Completeness of Workers' Compensation Data in Identifying Work-Related Injuries

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Introduction

The administrative data base compiled by state workers' compensation agencies is readily available in many states and has been used to enumerate the annual number of work-related conditions and their costs. However, there is a substantial medical literature that shows that the majority of workers do not apply for workers' compensation; up to half of workers with work-related injuries and an even higher percentage for work-related illnesses (1- 9). The undercount in workers' compensation data has been shown comparing workers' compensation numbers with the numbers identified in medical records (5, 6, 8), surveys of individuals in the general population or with specific conditions (2, 3, 4, 9) and matching names in medical data bases with workers' compensation data (1, 7).

This presentation provides further evidence of the undercount in workers' compensation and compares, the age, gender, race, severity and industry for work related amputations, burns and skull fractures who received wage and/or medical benefits from the workers' compensation system with those who received medical treatment for these conditions but received neither wage nor medical benefits.

Methodology

All 134 acute care hospitals including Veterans' Administration Hospitals in Michigan were required to report work-related amputations, burns and skull fractures. Medical records were reviewed to identify these three work-related conditions treated at a hospital/emergency department (ED) or as an outpatient visit at a hospital based clinic. A case identified using hospital medical records was defined as an individual aged 16 years or older receiving medical treatment at a Michigan hospital/ED/outpatient clinic who had: (a) an amputation-related International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9CM) diagnosis code: 885.0-.1, 886.0-.1, 887.0-.7, 895.0-.1, 896.0-.3, and 897.0-.7 and the work-related incident occurred at work from 2006-2009; (b) a burn-related ICD-9CM diagnosis code: 940.0-.9, 941.0-.5, 942.0-.5, 943.0-.5, 944.0-.5, 945.0-.5, 946.0-.5, 947.0-.9, 948.0-.9, 949.0-.5; ICD-9CM codes for accidents caused by fire: E890.0-.9, E891.0-.9, E892, E893.0-.9, E894, E895, E896, E897, E898.0-.1, E899) and the work-related incident occurred at work in 2010; (c) a skull fracture ICD-9 diagnosis code (excluding nasal fractures): 800.0-.9, 801.0-.9, 803.0-.9, 804.0-.9. Individuals were contacted via mail and telephone when it could not be determined from the medical record whether the injury was work-related and/or the name of the employer. For amputations, only Michigan residents were included. There were 35 additional work-related amputations treated in Michigan hospitals.

The Workers' Compensation Agency in the Michigan Department of Licensing and Regulatory Affairs provided access to a database of claims for wage replacement due to lost work time. Individuals are eligible for wage replacement in Michigan when they have had at least seven consecutive days away from work (i.e. weekend and five work days). A case identified using Michigan's workers' compensation system was defined as an individual who was in the lost work time wage replacement database with an accepted claim for an amputation (American National Standards Institute (ANSI) nature of injury code 100) that occurred in 2006-2009, a burn (ANSI nature of injury codes 120 or 130) that

occurred in 2010, or a skull fracture (ANSI nature of injury code 210 and body part 100, 110,140, 141,146, 148,149, 150, 160, or 198) that occurred in 2010.

Michigan's Poison Control Center (PCC) was used as one source to identify work-related burns, which were defined as an individual for whom a call was made by a burned employee, family member, coworker, or healthcare provider, regarding a consultation of a work-related burn injury in 2010.

The Michigan Fatality Assessment and Control Evaluation (MIFACE) program was used to identify work-related burns and skull fractures that caused death in 2010. This system relies on required reporting by employers to the OSHA State plan's hot line, death certificates and medical examiner reports.

Information from the hospital/ED medical reports, PCC reports and MIFACE reports on each case was abstracted onto a form, including: reporting source(s), payer, type of medical care (hospital, ED, outpatient), hospital name, type of visit, date of admission and discharge, age, gender, race, city and county of residence, employer information (name, address, NAICS code) and injury date. Information unique to the condition was also abstracted, including amputation of multiple digits, first, second or third degree burn, chemical or thermal burn and part of skull fractured. Duplicates identified by more than one reporting source or secondary visits to the same or a different hospital were eliminated, after abstracting all information from every data source where the individual was identified.

Once case ascertainment from medical record review and patient interviews was completed, records in the work-related amputation database were linked to records in the workers' compensation claims database using SAS software, version 9.2 of the SAS System for Windows (copyright 2002-2008 by SAS Institute Inc.). There were several steps in the record-linkage process. First, matches were identified using various combinations of social security number (either all nine digits or the last four digits which often were all that medical records provided), date of injury (or date of hospital admission), first three letters of last name, date of birth, and company name. For cases that matched, the linked record was visually assessed to verify the match. Once this set of matched cases was created, additional matches were sought using less unique information (e.g., patient zip code of residence, date of injury plus/minus thirty days). The matching process was performed on the entire workers' compensation claims database to allow for links to cases not categorized as amputations by that system. For burns and skull fractures all matches were performed manually after merging the data from the non worker compensation sources into the worker compensation file in alphabetical order by last name.

Cases where workers' compensation was identified as the source of payment in a medical record but where the case was not found in the WC wage replacement data base were assumed to have received medical benefits without wage replacement. Finally, WC cases meeting the condition definition that did not match with cases in any of the other data sources (i.e. where WC was the sole source of the case report) were added to the final data base that was used for analysis.

For the analyses comparing the characteristics of individuals who received wage replacement, medical benefits only, or neither (Tables 3 and 4), the grouping for wage replacement only included injuries coded as that injury in the WC data base. This grouping allows comparison to the most common way that WC data is accessed.

Results

From 2006-2009, 2,555 work-related amputations were identified in Michigan. For 2010, 1,885 work-related burns and 114 work-related skull fractures (excluding nasal fractures) were identified in Michigan.

The first column in table 1 shows that 36.1% of the total number of work-related amputations, 16.0% of the total number of work-related burns and 21.1% of the total number of

work-related skull fractures identified were coded as these conditions in the Workers' Compensation wage replacement claims data base. After matching the worker compensation data base with the other sources of injury data, 55.4% of the amputations, 17.2% of the burns and 54.4% of the skull fractures were in the wage replacement data base. The additional matches for amputations occurred because an injury that was coded as an amputation in the medical record was coded as a crush, fracture or laceration in the Workers' Compensation data base. For burns, the difference was because of injuries coded as burns in the medical records but coded as multiple injuries or electrical shock in the worker compensation data base. For skull fractures the difference was because of injuries coded as skull fractures in the medical records but coded as multiple injuries or fractures other than skull in the Workers' Compensation data base.

Table 2 shows the percentage of individuals by each of the three work-related conditions with wage replacement, with medical benefits only and who received neither wage replacement nor medical benefits; 22.9% of amputations, 35.2% of burns and 26.3% of skull fractures received neither wage replacement nor medical benefits. The percentage of individuals receiving no workers' compensation benefits who were self-employed was 27.6% for amputations, 5.1% for burns and 23.3% for skull fractures.

Table 3 compares basic demographics and measures of severity for each of the three conditions by workers' compensation status. For amputations, the only significant difference found was that individuals who received wage replacement were the more severe cases, cases involving multiple digits. For burns, significant differences for individuals who received wage replacement were that they were on the average older, had a larger percentage of men and African Americans, had a higher percentage of thermal versus chemical burns, and had a higher percentage of more severe third degree burns. For skull fractures, significant differences for individuals who received wage replacement were that they were on the average younger, had a higher percentage of women and Caucasians, and had a higher percentage with a skull fracture not involving the base or vault of the skull.
Table 4 shows the top five National Occupational Research Agenda (NORA) sectors for each of the three conditions. For amputations, individuals who received wage replacement from workers' compensation were more likely to have been injured in the manufacturing sector and cases from the agricultural sector were absent. For burns, individuals who received wage replacement, manufacturing was the second most important sector as compared to healthcare/social assistance in medical only or no compensation. For skull fractures, individuals who received wage replacement had more injuries in the wholesale retail sector and the healthcare/social assistance sector but agriculture and public safety were absent.

Discussion

The data from Michigan's multi data source surveillance system found that only 55% of work-related amputations, 17% of work-related burns and 54% of work-related skull fractures received wage replacement from the Workers' Compensation system (Table 1). Since many of these injuries had alternative codes in the Workers' Compensation data base, if one had used the worker compensation data base to provide estimates then only 36% of the amputations, 16% of the burns and 21% of the skull fractures would have been identified (Table 1). The large number of injuries missing from the wage replacement data base raises concerns about generalizing findings about these injuries from using the data generally available from worker compensation agencies. Even if access was available to medical only claims, which are not computerized in most states, 23% of the work-related amputations, 35% of the work-related burns and 26% of the work-related skull fractures would be missed (Table 2).

Significant differences between injuries in the workers' compensation system and injuries not in the system included age, gender, race,

and severity. Although injuries receiving wage replacement compensation had a higher percentage of severe amputations (amputations of multiple digits), there were a larger number of severe amputations in the medical only and no compensation categories; 109 medical only and 54 neither wage replacement nor medical compared to 98 with wage replacement. Similarly, although a higher percentage of burns receiving wage replacement were more severe (16.3% vs. 3.2% vs. 2.9%), there were a larger number, 23 third degree burns in medical only and 12 third degree burns receiving neither medical or wage replacement versus 21 third degree burns receiving wage replacement (Table 3).

Decisions on which industries to target for intervention would vary depending on which data source was used. Services, healthcare and social assistance and agriculture would receive more attention if non-workers' compensation cases were used for targeting (Table 4).

All the data we used had limitations. We know that the payer in medical records can be inaccurate or change at a later date after more information is obtained by the hospital. For example, we found that in 26% of the charts for amputations, 6% for burns and 30% for skull fractures where workers' compensation was not listed as the payer on the record reviewed that the individual from that medical record could be found in the wage replacement data base. Presumably there are other individuals who received medical only benefits where workers' compensation was not listed as the payer found in the medical chart. We had no way to check on the magnitude of this missing information but presumably it is comparable to the error found with missing information related to wage replacement. We presume that hospital data was missing industry and employment status (i.e. self-employed vs. employed) in a percentage of the records. We were able to address this issue when we matched records with workers' compensation or when we interviewed the injured patients. Finally, the workers' compensation data base was limited to wage replacement with at least 7 consecutive days away from work (i.e. five work days and a weekend) and workers' compensation records were missing race, ethnicity and severity. As with missing information in medical records, we were partially able to obtain some of the missing information when we could match the workers' compensation and medical records and find the missing information in the matching records.

In summary, workers' compensation is not a panacea to address the undercount in the Bureau of Labor Statistics annual survey since it also has a marked undercount. Rather, workers' compensation is a useful component of a multi-source surveillance system that can identify additional injuries and can provide information missing in other sources.

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Table 1. Percentage Coded/Not Coded as Condition in Workers' Compensation Wage Replacement Data Base in Comparison to Multi Source Data

	In Data Base	
	Coded as Condition	Coded and Not Coded as Condition
Amputations	36.1%	55.4%
Burns	16.0%	17.2%
Skull Fractures	21.1%	54.4%

Table 2. Percentage with Work-Related Condition who Received Wage Replacement, Medical Only or No Workers' Compensation

	Wage Replacement	**Medical Only**	**Neither**	**Total**
Amputations	1417 (55.4%)	554 (21.7%)	584* (22.9%)	2,555
Burns	324 (17.2%)	898(47.6%)	663* (35.2%)	1,885
Skull Fractures	62 (54.4%)	22 (19.3%)	30*** (26.3%)	114

Self-Employed: *161(27.6%), **34 (5.1%), ***7 (23.3%)

Table 3. Comparison of Work-Related Amputations, Burns, and Skull Fractures by Workers' Compensation Status

	Wage Replacement	Medical Only	Neither	All
Amputations				
Average Age (range)	40.2 (16-75)	38.9 (16-78)	41.0 (16-86)	39.8 (16-86)
≤18 years (%)	1.8	2.9	2.6	2.4
Men (%)	86.9	86.5	90.8	87.6
African American (%)	11.1	11.0	8.1	8.0
Hispanic (%)	7.8	8.1	8.1	8.0
Severity* Multiple Digits (%)	17.0	10.4	9.2	11.8
Burns				
Average Age (range)*	36.6 (16-70)	33.7 (16-78)	33.2 (14-71)	34 (14-71)
≤18 years (%)	2.9	4.9	5.4	4.8
Men (%)*	78.7	58.2	65.3	64.0
African American (%)*	15.5	12.6	12.7	12.9
Hispanic (%)	5.2	4.4	2.2	3.8
Type of Burn (%)*				
Thermal	82.9	70.6	55.2	67.2
Chemical	13.4	23.7	38.3	27.1
Severity (%)*				
1°	6.2	29.0	24.7	25.3
2°	77.5	67.6	72.4	70.2
3°	16.3	3.4	2.9	4.5
Skull Fractures				
Average Age (range)*	39.3 (19-60)	43.5 (20-65)	46.4 (17-75)	44 (17-75)
≤18 years (%)	0	0	2.4	0.9
Men (%)*	70.8	87.8	85.4	83.3
African American (%)*	0	3.7	7.4	5.2
Hispanic (%)	0	3.7	7.4	5.2
Part of Skull (%)*				
Vault	9.5	14.3	7.3	10.5
Base	14.3	79.6	70.7	62.3
Other	76.2	6.1	22.0	27.2

*P<.05

Table 4. Top Five NORA Sectors by Workers' Compensation Status for Work-Related Amputations, Burns and Skull Fractures

Amputations			
Wage Replacement	**Medical Only**	**Neither**	**All**
Manufacture (52%)	Manufacture (49%)	Services (27%)	Manufacture (46%)
Services (20%)	Services (20%)	Manufacture (25%)	Services (21%)
Construction (10%)	Construction (11%)	Construction (18%)	Construction (12%)
Wholesale/Ret (10%)	Wholesale/Ret (11%)	Wholesale/Ret (18%)	Wholesale/Ret (12%)
Trans/Ware/Utilities (3%)	Trans/Ware/Utilities (3%)	Agriculture (11%)	Agriculture (4%)
Burns			
Services (51%)	Services (50%)	Services (55%)	Services (51%)
Manufacture (26%)	Healthcare/Soc Assist (17%)	Healthcare/Soc Assist (14%)	Manufacture (15%)
Wholesale/Ret (9%)	Manufacture (13%)	Wholesale/Retail (12%)	Healthcare/SocAssist (13%)
Construction (6%)	Wholesale/Ret (9%)	Manufacture (12%)	Wholesale/Ret (10%)
Healthcare/Soc Assist (4%)	Public Safety (4%)	Construction (3%)	Construction (4%)
Skull Fractures			
Services (25%)	Services (29%)	Services (27%)	Services (28%)
Wholesale/Ret (21%)	Construction (17%)	Manufacture (21%)	Manufacture (17%)
Healthcare/Soc Assist (17%)	Manufacture (17%)	Construction (12%)	Construction (13%)
Manufacture (13%)	Trans/Ware/Utilities (17%)	Agriculture (9%)	Trans/Ware/Utilities (12%)
Construction (8%)	Public Safety (6%)	Public Safety (9%)	Wholesale/Ret (9%)
Trans/Ware/Utilities (8%)	Wholesale/Ret (6%)	Wholesale/Ret (9%)	

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