Numbers and Costs of Occupational Injury and Illness in Low-Wage Occupations

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Abstract: Economists have estimated the medical and productivity costs of workplace injuries and illnesses for U.S. workers in all occupations. The slow economic recovery, however, has shifted job creation toward low-wage jobs and industries. This paper provides the first estimates of the numbers and costs of occupational injury and illness in low-wage occupations during the Great Recession, specifically in 2010.

To generate these estimates, I use critical definitions and assumptions to identify low-wage occupations, to define medical and productivity costs, and to note which occupations are omitted from the data and results.

The paper reports on costs in 65 low-wage occupations for four classes of injury and illness: nonfatal injuries, nonfatal illnesses, fatal injuries, and fatal illnesses. I estimate 596 fatal injuries and 1,625,152 nonfatal ones, costing $441 million and $28.3 billion in 2010. For illnesses, the estimates are 12,415 fatal and 87,857 nonfatal cases, with costs of $8.77 billion and $1.53 billion. Seven low-wage occupations account for a substantial share of the injuries and illnesses, and the greatest total costs: retail salespersons ($4.5 billion); janitors and cleaners ($4.1 billion); maids and housekeeping cleaners ($3.1 billion); stock clerks and order fillers ($2.7 billion); food preparation and serving workers ($2.1 billion); restaurant cooks ($1.8 billion); and cashiers ($1.8 billion).

These estimates suggest that workers in low-wage occupations contribute significantly more medical and productivity costs than is generally assumed.

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EXECUTIVE SUMMARY

Whereas many cost-of-illness studies are available for a variety of different diseases, few are available for occupational injuries and illnesses. Moreover, I am not aware of any research on the economic burden of occupational injury and illness in low-wage occupations. This lack of knowledge is in contrast to the significant research on low-wage occupations involving, for example, numbers of people employed, average wages, poverty status of incumbents, and health insurance coverage. This is unfortunate for both efficiency and equity reasons. The efficient allocation of scarce health care resources requires knowledge of injury and disease costs. We need to know whether spending is too little or too much on specific diseases or injuries and whether the spending is consistent with optimum population health. Regarding equity, persons in low-wage jobs may be especially vulnerable to disease and injury. Documenting the extent of the burden among persons in low-wage jobs represents an important step toward rectifying the inequities. This study provides estimates of the national number and costs of occupational injury and illness among civilians within low-wage jobs in the U.S. for 2010.

This study draws from a previous one that estimated the national costs for occupational injuries and illnesses across all occupations and employments, not just low-wage ones (Leigh, 2011). The previous study estimated medical and lost productivity costs associated with both the incidence of fatal and non-fatal injuries and non-fatal illnesses as well as the prevalence of fatal diseases. Parameters from the literature, model assumptions, and data files were combined to generate estimates. Parameters included attributable fractions (AF) of diseases with occupational components and national estimates for all health care costs. Data files included information on injury, disease, employment, inflation, and average costs from the Bureau of Labor Statistics (BLS), the Centers for Disease Control and Prevention, the National Council on Compensation Insurance, and the Healthcare Cost and Utilization Project. Total costs were calculated by multiplying numbers of cases with average costs per-case. In the current study, low-wage occupations are defined as occupations for which the median wage, multiplied by 2,000 hours per year (full-time, year-round work), would be at or below the poverty line for a family of four.

To estimate costs, injury and illness categories (nonfatal injuries and illnesses; fatal injuries; fatal diseases) and two cost categories (medical and productivity) are developed. A "top down" approach is taken whereby portions of the costs from the previous study for all occupations are allocated across the low-wage occupations. The allocation is governed by varying criteria, including: the percent contribution of each occupation to the total number of injuries, illnesses, or diseases for all occupations; the percent contribution to total employment for all occupations; and the ratio of the occupation wage to median wage for all occupations. Because of data limitations and unique characteristics, three groups are excluded: the self-employed, farm workers on crop and livestock farms, and domestic workers.

Fatal and non-fatal injury cases for low-wage workers in 2010 are estimated to be 596 and 1,625,152 respectively, with costs of $441.4473 million and $28.338734 billion (see Executive Summary Table). Fatal and non-fatal illness cases are estimated at 12,415 and 87,857, respectively, with cost estimates of $8.7687977 billion and $1.532018 billion. For injuries and diseases combined, medical cost estimates are $15.229034 billion (39% of the total costs) and productivity costs are $23.851962 billion (61% of the total costs). Within productivity costs, lost earnings comprise $14.185488 billion (59.5% of lost productivity), lost fringe benefits comprise $3.8669647 billion (16.2%), and lost home production $5.7995086 billion (24.3%). Injuries comprise $28.78018 billion (74% of the total) and diseases $10.430081 billion (26%). Total estimated costs are $39.080996 billion or $39.1 billion.

Executive Summary Table. Medical and Productivity Costs of Occupational Injuries & Illnesses within 65 Low-Wage Occupations, 2010

Category	Number of Cases	Medical Costs in $Billions	Productivity Costs in $Billions	Total Costs in $Billions
Total Injuries	**1,625,748**	**$10.143433**	**$18.636748**	**$28.780180**
Fatal injuries	596	$0.036864	$0.404583	$0.4414473
Nonfatal injuries	1,625,152	$10.106569	$18.232165	$28.338734
Total Diseases/Illnesses	**100,272**	**$5.085601**	**$5.2152147**	**$10.300815**
Fatal diseases/illnesses	12,415	$4.539230	$4.2295677	$8.7687977
Nonfatal diseases/illnesses	87,857	$0.546371	$0.9856470	$1.5320180
Grand Totals	**1,726,020**	**$15.229034**	**$23.851962**	**$39.0809950**

Occupations contributing the greatest total costs include:

Occupations	Medical & Productivity Costs Estimate, 2010 (in $Billions)
Retail Salespersons	$4.52
Janitors & Cleaners, Except Maids & Housekeeping Cleaners	$4.10
Maids & Housekeeping Cleaners	$3.13
Stock Clerks & Order Fillers	$2.69
Combined Food Preparation & Serving Workers, Including Fast Food	$2.06
Cooks, Restaurant	$1.82
Cashiers	$1.77

This final amount, $39.1 billion in 2010, is significant. It can be compared to national cost estimates for other adverse health conditions, such as stroke, with an estimated cost of $36.6 billion (in 2010 dollars), and hypertension at $54.0 billion (in 2010 dollars) (Roger et al 2012, with 2010 updates by author).

In conclusion, the medical and productivity costs of occupational injuries and illnesses within low-wage occupations are sizeable. The contributions of job-related injuries and illnesses within low-wage occupations to the overall cost of medical care and ill-health are greater than may be generally assumed.

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See the companion policy brief *"Mom's off Work 'Cause She Got Hurt: The Economic Impact of Workplace Injuries and Illnesses in the U.S.'s Growing Low-Wage Workforce"* available at: http://defendingscience.org/low-wage-workers.

BACKGROUND

Low-wage occupations have elicited considerable research and public policy attention. Jackson et al (2000) investigate the effects of holding low-wage jobs on the ability of single mothers to be effective parents. Chapters in the highly regarded book *Low-wage America: How Employers are Reshaping Opportunity in the Workplace* (Applebaum et al, 2006) address work hours, trends in employment over time, and the role of technology in shaping tasks, among many others. Stewart (2007) considers the reciprocal effects among employment in low-wage jobs, unemployment, and human capital accumulation. But links between low-wage occupations and occupational safety and health appear to be understudied. As far as I am aware, the current study is the first to address some of the most basic issues: what are the costs of occupational injury and illness within low-wage occupations, and which of these occupations contribute the most to those costs?

METHODS: Definitions and Assumptions

Defining Low Wages

In defining low-wage occupations, the first issue involves whether to use the mean or the median to measure wages. I use the median. Wage distributions are known to be skewed, with most people in the lower and middle ranges and a few with very high wages. This skewness undermines the ability of the mean to measure the actual experience of typical workers within or across jobs.

A second issue involves the method used to determine which jobs are "low-wage." The two most popular methods are: 1) jobs that generate annual earnings that are less than the federal poverty line for a family of four; and 2) jobs that provide wages that place earners in the lowest 10% or 20% of the wage distribution (Bernstein and Hartman, 2000). The first is referred to as an "absolute" measure and the second as a "relative" measure. I use the "absolute" measure. This "poverty line" measure appears more frequently in the literature in defining not just low-wage jobs, but also low-wage workers (Health and Human Services, 2009; Applebaum et al, 2006; BLS, 2011).

For a family of four, $22,350 is the poverty line for the 48 contiguous states and the District of Columbia for 2010 (Health and Human Services, 2012). Alaska and Hawaii are outliers with a poverty line annual salary of $28,000 and $26,000, respectively. For my purposes, it is better to express the poverty line amount as a wage. I assume that people who are employed full-time for one year will work 2,000 annual hours. This 2,000 is derived assuming a 40-hour week and 50 weeks per year. This is a standard assumption in economic research for defining full-time work (Davis, Mazzocco, Yamaguchi, 2005). I assume holidays and vacations sum to two weeks of the year. Dividing $22,350 by 2,000 hours yields $11.18 per hour.

The next step is to find occupations that pay $11.18 per hour or less. The Bureau of Labor Statistics' (BLS) Occupation Employment Statistics (OES) generates a list of over 800 occupations with numbers on employment as well as mean and median wages within occupations (BLS, 2012a). Data are coded into the Office of Management and Budget's Standard Occupational Classification (SOC) system. Information is collected on wage and salary workers in roughly 200,000 nonfarm establishments. Self-employed persons are excluded, as are farm workers in some industry sectors and domestic workers (BLS, 2012a).

Identifying Low-Wage Occupations

I first ranked roughly 800 OES occupations according to the median wage. Some occupations have no median wage listed because of problems BLS had with assigning work hours to these occupations. These "not listed" occupations include: Legislators; Education Administrators; Umpires, Referees, Athletic Trainers; Airline Pilots, Copilots, Flight Engineers, and Commercial Pilots; Flight Attendants; Oral and Maxillofacial Surgeons; Orthodontists; Anesthesiolo-

gists; Obstetricians and Gynecologists; Surgeons, and All Other Physicians; as well as numerous Elementary, Secondary, and Postsecondary School Teachers (e.g., Computer Science Teachers, Mathematical Science Teachers, Engineering Teachers, Agricultural Sciences Teachers Biological Science Teachers, Chemistry Teachers, Physics Teachers, and Economics Teachers). All of these occupations (as BLS data reveal) have annual earnings well over the poverty line of $22,350.

Applying the $11.18 per-hour threshold, I generated a list of 65 occupations which appear in Table 1. Occupations with the greatest number of members (and their median hourly wage) include: **Fast Food Cooks** ($8.80); **Food Preparation and Serving Workers** ($8.76); **Dishwashers** ($8.83); **Cafeteria and Coffee Shop Counter Attendants** ($8.90); **Hosts and Hostesses at Restaurants** ($8.92); **Cashiers** ($9.05); **Waiters and Waitresses** ($8.93); **Retail Salespersons** ($10.10); **Stock Clerks** ($10.52); **Childcare Workers** ($9.34); **Laundry and Dry-cleaning Workers** ($9.46); **Maids** ($9.32); **Parking Lot Attendants** ($9.53); **Home Health Aides** ($9.91); **Janitors** ($10.75); **Meat Cutters** ($10.92); and **Counter and Retail Clerks** ($10.93).

The numbers of workers within these 65 occupations sum to 30,855,260, comprising a significant percent of the entire U.S. workforce of 139,064,000 (U.S. Census Bureau, 2012). Expressing low-wage workers as a percentage of the number of people working in 2010 yields 30,855,260/139,064,000 = 0.2218, or 22.2%. This percentage can be compared to a Health and Human Services report from 2009 that found nearly one-third of the American workforce to be "low-wage workers" using a similar definition involving the four-person poverty line (but using mean rather than median wages). Of course, "low-wage workers" will include more people than "low-wage occupations" because there are wage distributions within each occupation. Many workers in occupations that are not "low-wage" on average nevertheless earn less than the poverty threshold because they are in the lower regions of the wage distribution for their occupation.

Defining Medical and Productivity Costs

This study for low-wage occupations relies on data from a previous study on all occupations combined (Leigh, 2011). Estimates in both studies use the cost-of-illness approach. Costs are divided into medical and productivity loss categories from the societal perspective (Rice, Hodgson, and Kopstein, 1985). Medical costs include spending on hospitals, physicians, pharmaceuticals, and nursing homes. Productivity costs include current and future lost earnings, fringe benefits, and home production (e.g., home repairs, cooking, cleaning, and rearing children). Productivity costs for fatal injuries and diseases use present value formulas with 3% discount rates.

Incidence methods estimate new injuries and illnesses in a given year as well as current and future costs. Prevalence methods estimate costs within a given year even if the injuries or diseases occurred or were diagnosed in previous years. Because rich data are available, this study uses the incidence method for nonfatal and fatal injuries as well as nonfatal illnesses.

Following methods for diseases in other highly regarded studies (Rosamond et al, 2007 and 2008; Petersen et al, 2008; Foster, 2006) this study uses prevalence methods for fatal diseases. Prevalence data are readily available on numbers of disease deaths and hospital costs. But in comparison, few data are available on numbers of newly diagnosed diseases and even less on forecasted future costs. Numbers of non-fatal injuries are taken from BLS' Annual Survey of Occupational Injuries and Illnesses (SOII) and the federal Office of Workers' Compensation Programs. Neither data set includes military personnel.

The previous study, and as a result the current study, adjust for underreporting, i.e., accidental or willful omissions of injury or illness cases on the OSHA 300 forms, which are the basis of the SOII. The previous study used the most probable rate of 40% for underreporting. Percentages other than 40% are considered in the sensitivity analysis below. Estimates of cost-per-injury are taken from the National Council on Compensation Insurance (NCCI) (National Council on Compensation Insurance, 2008). Wage-replacement rates (ratios of workers' compensation benefits to wages) are taken from Boden et al (2005); Reville et al (2001); Guo and Burton (2010); and Hunt et al (2004). Fringe benefits and home production are from Grosse (2003); Leigh et al (1997); and Bradley et al (2008).

Table 1. 65 Low-Wage Occupations Using the Poverty Line Definition: Occupation Codes, Descriptions, Employment and Median Hourly Wages, 2010

Occupation Code (SOC)	Occupation Descriptive Title	Employment, within Occupation	Median Hourly Wage
35-3021	Combined Food Preparation & Serving Workers, Including Fast Food	2,799,430	$8.76
35-2011	Cooks, Fast Food	502,450	$8.80
35-9021	Dishwashers	504,280	$8.83
35-9011	Dining Room & Cafeteria Attendants and Bartender Helpers	391,290	$8.86
39-5093	Shampooers	13,240	$8.86
39-3011	Gaming Dealers	88,370	$8.87
35-3022	Counter Attendants, Cafeteria, Food Concession, & Coffee Shop	441,830	$8.90
35-9031	Hosts & Hostesses, Restaurant, Lounge, & Coffee Shop	329,070	$8.92
35-3031	Waiters & Waitresses	2,289,010	$8.93
39-3031	Ushers, Lobby Attendants, & Ticket Takers	105,560	$8.95
39-3091	Amusement & Recreation Attendants	253,110	$8.97
41-9012	Models	2,760	$8.97
45-2092	Farmworkers & Laborers, Nursery, & Greenhouse (not in Crop or Livestock Farming)	233,280	$8.99
41-2011	Cashiers	3,314,870	$9.05
35-3011	Bartenders	512,230	$9.06
33-9092	Lifeguards, Ski Patrol, & Other Recreational Protective Services	123,140	$9.09
45-2041	Graders & Sorters, Agricultural Products	40,970	$9.17
39-3093	Locker Room, Coatroom, & Dressing Room Attendants	18,410	$9.26
35-2021	Food Preparation Workers	775,140	$9.27
37-2012	Maids & Housekeeping Cleaners	877,980	$9.32
39-9011	Childcare Workers	631,240	$9.34
39-5092	Manicurists & Pedicurists	56,270	$9.35
51-6021	Pressers, Textile, Garment, & Related Materials	52,790	$9.35
39-2021	Nonfarm Animal Caretakers	144,240	$9.38
35-3041	Food Servers, Nonrestaurant	221,000	$9.40
51-6011	Laundry & Dry-Cleaning Workers	201,180	$9.46
39-9021	Personal Care Aides	820,600	$9.49
35-9099	Food Preparation & Serving Related Workers, All Other	41,730	$9.50
35-2015	Cooks, Short Order	168,320	$9.51
53-6021	Parking Lot Attendants	126,160	$9.53
53-7061	Cleaners of Vehicles & Equipment	290,780	$9.54
53-7064	Packers & Packagers, Hand	666,860	$9.55
53-6031	Automotive & Watercraft Service Attendants	102,090	$9.58
43-4081	Hotel, Motel, & Resort Desk Clerks	224,430	$9.68
39-3021	Motion Picture Projectionists	8,890	$9.78
39-9099	Personal Care & Service Workers, All Other	70,170	$9.84
31-1011	Home Health Aides	924,650	$9.91

Table 1 (continued)

Occupation Code (SOC)	Occupation Descriptive Title	Employment within Occupation	Median Hourly Wage
39-6011	Baggage Porters & Bellhops	44,130	$10.04
41-2031	Retail Salespersons	4,270,550	$10.10
51-6031	Sewing Machine Operators	142,860	$10.15
39-3099	Entertainment Attendants & Related Workers, All Other	22,500	$10.17
39-3012	Gaming & Sports Book Writers & Runners	12,800	$10.25
53-6061	Transportation Attendants, Except Flight Attendants	27,040	$10.41
43-5081	Stock Clerks & Order Fillers	1,782,800	$10.52
31-9095	Pharmacy Aides	45,130	$10.56
39-3019	Gaming Service Workers, All Other	10,270	$10.61
35-2014	Cooks, Restaurant	947,060	$10.61
45-2093	Farmworkers, Farm, Ranch, & Aquacultural Animals (not in Crop or Livestock Farming)	29,790	$10.62
39-9032	Recreation Workers	301,840	$10.64
41-9091	Door-to-Door Sales Workers, News & Street Vendors, & Related Workers	6,910	$10.66
37-2011	Janitors & Cleaners, Except Maids & Housekeeping Cleaners	2,068,460	$10.75
41-9041	Telemarketers	258,060	$10.83
51-9198	Helpers—Production Workers	420,910	$10.83
39-5012	Hairdressers, Hairstylists, & Cosmetologists	357,030	$10.85
35-2012	Cooks, Institution & Cafeteria	396,970	$10.92
51-3022	Meat, Poultry, & Fish Cutters & Trimmers	164,650	$10.92
41-2021	Counter & Rental Clerks	420,070	$10.93
39-4021	Funeral Attendants	30,940	$10.94
53-3041	Taxi Drivers & Chauffeurs	166,890	$10.94
53-3031	Driver/Sales Workers	387,950	$10.95
35-2019	Cooks, All Other	20,700	$10.96
53-3011	Ambulance Drivers & Attendants, Except Emergency Medical Technicians	18,080	$10.97
31-9096	Veterinary Assistants & Laboratory Animal Caretakers	72,530	$10.98
51-9151	Photographic Process Workers & Processing Machine Operators	50,570	$10.99
49-3091	Bicycle Repairers	9,950	$11.16
	Total Employment in the 65 Low-Wage Occupations	**30,855,260**	

This study first estimates medical costs and then productivity costs. Separate estimates are also generated for cases of nonfatal injuries and illnesses, fatal injuries, and fatal diseases. I take a "top down" approach whereby first, the total costs across all 800+ occupations are derived and second, some of the total costs are apportioned across the 65 low-wage occupations.

Excluding Self-Employed, Certain Farm Workers, and Domestic Workers

For the current study, I exclude the self-employed, farm workers on crops and livestock farms, and domestic workers. Excluding these occupations is necessary because they are not included in BLS's Occupational Employment Statistics (OES), which is the basis of the estimates for employment and wages. Moreover, the self-employed, domestic workers, and farm workers on all farms with fewer than 11 employees are also excluded from the BLS's Survey of Occupational Injuries and Illnesses (SOII), which is partly the basis of the estimates for the numbers of nonfatal injuries and illnesses. The OES is by far the best data on employment and wages within occupations nationwide, but its exclusion of these occupations forces adjustments in this analysis of low-wage occupations.

Looking at the list of the 65 low-wage occupations, it is unlikely any large portion of the self-employed would identify one of them as their occupation. Excluding the self-employed therefore will not substantially affect the validity of this analysis. By contrast, excluding certain farm workers and domestic workers will affect the validity of the analysis, but is necessary due to data limitations. Virtually all BLS data sets acknowledge serious data-collection problems associated with farm workers on crops and livestock farms. A major complication is that many of these individuals are migrant workers and have no permanent address. Similar problems afflict BLS attempts to gather data on domestic workers. As a result, without data on farm workers on crops and livestock farms and domestic workers, this analysis will understate the number and cost of injuries and illnesses among low-wage workers.

In order to reconcile data differences between the previous study (Leigh, 2011) and this analysis, I remove estimates for farm workers on crops and livestock farms, as well as domestic workers, while maintaining estimates for farm workers in Support Activities and Forestry and Logging. This is necessary because the OES program does not survey firms in: Crop Production; Animal Production; Fishing, Hunting, and Trapping; and Private Households (Bureau of Labor Statistics, 2012b). But OES does not specifically mention that either Support Activities for Agriculture or Forestry and Logging are excluded. Most farm workers in the OES work in the Support Activities industry. In the previous study, the estimate for farm workers on crop and livestock farms and domestic workers is 59,700 cases out of a total 5,126,900 (Leigh, 2011). The ratio is 59,700/5,126,900 = 0.0116 or 1.116%. This 1.16% is subtracted from the previous study estimate prior to conducting estimates for this study on low-wage occupations.

Using data from the previous study and the *U.S. Statistical Abstract*, (U.S. Census Bureau, 2012) I assume 6.6% of the previous study's medical costs for nonfatal injuries and illnesses apply to the self-employed and farm workers on crops and livestock farms. I assume 6.4% applies to productivity costs for nonfatal injuries and illnesses as well as all other cost categories for both injury and disease fatalities.

METHODS: Calculations

Nonfatal Injury and Illness Cases

Medical Costs

The national study for all occupations combined (Leigh, 2011) generated estimates for medical costs of $45.95 billion for nonfatal injuries and $3.17 billion for nonfatal illnesses, for a total of $49.12 billion for 2007. After adjusting for the self-employed, farm workers on crop and livestock farms, and domestic workers, the total is $45.88 billion. To derive the medical cost estimate for nonfatal injuries and illnesses, the $45.88 billion is apportioned based upon either the percent contribution to injuries and illnesses by each of the 65 low-wage occupations to the total for all 800+ occupations; or, the percent contribution to employment by each of the 65 low-wage occupations to the total for all 800+ occupations.

The injury and illness data are drawn from the Bureau of Labor Statistics' Survey of Occupational Injuries and Illnesses (SOII) (BLS, 2012c). The data on employment are drawn from the same 800+ occupation OES source cited above (BLS, 2012a). An example will illustrate the method:

> "Cooks, fast food" contributed 1,660 injury and illness cases requiring at least one day away from work to the total of 936,008 total cases recorded by the BLS. (These 936,008 do not include the self-employed or farm workers or managers on farms with fewer than 11 employees or domestics.) This represents a 1660/936,008 = 0.177% contribution by "Cooks, fast food" to the total number of injury and illness cases. This 0.177% is then multiplied by $45.88 billion to yield $0.08121 billion in costs, representing the estimate of the medical costs contributed by "Cooks, fast food" for 2007. (The adjustment to express all values applying to 2010 is described below.)

There are four occupations of the 65 for which the BLS SOII survey did not record any injury and illness cases. They are: Shampooers; Models; Transportation Attendants (except flight attendants); and Bicycle Repairers. To estimate a medical cost for these low-wage occupations, I use the employment contribution of the occupation. I assume that the occupation has the average injury and illness rate for all 800+ occupations combined. An example will illustrate:

> Shampooers employment is 13,240 and for all 800+ occupations employment is 128,278,550. The ratio of Shampooers to all occupations is 0.000103213, and when multiplied by $45.88 billion yields, with rounding, $0.00474 billion. This is the estimate for medical costs associated with Shampooers' occupational injuries and illnesses for 2007.

Adjusting from 2007 to 2010

The numbers resulting from the above multiplications apply to 2007. To update them to 2010 requires an adjustment for inflation as well as an adjustment for changes in the number of cases from 2007 to 2010. The Bureau of Labor Statistics estimates that medical inflation was 10.65% from 2007 to 2010 (BLS, 2012d). It is tempting to use the SOII reduction in cases from 2007 to 2010. This is problematic, however. The SOII is well-known to underestimate cases, by 40% or more, and the underestimate is thought to have been increasing in recent years (Leigh, 2011). We therefore use the Census of Fatal Occupational Injuries (CFOI) reduction in fatal injuries (BLS, 2012e). The CFOI is a more reliable measure than the SOII. The CFOI number falls from 5,657 in 2007 to 4,690 in 2010, representing a 17.09% drop. The 10.65% inflation increase can be added to the 17.09% CFOI decrease for a net decrease of 6.44%. After applying the inflation and CFOI adjustments, I estimate $10.65294 billion for medical costs for 2010.

This number, $10.65294 billion, can be divided into nonfatal injuries and nonfatal illnesses. I assume that the division matches the number of injuries versus illnesses estimated in the national 2007 estimate: 8,558,962 for nonfatal injuries and 462,704 for nonfatal illnesses. Nonfatal injuries comprise 94.87119% of the total injuries and illnesses, and nonfatal illnesses comprise 5.12881%. Applying these percents to the medical cost estimate yields $10.65294 x 94.87119%= $10.106569 billion for injuries and $0.546371 billion for illnesses.

Productivity Costs

These costs are proportional to wages. The higher the wages in an occupation, the higher the productivity costs. If all occupations paid the same, then I could simply multiply by the percent contribution based on the occupation's contribution to the number of injury and illness cases as I did above. But an injury case from a $10 per-hour job, in terms of productivity costs, is not as costly as a case from $20 per-hour job. The best estimate of the difference between these jobs would be the ratio of $10-to-$20.

To estimate productivity costs, I therefore take ratios for the median wage in the occupation to the median wage for all 800+ occupations. Then I multiply that figure by the percent contribution to either the total number of injury cases or employment by the occupation. This product is then multiplied by the estimate for all occupational nonfatal injuries and illnesses. The median wages for these 65 occupations are less than the median for all 800+ occupations, e.g., $9 to $11 in these low-wage occupations versus $16.57, where $16.57 is the median wage for the 800+ occupations (BLS, 2012a).

For nonfatal injuries, productivity costs are $139.89 billion for all occupations and employments combined (Leigh, 2011). For nonfatal illnesses, they are $9.09 billion, and summing yields $148.98 billion. Subtracting for the self-employed, workers on crops and livestock farms, and domestic workers, i.e. multiplying (100% - 6.4%) x $148.98, yields $139.44 billion. These $139.44 billion are apportioned across the 65 occupations. An example will illustrate:

> For "Cooks, fast food," the median wage is $8.80. The median wage for all 800+ occupations is $16.57. The ratio is 0.53108. This ratio, in turn, is multiplied by the contribution of "Cooks, fast food" to all injury and illness cases, so that 0.53108 x 0.00177 = 0.000940012. This 0.000940012 is then multiplied by the total productivity costs, $139.44 billion, to yield $0.1310753 billion for "Cooks, fast food."

After adjusting for inflation and an estimate of the decrease in nonfatal injuries and illnesses (17.09%) from 2007 to 2010, these calculations result in an estimate of $19.217812 billion for 2010 for all 65 occupations in productivity costs.

This number, $19.217812 billion, can be divided into productivity costs related to nonfatal injuries and nonfatal illnesses. I assume that the division matches the number of injuries versus illnesses estimated in the national 2007 estimate: 8,558,962 for nonfatal injuries and 462,704 for nonfatal illnesses. Nonfatal injuries comprise 94.87119% of the total injuries and illnesses, and illnesses 5.12881%. Applying these percentages to the total productivity cost estimate yields $19.217812 x 94.87119% = $18.232165 billion for injuries and $0.985647 for illnesses.

Percentage of Productivity Costs Attributed to Different Loss Categories

	Cases of Work-Related Non-fatal Injuries, Non-fatal Illnesses and Fatal Injuries	Cases of Work-related Fatal Illnesses and Diseases
Lost Earnings	62.5%	45.43%
Lost Fringe Benefits	16.7%	13.95%
Lost Home Production	20.8%	40.62%

Productivity costs include current and future lost earnings, fringe benefits, and home production, which includes the inability to contribute to household duties such as rearing children, cooking, making home repairs, and cleaning.

To generate costs within different productivity categories I use the ratios from the national study (Leigh, 2011). For lost earnings, fringe benefits, and home production, I use the nonfatal injury numbers and calculate percentages ($87.45 + $23.35 + $ 29.09 = $139.89). Ratios are: $87.45/$139.89 = 62.5% for lost earnings; $23.35/139.89 = 16.7% for fringe benefits; and 29.09/139.89 = 20.8% for home production (which adds to 100%). The estimates for the 65 occupations would then be: 62.5% x $19. 217812 = $12.011132 for lost earnings; 16.7% x $19.217812 = $3.2093746 for fringe benefits; and 20.8% x $19.217812 = $3.9973048 for home production (and these sum to the correct $19.217812).

The above numbers can also be divided between nonfatal injuries and illnesses:

$12.011132 billion for lost earnings can be split into $12.011132 billion x 94.87119% = $11.395103 billion for injuries and $0.616029 billion for illnesses; $3.2093746 billion for fringe benefits can be split into $3.2093746 billion x 94.87119% = $3.0447718 billion for injuries and $0.1646028 billion for illnesses; $3.9973048 billion for home production can be split into $3.9973048 billion x 94.87119% = $3.7922906 billion for injuries and $0.2050142 billion for illnesses.

Medical costs for nonfatal injuries and illnesses combined are $10.65294 billion. The injuries-to-total ratio is 1,625,152/1,713,009 = 0.9487118 or 94.87118%. Multiplying the latter with costs for both nonfatal injury and illness equals $10.106569 billion for injuries and (remainder) $0.546371 billion for illnesses. Productivity costs for nonfatal injuries and illnesses combined are $19.2178123 billion. Multiplying the injury-to-total ratio with costs for both nonfatal injury and illness equals $18.232165 billion for injuries and (remainder) $0.985647 billion for illnesses. Finally, I also estimate 1,625,152 as the number of nonfatal injuries and 87,857 for the number of nonfatal illnesses after subtracting the percent for the self employed, farm workers on crops and livestock farms, domestic workers, and the CFOI reduction from 2007 to 2010.

Fatal Injury Cases

The procedures for estimating the costs of fatal injuries are similar to those for nonfatal injuries and illnesses. The BLS has a special dataset that counts fatal injuries: the Census of Fatal Occupational Injuries (CFOI). In 2010, 4,690 fatalities were recorded. Because CFOI is a census, rather than a survey, it is much more complete than the SOII. Unfortunately, the published CFOI tables do not contain occupation code numbers. However, CFOI does list the English definitions in *Table A-5. Fatal occupational injuries by occupation and event or exposure, by occupation and event or exposure, All United States, 2010* (BLS/CFOI, 2010). So, instead of standard occupational classification code 35-3021, for example, this table has "Combined food preparation and serving workers, including fast food" and lists five deaths.

On my list of the 65 low-wage occupations, however, there are many that are not listed on *Table A-5*. To reconcile this difference, I use the numbers of employed persons in the occupation and assume the average occupational fatality rate for the entire U.S. applies to those occupations that do not appear on *Table A-5*.

The two OES farm worker categories (i.e., Logging and Support Agriculture) require special attention. The CFOI counts 621 deaths for all Agriculture, Forestry, and Fishing, which includes occupations under Logging and Support Agriculture. The OES does not count employment in crops or livestock farm work, but does count Logging and Support Agriculture employment.

I subtract the 73 work-related deaths in the Logging industry and the 35 deaths in the Support Agriculture sector to estimate 108 deaths in 2010 (BLS, 2012d). Not all of these deaths, however, will occur among farm workers. I assume that farm workers in either Logging or Support Agriculture contribute the same percentage as farm workers in crops and livestock. This percentage is 108/621 or 17.4%. The CFOI identifies: 106 deaths for farm workers and laborers, crop, nursery, and greenhouse and 40 deaths for farm workers, farm and ranch animals. Multiplying these latter numbers by 17.4% yields 18 and 7, respectively, for the two farm worker categories in the OES.

Medical Costs

To calculate medical costs within the 65 occupations, I multiply either the fatality percent or the employment percent times the national estimate for medical costs. I also subtract for the self-employed, farm workers in crops and livestock, and domestic workers. Assuming the 6.4% of nonfatal injuries (above) applies to fatal injuries for the self-employed, farm workers in crops and livestock, and domestic workers, then the national estimate for medical costs is $0.31 billion x (1-0.064) or $0.29016 billion. (The $0.31 billion is drawn from the previous study (Leigh, 2011)).

The estimate is $0.03940181 billion for the 65 occupations for 2007 and $0.03686433 billion for 2010. The 2010 figure accounts for inflation of 10.65% from 2007 as well as a decrease in total injuries by 17.09%. This $0.03940181 billion represents $0.03940181 billion/$0.31 billion or 12.7% of the total for all occupations. This 12.7% is less than the employment contribution of the 65 occupations, which is 22.2%. This simply means the portion of fatal injuries is not distributed evenly across occupations. Although some workers in low-wage occupations died in 2010 from fatal work-related injuries, as a subgroup, the 65 low-wage occupations are under-represented in worker fatality cases. These percentages—12.7% for fatalities and 22.2% for employment—suggest that these 65 occupations are not as fatally dangerous as other occupations, on average. But the nonfatal injury percentage above (23%) suggests that these 65 are on a par with reported injury rates in other occupations as measured by nonfatal events.

Productivity Costs

I begin with the $5.68 billion in productivity costs for the all-occupation estimate for fatal injury cases (Leigh, 2011). Subtracting the 6.4% to eliminate the self-employed, farm workers on crops and livestock, and domestic workers results in $5.31648 billion. This $5.31648 billion is allocated across the 65 occupations based upon either the fatality or employment percentage within the occupation as well as the ratio of median wages. Since the fatality and employment percents together generate only 12.7% of total costs attributed to these 65 occupations, I anticipate even less for productivity costs given that wages in low-wage jobs are so much less than all other jobs. This method results in an estimate of $0.404583 billion for these 65 occupations for 2010 and $0.43243200 billion for 2007. The 2010 figure accounts for inflation of 10.65% from 2007 as well as a decrease in total injuries by 17.09%. This $0.43243200 (2007) billion is roughly 7.6% of the $5.68 (2007) billion for all occupations, including the self-employed, farm workers on crops and livestock, and domestic workers.

To generate costs within different productivity categories I use percents from the national study (Leigh, 2011). For lost earnings, fringe benefits, and home production, I calculate: 62.5% for lost earnings; 16.7% for fringe benefits; and 20.8% for home production (which sums to 100%). The estimates for the 65 occupations would then be 62.5% x $0.404583 billion = $0.2528643 billion for lost earnings; 16.7% x $0.404583 billion = $0.0675653 billion for fringe benefits; and 20.8% x $0.404583 billion = $0.0841532 billion for home production, all for 2010 (and these sum to the correct $0.404583 billion for 2010).

Total injury deaths for the 65 low-wage occupations are estimated to be 596 in 2010 after accounting for the CFOI decrease from 5,657 in 2007 to 4,690 in 2010. Medical and productivity costs sum to $0.03686433 billion + $0.404583 billion = $0.4414473 billion (or $441 million) for 2010.

Fatal Disease Cases

For fatal diseases, there is no equivalent BLS data set, i.e., there is no SOII or CFOI for diseases. Three methods can be suggested. The first method would assume that disease deaths correspond to nonfatal BLS rates within occupations; the second, that diseases correspond to employment percentages; and the third, that diseases correspond to fatal injury rates. Whereas all of these methods have serious limitations, the flaws in the second and third options are even greater. For that reason, I use the first method. Some (roughly 8%) of the nonfatal cases involve illnesses, and some of these illnesses—such as COPD and asthma—can be fatal. Using fatal injury percentages, however, will generate much lower estimates than the other two options. Whereas these 65 occupations may have lower injury fatality rates, they may not have lower disease fatality rates. In general, chemical and toxic exposures are greater in blue-collar than white-collar jobs (Steenland et al, 2003). Janitors and Cleaners, for example, have an employment percent of 0.016124754 but a fatality percent of 0.008102345—roughly one-half of the employment rate. But Janitors and Cleaners are exposed to numerous solvents and types of dust (Steenland et al, 2003).

Medical Costs

The medical costs for all occupations in the previous study are estimated to be $17.66 billion (Leigh, 2011). Again, however, I must subtract those attributable to the self-employed and farm workers on crops and livestock farms, and

domestic workers: $17.66 x (1 – 0.064) = $16.530 billion. The productivity costs for all occupations are estimated to be $27.89 billion, and again subtracting for these three occupation categories yields $27.89 x (1 – 0.064) = $26.10504 billion.

Using the first method that relies on the nonfatal BLS percentages, the estimate for medical costs is $4.53923 billion for 2010 and $4.10233 billion for 2007. This compares to $17.66 billion for all occupations for 2007. The ratio is 4.10233/17.66, which means 23.23% of the total medical costs for fatal work-related diseases is attributed to workers in low-wage occupations. The estimate for productivity costs is $4.2295677 billion for 2010 and $3.8224743 billion for 2007. This compares to $27.89 billion for 2007 for all occupations, including the self-employed, farm workers on crop and livestock farms, and domestic workers. The ratio is $3.8224743/$27.89 = 13.71%. This 13.71% is less than the 23.37% for medical costs, but again, it is expected, given that this study population earns lower wages.

Whereas I did make an inflation adjustment from 2007 to 2010, I did not make any adjustment for a reduction or increase in the number of disease deaths from 2007 to 2010. There are no clear data suggesting a change in the rate or proportion of occupational disease deaths. Finally, I estimate the total number of occupational disease deaths among low-wage workers is 12,415 in 2010.

Productivity Costs

To generate costs within different productivity categories I use the ratios from the previous study (Leigh, 2011). For lost earnings, fringe benefits, and home production, the ratios are: 12.67/27.89 = 45.43%; 3.89/27.89 = 13.95%; and 11.33/27.89= 40.62%, respectively (and these percentages sum to 100%). This study's estimates for the 65 occupations would then be: 45.43% x $4.2295677 billion = $1.9214926 billion for lost earnings; 13.95% x $4.2295677 billion = $0.5900246 billion for fringe benefits; and 40.62% x $4.2295677 billion = $1.7180503 billion for home production.

RESULTS

Occupations, Employment, and Wages

Table 1 lists the 65 low-wage occupations, including occupation codes, descriptions, employment, and median hourly wages (i.e., $11.18 per hour or less). More than 30.8 million workers are in these occupations, representing 22 percent of the U.S. workforce. Employment ranges from lows of 2,760 and 6,910 for Models and Door-to-Door Sales Workers, to highs of 4,270,550 and 3,314,870 for Retail Salespersons and Cashiers. Wages range from a low of $8.76 per hour for Combined Food Preparation and Serving Workers, Including Fast Food to a high of $11.16 for Bicycle Repairers.

Table 2. Estimated Cases of Work-Related Injuries, Illnesses & Deaths in 65 Low-Wage Occupations, 2010

Incident Case Category	Number of Cases
Non-fatal Injury cases	1,625,152
Non-fatal Illness cases	87,857
Fatal Disease cases	12,415
Fatal Injury cases	596
Total Cases	**1,726,020**

Table 2 summarizes the number of work-related fatal and non-fatal injuries and illnesses estimated for 2010 among workers in the 65 low-wage occupations. The nonfatal cases involve lost workday cases and those that required medical treatment but no lost workdays, as well as other non-disabling events. On average, roughly 6,250 nonfatal injuries and over two injury deaths occur every day in U.S. workplaces among low-wage workers (i.e., 1.625 mil-

lion and 596 divided by 260 (=52 weeks x 5 days)). The estimate also includes 100,272 cases of fatal and non-fatal work-related diseases afflicting workers in low-wage occupations.

Medical and Productivity Costs

Tables 3 and 4 summarize the medical and productivity costs for all 65 occupations combined. Total costs are $39.1 billion with roughly $15.2 billion (39% of total) from medical costs and $23.9 billion (61% of total) from lost productivity.

Table 3. Costs of Occupational Injuries and Illnesses Within 65 Low-Wage Occupations, by Type of Cost, 2010

Category	Injury Costs in $Billions	Disease Costs in $Billions	Total Injury and Disease Costs in $Billions
Medical Costs, Total	**$10.143433**	**$5.0856010**	**$15.229034**
Medical Costs, Fatalities	$0.036864	$4.5392300	$4.576094
Medical Costs, Non-Fatalities	$10.106569	$0.5463710	$10.652940
Productivity Costs, Total	**$18.636748**	**$5.2152147**	**$23.851962**
Lost Earnings	$11.647967	$2.5375219	$14.185488
Fatalities	$0.2528643	$1.9214926	$2.174357
Non-Fatalities	$11.395103	$0.6160293	$12.011132
Lost Fringe Benefits	$3.1123371	$ 0.7546276	$3.866964
Fatalities	$0.0675653	$ 0.5900246	$0.657588
Non-Fatalities	$3.0447718	$0.1646030	$3.209375
Lost Home Production	$3.8764438	$ 1.9230648	$5.799508
Fatalities	$0.0841532	$1.7180503	$1.802203
Non-Fatalities	$3.7922906	$ 0.2050145	$3.997305
Total Costs	**$28.780181**	**$10.3008157**	**$39.1 billion**

Table 4. Costs of Occupational Injuries and Illnesses Within 65 Low-Wage Occupations, by Case Type, 2010

Category	Number	Medical Costs in $Billions	Productivity Costs in $Billions	Total Costs in $Billions
Injuries, Total	**1,625,748**	**$10.143433**	**$18.636748**	**$28.78018**
Fatal Injuries	596	$0.036864	$0.404583	$0.44145
Non-Fatal Injuries	1,625,152	$10.106569	$18.232165	$28.33873
Diseases, Total	**100,272**	**$5.085601**	**$5.2152147**	**$10.30081**
Fatal Diseases	12,415	$4.539230	$4.2295677	$8.76879
Non-Fatal Diseases	87,857	$0.546371	$0.985647	$1.53201
Total Costs	**1,726,020**	**$15.22903**	**$23.851962**	**$39.1 billion**

Table 5. Medical and Productivity Costs for Nonfatal Injuries & Illnesses and Fatal Injuries & Fatal Diseases for the 65 Low-Wage Occupations, 2010

Low-Wage Occupations	Total Costs, Millions	Medical Costs, Millions	Productivity Costs, Millions
Retail Salespersons	$4,519.3097	$1,740.1400	$2,779.1697
Janitors and Cleaners, Except Maids & Housekeeping Cleaners	$4,102.8120	$1,517.5700	$2,585.2420
Maids & Housekeeping Cleaners	$3,132.3214	$1,270.1300	$1,862.1914
Stock Clerks & Order Fillers	$2,694.5986	$1,014.8000	$1,679.7986
Combined Food Preparation & Serving Workers, Including Fast Food	$2,061.8469	$867.1400	$1,194.7069
Cooks, Restaurant	$1,815.8118	$679.4000	$1,136.4118
Cashiers	$1,768.4582	$718.9400	$1,049.5182
Food Preparation Workers	$1,549.6477	$625.4300	$924.2177
Driver/Sales Workers	$1,402.7532	$506.8300	$895.9232
Home Health Aides	$1,351.5226	$527.9600	$823.5626
Waiters and Waitresses	$1,281.6673	$532.3600	$749.3073
Personal Care Aides	$1,240.5082	$492.0800	$748.4282
Farmworkers and Laborers, Nursery, & Greenhouse (not on Crop or Livestock Farms)	$976.4993	$400.9200	$575.5793
Cooks, Institution & Cafeteria	$873.1254	$318.5600	$554.5654
Packers & Packagers, Hand	$819.3183	$322.7900	$496.5283
Cleaners of Vehicles & Equipment	$671.6102	$264.9500	$406.6602
Taxi Drivers & Chauffeurs	$637.3617	$220.4200	$416.9417
Farmworkers, Farm, Ranch, & Aquacultural Animals (not on crop or livestock farms)	$595.0739	$221.4400	$373.6339
Childcare Workers	$585.5000	$235.5900	$349.9100
Dishwashers	$579.6502	$242.0600	$337.5902
Food Servers, Nonrestaurant	$552.2839	$221.4500	$330.8339
Food Preparation & Serving Related Workers, All Other	$432.5160	$173.3300	$259.1860
Bartenders	$391.2810	$160.6500	$230.6310
Counter Attendants, Cafeteria, Food Concession, & Coffee Shop	$381.3017	$155.8000	$225.5017
Nonfarm Animal Caretakers	$380.4600	$152.2700	$228.1900
Helpers—Production Workers	$358.6735	$131.8800	$226.7935
Dining Room and Cafeteria Attendants & Bartender Helpers	$341.5894	$142.2200	$199.3694
Laundry & Dry-Cleaning Workers	$339.4843	$135.1100	$204.3743
Cooks, Fast Food	$260.0861	$108.5600	$151.5261
Meat, Poultry, & Fish Cutters & Trimmers	$255.0652	$93.2600	$161.8052
Recreation Workers	$208.4426	$76.8500	$131.5926
Veterinary Assistants & Laboratory Animal Caretakers	$200.3686	$72.9900	$127.3786
Personal Care & Service Workers, All Other	$180.8582	$70.5400	$110.3182
Amusement & Recreation Attendants	$171.4227	$68.6700	$102.7527
Sewing Machine Operators	$146.5345	$55.3900	$91.1445
Cooks, All Other	$145.4256	$53.3000	$92.1256
Baggage Porters & Bellhops	$139.8684	$53.9600	$85.9084

Table 5 (continued)

Low-Wage Occupations	Total Costs, Millions	Medical Costs, Millions	Productivity Costs, Millions
Counter & Rental Clerks	$139.6943	$50.4500	$89.2443
Lifeguards, Ski Patrol, & Other Recreational Protective Service Workers	$127.6582	$51.6900	$75.9682
Parking Lot Attendants	$125.2887	$49.2400	$76.0487
Hosts & Hostesses, Restaurant, Lounge, & Coffee Shop	$114.8088	$45.3900	$69.4188
Automotive & Watercraft Service Attendants	$107.2085	$41.4100	$65.7985
Cooks, Short Order	$104.7984	$40.7600	$64.0384
Hairdressers, Hairstylists, & Cosmetologists	$104.1228	$35.6500	$68.4728
Telemarketers	$79.7948	$27.4800	$52.3148
Hotel, Motel, & Resort Desk Clerks	$71.8793	$26.8100	$45.0693
Ushers, Lobby Attendants, & Ticket Takers	$65.7299	$26.5500	$39.1799
Gaming Dealers	$62.0593	$25.2900	$36.7693
Pressers, Textile, Garment, & Related Materials	$61.6727	$24.5900	$37.0827
Graders & Sorters, Agricultural Products	$60.6840	$24.5700	$36.1140
Photographic Process Workers & Processing Machine Operators	$51.4411	$18.4700	$32.9711
Ambulance Drivers & Attendants, Except Emergency Medical Technicians	$37.1573	$13.5100	$23.6473
Pharmacy Aides	$35.3674	$12.9500	$22.4174
Transportation Attendants, Except Flight Attendants	$34.6980	$12.9600	$21.7380
Door-to-Door Sales, News & Street Vendors, & Related Workers	$27.9351	$8.4800	$19.4551
Entertainment Attendants & Related Workers, All Other	$21.2452	$8.0100	$13.2352
Manicurists & Pedicurists	$19.4800	$7.4700	$12.0100
Locker Room, Coatroom, & Dressing Room Attendants	$16.9547	$6.7700	$10.1847
Funeral Attendants	$15.8301	$5.5800	$10.2501
Shampooers	$15.4084	$6.3500	$9.0584
Bicycle Repairers	$13.3454	$4.7700	$8.5754
Gaming Service Workers, All Other	$10.0602	$3.6900	$6.3702
Motion Picture Projectionists	$4.8814	$1.8600	$3.0214
Gaming and Sports Book Writers & Runners	$3.5362	$1.2600	$2.2762
Models	$3.2519	$1.3400	$1.9119

SENSITIVITY ANALYSIS

Table 6 presents a sensitivity analysis allowing for five scenarios (Leigh, 2011). The first two involve the underreporting rate, i.e., the amount by which nonfatal injuries and illnesses go unreported due to either worker or employer inaction (Azaroff et al, 2002). The first scenario allows the underreporting rate to increase from 40% to 60% and the second, to decrease to 20%. The third and fourth scenarios consider decreases and increases in the wage-replacement rate for workers' compensation. If, for example, the replacement rate for permanent partial disabilities is 28% rather than 35%, then the preferred estimates in the above analysis are low because the measure I use for lost productivity is now multiplied by 100/28 rather than 100/35. The opposite is true if the "true" replacement rate is 42% rather than 35%. The fifth scenario allows for employers' costs for turnover and retraining. Combining all negative scenarios, a lower bound is $39.1 – $10.1 = $29.0 billion. Combining all positive scenarios, an upper bound is $39.1 + $13.1 = $52.2 billion.

Table 6. Sensitivity Analysis: Different Scenarios Generate Alternative Estimates for Total Costs

Alternative Scenarios, and Lower & Upper Bounds	Costs in $Billions and Increase (+) or Decrease (-) over the Most Probable Estimate of $39.1 billion	Percentage Increase (+) or Decrease (-) over Most Probable Estimate
Scenario #1 and #2: Increase of underreporting percentage from 40% to 60%, or decrease from 40% to 20%	+ or - $6.2 billion	+ or – 15.9%
Scenario #3: Decrease in workers' compensation wage replacement rates by 20%, from 35% to 28% for permanent partial disabilities	+$5.7 billion	+ 14.9%
Scenario #4: Increase in workers' compensation wage replacement rates by 20%, from 35% to 42% for permanent partial disabilities	-$3.9 billion	- 9.9%
Scenario #5: Add employer turnover, retraining, and hiring costs	+$1.1 billion	+ 2.7%
Lower Bound Estimate	$29 billion	-25.8%
Upper Bound Estimate	$52.2 billion	+33.5%

DISCUSSION

Nearly 31 million workers in the U.S.—22 percent of the workforce—are employed in low-wage occupations where they earn wages of $11.18 per hour or less. The estimated cost of fatal and non-fatal occupational injuries and illnesses for this population is significant, totaling more than $39.1 billion in 2010. This amount can be compared to the cost of other diseases, such as stroke in the U.S. population with an estimated cost of $36.6 billion (in 2010 dollars), and hypertension at $54.0 billion (in 2010 dollars) (Roger et al, 2012).

There are a number of limitations to this analysis, as detailed in the previous study (Leigh, 2011). The greatest limitations involve the five assumptions addressed in the sensitivity analysis: variability in the underreporting rates and wage-replacement rates; and accounting for employer turnover and rehiring costs. But three specific limitations for this low-wage study bear mentioning. First, a different method for defining "low-wage occupation" is the "relative" approach whereby, for example, the occupations in the lowest 10th or 20th or 33rd percentile are selected (National Employment Law Project, 2011). If there are roughly 800 occupations overall, then the lowest 10th or 20th would correspond to 80 or 160 occupations. The list of 65 above would, obviously, capture the great majority of the "lowest 80." As mentioned above, the "absolute" approach using the poverty line measure appears more popular in the literature. In addition, the "lowest 160" might be overwhelming; tables with 160 occupations would cover several pages.

Second, the essential BLS source for selecting the 65 occupations (the BLS's OES) explicitly ignored farm workers on crop and livestock farms. But workers on these farms outnumber all other farm workers included in the OES. This study on the 65 occupations, therefore, does not present an estimate for all farm workers in total, only those employed in the Support Agriculture and Logging industries. Nor does it include estimates for domestic workers, again, due to OES data limitations. As a result, without data on farm workers on crops and livestock farms and domestic workers—occupations undoubtedly in the low-wage category—estimates in this study understate the true number and cost of injuries and illnesses among all low-wage workers. Third, 2010 was a recession year with fewer than the average number of people employed. In normal years, more people would be employed and, virtually by definition, more injury and illness cases would occur and generate costs.

In conclusion, considerable research and public policy attention has been directed at persons in low-wage occupations regarding work hours, possibilities for promotion, causes of poverty, and so on; but occupational safety and health within these occupations does not appear to have garnered commensurate attention. This study takes a step to rectify this gap in our knowledge. Estimated costs for occupational injury and illness in 65 low-wage jobs are $39.1 billion in 2010—an amount that exceeds the costs of stroke in the U.S. In part, this large amount reflects the high percentage of the workforce (22.2%) in these 65 occupations and the fact that work exposures may occur at any time over, roughly, 40 hours per week and 50 weeks out of the year for most workers. Perhaps 25% of these costs are absorbed by workers' compensation insurance systems, but the large remainder, 75%, are absorbed by workers and their families; other (non-workers' compensation) private health insurance; and Medicare and Medicaid, i.e. taxpayers (Leigh, 2011). But in spite of the high costs, occupational safety and health in low-wage occupations do not receive the attention they deserve. This is unfortunate because economic efficiency requires that medical resources flow to their most profitable use.

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