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Low Back Pain Prevalence and Related Workplace Psychosocial Risk Factors: A Study Using Data From the 2010 National Health Interview Survey

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Abstract

Objectives—The objectives of this study were to estimate prevalence of low back pain, to investigate associations between low back pain and a set of emerging workplace risk factors and to identify worker groups with an increased vulnerability for low back pain in the US.

Methods—The data used for this study came from the 2010 National Health Interview Survey (NHIS), which was designed to collect data on health conditions and related risk factors obtained from the US civilian population. The variance estimation method was used to compute weighted data for prevalence of low back pain. Multivariable logistic regression analyses stratified by sex and age were performed to determine the odds ratios (ORs) and the 95% Confidence Interval (CI) for low back pain. The examined work-related psychosocial risk factors included work-family imbalance, exposure to a hostile work environment and job insecurity. Work hours, occupation and other work organizational factors (non-standard work arrangements and alternative shifts) were also examined.

Results—The prevalence rate of self-reported low back pain in previous three months among workers in the U.S. was 25.7% in 2010. Female or older workers were at increased risk of experiencing low back pain. We found significant associations between low back pain and a set of psychosocial factors, including work-family imbalance (OR 1.27, CI 1.15–1.41), exposure to hostile work (OR 1.39, CI 1.25–1.55), and job insecurity (OR 1.44, CI 1.24–1.67), while controlling for demographic characteristics and other health related factors. Older workers who had non-standard work arrangements were more likely to report low back pain. Females who worked 41–45 hours per week and younger workers who worked over 60 hours per week had an increased risk for low back pain. Workers from several occupation groups, including, male

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healthcare practitioners, female and younger healthcare support workers, and female farming, fishing and forestry workers had an increased risk of low back pain.

Conclusions—This study linked low back pain to work-family imbalance, exposure to a hostile work environment, job insecurity, long work hours and certain occupation groups. These factors should be considered by employers, policy makers, and healthcare practitioners who are concerned about the impact of low back pain in workers.

Introduction

Low back pain is a common health problem in the workplace and most workers are expected to experience symptoms of low back pain during their working life.[1,2] Low back pain has a profound impact both directly and indirectly on individual workers and their families, industries and governments.[3–6] Direct healthcare expenditure for low back pain has been reported to range from $50 to $90.7 billion yearly in the US.[6–8] Total costs of direct medical expenditures and loss of work productivity combined related to low back pain have been estimated to be as high as $635 billion annually in the US.[9]

Considerable research conducted on this topic in past 3 decades has identified a number of demographic, behavioral, health and work-related factors associated with low back pain.[2,10–12] The 2 major categories of work-related risk factors for low back pain are physical[13–20] and psychosocial.[12–14,20–25] In the past, much of the research on work-related psychosocial risk factors was conducted within the job strain framework.[26,27] In this framework, job strain occurs when there is a combination of high job demands and low job control. Job demands are operationalized as psychosocial demands (work pace, time pressure, competing demands) and job control is defined as job autonomy and skill discretion.[22,28,29] This area of research has reported an association between job strain and low back pain, as well as the association between job demands and low back pain.[19,30–33]

In recent years, emphasis has shifted toward identifying some emerging psychosocial risk factors and work organizational characteristics associated with low back pain, including work-family conflict,[34] hostile work environment,[35] job insecurity,[36,37] long work hours and mandatory overtime work hours.[38–40] Two studies on the US working population show an association between low back pain and a set of psychosocial variables, including job satisfaction, supervisor support, job freedom and mandatory overtime work.[13,14] Another US population-based study link long work hours to occupational injuries and illnesses, including low back pain.[40] Two occupation-based studies on US healthcare workers also reveal an association between musculoskeletal pain and work-family conflict as well as a hostile work environment. [35,41]

The above mentioned emerging psychosocial and work organizational risk factors for low back pain have been examined for specific occupations in the US.[42,43] However, no research has been conducted to explore their associations with low back pain at the population level.

The purposes of this study are: a) to estimate low back pain prevalence in the general working population in different demographic groups in the US; b) to explore the associations between low back pain and a set of emerging workplace psychosocial risk factors in

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different demographic groups in the US; and c) explore the associations between low back pain and a set of work organization and job related risk factors in different demographic groups of the working population in the US.

Methods

Data

Data for this study came from the 2010 National Health Interview Survey (NHIS) core and supplementary occupational health questions. The NHIS is a yearly cross-sectional survey of the civilian and non-institutionalized population in the US. The NHIS core questionnaire remains the same each year while the supplementary questions vary from year to year, collecting additional data on special health topics.[44] The 2010 NHIS included an Occupational Health Supplementary Survey (NHIS-OHS)[45] which provided new data on emerging psychosocial and work organizational factors.[42] Two 2010 NHIS data files used for this study were the Person and Sample Adult files. The data of the Occupational Health Supplementary Survey was included in the Sample Adult file. The final response rate for the Sample Adult component was 60.8% for 2010.[46] The measurements of variables used in this study included low back pain, demographics, socioeconomic status, health behavior, mental health, and work-related factors. The data used for this study included respondents aged 18–64 years who worked for pay in the week prior to the interview. The sample size was 13,924 for the variance estimations of the study population. This study used the public use files from the NHIS which were approved by the Research Ethics Review Board of the National Center for Health Statistics[47] and the study was exempted the Institutional Review Board of the University of California, Irvine.

Measurements

Low back pain—The low back pain in the NIHS-OHS survey was self-reported and defined by the yes/no question “During the past three months, did you have low back pain?” This definition is similar to the chronic low back pain classification defined by the Research Task Force on Chronic Low Back pain but it has no assessments of the chronicity, intensity, and interference.[48]

Work-related factors—Work-related factors explored in this study were: psychosocial risk factors, work organizational factors, work hours per week, and occupation. Psychosocial risk factors included: work-family imbalance, exposure to hostile work environment, and job insecurity. Work-family imbalance was measured by the following question: “Please tell me whether you: strongly agree, agree, disagree, or strongly disagree with this statement: It is easy for me to combine work with family responsibilities.” Responses of “strongly disagree” and “disagree” were defined as high work-family imbalance. Exposure to hostile work environment was measured by the question “During the past 12 months were you threatened, bullied, or harassed by anyone while you were on the job?” Response of “Yes” was defined as exposure to hostile work environment. Job insecurity was measured by the question: “Please tell me whether you: strongly agree, agree, disagree, or strongly disagree with this statement: I am worried about becoming unemployed.” Responses of “strongly agree” and “agree” were defined as high job insecurity.

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The 2 work organizational factors examined were: non-standard work arrangements and alternative shifts. Non-standard work arrangement was defined as work arrangement with any of the following categories: (a) work/worked as an independent contractor, independent consultant, or freelance worker; (b) are/were on-call and work/worked only when called to work; c) are/were paid by a temporary agency; (d) work/worked for a contractor who provides workers and services to others under contract and (e) other work arrangement. Alternative shifts were measured by the question “Which of the following best describes the hours you usually work/worked?” with responses: “a regular evening shift,” “a regular night shift,” “a rotating shift” or “some other schedule.”

Hours of work were assessed using the question on hours of work last week at all jobs or businesses. The variable of hours of work per week was coded into 5 categories: (a) 8–39 hours, (b) 40 hours, (c) 41–45 hours, (d) 46–59 hours and (e) 60 and more hours. Regular working hours 40 hours was used as the reference group in the analysis.

The variable occupation used in this study came from the NHIS 22 occupation classifications[49] which included: (1) management, (2) business and financial, (3) computer and mathematical, (4) architecture and engineering, (5) life and physical and social science, (6) community and social services, (7) legal, (8) education, training, and library occupations, (9) arts, design, entertainment, sports and media, (10) healthcare practitioners and technical, (11) healthcare support, (12) protective service, (13) food preparation and serving related, (14) building and ground cleaning and maintenance, (15) personal care and service, (16) sales and related, (17) office and administrative support, (18) farming, fishing and forestry, (19) construction and extraction, (20) installation, maintenance and repair, (21) production and (22) transportation and material moving. The Computer and mathematical related occupation group, which had the lowest level prevalence for the total population of low back pain, was used as the reference group in the analysis.

Demographic characteristics and socioeconomic status—Demographic characteristics and socioeconomic status were treated as potential confounders. Demographic variables used in the analysis included sex and age, as well as race and ethnicity. Age was coded into 4 age groups: (a) 18–25, (b) 26–40, (c) 41–55 and (d) 56–64 years. The reference group used in the analysis was “18–25.” Race and ethnicity was coded into 5 groups: Hispanic, Non-Hispanic White, Non-Hispanic Black, Non-Hispanic Asian and Non-Hispanic Others. The Non-Hispanic White group was used as the reference group. In addition, socioeconomic status (SES) variables included: education and income earning. Imputation of missing values for earning was not conduced as the missing values for earning were not systematically related to low back pain.

Other related risk factors—Other related risk factors were leisure-time physical activity, serious psychological distress, and obesity. Regular leisure-time physical activity was defined as engaging in moderate physical activity for at least 30 minutes per day for 5 or more days per week or vigorous physical activity for at least 20 minutes per day for 3 or more days per week. A dummy variable was coded based on a set of questions related to intensity, duration and frequency of physical activity according to the guidelines of Healthy People 2020. [50] Serious psychological distress was measured by the Kessler 6 K6 Scale in

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the NHIS,[51] which assessed the frequency of six symptoms of nonspecific psychological distress in the past 30 days with the following question: “During the past 30 days, how often did you feel...” (a) So sad that nothing could cheer you up; (b) Nervous; (c) Restless or fidgety; (d) Hopeless; (e) That everything was an effort; and (f) Worthless. The answering options included: (a) All of the time; (b) Most of the time; (c) Some of the time; (d) A little of the time; and (e) None of the time. Serious psychological distress was coded by reversing the scores, giving “None of the time” equal 0”All of the time” equal 4, and summing up a score for the six items. A score of 13 or above was used to indicate serious psychological distress. Obesity was computed by a formula (weight kg/height m^2) and defined as Body Mass Index (BMI) of 30 or higher.[52]

Statistical Analysis

To account for the complex sampling design of the NHIS, direct standardization and the Taylor linearized variance estimation methods in STATA 12 [StataCorp, College Station, TX] was used to compute weighted descriptive statistics and measures of associations. Risk of low back pain was estimated using multivariable logistic regression with odds ratios (ORs) and the 95% CI. The descriptive statistics and measures of associations were stratified by demographic factors.

The rationale of using the variance estimation method is to report the findings representing the US adult population as the NHIS is based on a multi-stage stratified sample design of households with in-person interviews of persons aged 18 years and older in the US. The NHIS survey over-samples Black, Hispanic and Asian persons to allow for improved estimation of special health issues in these minority populations. The probabilities of sample selection, along with adjustments for nonresponse and the minority strata are reflected in sampling weights used for the data analyses with the variance estimation method. The 2010 NHIS data sample weights were calibrated to 2000 census, and are based population estimates for sex, age, and race/ethnicity of the US. The final proportions of the Black, Hispanic and Asian in NHIS are comparable as that of the US Census and thus the reported findings are representative of the US adult population.[44,53]

A full multivariate logistic regression model was developed to explore the relationship between low back pain and a set of emerging psychosocial and work organization factors including work-family imbalance, exposure to hostile work environment, job insecurity, non-standard work arrangements, alternative shifts, work hours and occupation. The potential confounding factors controlled in the analyses included demographic and other characteristics including sex, age, race, ethnicity, socioeconomic variables, education, earning, leisure-time physical activity, serious psychological distress and obesity. To avoid multiple collinearity, 3 variables were eliminated from the regression models, including hourly paid job, multiple jobs and temporary job. In other words, the 3 variables were highly correlated with other work organization-related variables and the estimate of the associations between low back pain and the key workplace risk factors may become less precise than these variables are eliminated in the regression model. Additional multivariate logistic regression models were constructed by stratifying sex and age - male workers, female workers, younger workers (18 to 40) and older workers (41 to 64).

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Five logistic regression models were constructed to explore the associations in the general worker population and different demographic sub groups of the working population. The first model (Model A) focused on the all workers. Additional multivariate logistic regression models were constructed by stratifying sex and age in the worker population, male workers, female workers, younger workers (18 to 40) and older workers (41 to 64). Sex stratified logistic regression analysis was done through these two models: Model B focused on male workers and Model C focused on female workers. Age stratified logistic regression analysis was done through these models: Model D focused on younger workers (18 to 40) and Model E focused on older workers (41 to 64).

Results

Prevalence of low back pain in US workers

The prevalence of low back pain was 25.7% for all workers, 24.5% for males, 27.1% for females, 23.8% for younger workers and 27.7% for older workers. Table 1 shows sex and age-group specific prevalence rates for low back pain with 22.5% for males in the younger age group and 28.8% for females in the older age group. Non-Hispanic White female workers (27.8%) and Hispanic older workers (28.7%) were the 2 groups with higher prevalence of low back pain. In comparison, the prevalence for low back pain in non-Hispanic Asians in different age and sex groups was much lower, with 14.1% for males, 17.8% for females, 13.3% for younger workers, and 18.5% for older workers.

Demographic and socioeconomic characteristics of workers in the US are presented in Table 1. The relationships between low back pain and demographic and socioeconomic factors analyzed in the logistic analyses are presented in Table 3. The all worker group combined model showed, compared with the 18–25 age group, workers in 26–40, 41–55, and 60–64, had an increased risk for low back pain, controlling for other risk factors. Female workers also had a limited increased risk for low back pain, compared with male workers. The demographic stratified analysis indicated that, when compared with workers with Non-Hispanic White racial and ethnic backgrounds, male workers with Non-Hispanic Black, Hispanic and Non-Hispanic Asian had a significantly lower likelihood for low back pain. A similar racial and ethnic low back pain pattern was also observed among younger workers. Model A shows that workers who had master or above level education have a lower risk for low back pain, compared with the workers with high school education.

Emerging psychosocial, organizational risk factors and low back pain

Table 2 shows associations between the emerging psychosocial/organizational factors and low back pain. Workers who reported exposure to work-family imbalance, exposure to a hostile work environment or job insecurity had increased prevalence for low back pain, compared with those were not exposed to these risk factors. Female workers who were exposed to hostile work environment had the highest prevalence of low back pain (37.9%), compared with female workers exposed to other work-related psychosocial factors. A similar pattern was observed among male workers. Younger workers who reported job insecurity had the highest prevalence of low back pain (36.2%) compared with workers in the same age group who were exposed to other work-related psychosocial factors. Male

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workers (21.5%) and younger workers (22.5%) who worked alternative shifts had the lowest prevalence of low back pain.

Table 4 presents the logistic regression analyses of the associations between low back pain and the psychosocial and work organizational factors with 5 models. Model A on general population showed that while controlling for demographic characteristics, socioeconomic status, other health and health behavior-related factors, and other work-related variables, all workers who experienced work-family imbalance, were exposed hostile work, or had job were more likely to have low back pain. The sex and age stratified logistic analyses for the psychosocial and work organizational factors indicated similar patterns. Model B on male workers, Model C on female workers, Model D on older workers, and Model E on younger workers all demonstrated similar patterns of associations between low back pain and these emerging psychosocial factors, when controlling for demographic characteristics, socioeconomic status, health and health behavior -related factors, and other work-related variables.

However, associations between low back pain and work organization factors were not the same in different demographic groups of workers. Older workers who had non-standard work arrangements were significantly more likely to have low back pain. Model B male workers, Model D on older workers and Model E on younger workers showed that male, younger and older workers who did alternative shifts were significantly less likely to have low back pain. Model C on female workers showed no similar difference in risk in organizational risk factors for low back pain in female workers.

Work hours and low back pain

Table 2 shows that those who worked regular hours per week, 40 hours, seemed to have the lowest prevalence of low back pain in all sex and age groups, while those working shorter hours appeared to experience an increased proportion for low back pain compared to those who worked 40 hours per week. Male and younger workers who did extraordinarily long work hours 60 hours and more also had higher prevalence for low back pain, compared with their counterparts who worked fewer hours per week.

Associations between low back pain and long work hours were not the same in different demographic groups of workers. Model C on female workers (Table 4) show that compared with those who worked 40 hours per week, females who worked 41 to 45 hours per week had a higher likelihood of experiencing low back pain, when controlling for other demographic, behavior and work-related risk factors. While controlling for the same demographic, behavior and work-related risk factors, younger workers who did 60 hours or more were also more likely to have low back pain, compared with those who worked 40 hours per week.

Occupational patterns of low back pain

Table 2 indicates that construction and extraction workers had the highest prevalence for low back pain among all occupation groups. Other occupation groups in different demographic groups with increased prevalence of low back pain included: community and social service, installation maintenance and repair, and health care practitioners and technical for males;

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farming, fishing and forestry for females and older workers; healthcare support and production for females; arts, design, entertainment, sports and media, and legal occupations for younger workers.

The sex and age stratified logistic analyses presented in Table 4 indicates different occupational patterns of low back pain. Model B shows that male healthcare practitioners had an increased likelihood for low back pain when controlled for demographic, socioeconomic, health and health behavior and other work-related risk factors. Model C indicates that female workers in the farming, fishing, and forestry occupation group and the healthcare support occupation group had a significantly increased risk for low back pain compared with female workers in other occupation groups. Model D indicates that younger workers in the healthcare support occupation group were more likely to experience low back pain compared with younger workers in other occupation groups. No similar difference in risk for low back pain was seen in older workers.

Discussion

This study indicates that the general prevalence rate of low back pain among US workers in 2010 was 25.7%. This finding is consistent with other studies using the US working population data, which indicate a comparable prevalence rate of 28.0% in 2002 and 2006, and 25.3% in 2010.[13,14] The prevalence rate found in this study is also similar to 28.7% in Canadian working population[54] and about 1.5 times the rate of 18% in the United Kingdom.[2,55] This study also demonstrates demographic differences in low back pain prevalence: 23.8% for younger workers (18–40 years) and 27.7% for older workers (41 to 64 years), 24.5% for male, and 27.1% for female workers. The finding is consistent with other studies that have found similar age and sex differences.[9,56,57]

This study shows the occupational pattern of low back pain by sex and age. Male healthcare practitioners had an increased risk for low back pain. Female workers in the farming, fishing and forestry and healthcare support occupations had an increased likelihood of experiencing low back pain. In addition, younger workers who were in the healthcare support occupation had an increased risk for low back pain. These gender and age effects found in this study agree with several previous studies, especially in healthcare workers,[38,58–60] and farmers.[32,61,62]

Long work hours in females (41–45 work hours) and younger workers (60 or longer work hours) were associated with low back pain in this study. This finding appears to be in agreement with those from the population-based longitudinal analysis of workers in the US by Dembe et al.[40] In that study, a link was found between overtime and long work hours to all forms of occupational injuries and illnesses, with 34.9% of these injuries and illnesses being musculoskeletal conditions.

Associations between several emerging psychosocial factors and low back pain were found in this study. Workers who were exposed to hostile work environment, work-family imbalance or job insecurity were more likely to report low back pain. The risk associations were similar (OR ranging from 1.23–1.49) among different demographic groups, males and

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females, younger and older workers. The associations between low back pain and these emerging psychosocial factors are consistent with evidence from a number of studies.[34–36,41,63]

Work organization structures and job characteristics have changed profoundly during the process of globalization. Intensifying global economic competitions, increasing use of information technologies, continuing expansion of the service sectors, increasing women labor force participation, deregulations, increasing political and cultural openness and fluctuating economy growth have been seen as features of globalization that reshaping ways people used to work and heightened the complexities of the workplace psychological risk factors.[64,65,66,67]

Under these circumstances, uncertainty about job security as well as flexibilities in work arrangements become the hallmark of the jobs.[68] An increasing body of research has indicated deleterious health effects of job insecurity including hypertension, poor sleep, depression and anxiety,[69–71] as well as work-related musculoskeletal disorders, including back pain.[36,72–74] This is probably due to possible economic deprivation that occurs after lost job and concerns about the future welling being.[75,76] There is a growing body of research which indicates that job insecurity may lead to comparable vulnerability or even a stronger threat to health of workers than unemployment.[77] Mental strain associated with job insecurity may indirectly lead to "physiological vulnerability" which, in turn, may contribute to low back pain.[78–84]

Increasing numbers of women are entering the work force with increasing work intensity in the context of globalized economy. At the same time there has been a change in social norm that emphasizes equal importance of women and men both at work and in the family responsibilities.[85] These changing roles for family members have heightened the importance of work-family imbalance as a health risk factor.[86] Work-family imbalance is considered as a factor that is significantly and strongly associated with unhealthy behaviors as well as negative health outcomes.[85,87] There has also been new research evidence linking exposure of work-family conflicts to low back pain.[34,41,88] One possible result of how work-family life imbalance is related to low back pain may be the draining of psychological and physical resources leading to unhealthy behaviors, including alcohol and tobacco use and decreased leisure-time physical activity.[77, 89] Another postulated pathway between work-family life imbalance and low back pain is that mental strain can cause muscle tension or other physiological processes that might aggravate low back pain.[90]

Early research in hostile work environment or bullying was conducted primarily in the Northern European countries in the 1990s and expanded to other countries in recent years.[91] The research health impact of hostile work environment in the US has been primarily focused on the area of healthcare workers.[35,92] There has been an increasing body of research linking hostile work environment to sickness absence, coronary heart diseases, depression, work related injuries, sleeping problem and musculoskeletal disorders.[80,93–96] Although the underlying mechanism for low back pain due to the exposure to hostile work environment is not well understood, it is likely involved increased psychosocial strain.[80,97,98] An increase in psychosocial strain has been hypothesized to affect both

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biomechanical and physiological processes as well as perception of pain.[90,99,100] Recent studies have provided some epidemiological evidence of supporting the hypothesized pain mechanism.[80,101]

Bullying has also become a burning issue in the public arena in the past few years in the US. [80,102] The Healthy Workplace Campaign at the national level launched in 2001 holds the employer accountable for "abusive work environment" and encourages employers to prevent bullying with policies and procedures that apply to all employees. There have also been legislative efforts in the US. The Healthy Workplace Bill was proposed in 2001 and so far, 31 Legislatures in 29 States and 2 Territories have introduced the Healthy Workplace Bill.[103] California started mandating training in Abusive Conduct for supervisors at workplaces with over 50 workers in 2015.[104] These changes in law hold the potential for reducing work place abuse and reduce the impact of these factors on low back pain.

Implications

One of the implications of the findings is a need in developing public health and occupational health strategies, programs and guidelines in reducing, managing and preventing low back pain among different worker groups.[9,105,106] This need is made particularly urgent as the labor force is becoming aging in the next decade to come. The total labor force is projected to increase 6.8% during the period of 2010–2020 in the US, while the number of workers will increase 25.8% during the same period.[107]

To our knowledge, this study is the first population-based study that focuses on the emerging work-related psychosocial risk factors for low back pain. This study also demonstrates the importance of focusing the emerging work-related psychosocial risk factors for low back pain in future research. Much of the research in the field of psychosocial risk factors for low back pain in the past few decades have been guided by the job strain framework.[26,27] The job strain framework was fully developed in the late 1980s and much of the research has been devoted to the field of cardiovascular health.[108,109] In addition, the associations between low back pain and job strain variables have been conducted in workers in several European countries.[15,73,110,111] and in Asian countries such as China[112,113] However, the traditional psychosocial job strain model may not account for the studied psychosocial stressors that have emerged in recent years.

In short, the findings of this study shed light on the field of research linking risk factors to low back pain and also provide support for intervention programs aimed at reducing and preventing low back pain in the workplace.[114–116] Understanding these emerging work-related risk factors for low back pain is important if the resultant suffering, activity limitations and loss of productivity for individuals, as well as the social and economic impact of this condition at the societal level, are to be addressed.[9] These risk factors should be kept in mind by healthcare practitioners, including nurses, psychologists, physicians, physical therapists and chiropractors.[9] These risk factors should also be considered by employers who might wish to develop future multifactorial interventions at the workplace[117] as well as by policy makers in developing population-based public health strategies for prevention, treatment, management and research of low back pain.[9]

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Limitations

There are several limitations in this study. First, low back pain defined in this study does not provide information on pain intensity and pain interference, both of which may be more important than simply the presence of low back pain in the workplace.[118] Second, the assessment of the psychological risk factors used in the present study was derived from single items for each psychological domain. Having just a single question may result in low reliability and validity for each of the domains.[119] Third, due to lack of information for constructing the traditional job strain variables, comparisons of the effects of the emerging work-related psychosocial risk factors and the job strain psychosocial variables were not done. Forth, information on work-related physical risk factors for low back pain was not available in the 2010 NHIS survey, such as repetitive work, awkward posture and heavy physical work. Although work hours and occupations may be considered indirect measurements for the physical risk factors, the lack of physical risk information may underestimate exposure to work-related physical risk factors and overestimate psychosocial factors.[13,120] Finally, because of the nature of the cross-sectional data used in this study, the directionality of the risk associations cannot be confirmed. The use of one year data in this study may contribute to instability in risk variance estimation. This limitation, however, may be overcome when the 2015 Occupational Health Supplementary Survey data for NHIS become available.

Conclusions

This population-based study shows that the prevalence of self-reported low back pain in previous three months among workers in the U.S. was 25.7% in 2010. Female or older workers were at increased risk of experiencing low back pain. Work-family imbalance, exposure to hostile work environment, and job insecurity were associated with low back pain after adjusting for different demographic, socioeconomic and occupational factors. Among all male workers' occupations, healthcare practitioners had the highest risk for low back pain, while among female workers, the farming, fishing and forestry occupation had the highest risk. Long work hours (41–45 hours) were associated with an increased risk of low back pain. In particular, younger workers working for 60 hours or longer; and female workers working for 41–45 hours were associated with increased reporting of low back pain. Future research focusing the associations of the emerging psychosocial factors and low back pain is recommended.

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Table 1

Description of Study Population and Low Back Pain by Sex and Age Group, Demographic Characteristics, Socioeconomic Status and Other Factors, Weighted Percent

	All Workers		Male Workers		Female Workers		Younger Workers (18–40)		Older Workers (41–64)	
Variable	**% in Pop**	**% Low back pain**	**% in Pop**	**% Low back pain**	**% in Pop**	**% Low back pain**	**% in Pop**	**% Low back pain**	**% in Pop**	**% Low back pain**
Low back pain		25.7	53.0	24.5	47.0	27.13	50.0	23.8	50.0	27.7
Demographics										
Age										
18 – 25	15.3	21.2	14.9	18.3	15.9	24.2				
26 – 40	34.6	25.0	36.1	24.3	33.0	25.9				
41 – 55	36.7	27.6	35.9	26.3	37.6	28.9				
56 – 64	13.4	28.0	13.2	27.4	13.6	28.7				
Sex										
Male	53.1	24.5	53.0	24.5			54.1	22.5	52.0	26.6
Female	46.9	27.1			47.0	27.1	45.9	25.3	48.0	28.8
Ethnicity and race										
Non-Hispanic White	67.8	27.1	67.6	26.6	68.0	27.8	63.7	25.7	71.9	28.4
Non-Hispanic Black	10.9	23.2	9.4	18.5	12.4	27.2	11.6	20.8	10.1	25.9
Hispanic	14.7	24.5	16.7	22.5	12.4	27.5	17.9	21.8	11.5	28.7
Non-Hispanic Asian	4.9	15.9	4.7	14.1	5.2	17.8	5.0	13.3	4.9	18.5
Non-Hispanic Others	1.8	26.0	1.6	24.9	2.0	27.1	1.9	24.9	1.6	27.4
Education										
Less than high school	12.2	29.2	14.0	26.1	10.2	34.1	13.3	26.8	11.2	32.1
High school	22.0	25.7	22.8	25.1	21.2	26.6	20.6	22.6	23.5	28.5
Some college	31.8	29.2	29.6	27.3	34.3	31.1	34.5	26.9	29.1	32.0
College	22.0	21.6	22.1	21.4	22.0	21.8	22.2	20.5	21.8	22.7
Master and above	12.0	21.1	11.6	20.9	12.4	21.3	9.5	19.4	14.4	22.2
Earning										
< $14,999	19.0	28.8	14.5	26.3	24.1	30.4	24.1	26.6	13.9	32.5
$15,000 – $34,999	30.5	27.1	27.3	26.0	34.2	28.1	34.3	24.8	26.7	30.0
$35,000 – $64,999	30.3	25.7	32.0	26.2	28.3	25.0	28.1	24.6	32.4	26.6

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Variable	All Workers		Male Workers		Female Workers		Younger Workers (18–40)		Older Workers (41–64)	
	% in Pop	% Low back pain	% in Pop	% Low back pain	% in Pop	% Low back pain	% in Pop	% Low back pain	% in Pop	% Low back pain
> =$65,000	20.2	24.8	26.2	24.1	13.5	26.4	13.5	21.9	27.0	26.2
Other related factors										
Leisure-time physical activity	51.7	24.4	56.0	23.7	46.9	25.4	55.2	24.1	48.2	24.8
Serious Psychological Distress	2.5	49.3	2.2	44.2	2.8	53.7	2.3	45.6	2.7	52.3
Obesity	26.9	30.1	27.9	27.7	25.7	33.0	23.3	27.2	30.5	32.3

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Table 2

Description of Study Population of Low Back Pain by Sex and Age, Work-Related Factors, Weighted Percent

	All Workers		Male Workers		Female Workers		Younger Workers (18–40)		Older Workers (41–64)	
Variable	**% in Pop**	**% Low back pain**	**% in Pop**	**% Low back pain**	**% in Pop**	**% Low back pain**	**% in Pop**	**% Low back pain**	**% in Pop**	**% Lowe back pain**
Workplace psychological factors										
Work-family imbalance	16.8	32.3	16.2	29.6	17.5	35.1	17.0	30.2	16.6	34.4
Exposure to hostile work environment	7.6	35.7	6.3	33.0	9.0	37.9	7.4	28.2	7.8	35.3
Job insecurity	32.4	30.2	33.7	28.6	30.9	32.1	30.5	36.2	34.3	32.0
Work organization characteristics										
Non-standard work arrangement	28.2	15.8	17.7	27.4	13.6	29.4	14.2	23.1	17.3	32.4
Alternative shifts	27.1	24.4	28.2	21.5	25.8	28.0	33.0	22.5	21.2	27.4
Work hours per week										
8 to 39	28.4	27.4	20.3	25.4	37.6	28.7	32.7	25.4	24.2	30.2
40 hours	43.5	23.3	44.5	22.5	42.3	24.2	41.8	20.8	45.1	25.6
41 to 45	6.8	28.5	7.9	25.6	5.6	33.1	6.7	25.2	7.0	31.6
46 to 59	13.3	26.9	16.8	26.2	9.2	28.3	11.8	26.2	14.7	27.5
60 hours and over	8.0	28.2	10.4	27.0	5.3	30.7	6.9	28.1	9.1	28.3
Occupation										
Management	9.5	24.8	11.4	23.8	7.3	26.5	7.4	25.8	11.6	24.1
Business and financial operations	4.7	21.5	3.9	17.5	5.5	24.7	4.3	19.1	5.0	23.7
Computer and mathematical	3.1	19.4	4.3	19.4	1.7	19.1	3.5	17.8	2.7	21.5
Architecture and engineering	2.1	20.1	3.2	19.6	0.7	22.4	1.8	15.2	2.4	23.8
Life, physical, and social science	1.2	22.9	1.1	23.3	1.3	22.6	1.0	23.8	1.3	22.2
Community and social services	1.8	26.3	1.3	29.5	2.3	24.2	1.9	22.9	1.7	30.0
Legal occupations	1.3	25.7	1.3	20.7	1.4	30.9	1.3	26.4	1.3	25.0
Education, training and library	6.5	23.1	3.6	24.7	9.8	22.4	6.2	21.2	6.9	24.8
Arts, design, entertainment, sports and media	1.9	26.2	2.1	24.9	1.8	28.0	2.0	27.2	1.9	25.2
Healthcare practitioners and technical	5.2	26.3	2.4	28.1	8.4	25.7	4.8	22.2	5.6	29.8
Healthcare support	2.6	33.6	0.6	25.9	4.9	34.7	2.7	31.2	2.5	36.2
Protective service	2.1	23.5	3.1	23.8	0.9	22.2	2.1	23.9	2.1	23.0

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	All Workers		Male Workers		Female Workers		Younger Workers (18–40)		Older Workers (41–64)	
Variable	**% in Pop**	**% Low back pain**	**% in Pop**	**% Low back pain**	**% in Pop**	**% Low back pain**	**% in Pop**	**% Low back pain**	**% in Pop**	**% Lowe back pain**
Food preparation and serving related	5.7	27.2	4.9	20.6	6.6	32.6	8.0	25.2	3.4	32.0
Building and grounds cleaning and maintenance	4.0	25.3	4.5	22.7	3.4	29.1	3.9	20.9	4.1	29.5
Personal care and service	3.5	28.5	1.4	24.4	5.9	29.6	3.9	23.6	3.2	34.4
Sales and related	10.5	26.9	10.2	25.7	10.7	28.2	11.9	25.6	9.0	28.6
Office and administrative support	13.2	25.1	6.5	21.9	20.7	26.2	13.1	23.2	13.2	27.0
Farming, fishing, and forestry	0.6	28.0	0.9	21.0	0.3	49.5	0.7	15.9	0.5	46.5
Construction and extraction	5.2	31.8	9.7	31.8	0.2	30.8	5.2	29.3	5.2	34.2
Installation, maintenance and repair	3.7	27.9	6.8	28.1	0.3	24.0	3.4	25.7	4.1	29.8
Production	6.0	26.7	7.8	24.0	3.8	33.0	5.3	23.8	6.6	29.0
Transportation and material moving	5.7	25.7	9.0	26.0	2.0	24.2	5.6	24.4	5.8	26.9

Note: Pop=Population.

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Table 3

Logistic Regression of Demographic Characteristics, Socioeconomic Status and Other Factors for Low Back Pain, Sex and Age Stratified Analysis

	All Workers (Model A)		Male Workers (Model B)		Female Workers (Model C)		Younger Workers (18–40) (Model D)		Older Workers 41–64 (Model E)	
Factors	**OR**	**95%Conf**	**OR**	**95%Conf**	**OR**	**95%Conf**	**OR**	**95%Conf**	**OR**	**95%Conf**
Age										
18 – 25	1.00		1.00		1.00		1.00			
26 – 40	1.30*	1.11–1.52	1.55*	1.21–2.00	1.13	0.90–1.41	1.31*	1.11–1.55		
41 – 55	1.39*	1.18–1.64	1.60*	1.24–2.08	1.26	0.99–1.59			1.00	
60 – 64	1.46*	1.19–1.79	1.74*	1.28–2.37	1.26	0.97–1.63			1.04	0.61–0.89
Sex										
Male	1.00						1.00		1.00	
Female	1.14*	1.01–1.29					1.22*	1.02–1.46	1.08	0.93–1.26
Ethnicity and race										
Non-Hispanic White	1.00		1.00		1.00		1.00		1.00	
Non-Hispanic Black	0.75*	0.65–0.88	0.62*	0.49–0.78	0.86	0.71–1.03	0.71*	0.57–0.89	0.79*	0.64–0.97
Hispanic	0.80*	0.69–0.92	0.76*	0.62–0.94	0.84*	0.70–1.00	0.73*	0.60–0.89	0.90	0.72–1.11
Non-Hispanic Asian	0.58*	0.46–0.72	0.51*	0.36–0.70	0.64*	0.45–0.91	0.51*	0.37–0.71	0.62*	0.46–0.84
Non-Hispanic Others	0.87	0.62–1.21	0.80	0.47–1.34	0.88	0.57–1.38	0.81	0.51–1.27	0.92	0.55–1.52
Education										
High school	1.00		1.00		1.00		1.00		1.00	
Less than high school	0.99	0.97–1.02	1.01	0.98–1.05	0.97	0.93–1.01	0.98	0.94–1.02	1.01	0.97–1.04
Some college	1.19*	1.02–1.39	1.08	0.88–1.32	1.33*	1.08–1.63	1.21	0.981.50	1.15	0.94–1.42
College	0.82	0.66–1.01	0.74*	0.55–0.99	0.91	0.67–1.23	0.86	0.63–1.19	0.75*	0.56–1.00
Master and above	0.75*	0.57–0.99	0.65*	0.44–0.97	0.85	0.57–1.26	0.82	0.54–1.24	0.68*	0.48–0.96
Earning										
$15,000 – $34,999	1.00		1.00		1.00		1.00		1.00	
<$14,999	1.22*	1.06–1.41	1.00*	1.07–1.68	1.14	0.93–1.38	1.29*	1.05–1.58	1.12	0.89–1.40
$35,000 – $64,999	1.03	0.91–1.17	1.34	0.91–1.27	0.96	0.80–1.16	1.09	0.90–1.32	0.98	0.82–1.17
> =$65,000	1.13	0.95–1.33	1.07	0.85–1.31	1.21	0.94–1.56	1.00	0.79–1.26	1.21	0.97–1.50

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Factors	All Workers (Model A)		Male Workers (Model B)		Female Workers (Model C)		Younger Workers (18–40) (Model D)		Older Workers 41–64 (Model E)	
	OR	95%Conf	OR	95%Conf	OR	95%Conf	OR	95%Conf	OR	95%Conf
Other related factors										
Leisure-time physical activity	0.93	0.84–1.03	0.93	0.81–1.07	0.94	0.93–1.24	1.08	0.93–1.24	0.81*	0.70–0.93
Serious Psychological Distress	2.63*	1.99–3.47	2.56*	1.60–4.00	2.62*	1.70–3.90-	2.57*	1.70–3.90	2.69*	1.87–3.85
Obesity	1.27*	1.15–1.41	1.17*	1.01–1.37	1.37*	1.04–1.44	1.23*	1.04–1.44	1.31*	1.14–1.51

*P<=0.05

Note: OR= Odds ratio; 95%Conf= 95% Confidence Interval; Pop=Population.

Results are weighted to account for the complex survey design.

The work-related factors for low back pain, work-family imbalance- exposure to hostile work environment, job insecurity, non-standard work arrangements, alternative shifts, work hours and occupation were controlled.

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Table 4

Logistic Regression of Work-Related Factors for Low Back Pain, Sex and Age Stratified Analysis

	All Workers (Model A)		Male Workers (Model B)		Female Workers (Model C)		Younger Workers (18–40) (Model D)		Older Workers (41–64) (Model E)	
Factors	**OR**	**95%Conf**	**OR**	**95%Conf**	**OR**	**95%Conf**	**OR**	**95%Conf**	**OR**	**95%Conf**
Workplace psychological factors										
Work family imbalance	1.27*	1.15–1.41	1.30*	1.10–1.54	1.49*	1.27–1.75	1.39*	1.17–1.66	1.42*	1.21–1.66
Exposure to hostile work environment	1.39*	1.25–1.55	1.41*	1.10–1.80	1.47*	1.20–1.80	1.58*	1.27–1.97	1.29*	1.04–1.60
Job insecurity	1.44*	1.24–1.67	1.28*	1.11–1.47	1.26*	1.1–1.44	1.33*	1.15–1.55	1.23*	1.08–1.40
Work organization characteristics										
Non-standard work arrangement	1.09	0.95–1.25	1.10	0.92–1.32	1.08	0.88–1.33	0.92	0.76–1.11	1.27*	1.06–1.52
Alternative shifts	0.81*	0.73–0.90	0.74*	0.64–0.86	0.90	0.76–1.07	0.77*	0.66–0.90	0.85*	0.72–0.99
Work hours per week										
40 hours	1.00		1.00		1.00		1.00		1.00	
8 to 39	1.11	0.97–1.26	1.09	0.90–1.32	1.14	0.97–1.34	1.16	0.96–1.41	1.06	0.9–1.25
41 to 45	1.25*	1.03–1.52	1.09	0.82–1.44	1.52*	1.16–1.98	1.20	0.92–1.58	1.30	0.98–1.72
46 to 59	1.15	0.99–1.34	1.15	0.95–1.39	1.12	0.88–1.42	1.25	0.99–1.56	1.08	0.89–1.32
60 hours and over	1.19	0.99–1.43	1.16	0.90–1.49	1.27	0.96–1.67	1.38*	1.07–1.78	1.07	0.83–1.37
Occupation										
Computer and mathematical	1.00		1.00		1.00		1.00		1.00	
Management	1.13	0.82–1.55	1.05	0.73–1.51	1.33	0.78–2.25	1.41	0.94–2.1	0.95	0.60–1.50
Business and financial operations	0.98	0.68–1.43	0.78	0.46–1.33	1.30	0.73–2.33	0.99	0.59–1.67	0.95	0.58–1.56
Architecture and engineering	0.94	0.62–1.42	0.86	0.53–1.41	1.33	0.58–3.05	0.81	0.41–1.63	0.96	0.53–1.71
Life- physical- and social science	1.25	0.75–2.07	1.18	0.60–2.32	1.43	0.68–3.04	1.47	0.70–3.08	1.06	0.54–2.09
Community and social services	1.35	0.86–2.12	1.74	0.89–3.43	1.29	0.69–2.41	1.26	0.64–2.46	1.42	0.74–2.75
Legal occupations	1.23	0.75–2.02	0.98	0.46–2.10	1.70	0.83–3.52	1.42	0.72–2.79	1.04	0.50–2.15
Education- training and library	1.10	0.78–1.53	1.24	0.74–2.08	1.22	0.73–2.05	1.07	0.66–1.73	1.11	0.68–1.81
Arts- design- entertainment- sports and media	1.29	0.84–2.00	1.22	0.69–2.15	1.53	0.75–3.12	1.50	0.86–2.62	1.09	0.57–2.07
Healthcare practitioners and technical	1.30	0.92–1.83	1.71*	1.01–2.88	1.35	0.80–2.29	1.14	0.72–1.82	1.38	0.84–2.26
Healthcare support	1.51*	1.05–2.18	1.26	0.49–3.20	1.71*	1.02–2.86	1.60*	1.00–2.56	1.44	0.81–2.57

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Factors	All Workers (Model A)		Male Workers (Model B)		Female Workers (Model C)		Younger Workers (18–40) (Model D)		Older Workers (41–64) (Model E)	
	OR	**95%Conf**	**OR**	**95%Conf**	**OR**	**95%Conf**	**OR**	**95%Conf**	**OR**	**95%Conf**
Protective service	1.01	0.67–1.52	1.06	0.65–1.72	0.93	0.42–2.07	1.23	0.68–2.19	0.82	0.47–1.43
Food preparation and serving related	1.31	0.94–1.84	1.10	0.67–1.81	1.63	0.99–2.7	1.39	0.89–2.16	1.23	0.74–2.04
Building and grounds cleaning and maintenance	1.15	0.79–1.68	1.13	0.69–1.85	1.30	0.74–2.29	1.07	0.65–1.77	1.21	0.73–2.01
Personal care and service	1.27	0.85–1.89	1.20	0.55–2.59	1.44	0.83–2.5	1.13	0.65–1.96	1.43	0.85–2.41
Sales and related	1.25	0.90–1.73	1.23	0.81–1.86	1.34	0.82–2.2	1.37	0.91–2.05	1.11	0.7–1.77
Office and administrative support	1.04	0.76–1.42	0.99	0.63–1.56	1.21	0.75–1.94	1.10	0.73–1.65	0.98	0.63–1.53
Farming- fishing- and forestry	1.25	0.69–2.25	0.86	0.38–1.92	2.66*	1.05–6.79	0.80	0.33–1.96	2.11	0.82–5.42
Construction and extraction	1.41*	1.00–2.01	1.31	0.88–1.96	1.61	0.37–6.98	1.56	0.98–2.49	1.27	0.77–2.1
Installation- maintenance and repair	1.21	0.83–1.78	1.15	0.74–1.78	1.15	0.38–3.46	1.31	0.79–2.17	1.13	0.67–1.9
Production	1.20	0.86–1.69	1.06	0.69–1.63	1.61	0.94–2.77	1.21	0.76–1.94	1.17	0.72–1.9
Transportation and material moving	1.14	0.80–1.61	1.16	0.77–1.75	1.01	0.52–1.97	1.33	0.85–2.10	0.96	0.59–1.56

*P<=0.05

Note: OR= Odds ratio; 95%Conf= 95% Confidence Interval; Results are weighted to account for the complex survey design.

The demographic, socioeconomic and behavior-related factors for low back pain were controlled.