification of cases counted	Number	Total	Per case
Dept. of the Navy	OWCP 1990 chargeback tape	1 July 1989 - 30 June 1990	all cases newly created* or incurring payments	45,932	$218,992,216	$4,768
Dept. of the Navy	Navy Office of Civilian Personnel Management report YCFD1Q (based on OWCP's 1993 chargeback tape[12])	1 July 1992 - 30 June 1993	all cases incurring payments	34,516	$250,552,061	$7,259
All federal agencies combined	Secretary of Labor's annual report to the President (based on OWCP chargeback data[3])	1 Oct 1989 - 30 Sept 1990	all cases newly created*	179,869	$1,440,980,764	$8,011
U.S. Navy	Chief of Naval Operations, Logistics (N-454C), annual report to OSHA (based on OWCP "Table 2" reports[13])	1 Oct 1989 - 30 Sept 1990	all non-first-aid, newly created cases*	19,613	$201,000,000	$10,248

* OWCP counts among its "newly created cases" all cases filed and created, including those cases that are eventually denied benefits. For the federal government as a whole during the 1990's, the denial rate for injury claims (i.e., those filed on a CA-1 form) has been approximately 4 percent; for illnesses (those filed on a CA-2 form) the denial rate has been about 33 percent.[14]

classification scheme whereby cases with substantially different costs might be grouped and differentiated on the basis of information available at or near the time a case is first reported.

METHOD

Primary Data Source and Cohort Definition

The primary data sources available for this study were four computer tapes containing OWCP's end-of-year chargeback records for the Department of the Navy for chargeback years 1990, 1991, 1992, and 1993, respectively. (Again, OWCP's accounting year runs from 1 July to 30 June; the 1990 chargeback year, for example, therefore encompasses the period 1 July 1989 to 30 June 1990.) The data for each case on these tapes comprise what OWCP refers to as a "summary record," which includes a variety of recordkeeping, demographic, descriptive, diagnostic, and accounting information contained in 74 separate fields.[15] Records are created on a tape for every case newly reported to OWCP as well as for every pre-existing case that generates an accounting transaction (i.e., a payment). For each case, three accounting totals are available: (1) the sum of all payments made during the year to health care providers, (2) the sum of all payments made by OWCP during the year to the claimant or beneficiary for lost wages (i.e., compensation, or "indemnity" payments), and (3) the grand total of these two sums. Cases are individually identifiable by social security number and by a unique OWCP-assigned case number.

The four chargeback years for which we had tapes were all similar with respect to overall case count (about 45,000 per tape) and case distribution by year of occurrence. Figure 1 shows this distribution (along with the cases' attendant costs) for the 1990 chargeback year. To obtain these distributions we defined a case as belonging to a given accident year (or "injury cohort") if the date of an individual's injury or diagnosis of illness fell within the 1 July to 30 June time frame of a corresponding OWCP accounting year. For example, an individual hurt in June 1961 was assigned to the 1961 injury cohort and an individual hurt in July 1988 was assigned to the 1989 injury cohort, even though both cases might have had accounting transactions, and therefore records, on the 1990 chargeback tape.

Formation of the 1990 Injury Cohort

As previously noted, the 1990 chargeback tape contains records for 72 people first hurt in 1961. This group is all that remains from an inception cohort that might originally

have consisted of 20,000 to 25,000 workers injured in 1961. Data about this original cohort and its intervening history were not available to us, however, nor were such complete data available for any cohort prior to 1990. In 1990, 18,743 cases were reported to OWCP as having injuries or illnesses newly occurring that year. These cases do not constitute the entire 1990 cohort, however, because many cases involving injuries or illnesses newly occurring in a given year do not get reported until much later.

To identify cases injured in 1990 but not reported until later, we searched the 1991, 1992, and 1993 chargeback tapes for cases not previously reported but with injury or illness dates that fell within the time frame defining the 1990 injury cohort. All records for all cases in the 1990 cohort were then retrieved from the four available chargeback tapes and consolidated into a single database; whether a case was immediately opened and then closed, or whether it remained active through the end of the 1993 chargeback year, this database contained the complete history of all persons hurt in 1990, from the date of their injury or illness through 30 June 1993.

Secondary Data Source and Continuation of Pay

In addition to the taped data from OWCP, we obtained information from the Defense Finance Accounting Service regarding continuation of pay. Under the Federal Employees' Compensation Act, OWCP does not begin compensating an injured worker for lost wages until 45 days after the date of injury (this provision does not apply to illnesses, for which OWCP assumes immediate responsibility for compensation).[16, Subpart C] During the first 45 days following an injury a worker's wages are paid by his or her employing activity as if the employee were uninjured and still working (i.e., payment is made at 100 percent of the employee's salary and is fully taxable; later, if the employee begins to receive compensation from OWCP, payment is two-thirds or three-quarters of the employee's salary—depending on whether the employee has dependents—and is tax-free).

The amount paid to injured workers receiving continuation of pay is reported in aggregate by employing activities each quarter to the Defense Finance Accounting System. To supplement our OWCP data on costs generated by the 1990 injury cohort, we obtained the quarterly reports summarizing the continuation of pay records for all Department of the Navy facilities for the period 1 July 1989 to 30 June 1990. This information included the

total amounts paid as well as the number of employees and number of days for which payments were made.

Modeling Future Cost Development

The use of accrual accounting methods requires projections of the total amount of money of that will be paid on a group of injuries or illnesses from the time they first occur until they are finally resolved. These projections are derived by applying a model, or models, to whatever information is already known about an injury cohort.

The preferred tool in actuarial modeling is called the loss development factor.[7, 17] These are multiples, or ratios, derived from inception-to-date payment histories for accident year cohorts. For instance, experience from the longitudinal observation of several accident-year cohorts might indicate that the payments made in the second year of a cohort's existence tend to be twice the amount paid in its first. From these data a mean loss development factor of 2 would be calculated. In turn, this value could be used to predict that for a new injury cohort incurring $1 million in payments during its first year of existence, an additional $2 million would be paid in its second year of existence (yielding a projected cumulative total of $3 million through the end of the cohort's second year).

Because the calculation of loss development factors requires the organization of payment data by accident year, our first step in creating a model for use in projecting costs was to total the per-case payments on each of the four chargeback tapes by accident year and then to arrange these totals so the year-by-year payment totals for each individual injury cohort could be viewed side-by-side. Payments made in 1990 for the 1990 injury cohort, for example, were aligned next to the payments made for this same cohort in 1991, 1992, and 1993, thereby permitting a ready calculation of the total amount paid for each injury cohort during the 4 years for which data were available. This procedure was performed separately for medical payments, for compensation payments, and for both medical and compensation payments combined.

Projections based on loss development factors are considered highly reliable within the insurance industry; moreover, their application is relatively straightforward. Their calculation, however, requires complete inception-to-date payment histories. Because such histories were available only for the four most recent injury cohorts (1990 to 1993), and

because the longest-running of these histories only extended for 4 years, loss development factors alone were inadequate for our needs.

To ensure the best selection and application of additional techniques, we engaged an actuarial consulting firm with extensive experience in the field of workers' compensation (Towers Perrin, St. Louis, MO.). Using the data described, along with Department of the Navy annual full-time civilian employee population counts dating back to 1961,[18] this firm developed a two-part model for the projection of future costs.[19] Loss development factors were used for years 1 through 3, and "persistency ratios" for years 4 through 32. Persistency ratios are calculated after standardizing each injury cohort's current case counts to reflect the number of employees originally at risk, and express the proportion of cases that tend to persist from one year to the next. A persistency ratio of 0.95 for the 30th post-accident year would suggest, for example, that if the 1963 injury cohort had 100 cases still active in 1993, it would have 95 cases still active in 1994. Persistency ratios take advantage of the relative stability after the first few years of cohort case history patterns under FECA. The resulting projected annual case counts can then be multiplied by historically derived annual per-case expenditure estimates to produce annual projected costs.

A third model segment was also provided to permit the estimation of projected costs beyond 32 years. However, because of its lack of supporting data (the oldest injury cohort for which we had data, the 1961 cohort, had only 32 years of history), we chose not to use this segment. The two-part model was therefore used to predict the total costs generated by the 1990 injury cohort as they are projected to accrue through 32 years.

Classification Scheme

We sought to test and apply a classification scheme using information available early in a case's history and which we believed would identify groups of cases with substantially differing costs. Accordingly, we classified cases as being either an injury or an illness, as involving either no or some time lost from work, and, if a lost-time injury, as involving less or more than 45 days of lost time (generally, a claim for compensation cannot be filed until 45 days have elapsed from the date of injury; the absence of such a claim was therefore used as a proxy for injuries involving less than 45 days of lost time). Details of the construction of this algorithm are shown in Figure 2.

The resulting five "case severity" categories were as follows: (1) injuries with no lost time, (2) injuries with lost time of less than 45 days, (3) injuries with lost time of more than 45 days, (4) illnesses with no lost time, and (5) illnesses with lost time.

Cost Determination and Breakdowns for the 1990 Injury Cohort

Three sets of figures were summed to estimate the total cost that will be generated by the 1990 injury cohort through 32 years: (1) the actual costs that have been paid for the cohort by OWCP through 4 years; (2) the projected annual payments for years 5 through 32, from the actuarial model; and (3) the actual continuation of pay totals for the 1990 chargeback year, from the Defense Finance Accounting System.

Once an estimate of total projected cost for the entire cohort had been produced, costs were allocated within the five case severity categories in the following manner. All cases in the cohort were classified as per Figure 2. Actual costs paid through 4 years for cases within each severity grouping were then summed. Projected costs for years 5 through 32 were allocated to each of the five severity categories after determining for each category the number of cases still open at the end of 4 years (it was assumed that all costs projected to accrue from years 5 through 32 would be due to these cases). Within this subgroup of cases still open after 4 years, a calculation was made of the proportion of actual costs paid through 4 years for which each severity category was responsible. Projected costs for years 5 through 32 were then allocated to each severity category according to this proportion. This procedure was applied separately for both medical and compensation costs.

Continuation of pay costs were allocated only between the two lost-time injury categories. All injured individuals classified as having lost more than 45 days from work were assumed to have received the maximum possible continuation of pay (based on the average amount paid per day, multiplied by the average number of paid workdays in a 45-day calendar period, which is 33). The balance was then allocated to those injuries involving less than 45 days of lost time.

Once the estimated total cost for the cohort had been allocated among the five severity categories, cost-per-case estimates were calculated using as denominators the case counts within each category.

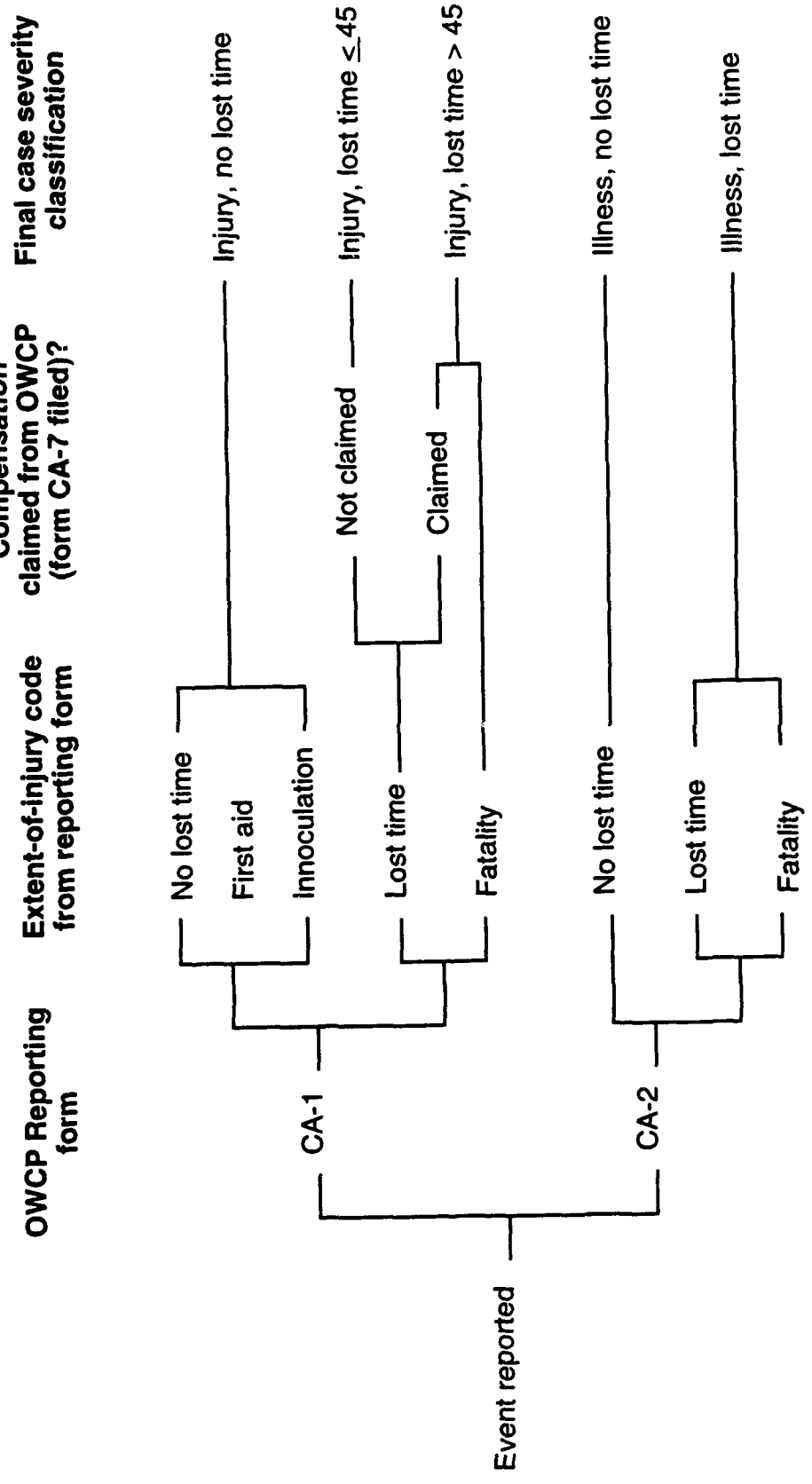

Figure 2: Algorithm for determining case severity classifica[illegible]

RESULTS

Table 2 shows the case counts and cost totals (medical and compensation combined) of the four OWCP chargeback tapes, by accident year (i.e., the year in which an individual was originally injured). Also shown in Table 2 are inception-to-date cost totals for the four injury cohorts with complete histories. The 1990 cohort, for example, had generated nearly $80 million in payments from OWCP through the end of the 1993 chargeback year.

The actuarial loss development factors calculated from the inception-to-date data are shown in Table 3. The "1st/2nd," "2nd/3rd," and "3rd/4th" terminology refers to the ratio of the cumulative amount paid for a cohort through the end of the earliest year referred to (e.g., the 1st) to the amount paid cumulatively through the end of the latter (e.g., the 2nd). Multiplying together the means of the available loss development factors yields a projected cumulative cost for a new injury cohort through the end of the farthest year out available, in this case, 4 years. For example, the amount paid for the 1993 injury cohort in its first year of existence was $13.7 million. The cumulative total projected to have been paid for this cohort through the end of 1996 is therefore $13.7 million times 2.879 times 1.505 times 1.272, or $75.5 million.

The result of the more comprehensive two-part cost projection model developed by the Towers Perrin actuaries is shown graphically for the 1990 cohort in Figure 3. After the $80 million known to have been paid after the first 4 years, the model predicts annual payments on the order of $10 million per year, for a projected cumulative total (exclusive of continuation of pay) of $382 million after 32 years.

Table 4 shows the cumulative cost projections from the model for the 1990 through 1993 injury cohorts, expressed both in aggregate and per each member of the Department of the Navy's civilian work force.

The composition of the 1990 injury cohort by case severity group and reporting year is shown in Table 5. The number of cases identified as belonging to the cohort is 22,546. (This total differs from the sum of the 1990 year-by-year active case counts provided in Table 2 because the latter are not mutually exclusive. The difference between the two tables in the number of 1990 cases reported in the 1990 chargeback year (18,743 versus 18,740) is accounted for by three individuals thought by OWCP in 1990 to be Department of the Navy employees but later identified as employees of another government agency.)

Table 2

Department of the Navy Civilian Employee Injury Cohort Histories by OWCP Chargeback Year

Accident year (1 July to 30 June)	Chargeback year (1 July to 30 June)								
	Cases*				Costs**				
	1990	1991	1992	1993	1990	1991	1992	1993	Inception-to-date***
≤1961	72	67	62	64	$1068	$1007	$1002	$1002	
1962	81	80	72	68	1080	1075	1047	1006	
1963	80	77	69	69	1299	1097	1105	1171	
1964	100	99	95	87	1495	1538	1342	1344	
1965	119	117	113	110	1765	1789	1622	1711	
1966	133	117	112	113	1913	1715	1672	1530	
1967	166	160	149	139	2319	2042	2039	2148	
1968	224	201	202	197	3401	3061	3152	3169	
1969	254	228	213	214	3445	3123	3161	3071	
1970	307	282	273	264	4050	4186	4089	3985	
1971	344	312	289	275	4352	4577	4180	4244	
1972	409	384	364	344	5679	5510	5677	5698	
1973	474	440	446	418	6724	6527	6660	6200	
1974	535	501	461	450	6722	7224	6762	6729	
1975	540	508	484	461	7169	6617	6696	6669	
1976	673	653	627	559	8458	8324	7845	8041	
1977	773	755	726	630	8038	8705	7983	7595	
1978	590	585	548	532	7498	7638	7032	6832	
1979	655	586	575	520	7224	7224	7453	6854	
1980	612	583	566	523	6427	6230	5926	6192	
1981	622	593	554	511	7301	6487	6546	6861	
1982	643	575	569	555	7084	6490	6456	6813	
1983	708	662	597	585	9192	7791	8136	7833	
1984	816	770	698	659	9274	8961	9177	9153	
1985	952	868	763	708	10878	9773	9273	9314	
1986	1329	1167	993	878	12692	12021	11059	10252	
1987	1757	1281	1004	891	13999	12319	11316	10360	
1988	3187	1974	1400	1146	18365	15329	14122	12931	
1989	10034	3380	2054	1474	25126	18638	16588	13823	
1990	18743	9672	3317	2204	14955	26469	21473	17074	$79,971
1991		17303	8927	3435		13566	26747	19823	60,136
1992			16929	9072			14468	27425	41,893
1993				15543				13702	13,702
Total	45,932	44,980	44,251	43,698	$218,992	$227,053	$241,806	$250,555	

* Individuals newly reporting an injury or illness to OWCP, or, if previously reported, for whom a payment has been made during the chargeback year.

** Combined totals for medical and compensation payments made by OWCP (in 000s).

*** Not available for cohorts with inception dates prior to 1990.

Table 3

Loss Development Factors for the Department of the Navy Civilian Employee 1990 - 1992 Injury Cohorts

Accident year (1 July to 30 June)	1st/2nd	2nd/3rd	3rd/4th
1990	2.770	1.518	1.272
1991	2.972	1.492	
1992	2.896		
mean	2.879	1.505	1.272

Table 4

Model-Based Cumulative Cost Projections Through 32 Years for the Department of the Navy Civilian Employee 1990 - 1993 Injury Cohorts

Accident year (1 July to 30 June)	Projected cumulative costs through 32 years (medical and compensation combined, and exclusive of continuation of pay)	Estimated size of midyear full-time work force*	Cost per full-time civilian employee
1990	$382,110,000	318,112	$1,201
1991	381,564,000	308,198	1,238
1992	367,202,000	298,615	1,230
1993	338,809,000	287,921	1,177

* Interpolated for 31 December from annual population counts for 30 September from the Office of Civilian Personnel Management, Department of the Navy.[18]

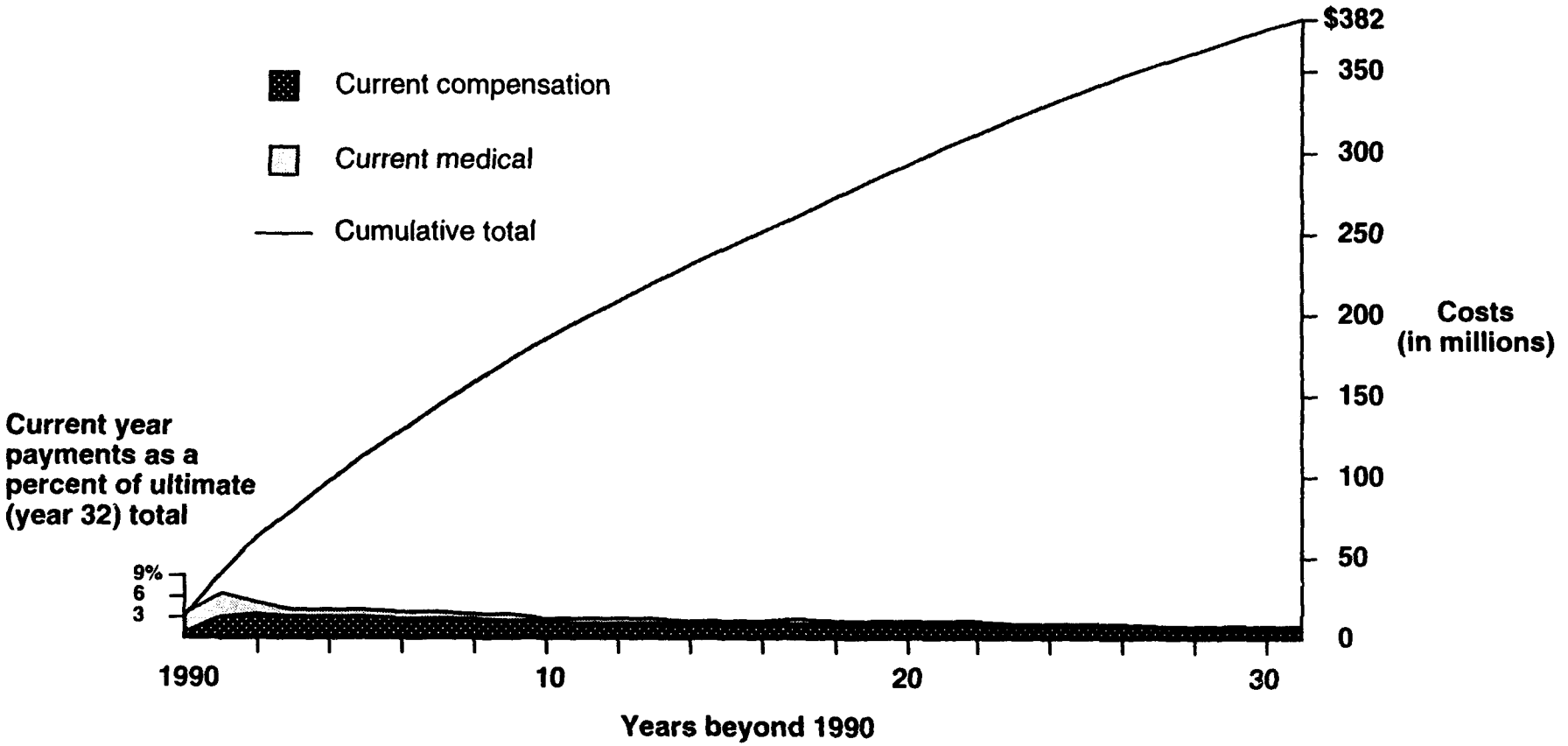

Figure 3: Actuarial projections of eventual Department of the Navy costs for occupational mishaps occurring during chargeback year 1990 (1 July 1989 - 30 June 1990)

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 19).

Table 5

Department of the Navy Civilian Employee 1990 Injury Cohort by Severity Group and Chargeback Year Reported to OWCP

Severity group	Chargeback year (1 July to 30 June) Cases reported (Row percent)				Total
	1990	1991	1992	1993	
Injuries					
No lost time	6,635 (85.6)	1,053 (13.6)	47 (0.6)	18 (0.2)	7,753 (100)
Lost time $\leq$ 45 days	9,491 (87.0)	1,379 (12.6)	26 (0.2)	10 (0.1)	10,906 (100)
Lost time > 45 days	1,469 (86.2)	224 (13.1)	8 (0.5)	4 (0.2)	1,705 (100)
Illnesses					
No lost time	800 (53.7)	461 (30.9)	144 (9.7)	85 (5.7)	1,490 (100)
Lost time	345 (49.9)	268 (38.7)	45 (6.5)	34 (4.9)	692 (100)
Total	18,740	3,385	270	151	22,546

From the data in Table 5 it is apparent that injuries and illnesses differ in the timeliness with which they are reported to OWCP. Of the 20,364 injuries claimed during a four-year time period to have been newly occurring during 1990, more than 99 percent had been reported as of the end of the second year. In contrast, only 86 percent of the claimed illnesses had been reported after the same period of time. Extrapolations from the data in Table 5 suggest that the total reported size of the 1990 injury cohort could ultimately increase by approximately 200 individuals over the next 4 or 5 years, with almost all these new cases representing claimed illnesses.

Table 6 shows the costs known to have been paid over 4 years for the 1990 injury cohort. Injuries involving more than 45 days of lost time clearly predominate over other categories of injuries and illnesses with respect to cost. In aggregate, these injuries (which comprise only 8 percent of all cases) are responsible for 60 percent of the costs generated by the entire cohort through 4 years; on a per-case basis they are nearly five times more expensive than the next most expensive category at this point, lost-time illnesses.

Counts and costs through 4 years for cases that were still open and active at the end of the 1993 chargeback year are shown in Table 7. These cases were assumed to be responsible for the additional costs yet to be generated by the cohort in years 5 through 32, and the allocation of these projected costs is shown in Table 8. Table 8 also shows the projected grand total for the 1990 injury cohort through 32 years ($391 million, which includes continuation of pay costs), and various cost-per-case estimates.

Just under 7 percent of the cases reported were denied benefits in OWCP's adjudication process.[16, Subpart B] Because these cases are associated with few, if any, costs, the "per case" estimates in Table 8 are only for cases accepted by OWCP as qualifying for benefits. These estimates indicate that the average cost that will accrue over 32 years to the Department of the Navy for a work-related injury or illness that occurred in 1990 and was reported to OWCP and accepted for coverage was $18,632. However, no single category of cases behaved like the "average," with a greater than seventyfold difference in the average cost per case in the least expensive category as opposed to the most expensive. In all categories, cases that remained open beyond 4 years were exceptionally expensive.

Table 9 presents data consolidated from previous tables to facilitate cost comparisons with sources that use the traditional dichotomization of cases as no lost-time or lost-time.

Table 6

Department of the Navy Civilian Employee 1990 Injury Cohort: Actual Costs Through 4 Years, by Severity Group

Severity group	Cases reported	Payments (000s)				
		Medical	Compensation (from OWCP)	Continuation of pay estimate	Total	Per case (mean)
Injuries						
No lost time	7,753	$5,618	$4,241	$0	$9,859	$1.3
Lost time ≤ 45 days	10,906	7,214	1,519	5,390	14,123	1.3
Lost time > 45 days	1,705	22,010	28,259	4,045	54,314	31.9*
Illnesses						
No lost time	1,490	1,616	4,867	0	6,483	4.4*
Lost time	692	1,312	3,316	0	4,628	6.7*
Total (mean)	22,546	$37,770	$42,202	$9,435	$89,407	($4.0)

* Differs from all other group means ($p < .05$) using Scheffe's multiple pairwise comparisions test. (Statistical testing was conducted prior to the addition of the continuation of pay estimates for the two lost-time injury groups; means at this time were $0.8 thousand for the injury group with less than 45 days of lost time, and $29.5 thousand for the injury group with more than 45 days of lost time.)

Table 7

Department of the Navy Civilian Employee 1990 Injury Cohort: Actual Costs Through 4 Years for Cases Still Open at the End of 4 Years, by Severity Group

Severity group	Cases still open after 4th year	Payments (000s)				
		Medical	Compensation (from OWCP)	Continuation of pay estimate	Total	Per case (mean)
Injuries						
No lost time	155	$2,151	$3,015	$0	$5,166	$33.3
Lost time ≤ 45 days	85	850	986	42	1,878	22.1
Lost time > 45 days	600	15,200	21,809	1,423	38,432	64.1*
Illnesses						
No lost time	251	673	2,652	0	3,325	13.2
Lost time	104	761	2,676	0	3,437	33.0
Total (mean)	1,195	$19,635	$31,138	$1,465	$52,228	($43.7)

* Differs from all other group means ($p < .05$) using Scheffe's multiple pairwise comparisions test. (Statistical testing was conducted prior to the addition of the continuation of pay estimates for the two lost-time injury groups; means at this time were $21.6 thousand for the injury group with less than 45 days of lost time, and $61.7 thousand for the injury group with more than 45 days of lost time.)

Table 8

Department of the Navy Civilian Employee 1990 Injury Cohort: Total Cost Projections Through 32 Years, by Severity Group

Severity group	Cases		Payments (000s)				Cost per:	
	Reported	Accepted	4-year actual	Projected for years 5-32		Projected 32-year total	Accepted case	Case open after 4th year
				Medical	Compensation			
Injuries								
No lost time	7,753	7,545	$9,859	$6,410	$23,580	$39,849	$5,282	$226,813
Lost time ≤ 45 days	10,906	10,133	14,123	2,535	7,722	24,380	2,406	142,803
Lost time > 45 days	1,705	1,621	54,314	45,318	170,615	270,247	166,716	424,065
Illnesses								
No lost time	1,490	1,201	6,483	2,008	20,754	29,245	24,351	103,932
Lost time	692	515	4,628	2,271	20,925	27,824	54,027	256,087
Total (average)	22,546	21,015	$89,407	$58,542	$243,596	$391,545	($18,632)	($296,614)

Table 9

Department of the Navy Civilian Employee 1990 Injury Cohort: Average Cost Projected Through 32 Years for Accepted Cases Classified as No Lost-Time or Lost-Time

Case type	Accepted cases	Projected 32-year payments per case		
		Medical	Indemnity*	Total
No lost time	8,746	$1,790	$6,110	$7,900
Lost time	12,269	$6,574	$19,707	$26,281

* Includes compensation from OWCP and continuation of pay

DISCUSSION

The issues of whether federal workers' compensation costs indeed rose more slowly than private sector costs during the period 1986 to 1991, and why, are unresolvable from our results. The requisite data (e.g., cost-per-employee estimates for the entire federal government for the time span in question) are simply not available.

Nonetheless, the value of using accrual rather than pay-as-you-go accounting methods in policy-making decisions is demonstrated clearly in this study. In 1990 the Department of the Navy's OWCP chargeback bill was $219 million. While alarming in itself, this figure understates the true cost of the work-related injuries and illnesses that occurred that year. Given the available data, at least $391 million in costs can be expected to accrue to the Department of the Navy over 32 years as a result of the new cases that occurred in 1990. (The true cost is likely to be higher still because neither costs beyond 32 years nor the value of in-house medical care provided by the Department of the Navy have been included.) Similarly, the highest estimate of the average cost of a case in 1990 using pay-as-you-go data ($10,248, from Table 1) is just over half the $18,632 that we estimate the average new case that year will cost.

Whether viewed in aggregate or on a cost-per-case basis, pay-as-you-go accounting methods substantially and consistently underestimate the cost of new injuries and illnesses and therefore the economic value of their prevention. Moreover, they obscure trends in the

data that may reflect the effects of recent prevention and cost-control efforts. For example, annual OWCP chargebacks to the Department of the Navy have risen from $219 million in 1990 to $250 million in 1993,[2] suggesting that efforts to control costs have been ineffective during this period. However, when accrual methods are used and expressed on a per-employee basis, as in Table 4, the results show that costs have held steady during this period, implying that injury prevention and cost-control efforts have been more effective than might otherwise be supposed.

As mentioned, costs that will accrue beyond 32 years have not been included in the model upon which this analysis is based. Drawing from previous actuarial studies, Towers Perrin estimates "very roughly" that these costs may add 25 percent to the expense predicted through 32 years.[19] Obviously, this portion of the predictive model needs development; similarly, Towers Perrin has described a variety of methods (most requiring additional data) by which the accuracy of the existent model could be enhanced. Nonetheless, its general validity can be assessed by comparing the cost-per-case estimates to which it gives rise with those from other sources.

Table 10 shows the estimated average cost to the Department of the Navy for an accepted lost-time injury or illness occurring in 1990, as derived from the analyses described in this paper. Also shown are estimates of averages for similar cases covered by private insurers and for cases covered under the U.S. Longshore and Harbor Workers' Compensation Act, which is similar to FECA with the major exception that it limits all beneficiaries' indemnity payments to two-thirds of salary and its cap on maximum indemnity benefits is about half that of FECA's. Both sets of estimates are from the National Council on Compensation Insurance, a nonprofit data-collection and research organization for providers of workers' compensation insurance.[17, 20]

The comparisons made in Table 10 suggest that the cost estimates generated by our model are consistent with those for similar cases covered by other insurers. There is little difference in estimated medical expenses under the three program types, and the differences in indemnity expenses are as expected. The Harbor Workers' costs are estimated to their "ultimate" resolution,[17] and adding 25 percent (or some similar amount) to our estimate to account for expenses likely to accrue beyond 32 years makes the total projected indemnity

Table 10

Estimated Average Cost of a New Lost-Time Case Under Three Different Workers' Compensation Insurance Programs

Expense	Cost per case		
	Department of the Navy under OWCP	Representative private insurers	U.S. Longshore and Harbor Workers' Compensation Act
Medical	$6,574	$6,679	$8,704
Indemnity	$19,707	$14,098	$22,466
Total	$26,281	$20,777	$31,170

Notes: Accident year dates are as follows:

Department of the Navy (OWCP):	1 July 1989 to 30 June 1990.
Private insurers:	1 January 1990 to 31 December 1990.
Harbor Workers' Act:	1 February 1988 to 31 January 1989.

The National Council on Compensation Insurance is the source of estimates for both the private insurers and the Harbor Workers' Act (references 20 and 17, respectively).

costs under the two programs highly consistent. Our estimate of indemnity costs for the Department of the Navy should be higher than those for private insurers because of the greater generosity of benefits under FECA than under the state laws that govern private insurers (the benefit cap is higher, beneficiaries tend not to be subject to negotiated settlements, and, if it is to their financial disadvantage, they needn't convert to social security upon eligibility).

Utility of the Case Severity Classification Scheme

A common rule of thumb in the field of occupational safety and health is that 10 percent of injury cases account for 80 percent of workers' compensation costs.[21] This concentration of costs suggests the possibility of substantial savings if such cases can be prevented or identified sufficiently early in their course to permit effective use of intervention strategies such as return-to-work or light-duty assignments.[10] In our study, 90 percent of the

total projected costs were attributable to just 5 percent of the accepted cases—specifically, those that were still open 4 years after they originally occurred.

While this represents an even greater concentration of costs than is conventionally described, the formulation is less than ideal for cost-control interventions given that it requires the passage of 4 years before these expensive cases can be identified. The case severity classification scheme developed in this study, however, does begin to offer a potentially more useful alternative for this purpose.

The scheme relies on four dichotomous pieces of information: whether a case was (1) an injury or an illness, (2) associated with time lost from work, (3) associated with a claim for wage-replacement compensation from OWCP via the filing of a CA-7 form, and (4) accepted by OWCP for coverage. The first and second of these pieces of information are immediately available when a claim is filed, and the third is available within 45 days of the date of injury. Analysis of the 1990 cohort indicates that the median time to availability of the last bit of information—the decision by OWCP to accept or deny the case for coverage—is between 51 and 57 days from the date the injury or illness occurred (data not shown). Within 60 days, therefore, enough information will usually be available to permit the discrimination of cases that, on average, will cost $2,406 from those that will cost $166,716.

Cruder discriminations are possible earlier (the moment a lost-time illness claim is filed, for instance, it can be predicted from Table 8 that it will cost eight times as much as a no-lost-time injury). And finer discrimination will become possible through the application of appropriate statistical techniques[22] and the use of additional key information available at the time a case is filed (e.g., the anatomical location of an injury).[15] Yet even in its current stage of development, the classification scheme we describe should be of use to Navy Injury Compensation Program Administrators[10] and others whose job it is to oversee day-to-day case management of claims and to promote and apply appropriate and effective interventions for cost control. (One such intervention is readily apparent from the preceding discussion. Slow claims processing—whether associated with reporting or adjudication—is associated with increased costs.[23, 24] Yet the *median* time between the occurrence of an event in 1990 and its adjudication was close to 2 months. This delay is entirely within the joint control of the

Department of the Navy and OWCP, and should be subject to meaningful reduction through concerted effort.)

Similarly, a case's continued active status 4 years after the original occurrence of an injury or illness is a marker for a considerable increase in average costs. In 1992 OWCP began a program to review the continued eligibility for benefits of cases that had been assigned to its long-term roles within the preceding 5 years. Because the average cost of a case will increase roughly seven-and-one-half times from the end of the 4th to the end of the 32nd year, programs such as this have the potential to be highly cost-effective.

Conclusions and Recommendations

The highest estimate previously available of the average cost to the Department of the Navy for newly occurring injuries and illnesses is approximately half the amount indicated by our findings. From this it can be assumed that previous economic evaluations of prevention and other cost-control programs have been correspondingly low.

The reliance on pay-as-you-go accounting methods within the Department of the Navy (and the federal government as a whole) to estimate the costs of work-related injuries and illnesses has led unavoidably to flawed or erroneous assumptions about workers' compensation costs, the influences on these costs, and their trends. The ability to estimate the cost of an injury or illness from the time of its occurrence to the time of its resolution is widespread outside the federal government, and the absence of this capability within the federal government currently limits policy-makers, safety managers and others from designing and assessing prevention and cost-control programs that are optimally effective. Program effectiveness cannot be gauged if program outcomes are not correctly measured.

We have demonstrated the feasibility of projecting future costs for injuries and illness newly occurring among the Department of the Navy's civilian employees. The cost projection model upon which this study is based nonetheless offers important additional opportunities for enhancement,[19] primarily through the acquisition and incorporation of additional data. In addition, the current model only provides the ability to project costs in terms of contemporary dollars paid, and the inclusion of parameters that permit the calculation and presentation of results in terms (e.g., inflation-adjusted constant dollars or net present value[8]) that help address the changing value of money over time would increase the

model's utility. We recommend that these enhancements be developed and that this occur in close cooperation with experienced actuaries.

OWCP or the Office of Federal Agency Programs[3] are the logical homes for the development of comprehensive cost projection models suitable for use throughout the federal government. Until such time as these agencies are able to provide this capability, however, we recommend that the Department of the Navy continue to develop its own expertise internally. We recommend further that the Department's ability to estimate the full cost of injuries and illnesses be sufficiently refined to enable the accurate projection of costs at the facility level. Doing so will permit the annual chargeback bills passed to commands to reflect contemporary rather than historical losses, thereby better achieving the Navy's intent of making commanding officers more aware of the influence their actions have on costs.[10]

Finally, we recommend that consideration be given to incorporating the case severity classification scheme developed here into the annual Occupational Safety and Health Program Improvement Plans currently required from Echelon II commands and large activities.[25 ¶0505] These plans are intended in part to reduce injury- and illness-related costs. But because most mishaps are relatively inexpensive, it is possible for an activity to achieve an impressive reduction in its overall mishap rate without appreciably reducing its costs. Rather than set as a goal an overall reduction in rates, it may therefore be more effective for an activity to seek to reduce its rate of a specific class of injuries or illnesses. Substantial savings could be realized, for example, by focusing solely on reducing the rate of injuries involving more than 45 days of lost time, and the setting of such goals should be supported by policy-makers.

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13. ABSTRACT *(Maximum 200 words)*

Costs to the Department of the Navy for occupational mishaps suffered by its civilian employees have been rising for more than a decade. This trend has prompted concern, yet fundamental information about the underlying nature of these costs has been missing. For instance, the average cost of a workers' compensation cost is not known.

This paper describes the use of actuarial accounting methods to determine the average cost of a workers' compensation case among the Department's civilian employees originally injured in 1990. Included are projections of all costs that will accrue from these injuries for 32 years into the future. Additionally, a classification scheme is developed which uses information available at or near the time of injury to project the average costs for five different categories of injury or illness.

Results indicate that costs projected to accrue for those injuries and illnesses newly occurring in 1990 will exceed $391 million. The average cost of a new mishap that year is projected to be $18,632—an amount nearly twice the highest estimate previously available using the government's conventional accounting methods. Average costs for individual categories of mishap ranged from $2,406 for an injury with no lost time to $166,716 for injuries involving more than 45 days of lost time. Implications of these findings are discussed.

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