Revised Medical Cost Estimates for the Injury Cost Model

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Background

In the late 1970s, the U.S. Consumer Product Safety Commission (CPSC) developed an Injury Cost Model (ICM) (Technology and Economics, Inc., 1980) to estimate the dollar costs to society of non-fatal injuries associated with consumer products. In the late 1990s, a major revision of the ICM was undertaken to take advantage of improved and expanded data and new methods, such as the duration model used in estimating time lost from work. This revision, completed in 2000, defined four components of injury costs: medical costs, work losses, pain and suffering, and liability insurance administration and litigation costs (Miller et al, 2000). Pain and suffering costs generally make up the bulk of costs for any given injury, almost three-quarters on average. Medical costs account for about 10 percent and work losses account for about 15 percent. Liability insurance and litigation costs account for less than one percent of injury costs.

In 1989, a study titled *Cost of Injury in the United States - A Report to Congress* (Rice, MacKenzie and Assoc., 1989) provided a comprehensive overview of both fatal and non-fatal injuries and the economic costs of these injuries. This study evaluated injuries in all spheres: occupational, motor vehicle, consumer product related, and others. The study also provided breakdowns by age, sex, medical treatment level (e.g., hospitalized), intentionality (e.g., homicide vs. unintentional death) and cause. In 2002, the Centers for Disease Control and Prevention, National Center for Injury Prevention and Control (CDC) sponsored a multi-year study to update the injury incidence and cost estimates presented in the 1989 study. The CDC took a cost-of-illness (COI) approach, using medical costs and productivity losses exclusively to estimate the potential benefits from reducing injuries. The study was peer-reviewed and published in book form by Oxford University Press: *The Incidence and Economic Burden of Injuries in the United States, 2000* (Finkelstein et al, 2006).

CPSC staff participated in a review panel on the CDC study and determined that the CDC efforts to estimate medical costs could provide an effective basis for updating and revising the medical costs in the ICM. In 2005, CPSC issued a contract to Pacific Institute for Research and Evaluation (PIRE) to update the ICM estimates (contractor's reports attached). While the medical cost component accounts for only about 10 percent of injury costs, it is a key component of the ICM because it provides part of the basis for the regression analyses that estimate pain and suffering and is used in the estimation of liability insurance administration and litigation costs. Medical costs are also important because they are tangible costs.

This report describes the derivation of the new medical costs for the ICM, which are termed "revised medical costs," from the CDC medical costs. The report then discusses briefly how the data sources and methods for the revised medical costs differ from those in the 2000 ICM and how factors such as coverage and mapping affect the detail of the medical cost estimates in the age, sex, and diagnosis categories.

Methodology

The basic methodology for revising medical costs is presented in the CDC study. Medical cost estimates are derived by first analyzing hospital cost data and then building total medical costs from the hospital cost estimates. Hospital costs are coded by a system known as the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM). This system was adapted from the World Health Organization's classification system for morbidity data, including injuries, and is used extensively for billing, medical care review, and basic health statistics. By contrast, the National Electronic Injury Surveillance System (NEISS)[1] used by CPSC codes each injury with a diagnosis (also referred to as nature of injury) and a body part. Thus, the first steps in developing the revised hospital costs from the CDC estimates included mapping costs from ICD-9-CM codes to NEISS codes, grouping costs to ensure adequate sample size, and checking for coverage. Out-of-scope hospital costs, such as those associated with motor vehicles, intentional injuries, and fatalities were eliminated from the data.

Since the NEISS coding system used by the ICM does not match other medically-based injury coding systems in many cases, the CDC hospital costs had to be mapped into the NEISS diagnosis-body part injury codes. In addition, when sample sizes for the NEISS diagnosis codes were small, similar injuries were grouped to obtain adequate sample sizes. The techniques for making these adjustments are described in two memos from PIRE dated April 4, 2006, and June 26, 2006 (attached).

Other medical costs that are added to hospital costs include doctors' fees, costs for all types of follow-up care, long-term care costs for certain diagnoses, and ambulance costs. In addition, the ICM also includes factors for claims processing costs not included in the CDC study. The revised medical costs build up medical costs from hospital costs using the same method as that used in the CDC study, but add claims processing costs to make the medical costs conceptually comparable to the ICM medical costs.

With the exception of long-term medical costs, which are still calculated using the Detailed Claims Information from Worker's Compensation data, the revised medical costs for hospitalized injuries are based on different databases than the medical costs in the ICM (Miller et al, 2000). The 2000 ICM relied on data on the medical costs of military dependents from what is now called Tricare, the National Hospital Discharge Survey (NHDS), the National Medical Expenditure Survey (NMES), and discharge data from several states. The revised medical costs use the 2000 National Healthcare Cost and Utilization Project – National Inpatient Sample (HCUP-NIS) data, MarketScan® data, Prospective Payment System reimbursements, the Medical Expenditure Panel Survey (MEPS), National Nursing Home Survey data, discharge data from several states, and Agency for Healthcare Research and Quality (AHRQ) cost-to-charge ratios to estimate costs for hospitalized injuries.

The revised medical cost estimates are obtained more directly from the data than those in the 2000 ICM. For example, the ICM estimates for hospital costs for hospitalized injuries use length of stay from NHDS adjusted by regression analysis and hospital cost per day from state

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[1] The NEISS is a hospital emergency room based system of approximately 100 hospitals which collects data on a continuous basis to make statistically valid national estimates of consumer product related injuries.

discharge data. The revised medical costs use adjusted charges from HCUP-NIS alone. There are fewer steps in the process and the hospital costs are not derived from two entirely different data sources.

The same pattern holds true for non-hospitalized injuries, where the revised medical costs again use different data and use it more directly. The ICM uses cost estimates from military dependent data with adjustments provided by NMES and the National Health Interview Survey. The CDC study relies on the MEPS data almost exclusively, the exception being transport costs for non-hospitalized emergency room treated injuries, which are based on Medicare claims and incidence data from a pediatric trauma registry. Using one consistent data source likely increases accuracy.

Generally, there is less age, sex, and injury category detail in the revised medical costs than in the 2000 ICM, particularly in the non-hospitalized patient categories. The MEPS data have fewer observations available to make demographic differentiations for non-hospitalized injuries than the military dependent data. The level of detail is greater in the hospitalized injuries, where length of stay and other issues cause greater variations in costs. Thus, for example, the revised medical costs for a 75-year-old female hospitalized due to a hip fracture would be different from those of a 40-year-old male with the same diagnosis and disposition. However, the revised medical costs for a non-hospitalized finger laceration for the same 75-year-old female and 40-year-old male might not be different. This is not troubling because a large proportion of charges for outpatient visits are fixed costs, such as emergency room charges. Additionally, the revised medical costs use national datasets that are more demographically representative of the nation as a whole than the military dependent data. As noted above, they are also estimated more directly and using fewer databases for the core hospital cost estimates.

Coverage and mapping are also improved in the revised medical costs. Coverage refers to the percentages of injuries found in the 1995-2003 NEISS records that could be assigned medical costs from either the HCUP-NIS (hospitalized) or MEPS (non-hospitalized) databases. Coverage was improved by carefully examining which NEISS diagnoses were not included in the ICM and then analytically assigning them costs from similar diagnoses. As a result, fewer injuries are assigned to "other injury" categories.

Mapping is necessary because medical costs are coded using different systems than the NEISS. The CDC Study (Finkelstein et al, 2006) provided medical costs for hospitalized injuries according to the ICD-9-CM system, and, therefore it was possible to map them to the NEISS codes in the same manner as the ICM. The CDC study provided medical costs for non-hospitalized injuries according to a third coding scheme, the Barell scheme. Thus, these costs had to be recoded from Barell to NEISS. Since the Barell scheme is a nature of injury/body region classification system similar to the NEISS injury coding scheme, converting Barell-coded costs to NEISS-coded costs was readily accomplished.

The three systems, NEISS, Barell, and ICD-9-CM, have different levels of detail because of the different purposes for which they are intended. The ICD-9-CM, as a medical system, is highly detailed about certain types of fractures and head injuries compared to the NEISS, but less detailed about body regions for some minor injuries. Thus, converting from one system to another always involves mapping. Possible mappings are one-to-one, one-to-many, many-to-one,

and many-to-many. One-to-one mappings involve no blending of costs of different diagnoses and thus offer greater precision. An example of a one-to-one mapping is the ICD-9-CM code 832, dislocation of elbow, which maps directly into the NEISS diagnosis 55 (dislocation), body part 32 (elbow). On the other hand, the ICD-9-CM code 910, superficial injury of face, neck, and scalp, except eye, maps into NEISS diagnosis 53 (contusion, abrasion), body part 88 (mouth), but it also maps into several other NEISS combinations.

Once the revised medical costs were compiled, they were used (along with the work loss costs from the ICM) to recalculate pain and suffering costs, legal and liability costs, and thus, total injury costs. Work losses were not changed, since the methodology and data used in the CDC study were largely the same as those used in the ICM revision of 2000.

Summary of Major Results

- Overall total costs of one year (average from 1995-2003) of NEISS injuries decline by 8.6 percent, from $533 billion to $476 billion in 2000 dollars.
- While the change in aggregate injury costs is relatively small, there are some large changes in the average costs associated with different medical dispositions (hospitalized injuries, emergency department-treated injuries, and injuries treated in doctors' offices or clinics) and the costs associated with certain diagnoses.
- Medical costs for doctor's office/clinic-treated injuries fall by 25 percent. Medical costs for emergency department-treated injuries rise 13 percent. Medical costs for hospitalized injuries fall by 58 percent.
- Medical costs for internal injuries and nerve damage injuries fall by about 90 percent for doctor/clinic treated injuries while medical costs for crushing injuries treated in doctors' offices or clinics increased by 154 percent.
- For treated and released injuries (not hospitalized) medical costs for burns, anoxia, hemorrhage, electric shock, and submersion all more than double, while amputation, nerve damage, and internal injury medical costs fall by more than half.
- For hospitalized injuries, electric shock medical costs double, but nerve damage, aspiration, internal injury and anoxia costs fall substantially because the nursing home component of the CDC medical costs is reduced substantially. Only burns and spinal cord injuries are allocated special nursing home costs, and the costs are more modest than current ones found in the ICM. This is also reflected in total costs for these diagnoses.

Attachments

The two attached memoranda, "Revised Medical Costs for the Injury Cost Model" dated April 4, 2006, and "Revised Input Datasets for the Injury Cost Model" dated June 26, 2006, provide additional detail on the process of developing the revised medical costs and additional comparisons of costs before and after the implementation of the revised medical costs. They also provide documentation of the revised datasets provided by the contractor.

References

Eric A. Finkelstein, Phaedra S. Corso, Ted R. Miller, Ian C. Fiebelkorn, Eduard Zaloshnja, and Bruce A. Lawrence. *The Incidence and Economic Burden of Injuries in the United States, 2000.* New York, New York: Oxford University Press, 2006.

Miller et al. "The Consumer Product Safety Commission's Revised Injury Cost Model," Public Services Research Institute, Calverton, MD, December 2000.

Dorothy P. Rice, Ellen J. MacKenzie, and Associates. *Cost of Injury in the United States - A Report to Congress.* San Francisco, CA: Institute for Health & Aging, University of California and Injury Prevention Center, The Johns Hopkins University, 1989.

Technology and Economics, Inc. *The Consumer Product Safety Commission Injury Cost Model.* Washington, DC: The Consumer Product Safety Commission, 1980.

PIRE

Date: 4 April 2006

To: Bill Zamula, CPSC

From: Bruce Lawrence, PIRE

Subject: Revised Medical Costs for the Injury Cost Model

In partial fulfillment of CPSC Task Order Number CPSC-F-05-0019, awarded under GSA
Schedule Contract #GS-10F-0128R, I have produced SAS datasets containing new medical costs
for use with CPSC's Injury Cost Model (ICM). The datasets contain lifetime medical costs in
2000 dollars for three treatment levels:

- Patients admitted to a hospital, by NEISS diagnosis, sex, and age group.

- Patients treated in a hospital emergency department, by NEISS diagnosis.

- Patients treated in a doctor's office or clinic, by NEISS diagnosis.

I began with medical datasets previously costed by my colleague Eduard Zaloshnja for a project
sponsored by the Centers for Disease Control (CDC). Full methods from that project will be
published in a peer-reviewed book in mid-April:

> Finkelstein EA, Corso PS, Miller TR, Fiebelkorn IC, Zaloshnja E, Lawrence BA (2006).
> *The Incidence and Economic Burden of Injuries in the United States, 2000.* New York:
> Oxford University Press.

A summary of the CDC project methods follows.

Medical costs for hospital-admitted injury patients. A hospital-admitted injury victim may
incur several different types of medical costs. In addition to the facility and non-facility costs of
the admission itself, the patient may incur costs for emergency transport, follow-up treatments,
readmissions, rehabilitation, nursing home stays, and, for particularly serious injuries, long-term
care. The CDC project derived its estimates of facility costs from hospital charges, as recorded in
the 2000 HCUP-NIS, multiplied times hospital-specific cost-to-charge ratios provided by
AHRQ. It supplemented this with Medstat's MarketScan® database for non-facility fees, the
Prospective Payment System (PPS) for rehabilitation expenses, and the Medical Expenditure
Panel Survey (MEPS) for follow-up costs. An overview of the approach is presented in Table 1.

Medical costs for non-admitted injury patients. The project used the 1996-1999 MEPS data to
quantify direct medical costs for injuries not requiring hospitalization. MEPS participants with
injury-related expenditures but without an inpatient admission were divided into three categories

by primary treatment location, according to this hierarchy: 1) any ED utilization; 2) any office-based utilization but no ED utilization; and 3) any outpatient treatment but no ED or office-based utilization. Even after pooling four years of data, the MEPS sample of non-admitted injuries remained small for some injury diagnoses. Therefore, the project pooled injuries into diagnosis groups: 51 groups for ED visits, 52 for office-based visits, and 7 for outpatient clinic cases.

Having classified each patient into one of these 110 location/diagnosis-group categories, the CDC project added up all medical costs for each patient (including costs incurred at other treatment locations lower in the hierarchy), and then calculated the average total medical cost across all patients in each location/diagnosis category. These direct cost estimates were then applied to the incidence estimates in the corresponding location/diagnosis categories to quantify total injury costs for non-admitted injuries. This procedure avoids double-counting costs for individuals seen in multiple locations. The project assumed that half of injuries treated in the ED would be EMS-transported. Accordingly, half of the average one-way emergency transport cost of $212 was added to each ED case.

Methods for hospital-admitted costs. Beginning with the costed 2000 HCUP-NIS file we produced for the CDC project, my goal was to produce a file of costs by NEISS injury type and body part, sex, and age group. I used the same four age groups used in the ICM: 0-19, 20-54, 55-69, and 70+. I dropped all fatalities, intentional injuries, and injuries related to motor vehicle traffic crashes, since the ICM is not intended to cover such cases.

One cost omitted from the CDC medical costs was required for the ICM – the expenses incurred by payers in processing medical claims. The 2000 HCUP-NIS file included a *primary expected payer* variable. Based on this payer variable, I assigned claims-processing percentages as per Table 10 of the revised ICM report (*The Consumer Product Safety Commission's Revised Injury Cost Model*, 2000) and factored up medical costs accordingly. For the handful of cases (0.35%) where the payer variable was missing, I computed the weighted average of claims-processing percentages (for the cases with known payers) by age group and applied these average percentages to the cases with unknown payers by age group:

0-19	7.565%
20-54	7.376%
55-69	6.061%
70+	3.715%

The primary injury diagnosis of each costed HCUP-NIS case was then mapped from ICD-9-CM to NEISS. (There were no costed cases corresponding to the NEISS category *dermatitis/conjunctivitis*. CDC did not classify these cases as injuries, so we did not update these costs.) The mean cost was then computed for each combination of NEISS diagnosis (nature of injury and body part), sex, and age group. In instances where the cell size was thin, I combined cells in various ways: 1) combining two similar diagnoses; 2) combining age groups; 3) combining male and female for a given age group. For the NEISS diagnoses with the smallest case counts, I ignored age and sex, calculating a single average cost for the diagnosis. I then tested the completeness of my NEISS costs by mapping them onto nine years of NEISS data and seeing what diagnoses remained un-costed. For these 33 odd diagnoses, I copied the costs from

similar diagnoses. For a few diagnoses that did not make sense, I checked the text fields of the NEISS cases to see what the injuries actually looked like and copied costs accordingly.

Methods for non-admitted costs. For cases treated in EDs and doctor's offices or clinics, respectively, I began with the costed NHAMCS and NAMCS datasets, which we produced for the CDC project. The sample sizes were too small to support breakdowns of costs by age and sex, so my goal was simply to compute an average cost for each NEISS diagnosis.

As with the costs for hospital-admitted cases, the CDC medical costs omitted the cost to payers of processing medical claims. Each dataset included a variable for the primary expected payer, and the payer was known in 96.5% of ED cases. Using the factors from Table 10 of the revised ICM report, I computed the average claims-processing percentage by Barell nature of injury:

	Claims Processing Percentage	
Nature of Injury	ED	Doc/clinic
Fracture	6.660%	7.712%
Dislocation	5.933%	8.196%
Sprain/strain	6.900%	8.464%
Internal organ	6.286%	10.228%
Open wound	6.741%	8.223%
Amputation	6.741%	8.223%
Blood vessels	6.741%	8.223%
Contusion/superficial	6.530%	7.898%
Crush	9.305%	7.898%
Burns	7.398%	5.669%
Nerves	5.966%	7.238%
Unspecified	6.490%	7.975%
Other	5.966%	7.238%

When a nature of injury had a small case count, I combined it with another group (this accounts for the identical percentages assigned to multiple groups in each column). I then assigned the appropriate percentage to each case based on its Barell nature of injury and factored up the medical cost accordingly.

The medical costs assigned to these cases were not based directly on the ICD-9-CM diagnoses, but rather on the nature of injury and body region according to the Barell matrix, a two-dimensional diagnosis classification system similar to the NEISS system. (See <www.cdc.gov/nchs/about/otheract/ice/barellmatrix.htm> for further information.) Therefore, I mapped costs directly between the two diagnosis systems, taking advantage of their similarities. NEISS tends to have more detail in nature of injury; therefore, in a number of cases, multiple NEISS categories were mapped from a single Barell category (e.g., both laceration and puncture were mapped from open wound).

I tested the completeness of my costs by merging them onto 9 years of NEISS data. Because of the small sample sizes – *very* small for doctor's office/clinic costs – many NEISS diagnoses did not receive costs. Using Eduard Zaloshnja's costing programs as a guide, I assigned the costs that the Barell equivalents of these cases would have received if any such cases had existed in NHAMCS/NAMCS.

Comparison with old costs. In order to provide a first glance at the impact of this update of medical costs, I merged both the old and new medical costs onto the 1995-2003 NEISS data and computed average costs by NEISS nature of injury. The results are shown in Tables 2, 3, and 4.

The cost of cases treated in a doctor's office or clinic, but not in an ED, fell by 25% (Table 2). This change was not even across all categories, however. The costs of nerve damage and internal organ injuries fell by 88% and 89%, respectively, while the cost of crushing injuries rose by 154%.

In Table 3, we see that, on average, the medical costs of ED-treated injuries changed little, rising by about 10%. Burns, anoxia, hemorrhage, electric shock, submersion, crushing, and sprain/strain all more than doubled. Meanwhile, amputation, dental injury, nerve damage, and internal injury fell by more than half.

Among hospital-admitted injuries (Table 4), we find much more substantial shifts in cost. The average cost of a hospital-admitted injury *fell* by 58%. Electric shock is the only category whose cost doubles. Most categories have lower costs, with substantial drops in nerve damage, aspiration, internal injury, and anoxia. These last three categories were ones where we added the cost of up to 10 years of nursing home care in the old ICM medical costs. In the new CDC cost model, only burns and spinal cord injuries receive special additional costs, and even these are more modest than in the original model.

Table 1. Summary of Data and Methods for Estimating Medical Costs of Hospital-Admitted Non-Fatal Injuries

Cost category	Description, Unit Cost (in 2000 U.S. Dollars)	Source/Notes
Inpatient Stay - Facilities Component	Inpatient facility charges times facility-specific (or hospital stratum average) cost-to-charge ratios	2000 HCUP-NIS and cost-to-charge ratios from AHRQ
Inpatient Stay - Non-Facilities Component	Estimated via ratio of total costs to facilities costs by body region and nature of injury	1996-97 MarketScan® data
Hospital Readmission	Probability of readmission times average readmission costs by 3-digit ICD-9 diagnosis	Probability from 1997 CA, MD, and PA hospital discharge data, costs from 2000 HCUP-NIS/MarketScan®
Hospital Rehabilitation	Estimated for 14 diagnosis groups and 6 mechanisms	Costs estimated using Prospective Payment System reimbursements, as per Miller et al. (2004)
Nursing Home	Costs added to HCUP/NIS patients discharged directly to nursing home. Costs estimated for hip-related fractures by age group and for all other injuries	1999 National Nursing Home Survey
Short- to Medium-Term Costs (Non-Inpatient)	Estimated as the ratio of inpatient to total costs in months 0-18 (on average) by select diagnosis groupings	1996-1999 MEPS
Long-Term Costs - 18 Months to 7 Years	Estimated using ratios of total costs to 18-month costs by diagnosis/age group. Captures costs up to 7 years post injury	1979-88 Detailed Claim Information (DCI) data from Worker's Comp claims; adjustment factor for youth from Miller et. al. (2000)
Long-Term Costs - Beyond 7 Years	SCI: Ratio of lifetime costs to 7 year costs estimated from survey data TBI: 7+ year costs estimated at 75% of SCI costs	1986 survey data reported in Berkowitz et al. (1990)
Transport	50% of admissions assumed to have transport costs of $212	Mean cost estimated using 1999 Medicare ambulance claims with an injury E code

Berkowitz M, Harvey C, Greene C, Wilson S (1990). *The Economic Consequences of Spinal Cord Injury*, Paralysis Society of America of the Paralyzed Veterans of America, Washington, DC.

Miller TR, Langston E, Lawrence BA, Becker L, Snowden C, Granger C, Russell C, Kreutzer J, Marwitz J (2004). *Rehabilitation Costs and Long Term Consequences of Motor Vehicle Injury*, Final Report to NHTSA, Calverton MD: Pacific Institute for Research and Evaluation.

Miller TR, Romano EO, Spicer RS (2000). The cost of unintentional childhood injuries and the value of prevention. *The Future of Children* 10(1):137-63.

Table 2. Comparison of Old and New ICM Doctor's Office/Clinic Medical Costs as Applied to 1995-2003 NEISS Data

NEISS Injury	Lifetime Medical Cost (*2000 Dollars*)		
	Old	New	Difference
41 Ingested Object	374.58	571.53	196.95
42 Aspirated Object	690.32	175.38	-514.94
46 Burn, Electrical	407.20	184.44	-222.76
47 Burn, Not Specified	439.16	189.37	-249.79
48 Burn, Scald	496.51	191.89	-304.62
49 Burn, Chemical	321.45	185.90	-135.55
50 Amputation	1,270.25	183.94	-1,086.31
51 Burn, Thermal	425.33	187.34	-237.99
52 Concussion	665.79	546.28	-119.51
53 Contusion/Abrasion	363.72	330.80	-32.92
54 Crushing	672.38	1,705.63	1,033.25
55 Dislocation	1,804.10	633.89	-1,170.21
56 Foreign Body	399.01	207.38	-191.63
57 Fracture	1,564.21	958.66	-605.55
58 Hematoma	402.74	282.91	-119.83
59 Laceration	535.76	410.13	-125.63
60 Dental Injury	1,307.87	379.86	-928.01
61 Nerve Damage	6,368.26	736.78	-5,631.48
62 Internal Organ Injury	4,871.52	544.46	-4,327.06
63 Puncture	331.76	345.14	13.38
64 Strain/Sprain	411.43	640.39	228.96
65 Anoxia	466.00	836.06	370.06
66 Hemorrhage	470.67	605.96	135.29
67 Electric Shock	451.92	836.06	384.14
68 Poisoning	272.54	307.98	35.44
69 Submersion	466.00	836.06	370.06
70 Not Stated	1,110.91	792.37	-318.54
71 Other	1,043.45	769.95	-273.50
72 Avulsion	376.55	386.84	10.29
73 Burn, Radiation	333.41	185.10	-148.31
74 Dermat/Conjunctivitis	139.64	NA	NA
Average*	739.85	553.45	-186.40

* Not including 74 Dermat/Conjunctivitis.

Table 3. Comparison of Old and New ICM ED Medical Costs as Applied to 1995-2003 NEISS Data

NEISS Injury		Old	New	Difference
		Lifetime Medical Cost (*2000 Dollars*)		
41	Ingested Object	607.69	1,129.76	522.07
42	Aspirated Object	1,081.30	630.87	-450.43
46	Burn, Electrical	648.07	1,944.45	1,296.38
47	Burn, Not Specified	743.51	1,964.51	1,221.00
48	Burn, Scald	877.76	1,943.90	1,066.14
49	Burn, Chemical	596.01	2,010.60	1,414.59
50	Amputation	2,998.60	1,116.72	-1,881.88
51	Burn, Thermal	707.87	1,948.91	1,241.04
52	Concussion	1,788.51	1,574.50	-214.01
53	Contusion/Abrasion	724.13	956.57	232.44
54	Crushing	801.46	1,613.65	812.19
55	Dislocation	1,285.25	1,548.31	263.06
56	Foreign Body	833.20	710.30	-122.90
57	Fracture	1,362.24	1,599.44	237.20
58	Hematoma	551.14	923.76	372.62
59	Laceration	1,086.80	880.61	-206.19
60	Dental Injury	2,183.74	791.51	-1,392.23
61	Nerve Damage	5,306.14	2,052.28	-3,253.86
62	Internal Organ Injury	2,536.08	1,015.24	-1,520.84
63	Puncture	871.29	813.67	-57.62
64	Strain/Sprain	627.61	1,352.78	725.17
65	Anoxia	650.37	2,327.63	1,677.26
66	Hemorrhage	1,933.08	4,242.77	2,309.69
67	Electric Shock	630.72	2,327.63	1,696.91
68	Poisoning	885.01	1,029.81	144.80
69	Submersion	650.37	2,327.63	1,677.26
70	Not Stated	1,920.03	1,560.26	-359.77
71	Other	1,836.25	1,658.17	-178.08
72	Avulsion	969.84	895.29	-74.55
73	Burn, Radiation	588.35	2,040.94	1,452.59
74	Dermat/Conjunctivitis	273.70	NA	NA
	Average*	1,037.55	1,177.33	139.78

* Not including 74 Dermat/Conjunctivitis.

Table 4. Comparison of Old and New ICM Hospital Medical Costs as Applied to 1995-2003 NEISS Data

NEISS Injury		Lifetime Medical Cost (*2000 Dollars*)		
		Old	New	Difference
41	Ingested Object	7,767.96	11,834.54	4,066.58
42	Aspirated Object	304,473.42	17,444.28	-287,029.14
46	Burn, Electrical	20,691.83	23,362.79	2,670.96
47	Burn, Not Specified	27,615.40	25,118.08	-2,497.32
48	Burn, Scald	30,901.89	23,358.16	-7,543.73
49	Burn, Chemical	16,312.70	18,327.55	2,014.85
50	Amputation	16,396.61	13,959.61	-2,437.00
51	Burn, Thermal	50,558.16	27,359.53	-23,198.63
52	Concussion	6,737.43	10,591.22	3,853.79
53	Contusion/Abrasion	19,504.76	9,457.09	-10,047.67
54	Crushing	22,331.14	14,943.86	-7,387.28
55	Dislocation	24,571.45	13,086.20	-11,485.25
56	Foreign Body	11,937.81	11,063.66	-874.15
57	Fracture	24,180.35	13,700.15	-10,480.20
58	Hematoma	15,243.12	9,521.22	-5,721.90
59	Laceration	16,626.78	9,472.20	-7,154.58
60	Dental Injury	14,205.56	8,255.67	-5,949.89
61	Nerve Damage	563,258.20	84,763.85	-478,494.35
62	Internal Organ Injury	187,733.99	52,086.69	-135,647.30
63	Puncture	13,848.79	9,701.48	-4,147.31
64	Strain/Sprain	16,893.12	11,894.18	-4,998.94
65	Anoxia	221,396.67	11,484.11	-209,912.56
66	Hemorrhage	27,680.92	18,357.41	-9,323.51
67	Electric Shock	4,159.12	9,244.31	5,085.19
68	Poisoning	11,104.98	6,075.47	-5,029.51
69	Submersion	39,747.26	19,154.00	-20,593.26
70	Not Stated	37,899.67	9,575.59	-28,324.08
71	Other	33,899.00	13,556.45	-20,342.55
72	Avulsion	13,817.54	9,338.42	-4,479.12
73	Burn, Radiation	13,168.01	14,232.60	1,064.59
74	Dermat/Conjunctivitis	28,039.52	11,637.15	-16,402.37
	Average	36,780.47	15,638.38	-21,142.09
	Average*	36,839.94	15,761.28	-21,078.66

* Including admissions that did not come through the ED.

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PIRE

Date: 26 June 2006

To: Bill Zamula, CPSC

From: Bruce Lawrence, PIRE

Subject: Revised Input Datasets for the Injury Cost Model

In completion of CPSC Purchase Order Number CPSC-F-05-0019, awarded under GSA Schedule Contract #GS-10F-0128R, I have produced new versions of the two SAS datasets used by the CPSC's Injury Cost Model (ICM). These datasets are identical in layout to the datasets they replace – the same variables with the same names (see appendix) – so they should be compatible with the ICM's existing SAS programs. One dataset applies to hospital-admitted NEISS cases and the other to ED-treated NEISS cases. The latter dataset includes separate medical, pain-and-suffering, and total costs for non-admitted cases treated in non-ED settings, such as doctor's offices and clinics. (Work loss costs are not differentiated by treatment setting. Likewise, costs in the hospital-admitted dataset apply without differentiation to both admissions originating in the ED and admissions from other sources.)

These two datasets differ from the ones they replace in the following ways:

- They incorporate our new medical costs from the CDC-sponsored injury-cost project, as detailed in an earlier memo dated 4 April. The pain and suffering, legal/liability, and total costs were also re-calculated, since they draw on medical costs as an input. The only costs that were not revised are the ones associated with work loss.

- The pain and suffering cost calculations now take into account the burn cost adjustment factors, which differentiate medical costs by type of burn (thermal, scald, chemical, etc.). It appears that when we added the burn factors to the ICM in the 2000 revision, the calculation of pain and suffering costs was not revised to take into account the new medical costs of burns.

- All costs are in 2000 dollars. I updated all of the inflators I came across throughout all of the programs. Therefore, the only inflators that were not updated are the ones in the work-loss programs. Since the wage inflators never change, this means that all costs have been inflated to 2000 dollars with the most up-to-date inflators as of 2006. Future changes to the medical inflator are possible, but they are likely to be small.

- The selections of NEISS diagnoses (nature of injury / body part combinations) have changed slightly – some diagnoses were added and others dropped. The new diagnosis selections include all of those in the updated medical costs plus a few additional diagnoses added to fill in small gaps in the diagnosis coverage. Each dataset now includes all diagnoses that actually occur in the 1995-2003 NEISS data in cases of the corresponding admission category.

- All costs are formatted to two decimal places, making them easier to read if one has to look at the raw data in SAS.

The previous memo examined how medical costs will change with this update. Tables 1 and 2 (below) summarize the how pain and suffering and total costs, respectively, will change. Overall, pain and suffering costs of NEISS cases will fall by 5.0%, while total costs of NEISS cases will fall by 8.6%. For both kinds of costs, burns and electric shock increase substantially, while nerve damage, internal organ injuries, and aspirated objects fall substantially. The average annual aggregate cost of NEISS cases for 1995-2003 falls from $260.4 billion to $237.9 billion. The average annual aggregate cost of all injuries, including those not treated in an emergency department, falls from $533.2 billion to $475.5 billion.

Table 1. Comparison of Old and New ICM Pain and Suffering Costs
Mean Estimated Lifetime Pain and Suffering Costs of 1995-2003 NEISS Data

NEISS Injury	Lifetime Pain & Suffering Cost (*1995 $*)		
	Old	New	Difference
41 Ingested Object	8,965.50	10,898.59	1,933.09
42 Aspirated Object	36,848.58	14,530.79	-22,317.79
46 Burn, Electrical	32,655.86	37,113.53	4,457.67
47 Burn, Not Specified	25,978.54	31,564.01	5,585.47
48 Burn, Scald	28,304.74	31,628.62	3,323.88
49 Burn, Chemical	19,546.02	27,793.87	8,247.85
50 Amputation	147,071.24	134,625.32	-12,445.92
51 Burn, Thermal	27,005.19	33,293.90	6,288.71
52 Concussion	32,822.89	32,564.69	-258.20
53 Contusion/Abrasion	2,772.23	2,981.42	209.19
54 Crushing	16,652.06	18,933.43	2,281.37
55 Dislocation	22,910.42	22,996.89	86.47
56 Foreign Body	2,594.39	2,561.46	-32.93
57 Fracture	24,824.34	23,610.18	-1,214.16
58 Hematoma	3,077.19	3,346.45	269.26
59 Laceration	7,462.48	6,883.50	-578.98
60 Dental Injury	7,391.75	5,682.63	-1,709.12
61 Nerve Damage	240,044.86	118,691.55	-121,353.31
62 Internal Organ Injury	78,203.44	52,613.54	-25,589.90
63 Puncture	6,856.38	6,668.97	-187.41
64 Strain/Sprain	8,028.53	9,149.78	1,121.25
65 Anoxia	22,382.76	18,595.19	-3,787.57
66 Hemorrhage	8,926.77	9,177.58	250.81
67 Electric Shock	11,403.52	16,066.62	4,663.10
68 Poisoning	11,198.64	11,111.55	-87.09
69 Submersion	61,910.77	56,721.43	-5,189.34
70 Not Stated	13,620.08	11,628.19	-1,991.89
71 Other	12,384.31	11,021.67	-1,362.64
72 Avulsion	25,401.97	24,955.21	-446.76
73 Burn, Radiation	23,267.33	32,051.38	8,784.05
74 Dermat/Conjunctivitis	2,140.96	2,119.21	-21.75
Average	12,829.65	12,001.48	-828.17

Table 2. Comparison of Old and New ICM Total Costs
Mean Estimated Total Lifetime Cost of Injury, 1995-2003 NEISS Data

NEISS Injury		Lifetime Total Injury Cost (*2000 $*)		
		Old	New	Difference
41	Ingested Object	14,150.96	17,241.90	3,090.94
42	Aspirated Object	113,679.29	25,351.64	-88,327.65
46	Burn, Electrical	46,652.42	52,899.07	6,246.65
47	Burn, Not Specified	36,450.95	43,918.29	7,467.34
48	Burn, Scald	40,455.04	44,472.34	4,017.30
49	Burn, Chemical	26,023.88	37,063.37	11,039.49
50	Amputation	250,314.46	232,922.24	-17,392.22
51	Burn, Thermal	39,852.33	47,552.86	7,700.53
52	Concussion	45,548.63	45,340.00	-208.63
53	Contusion/Abrasion	5,344.53	5,675.44	330.91
54	Crushing	25,117.67	28,426.50	3,308.83
55	Dislocation	36,042.16	35,653.73	-388.43
56	Foreign Body	5,142.77	5,050.82	-91.95
57	Fracture	43,180.11	40,243.95	-2,936.16
58	Hematoma	6,995.11	7,310.20	315.09
59	Laceration	11,275.10	10,282.78	-992.32
60	Dental Injury	13,801.75	10,282.46	-3,519.29
61	Nerve Damage	462,052.69	188,001.05	-274,051.64
62	Internal Organ Injury	122,159.79	75,894.41	-46,265.38
63	Puncture	10,841.72	10,483.48	-358.24
64	Strain/Sprain	12,563.01	14,590.95	2,027.94
65	Anoxia	72,138.11	46,397.46	-25,740.65
66	Hemorrhage	31,503.87	29,853.39	-1,650.48
67	Electric Shock	21,408.16	28,917.75	7,509.59
68	Poisoning	18,477.42	17,989.53	-487.89
69	Submersion	242,736.44	224,886.39	-17,850.05
70	Not Stated	27,642.45	21,984.37	-5,658.08
71	Other	23,089.26	19,596.41	-3,492.85
72	Avulsion	34,103.81	33,380.77	-723.04
73	Burn, Radiation	30,360.51	42,260.25	11,899.74
74	Dermat/Conjunctivitis	3,787.42	3,663.78	-123.64
	Average	21,224.62	19,391.39	-1,833.23

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Appendix A. Variable Names in ICM Datasets

Each variable name consists of four fields – sex (three letters), age (two-digit number), treatment level (one letter), and cost category (two letters). Non-cost variables use the last three fields for category.

Sex: fem = female
          mal = male

Age: 00 = <1
          04 = 1-4
          09 = 5-9
          14 = 10-14
          19 = 15-19
          24 = 20-24
          29 = 25-29
          34 = 30-34
          39 = 35-39
          44 = 40-44
          49 = 45-49
          54 = 50-54
          59 = 55-59
          64 = 60-64
          69 = 65-69
          74 = 70-74
          79 = 75-79
          84 = 80-84
          85 = ≥85

Level: d = doctor's office/clinic
          e = emergency department
          n = non-admitted (d & e)
          h = hospital-admitted

Cost: om = medical
          oc = claims processing
          tm = total medical (om + oc)
          ow = work loss, short term
          cd = disability, long term
          vw = victim work loss (ow + cd)
          of = family work loss
          oe = employer loss
          tw = total work loss (ow + cd + of + oe)
          cp = pain and suffering
          cl = legal and liability
          ct = total (tm + tw + cp + cl)

Other: crd = ratio of doctor's office/clinic cases to ED cases
           crr = ratio of restricted activity cases to ED cases