

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/12508495>

# Women in construction: Occupational health and working conditions

Article in *Journal of the American Medical Women's Association* (1972) · February 2000

Source: PubMed

CITATIONS

16

READS

207

3 authors:



Laura Welch

Center for Construction Research and Training - CPWR

121 PUBLICATIONS 3,067 CITATIONS

SEE PROFILE



Linda M Goldenhar

Center for Construction Research and Training - CPWR

82 PUBLICATIONS 2,929 CITATIONS

SEE PROFILE



Katherine Hunting

George Washington University

50 PUBLICATIONS 1,515 CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:



Building Trades Medical Screening Program [View project](#)



mesothelioma [View project](#)

# Women in Construction: Occupational Health and Working Conditions

**LAURA S. WELCH, MD**  
**LINDA M. GOLDENHAR, PHD**  
**KATHERINE L. HUNTING, PHD**

Construction is one of the largest industries in the United States, employing 7.6 million workers, or about 5% of the US work force. More women have taken jobs in the construction industry over the last two decades, as they have in other non-traditional industries. In 1997, there were 8.1 million construction workers, of whom 781,000 (9%) were women. Approximately 2% of those were employed as skilled tradeswomen. There is no disputing that construction work is dangerous. Seventeen percent of all fatal on-the-job injuries occur in construction, which is about three times its 6% share of total employment. In this paper, we review the medical literature on the safety and health hazards for women working in the construction industry. Women have a different pattern of fatal injuries and some differences in patterns of nonfatal injuries than men and report unique problems and concerns related to working in this industry.

Construction is one of the largest industries in the United States, employing 7.6 million workers, or 5% to 6% of the US work force. Over the last two decades, an increasing number of women have taken jobs in the construction industry, as they have in other nontraditional industries. Due to a shortage in skilled labor, the industry has begun taking a more active role in recruiting women (and minorities),

Dr. Welch is in the Section of Occupational and Environmental Medicine, Department of Medicine at the Washington Hospital Center in Washington, DC. Dr. Goldenhar is with the National Institute for Occupational Safety and Health in Cincinnati. Dr. Hunting is in the Department of Environmental and Occupational Health at George Washington University in Washington, DC.

rather than passively accepting them as they have done for the last 20 years. In 1997, there were 8.1 million construction workers, of whom 781 000 (9%) were women and 145 600 were skilled tradeswomen. The remaining 7% were employed in management or support positions.

There is no disputing that construction work is dangerous. Seventeen percent of all fatal on-the-job injuries occur in construction, nearly three times its 6% share of total employment,<sup>1</sup> and half of all fatal falls occur on construction sites. Construction also has a high rate of nonfatal injuries. In 1997 there were 4.4 lost-time injuries per 100 full-time equivalent construction workers compared to 3.3 per 100 full-time equivalent workers in all private industry, a rate higher than all other sectors except transportation.<sup>2</sup> The overall recordable injury and illness rate in construction was 9.5 per 100 full-time equivalent workers in 1997, second only to manufacturing.<sup>2</sup>

In addition to the obvious short-term consequences, the injuries sustained by construction workers can have long-term health and economic effects. Gillen<sup>3</sup> reported that 7% of construction workers who sustained falls at work had permanent disabling injuries preventing them from returning to their jobs. Eleven

percent of injured workers left construction work either because they had permanent impairments from their falls, or because they simply decided not to return to construction. Clearly, both the workers and the construction industry suffer the consequences of these outcomes.

Yet as we look at the specific, albeit limited, information available on women employed as skilled tradespeople in construction, we find some unique concerns as well as some unique opportunities to improve working conditions. This paper reviews the medical literature on the health and safety of women working in construction. We searched Medline and Silver Platter for research on women, construction, and injury published from 1960 to 1999.

## Fatal and Nonfatal Injuries

Several analyses have focused specifically on deaths among women construction workers. A study of 139 deaths of US female construction workers for the period 1980 to 1992 found that women represented about 1% of fatalities in construction, and that construction was responsible for 3% of all work-related deaths of women.<sup>4</sup> The average fatality rate of 1.80 per 100 000 workers for female construction workers was more than twice the all-industry average for women

**Table 1. Sex Differences in Cause of Death Among Male and Female Construction Workers, 1980-1992<sup>4</sup>**

Cause of Death	Women			Men		
	n	(%)	rate	n	(%)	rate
Motor vehicle	69	43	0.79	2084	15	2.55
Machinery	22	16	0.29	1879	13	2.30
Homicide	15	11	0.19	360	3	0.44
Falls	13	9	0.17	3632	26	4.45
Suicide	7	5	0.09	194	1	0.24
Other	22	16	0.27	5969	42	7.31
Total	148	100	1.80	14118	100	17.29

\* From: Ore T. Women in the construction industry: An analysis of fatal occupational injury experience, 1980-1992. *Am J Ind Med.* 1998;33:256-262. Reprinted with permission of Wiley-Liss Inc, a subsidiary of John Wiley & Sons, Inc.

**Table 2. Five Most Frequent Occupations of Male and Female Injured Construction Workers Seen in an Urban Hospital Emergency Department, 1990-1998**

Trade Group	Women (n=107)		Men (n=3294)	
	n	(%)	n	(%)
Carpenters	23	22	610	19
Exhibit technicians	19	18	57	2
Laborers	20	19	942	29
Pipe trades	6	6	224	7
Electricians	9	8	447	14
Other	30	28	1014	31

workers of 0.82.<sup>4</sup> The average fatality rate for women in construction, however, was much lower than that of men (17.29 per 100 000 workers per year). We must note that this rate is based on all women employed in construction, including office and other workers, and that rates might be higher if only site-specific occupations were used.

The leading causes of death were quite different for men and women in construction, as can be seen from Table 1. Women construction workers were more likely than male construction workers to die in motor vehicle accidents or from homicide and less likely to die from falls (0.17 v 4.45). Thirty percent of women killed by motor vehicles worked as flaggers, compared to 3% of men.

We see a similar pattern of work-related fatalities among female and male construction laborers.<sup>5</sup> Fifty-three of the 3700 occupational fatalities recorded for all US construction laborers 16 years of age and older from 1980 to 1992 occurred among female laborers. The average fatality rate for women laborers during that period (17.4 deaths/100 000 workers) was virtually identical to that for all male construction workers (17.3 deaths/100 000 workers) and ten times higher than that of all female construction workers. Overall, female laborers died less frequently from falls, machinery-related injuries, and injuries in which they were struck by objects than their male counterparts did. However, they were at a higher risk (10.8 deaths/100 000 workers) for motor vehicle injury than were male laborers (6.1 deaths/100 000 workers). Motor vehicle accidents accounted for 62% of all deaths among female laborers, compared to 16% for

male laborers.

A study that used National Traumatic Occupational Fatalities data to examine 2144 work-related motor vehicle fatalities in the construction industry from 1980 to 1992<sup>6</sup> found that construction workers were twice as likely as average workers to be killed by motor vehicles, with an annual crude mortality rate of 2.3 per 100 000 workers. Forty percent of work-related motor vehicle accident deaths occurred among pedestrians, with construction accounting for more than one-fourth of all occupational deaths of pedestrians. At least 6% of these pedestrian fatalities were flaggers or surveyors. Female flaggers accounted for half the 34 pedestrian fatalities among women laborers, compared with only 3% among male laborers.

The impact of fatalities also differed somewhat between men and women. Compared to men, women had higher cause-specific years of potential life lost (to age 65 years) from deaths due to

motor vehicles (33 v 24.8), machinery (29 v 24.8), homicide (26.1 v 24.6), and falls (31.9 v 24.7). More than half (53%) of female fatalities occurred in women under age 35, compared to 46% for men.<sup>6</sup>

There are few data on patterns of non-fatal injuries among female construction workers. Among union carpenters working in Washington State from the years 1989 to 1992, women had higher rates of sprain/strains and nerve conditions of the wrist/forearm than men.<sup>7</sup> Brage<sup>8</sup> investigated the occupation-specific prevalence of musculoskeletal disease in Norway, using a cross-sectional interview survey of a representative sample of households, and found that among women, those in construction had the highest prevalence.

Hunting et al.<sup>9,10</sup> developed a system to identify nonfatal injuries among construction workers who sought treatment in emergency departments. One hundred seven of 3400 injured construction workers seen at the George Washington University Emergency Department from 1990 through 1998 were women (3%). These construction workers were engaged primarily in building commercial buildings, and almost none were engaged in highway or residential construction; these injury statistics must be interpreted with this information in mind.

Table 2 shows the distribution of trades for these women and the approximately 3300 men.<sup>10</sup> As can be seen, injured women were more likely to work as exhibit technicians (carpenters who specialize in construction of exhibits

**Table 3. Cause of Injury Among Male and Female Construction Workers Seen in an Urban Hospital Emergency Department, 1990-1998**

Cause of Injury	Women (n=107)		Men (n=3288*)	
	n	(%)	n	(%)
Struck by, against object	25	23	640	20
Cutting/piercing object	16	15	885	27
Overexertion, strenuous movement	16	15	388	12
Fall	15	14	564	17
Caught between objects	13	12	138	4
Foreign body in eye	10	9	264	8
Involving machinery	2	2	164	5
Other	10	9	245	8

\*Cause of injury was missing for six men.

in hotels and convention centers) and were more likely to be injured by being caught between objects (12% v 4%), and were less likely to be injured by cutting/piercing objects (15% v 27%) than men (Table 3). The numbers in each trade were too small to examine injury types or circumstances for each one separately. We do know from an analysis of injuries of all (male and female) exhibit technicians, that these workers are more likely to be involved in "struck-by" injuries, and to suffer contusions or fractures as a result.

### **Working Conditions/ Quality of Work Life**

Women working in construction have identified some additional concerns beyond the more traditional occupational health and safety issues related to fatal and nonfatal injuries and illnesses. Recent studies<sup>11-13</sup> suggest that women in construction face six safety and health issues: reproductive hazards; ergonomic concerns; lack of adequate sanitary facilities; workplace culture; ill-fitting personal protective equipment and clothing; and lack of proper health, safety, and skills training.

The vast majority of *all* construction workers are of reproductive age, and thus the impact of workplace exposures on reproductive health is an issue for both men and women.<sup>14-16</sup> Some construction tasks, for example, entail significant exposure to lead,<sup>17</sup> which has been shown to cause developmental delays in children exposed in utero and during the early years of life<sup>18</sup> and to have small (and partially reversible) adverse effects on sperm quality, including count, volume, and motility.<sup>16</sup> Prolonged heat exposure has known detrimental effects on spermatogenesis<sup>16</sup> and prolonged standing during pregnancy is associated with preterm birth.<sup>20</sup> (American Medical Association guidelines on work in pregnancy have addressed the physical stresses of work.<sup>21,22</sup>)

Work-related musculoskeletal diseases in construction are a significant problem,<sup>23</sup> and solutions to the ergonomic stresses that cause them have been developed specifically for construction.<sup>24</sup> Female workers have suggested that tools, materials, and equipment be available in

sizes and designs appropriate for women.<sup>12</sup> Like their male counterparts, tradeswomen often cite back injuries as a major concern and have said that safe lifting techniques should be encouraged for those who have less upper-body strength than the average male construction worker. According to the revised National Institute for Occupational Safety and Health lifting equation, if the lifting demands are limited to what about 75% of women can safely lift, then most men or women should be able to perform the job without significantly increasing their risk of low back pain.<sup>25</sup> Discussions with tradeswomen found that many felt that "working smarter, not harder" was key to staying safe and uninjured.<sup>12</sup>

The availability and cleanliness of toilet and hand-washing facilities is a major concern for most female (and, likely, most male) construction workers. Although not having proper sanitary facilities violates Occupational Safety and Health Administration standards, 80% of tradeswomen surveyed recently reported work sites with no toilets or dirty toilets.<sup>26</sup> The health risks associated with the lack of adequate sanitary facilities include an increased risk of bladder infections from holding urine too long<sup>27</sup> and the transmission of illnesses from unwashed hands.

Interviews with tradeswomen reflect the stress of individuals who are the first to break down barriers of longstanding societal or cultural morés. They have reported harassment and verbal abuse by co-workers and isolation on the job severe enough that some women have looked for other employment. To reduce the incidence of complaints and potential for litigation, some segments of the industry are beginning to act through training and enforcement of federal laws.<sup>13</sup>

Women in construction often find it difficult to obtain properly fitting protective clothing or equipment.<sup>11</sup> In interviews, tradeswomen report that ill-fitting clothing and personal protective equipment, such as gloves and coveralls, pose safety hazards because they can get caught in machinery. Approximately half the respondents in a survey of 200 tradeswomen reported difficulty in finding appropriately sized safety shoes and gloves. Some manufacturers of protective clothing

are beginning to recognize that there will be a market for clothing sized for women.<sup>11</sup>

Working safely involves understanding the hazards of the job and learning how to carry out specific tasks in a safe manner. In construction, some of this information is learned through formal apprenticeship or vocational programs; much of it, however, is transmitted on the job from journey-level workers to apprentices and among co-workers. Many tradeswomen have reported that, because some supervisors did not want to spend the time training them and because many of their co-workers were less than enthusiastic about teaching them the tricks of the trade, the on-the-job training they received was less than optimal. A potentially dangerous cycle is created when tradeswomen are asked to do jobs for which they are not properly trained, and then, when they are unable to do them, they are seen as being incompetent, or worse, they get injured.<sup>13</sup>

### **Discussion**

These data show that there are some differences in risk of injury between tradeswomen and tradesmen. Further studies are needed to explore differences in leading causes of death between female and male construction workers. Are women assigned to particular jobs, and does the pattern of injury therefore reflect the risk of those jobs? Or is there something about their gender or their training that puts them at higher risk than their male colleagues in a particular job? A high proportion of both women laborers and women construction workers die as the result of motor vehicle accidents. We need to know if female flaggers receive the same training as male flaggers, or if this pattern is due to the more frequent assignment of women to this task. Effective prevention measures, such as traffic control in highway construction zones, fall-protection training, and machinery-operation training, could reduce the risk of fatal occupational injuries for construction workers, regardless of sex.

In addition, with more than a quarter of construction fatalities occurring among laborers, and with women laborers being at particular risk compared to all other women construction workers, additional

occupational injury research on laborers is needed.

Construction work is, in most instances, difficult, dirty, and dangerous. It is important for the health and safety community and the construction industry to recognize that the risks involved in construction work are not immutable and that taking preventive actions and paying attention to health and safety are worth the time and effort. New recommendations for ergonomic improvements in the construction industry will be a major step toward implementation of this philosophy; for example, to help reduce the incidence of low back injury, construction workers of both sexes should be provided with help or use assistive devices when heavy lifting is required. Construction management as well as all skilled workers should understand that "working smarter, not harder" is the key to staying safe, uninjured, and healthy. This approach should improve working conditions on construction sites as well as reduce injury rates for all construction workers. ■

Work performed under a contract to George Washington University and the Washington Hospital Center/Medlantic Research Institute from the Center to Protect Workers' Rights, as part of a cooperative agreement between CPWR and NIOSH (CCU306169). This research is solely the responsibility of the authors and does not necessarily represent the views of CPWR.

#### References

1. *National Census of Fatal Occupational Injuries*. Washington, DC: Bureau of Labor Statistics, US Department of Labor; August 7, 1997.
2. *Workplace Injury and Illness in 1997*. Washington, DC: Bureau of Labor Statistics, US Department of Labor; 1999. [www.osha.gov/oshstat](http://www.osha.gov/oshstat).
3. Gillen M, Faucett JA, Beaumont JJ, McLoughlin E. Injury severity associated with nonfatal construction falls. *Am J Ind Med*. 1997;32:647-655.
4. Ore T. Women in the construction industry: An analysis of fatal occupational injury experience, 1980-1992. *Am J Ind Med*. 1998;33:256-262.
5. Ore T, Stout NA. Risk differences in fatal occupational injuries among construction laborers in the United States, 1980-1992. *J Occup Environ Med*. 1997;39:832-843.
6. Ore T, Fosbroke DE. Motor vehicle fatalities in the United States construction industry. *Accid Anal Prev*. 1997;29:613-626.
7. Lipscomb HJ, Dement JM, Loomis DP, Silverstein B, Kalat J. Surveillance of work-related musculoskeletal injuries among union carpenters. *Am J Ind Med*. 1997;32:629-640.
8. Brage S, Bjerkedal T, Bruusgaard D. Occupation-specific morbidity of musculoskeletal disease in Norway. *Scand J Soc Med*. 1997;25:50-57.
9. Hunting KL, Nessel-Stephens L, Sanford SM, Shesser R, Welch LS. Surveillance of construction worker injuries through an urban emergency department. *J Occup Environ Med*. 1994;36:356-364.
10. Hunting KL, Welch LS, Nessel-Stephens L, Anderson JAD, Mawadeku A. Surveillance of construction workers injuries: Utility of trade specific analysis. *Applied Occupational and Environmental Hygiene*. 1999;14:458-469.
11. Goldenhar LM, Swanson NG, Ruder A, Hurrell Jr JJ, Deddens J. Stressors and adverse outcomes for female construction workers. *Journal of Occupational Health Psychology*. 1998;3:19-32.
12. Goldenhar LM, Sweeney MH. Tradeswomen's perspectives on occupational health and safety: A qualitative investigation. *Am J Ind Med*. 1996;29:516-520.
13. Health and Safety for Women in Construction. *Women in the Construction Workplace: Providing Equitable Safety and Health Protection: Working Paper of the Health and Safety of Women in Construction Workgroup*. Washington, DC: US Department of Labor, Occupational Safety and Health Administration; 1997.
14. *The Effects of Workplace Hazards on Female Reproductive Health*. Cincinnati, Ohio: National Institute for Occupational Safety and Health; 1999. DHHS publication 99-104.
15. *The Effects of Workplace Hazards on Male Reproductive Health*. Cincinnati, Oh: National Institute for Occupational Safety and Health; 1996. DHHS publication 96-132.
16. Lahdetie J. Occupation and exposure-related studies on human sperm. *J Occup Environ Med*. 1995;37:922-930.
17. Osorio AM, Melius J. Lead poisoning in construction. In: Ringen K, Englund A, Welch LS, Weeks JL, Seegal J, eds. *Health and Safety in Construction: State of the Art Reviews in Occupational Medicine*. Philadelphia, Pa: Hanley and Belfus; 1995:353-362.
18. Winder C. Lead, reproduction and development. *Neurotoxicology*. 1993;14:303-317.
19. Viskum S, Rabjerg L, Jorgensen PJ, Grandjean P. Improvement in semen quality associated with decreasing occupational lead exposure. *Am J Ind Med*. 1999;35:257-263.
20. Teitelman A, Welch LS, Bracken MB. Work activity during pregnancy and risk of prematurity. *Am J Epidemiol*. 1990;131:104-113.
21. Council on Scientific Affairs. Effects of pregnancy on work performance. *JAMA*. 1984;251:1995-1997.
22. Council on Scientific Affairs. Effects of pregnancy on work performance. *JAMA*. In press.
23. Holmstrom F, Moritz U, Engholm G. Musculoskeletal disorders in construction workers. In: Ringen K, Englund A, Welch LS, Weeks JL, Seegal J, eds. *Health and Safety in Construction: State of the Art Reviews in Occupational Medicine*. Philadelphia, Pa: Hanley and Belfus; 1995:295-312.
24. Schneider S, Punnett L, Cook TM. Ergonomics: Applying what we know. In: Ringen K, Englund A, Welch LS, Weeks JL, Seegal J, eds. *Health and Safety in Construction: State of the Art Reviews in Occupational Medicine*. Philadelphia, Pa: Hanley and Belfus; 1995:385-394.
25. Waters T, Putz-Anderson V, Garg A, Fine LJ. Revised NIOSH equation for the design and evaluation of manual lifting tasks. *Ergonomics*. 1993;36:749-776.
26. LeBreton LW, Loevy SS. *Breaking New Ground: Worksites 2000*. Chicago, Ill: Chicago Women in Trades; 1992.
27. Foxman B, Frerichs RR. Epidemiology of urinary tract infection: II. Diet, clothing and urination habits. *Am J Public Health*. 1985;75:1314-1317.