

## Physical and psychosocial demand at work: inequities related to race/skin color

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**Abstract** *This cross-sectional study investigated the association between self-reported race/skin color and two outcomes – psychosocial demand and physical demand at work – in 1,032 workers in an urban cleaning services company and two footwear manufacturers, located in the State of Bahia, Brazil. Psychosocial demand was measured through the Job Content Questionnaire and physical demand was measured through questions about postures and cargo handling. A Cox regression analysis provided prevalence ratios (PR) adjusted by age, gender, and educational level. Among blacks, there is a higher proportion of garbage collectors and a lower proportion of supervisory positions. Black workers are more subject to high psychological demand and low job control and, consequently, to high strain (PR=1.65). Also, they are more exposed to work with arms above shoulder level (PR=1.93), and material handling (PR=1.62), compared to white workers. Brown workers are more exposed to low job control (PR=1.36), work with arms above shoulder level (PR=1.48), and material handling (PR=1.25), also compared with whites. Social support is lower among blacks and brown. The study demonstrated inequities in psychosocial and physical exposures at work that are in line with the structural conception of racism. This evidence can contribute to the adoption of practices that increase equity in the world of work.*

**Key words** *Psychosocial factors, Physical effort, Inequities, Racism, Worker's health*

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## Introduction

The world of work is marked by inequalities and inequities. While the former arises from the variability of human characteristics, inequities consist of differences that are unjustly produced, avoidable, and liable to extinction. They make social groups vulnerable and are generally maintained by power relations<sup>1-3</sup>.

Structural racism, present in society and thus in institutions, contributes to the perpetuation of disadvantages among historically subjugated ethnic groups, sustaining inequities<sup>4-6</sup>.

The concentration of the worst socioeconomic status among blacks or mixed – often understood in the literature as “Afrodescendants”, due to the common history of vulnerability<sup>7-9</sup> – is one of the effects of structural racism, and may have repercussions on occupational exposures<sup>4,6,9,10</sup>. Being African American has been associated with work in occupations that have a high risk of non-fatal injuries and sickness, in the United States<sup>11</sup>. Moreover, occupations in which there is a higher proportion of Afrodescendants are associated with the worst self-reported health status by Afrodescendant and non-Afrodescendant workers<sup>12</sup>.

In the world of work, tasks with the least autonomy and social recognition, and the highest physical demand are frequent among Afrodescendant workers. Domestic work was highlighted among Afrodescendant female workers (21.8% among Afrodescendant women versus 12.6% among white women)<sup>8</sup>, as well as informal, more precarious work was superior among Afrodescendants (47.3% versus 34.6%)<sup>9</sup>, while whites predominate among magistrates (82.8%)<sup>13</sup> and in managerial positions (68.6%)<sup>9</sup>. This panorama shows the establishment of a racial hierarchy in the world of work<sup>6,14</sup>.

In this perspective, a race is understood as a product of historical, socio-cultural, and ancestral relations that contribute to the constitution of identity, as opposed to identities based on genetic differentiations<sup>15-19</sup>. In epidemiological studies, the race is used for the operationalization of the “ethnic group” construct.

This study is based on the hypothesis that there are – scarcely investigated – racial inequities related to occupational exposure, that is, the highest physical and psychosocial overload is found in tasks performed by black and mixed, expressing the adverse conditions in the world of work.

The study of psychosocial demand at work has been based on theoretical models, among

which the Job Demand-Control (JDC) model<sup>20</sup>, which advocates that psychosocial aspects can act as stressors, constituting risk factors for physical and psychological disorders. This model defines two dimensions: psychological, which consists of the psychological demand required in the course of a task, and control at work, which involves the worker’s use of skills and creativity, in addition to autonomy for executing work. The model describes four experiences at work, according to levels of exposure to psychological demand and control. High-demand work, which results from high psychological demand combined with low control, is related to lack of motivation, low self-esteem, and loss of skills at work<sup>20</sup>, and is the experience most associated with health problems when compared to other work experiences: low-demand work, passive work, and active work<sup>20</sup>.

The JDC model was expanded to incorporate the social support dimension, coming from co-workers and supervisors, and this is understood as the dimension that can change the high-demand work experience, protecting workers who benefit from high social support<sup>21</sup>.

There is evidence that Blacks and mixed are more exposed, mainly, to low control and high demand, but the scientific literature on the subject is scarce<sup>10,22-24</sup>.

In addition to higher psychosocial demand, black and mixed workers may be more subject to physical demand at work, which involves pain-taking whole-body or body segments postures, in addition to load handling and use of force<sup>25</sup>, associated, among other harms, with musculoskeletal disorders and, particularly, with occupational back pain<sup>26-30</sup>. This situation was verified among African American workers, who perform more tasks involving squatting and load handling, contributing to a higher perception of pain among them, when compared to White workers<sup>31</sup>.

Thus, this study aimed at analyzing the association between race/skin color and two work outcomes – the psychosocial and physical demands to which the workers are subject.

## Method

A cross-sectional study was carried out with workers from an urban cleaning services company and with workers from two footwear manufacturing companies, in the State of Bahia, Brazil. A survey pool was conceived in the context of an international cooperation project<sup>32,33</sup>. The

strategy of aggregating surveys – conducted with the same procedures and techniques – aimed at ensuring the participation of as many workers as possible and favoring the variability of occupational exposure, both aspects of interest from an analytical perspective.

The survey with urban cleaning services workers – all of them male – was a census (n=624) conducted in Salvador, the capital of the State, in the year 2010. The second survey, with workers from two footwear manufacturing companies, both located outside Salvador, used a random sample stratified by gender and company (n=446) and was conducted in the year 2012. The urban cleaning services workers were allocated to operation and maintenance occupations, while the footwear manufacturing workers were in administrative, operational, and maintenance occupations. The most frequent occupations were those of collectors, cleaning agents, and those related to footwear manufacturing operational activities. In both surveys together, the response rate was 97%. The surveys were conducted based on the premises of Worker's Health Surveillance –which indicated their opportunity–, in the context of interventions in working conditions, in cooperation with the State's official agencies related to Workers' Health.

#### Procedures and data collection tool

The questionnaire was applied in the workplace, during work hours, by a team of trained interviewers composed by five master's program students (three physical therapists, one safety engineer, and one ergonomist) and four physical therapy undergraduate students. All the workers were informed about the objectives of the study. The confidentiality of the collected data was guaranteed and the workers' privacy was ensured.

From the original questionnaire, the following types of questions were used in this study: questions regarding socio-demographic data – age, gender, and educational level –, questions about occupations –related to the Job Content Questionnaire (JCQ)<sup>34,35</sup> –, and questions regarding physical demand.

To minimize the healthy worker survival effect (that may result from the exclusion of those temporarily incapacitated for work), all workers that were employed for 12 or more months at the time of the study were considered eligible. Once drawn, individuals that were on leave of absence for reasons that supposedly were not related to work – such as maternity leave – were replaced by

the next individual in the nominal list of workers provided by the respective company. There was a home interview with a worker from the footwear manufacturing company who was on medical leave. There was no long-term leave among the respondents.

#### Dependent Variables

##### Psychosocial demand at work

According to the Job Demand-Control-Support (JDCS) model<sup>20,21</sup>, the psychosocial aspects of work that characterize the psychosocial demand are psychological demand, control over work, social support, and high-demand work experience, measured using the JCQ<sup>34,35</sup>. The JDC model quadrants describe distinct forms of psychosocial exposure. High control and high demand constitute active work; low control and low demand configure passive work; low demand and high control result in low-demand work; finally, high demand and low control characterize high-demand work, which is considered the most deleterious experience<sup>20</sup>.

Social support from supervisors and coworkers, together, composed the dimension of social support.

The JCQ uses a 4-point Likert scale, ranging from “strongly disagree” (1) to “strongly agree” (4).

The validity and reproducibility of the JCQ were evaluated and considered good in a study conducted with formal and informal workers<sup>35</sup>. Santos et al.<sup>36</sup> confirmed the dimensionality of the JCQ, according to the JDSC model.

##### Physical demand at work

Physical demand at work was investigated utilizing six questions regarding general postures or postures of body segments (standing; walking; squatting; rotating trunk; arms above shoulder level; exert pressure with hands on an object); and three questions regarding load handling (lifting; pushing; pulling). A six-point numeric response scale (0 to 5) with duration qualifiers (0-“never” and 5-“all the time”) was used, except for the item regarding exerting pressure with hands on an object, whose response scale was of intensity (0-“very weak” and 5-“very strong”). The validity and reliability of these items of physical demand were tested by Fernandes et al.<sup>37</sup> in the population of this study. The results show dimensionality and reliability ranging from excellent to moderate for most items, which recommends the use of the questions in epidemiological studies.

The utilization of questions regarding physical demand aims at overcoming the measurement of exposure based on the job title, allowing for incorporating the variability of exposure among subjects that have the same job title, by considering the tasks performed. Therefore, self-reporting by workers has been considered the most valid measure in the evaluation of physical exposure<sup>37</sup>.

### Main independent variable

The variable “race/skin color” was obtained through self-reporting, according to the categories proposed by the *Instituto Brasileiro de Geografia e Estatística* (IBGE): white, black, yellow, mixed, and indigenous<sup>7</sup>. The co-variables of interest were: age, gender, and educational level.

### The statistical approach to data

#### Descriptive approach

The minimum and maximum values, means, and medians of quantitative variables were obtained. The absolute and relative frequencies of the qualitative variables were also obtained.

Arising from the notion of homogeneous exposure groups, five occupational groups were defined according to similarities between the tasks performed and also based on the positions occupied by workers in their respective organizational structures. The occupational groups are collectors/cleaning agents; urban cleaning drivers; coordinator/supervisor/administrative position; workers in operations and footwear manufacturing workers; and maintenance workers. The distribution of workers according to race/skin color in each of the occupational groups was presented. The description of the tasks performed in each occupational group is not the object of this article<sup>32</sup>.

The scores obtained from the JDCS model dimensions were described by median, maximum, and minimum values. Then, “psychological demand” and “control over work” were dichotomized in high or low exposure, from the median. The same occurred to the score obtained in the “social support” dimension, which encompasses the support of coworkers and supervisors.

The categorical variables of the JDCS model – demand, control, and social support – were described separately. Then, the JDC model quadrants were used; the high-demand work was the risk stratum to be compared with the absence of high demand, which aggregated the other quad-

rants: passive work, active work, and low-demand work, being described according to the race/skin color variable.

The answers to the questionnaire on physical demand at work were categorized. Answers ranging from zero to two in the numeric scale corresponded to “low exposure” and answers ranging from three to five corresponded to “high exposure”. Exposure to physical demand was described for each item, according to race/skin color.

The variable race/skin color was categorized into “white”, “black”, and “mixed”. Workers who self-reported as yellow (n=15) or indigenous (n=20) were excluded from the study population. They existed in small numbers, which rendered analyzing the main independent variable in separate strata not viable. The inclusion of indigenous to the black stratum and of yellows to the white stratum –in order not to exclude them from the analysis– was explored by the authors. The results obtained in these analyses were similar to those obtained without the aforementioned incorporations, as expected, given the low number of individuals in each of those groups. However, the decision for exclusion was based on the criticism of a classification that did not rely on self-reporting.

#### Analytical approach

The category “white” of the independent variable race/skin color was considered the reference stratum (not exposed) in the analyses.

The variable “age” was dichotomized from the median (31 years) and the “educational level” was stratified into less than high school and high school graduate.

Associations were presented through prevalence ratios (PR) provided by the Cox regression analysis for cross-sectional studies<sup>38,39</sup>.

For the modeling, besides the main independent variable (race/skin color), the variables gender, age, and educational level were inserted, selected based on evidence in the literature. The first model presents the gross prevalence ratio (PR) for each of the two outcomes, a result of the univariate analysis. In the second model, PR is adjusted by gender and age (women and youngsters were the exposure strata)<sup>40</sup>. In the third model, the variable “educational level” was inserted – in addition to the three variables previously inserted – and the PR adjusted by the three covariables was obtained, constituting the final models.

Since the population of this study is not a random sample, the inferential approach was avoid-

ed. Such an approach is inappropriate – despite being usual – when a census or a nonrandom sample is involved. This is an analytical study in which procedures compatible with the nonrandom nature of the population investigated were adopted, as recommended by the specialized literature on the subject<sup>41-43</sup>. Thus, the multivariate analysis presents the variables with their respective measures of association (prevalence ratios), which characterize an analytical study.

The data analysis was performed using the Statistical Package for Social Sciences (SPSS) software, version 21.0.

### Ethical aspects

The research project from which the study is derived was approved by the *Comitê de Ética em Pesquisa* of the *Faculdade de Medicina da Universidade Federal da Bahia*, in accordance with Resolution No. 466/2012 of the *Conselho Nacional de Saúde*. All the survey participants provided written informed consent.

### Results

A total of 1,032 workers were studied, among whom blacks predominate (47.4%; n=489), followed by mixed (42.7%; n=441) and whites (9.9%; n=102). There was lost data for race/skin color of three individuals.

The median age was 31 years and the male gender represented 78.7% (842). A significant portion of the workers did not graduate from high school (46.0%; n=490). Whites had higher

educational level (62.7%), i.e. high school graduate or completed undergraduate course, followed by mixed (58.0%) and blacks (48.6%).

Table 1 shows the distribution of occupational groups according to race/skin color. Among blacks, there is a higher proportion of “urban garbage collector” (57.5%) and a lower proportion in positions that involve supervision, coordination, and administrative work (3.5%), while among whites, 23.5% are collectors and 20.6% have supervisory and administrative functions. While 17.6% of whites are urban cleaning drivers, this percentage is approximately 8.0% among blacks.

Table 2 shows the variables related to psychosocial exposure at work according to the JDCS model, stratified by race/skin color. Black individuals had higher psychological demand and lower control over work; whites had the most favorable measures –higher control and lower psychological demand. The prevalence of high demand at work was higher among blacks. Among these, the highest frequency of low social support from supervisors was observed, however, the highest frequency of high support from co-workers.

The multivariate analysis showed that compared to whites, blacks had 65% more prevalence of high-demand work and 60% more prevalence of low control at work, in models adjusted by age, gender, and educational level. High psychological demand and low social support were also more prevalent among blacks, but these associations had smaller magnitudes. Among mixed, the prevalence of low control was 36% higher than the prevalence of low control among whites (Table 3).

**Table 1.** Distribution of urban cleaners and footwear manufacturing workers by occupational groups according to race/skin color in the State of Bahia.

Race/skin color	Occupational groups					Total n=1,032
	Collectors/ cleaning agents (n=437) 42,4%	Urban cleaning drivers (n=112) 10,9%	Maintenance workers (n=83) 8,0%	Coordinator/ Supervisor/ Administrative position (n=84) 8,1%	Footwear Manufacturing* (n=316) 30,6%	
Black	281 (57,5%)	40 (8,2%)	35 (7,1%)	17 (3,5%)	116 (23,7%)	489
Mixed	132 (29,9%)	54 (12,3%)	42 (9,5%)	46 (10,4%)	167 (37,9%)	441
White	24 (23,5%)	18 (17,6%)	6 (5,9%)	21 (20,6%)	33 (32,4%)	102

\*Footwear Manufacturing: Footwear fitter/Machine operator/Tailor.

Source: Elaborated by the authors.

**Table 2.** Psychosocial demand at work according to the JDSC model stratified by race/skin color in urban cleaners and footwear manufacturing workers of the State of Bahia.

Work psychosocial demand at work (MDC-AS)	Race/Skin color		
	Black	Mixed	White
Psychological demand			
Median (min.-max.)*	36,0 (20-48)	34,0 (16-48)	34,5 (16-48)
Low n (%)	208 (42,5)	259 (58,7)	54 (53,0)
High n (%)	281 (57,5)	182 (41,3)	48 (47,0)
Control over work			
Median (min.-max.)*	58,0 (26-88)	60,0 (32-86)	64,0 (40-94)
Low n (%)	287 (58,7)	231 (52,4)	39 (38,2)
High n (%)	202 (41,3)	210 (47,6)	63 (61,8)
Social Support from supervisor			
Median (min.-max.)*	11 (03-16)	11 (05-16)	11 (04-16)
Low n (%)	323 (66,1)	266 (60,3)	58 (56,9)
High n (%)	166 (33,9)	175 (39,7)	44 (43,1)
Social Support from coworkers			
Median (min.-max.)*	12 (04-16)	12 (06-16)	12 (04-16)
Low n (%)	272 (55,6)	296 (67,1)	64 (62,8)
High n (%)	217 (44,4)	145 (32,9)	38 (37,2)
Social Support (supervisor and coworkers)			
Median (min.-max.)*	23,0 (10-32)	23,0 (12-32)	23,0 (12-32)
Low n (%)	291 (59,9)	257 (58,3)	51 (50,0)
High n (%)	195 (40,1)	184 (41,7)	51 (50,0)
High Strain n (%)			
Yes	186 (38,0)	114 (25,9)	23 (22,5)
No	303 (62,0)	327 (74,1)	79 (77,5)

\*Minimum and maximum values obtained for the median in each dimension of the Demand, Control and Social Support Model.

Source: Elaborated by the authors.

**Table 3.** Association between psychosocial demand at work, according to the JDSC model, and race/skin color in urban cleaning and footwear manufacturing workers of the State of Bahia.

Race/skin color		Psychosocial demand at work			
		High Demand vs. Low Demand (PR)	Low Control vs. High Control (PR)	Low Social Support vs. High Social Support (PR)	High Strain Yes vs. No (PR)
Black	Model 1	1,22	1,53	1,20	1,67
	Model 2	1,19	1,60	1,24	1,67
	Model 3	1,18	1,60	1,25	1,65
Mixed	Model 1	0,88	1,37	1,17	1,11
	Model 2	0,88	1,36	1,16	1,11
	Model 3	0,88	1,36	1,17	1,10
White	-	1	1	1	1

JDSCM: Job Demand, Control and Social Support Model; Model 1 - Brut prevalence ratios (PR); Model 2 - Adjusted by sex and age; Model 3 - Additional adjustment by educational level.

Source: Elaborated by the authors.

Table 4 shows the distribution of the items of physical demand at work, according to race/skin color. Exposure to standing work was more frequent among blacks. In the other items, there

are higher frequencies of exposure among blacks, followed by mixed, and the lower frequencies are for whites.

A positive association between physical demand and race/skin color black was verified for all items. The associations were maintained after adjustment by gender, age, and educational lev-

el. Work with arms above shoulder level and in squatting posture were highlighted, besides load handling, with high exposure prevalences, at least 44% higher among blacks, when compared to whites (Table 5).

When compared to whites, mixed had higher exposures in all physical demand items, even

**Table 4.** Physical demand exposure at work by race/skin color in urban cleaning and footwear manufacturing workers of the State of Bahia.

Work physical demand	Race/skin color					
	Black		Mixed		White	
	Low Exposure	High Exposure	Low Exposure	High Exposure	Low Exposure	High Exposure
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Work postures (general postures or postures of body segments)						
Standing	85 (17,5)	400 (82,5)	143 (32,6)	295 (67,4)	35 (34,3)	66 (64,7)
Walking	226 (46,9)	256 (53,1)	244 (55,7)	194 (44,3)	59 (57,8)	42 (42,2)
Squatting	215 (44,5)	268 (55,5)	283 (65,1)	152 (34,9)	68 (66,6)	33 (33,4)
Rotated Trunk	120 (24,8)	363 (75,2)	169 (38,7)	268 (61,3)	48 (47,0)	54 (53,0)
Arms above shoulders level	241 (50,0)	241 (50,0)	298 (67,9)	141 (32,1)	81 (79,4)	21 (20,6)
Exert pressure with hands on an object	134 (27,7)	350 (72,3)	164 (37,3)	276 (62,7)	50 (50,0)	50 (50,0)
Load Handling						
Lifting	161 (32,9)	328 (67,1)	239 (54,2)	202 (45,8)	62 (60,8)	40 (39,2)
Pushing	200 (41,0)	287 (59,0)	260 (59,0)	181 (41,0)	69 (67,6)	33 (32,4)
Pulling	211 (43,2)	277 (56,8)	265 (60,1)	176 (39,9)	68 (66,7)	34 (33,3)

Source: Elaborated by the authors.

**Table 5.** Association between physical demand exposure at work and race/skin color in urban cleaning and footwear manufacturing workers of the State of Bahia.

Race/skin color		High exposure to physical demand at work vs. Low exposure (Prevalence Ratio)								
		General postures or postures of body segments					Load Handling			
		Stand	Walking	Squatting	Trunk Rotated	Arms above shoulders level	Exert pressure with hands on an object	Lifting	Pushing	Pulling
Black	M1	1,26	1,25	1,70	1,42	2,43	1,42	1,71	1,82	1,70
	M2	1,21	1,17	1,57	1,39	2,16	1,37	1,63	1,71	1,60
	M3	1,18	1,12	1,44	1,37	1,93	1,35	1,55	1,62	1,51
Mixed	M1	1,03	1,04	1,07	1,16	1,56	1,23	1,17	1,27	1,20
	M2	1,05	1,06	1,10	1,16	1,61	1,23	1,18	1,30	1,22
	M3	1,04	1,03	1,03	1,15	1,48	1,22	1,14	1,25	1,17
White	-	1	1	1	1	1	1	1	1	1

M1: Model 1 - Gross prevalence ratio; M2: Model 2 - Adjusted by gender and age; M3: Model 3 - Additional adjustment by educational level.

Source: Elaborated by the authors.

after adjustment, however, the associations had smaller magnitudes than when comparing blacks to whites. Pushing load and working with arms above shoulder level were 25% and 48% more frequent, respectively, among blacks (Table 5).

## Discussion

The findings are in line with the study hypothesis about racial inequities in occupational exposure. Black workers are subject to higher physical and psychosocial demands at work. Mainly, blacks had a lower degree of control over their work, besides being more subject to high psychological demand – and consequently to high-demand work – when compared to whites. They are also more exposed to anomalous body postures, such as working with arms above shoulder level and squatting, besides performing more load handling. Among the mixed, there have been, in general, associations of smaller magnitudes with the demands at work, when compared to whites.

Therefore, the physical work that imposes higher demands on the body, also designated as heavy physical work, has been destined mainly to blacks, who, moreover, are subject to stressful situations, with a higher time pressure and less autonomy to execute tasks.

Black workers predominated in operational occupations but were much less represented in coordination, supervision, and administrative positions, compared to whites – 3.5% and 20.6%, respectively. Besides, in garbage collection teams, blacks were predominantly collectors rather than urban cleaning drivers. Although the population of this study is relatively homogeneous in terms of low social status, there are differences in the levels of control over the work according to the occupational group, as is the case of urban cleaning drivers – with a higher proportion among whites –, who have a higher degree of control than collectors/cleaners, the latter with a higher proportion among blacks<sup>28</sup>. As for this aspect, a study on the work of garbage collection teams, based on Ergonomic Work Analysis, revealed that drivers led the collection team and were responsible for determining the work pace and making decisions for the team<sup>44</sup>. Therefore, it was observed a level of control among drivers that surpasses that of the collectors.

Meyer et al.<sup>10</sup>, verified the highest scores of the JCQ for psychological demand and the lowest scores for control over work among Black workers, compared to Whites. However, the authors

used fewer JCQ items than this study, making comparison difficult. There is a gap in scientific production about the ethnic distribution of occupational exposures, which limits the discussion of the results obtained based on other evidence.

However, there are findings in the literature that converge with those of the present study, including greater magnitudes of association between race/skin color and psychosocial demand, obtained among nursing professionals<sup>22</sup>. Blacks had twice as much low control and almost three times high-demand work, after adjustment by socio-demographic and occupational variables. When stratifying by performance categories, the frequency of high demand was increased among Black nursing assistants, but there were no disparities by race/skin color among the most qualified professionals.

A study found a higher prevalence of high psychological demand among yellows (54.8%), followed by whites (51.2%), mixed (49.9%), blacks (48.8%) and indigenous (41.8%) and showed that the proportion of high level of control at work was observed in the same order<sup>23</sup>. Therefore, the frequencies of high demand and high control between yellows and whites observed by the authors correspond to active work – the most favorable experience according to the JCD model –, which is related to motivation, the elevation of self-esteem, and development of new skills for work<sup>20</sup>. High psychological demand and low control at work, in turn, more frequent among blacks, configure high-demand work, consistent with our findings. Similarly, other authors<sup>24</sup> found that the high demand was higher among non-Whites (28.1%) when compared with Whites (21.6%).

The means of psychological demand and decision authority found by Thomas et al.<sup>45</sup> through the JCQ were similar among the racial groups studied. Other authors<sup>46</sup> also found no differences in the psychosocial demands at work according to race/skin color, in a study with workers aged 50 years or older, however, these authors did not use the JDCS model or the JCQ, which restricts comparison of results.

The social support coming from supervisors was lower among blacks. It is known that social support coming from supervisors tends to be more protective in the face of work situations with high psychological demand, given the role of supervisors in managing and organizing work<sup>47</sup>. Thus, the low social support of supervisors can contribute to conditions of psychological and physical suffering, including musculoskeletal pain<sup>48</sup>.



On the other hand, the higher social support from coworkers among blacks may indicate greater solidarity among these workers, probably as a strategy to cope with higher exposure to adverse conditions at work. Therefore, social support is also referred to as collective control<sup>22,47</sup>. However, low social support, combining coworkers and supervisor support, predominated among blacks and mixed, compared with whites. In situations where there is high psychological demand, low control to regulate work pace and workload, and low social support, the adoption of breaks during the working day and the relieving of body postures – intended to avoid physical and mental overload – are compromised<sup>47</sup>.

Racial inequities have also been found in physical demand at work, revealing an overlap of disadvantages among Afrodescendant individuals. Work with arms above shoulder level was more frequent among them. This posture reduces the subacromial space in the shoulder and can cause disabling pain<sup>27,30,49,50</sup>. Frequently the arms above shoulder level posture and load handling occur simultaneously<sup>27,49</sup>, as when collectors throw loads into garbage trucks<sup>44,51</sup>.

Cargo handling and squatting, which have been associated with musculoskeletal symptoms<sup>30,31,50</sup>, occurred in greater proportions among Afrodescendants – mixed and blacks – and may be related to tasks performed by urban garbage collectors.

While lifting materials is mainly associated with back pain, tasks involving pushing and pulling are often related to pain in the cervical region and also to shoulder pain<sup>30,50</sup>. By simulating in the laboratory tasks performed by urban garbage collectors, Schibye et al.<sup>26</sup> found increased compressive and shearing forces on the vertebral column when lifting materials and when pushing and pulling containers on two wheels.

High exposure to the handling of materials or to anomalous postures at work was associated with long term absenteeism<sup>52</sup> and a 50% increase in pain at multiple body sites in the previous seven days<sup>33</sup>. This higher morbidity is related to a higher prevalence of limitations to work<sup>33</sup>.

There was a lower proportion of blacks in coordination, supervision, or administrative positions, which generally favor the adoption of diversified body postures and little cargo handling. On the other hand, high exposure of blacks to sustained standing work –which is strenuous– can result in lower back pain and lower limb edema<sup>29</sup>. The requirement of adopting a standing posture to perform tasks is described in the sec-

tors of cutting, assembly, and finishing of footwear manufacturing, sometimes associated with rotation of the trunk<sup>53</sup>.

The higher frequencies of cargo handling and anomalous postures between blacks and mixed raise the discussion about the slavery period, when bodies of Africans and Afrodescendants were used for cargo transportation. Thus, heavy physical work can represent the perpetuation of racism that is made explicit by inequality of exposure at work<sup>6,14</sup>.

In line with the literature<sup>54</sup>, the exposure gradients found among blacks and mixed suggest that individuals with more pronounced Afrodescendant characteristics –such as darker skin tone–, probably self-reported as blacks, are more vulnerable than those with lighter skin colors. These, however, remain at a disadvantage compared to whites. Therefore, the gradients expressed in this study for the prevalence ratios could be higher if it were not for miscegenation, which is characteristic among the studied population, especially in the city of Salvador. At the same time, the narrative of miscegenation as a mechanism of racial democratization has contributed to the concealment of inequities<sup>6</sup>.

The lower educational level among Afrodescendants, observed in the characterization of the study population, is possibly one of the manifestations of structural racism, which includes the naturalization of multigenerational inequities of economic status and reflects the past of slavery, although it is not the exclusive and irreversible consequence of this history<sup>6,14</sup>. A low educational level was found in the studied population. The association between race/skin color and demand at work – physical or psychosocial – was adjusted by the educational level, as can be seen in the analysis models. Adjustments were also made by gender and age. The findings show that black workers, therefore, are destined to jobs that involve higher physical and psychological overload, compared to white workers of the same educational level, gender, and age, ratifying the role of race/skin color in occupational exposure.

This study contributes to the scientific literature by presenting a little-explored approach: the racial inequities in the distribution of exposure to physical and psychosocial demands, which are important modalities of occupational exposure.

In the world of work in the private sector, studying 1,032 workers from the industrial and services sectors performing in-person data collection represents the overcoming of a barrier in terms of the access of researchers to this popula-

tion. Epidemiological studies in Workers' Health have often been restricted to populations of public servants or the general public, in which an attempt is made to specify "occupation" and the contributions of work, with all the limitations of validity that are known in such circumstances. Moreover, the variability in the study population regarding occupations has favored the variability of race/skin color.

The procedures adopted may represent strong points of the study: guaranteeing privacy and confidentiality to collect data in the workplace, considering the possibility of conflicts of interest between workers and employers; the independence of the researchers to companies; and data collection through interviews conducted by researchers affiliated to a public education institution, which made it possible to minimize information bias and increase the response rate. Also, the selection strategy of the participants contributed to reducing the possibility of healthy worker survival bias.

The race/skin color variable may present classification errors and transience over time. Besides, it may convey conceptual inaccuracy, for health studies<sup>17-20</sup>. However, the epidemiological analysis was performed in line with the use of this variable that is recommended in the literature. The methodological decision of excluding yellows and indigenous was justified based on the number of individuals from these ethnic groups in the studied population. However, it is worth

highlighting the gap in the literature regarding occupational exposure in these ethnic groups and the precarious participation of indigenous people, especially in the labor market<sup>9</sup>.

## Conclusion

The race/skin color of workers is a marker of inequities in the world of work, evidenced in this study by the greater exposure to psychosocial and physical demand among blacks and mixed, with a gradient of exposure between them, when compared to whites.

Among black workers, were highlighted the highest exposure to high psychosocial demand, as well as to heavy physical work requiring the adoption of anomalous postures, besides load handling. The mixed workers also presented low control over the work and physical exposure to anomalous postures, mainly.

The evidence presented, added to the available literature, may contribute to the social debate about the repercussions of structural racism in the world of work, as well as to the formulation of antiracist strategies by companies focusing on the restructuring of work environments and processes, aiming at racial equity. Interventions to minimize the exposure of all workers to psychosocial and physical demands and those directed to selection processes and mobility mechanisms in the organization are some possibilities.

## Collaborations

JS Siqueira and RCP Fernandes participated equally in the study design, data analysis and interpretation, writing, critical review of the intellectual content and approval of the final version of the article. They are therefore responsible for all aspects of the work in ensuring the accuracy and completeness of any part of the article.

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Article submitted 05/02/2020

Approved 13/08/2020

Final version submitted 15/08/2020

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Chief editors: Romeu Gomes, Antônio Augusto Moura da Silva