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Comparison of Health Outcomes Among Older Construction and Blue-Collar Employees in the United States

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Using the Health and Retirement Study, we compare the health outcomes of older male construction workers with their counterparts in other occupations. We find that construction workers are more susceptible to musculoskeletal problems, chronic lung disease, and emotional/psychiatric disorders. Older construction workers were 1.4 times more likely to have a back problem and 1.3 times more likely to have a foot or leg problem than were other blue-collar workers. Nonsmoking older construction workers were 3.2 times more likely to have chronic lung disease than their nonsmoking blue-collar counterparts. When accounting for alcohol consumption, older construction workers were 1.7 times more likely to have been diagnosed with an emotional problem than other older blue-collar workers. The high rate of chronic lung disease is most likely related to on-the-job dust exposure, while the increased risk of emotional disorders might be due to the dynamics of the construction labor market. Am. J. Ind. Med. 34:280–287, 1998. *© 1998 Wiley-Liss, Inc.*

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INTRODUCTION

Construction workers face numerous job-related hazards. Several studies have documented that the physical demands of construction work result in a higher rate of musculoskeletal disorders for construction employees, as compared with workers in other occupations [Holmstrom et al., 1995; Arndt et al., 1996; Guo et al., 1995]. Several studies have also found negative health outcomes associated with exposure to hazardous substances at construction sites [Sullivan et al., 1995; Dong et al., 1995; Epling et al., 1996; Keller and Howe, 1993; Bresnitz et al., 1993]. This research has been conducted primarily through several large data sets of construction workers in Northern European countries, or small case (and case-control) studies in the United States.

Using a cross-sectional data set of older construction workers (40–64 years) in Germany, Arndt et al. [1996] found that construction employees had a higher prevalence of musculoskeletal disorders, signs of obstructive lung disease, hearing deficiencies, and increased body mass index (BMI), as compared with white-collar employees. Sullivan et al. [1995] presented a wide range of evidence linking construction work and respiratory disease, and found that increased risk of lung cancer is observed in all the trades. Their results are consistent with a study on British construction workers by Dong et al. [1995] and with case (and case-control) studies of U.S. construction workers by Epling et al. [1996], Keller and Howe [1993], and Bresnitz et al. [1993]. Holmstrom et al. [1995, 1992a, 1992b] have consistently found musculoskeletal problems associated with construction work. Guo, et. al. [1995] used the Occupational Health Supplement to the 1994 National Health Interview Survey to assess the scope of back pain problems. They found that construc-

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tion workers had the highest risk of occupationally related back pain problems.

In this article, we use the Health and Retirement Study, a nationally representative longitudinal data set of older persons in the United States, to examine health outcomes of older construction workers (age 51–61), as compared with older workers in other blue-collar occupations (age 51–61). We find that older construction workers are significantly more susceptible to chronic lung disease, musculoskeletal problems, and emotional disorders. In the Discussion section, we suggest explanations for why construction workers have these different health outcomes based on the characteristics of the construction labor market.

MATERIALS AND METHODS

Study Population

Our cohort analysis derives from the Health and Retirement Study (HRS). Designed and carried out by the Survey Research Center at the University of Michigan in cooperation with the National Institute on Aging, the HRS focuses on persons born between 1931 and 1941 and questions the respondents on topics of health, retirement, and economic status.

Our study is confined to ''age-eligible'' nondisabled males who reported an occupation in Wave I of the HRS. A respondent is considered ''age eligible'' if they were born between 1931 and 1941. Wave I was conducted in 1992; thus, our sample population ranges in age from 51 to 61years. These males could either be currently working, unemployed, or retired. Females were excluded because of their small number of construction workers in the HRS (n = 7), as would be expected in a sample of older workers in a male-dominated profession.

The construction cohort is limited to respondents who reported ''construction''(Standard Occupation Codes (SOC) 6312–6479) in response to the question(s) ''what sort of work do/did you do/used to do?'' The blue-collar cohort is composed of respondents who classified themselves in any of the following occupational categories: (1) service employees (private household, cleaning, and building services, protection, food preparation, health, or personal) (SOC [5030–5269]); (2) farming, fishing, or forestry (SOC [5512–5840]); (3) mechanics or repair (SOC [6000–6179]); (4) precision production (SOC [6700–6960]); (5) operators (machine, transportation, or handlers) (SOC [7312–8769]); or (6) armed forces (no SOC available). The white-collar cohort is composed of respondents who classified themselves in any of the following occupational categories: (1) managerial (SOC [1131–1490]); (2) professional specialty (SOC [1610–3400]); and (3) technical, sales, and administrative support (SOC [3620–4799]).

Variables

The HRS data were collected using an in-person interviews process. In addition to a host of other questions, the health section of the interview asks respondents a wide range of health status questions requiring a ''yes or no'' answer. We used the responses to the following questions in our analysis of health outcomes.

1. Do you have any of the following health problems: asthma, problems with your back, problems with your feet and legs, kidney or bladder problems, stomach or intestinal ulcers, high cholesterol?
2. Have you ever had, or has a doctor ever told you that you have, arthritis or rheumatism?
3. Has a doctor ever told you that you had emotional, nervous, or psychiatric problems?
4. Not including asthma, has a doctor ever told you that you have chronic lung disease such as chronic bronchitis or emphysema?
5. Has a doctor ever told you that you had a heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems?

For those respondents who provided a positive responses to these health questions, follow-up questions were asked to assess the severity of the health problem. These questions addressed both the degree of impairment as well as the type of treatment. The HRS also surveys respondents on health behaviors. We used responses to the following questions in our empirical analysis of chronic lung disease and emotional disorders:

1. Have you ever smoked cigarettes? Do you smoke cigarettes now?
2. Do you drink any alcoholic beverages such as beer, wine, or liquor?
3. In general, do you have less than one drink a day, one to two drinks a day, three or four drinks a day, or five or more drinks a day?
4. Have you ever felt that you should cut down on your drinking?
5. Have people ever annoyed you by criticizing your drinking?
6. Have you ever felt bad or guilty about drinking?
7. Have you ever taken a drink first thing in the morning to steady your nerves or get rid of a hangover?

Questions 4–7 are the CAGE screening test for alcoholism (Bush et al., 1987). CAGE is an acronym for ''*c*ut,'' ''*a*nnoyed,'' ''*g*uilty,''and ''*e*yeopener,'' in the question set.

Our employment status variables come from the employment section of the HRS which begins by asking the respondent to describe their present job status as (1) working

now, (2) temporarily laid off, (3) unemployed and looking for work, or (4) retired. Currently active workers are asked, ''what is the official title of your job?'' Unemployed or retired respondents are asked, ''what was the official title of your job?'' In the retirement section, respondents are asked to characterize themselves as (1) fully retired, (2) partially retired, or (3) not at all retired.

Data Analysis

Our analysis starts by describing the demographic characteristics of our cohorts. We then calculate the univariate associations between health outcomes and occupation, controlling for working status, and age. This comparison of the construction and blue-collar cohortswith the white-collar cohort showed three areas where health outcomes differed substantially: (1) musculoskeletal problems, (2) chronic lung disease (CLD), and (3) emotional/psychiatric disorders. The white-collar cohort is then dropped from the analysis and we compare the rates of lung and emotional disorders among the construction cohort with those among the blue-collar cohort. We drop the white-collar cohort because we are interested in examining health outcomes associated with the physically demanding work and hazardous working conditions of construction in comparison with other blue-collar occupations. We estimate the effect of occupation, working status, smoking behavior, and age on chronic lung disease on these two cohorts. Finally, we assess the effect of occupation, alcohol consumption, and the CAGE alcoholism screening questions on an individual being diagnosed with an emotional or psychiatric disorder.

Unless otherwise stated, results were considered statistically significant at $p < 0.05$. Preliminary modeling used the PROC LOGISTIC statement in SAS [SAS, 1993]. However, in order to account for the complex structure of the HRS in calculating the variances of the control variables in our models, we re-calculated the final models using SUDAAN software [Shah et al., 1992].

RESULTS

Table I presents the demographic characteristics (age, working status, and race) of the cohorts in our analysis. The cohorts are relatively similar in all categories, except that construction workers have an employment status of ''fully retired'' at almost twice the rate of the other cohorts.

Table II compares health outcomes of the construction and blue-collar cohorts with the white-collar cohort. Statistically significant results are attained in the areas of musculoskeletal problems, emotional disorders, CLD, kidney/bladder problems, asthma, and high cholesterol. Compared with the white-collar cohort, the construction and blue-collar cohorts were consistent in exhibiting increased risk of musculoskeletal problems and CLD, and decreased risk of high cholesterol. Construction workers were more likely to be diagnosed with an emotional disorder, while blue-collar workers were more likely to have asthma and kidney/bladder problems. Construction workers had the highest rates of musculoskeletal problems with 35.2% reporting a foot or leg problem, 41.5% a back problem, and 36.0% arthritis or rheumatism with odds ratios (ORs) for the conditions at 1.9, 1.8, and 1.8, respectively (all significant at the 0.0001 level). A separate regression comparing the construction and blue-collar workers showed that the construction workers were 1.4 times more likely to have a back problem and 1.3 times more likely to have a foot or leg problem. The rate of emotional disorders for the construction worker cohort was 11.3% versus 6.4% for blue collar and 5.3% for white collar (OR for construction was 2.2 and significant at the 0.0001 level). Construction workers also exhibit a higher prevalence of CLD with 9.6% having a problem compared with 7.3% and 5.3% for the blue-collar and white-collar cohorts, respectively.

Table III reports the results of our analysis on CLD among the construction workers compared with the blue-collar employees. The white-collar cohort is not included in this analysis. Construction workers exhibit a counterintuitive rate of CLD when categorized by smoking behavior. Part 1 of Table III shows that the group of construction workers who have the highest rate of CLD are those who never smoked (10.4%), followed by those who formerly smoked (9.9%), and current smokers (8.6%). The ORs for having CLD based on occupation and smoking behavior are presented in section 2 of table III. The logistic regression model from which these ORs were attained accounted for age and working status, and the reference group is blue-collar workers who never smoked. Construction workers exhibit the opposite pattern of blue-collar employees in terms of their risk of having CLD based on smoking behavior. Blue-collar workers who currently smoke were 3.5 times more likely to have CLD than nonsmoking blue-collar workers. The construction cohort had odds ratios for CLD of 3.2, 2.8, and 2.5 for nonsmokers, former smokers, and current smokers, respectively. Thus, older construction workers who never smoked were equally as likely to have CLD as older blue-collar workers who currently smoke. This surprising result is examined in the Discussion section. Section 3 of Table III reports the results of questions that examine the severity of the CLD. The construction and blue-collar cohorts mirror each other except for the question on activity limitation. Sixty percent of construction workers said the CLD limited their normal activities, while only 19% of blue-collar workers answered ''yes'' to this question.

Table IV reports the results of our analysis of emotional disorders among the construction workers, as compared with the blue-collar employees. Once again, the white-collar cohort is not included in this analysis. Part 1 of Table IV reports alcohol consumption and responses to the CAGE

TABLE I. Age, Working Status, and Race of Construction, Blue-Collar, and White-Collar Cohorts in the Health and Retirement Survey, 1992

			Working status (%)			Race (%)				
	n	Age	Actively working	Partially retired	Fully retired	White	Black	Hispanic	Asian	Other
Construction workers	312	55.5	74.8	9.7	15.5	84.4	9.2	5.6	0.4	0.4
Blue-collar workers	1,716	56.0	85.9	6.9	7.2	77.4	12.0	8.7	1.0	0.9
White-collar workers	2,064	55.9	83.7	8.0	8.2	90.1	4.2	2.9	2.2	0.6

TABLE II. Health Status of Male Construction Workers (Age 51–61) and Blue-Collar Workers (Age 51–61) Compared to White-Collar Workers (Age 51–61) in the Health and Retirement Survey: 1992*

	Independent variables = Construction worker, blue-collar worker, fully retired, partially retired, age				
	OR for health conditions (95% CI)		Frequency of health conditions (%)		
Dependent variable Health condition	Construction workers (n = 312)	Blue-collar occupations (n = 1,716)	Construction workers (n = 312)	Blue-collar occupations (n = 1,716)	White-collar occupations (n = 2,064)
1. Foot/leg problem	1.907[a] (1.413–2.573)	1.417[a] (1.207–1.662)	35.2	28.5	22.0
2. Back problem	1.774[a] (1.341–2.347)	1.224[a] (1.052–1.424)	41.5	32.6	28.4
3. Arthritis/rheumatism	1.813[a] (1.382–2.379)	1.489[a] (1.238–1.791)	36.0	32.0	24.1
4. Emotional/psych prob.	2.146[a] (1.439–3.200)	1.232 (0.870–1.744)	11.3	6.4	5.3
5. Chronic lung disease	1.958[b] (1.137–3.773)	1.482[b] (1.167–1.882)	9.6	7.3	5.1
6. Heart problem	0.814 (0.521–1.272)	0.924 (0.717–1.192)	11.4	12.4	13.3
7. Kidney/bladder prob.	0.976 (0.547–1.742)	1.455[b] (1.073–1.975)	4.9	7.1	5.0
8. High cholesterol	0.682[c] (0.491–0.947)	0.668[a] (0.566–0.788)	18.6	17.9	24.7
9. High blood pressure	0.991 (0.750–1.308)	0.935 (0.811–1.081)	38.2	36.2	37.9
10. Diabetes	1.065 (0.624–1.819)	1.028 (0.801–1.319)	9.1	8.6	8.4
11. Cancer (other than skin)	1.181 (0.578–2.415)	1.244 (0.821–1.885)	3.1	3.2	2.6
12. Asthma	1.067 (0.556–2.048)	1.385[c] (1.030–1.864)	4.2	5.2	3.8
13. Stomach ulcer	1.060 (0.491–0.947)	1.235 (0.925–1.649)	7.7	8.6	7.1

*Each logistic regression has 4,092 observations. The $-2 \log L\ \chi^2$ is statistically significant at the 0.0001 level for regressions 1–9, the 0.001 level for 10, the 0.01 level for 11, and insignificant for 12–13. In these three regressions, the $-2 \log L\ \chi^2$ is not statistically significant.
[a]Statistically significant at 0.0001 level.
[b]0.01 level.
[c].05 level.

alcoholism screening questions. The construction and blue-collar cohorts were nearly identical in alcohol consumption and CAGE responses. Among the respondents who reported being diagnosed with an emotional disorder, construction workers were less likely to consume any alcohol, but CAGE responses were nearly the same. Logistic regression results of the influence of construction employment, working status, alcohol consumption, and CAGE responses on emotional disorders are reported in part 2 of Table IV. The construction cohort was 1.7 times more likely to have an emotional disorder when controlling for these other factors. Individuals who consumed moderate amounts of alcohol were less likely to be diagnosed with an emotional disorder than were those who did not consume any alcohol, while heavy alcohol consumption was not significantly associated with emotional disorders. However, if an individual answered ''yes'' to two or more of the CAGE questions, he was twice as likely to have an emotional problem than those who gave less than two positive responses.

DISCUSSION

Our data suggest that older construction workers are more likely to have CLD, emotional problems, and musculoskeletal disorders than are older males in other occupations. Specifically, comparing the construction workers with the blue-collar employees on CLD and emotional problems, we found older construction workers to be at a higher risk of

TABLE III. Chronic Lung Disease Among Male Construction Workers (Age 51–61) Compared to Males in Other Blue-Collar Occupations (Age 51–61) in the Health and Retirement Survey: 1992*

	Never smoked (%)	Former smoker (%)	Current smoker (%)
1. Frequency of smoking			
Construction workers	26.2	41.8	31.9
Blue-collar workers	23.0	44.1	32.9
2. Frequency of chronic lung disease based on smoking behavior			
Construction workers	10.4	9.9	8.6
Blue-collar workers	3.7	6.2	11.2
3. Odds ratios for having chronic lung disease			
Construction workers	3.238[c] (1.043–10.051)	2.795[b] (1.141–6.844)	2.648 (0.991–7.081)
Blue-collar workers	—	1.741 (0.864–3.508)	3.678[a] (1.906–7.099)

4. Responses to illness severity questions by people with chronic lung disease	Construction workers (%)		Blue-collar workers (%)	
Question	**Yes**	**No**	**Yes**	**No**
1. Does your condition limit your usual activities such as household chores or going to work?[d]	60.3	39.7	19.3	80.7
2. Are you taking any medication or other treatments for your lung condition?	32.2	67.8	24.4	75.6
3. Are you sometimes short of breath because of your lung condition?	71.4	28.6	71.3	28.7
4. Do you sometimes have wheezing or persistent cough, or bring up phlegm because of your lung condition?	79.2	20.8	64.6	35.4

*Logistic regression model controlled for working status and age. 95% confidence intervals are in parentheses. Blue-collar workers who never smoked are the reference group. Number of observations is 2,173 and the $-2 \log L$ χ^2 is 42.18, which carries a p-value of 0.0001.
[a]Statistically significant at $p = 0.0001$ level.
[b]$p = 0.01$.
[c]$p = 0.05$.
[d]Difference between responses of construction and blue collar is statistically significant at $p = 0.0001$ level.

these health problems, even when controlling for other risk factors such as smoking and alcohol consumption.

The results of our analysis on CLD yield a surprising result. We find that older construction workers who never smoked are more likely to have CLD than their counterparts who currently, or formerly, smoked. We are somewhat limited in drawing conclusions from the correlations of CLD and smoking behavior due to the small number of construction workers with CLD in our sample ($n = 30$). With these limitations in mind, we believe that our statistically significant finding of the correlation between nonsmokers and CLD may be due to a ''self selection'' out of the construction occupation by workers who smoke. Prior studies have shown that the cigarette smoking enhances the problems of exposure to substances associated with construction work (Nyren et al., 1996; Keller and Howe, 1993; Baker et al., 1985). Thus, construction workers who smoke may begin to encounter heightened symptoms of CLD at an early stage of their career. These employees are unable to keep up with the physical demands of the job and ''select-out'' of construction work and into another occupation. Since the HRS is only composed of older employees, these workers who ''select-out'' are not in the construction cohort in our analysis. A similar ''self-selection'' process was noted among older hemp workers [Bouhuys et al.,1969].

Support for this ''self-selection'' out of construction work by employees who smoke is found in response to the question about activity limitation due to CLD. Construction

TABLE IV. Emotional Disorders Among Male Construction Workers (Age 51–61) Compared to Males in Other Blue-Collar Occupations (Age 51–61) in the HRS

	No. of drinks per day					No. of positive CAGE items		
	0	<1	1–2	3–4	5+	0	1–2	3–4
1. Alcohol Consumption and CAGE Scores (all numbers in percentages)								
1. Construction workers	31.4	40.0	16.8	8.0	3.8	60.7	24.6	14.7
2. Blue-collar workers	11.8	32.7	42.8	14.3	6.8	3.4	63.1	25.1
3. Construction workers with an emotional disorder	59.3	22.1	5.6	4.5	8.5	54.4	18.7	26.9
4. Blue-collar workers with an emotional disorder	37.4	43.3	5.8	5.7	7.8	46.1	26.4	27.5

2. Logistic Regression Estimates of the Factors Influencing Emotional Disorders
Dependent variable = diagnosed with an emotional disorder

Independent variables	OR (95% CI)	P
1. Construction worker	1.695 (1.049–2.737)	0.032
2. Fully retired	1.892 (1.099–3.258)	0.022
3. Partially retired	1.482 (0.754–2.915)	0.249
4. Moderate alcohol consumption (<5 drinks per day)	0.590 (0.381–0.915)	0.019
5. Heavy alcohol consumption (>5 drinks per day)	1.471 (0.724–2.990)	0.280
6. CAGE items ≥2	2.096 (1.366–3.217)	0.001
No. of observations	2,173	
$-2 \log L\ \chi^2$	49.49	0.0001

3. Responses to illness severity questions by persons with an emotional disorder

	Construction workers (%)		Blue-collar workers (%)	
Question	Yes	No	Yes	No
1. During the past 12 months, have you had any emotional nervous, or psychiatric problems?	59.0%	49.6	50.4	41.0
2. Do you now get psychiatric or psychological treatment for your problems?	85.6%	16.3	83.7	14.4
3. Do you now use tranquilizers, antidepressants, or pills for nerves?	29.6%	70.4	16.9	83.1

workers with CLD say that the disease limits their ability to perform their usual activities at nearly three times the rate of other blue-collar employees. Since construction work is more physically demanding than other blue-collar occupations (as noted by the higher rate of musculoskeletal disorders), construction employees with CLD are not able to perform their normal working duties. Thus, when CLD develops, construction workers tend to stop working because they are not able to handle the physical demands of the job when saddled with a respiratory problem.

Our finding on CLD among older construction workers has important occupational health and economic consequences. Nonsmoking construction workers are three times more likely to have CLD than are nonsmoking blue-collar employees. Dust exposure is the most likely culprit for this discrepancy in health outcomes. Unlike construction work-

ers who smoke and have their symptoms of CLD enhanced, younger nonsmoking construction workers appear to have a delayed reaction to substances associated with CLD which manifest themselves at an older age.

The economic consequences of CLD are found in shortened working lives. When employees exit an occupation due to poor health, employers have to find new employees and re-train them. The exiting individual also experiences this problem as they must search for a new occupation and obtain the training to perform their new job duties. Not only do individuals and employers pay these costs of CLD, but society also pays because of the lost productivity of the exiting employees. Economists refer to this type of unemployment as ''frictional.'' Frictional unemployment due to the normal dynamics of free enterprise, where businesses come and go, is to be expected. However, frictional unemployment due to poor health in an industry can be avoided by increasing safety standards and improving worker's health behavior. We believe our findings on CLD highlight the need for both interventions.

Construction workers may also be ''self-selecting'' out of construction at early ages due to the high prevalence of musculoskeletal problems. As noted earlier, several studies have documented the higher rates of musculoskeletal disorders among construction workers compared to other occupations. Our findings are consistent with those results. However, since our analysis is focused on older workers, we might be underestimating the problem. Construction workers who experience chronic pain as a result of a musculosketelal problem may drop out of the profession at an early age. Thus, they would not be in our sample. In the same manner that CLD may be shortening construction workers' lives, musculosketal disorders might be imposing costs to employers and society that could be avoided with improved safety equipment and education of the workforce.

The high rate of emotional disorders among construction workers may well be related to the characteristics of the labor market. Construction work is cyclical, seasonal, and sporadic [Ghilarducci et al., 1995]. This means that construction workers face a labor market that is influenced by the business cycle, weather, and high worker turnover. The business cycle causes construction workers to face periods of ''booms'' and ''busts'' as their local economies expand or shrink. Periods of ''construction booms'' result in long, grueling work hours as contractors meet the needs of businesses and residential housing. Periods of ''construction busts'' result in construction workers seeking jobs in other geographic areas. This causes separation from family and friends resulting in mental stress. In geographic areas where weather patterns are tumultuous, construction workers do not know on a daily basis if they will be able to work. Finally, the construction industry is characterized by small employers with projects that typically last from a day to a month. Thus, construction workers often work for up to 100 different employers during their careers. The interaction of sporadic working hours, inconsistent local job sites, and job-seeking in other geographic areas results in substantial swings in worker's pay, potential loss of benefit coverage for the worker and his/her family, and frequent separation from the family. All these factors tend to weaken construction workers' social supports and may contribute to emotional disorders.

An alternative explanation for the high rate of emotional disorders among older construction workers might be that construction work attracts individuals who have emotional problems. Some construction jobs can be routinely performed without extensive interpersonal contact. This may especially be the case among laborers. Isolated working environments with limited social interaction might attract individuals with emotional disorders. Thus, in essesnce, these workers could ''select into'' the construction industry.

In conclusion, our findings on emotional disorders, musculoskeletal problems, and CLD among older construction workers suggest the need for further research on these topics. Such research should incorporate questions about the dynamics of the construction labor market that may be related to increased risk of emotional disorders. Solutions to musculosketal problems could focus on ergonomic interventions, which improve the tools of the trades and educate workers about better techniques to perform their jobs, to alleviate the chronic pain suffered by a large percentage of the workforce. Our findings on CLD suggest not only the need to decrease smoking, but also the importance of controlling occupational dust exposure.

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