



Published in final edited form as:

Am J Ind Med. 2009 April ; 52(4): 331–340. doi:10.1002/ajim.20687.

Upper-extremity Musculoskeletal Symptoms and Physical Health Related Quality of Life Among Women Employed in Poultry Processing and Other Low-Wage Jobs in Northeastern North Carolina

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Abstract

Background—The purpose of this study was to evaluate the association between upper-extremity musculoskeletal symptoms (MS) and diminished physical health related quality of life (PHRQoL) in a population of women, mostly African-American working in poultry processing and other low-wage jobs in rural northeastern North Carolina.

Methods—A cross-sectional analysis was performed on baseline data of self-reported PHRQoL and musculoskeletal symptoms for 291 poultry processing workers and 299 community comparison women. Logarithmic binomial regression was performed to assess the relationship between moderate to severe MS on low PHRQoL.

Results—Prevalence of poor PHRQoL was 35.5% among poultry processing workers, and 14.7% among community comparison group. Moderate to severe upper-extremity musculoskeletal symptoms were present in 34.4% of the poultry workers and 10.7% of the comparison group. After adjusting for age and other chronic conditions, moderate to severe musculoskeletal symptoms were associated with low PHRQoL in both groups. Although the observed effect was stronger among the comparison group (Adjusted prevalence ratios (95% confidence interval): poultry workers= 1.89 (1.36,2.64), community comparison= 4.26 (2.51,7.24), the population attributable risk percent was similar (poultry workers=28.9, community comparison=31.3%) due to the higher prevalence of moderate to severe symptoms in the poultry workers.

Conclusions—Significant upper extremity musculoskeletal symptoms were associated with poor PHRQoL among both groups of women employed in low-wage jobs. Nationwide, poultry work is over-represented by minorities and immigrants. Though challenging, we need to search for ways to improve the conditions of these women as a matter of social justice.

Keywords

poultry processing; women's health; health related quality of life; musculoskeletal disorders; community-based research; occupational health and safety; upper-extremity disorders

BACKGROUND

Musculoskeletal symptoms (MS) and disorders are prevalent and important health problems in both the general population and among workers [Blyth, et al. 2001, Carmona, et al. 2001, Institute of Medicine. and National Research Council (U.S.). Panel on Musculoskeletal Disorders and the Workplace. 2001, Melchior, et al. 2006, Roquelaure, et al. 2006, Taylor 2005]. A number of recent studies have examined and reported relationships between musculoskeletal symptoms and diminished physical health related quality of life (PHRQoL) [Bingefors and Isacson 2004, Coutu, et al. 2005, Picavet and Hoeymans 2004, Salaffi, et al. 2005, Tüzün 2007]. Additionally, research has been done to specifically explore musculoskeletal symptoms among working women, and some findings indicate that they suffer from more musculoskeletal symptoms than working men [Roquelaure, et al. 2006, Strazdins and Bammer 2004, Wijnhoven, et al. 2006, Wijnhoven, et al. 2006]. There is also a growing literature that the gender differences in musculoskeletal outcomes in the workplace reflect differences in work exposures, even in situations where job assignment for men and women is similar [Leijon et al., 2005; Karlqvist et al., 2003; Nordander et al., 2007; Messing et al., 1994]. Perhaps because working populations tend to be healthier than the general population, as in the extensively documented healthy worker effect [Arrighi and Hertz-Picciotto 1994], very few studies have explored associations between MS and PHRQoL in occupational populations [Beaton, et al. 1996, Li and Sung 1999, Morken, et al. 2002].

A great deal of occupational research has focused on workers compensation and disability claims filed as important health outcomes. However, these are both complicated outcomes, which may be affected by other workplace factors including response to treatment, psychosocial factors, and workplace policies. Instead a study by Katz et al., suggests that self-reported health related quality of life might be a more meaningful endpoint due to its incorporation of assessments of symptoms as well as treatment [Katz, et al. 1996]. Furthermore, research has shown that physicians often underestimate patients' quality of life and physical functioning [Calkins, et al. 1991].

We evaluated the relationship between moderate to severe upper extremity musculoskeletal symptom reports and poor PHRQoL among a group of women employed in poultry processing in rural North Carolina and a comparison group of women in other low-wage jobs in the same community. Data on the poultry workers are drawn from baseline assessments conducted as part of a 3-year longitudinal study of incident musculoskeletal symptoms and disorders [Lipscomb et al., 2008].

This project grew from requests from women in northeastern North Carolina to examine health effects of poultry processing on African-American women. In addition to concerns about musculoskeletal symptoms resulting from the work in the processing plants, women in this rural area also expressed concerns about how work affected their quality of life [Lipscomb, et al. 2007]. Earlier analyses from this study revealed that women employed in poultry processing had 2.4 times higher prevalence of upper extremity musculoskeletal symptoms than other working women of similar economic status in the same geographic area after adjusting for other associated factors including age, depressive symptoms, and levels of perceived isometric load at work [Lipscomb, 2007].

Northeastern North Carolina is an impoverished area with an African-American majority population. Poultry processing is the largest single employer of women in the area, with a single plant employing roughly 2,500 individuals. Poultry processing plants have long been a source of occupational safety and health concerns, around the world as well as in North Carolina [Armstrong, et al. 1982, Grzywacz, et al. 2007, Madeleine, et al. 2003, North

Carolina Department of Labor. 1989, Quandt, et al. 2005, Quandt, et al. 2006, Stuart-Buttle 1994, Zuskin, et al. 1994]. The work involves repetitive work, awkward postures, along with vibrating machinery and cold temperatures necessary for sanitary operations [Occupational Safety and Health Administration. 2004].

METHODS

Study design

The current cross-sectional analysis is comprised of 291 women employed in poultry processing and 299 women in other low-wage jobs in the same community. Study design and recruitment of the participants in the Safety and Health of Working Women Study (SHOWW) including longitudinal poultry worker and population cross-section have previously been described in detail [Lipscomb, et al. 2005, Lipscomb, et al. 2007].

Recruitment of poultry workers took place between May 2002 and March of 2004. In an attempt to recruit women with low baseline exposure and low disease prevalence for the purposes of the longitudinal design, women who had worked in the poultry processing industry for 9 months or less were intentionally over-sampled. Women from the study area employed in non-poultry processing jobs were recruited between December 2005 and March 2006 to function as a community comparison group. This group was designed to have similar characteristics from the poultry processing workers, with a different set of occupational exposures. These women were frequency matched by 10-year age group to the poultry workers.

The study was designed to avoid employer involvement and was heavily influenced by community based participatory research methods [Israel, et al. 1998, Lipscomb, et al. 2005, Minkler 2004]. Recruitment of all participants and data collection were completed by five Black women from the community who were trained members of the study team. Recruitment was facilitated through the use of social networks and by word of mouth. To accommodate participants and increase their comfort, interviews were conducted in the study field-office, participants' homes and other private locations, even at times including personal vehicles. All recruitment was without regard to health status, and protocols and eligibility criteria were consistent for community comparison and poultry workers. Participation occurred after signed informed consent. All procedures were approved by the Duke University Medical Center Institutional Review Board.

Outcome of Interest

Physical health related quality of life was assessed using the SF-12 Physical Component Survey (SF-12). PHRQoL attempts to assess the degree to which poor health alters daily activities, as well how respondents feel and their self-reported physical function. The questionnaire incorporates measures of participants' bodily pain, general health, and vitality [Ware, et al. 1996]. Validity of the tool has been reported among low-income African Americans in a community-based research initiative (Larson, et al. 2008). The Scores range from 0 to 100, with 0 indicating maximum impairment of PHRQoL and 100 indicating no impairment. In the overall US population, the mean score is 50 (SD 10). Stratified by age, a score of 50 corresponds to men and women 45-50 years of age [Ware, et al. 1995]. In the current analysis, we evaluated the relationship between musculoskeletal symptoms and low PHRQoL, defined as the lowest quartile of PHRQoL scores among our entire population of these working women. Scores for these working women were compared to gender and age-specific national norms (Hamner et al. 2006).

Main Explanatory Variable

Upper extremity musculoskeletal symptoms were assessed using a questionnaire adapted from the National Institute for Occupational Safety and Health Research Program for the Prevention of Work-related Musculoskeletal Disorders [NIOSH 2000]. Participants were considered to have significant musculoskeletal symptoms in these analyses if they reported having moderate to severe (between 3 and 5 on a scale where 0=no pain, 1= very mild, 2=mild, 3=moderate, 4=severe and 5= most severe possible pain) upper-extremity musculoskeletal symptoms. Upper-extremity symptoms included the hand/wrist, elbows/forearm, shoulders, or neck and must have occurred at least 3 times during the last year or lasted one week or longer on at least one occasion.

Covariates

Several variables were considered as covariates in the relationship between upper-extremity MS and diminished PHRQoL. In addition to race and age, covariates addressed factors including childcare responsibilities, work hours, physical exhaustion at the end of the workday, and socioeconomic conditions. Instead of marital status, we considered whether or not the participant had another adult in the home to share responsibilities. In this population of women, non-traditional households, in which family members, significant others or friends shared a living space, were not uncommon. Similarly, we felt number of children in the home was a more meaningful measure than number of children.

Smoking status was included as a dichotomous covariate (ever smoker, never smoker). Information on other chronic conditions was compiled into a binary variable in which any positive responses to yes or no questions about the following conditions were coded as having another chronic condition: thyroid problems, graves disease, lupus, kidney failure, high blood pressure, migraine headaches, heart attack, diabetes, sickle cell anemia, or a report of moderate to severe low back pain in the last year based on the same scale used for upper extremity MS reports.

Work variables included number of working hours (full-time with overtime, full-time without overtime, part-time), where full-time work was considered more than 30 hours per week. Additionally, physical exhaustion at the end of the workday was evaluated (never or seldom/often - always) using an item from the NIOSH tool designed to assess work-related musculoskeletal disorders [NIOSH 2000].

Socioeconomic depravity was estimated through a question about the length of time a participant could go without a paycheck before the loss of pay became a significant problem for her and her family. The variable also accounts for stress caused by needing to continue work despite physical symptoms, and considers other wage earners in the home.

Statistical Analyses

Prevalence of low PHRQoL, significant MS symptoms and the covariates of interest were calculated separately for the poultry workers and other employed women. Statistical differences in these categorical variables across work strata were assessed using a chi-square statistic. Confounding was assessed through the use of a directed acyclic graph (DAG) [Greenland, et al. 1999], and prevalence ratio modification was evaluated through examination of prevalence ratios stratified by job (poultry vs other). Generalized linear models with binomial distribution and a logarithmic link were used to estimate crude and adjusted prevalence ratios (PR) and 95% confidence intervals (95% CI) (STATA SE v10.0). Confidence limit ratios (CLR, calculated as the upper confidence limit divided by the lower confidence limit) were calculated to assess precision of estimates as described by Poole [2001]. Population attributable risk percent (PAR%) [prevalence (RR-1)/prevalence(RR-1)

+1 *100] (Hennekens and Buring, 1987), was calculated to estimate the impact of moderate to severe MS in these working women. In this case, if the relationship is causal, the PAR% represents the proportion of women in the lowest quartile of PHRQoL which would be prevented if their moderate to severe musculoskeletal symptoms were prevented.

RESULTS

The characteristics of the study population are displayed in Table I. Both groups of working women were more than 98 percent Black, therefore race was not included as a covariate in analyses. By frequency matching design, the average age of participants was nearly identical; 31.3 years among poultry processing workers and 31.4 years in the community comparison group. The poultry workers had been in their jobs for relatively shorter periods of time than the women in the comparison group, although not at a level of statistical significance.

While fewer than 23% of study participants were married, over 63% of participants had another adult in the home to help out. Prevalence of another adult in the home to share household responsibilities, number of children in the home, having another chronic health condition, having a second job, and survival time without a paycheck were similar between the poultry processing workers and community comparison workers. Frequency of exhaustion at the end of the working day, working fulltime with over time, and ever having been a smoker were both much more prevalent among the poultry processing workers than among the comparison group.

The comparison group was comprised of women working in a variety of jobs, including retail (22.4%), as nurse's aides (22.4%), fast food (13.4%), and clerical (13.0%). The average hourly wages of the comparison group was \$8.30/hour, compared with \$8.18 among women employed in poultry processing.

Figures I and II display the distributions of PHRQoL stratified by worker type. Figure I indicates that although community comparison workers had some extremely low scores on the physical function survey, the majority of women scored in the mid to high 50s. In contrast, Figure II demonstrates that the poultry workers had a higher proportion of scores in the low to mid 40s. The cut-point of 48.19, represents the lowest quartile of physical function scores among all the study women.

The prevalence of low PHRQoL in each covariate by category is reported in Table II as well as the crude prevalence ratios comparing category levels. The prevalence of low PHRQoL increased with age. Women 45 and above had 1.71 (95% CI: 1.2, 2.5) times the prevalence of diminished PHRQoL as women 18-24 years of age. Presence of another chronic condition, ever having smoked, and frequency of physical exhaustion at the end of the workday were all associated with an increased prevalence of the outcome.

The prevalence of diminished PHRQoL and musculoskeletal symptoms stratified by worker type are presented in Table III. The prevalence of low PHRQoL among poultry processing workers (35.5%) was 2.4 times that among the comparison group (14.7%). Moderate to severe upper-extremity musculoskeletal symptoms were 3.2 times more prevalent in the poultry processing workers (34.4% compared to 10.7%).

In Table IV, we provide the prevalence ratios and 95% confidence intervals from the crude log-binomial regression model exploring the association between upper-extremity MS and low PHRQoL. Among both groups, presence of moderate to severe upper-extremity MS symptoms in the past year was associated with low PHRQoL. This effect was stronger (PR 5.25, 95% confidence interval 3.24 - 8.52) in the community comparison group than in

poultry workers (PR 2.18, 95% confidence interval 1.61 - 2.94) and subsequent models were stratified by worker status. An analysis of effect measure modification indicated that no other covariates modified the estimated prevalence ratio for the association between MS and low PHRQoL.

The adjusted prevalence ratios are displayed in Table V. We elected not to include physical exhaustion in multivariate modeling because it could be affected by the outcome. Smoking status and work hours were not included due to convergence problems. Categorized age and presence of another chronic disease were kept in the model due to a priori considerations and strong associations with both outcome and main exposure; categories of age defined by 10-year intervals were entered as a continuous variable.

Adjusting for age in years at baseline and presence of other chronic conditions, upper-extremity MS symptoms were still significantly associated with low PHRQoL in both populations, with a stronger association remaining in the community comparison group (Community PR (95% Confidence Interval (CI)) =4.26 (2.51, 7.24); Poultry PR (95% CI) = 1.89 (1.36, 2.64)). Both prevalence ratios have good precision (Confidence Limit Ratio (CLR) among community comparison=2.8; poultry processing=1.9) and their 95% confidence intervals exclude the null (1.0).

Because of the effect measure modification, the attributable risk and population attributable risk percents of low PHRQoL related to moderate to severe upper extremity MS were estimated for each group of women. The PAR% were similar (28.9% among the poultry workers and 31.3% among the comparison group).

In Table VI, the PHRQoL scores among the participants in each worker category are compared with the national averages by age and gender-specific group. The scores of the comparison workers were close to or above the national average for all age groups, while the younger poultry processing workers (less than 40 years of age) had lower PHRQoL than the US national average for women.

DISCUSSION

This analysis examines physical health related quality of life and upper-extremity musculoskeletal symptoms among women employed in low-wage jobs in rural North Carolina. Through the use of community based participatory research concepts and social networking, we were able to obtain information on physical symptoms and health related quality of life. Our findings suggest that presence of moderate to severe MS symptoms were strongly associated with PHRQoL among these working women regardless of employment category. Interestingly, these two groups of women in low-wage jobs have many similarities including working hours, wages, and childcare responsibilities, and the contribution of moderate to severe musculoskeletal symptoms to the PAR% of poor PHRQoL among these women is quite similar in both groups of women. However, in the poultry workers this is influenced more by the high prevalence of symptoms, while the magnitude of the prevalence ratios was more influential for the other low-wage workers. In both groups reduced prevalence and/or severity of their upper extremity MS could potentially reduce low PHRQoL by over 25%.

Our finding of diminished PHRQoL in poultry workers compared to national averages is consistent with PHRQoL findings from a survey of industrial workers in Norway [Morken, et al. 2002], but inconsistent with the notion that workers should have higher PHRQoL scores than the general population which includes individuals who are unable to work. In each age category, women employed in poultry processing reported physical health related quality of life comparable to that of individuals at least 5 years older than they were; in the

two lowest age categories, the values of the poultry workers were comparable to other American women 15-20 years older.

While the stronger association of moderate to severe symptoms and poor PHRQoL among women in the community comparison group was unexpected, a number of explanations are possible. In this cross-sectional analysis, the “exposed” population included women with significant levels of MS. It is unlikely that women with significant pre-existing upper-extremity pain would choose to work in an environment requiring intensive and repetitive upper-extremity motion such as poultry processing. This could explain the stronger association between musculoskeletal pain and poor PHRQoL observed among the community comparison group if women with more severe MS select out of poultry work because they do not tolerate the work for instance. Longitudinal analyses of the poultry processing workers suggests that new hires initially experience MS which subside after an adjustment period, only to return and worsen as the condition becomes chronic with continued work [Lipscomb, et al. 2008]. It is possible that the intentional over-recruitment of new hires in the poultry processing industry affected the quantity and severity of musculoskeletal symptoms in that group of workers. Although the distributions of time in current employment were not statistically different, the larger number of relatively new hires among the poultry workers could have influenced our findings. Of note, the youngest poultry workers had the greatest differences in mean PHRQoL compared to age-specific national averages. Unfortunately the number of participants and the distribution of the data did not allow further sub-analyses based on time since hire and type of work.

Previous studies of musculoskeletal symptoms have found a strong relationship between MS and diminished PHRQoL measured using a variety of validated instruments in different populations [Carmona, et al. 2001, Picavet and Hoeymans 2004, Reisine, et al. 2004, Salaffi, et al. 2005, Taylor 2005, Tüzün 2007]. Much of this research also reports high baseline prevalence of MS in general populations around the world [Blyth, et al. 2001, Taylor 2005]. Recently, a number of studies have also explored the greater reported frequency of MS among women compared to men [Bingefors and Isacson 2004, Strazdins and Bammer 2004, Wijnhoven, et al. 2006]. A number of reports [Strazdins et al., 2004; Leijon, et al. 2005; Karlqvist et al., 2003; Messing et al., 1994] document the more common employment of women in occupations with a higher prevalence of upper-extremity MS with some suggestion that the excess of MS reported by women may not be due to increased susceptibility, but rather higher demands both in the workplace and at home. Authors have hypothesized that with additional household responsibilities, women spend less time relaxing and participating in other activities that might allow relief and healing of workplace associated MS [Strazdins and Bammer 2004]. Franche et al., reported that MS related to work have an important effect on care giving activities in the home [Franche, et al. 2006] as well. Of greater public health importance are concerns that women in such high exposure jobs often have few possibilities for less hazardous work [Karlqvist, et al., 2003], and our failure to recognize structural factors in the labor market that create such conditions [Leijon et al., 2005]. Consequently, interventions on behalf of these workers are challenging. Both are certainly the case among these women in low-wage jobs in an economically deprived area of the rural South.

Limitations and strengths

There are both limitations and strengths to this work. These analyses focused on upper-extremity symptoms. Due to the cross-sectional nature of this analysis, temporality cannot be clearly defined. Additionally, because of the need to stratify our models, small sample-sizes created challenges with model convergence when we attempted to adjust for several potential confounders. Medical histories were taken specifically to identify confounders to upper extremity MS and consequently, full information on all medical conditions was not

assessed. Even so, we still had information on a number of major medical conditions as well as reports of moderate to severe low back pain in the last year. Additionally, we acknowledge that the community-based design necessitated by poor labor relations in this geographic area, meant that we could not randomly select female participants from the labor pool. However, we relied on the same social networks of the community-based staff to recruit all participants irrespective of any medical condition. Although the data for the poultry workers was collected prior to those of the other working women, we know of no significant changes in work conditions in the poultry plant during this time period that might have influenced the results.

Despite these limitations, the analysis has a number of important strengths. Through the use of validated measurement tools, and the use of community based participatory research methods, we have assessed musculoskeletal symptoms and PHRQoL among women in low-wage jobs, without involvement of the employers. These women can be a difficult group to reach and are often ignored in occupational health research, yet the research question is particularly salient for them. In many of their job positions these women have little or no prospect for upward mobility.

CONCLUSIONS

The results of this analysis are consistent with studies done around the world finding high prevalence of musculoskeletal symptoms in working populations, as well as those documenting decreased PHRQoL associated with significant MS. Workers employed in poultry processing had a higher prevalence of both significant musculoskeletal symptoms and low PHRQoL. Notably, PHRQoL among younger women employed in poultry processing was what would be expected among women 15 years their senior. Poultry processing is an important and growing industry in rural areas of the southern United States. Due to the intense physical nature of working in poultry processing plants and the low compensation, workers are predominantly minorities or immigrants. Further research should emphasize the unique characteristics of these working women and MS compounded by workplace and household responsibilities, and the impact on PHRQoL. Though challenging, we need to search for ways to improve the conditions of these women as a matter of social justice.

Acknowledgments

This project was funded by the National Institute of Environmental Health Sciences and the National Institute of Arthritis, Musculoskeletal and Skin Diseases, Grant Number R01 ES10939-01, and in part by NIEHS T32 ES7018. The authors have no competing financial interests.

We acknowledge the essential contributions of the community-based staff, including Emma Pender, Rita Perry, Christal Rankins, and Chaniqua Rodgers who recruited participants and collected the interview data. Lola Williams is acknowledged posthumously. She was the inspiration behind this project, seeking academic partners to address issues of health disparities in her community.

The questionnaire used to collect musculoskeletal symptom data was adapted from the questionnaire developed by the National Institute for Occupational Safety and Health Research Program for the Prevention of Work-related Musculoskeletal Disorders.

Grant sponsor: The National Institute of Environmental Health Sciences and the National Institute of Arthritis Musculoskeletal and Skin Diseases; Contract grant number: 01 ES10939-01.

Grant sponsor: The National Institute of Environmental Health Sciences Environmental and Occupational Epidemiology Training Grant; grant number: T32 ES7018.

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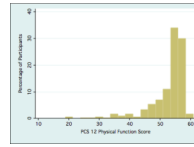


Figure 1. Distribution of physical health related quality of life measures (SF-12) among community comparison group.

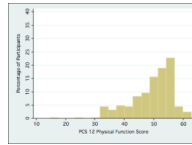


Figure 2. Distribution of physical health related quality of life measures (SF-12) among poultry workers.

Table ICharacteristics of Low Wage Working Women in Northeastern North Carolina.^a

	Poultry Processing Workers (n=291)	Community Comparison Workers (n=299)	P-value ^b
	n (%)	n (%)	
Black	286 (98.3)	295 (98.7)	0.7
Age	18-61; median 28, mean 31.3	18-59; median 29, mean 31.4	0.9
Other chronic condition ^c			
Yes	132 (45.4)	112 (37.5)	0.05
No	159 (54.6)	187 (62.5)	
Other adult(s) at home to help ^d			
Yes	175 (60.1)	199 (66.6)	0.1
No	116 (39.9)	100 (33.4)	
Number of children in the home ^e			
0	57 (19.6)	83 (27.8)	
1	84 (28.9)	84 (28.1)	
2	85 (29.2)	77 (25.8)	
3-6	65 (22.3)	55 (18.4)	0.1
Smoking status			
Ever Smoker	94 (32.3)	53 (17.7)	<0.001
Never Smoker	197 (67.7)	246 (82.3)	
Work hours ^f			
Part time	21 (7.2)	96 (32.1)	
Full-time, no overtime	116 (39.9)	141 (47.2)	
Full time w/ overtime	154 (52.9)	62 (20.7)	<0.001
Second Job			
Yes	18 (6.2)	31 (10.4)	0.07
No	272 (93.8)	268 (89.6)	
Frequency of physical exhaustion at the end of the day			
Never or seldom	106 (36.6)	194 (64.9)	
Often - always	184 (63.4)	105 (35.1)	<0.001
Time of survival without paycheck ^g			
1 week or less	181 (62.2)	177 (59.8)	0.6
2 weeks or longer	110 (37.8)	119 (40.2)	
Months in current job	1 - 418	1 - 386	0.15
	mean 53.8	mean 45.3	
	median 7	median 23	

^a Cross-section of low-wage working women from 5 counties in north Carolina. 291 Poultry processing workers were recruited between 2002 and 2004, and 299 community comparison workers were recruited between 2005 and 2006.

^b P-values based on chi-square statistic for categorical variables and t -tests for continuous variables.

^c Presence of other chronic conditions including moderate to severe back pain during the last 12 months, thyroid problems, graves disease, lupus, kidney failure, high blood pressure, migraine headaches, heart attack, diabetes, and sickle cell anemia.

^d Another adult in the home to help included friends, family members or partners.

^e Included adopted children or children of other friends or family members also living in the household.

^f Full time was defined as 30 or more hours per week. Hours combined if participant worked > 1 job.

^g A surrogate measure for socioeconomic depravity. Participants were asked how long it would be before the loss of her income became a serious problem for herself and her family.

Table II

Prevalence and Crude Prevalence Ratios (95% CI) of Lowest Quartile Physical Health Related Quality of Life Among Working Women in Northeastern North Carolina by Explanatory Covariates

	Prevalence of low PHRQoL in category (n) (total no/cases=147)	Crude Prevalence Ratio (95% CI)
Age Category (years)		
18 - 24	22.7 (46)	1.0
25 - 34	21.1 (38)	0.93 (0.63, 1.36)
35 - 44	26.2 (34)	1.15 (0.78, 1.70)
45 and above	28.7 (29)	1.71 (1.16, 2.50)
Other Chronic Condition ^a		
Yes	56.8 (88)	1.21 (1.00, 1.47)
No	17.1 (59)	1.0
Other Adult (s) at home to help ^b		
Yes	25.7 (96)	1.08 (0.81, 1.45)
No	23.7 (51)	1.0
Number of children in the home ^c		
0	22.9 (32)	1.0
1	26.2 (44)	1.14 (0.77, 1.70)
2	26.7 (43)	1.17 (0.78, 1.74)
3-6	23.3 (28)	1.02 (0.65, 1.59)
Smoking Status		
Ever Smoker	30.8 (45)	1.34 (0.99, 1.80)
Never Smoker	23.0 (102)	1.0
Work Hours ^d		
Part Time	19.0 (22)	0.60 (0.39, 0.92)
Full-time, no overtime	22.2 (57)	0.70 (0.52, 0.96)
Full time w/ overtime	31.5 (68)	1.0
Second Job		
Yes	22.5 (11)	0.89 (0.52, 1.54)
No	25.1 (135)	1.0
Frequency of physical exhaustion at the end of the day		
Never or Seldom	16.0 (48)	1.0
Often - Always	34.4 (99)	2.15 (1.58, 2.91)
Time of Survival Without Paycheck ^e		
1 week or less	26.2 (86)	0.92 (0.69, 1.22)
2 weeks or longer	24.1 (60)	1.0

^aPresence of other chronic conditions including moderate to severe back pain in the last 12 months, thyroid problems, graves disease, lupus, kidney failure, high blood pressure, migraine headaches, heart attack, diabetes, and sickle cell anemia.

^bAnother adult in the home to help included friends, family members or partners.

^cIncluded adopted children or children of other friends or family members also living in the household.

^d Full time was defined as 30 or more hours per week. Hours combined if participant worked > 1 job.

^e Designed as a surrogate measure for socioeconomic depravity to determine how long before the loss of a participant's income would become a serious problem for the herself and her family.

Table III

Association Between Work in Poultry Processing Versus Other Low-Wage Jobs and the Prevalence of Physical Conditions

	Poultry Processing Workers (n=291)	Community Comparison Workers (n=299)	Prevalence Ratio^a (95% CI)
	n (%)	n (%)	
Physical Health Related Quality of Life ^b			
≤48.14	103 (35.5)	44 (14.7)	2.41 (1.76 - 3.30)
>48.14	187 (64.5)	255 (85.3)	
Upper-extremity Musculoskeletal symptoms ^c			
Moderate to Severe	100 (34.4)	32 (10.7)	3.21 (2.23 - 4.62)
Mild or None	191 (65.6)	267 (89.3)	

^aPrevalence ratio is the proportion with low quality of life or moderate to severe musculoskeletal symptoms among poultry workers (the index exposure) relative to the proportion of each outcome among community comparison workers.

^bScore on SF-12 Health Summary Survey Instrument. [Ware, et al. 1995]

^cSymptoms defined as hand/wrist, elbows/forearm, shoulders or neck pain at least 3 times or lasting one week or longer during the past year.

Table IV

Crude prevalence ratios and 95% confidence intervals for low physical health related quality of life in association with upper-extremity musculoskeletal symptoms according to type of work among 590 low-wage working women in northeastern North Carolina. (Log-binomial model)

	Poultry Processing Workers (n=291)	Community Comparison Workers (n=299)
	PR (95% CI)	PR (95% CI)
Upper-extremity musculoskeletal symptoms ^a		
Moderate - Severe	2.18 (1.61, 2.94)	5.25 (3.24, 8.52)
Mild or None	1.0	1.0

^aSymptoms defined as hand/wrist, elbows/forearm, shoulders or neck pain at least 3 times or lasting one week or longer during the past year.

Table V

Adjusted prevalence ratios and 95% confidence intervals for low physical health related quality of life in association with upper-extremity musculoskeletal symptoms among 590 low-wage working women in northeastern North Carolina.^a (Log-binomial model)

	Poultry Processing Workers (n=291)	Community Comparison Workers (n=299)
	PR (95% CI)	PR (95% CI)
Upper-extremity musculoskeletal symptoms ^b		
Moderate - Severe	1.89 (1.36, 2.64)	4.26 (2.51, 7.24)
Mild or None	1.0	1.0
Other chronic disease		
Yes	1.33 (0.96, 1.85)	2.20 (1.22, 3.99)
No	1.0	1.0
Age		
Continuous 10-year age categories		
Referent, ages 18-24	1.0	1.0

^a Adjusted for age at baseline interview as a continuous categorical variable and presence of other chronic conditions.

^b Symptoms defined as hand/wrist, elbows/forearm, shoulders or neck pain at least 3 times or lasting one week or longer during the past year.

Table VIComparison of national averages to study participants PHRQoL scores.^a

	US National average ^b	Poultry processing workers	Community comparison workers
Age category	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)
18-19	-	49.3 (45.2 - 53.4)	54.7 (53.4 - 56.0)
20-29	53.0 (52.7 - 53.3)	50.0 (48.7 - 51.2)	53.5 (52.5 - 54.4)
30-39	51.6 (51.2 - 52.1)	49.2 (47.3 - 51.1)	52.9 (51.6 - 54.0)
40-49	49.5 (49.0 - 50.0)	49.5 (47.7 - 51.4)	50.1 (47.7 - 52.6)
50-59	46.8 (46.3 - 47.4)	45.2 (40.4 - 50.0)	50.0 (45.6 - 54.4)

^a One poultry worker participant, aged 61, was not included in these data. (PHRQoL = 49.1.)

^b Published national averages from [Hanmer, et al. 2006]