The Impact of Ergonomic Exposures on the Occurrence of Back Pain or Discomfort: Results from the First Working Conditions Survey in Quito-Ecuador

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Abstract. This article determines the prevalence of back pain or discomfort in the working population of Quito, the capital city of Ecuador, and examines its association with ergonomic exposures. A cross-sectional study based on data from the First Working Conditions Survey of Quito-Ecuador (364 women and 377 men) was performed. Overall, 56% of women and 43.5% of men reported back pain. Moreover, a gradient from upper to lower job categories was found for both sexes, especially among women. Among both sexes, back pain and discomfort were significantly associated with awkward, manual handling, repetitive movements and prolonged sitting or standing. The strongest associations were found among women. Therefore, monitoring ergonomic exposures and developing special programs for addressing back disorders are needed.

Keywords: Prevalence · Musculoskeletal disorders · Human engineering · Health surveys · Ecuador · Public health surveillance

1 Introduction

Back pain is prevalent among the working population worldwide and it is an important cause of disability and loss of working days. According to the 2005 European Working Survey (EWCS), 24.7% of the workers in the 27 member states of the European Union (UE-27) reported back pain [1]. In less economically developed countries data is scarce, however, a recent cross-sectional study based on 12 024 workers from the 2011 First Central American Survey of Working Conditions and Health (ECCTS, by its Spanish acronym), found that almost half of the working population reported having back pain in the previous 4 weeks [2]. On the other hand, it was estimated that low back pain arising from ergonomic exposures caused 21.7 million disability-adjusted life years (DALYs) worldwide, in 2010 [3].

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The effects of ergonomic risk factors on the occurrence of back pain in the working population have been studied extensively, especially in economically developed countries. Several studies have found evidence of an increased risk of low back pain for workers exposed to manual handling and awkward postures (flexion and rotation of the trunk) [4–6]. Further, there is also some evidence about the impact of prolonged standing on back pain [7].

The exposure to ergonomic risk factors has been found to be one of the most frequent for the working population among several countries [8–11]. However, currently there is no available information about the prevalence of back pain and its association with ergonomic exposures on the Ecuadorian working population. Recently, Quito, the capital city of Ecuador developed its First Working Conditions Survey (I ECSST) [12], which allows studying multiple variables on work and health including back pain or discomfort and several ergonomic risk factors.

The objectives of this study were: (i) to determine the prevalence of back pain or discomfort in the working population of Quito, the capital city of Ecuador and (ii) to examine the association between back pain or discomfort and ergonomic exposures.

2 Methods

2.1 Data Source

Data was taken from the First Survey on Safety and Health of Quito (I ECSST, by its Spanish acronym), the capital city of Ecuador, conducted in 2016. The I ECSST is a cross-sectional survey based on a representative sample of salaried workers insured by social security, aged 18 or older, from all sectors of economic activity, and residing in Quito. In this survey, sample selection followed a multistage stratified random sampling procedure. A sample of 741 workers was drawn from the projected population in 2015 based on the 2010 Ecuadorian Population and Housing Census. Trained interviewers administered the questionnaires in a face-to-face interview at the respondent's home between April and July 2016. Details of the survey are reported elsewhere [12].

2.2 Variables

Ergonomic Exposures. We examined five ergonomic exposures, including awkward postures, manual handling, repetitive movements and prolonged sitting or standing. For the first two variables, workers were asked: (i) "During your working day, do you perform tasks requiring awkward postures? (always, very often, sometimes, almost never and never)" and (ii) "During your working day, do you lift, move or carry animals or other heavy loads? (always, very often, sometimes, almost never and never)". The categories "always" or "very often" defined workers as being exposed. Repetitive movements, was determined by asking workers whether they perform repetitive movements in short periods of time, in a working day (yes/no). Prolonged sitting or standing was elicited by asking respondents to describe their usual work posture.

Back Pain or Discomfort. Data on back pain or discomfort was obtained by asking the respondents: "In the past month, have you had discomfort or pain in the back? (yes or no)."

Covariates. Analyses were adjusted for age (categorized into 18–34 years, 35 to 49 years, and more than 49 years) and job category. Job category was coded into three categories according to the nine original broad categories of the International Standard Classification of Occupations (ISCO): (i) upper (managers and professionals), (ii) medium (technicians and associate professionals, clerks, and service workers and shop and market sales workers), and (iii) lower (skilled agricultural and fishery workers, craft and related trades workers, plant and machine operators and assemblers, and elementary occupations).

2.3 Data Analysis

First, descriptive statistics were calculated for sociodemographic and labor characteristics, ergonomic exposures and back pain or discomfort.

Second, the prevalence of back pain or discomfort was calculated by age groups (18–34, 35–49 and ≥ 50 years), job category (upper, medium and lower), weekly working hours (≤ 40 and ≥ 41 h), and ergonomic exposures (awkward postures, manual handling, repetitive movements and prolonged sitting or standing).

Third, multiple logistic regression adjusted for age and job category were fitted in order to test the association between ergonomic exposures and back pain or discomfort. All the analyses were separated by sex. Analyses were conducted using Stats V.11.

3 Results

3.1 General Description of the Sample

A total of 741 workers (364 women and 377 men) were analyzed (Table 1). Most of the working population were young, with 87.1% of women and 80.9% of men under 50 years of age. Both women and men worked mainly in the service sector (90.1% and 83.8%, respectively), and most of them occupied medium job categories (63.5% of women and 56.2% of men). Regarding ergonomic exposures, more than 60% of all respondents said they were exposed to repetitive movements always or very often. This was followed by 30.2% of women and 22.6% of men reporting exposure to prolonged sitting or standing, 10.2% of women and 20.4% of men indicating exposure to manual handling, and 12.6% of women and 14% of men reporting being exposed to awkward postures. In regard to back pain or discomfort, almost half of the working population (56% of women and 43.5% of men) stated that they had experienced pain in the four weeks before the survey.

Table 1. General description of the population sample by sex, in Quito, 2016.

Characteristics	Women		Men		Total	
	n	%	n	%	n	%
Age groups						
18–34	168	46.2	146	38.7	314	42.4
35–49	149	40.9	159	42.2	308	41.6
≥ 50	47	12.9	72	19.1	119	16.1
Economic activity						
Agriculture, mining and quarrying	3	0.8	8	2.1	11	1.5
Industry	23	6.3	37	9.8	60	8.1
Construction	10	2.8	16	4.2	26	3.5
Services	328	90.1	316	83.8	644	86.9
Job category						
Lower	81	22.3	112	29.7	193	26.1
Medium	231	63.5	212	56.2	443	59.8
Upper	52	14.3	53	14.1	105	14.2
Weekly working hours (mean (SD))	40.6 (7.1)		42.4 (8.5)		41.6 (7.9)	
Ergonomic exposures						
Awkward postures	46	12.6	55	14.6	101	13.6
Manual handling	37	10.2	77	20.4	114	15.4
Repetitive movements	215	60.2	241	65.0	456	62.6
Prolonged sitting or standing	110	30.2	85	22.6	195	26.3
Back pain or discomfort	204	56.0	164	43.5	368	49.7

Salaried workers aged over 18 years, covered by social security.

3.2 Prevalence of Back Pain or Discomfort

According to the studied age groups, the prevalence of back pain in women was higher among workers aged over 49 years and in men among those aged 18 to 34 years old. Among the whole working population, women in lower job categories were more likely to report back pain or discomfort (70.4%). Specifically for ergonomic exposures, the prevalence of back pain or discomfort for both men and women was highest among those exposed to awkward postures (89.1% of women and 69.1% of men) (Table 2).

3.3 Associations of Ergonomic Exposures with Back Pain or Discomfort

For both women and men, being exposed to any of the ergonomic risk factors was significantly associated with back pain or discomfort (Table 3). The magnitude of the associations was much higher among women. The strongest association occurred between awkward postures and back pain or discomfort among men (aOR = 3.3, 95% CI = 1.7–6.1) and, especially, among women (aOR = 6.9, 95% CI = 2.6–18.2).

Table 2. Number (n) and prevalence (%) of back pain or discomfort according to sociodemographic and labor characteristics, and ergonomic exposures by sex, in Quito, 2016.

	Women			Men			Total		
	n	%	(95% CI)	n	%	95% CI	n	%	95% CI
Age groups									
18–34	96	57.1	(49.6–64.7)	67	45.9	(37.8–54.0)	163	51.9	(46.4–57.5)
35–49	78	52.4	(44.3–60.4)	66	41.5	(33.8–49.2)	144	46.8	(41.2–52.3)
≥ 50	30	63.8	(49.9–77.8)	31	43.1	(31.5–54.6)	61	51.3	(42.2–60.3)
Job categories									
Lower	57	70.4	(60.3–80.4)	55	49.1	(39.8–58.4)	112	58.0	(51.0–65.0)
Medium	124	53.7	(47.2–60.2)	94	44.3	(37.6–51.1)	218	49.2	(44.5–53.9)
Upper	23	44.2	(30.6–57.9)	15	28.3	(16.0–40.6)	38	36.2	(36.2–45.4)
Ergonomic exposures									
Awkward postures	41	89.1	(80.0–98.3)	38	69.1	(56.7–81.5)	79	78.2	(70,1–86,3)
Manual handling	29	78.4	(64.9–91.9)	46	59.7	(48.7–70.8)	75	65.8	(57.0–74.6)
Repetitive movements	136	63.3	(56.8–69.7)	119	49.4	(43.0–55.7)	255	55.9	(51.4–60.5)
Prolonged sitting or standing	75	68.2	(59.4–76.9)	46	54.1	(43.4–64.8)	121	62.1	(41.1–49.4)

Salaried workers aged over 18 years, covered by social security.

Table 3. Associations (odds ratios) between ergonomic exposures and back pain or discomfort by sex in Quito, 2016.

	Women				Men			
	OR	(95% CI)	aOR	(95% CI)	OR	(95% CI)	aOR	(95% CI)
Awkward postures								
No	1		1		1		1	
Yes	7,8	(3,0–20,4)***	6,9	(2,6–18,2)***	3,5	(1,9–6,4)***	3,3	(1,7–6,1)***
Manual handling								
No	1		1		1		1	
Yes	3,1	(1,4–7,1)**	2,7	(1,2–6,3)*	2,3	(1,4–3,8)**	2,1	(1,3–3,7)**
Repetitive movements								
No	1		1		1		1	
Yes	2,2	(1,4–3,3)***	2,1	(1,4–3,3)**	1,9	(1,2–2,9)**	1,9	(1,2–2,9)**
Prolonged sitting or standing								
No	1		1		1		1	
Yes	2,1	(1,3–3,3)*	1,9	(1,2–3,1)*	1,7	(1,1–2,7)*	1,6	(1,1–2,6)

Salaried workers aged over 18 years, covered by social security.
OR odds ratio; 95% confidence interval, aOR adjusted odds ratio for age and job category
*p < 0.05, **p < 0.01, ***p < 0.001

4 Discussion

To our knowledge, this is the first time that a sample of workers of different economic sectors from the capital city of Ecuador has been used to study ergonomic exposures and back pain or discomfort. The study has produced three main findings: (i) Back pain

or discomfort was prevalent among the formal working population in Quito, especially among women occupied in lower job categories. (ii) The most frequent ergonomic exposure for both men and women was the exposure to repetitive movements, followed by prolonged sitting or standing, especially among women; and manual handling, particularly among men; and (iii) all ergonomic exposures were associated with back pain or discomfort, however these associations were stronger among women.

Our results are consistent with previous studies, which have shown that back pain is very frequent among the working population worldwide. In fact, a study based on the ECCTS, found that the prevalence of back pain in workers was over 50%. However, it should be noted that the prevalence in our study is higher than in Panama and lower than in Nicaragua (29.1% and 71.5%, respectively) [13]. Moreover, this prevalence is much higher than in the 27 member states of the EU-27 (27.4%), according to data from the 2005 EWCS [10].

Gender differences, with more women than men reporting back pain, coincide with previous studies [14]. These differences could be explained by a greater pain sensitivity in women compared to men, as has been found in previous studies [15]. Nevertheless, other studies have shown that among women, work-family conflict plays a significant role in the occurrence of back pain [16]. Future studies are needed to assess this hypothesis. As expected, workers from lower job categories reported back pain more frequently, which is consistent with previous studies [17]. These inequalities have been attributed to differences in physical and psychosocial working conditions, as well as lifestyle factors [18]. Therefore, the interaction of household labor and job category, as a proxy of social class, might be having a negative impact on women's health [19].

The frequency of exposure to ergonomic risk factors in the working population of Quito follows a similar pattern than in other working populations. For example, according to the 2006 Korean Working Conditions Survey [8], the 2011 Spanish Working Conditions Survey [9], and the 2010 European Working Conditions Survey (EWCS) [10] repetitive movements was the most prevalent exposure among their workers. In addition, according to the EWCS, manual handling was very frequent in the UE-27. Recently, similar results were found in a study which used a sample of 15 241 workers from the working conditions surveys available in different Latin American countries [11]. This study found that repetitive movements and manual handling were among the most frequent exposures in Colombia, Argentina, Central America and Uruguay. On the other hand, differences of exposure between sexes might be explained by the horizontal segregation of the labor market, were women and men are concentrated in different economic activities, occupations or tasks [20].

As in our study, previous research has shown the association between awkward postures, manual handling, repetitive movements and prolonged sitting or standing with back pain. A research about the different levels of evidence of the relationship of back pain with ergonomic risk factors, found that there is a strong evidence for manual handling, mild evidence for awkward postures and insufficient evidence for static work posture [6]. It is important to note that all these associations were stronger for women than for men. Besides the double burden of job and family demands, women are usually exposed to a worse psychosocial work environment than men [19], which might explain these gender differences.

A limitation of this study is that it excluded informal workers, which have been linked to poorer working and employment conditions and health outcomes [21]. It is possible that the informal working population in Quito has a higher prevalence of back pain than the formal one, as has been found in several Latin American countries [13]. Another important limitation is that this study did not analyze work-family conflict and psychosocial work environment, which have been found to be important determinants of back pain [16, 22].

In conclusion, back pain is frequent among the formal working population in Quito, the capital city of Ecuador, especially among women engaged in low job categories. In addition, awkward postures, manual handling, repetitive movements and prolonged sitting or standing are associated with back pain or discomfort, for both women and men, although these associations are stronger among women. Consequently, monitoring ergonomic exposures should be prioritized. Moreover, future research should incorporate a multidisciplinary approach, exploring on the relationship between ergonomic risk factors, psychosocial exposures and family demands with back pain.

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