

Temporal Patterns in Work-Related Fatalities Among Foreign-Born Workers in the US, 1992–2007

Cammie K. Chaumont Menéndez · Solomone A. Havea

© US Government 2010

Abstract In the United States, approximately 20% of all workers who died on the job in 2007 were foreign-born. The objective of this study was to describe trends in occupational fatalities among foreign-born workers. An analysis of fatal injuries among foreign-born workers in the US occurring from 1992 through 2007 was conducted using the Bureau of Labor Statistics' Census of Fatal Occupational Injuries. Individual characteristics, employment characteristics, injury events and industry employment were summarized and evaluated for trends. Both the number and proportion of foreign-born workers who died from a traumatic work-related injury increased substantially over the time period studied. The proportion who were men, aged 25–44 years, Hispanic, non self-employed, employed by business establishments with 10 or fewer employees, working at private residences and working in Construction and Services consistently increased throughout the time period. While some trends among foreign-born decedents are improving, others are worsening. More comprehensive research efforts are needed to address the occupational injury and safety issues among foreign-born workers, with a focus on Hispanics.

Keywords Foreign-born · Immigrant · Work-related · Occupational · Fatalities · Injuries

Introduction

In 2003 there were 33.5 million foreign-born inhabitants of the United States, approximately 12% of the population [1]. The foreign-born population was markedly heterogeneous with substantial proportions originating from Latin America (53%), Asia (25%) and Europe (14%) [1]. A disproportionately greater share of the foreign-born lived below the poverty level, with emigrants from Latin America collectively experiencing the highest poverty rate [1]. Despite this, recently a review conducted of the health literature reported that foreign-born populations generally have more favorable health outcomes than their native-born counterparts [2]. However, when evaluating injury outcomes, foreign-born individuals experienced a greater share of occupational and transportation-related injuries [2, 3].

In 2008 preliminary data indicate 5,071 workers died of traumatic injuries in the US [4]. Foreign-born workers are a vulnerable population of workers that experience a disproportionate work-related fatality rate [5]. Since 1996, the proportion of foreign-born workers has steadily increased [6]. It is estimated that in 2007 almost 20% of the working population was foreign-born [6]. As foreign-born workers constitute a growing share of the US labor force, it is expected their disproportionate share of workplace fatality rates will continue.

Foreign-born workers face unique challenges in the American workforce. Lower educational levels, limited English language proficiency, lower literacy levels, limited knowledge of worker's rights and their employers' responsibilities coupled with high risk employment and low paying jobs presents a difficult scenario to achieve and maintain a safe and healthy work environment [5]. Furthermore, an evaluation of the US National Health Interview Survey found approximately one-third of foreign-born workers

C. K. C. Menéndez (✉)
Division of Safety Research, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, 1095 Willowdale Road, MS-1811, Morgantown, WV 26505, USA
e-mail: CMenendez@cdc.gov

S. A. Havea
Brigham Young University, Provo, UT, USA

experiencing injuries missed 6 or more days of work compared with less than 25% among injured US-born workers [7]. Moreover, a survey of 200 immigrant workers in the manufacturing sector found inadequate management safety practices and less flexible job design associated with illness and injury [8]. Although injuries are commonly underreported, a cohesive account of the experiences and challenges faced by foreign-born workers stems not just from a limited skills set but from tenuous employee-employer relationships [9].

There is a paucity of research evaluating the public health burden of occupational injuries among foreign-born workers. The existing research is focused on injuries and illnesses of segments of the foreign-born worker population: Hispanic immigrants [3, 8–12], Asian immigrants [13, 14], and specific industries [15, 16]. This literature plays a crucial role in identifying public health concerns specific to a population or industry, the limitations of data sources for the foreign-born population, and the heterogeneity of employment, education, and occupational health experience among foreign-born workers [2]. The occupational health literature focused on foreign-born workers is nascent and, consequently, its findings and reports present a fragmented portrayal of the occupational health burden among foreign-born workers. The existing national data sources are an important comprehensive complement to research targeting one aspect of occupational health among foreign-born workers. Longitudinal analyses of both national data sources and comprehensive community-level studies are essential for providing a cohesive and accurate description of the public health burden experienced by foreign-born workers.

The present study utilized a national surveillance database on fatal traumatic injuries compiled from multiple data sources. The objective is to provide estimates of the number and proportion of traumatic injury fatalities of foreign-born workers from 1992 through 2007 and to evaluate temporal patterns of the number and proportion of fatalities by individual characteristics, employment characteristics, injury events and industry employment.

Methods

Data Source

The Census of Fatal Occupational Injuries (CFOI) provides annual counts of traumatic occupational injury fatalities. The Bureau of Labor Statistics (BLS) within the Department of Labor maintains CFOI as an active surveillance system: data are gathered from an average of 4 sources and checked at state, regional and national levels over a 15-month time span before being published for a specific calendar year [17].

The National Institute for Occupational Safety and Health receives a CFOI data file from BLS for analysis through a memorandum of understanding which contains more detailed information on fatalities than published by BLS. The CFOI data analyzed by NIOSH include all 50 states, New York City (2003–2007), Washington DC, Puerto Rico, and the Virgin Islands.

To be included in CFOI a fatality must meet the following four selection criteria [17]: (1) be classified as a traumatic injury, (2) be work-related according to the CFOI criteria, (3) be substantiated by two independent source documents, or a source document and a follow-up questionnaire and (4) be designated on certain documents as ‘at work’, or ‘in work status’ or ‘work related’. Fatalities occurring during an individual’s normal commute to or from work are excluded. There are over 25 data elements collected, coded, and tabulated in CFOI.

Data Elements

The following CFOI data elements were included in the analysis.

Individual Characteristic

Age group of decedent at time of death was categorized into 15 years and under, 16–19, 20–24, 25–34, 35–44, 45–54, 55–64, 65 years and over, and “not reported”. Gender was categorized as male or female. Hispanic origin was characterized as not Hispanic, Hispanic and “not reported”.

Employment Characteristics

Employee status was coded as active duty armed forces, self-employed, work in family business, work for pay or compensation or other, volunteer, off-duty police, type of employment not reported, or unknown. Establishment size of the employer was categorized as 1–10 employees, 11–19 employees, 20–49 employees, 50–99 employees, more than 100 employees and “not reported”. Ownership of employer was described as federal government, state government, local government, foreign government, other government, private ownership and “not reported”. Region of employment were described using Census Bureau designations: Northeast, Midwest, South, West and “unknown”.

Injury Events

The event in which the manner of injury was produced or inflicted follows the Bureau of Labor Statistics Occupational Injury and Illness Classification Scheme [18]. Briefly, injury events were classified as resulting from

contact with objects and equipment, falls, a bodily reaction and exertion, exposure to harmful substances or environments, transportation accidents, fires and explosions, assaults and violent acts, other events or exposures, and events that are non-classifiable. Location of incident was described as occurring at a home or residence, farm, mine or quarry, industrial place or premises, recreational place, street or highway, public building, residential institution, or other places including those not reported. Reference year was the year the worker died.

Industry Employment

The industry of the employer was coded using two different classification schemes. Data from 1992 through 2002 were coded under the Standard Industrial Classification Manual, 1987 Edition [19]. Briefly, industry was categorized into ten divisions: (1) agriculture, forestry and fishing, (2) mining, (3) construction, (4) manufacturing, (5) transportation, communications, electric, gas, and sanitary services, (6) wholesale trade, (7) retail trade, (8) finance, insurance, and real estate, (9) services, and (10) public administration. Data from 2003 through 2007 were coded under the North American Industrial Classification System (NAICS), 2002 Coding Scheme [20]. Briefly, in order to facilitate eventual merging of data from the 2002 coding scheme industry was categorized into nine divisions: (1) agriculture, forestry, fishing and hunting, (2) mining, utilities, and construction, (3) manufacturing, (4) wholesale and retail trade, transportation and warehousing, (5) information and services, (6) educational services, health-care and social assistance, (7) arts, entertainment, and recreation, (8) other services (except public administration), (9) public administration.

Sample of Decedents

Foreign-born occupational fatalities were identified by the variable, “foreign birth”. A subset of the CFOI SAS data file for analysis was created by partitioning out decedents where foreign birth was declared [21]. For the purpose of this analysis decedents in the military were not included.

Analysis

Most of the variables were recoded in order to meet minimum reporting requirements for CFOI and sufficient data per cell to conduct statistical analyses. Age was re-categorized into <19, 20–24, 25–34, 35–44, 45–54, ≥55 years and “missing”. Employment status was reconfigured to “Self-employed”, “Work for pay or compensation” and “Other”. Establishment size was restructured to 1–10 employees, 11–49 employees, and 50 or more employees.

Location of injury was reworked to “Home or residence”, “Farm”, “Industrial location”, “Street or highway”, “Public building”, and “Other”. Ownership of employer was recategorized into “Private” and “Other”.

Industry of employer during years 2003 through 2007 was recoded to the Standard Industrial Classification (SIC) system (1987 version) to allow for comparison with years 1992 through 2002. Each industry code reported for 2003 through 2007 (NAICS) was examined, matched and recoded with the comparable industry code using SIC. The following industries were recoded into the following groupings: Logging was recoded from “agriculture, forestry, fishing and hunting” into “Manufacturing”. “Utilities” and “Waste Management and Remediation Services” were recategorized into “Transportation, Communications, Electric, Gas, and Sanitary Services”. “Information, Publishing” and “Music Publishers” were recoded as “Manufacturing”. “Software Publishers, Motion Picture and Sound Recording Industries, and Data Processing and other Information Services” were recoded to “Services”. “Broadcasting and Telecommunications” was recoded as “Transportation, Communications, Electric, Gas, and Sanitary Services”. “Car rentals and equipment rentals” were recoded to “Services”. Not reported data were converted to missing data.

Summary statistics were calculated using SAS software version 9.2 [22]. Data were grouped by approximate 5-year intervals guided by the cut point of 2002–2003 (when there was a change in industry classification). Cochran-Mantel-Haenszel statistics were computed to evaluate row mean squares difference over time for nominal variables (employee status, establishment size, injury event, gender, Hispanic origin, industry code, location type, nature of injury, ownership, and region). Cochran-Mantel-Haenszel statistics of nonzero correlation were conducted to evaluate differences over time for age group, the only ordinal variable evaluated. We considered two-tailed *P*-value of ≤0.05 to be statistically significant.

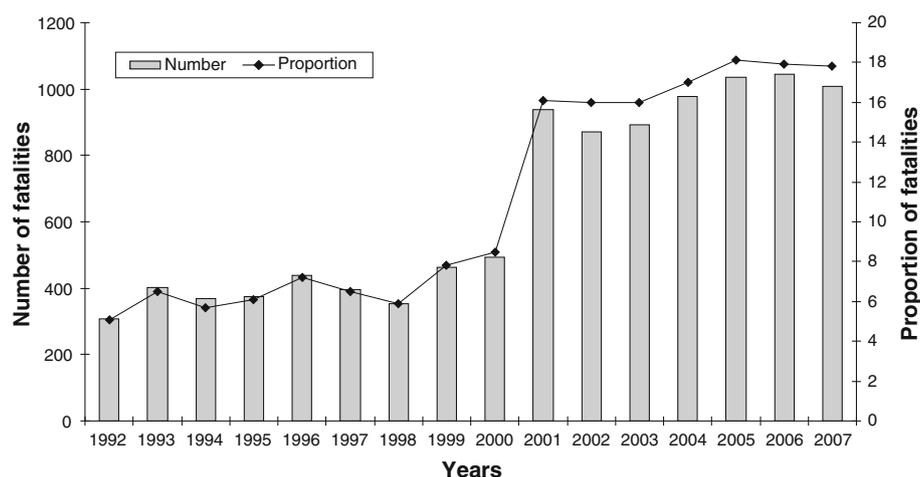
Results

There were 10,361 individuals reported as foreign-born who suffered a fatal traumatic injury as a result of work-related activities from 1992 through 2007. In 1992, the proportion of fatalities that were reported as foreign-born was 5% ($n = 307$). By 2007 the proportion had grown to 18% ($n = 1,009$) (Fig. 1). There was a 117% increase in fatalities from 2,287 in 1992–1997 to 4,960 in 2003–2007.

Individual Characteristics

Overall, there were significantly more foreign-born men than women who experienced fatalities due to traumatic injury (94 vs. 6%; $X^2 = 8,047$, $P < 0.001$) (Table 1). The

Fig. 1 Number and proportion of work-related injury deaths among foreign-born workers—United States, 1992–2007



age distribution was heterogeneous: Half of the decedents were aged 25–44 years, one-third were aged 45 years and older and less than one-sixth were teenagers ($X^2 = 4,069$, $P < 0.0001$). A significant majority were Hispanic (60%; $X^2 = 5,497$, $P < 0.0001$).

The proportion of fatalities that were men experienced a slight, but statistically significant increase over the studied time span ($X^2 = 4.54$; $P = 0.03$), whereas the proportion of fatalities among women decreased. The proportion of decedents aged 35–44 years gradually decreased while those aged 20 to 24 and 45 to 64 years increased

($X^2 = 6.73$, $P = 0.01$). The proportion of Hispanic decedents jumped to approximately 60% after 1997 from 54% between 1992 and 1997 while non-Hispanics decreased from 44% before 1997 to 38% after 1998 ($X^2 = 136$, $P < 0.0001$).

While the number of injuries increased from 1992 through 2007 for every subgroup within individual characteristics (Table 1), the highest percentage increase in the number of fatalities from 1992–2002 to 2003–2007 was among males (120%), age groups 20–24 (122%), 45–54 (141%), and 55–64 (144%), and Hispanic origin (149%).

Table 1 Fatal occupational injuries among foreign-born workers—individual characteristics

Characteristics	1992–2007 No. (%)	1992–1997 No. (%)	1998–2002 No. (%)	2003–2007 No. (%)
Total*	10,361	2,287	3,114	4,960
Male	9,746 (94) [§]	2,132 (93) [§]	2,925 (94)	4,689 (95)
Female	615 (6)	155 (7)	189 (6)	271 (5)
Age				
≤19 years	339 (3) [§]	78 (3) [§]	93 (3)	168 (3)
20–24 years	1,102 (11)	238 (10)	335 (11)	529 (11)
25–34 years	2,661 (26)	601 (26)	842 (27)	1,218 (25)
35–44 years	2,706 (26)	626 (27)	813 (26)	1,267 (26)
45–54 years	2,071 (20)	432 (19)	595 (19)	1,044 (21)
55–64 years	1,086 (10)	223 (10)	317 (10)	546 (11)
≥65 years	396 (4)	89 (4)	119 (4)	188 (4)
Hispanic origin [†]				
Yes	6,178 (60) [§]	1,223 (53) [§]	1,900 (61)	3,055 (62)
No	4,073 (39)	997 (44)	1,189 (38)	1,887 (38)

Census for Fatal Occupational Injuries (CFOI), United States, 1992–2007

* Percentages may not add to 100 because of rounding

[†] There were 110 cases for which Hispanic origin could not be ascertained

[§] $P < 0.05$

Employment Characteristics

A significant majority of the decedents worked for pay or compensation (81%) rather than in self-employment (17%) ($X^2 = 17,975$, $P < .0001$) (Table 2). One-third of decedents worked for an establishment with 10 or fewer employees and one-fifth worked for an establishment with 50 or more employees ($X^2 = 1,512$, $P < 0.0001$). Almost all of the decedents worked for a privately owned company (97 vs. 3%) ($X^2 = 8,997$, $P < 0.0001$). One-quarter of the decedents each worked at an industrial location (26%) and street or highway (24%) with twenty percent working at a public building ($X^2 = 1,827$, $P < 0.0001$). There were roughly three times as many decedents working in the South and West regions of the US than the Northeast and Midwest ($X^2 = 6,018$, $P < 0.0001$).

Over the time period, the proportion of decedents working for pay or compensation increased, while the proportion self-employed gradually decreased ($X^2 = 26.6$, $P < 0.0001$). For each time period, the proportion of decedents working in establishments with 10 or fewer employees increased ($X^2 = 67$, $P < 0.0001$). Employer ownership did not change significantly over the 16-year time span ($X^2 = 2$, $P = 0.15$). The proportion of decedents working at a private residence and industrial location

Table 2 Fatal occupational injuries among foreign-born workers—employment characteristics

Characteristics	1992–2007 No. (%)	1992–1997 No. (%)	1998–2002 No. (%)	2003–2007 No. (%)
Total*	10,361	2,287	3,114	4,960
Employment type [†]				
Work for pay or compensation or other	8,392 (81) [§]	1,803 (79) [§]	2,522 (81)	4,067 (82)
Self-employed	1,704 (17)	431 (19)	498 (16)	775 (16)
Other	265 (3)	53 (2)	94 (3)	118 (2)
Establishment size				
1–10 employees	3,166 (31) [§]	578 (25) [§]	951 (31)	1,637 (33)
11–49 employees	1,431 (14)	281 (12)	510 (16)	640 (13)
≥50 employees	1,856 (18)	401 (18)	655 (21)	800 (16)
Not reported	3,908 (38)	1,027 (45)	998 (32)	1,883 (38)
Employer ownership				
Private	10,008 (97) [§]	2,204 (96)	2,996 (96)	4,808 (97)
Other	353 (3)	83 (4)	118 (4)	152 (3)
Location				
Private residence	1,135 (11) [§]	122 (5) [§]	285 (9)	728 (15)
Farm	692 (7)	157 (7)	268 (9)	267 (5)
Industrial location	2,665 (26)	485 (21)	800 (26)	1,380 (28)
Street or highway	2,507 (24)	512 (22)	783 (25)	1,212 (24)
Public building	2,028 (20)	639 (28)	572 (18)	817 (16)
Other places	1,334 (13)	372 (16)	406 (13)	556 (11)
Region [†]				
Northeast	1,292 (12) [§]	129 (6) [§]	324 (10)	839 (17)
Midwest	1,214 (12)	298 (13)	368 (12)	548 (11)
South	3,792 (37)	600 (26)	1,095 (35)	2,097 (42)
West	4,052 (39)	1,258 (55)	1,322 (42)	1,472 (30)

Census for Fatal Occupational Injuries (CFOI), United States, 1992–2007

* Percentages may not add to 100 because of rounding

[†] There were 11 cases for which Region could not be ascertained

[§] $P < 0.05$

increased over time while the proportion of decedents working at a farm, public building, or other location decreased ($X^2 = 308$, $P < 0.0001$). The proportion of decedents working in the Northeast and South increased substantially throughout the time span ($X^2 = 599$, $P = <0.0001$).

While the number of injuries increased from 1992 to 2007 in every employment characteristic subgroup (Table 2), the highest percentage increase in the number of fatalities from 1992–1997 to 2003–2007 was among those not self employed (125%), establishments with less than 10 employees (183%) and 11–49 employees (128%), locations at a private residence (496%) and industrial sites (184%), in addition to regions of the Northeast (550%) and South (249%).

Injury Events

From 1992 to 2007 30% of the decedents were involved in transportation events (most often a highway accident –16%), with assaults and violent acts the second most frequently occurring injury event (26%) ($X^2 = 3,523$, $P < 0.0001$) (Table 3). Contacts with objects and

equipment and falls each accounted for approximately 15% of the events, and exposure to harmful substances or environment (such as electric currents) accounted for almost 10%.

Throughout the time span the proportion of decedents experiencing a traumatic fatality from being involved in contact with objects and equipment and falls increased, while the proportion involved in assaults and violent acts decreased ($X^2 = 231$, $P < 0.0001$).

While the number of injuries in every major injury event category increased from 1992 to 2007, the highest percentage increase in the number of fatalities from 1992–1997 to 2003–2007 was associated with contact with objects and equipment (268%) and falls (276%).

Industry Employment

Overall the construction industry contained the greatest number of foreign-born decedents (25%), followed by the services industry (17%), retail trade and transportation, communications, electric, gas and sanitary services industries (each 15%) and the agriculture, forestry and fishing industry (12%) ($X^2 = 7,710$, $P < 0.0001$).

Table 3 Fatal occupational injuries among foreign-born workers—injury event and industry employment characteristics

Characteristics	1992–2007 No. (%)	1992–1997 No. (%)	1998–2002 No. (%)	2003–2007 No. (%)
Total*	10,361	2,287	3,114	4,960
Injury event				
Contact with objects and equipment	1,587 (15) [§]	237 (10) [§]	478 (15)	872 (18)
Struck by or against ^a	883 (9)	134 (6)	262 (8)	487 (9)
Caught in, compressed or crushed	698 (7)	102 (4)	216 (7)	375 (8)
Falls	1,641 (16)	250 (11)	499 (16)	892 (18)
To lower level	1,532 (15)	223 (10)	464 (15)	839 (17)
Exposure to harmful substances or environment	943 (9)	200 (9)	285 (9)	458 (9)
Contact with electric current	485 (5)	105 (5)	147 (5)	233 (5)
Transportation events	3,254 (31)	701 (31)	1,049 (34)	1,504 (30)
Highway accident	1,662 (16)	343 (15)	537 (17)	770 (16)
Nonhighway accident	413 (4)	94 (4)	121 (4)	196 (4)
Pedestrian	684 (7)	129 (6)	240 (8)	314 (6)
Assaults and violent acts	2,688 (26)	843 (37)	741 (24)	1,104 (22)
Other or nonclassifiable	248 (2)	56 (2)	62 (2)	130 (3)
Industry employment				
Agriculture, forestry and fishing	1,238 (12) [§]	317 (14) [§]	540 (17)	381 (8)
Mining	102 (1)	16 (1)	31 (1)	55 (1)
Construction	2,550 (25)	330 (14)	755 (24)	1,465 (30)
Manufacturing	855 (8)	198 (9)	257 (8)	400 (8)
Transportation, communications, electric, gas and sanitary services	1,585 (15)	329 (14)	461 (15)	795 (16)
Wholesale trade	300 (3)	85 (4)	81 (3)	134 (3)
Retail trade	1,570 (15)	575 (25)	472 (15)	523 (11)
Finance, insurance, and real estate	157 (2)	38 (2)	43 (1)	76 (2)
Services	1,764 (17)	325 (14)	389 (12)	1,050 (21)
Public administration	199 (2)	46 (2)	78 (3)	75 (2)

Census for Fatal Occupational Injuries (CFOI), United States, 1992–2007

* Percentages may not add to 100 because of rounding

† There were 41 cases for which Industry employment could not be ascertained

§ $P < 0.05$

^a This is a hierarchical system; indented text reflects data that is part of a group

Over the time span studied, the proportion of traumatic injury fatalities among agriculture, forestry and fishing and retail trade declined while that of construction, transportation, communications, electric, gas and sanitary services and services increased ($X^2 = 543$, $P < 0.0001$).

While the number of injuries increased from 1992 to 2007 in every industry sector except retail trade (Table 3), the highest percentage increase in the number of fatalities from 1992–1997 to 2003–2007 was in mining (243%), construction (344%), transportation, communications, electric, gas and sanitary services (141%), and services (223%).

Discussion

Over the time span studied, the number and proportion of foreign-born workers experiencing traumatic fatalities has increased. Overall, there were significantly more men than women who died of a traumatic injury, half of the fatalities were between 25 and 44 years of age and the majority were

Hispanic. Most worked for pay or compensation, more worked in business establishments with 10 or fewer employees (when reported), almost all worked for private companies. Industrial location and street/highway were two most frequently occurring locations of injury event, with most decedents working in the South or West region of the United States. Transportation events and assaults and violent acts contributed to half of the fatalities, with Construction and Services the most frequent employment industries.

There were significant changes throughout the time span for every employment characteristic except for employer ownership (mostly private companies throughout the 16 years). Specifically, there were consistent increases over time observed in the number and proportion of fatalities that were: men, Hispanics, ages 20–24, 45–54, and 55–64, those not self employed, those employed in business establishments with 10 or fewer employees, injury events at private residences and industrial locations, Northeast and South regions, contact with objects and equipment and falls, and working in the Construction, Mining, Services,

and Transportation, Communications, Electric, Gas and Sanitary Services industries. Conversely, there were consistent increases over 1992–2007 in the number of fatalities and decreases in the proportion of fatalities that were: women, those that occurred in a public building, Midwest or West, those that occurred as a result of an assault and nonviolent act, and working in the Retail Trade industry sector, although retail was associated with a decrease in the number of fatalities.

The number of fatalities was very high and increased from over 20 to 550% over time in nearly every risk factor subgroup. Because the percentage of foreign born workers only increased about 20% from 1992 to 2007, it is likely that fatality rates have also increased over time. Data on the number of foreign born workers by risk factor group was not readily available for this paper. Denominator data are being assembled for a future analysis of rates. Under reporting in foreign born before 2001 cannot be ruled out as a possible explanation for the substantial increase in number of fatalities over time but the extent of any under reporting has not been substantiated.

Results suggested that fatalities increased significantly over time in Hispanics, the Northeast and South, among small business establishments and particularly among those in construction, mining, and services, among those not self-employed, among events due to contact with objects and equipment and falls, and particularly for those whose fatalities occurred at private residences and industrial locations. Further analysis found in the Northeast over the time frame studied the proportion of decedents who were Hispanic more than doubled (16 to 41%), the proportion of fatalities in business establishments with 10 or fewer employees experienced an almost 50% increase (30 to 43%), the proportion injured due to contact with objects or equipment increased (9 to 14%), the proportion injured due to falls increased (16 to 22%), and the proportion injured at a private residence doubled (9 to 18%). In the South over the time frame studied the proportion of decedents who were Hispanic increased 25% (56 to 70%), the proportion of fatalities injured due to contact with objects or equipment doubled (10% to 19%), the proportion injured due to falls increased (13 to 18%), and the proportion injured at a private residence tripled (5 to 14%). In both regions the proportion of decedents in the Construction industry increased substantially: from 15 to 30% in the Northeast and from 21 to 35% in the South. Additionally, in both regions the proportion of decedents in the Services industry increased substantially: from 12 to 21% in the Northeast and from 16 to 21% in the South.

Because Hispanics made up about 60% of the foreign-born fatalities reported in 2007 [4], it is logical to compare these findings with previous work focused solely on Hispanics (both US-born and foreign-born) over approximately

the same time period [12]. Similar to what was found in the current study, approximately 95% of fatalities among Hispanics were male [12]. Furthermore, Hispanic workers experienced the same trend over time as foreign-born workers: Assaults and violent acts were a leading cause of death for the early to mid-1990s with the leading cause of death shifting to transportation-related events [12]. Moreover, Construction was the industry with the majority of fatalities from 2003 to 2006 (the only time span evaluated for industry in the MMWR report) [12]. Also similar was the occurrence of the majority of fatalities occurring in the South and West.

To add perspective to the foreign-born fatalities, it is important to understand the labor force characteristics of foreign-born workers. Compared to the US born workforce, the foreign-born workforce in 2007 was characterized by: a larger proportion of men, more 25- to 54-year-olds (the age group with the highest labor force participation), predominantly Hispanic and Asian, and more likely to have not completed high school [6]. More of the foreign-born labor force worked in the West than any other region, and more were employed in the Service industry than US-born workers. The median income for foreign-born workers was 20% less than US-born workers [6].

In the most recent American Community Survey Reports released (2007), the US Census Bureau reported almost 20% of the labor force is foreign-born [6]. The differences in the labor force characteristics between foreign-born and US-born workers contribute to the type of employment many foreign-born workers take. It is widely believed foreign-born workers are more likely to be employed in jobs that require less skill, which oftentimes may result in more dangerous work environments. Furthermore, more dangerous jobs require safety training, training which may not be beneficial if risks are not communicated in an effective manner to the foreign-born population: either in a language that is understood by the worker or at a literacy level appropriate to the worker. Moreover, foreign-born workers may simply not know their rights to a safer workplace, which could lead many foreign-born workers to either choose or remain in unsafe work environments. This presents a golden opportunity for employers of foreign-born workers to address the unique safety challenges in the work environment and foreign-born workers to understand their rights to a safe work environment and actively seek out safety training.

A unique aspect of modern occupational safety and health is the growing representation of contingent workers in the US labor market [23]. This growth is occurring in both the public and private sectors, and across industries, occupational groups, skill levels and demographic groupings. Contractors, day laborers and temp workers can all be described as contingent workers, a category that can easily

include undocumented workers. This subpopulation of the workforce is very difficult to enumerate, is likely often misclassified or, worse, undetected in surveillance databases geared towards occupational health and safety, and is believed to be at even greater risk for occupational injuries. Although faced with significant methodological impediments to conducting research among this population, it is paramount that future research efforts on foreign-born workers focus on the unique aspects of contingent employment and accompanying risk factors for occupational injuries.

The principal limitation in this study was that the variable, “foreign-born” was not a required variable for CFOI. Data recorders are instructed to enter the data on nativity status only if it is available. In Fig. 1, a substantial increase is observed between the year 2000 and 2001. Starting in 2001 the definition and classification of foreign birth changed to a more comprehensive field based upon available data. There is a possibility for misclassification. However, the general findings reported in this paper coincide with those already published in the occupational health and safety literature regarding foreign-born workers. Additionally, the proportion of fatalities was modeled by year, resulting in an annual increase of 1% of fatalities. Another statistical model was run with a variable for the substantial increase in fatalities (between 2000 and 2001) included; the proportion of fatalities per year remained increasing and statistically significant. Thus, the authors believe no significant bias was introduced in this manner and felt the data on over 10,000 workers provided meaningful and crucial information in and of itself.

Overall, throughout the time period we found foreign-born workers that died on the job were predominantly Hispanic, younger men working in small establishments in the private sector in the South and West (United States). More comprehensive research efforts are needed to address the occupational injury and safety issues among foreign-born workers, with a focus on Hispanics. Such efforts include: (1) testing methodological approaches to enumerate and study this hard to reach population, (2) understanding what behavioral and environmental factors associated with foreign-born workers are determinants for fatal traumatic injuries, (3) describing the labor market experience of foreign-born workers and its role in health status and (4) understanding the occupational injury risk factors unique to foreign-born workers from a life course perspective (across the entire span of employment). The national surveillance database used for this study has established utility in descriptive research of fatal occupational injuries, but more comprehensive and in-depth community-based and long-term studies are crucial for addressing the occupational injury and safety issues in this population.

Acknowledgments Solomone A. Havea was a Project IMHOTEP 2009 Summer Intern at the Morehouse College Public Health Sciences Institute while co-authoring this paper. The authors extend a special thanks and acknowledgment to Scott A. Hendricks for his assistance with the statistical analyses and data management. The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

References

- Larsen LJ. The foreign-born population in the United States: 2003. Current Population Reports, P20–551. Washington: US Census Bureau; 2004.
- Cunningham SA, Ruben JD, Venkat Narayan KM. Health of foreign-born people in the United States: a review. *Health Place*. 2008;14:623–35.
- Pransky G, Moshenberg D, Benjamin K, Portillo S, Thackrey JL, Hill-Fotouhi C. Occupational risks and injuries in non-agricultural immigrant Latino workers. *Am J Ind Med*. 2002;42:117–23.
- Bureau of Labor Statistics. Injuries, illnesses and fatalities. Accessed online December 12, 2009 at <http://www.bls.gov/iif/> (2008), Preliminary data.
- Loh K, Richardson SR. Foreign-born workers: trends in fatal occupational injuries, 1996–2001. *Monthly Labor Rev*. 2004; June:42–53.
- Newburger E, Gry T. The foreign-born labor force in the United States American Community Survey Reports, 2009, ACS-10. Washington: US Census Bureau; 2007.
- Zhang X, Yu S, Wheeler K, Kelleher K, Stallones L, Xiang H. Work-related non-fatal injuries among foreign-born and US-born workers: findings from the US National Health Interview Survey, 1997–2005.
- Grzywacz JG, Arcury TA, Marin A, Carrillo L, Coates ML, Burke B, Quandt SA. The organization of work: implications for injury and illness among immigrant latino poultry-processing workers. *Arch Environ Occup Health*. 2007;62(1):19–26.
- Valenzuela A Jr. Day labor work. *Annu Rev Sociol*. 2003;29: 307–33.
- Dong X, Ringen K, Men Y, Fujimoto A. Medical costs and sources of payment for work-related injuries among Hispanic construction workers. *J Occup Environ Med*. 2007;49(12): 1367–75.
- Marin AJ, Grzywacz JG, Arcury TA, Carrillo L, Coates ML, Quandt SA. Evidence of organizational injustice in poultry processing plants: possible effects on occupational health and safety among Latino workers in North Carolina. *Am J Ind Med*. 2009;52:37–48.
- CDC. Work-related injury deaths among Hispanics—United States, 1992–2006. *MMWR*. 2008;57(22):597–600.
- Azaroff LS, Levenstein C, Wegman DH. Occupational health of Southeast Asian immigrants in a US city: a comparison of data sources. *Am J Public Health*. 2003;93(4):593–8.
- Tsai J, Bruck A. Sociocultural contexts and worker safety and health. Findings of a study with Chinese immigrant restaurant workers. *AAOHN J*. 2009;57(2):51–8.
- Culp K, Brooks M, Rupe K, Zwerling C. Traumatic injury rates in meatpacking plant workers. *J Agromed*. 2008;13(1):7–16.
- Frank AL, McKnight R, Kirkhorn SR, Gunderson P. Issues of agricultural safety and health. *Annu Rev Public Health*. 2004; 25:225–45.
- Bureau of Labor Statistics: Bureau of Labor Statistics handbook of methods. Washington, DC: US Department of Labor, Bureau of Labor Statistics (2008). Available at <http://www.bls.gov/opub/hom/pdf/homch9.pdf>.

18. Bureau of Labor Statistics. Occupational injury and illness classification manual. Washington: US Department of Labor; 1992.
19. Bureau of Labor Statistics: Standard Industrial Classification Manual, 1987 Edition. Accessed online at www.osha.gov/oshstats/sicser.html.
20. Department of Commerce: North American Industry Classification, 2002. Accessed online at www.census.gov/epcd/www/naics.html.
21. SAS software version 9.2.
22. Hendricks SA, Jenkins EL, Anderson KR. Trends in workplace homicides in the US 1993–2002: a decade of decline. *Am J Ind Med.* 2007;50:316–25.
23. Cummings KJ, Kreiss K. Contingent workers and contingent health: risks of a modern economy. *JAMA.* 2008;299(4):448–50.