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Review

Occupational Fatalities, Injuries, Illnesses, and Related Economic Loss in the Wholesale and Retail Trade Sector

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Background *The wholesale and retail trade (WRT) sector employs over 21 million workers, or nearly 19% of the annual average employment in private industry. The perception is that workers in this sector are generally at low risk of occupational injury and death. These workers, however, are engaged in a wide range of demanding job activities and are exposed to a variety of hazards. Prior to this report, a comprehensive appraisal of the occupational fatal and nonfatal burdens affecting the retail and wholesale sectors was lacking. The focus of this review is to assess the overall occupational safety and health burden in WRT and to identify various subsectors that have high rates of burden from occupational causes. Ultimately, these findings should be useful for targeted intervention efforts.*

Methods *We reviewed Bureau of Labor Statistics (BLS), 2006 fatality, injury, and illness data for the WRT sector and provide comparisons between the WRT sector, its' subsectors, and private industry, which serves as a baseline. The BLS data provide both counts and standardized incidence rates for various exposures, events, and injury types for fatalities, injuries, and illnesses. In an effort to estimate the economic burden of these fatalities, injuries, and illnesses, a focused review of the literature was conducted.*

Results and Conclusion *In 2006, WRT workers experienced 820,500 injuries/illnesses and 581 fatalities. The total case injury/illness rate for the retail sector was 4.9/100 FTE and for the wholesale sector 4.1/100 FTE. The WRT sector represents 15.5% of the private sector work population in 2006, yet accounts for 20.1% of nonfatal injuries and illnesses of the private sector. In 2003, the disparity was only 2% but increased to 3% in 2004 and 2005. Three WRT subsectors had injury/illness rates well above the national average: beer/wine/liquor (8.4/100); building materials/supplies (7.6/100); and grocery-related products (7.0/100). Occupational deaths with the highest rates were found in gasoline stations (9.8/100,000), convenience stores (6.1/100,000), and used car dealers (5.5/100,000). In terms of actual numbers, the category of food and beverage stores had 82 fatalities in 2006. Based on 1993 data, costs, both direct and indirect, in the WRT sector for*

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fatal injuries were estimated to exceed $8.6 billion. The full economic loss to society and the family has not been adequately measured. Overexertion and contact with objects/equipment represent the top two events or exposures leading to injury or illness. Together they account for 57% of the events or exposures for nonfatal WRT injuries and illnesses. This sector is important because it is large and pervasive as a result, even a relatively small increase in injury rates and accompanying days away from work will have significant impact on working families and society. Am. J. Ind. Med. 53:673–685, 2010. *© 2010 Wiley-Liss, Inc.*

KEY WORDS: wholesale retail trade; occupational; surveillance data; costs; injuries; fatalities

INTRODUCTION

The wholesale and retail trade (WRT) sector is an amalgam of two sectors: the wholesale trade sector (North American Industrial Classification System [(NAICS)] Code 42) and the retail trade sector (44–45) [Census Bureau, 2002].[1] Workers in the WRT combined sector are at a relatively low risk of occupational injury and death as compared with workers in the mining and agriculture industries. Yet, because workers in the WRT sector outnumber those workers in small industry sectors, such as mining and agriculture sectors, the actual number of injuries/illnesses and deaths is substantial. The WRT sector encompasses the distribution component of the manufacture–distribute–consume cycle of business. This combination sector has been considered by the National Institute for Occupational Safety and Health (NIOSH) as one of the eight major divisions of the economy for the purpose of establishing a National Occupational Research Agenda (NORA) [NIOSH, 2006a].

For many people in the United States, a job in the retail industry represents their initial entry to the workforce as well as their last place of work as older workers who are phasing out of the workforce or re-entering it after retirement. The data support this observation in that the WRT industries include a higher-than-average proportion of younger (i.e., less than 20 years of age) and older (i.e., 65 years and older) workers. Although in 2006, 4% of the total U.S. workforce was under the age of 20 years, the same age group represented nearly 8% of WRT workers. In 2006, the WRT sector employed 21.328 million workers: 4.561 million in wholesale and 16.767 million in retail. Table I shows the demographics of WRT and the employment levels by age of workers [BLS, 2006a,b].

This is the first comprehensive review of the occupational safety and health of workers in the WRT NORA sector. By investigating the sector comprehensively, it is possible to assess its overall occupational health burden and that of various subsectors. Generally, working in the WRT is perceived as safe work as compared with work in notably higher risk sectors such as construction, agriculture, manufacturing, mining, forestry, and fishing. However, at the 4- and 5-digit NAICS WRT subsector level, there is a broad range of work activities and physical hazards that may pose a considerable risk for thousands of WRT workers [NIOSH, 2006a].

TABLE I. Demographics WRT Sector Annual Average, 2006

	Number of employees (expressed in thousands)	% of total
WRT super sector	21,328	
Wholesale sector	4,561	21.4
Retail sector	16,767	78.6
Male	11,794	55.3
Female	9,534	44.7
Age of WRT employees		
16–19	1,744	8
20–24	2,941	14
25–34	4,296	20
35–44	4,520	21
45–54	4,289	20
55–64	2,585	12
65 and older	952	4
Total	21,328	100
WRT race–ethnicity[a]		
Caucasian (other)	15,702–17,960	~73.8
Hispanic/Latin	2,741	12.9
Black	1,992	9.3
Asian	893	4.2

Data from BLS [BLS, 2006a,b].
[a]The measure is subject to error in the source and may indicate double counting or an unclear category.

[1] The term super sector is frequently applied to combinations of NAICS sectors, such as the retail and wholesale trades, the subject of this article, to distinguish it from individual sectors. For the purpose of this article, we will refer to the WRT as a combined sector when necessary.

The focus of this review is to assess the occupational fatality, injury, and illness burden in the WRT and to identify subsectors where intervention efforts may be targeted.

METHODS

Definition of the Wholesale Retail Trade Sector

The WRT sector consists of the wholesale component and the retail component. ''The wholesale trade sector comprises establishments engaged in wholesaling merchandise (generally without transformation) and rendering services incidental to the sale of merchandise. The merchandise described in this sector includes the outputs of agriculture, mining, manufacturing, and certain information industries, such as publishing. The wholesaling process is an intermediate step in the distribution of merchandise. Wholesalers are organized to sell or arrange the purchase or sale of (1) goods for resale (i.e., goods sold to other wholesalers or retailers), (2) capital or durable nonconsumer goods, and (3) raw and intermediate materials and supplies used in production. Wholesalers sell merchandise to other businesses and normally operate from a warehouse or office.'' ''The retail trade sector comprises establishments engaged in retailing merchandise, generally without transformation, and rendering services incidental to the sale of merchandise. The retailing process is the final step in the distribution of merchandise; retailers are, therefore, organized to sell merchandise in small quantities to the general public. This sector comprises two main types of retailers: store and nonstore retailers'' [BLS, 2008a]. The WRT sector is important because it is large and pervasive; the sector itself is a growth sector. As a result, even small changes in incidence will have notable and growing implications for society [Dohm and Shniper, 2007].

Data Sources Reviewed

For appraisal of the occupational fatal and nonfatal burdens of the WRT sector, we used the following primary data sources from the Bureau of Labor Statistics (BLS): Survey of Occupational Injuries and Illnesses (SOII), Census of Fatal Occupational Injuries (CFOI), and data provided by the U.S. Census Bureau, namely the Current Population Survey (CPS). For purpose of comparison, we used the BLS data labeled as ''private industry'' to provide the annual averages across all privately employed workers, which for 2006 was approximately 111.3 million. The CFOI and SOII data sources were analyzed to determine those WRT subsectors with injury/fatality rates that exceed the private industry averages. The 2006 BLS data will also be used as a baseline against which subsequent interventions efforts can be assessed to determine the impact of new sector-focused information and intervention campaigns. To provide a perspective on the 2006 data, select BLS data sets from 2003 through 2007 were shown to assess any trends or changes that would impact its use as a baseline year. Economic data on direct and indirect costs of fatal and nonfatal injuries were drawn from NIOSH reports [NIOSH, 2006b,c] and from the findings of Leigh et al. [2004].

Nature of Activities and Hazards

The BLS uses a unique coding system for each case that provides information about the circumstance of the injury, illness, and fatality [BLS, 2007]. For the WRT sector, key case characteristics will be examined to determine the nature of the injury/illness, its source, body part, and the event or exposure. Information on the severity of the case will be assessed using the measure identified as the number of days-away-from-work (DAFW). This is often the most costly of the outcomes that can include transfer of duties or restriction of duties.

The most useful category for hazard identification is labeled as the ''event or exposure.'' The definition is based on the manner in which the injury or illness was produced or inflicted, such as slips, trips, or falls; overexertion; or contact with electric current, or caught in some piece of equipment. A source, secondary or primary, refers to the object, substance, person, exposure, bodily motion that produced the injury or illnesses previously identified in the nature of the injury or illness classification. Containers are included as objects that are common sources for an injury. Bodily motion or position includes injuries or illnesses resulting from reaching, turning, twisting, bending, walking, climbing, running, and from efforts to keep from falling. We will identify those subsectors at the 4th and 5th NAICS digit in which the rates of injuries/illnesses or fatalities are higher than expected as compared with the rates from the overall private industry.

Assessment of Economic Loss

The direct costs of fatalities, injuries, and illnesses in the WRT sector have not been assessed with recent data; we reviewed various published studies from 1992 to 2002.

RESULTS

Figure 1 provides a comparison across industry sectors showing the number of nonfatal injury/illnesses cases (total cases) and DAFW for years 2005 and 2006. This comparison provides an indication of the overall exposure and injury/illness burden of the WRT sector. The WRT sector exceeds other recognized high-risk sectors in the number of DAFW, an important indicator of severity.

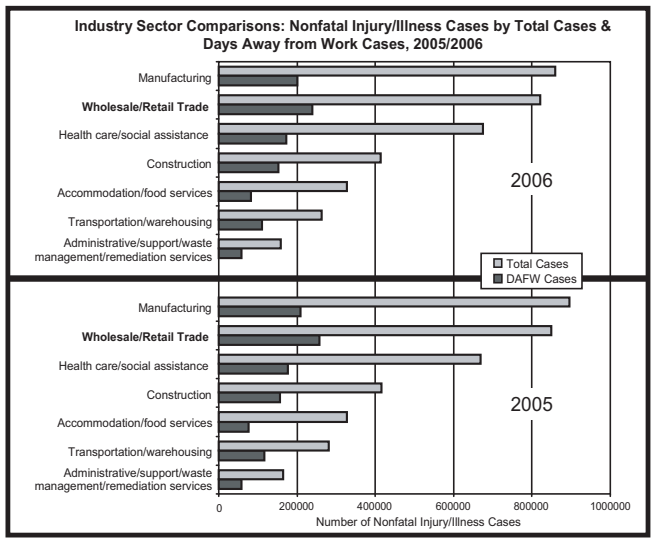

FIGURE 1. A comparison across industry sectors showing the number of nonfatal injury/illnesses cases by total cases and days-away-from-work (DAFW) for years 2005 and 2006.

TABLE II. Fatal Occupational Injuries/Illnesses in WRT by Event or Exposure, 2006

Event or exposure for fatal injury	Number	% of total
Wholesale sector		
Transportation incidents	109	49.1
Contact with objects and equipment	53	23.9
Falls	24	10.8
Exposure to harmful substances	18	8.1
Assaults and violent acts	12	5.4
Fires, explosions	6	2.7
Total wholesale sector	222	100.0
Retail sector		
Assaults and violent acts	169	47.1
Transportation incidents	113	31.5
Falls	31	8.6
Contact with objects/equipment	25	7.0
Exposure to harmful substances	13	3.6
Fires, explosions	8	2.2
Total retail sector	359	100.0

From BLS [2006d].

Fatal Injuries

Figure 2 shows the number of fatality cases from 2003 through 2007 for both the WRT sectors. What is evident is that the totals for both sectors were relatively consistent over the 5-year period, averaging 207 and 366 fatalities, respectively. The combined WRT averaged 572 fatalities over the time span. The WRT accounted for slightly more than 10% of the number of private sector annual fatalities, which averaged 5,183 for the 5-year period.

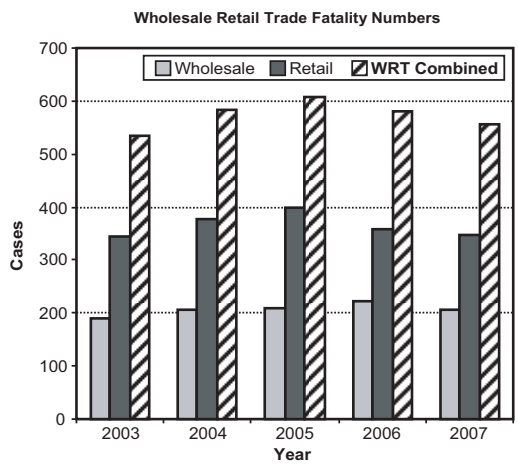

FIGURE 2. Number of annual fatalities over a 5-year span.

Table II provides an overview of events or exposures accounting for recorded fatalities within the wholesale and retail sectors.[2] In 2006, 222 U.S. workers in the wholesale sector died on the job, a rate of 4.9/100,000 FTEs. The leading event was related to transportation: 109 (49.1%). Contact with objects/equipment was associated with 53 deaths (23.9%) and falls were associated with 24 deaths (10.8%). Assaults and violent acts were less prevalent in the wholesale sector, with 12 deaths; including 5 cases labeled as homicides [BLS, 2006c,d].

The fatality rate for retail workers was 2.2/100,000 FTE, resulting in 359 deaths. Referring to Table II, assaults and violent acts led as the event associated with worker fatality in the retail sector; they accounted for 169 (47.1%) of the 359 deaths. Transportation incidents were the second most frequent event associated with worker fatality in the retail sector with 113 deaths (31.5%). Falls and contact with objects contributed a combined 56 deaths, accounting for nearly 16% of the remaining fatalities in the retail sector [BLS, 2006c,d].

Table III shows fatal occupational injuries, assaults/violent acts, and homicides in retail trade at 4- and 5-digit NAICS subsectors that had either high rates or a larger than expected number of fatal assaults/violent acts and work-related homicides, 2006. Homicides accounted for 141, or

[2] BLS states that "The event or exposure describes the manner in which the injury or illness was produced or inflicted by the source of injury or illness."

TABLE III. Fatal Occupational Injuries, Assaults/Violent Acts, and Homicides in Retail Trade at 4- and 5-Digit NAICS Subsectors, 2006

4- and 5-digit NAICS industry	Fatality incidence rate[a]	Number of fatalities	Assaults and violent acts	Work-related homicides
All private industries	4.3	5,320	677	540
Retail sector	2.2	359	169	141
Food and beverage stores	2.8	82	63	61
Grocery stores	2.2	57	48	46
Convenience stores	6.1	37	36	36[b]
Supermarkets and other grocery stores	0.7	17	9	7
Gasoline stations	9.8	52	42	40
Gasoline stations with convenience stores	5.9	44	36	35[b]
Automobile dealers	2.9	42	9	4
Used car dealers	5.5	7	3	3
Building material/garden equipment/supplies	2.7	41	3	4
Department stores	0.8	13	5	5

From BLS [BLS, 2006d,e].
[a]Number of fatalities per 100,000 FTE workers.
[b]Convenience stores alone or with gasoline stations resulted in 71 homicides.

more than 80% of the fatal assaults and violent acts. Of the 141 work-related homicides that occurred in the retail subsectors, 71 (50%) occurred in convenience stores—whether alone or combined with gasoline stations. Fatalities from events other than homicides were concentrated in subsectors of automobile dealers, building materials and supplies, direct selling establishments, department stores, and other general merchandise stores. Overall, gasoline stations had the highest fatality rate of 9.8/100,000 FTE, which involved 52 fatalities, a majority (40) of which were homicides [BLS, 2006d,e].

Nonfatal Occupational Injuries and Illnesses

Figure 3 provides an overview of the total number of nonfatal injuries/illnesses cases from 2003 through 2007 for the wholesale, retail, and combined WRT sectors. As was found with the fatality cases, there was also a high degree of consistency in the number of injuries/illnesses over the 5-year span. The averages for the wholesale, retail, and combined cases were 240,520, 605,180, and 845,700, respectively. The average for the private sector over the same period was approximately 4.0 million injury/illness cases. Although the WRT sector represents approximately 15–16% of the private sector employment, it accounts for nearly 20% of the annual nonfatal injuries/illnesses over the 5-year span.

Table IV provides a more detailed look at key injury/illness summary data for both the WRT sectors for 2006, as well as providing a comparison with private industry. The incidence rate for the wholesale sector averaged 4.1 per 100 FTE, whereas the retail sector averaged 4.9 per 100 FTE [BLS, 2006f].

The number of injury/illness-related incidents reported by private industry employers involving one or more DAFW equaled 1.18 million or 28.9% of the nearly 4.1 million recorded injury illnesses for 2006 (Table IV). Similarly, of the 820,500 WRT total injury/illness cases in the WRT sector less than 30% of them or 238,500 involved one or more DAFW. According to the BLS, both the rate and number of occupational injuries and illnesses requiring DAFW for the WRT 2006 sector decreased only slightly from 2005, as it had each in the preceding 3 years, to a rate for 2006 of 1.3 wholesale and 1.4 retail cases per 10,000 FTE [BLS, 2006f,g].

FIGURE 3. Number of injuries and illnesses over a 5-year span.

TABLE IV. Number and Rate of Nonfatal Occupational Injuries and Illnesses for the Wholesale and Retail Trade Sectors, Including Private Industry, 2006 (Numbers in Thousands)

	Private industry[a]		Wholesale trade (code 42)		Retail trade (codes 44 and 45)	
Characteristic	**Number**	**Rate**	**Number**	**Rate**	**Number**	**Rate**
Injuries and illnesses						
Total cases	4,085.4	4.4	232.0	4.1	588.5	4.9
Cases with days away from work, job, transfer, or restriction	2,114.6	2.3	140.6	2.5	308.6	2.6
Cases with days away from work[b]	1,183.5	1.3	75.7	1.3	162.8	1.4
Cases with job transfer/restriction	931.1	1.0	64.9	1.2	145.8	1.2
Other recordable cases	1,970.8	2.1	91.4	1.6	279.8	2.4
Injuries						
Total cases	3,857.4	4.2	226.2	4.0	572.7	4.8

From BLS [BLS, 2006f,g].

[a]Incidence rates represent the number of injuries and illnesses per 100 full-time workers and were calculated as: (N/EH) × 200,000, where N is the number of injuries and illnesses, EH is the total hours worked by all employees during the calendar year, 200,000 is the base for 100 equivalent full-time workers (working 40 hr per week, 50 weeks per year).

[b]Days-away-from-work cases include days away from work with or without job transfer or restriction.

Table V provides the number of nonfatal cases and the percent of the total for each of the primary events or exposures for the wholesale and retail sector involving DAFW. These events/exposures were substantial or severe enough to cause a loss of work time, measured as one or more DAFW. The wholesale sector had 75,700 cases requiring DAFW. The leading injury-producing event was contact with objects/equipment, accounting for 21,970 cases, 29.0% of all wholesale injuries, followed by overexertion with 19,900 cases (26.3%). Overexertion events or exposures arise most frequently from manual lifting and positioning of product. The retail sector produced 162,800 injury cases involving DAFW. Overexertion injuries were the most prevalent with 47,350 cases at 29.1% of the total cases, followed by contact with objects/equipment injuries with 47,090 cases (28.9%) [BLS, 2006d]. Because principal job activities in both the wholesale and retail sub sectors include receiving, transporting, storing, and delivering products, these findings are associated with events/exposures that lead to overexertion and contact with objects/equipment [BLS, 2006h].

TABLE V. Number of Nonfatal Occupational Injuries and Illnesses for the WRT Sector Involving Days Away From Work (DAFW) by Events/Exposures, 2006

Event or exposure for nonfatal injury	**Number**	**% of total**
Wholesale sector		
Contact with objects/equipment	21,970	29.0
Overexertion	19,900	26.3
Falls (same level)	6,590	8.7
Transportation incidents	5,410	7.1
Falls (lower level)	4,620	6.1
Exposed to harmful substances	2,640	3.5
Slips/trips (with no fall)	2,320	3.1
Repetitive motion	2,240	3.0
Assaults and violent acts	460	0.6
Fires/explosions	90	0.1
All other	9,064	12.5
Total DAFW	75,700	100.0
Retail sector		
Overexertion	47,350	29.1
Contact with objects/equipment	47,090	28.9
Falls to same level	22,700	13.9
Falls from elevation	8,560	5.3
Transportation incidents	5,780	3.6
Exposed to harmful substances	4,500	2.8
Repetitive motion	4,400	2.8
Slips/trips (with no fall)	4,300	2.6
Assaults and violent acts	1,530	0.9
Fires/explosions	310	0.2
All other	16,280	10.0
Total DAFW	162,800	100.0

From BLS [2006h].

Overexertion injuries and lifting

Table VI provides incidence rates for overexertion events/exposures for nonfatal occupational injuries and illnesses involving DAFW per 10,000 FTE workers for the WRT sectors. All 27 of the WRT industry subsectors listed in Table VI exhibited overexertion rates that exceed the average for private industry of 30.8/10,000 FTEs. The WRT sectors averaged 35.4 and 39.8 cases, respectively, per 10,000 full-time workers [BLS, 2006i]. The greatest risk of overexertion injury is in the wholesale subsector entitled: beer, wine, and distilled alcoholic beverage merchant wholesalers with a rate of 114.9 cases per 10,000 FTE involving one or more DAFW,

TABLE VI. Incidence Rates for Nonfatal WRT Occupational Injuries and Illnesses Involving Number of Days Away From Work (DAFW),[b] 2006

	Overexertion IRs[a]	
Sectors and subsectors	**All**	**In lifting**
Private industry	30.8	16.3
Wholesale sector	35.4	20.6
Lumber and other construction materials	46.6	22.0
Merchant wholesalers, nondurable goods	57.8	34.7
Paper and paper product	51.9	36.9
Grocery and related products	35.1	22.7
Farm products and raw material	79.0	44.2
Beer/wine/and distilled alcoholic beverages	114.9	65.3
Miscellaneous nondurable goods	43.7	31.1
Retail sector	39.8	25.0
Tire dealers	102.1	65.8
Furniture and home furnishings stores	60.6	33.2
Furniture stores	54.6	30.5
Home furnishings stores	67.9	36.5
Floor covering stores	43.7	19.0
Other home furnishings stores	86.5	50.0
Building material and supplies	72.8	49.2
Home centers	82.9	57.6
Other building materials	72.2	44.5
Food and beverage stores	48.0	32.1
Grocery stores	50.8	34.4
Supermarkets/other except convenience stores	53.8	36.4
Other health and personal care stores	53.9	34.8
Gasoline stations	31.0	17.2
General merchandise stores	50.5	30.9
Department stores	44.9	28.0
Other general merchandise stores	56.1	33.9
Warehouse clubs and superstores	52.1	32.0
All other general merchandise stores	69.7	40.2
Fuel dealers	52.4	25.1

From BLS [2006i].
[a]Incidence rates (IRs) represent the number of injuries per 10,000 full-time workers for the wholesale and retail trade sector for the event labeled as all overexertion and overexertion in lifting.
[b]Some DAFW cases include job transfer or restriction.

which was followed by farm products and raw materials with 79.0 cases. In the retail sector, tire dealers had the highest case rate of 102.1 DAFW per 10,000 FTE. Other subsectors with high case rates netting above average DAFW include the following: furniture and home furnishing stores, home centers, building materials and supplies, and other general merchandise stores [BLS, 2006i]. In general manual materials handling in the form of pushing, pulling, carrying, and lifting all contribute to the event or exposure labeled as overexertion.

Nonfatal injuries from falls

Despite the low relative risk of falls in the WRT sector, several wholesale and retail subsectors have surprisingly high incidence rates of nonfatal injury from falls. Table VII provides a listing of those subsectors for 2006. BLS differentiates falls based on whether the falls were ''to a lower level'' or ''on the same level.'' The private sector incidence rates for falls to a lower level and on the same level were 8.0 and 16.4/10,000 FTE, respectively. The wholesale sector incidence rates for falls to a lower level and on the same level were 8.2 and 11.7/10,000 FTE, respectively. Farm products and raw material wholesalers registered higher than average incidence rates for falls to a lower level and on the same level. Hardware and plumbing/heating

TABLE VII. Incidence Rates for Nonfatal WRT Occupational Injuries and Illnesses Involving Number of Days Away From Work (DAFW),[b] 2006

	Falls IRs[a]	
Sectors and subsectors	**To lower level**	**On same level**
Private industry	8.0	16.4
Wholesale sector	8.2	11.7
Farm products and raw material	24.5	24.7
Hardware, plumbing/heating equipment/supplies	20.0	8.0
Beer, wine, and distilled alcohol	10.2	24.0
Merchant wholesalers, nondurable goods	10.5	20.1
Lumber and other construction materials	16.7	20.3
Grocery-related product merchants	12.8	19.8
Miscellaneous nondurable goods merchants	8.8	21.5
Retail sector	7.2	19.1
Manufactured (mobile) home dealers	100.9	—
Used merchandise stores	51.7	55.7
Florists	—	53.0
Outdoor power equipment	—	44.0
Recreational vehicle dealers	20.8	20.8
Other motor vehicle dealers	18.8	12.4
Furniture stores	13.0	19.0
Home centers	10.3	19.6
Other gasoline stations	3.3	30.8
Lawn garden equipment and supplies	14.0	21.5
Supermarkets and other grocery stores	3.4	29.2
Grocery stores	3.2	28.3
Fuel dealers	12.3	31.7
Department stores	9.0	30.9
Warehouse clubs and superstores	5.5	26.3

—, Data too small to be displayed.
From BLS [2006i].
[a]Incidence rates (IR) represent the number of injuries/illness involving DAFW 10,000 per FTE workers.
[b]Some DAFW cases include job transfer or restriction.

equipment suppliers', beer/wine/and distilled alcoholic beverages, merchant wholesalers-nondurable goods, lumber and other construction materials suppliers, and grocery-related product merchants were also at high risk for falls, both to the lower and on the same level [BLS, 2006i].

The retail sector, similar to the wholesale sector, also registered higher rates of falls ''to a lower level'' and ''on the same level'' at 7.2 and 19.1/10,000 FTE workers, respectively (Table VII). However, manufactured (mobile) home dealers had an unusually high incidence of falls to a lower level of 100.9/10,000 FTE workers, but too few falls to report on the same level, whereas florists and outdoor power equipment had the opposite, high rates of falls on the same level, but too few to report regarding falls to a lower level. Used merchandise stores, recreational vehicle dealers, other motor vehicles dealers, furniture stores, home centers, lawn garden equipment and supplies, supermarket and other grocery stores, fuel dealers, department stores, and warehouse clubs and superstores all had combinations of falls either to a lower level or from a lower level, and frequently both occurrences, that were higher than the average for the retail sector and private industry [BLS, 2006i]. Each of the retail and wholesale subsectors identified in Table VII offers opportunities for improvements in either fall protection and/or attention to factors that contribute to slips and trips that often precede falls.

Nonfatal Occupational Illnesses

Table VIII displays the number and incidence rates of nonfatal occupational illness for private industry as well as by the WRT sectors in 2006. Although the WRT sector has more than 21 million employees, the number of annual recorded occupational illnesses was less than 22,000 cases, which amounted to about 10% of the 228,000 nonfatal occupational illnesses recorded for all private industry. Of all the named illness categories, occupational skin disorders represented the most frequently reported. Of the illness categories, the category entitled ''all other illnesses cases'' had the highest incidence rates for both wholesale and retail sector. Illnesses in the ''all other'' category involve conditions arising from the effects of thermal exposures, the effects of ionizing and nonionizing radiation, blood-borne pathogenic diseases, such as HIV, hepatitis, and benign tumors [BLS, 2009].

Costs of Fatal and Nonfatal Injuries and Illnesses

Leigh et al. [2004] calculated the total costs (in 1993 dollars) for fatal and nonfatal injuries across various WRT industries using the 1987 Standard Industrial Classification (SIC). Total costs included costs for medical care, lost productivity, and pain/suffering. Costs expressed in 1993 dollars were derived from workers' compensation records, estimates of lost wages, and injury awards. Table IX shows the nine WRT subsectors that are within the top 50 subsectors from all industries, as computed by Leigh et al. Costs of fatal and nonfatal injuries were estimated to be $8.63 billion for nine WRT subsectors.

Biddle [NIOSH, 2006b,c] calculated for the WRT sector the societal costs (in 2003 dollars) of fatal occupational injuries from 1992 through 2002. The total cost for fatalities that occurred in wholesale was $2.169 billion, whereas the total cost for fatalities that occurred in retail was $5.110 billion. In retail trade, the events or exposures with the greatest costs included assaults and violent acts at $3.268

TABLE VIII. Number and Rate of Nonfatal Occupational Illnesses for the Wholesale and Retail Trade Sectors, Including Private Industry by Illness Categories, 2006 (Numbers in Thousands)

	Private industry[a]		Wholesale trade (code 42)		Retail trade (codes 44 and 45)	
Characteristic	**Number**	**Rate**	**Number**	**Rate**	**Number**	**Rate**
Illnesses						
Total cases	228.0	24.6	5.8	10.3	15.8	13.2
Illness categories						
Skin disorders	41.4	4.5	1.1	1.9	3.2	2.7
Respiratory conditions	17.7	1.9	0.9	1.6	1.4	1.2
Poisoning	3.4	0.4	—	0.1	0.3	0.2
Hearing loss	24.4	2.6	0.3	0.5	0.1	0.1
All other illness cases	141.1	15.2	3.5	6.2	10.8	9.1

—, Fewer than 50 cases or rate <0.05.

From BLS [2006j,k].

[a]Incidence rates represent the number of illnesses per 10,000 full-time workers and were calculated as: $(N/EH) \times 20{,}000{,}000$, where N is the number of illnesses.

TABLE IX. Total Costs for Fatal and Nonfatal Injuries and Illnesses for Top-Ranking Retail Sectors by Standard Industrial Classification (SIC) (Costs in Billions)

SIC	Subsector	Total cost (1993 dollars)	Rank among all subsectors[a]
541	Grocery stores	$2.7	4
531	Department stores	$1.3	7
514	Grocery and related products	$1.3	8
551	New and used car dealers	$0.7	22
599	Retail stores (new)	$0.7	25
508	Machinery equipment supplies	$0.6	32
554	Gasoline service stations	$0.46	40
521	Lumber and other building materials	$0.45	42
507	Motor vehicle parts and supplies	$0.42	44
Total		$8.63	

Adapted from Leigh et al. [2004].
[a]Eight sectors in all.

billion and transportation accidents at $1.214 billion. In the wholesale sector, the events or exposures with the greatest costs were transportation accidents at $1.195 billion and contact with objects/equipment at $365 million.

Zaloshnja et al. [2006] calculated the savings (in 2000 dollars) for injury reduction in various sectors including wholesale trade and retail trade, based on reductions in occupational injuries between 1993 and 2002. He used a standard analytical tool known as the ''input–output'' model to determine the effects of changes in occupational injury rates on the economy and affected industries. Specifically, as injury rates fall, medical costs are reduced, workers' compensation disability costs are reduced, as well as reduction in costs from sick leave for injuries/illnesses not covered by workers' compensation. The model also considers the reduction in labor and production costs from employee turnover. When BLS information on workplace injuries/illness is accounted for, the model shows how improved workplace safety can increase employment allowing the economy to expand as funds once diverted to medical cost and employee compensation can be reinvested into the business allowing for growth and expansion. As an example, for wholesale trade, a 32% reduction in injuries resulted in $1.79 billion in savings. Similarly for retail trade, a 35% reduction in injuries resulted in $3.07 billion in savings that can translate into increase in employment and business growth. With this model, it is possible to assess the benefits of a company-wide prevention program on future growth of the enterprise.

DISCUSSION

This review illustrates that the occupational safety and health burden posed by WRT on our society is substantial. What is not clear is which set of subsectors should be the primary targets of intervention. The answer depends to a large extent on the criteria one uses. To maximize impact, the choice would likely be based on subsectors with large numbers of employees at risk. Sectors with higher than average incidence rates may be used to identify enterprises based on severity of the problem. Moreover, when high incidence rates are combined with measures of lost time, such as DAFW, enterprises with those criteria may be good candidates for intervention because of the likely costs that are being incurred from loss time and potential employee turnover. One may also focus on those high-risk sectors that have known hazards where interventions exist and have been successfully adopted, that is, the amenability factor. With an increase in minority workers, some researchers have targeted subsectors in which minority workers have been at high risk. Recently, there has been an interest in focusing on sectors that may provide the most economic benefit. Ultimately, which subsectors are most in need of intervention need to be based on the researcher's judgment and resources.

Table X consists of the top twelve 4- to 5-digit subsector WRT cases with a combination of high incidence rates expressed as total cases and DAFW. This table captures those subsectors that have higher than average rates of these two indicators. As a means of comparison, the rates for both the private sector and the service-providing sectors are shown in Table X. The top 12 subsectors include high-risk enterprises that have high employment rates and large numbers of minority workers, who are exposed to a number of well-recognized hazards, such as overexertion, lifting, and falls, as documented here. Further prioritization can be accomplished by computing the rate ratios consisting of the incidence rate of each subsector divided by the incidence rate of the overall private sector, or service sector, and then rank ordering those values. Other approaches to prioritization have included the use of a ''Prevention Index'' which treats frequency and relative risk as equally important [Silverstein et al., 2002].

Although the data supporting the overall exposure and injury/illness burden are substantial, the evidence supporting the cost issues are limited and certainly do not reflect current healthcare and business costs. Another limitation is that the cost estimates from the different studies cited here are priced in dollars in different years, which makes it hard to compare. One reviewer suggested that to bring the costs to a common reference year an inflation factor could be used. Since the costs include both medical and lost wages, which have different rates of cost growth, it also would be critical to select the correct inflation factor and attempt to disaggregate the costs between medical and lost wages to create an inflation factor that would fit the mix of costs. At a minimum, more current and comprehensive economic data are needed to make compelling business cases. Without good business cases, both large and small employers are hard pressed in this economy to invest in prevention efforts until or when they

TABLE X. WRT Largest 4- and 5-Digit Subsector Cases With Days Away From Work (DAFW) Measure as an Aid to Prioritization, 2006

Subsectors listings	NAICS	Total cases IR	DAFW[a] IR
Private industry		4.4	1.3
Service-providing sectors[b]		3.9	1.1
Manufactured (mobile) home dealers	45393	—[a]	3.0
Beer, wine, and distilled alcoholic beverage merchant wholesalers	4248	8.4	2.9
Other home furnishings stores	44229	5.5	2.5
Fuel dealers	45431	3.2	2.4
Grocery and related product merchant wholesalers	4244	7.0	2.3
Other building material dealers	44419	7.1	2.3
Tire dealers	44132	6.7	2.2
Home centers	44411	8.8	2.1
Lumber and other construction materials merchant wholesaler	4233	6.3	2.0
Farm product raw material merchant wholesaler	4245	4.2	2.0
Building material and supplies dealers	4441	7.6	2.0
Direct selling establishments	4543	5.2	2.0

IR, The incidence rates represent the number of injuries and illnesses per 100 full-time workers.
[a]Days-away-from-work cases (IR) include those that resulted in days away from work, some of which also included job transfer or restriction.
[b]Employment approximately 88 million of the 111 million employed in the private sector in 2006.

experience workplace injuries. Any attempt, however, to summarize the full economic loss from a workplace injury would be deficient in not acknowledging the significant human loss that adversely affects the family and the community of those injured workers; none of which can be adequately quantified or integrated into a business model [Keogh et al., 2000].

Unlike the uncertainty associated with collecting cost data, the BLS fatality data are based on a comprehensive census. From 2003 through 2006, fatalities in the wholesale sector increased each year, with the current year-high in 2006 of 222 deaths resulting in a rate of 4.9/100,000 FTE workers. As noted, the higher fatality rates can be traced to the wholesale sector in which transportation activities are prevalent. Transportation and road safety has been the subject of NIOSH research over the last decade [Murray et al., 2009].

The fatality rate for retail trade in 2006 was 2.2/100,000 FTE. Although the rate is lower than other sectors, the actual number of fatalities is substantial at 359, as is the impact on the affected families and business. What is evident from the BLS findings is that assaults and violent acts were more frequent in retail establishments where workers exchanged money with customers and/or employees worked alone or in small numbers in high-crime areas and had frequent and direct contact with the public. Establishments at high risk included convenience stores, with or without fuel service, gasoline stations, and businesses that sold alcoholic beverages [BLS, 2005].

In fact between 2006 and 2007, fatal work injuries in retail grocery stores were up to 26% (from 57 in 2006 to 72 in 2007), due largely to an increase in workplace homicides in that industry. It is clear from current BLS data and recent workplace surveys that violence in the workplace continues to be an important issue for employers and for stakeholders concerned with the well-being of WRT business and employees [BLS, 2005]. As a result, NIOSH in concert with private sector stakeholders has developed strategic plans for the WRT sector to continue efforts to reduce workplace violence [NIOSH, 2008].

Data from the annual survey of occupational injuries and illnesses indicated that one out of every five workers who suffered an occupational injury/illness in the private sector was employed in wholesale or retail jobs. Despite the large number of injuries/illnesses recorded for the WRT sector, there has been an overall downward trend in the number of wholesale/retail injuries and illness recorded from 2003 through 2006. Specifically, the wholesale sector decreased from 4.7 to 4.1/100 FTE over the 4-year period, whereas the retail sector decreased from 5.3 to 4.9/100 FTE. This downward trend parallels the BLS decreasing rates for private industry where the 2003 rate was 5.0/100 and the 2006 was 4.4/100 FTE. Some individuals see this as an indication that the workplace has become safer for workers. Others suggest that the lower figures may reflect underreporting or changes in the reporting criteria [Rosenman et al., 2006; BLS, 2008b].

The overall declining rate of injuries has also slowed the rate of growth in their cost. Despite the decline, Liberty Mutual's Research division noted that employers paid (in 2003 dollars) approximately $1 billion per week to injured workers and medical care providers. More than 25% of that payout is associated with overexertion injuries, also a leading event in the WRT combined sector. Experienced employers recognize that the cost of one disabling injury per year can have rippling repercussions on a business's profit, as well as have a long-term impact on its insurance rates, and trigger increases in personnel and training costs. According to a survey conducted by Liberty Mutual's Research Division to assess the views of Chief Financial Officers of mid- and large-size companies, over 60% of them surveyed reported that ''each $1 invested in injury prevention returns $2 or more'' [Liberty Mutual, 2008a,b].

In general, injuries/illnesses in the WRT sector can be attributed to combinations of tasks involving product handling and contact with objects/equipment. Such task activity has resulted in high rates of overexertion injuries and falls. This was evident in the beer/wine/and distilled alcoholic beverage subsector (2006) in which overexertion accounted for 39.7% of the adverse outcomes with a rate of 114.9/10,000 FTE workers, and contact with objects/equipment accounted for 22.4% of the injuries. Similarly in the retail trade sector, home centers had above average incidence rates, followed by warehouse clubs and superstores, other general merchandise stores, other building materials dealers, and supermarkets/other except convenience stores.

In the WRT combined sector, more than two dozen subsectors registered high incidence rates of overexertion and overexertion-in-lifting. As the BLS data indicate, overexertion injuries are frequently associated with lost time or DAFW, resulting in lost income and increased workers' compensation claims [BLS, 2006d]. Morse et al. [2005] reported on musculoskeletal disorders (MSD) in workers in Connecticut (1995–2001) and found, using capture–recapture analysis, that MSD were underreported in WRT. Out of 21,500 MSD cases, only 1,259 were reported to Office of Workers' Compensation Programs or to the Occupational Disease Surveillance System. An important advantage of identifying jobs within a subsector that pose a risk of injury is the corresponding opportunity to intervene before the condition becomes serious enough to result in loss of work. The interventions include job redesign and the use of existing material-handling equipment. Training is also needed in the proper use of manual materials handling devices [NIOSH, 2007; OSHA, 2008]. The most successful interventions involve consistent management commitment with input from the employees, and a plan for implementation with periodic reviews to assess progress [OSHA, 1989].

Although both NIOSH and OSHA over the last decade have produced numerous documents that address the causes and potential solutions to workplace safety and health problems in a number of the notably high-risk industries, WRT workplaces have been largely overlooked. Recognizing the size and growing importance of the WRT sector, NIOSH in collaboration with researchers and WRT stakeholders worked together over many months to identify both the critical risk factors as well as any existing knowledge gaps in surveillance that needed to be addressed. They also considered the importance of developing appropriate controls and interventions for the sector as well as gaps in translation and dissemination. The result of that effort is now available to the public in the form of a first *National Occupational Research Agenda for the Wholesale and Retail Trade Sector*. This document outlines ''what is needed to be done'' to reduce the WRT injuries, illnesses, and fatalities [NIOSH, 2008]. Many of those gaps in our understanding of the WRT sector are evident from this current review of the surveillance literature.

The *National Occupational Research Agenda for the Wholesale and Retail Trade Sector* or ''WRT Strategic Plan,'' as it is often called, is one of the eight sector plans developed under a program known as the National Occupational Research Agenda (NORA). NORA is a partnership program with NIOSH intended to stimulate innovative research and improved workplace practices. As such, the WRT NORA Research Agenda is good starting point for researchers who are interested in conducting studies in the WRT sector [NIOSH, 2008].

CONCLUSION

This article presents the first comprehensive review of the health and safety of workers in the WRT sector. The WRT sector is important because it is large and pervasive; the sector itself is a growth sector; as a result, even a relatively small increase in injury rates and accompanying days away from work will have significant impact on working families and society. A review of the tabular data presented in this report highlights numerous high-risk subsectors. Although it is generally accepted that preventing occupational injuries/illnesses can reduce labor costs to employers, limited data are available to estimate the costs of occupational illnesses/diseases, and many of those costs are borne outside workers' compensation programs. Information on the costs of fatal injuries for WRT, however, is somewhat easier to estimate and is currently at $8 billion. Although, the overall incidence rates in the WRT sector are low, the cumulative burden is great, and the sector merits further research and intervention.

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