

Did the COVID-19 pandemic influence inequality in self-reported work environment conditions based on gender and place of birth? A study of a Swedish commercial laundromat

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ARTICLE INFO

Keywords:

Hospital laundry service
SARS-CoV-2
Psychosocial factors

ABSTRACT

We evaluated differences in work environment conditions and health by gender and place of birth in a commercial laundromat prior to (baseline) and at the end of the first wave of the COVID-19 pandemic (follow-up). Using survey data, including dimensions from the Copenhagen Psychosocial Questionnaire, from forty-one workers, we assessed work environment conditions and health at baseline, follow-up and in change scores between baseline and follow-up. At baseline, men and women reported similar scores, while foreign-born (FB) workers reported better work environment conditions than Swedish-born (SB) workers. During the pandemic, conditions generally declined for all workers, but FB reported smaller declines than SB. A consistent inequality hierarchy across the 4 groups was not clear at baseline, follow-up or in change scores between time points. The study suggests potential cultural differences may exist in how work environment conditions are experienced. This should be considered in future studies and when managing future crises.

1. Introduction

External factors, outside the control of organizations, including political, economic, sociological, and environmental stressors, can impact work environment conditions (Newton and Bristoll, 2013) and have been shown to negatively affect the psychosocial work environment, work-related stress, stress-related sickness (Houdmont et al., 2012), and self-reported health (Torá et al., 2015). The COVID-19 pandemic was a world-wide external stressor that has been shown to negatively impact work environment conditions (Mohammadi et al., 2022; Sañudo et al., 2020) and, further, has been suggested to increase workplace social inequalities (Amoako and MacEachen, 2021; Blundell et al., 2020).

Labor market segregation in Europe is evident both between men and women, and between foreign-born and domestic-born workers (Eurofound, 2019), meaning that both gender and place of birth can influence a person's occupational position. Even within a given occupation, differential division of tasks has been documented based both on gender (ex (Eng et al., 2011; Gruchmann et al., 2021; Hooftman et al., 2005; Messing et al., 1998; Nordander et al., 2009):) and place of birth, race or

ethnicity (ex (Hoppe, 2011; Hoppe et al., 2010; Jordhus-Lier et al., 2019):). Differences both in occupations and in tasks within an occupation are likely to lead to differences in work environment conditions and ultimately health. Gendered differences in work environment conditions and health to the benefit of men have been clearly documented in non-crisis times (Game et al., 2020), and evidence suggests that the difference increases during periods of crisis, for example during economic recession (Landén et al., 2015). Evidence of gender inequalities resulting from effects of the COVID-19 pandemic have also been reported (Blundell et al., 2020), most notably in negative impacts on women's mental health (Chowdhury et al., 2022). Inequalities may also be present due to place of birth, but this issue has not been systematically investigated to the same extent as gender inequalities. Existing evidence suggests poorer work environment conditions and health for foreign-born workers compared to domestic-born in non-crisis times, including lower workplace decision latitude and social support, and higher rates of poor self-reported health, mental distress and burnout (Dunlavy and Rostila, 2013; Johansson and Vingård, 2012; Jönson and Giertz, 2013; Sundin et al., 2011; Sundquist et al., 2003). Foreign-born

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<https://doi.org/10.1016/j.apergo.2023.104113>

Received 22 February 2023; Received in revised form 9 August 2023; Accepted 10 August 2023

Available online 21 August 2023

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workers are also over-represented in low-skilled and low-paid, jobs in industry, cleaning, transportation, and retail - essential jobs that have been less attractive for domestic-born workers (Eurofound, 2019; Nordic Council of Ministers, 2019). Similar to gender, inequalities due to place of birth have been shown to escalate during times of crisis with foreign-born workers being among the first affected by recession and unemployment (Welfare, 1995) and accepting poorer work environment conditions during recession (International Labour Organisation, 2014).

Findings in a recent review suggest a hierarchy of inequalities based on intersections between gender and race/ethnicity, whereby racialized and (im)migrant women are positioned at the bottom of the hierarchy, indicating they experience the worst working conditions and health (Rydström et al., 2023). While the literature generally supports the positioning of domestic-born men at the top of the hierarchy, it is unclear whether a consistent ranking in working conditions and health of the two remaining groups (i.e., domestic-born women and foreign-born men) exists. Further, it is unknown how such a hierarchy might develop during crisis times.

During the COVID-19 pandemic, mobility restrictions and lockdowns adopted as a mean to slow down the transmission of the SARS-CoV-2 virus (Nussbaumer-Streit et al., 2020) led to considerable focus on essential workers. Even during lockdowns, the (often foreign-born) essential workers continued working on-site at their jobs to maintain economic and social infrastructure. While healthcare providers have been widely acknowledged both in scientific and grey media, much less attention has been paid to essential workers outside of healthcare, and consequences of the pandemic in the context of inequality based on gender, place of birth or the intersection of these factors have rarely been considered (Chowdhury et al., 2022; The Lancet, 2020).

Commercial laundromat workers are a specific example of non-healthcare workers that were essential during the COVID-19 pandemic for providing clean and sterile textile goods to hospitals (Owen and Laird, 2020). Laundromat workers were exposed not only to increased risk from person-to-person transmission of the virus since they were required to work on-site and be in close proximity with colleagues (Goldenfeld et al., 2022), but were also tasked with washing goods that had been in contact with patients hospitalized with COVID-19. Research from before the COVID-19 pandemic showed potential risk for pathogen contamination when handling infected textiles (Borg and Portelli, 1999). Despite laundromat workers being an important group from a societal perspective, few studies, to our knowledge, have addressed their psychosocial (IJzelenberg et al., 2004; Olesen et al., 2012b, 2012a) or physical (Brabant et al., 1989; IJzelenberg et al., 2004; Sacouche et al., 2012; Wands and Yassi, 1993) work environment conditions and health. We found only one study on work environment issues specifically among hospital laundry workers (Mohammadi et al., 2022). The study reported increased anxiety in both men and women due to the perceived risk of COVID-19 contamination from the laundry goods.

Building on an on-going collaboration with a Swedish commercial laundromat (Jackson et al., 2023), we performed a case study to assess the extent to which inequalities were present in the work environment and in health between males and females, and between Swedish- and foreign-born workers before and during the first wave of the COVID-19 pandemic. We believe that the effects of the pandemic on work environment conditions in the laundromat may be representative of other external stressors on organizations, and of other sectors with diverse work forces performing blue collar jobs. Thus, the study may contribute to understanding how the work environment is affected by a large, external, organizational-level crisis, and the extent to which inequalities change during the crisis.

2. Methods

2.1. Setting and study population

This study was part of an ongoing job rotation intervention project at a Swedish commercial laundromat. The facility is divided into two sides: one for receiving, sorting, and washing dirty laundry; the other for drying, folding, and packing customer orders for hotels, restaurants, and hospitals, including linens, worker uniforms and clothing for patients. In sorting and packing, many employees perform repetitive, often short cycle, manual materials handling tasks with minimal automation. The laundromat collaborates with the municipal labor market to provide workplace opportunities to new immigrants as well as applicants facing challenges to enter or re-enter the labor market. They also strive for organizational measures to promote and encourage equality and a good work environment for all workers.

The production workforce at the laundromat was culturally diverse, and at the time of the study an estimated 11 native languages were represented among the production workers. The employee population was approximately 50% women, 50% men, and 50% foreign-born (FB), 50% Swedish-born (SB).

The data used in this study were collected within an intervention study using a within-subject study design with repeated measurements before (baseline) and at the end of the first wave of the COVID-19 pandemic (follow-up). Initially, all permanent and long-term contract production workers were invited to participate in a scientific study which began prior to the onset of the pandemic (baseline, November 2019) to evaluate the effects of a job rotation intervention. The first wave of the COVID-19 pandemic in Sweden spanned from March to September 2020 and paused the intervention study. Instead, all permanent and long-term contract production workers were invited to participate in measurements at the end of the first wave of the pandemic, i.e., in September 2020, and data from this follow-up collection are presented in the present paper for the 'matched group' of workers for whom we had survey data at both time points.

The study was approved by the Swedish Ethical Review Authority (reference number 2019-00228); all procedures followed the Declaration of Helsinki and all individual participants received and signed an informed consent.

2.2. Survey

A custom survey was created to capture information specific to the commercial laundromat environment. The survey included both previously validated questionnaires and modules used in our research group to assess other occupational groups (e.g. (Bergsten et al., 2015)). The survey included questions on personal and demographic parameters (including age, height and weight to measure the body mass index [BMI] in kg/m²), employment characteristics, and work environment conditions, including most modules of the second version of the Copenhagen Psychosocial Questionnaire (COPSOQ-II) (Pejtersen et al., 2010b), as described below.

Workers filled in a paper copy of the survey during paid working hours. Considering the large variation in language proficiency and educational level across workers, substantial efforts were made to assist with survey comprehension. First, we simplified the survey language to the extent possible (validated scales were not revised) and a color bar, ranging from green ('positive') to red ('negative'), was added where appropriate to help participants understand response options. Color bar codes were explained to all workers prior to answering the survey. Before the baseline survey, the 20 workers identified by management as having the lowest language proficiency were offered language training during working hours with a certified language teacher. The survey was used as a learning material for four 1-h sessions, and the teacher read each question and explained the different types of response options (e.g., visual-analogue scales and multiple choice). Times were scheduled for

survey response in small groups of workers (10–12 at baseline, 4–6 at follow-up), and workers sharing a native language were scheduled together to the extent possible. A researcher was physically present in the room to offer help in responding to the survey. If the group preferred to have a question read aloud, the researcher did so.

2.3. Copenhagen Psychosocial Questionnaire – COPSOQ-II

COPSOQ-II is a reliable, valid, and standardized method to evaluate occupational physical and psychosocial work environment conditions and health, which has been used in many occupational settings (Burr et al., 2019; Pejtersen et al., 2010b). In this study, we evaluated work environment conditions using five dimensions (*demands at work, work organization and job content, interpersonal relations and leadership, work individual interface, values at workplace*) and we evaluated health using one dimension (*health and wellbeing*). We eliminated questions (items) from each dimension that were not central to the study aim or relevant at the laundromat. This resulted in a combination of short and long COPSOQ-II scales (see column ‘version’ in Table S1). Scores were calculated according to COPSOQ-II guidelines.

2.4. Work tasks

The tasks performed at the laundromat were divided into three groups based on the amount of on-the-job training required to learn each task. Low-training tasks, such as sorting dirty laundry, putting clothes on hangers, and placing sheets and towels into drying and folding machines could generally be learned within a few days. Mid-training tasks, such as managing the drying process, repairing clothes, and packing clean goods for customer orders required months of training and learning. High-training tasks, such as planning the flow of operations required years of training and learning and a high language proficiency. All workers had been trained in a base set of seven low-training tasks prior to this study, and all had been given a group of tasks through which they rotated. Data on the task type performed by individual workers were based on company data prior to the pandemic, and on self-report at follow-up.

2.5. Statistical analysis

Analysis was performed both for the whole group and stratified into four sub-groups based on gender and place of birth to assess differences between the groups (Swedish-born men - SB ♂, Swedish-born women - SB ♀, foreign-born men - FB ♂, foreign-born women - FB ♀). Average and standard deviation (SD) were computed for each scale at baseline, at follow-up, and for the change scores between the two time points.

To understand whether differences between groups were meaningful, we calculated the minimum clinically important difference (MCID) for each COPSOQ-II scale following the method described by Pejtersen et al. (2010a) on the data collected at baseline. Using the method, the magnitude of the MCID was $0.5 \times SD$ for all scales, except *quantitative demands, predictability, and social support from colleagues* for which MCID was 0.3 SD; and *influence, social support from supervisor and job satisfaction* for which the MCIDs were 0.2 SD, 0.7 SD and 0.4 SD, respectively.

As a complement to the MCIDs, a two-way analysis of variance (ANOVA) analysis was performed on baseline and follow-up data to evaluate whether differences based on gender and/or place of birth and the interactions were significant. Gender, place of birth, and their interaction were treated as predictor variables and COPSOQ-II scale scores as continuous outcome variables. We then considered the differences [Δ] between groups in the change scores between time points (follow-up minus baseline) as continuous outcome variables to assess the extent to which the effects of the first wave of the pandemic on work environment conditions and health differed based on gender and/or place of birth.

In case of a significant interaction between gender and place of birth ($p \leq 0.05$), we ran post-hoc pairwise comparisons between the four groups (SB♂, SB♀, FB♂, FB♀) using least significant difference tests (LSD). All analyses were conducted in SPSS (Statistical Package for Social Science, v. 27, IBM Corp, Armonk, NY, USA).

3. Results

At baseline, survey data were obtained from 62 workers, representing a response rate of 97% of all blue-collar workers in the company. In this total company population, 60% of the respondents were men, and there were equal proportions of Swedish- and foreign-born workers – Table 1, last column. Of these 62 workers, 42 also answered the survey at follow-up. One of the respondents preferred not to use a male/female distinction and given the importance of gender in our analyses, this participant was excluded from further analysis. The resulting study population ($N = 41$) comprised 51% men and, again, equal proportions of Swedish- and foreign-born workers – Table 1, first column. Participant characteristics of both the study population and the total laundromat population (Table 1) suggest the two populations to be similarly composed in terms of gender, country of birth, mean age, mean BMI, years employed and proportion of workers performing each type of task.

Descriptive data for the study population stratified by gender and place of birth (SB♂, SB♀, FB♂, FB♀) are also presented in Table 1. Significant differences were found among the four groups based on age and number of years employed ($p < 0.01$). Female participants were, on average, older than male participants, and Swedish women had worked significantly longer at the laundromat than any of the other groups. There was a tendency for FB workers to occupy lower-training positions and SB workers to occupy higher-training positions.

Table 1 also shows work tasks performed prior to the pandemic, distributed in groups according to training requirements. Self-reported data at follow-up showed individual workers performed the same type of task as prior to the pandemic (not shown in Table 1).

COPSOQ-II scale scores at baseline are presented for the study population (first column) and the total laundromat population (last column) in Table 2. For all dimensions the difference between the two groups was below the MCID calculated and reported in the table, and thus the study population proved representative of the total laundromat population.

COPSOQ scores stratified by gender and place of birth are also presented in Table 2 and detailed graphically in Fig. 1 together with the MCID for each dimension to aid in the interpretation of differences between groups and changes over time in work environment conditions and health.

3.1. Work environment conditions and health prior to the pandemic

At baseline, we did not find consistent evidence for an inequality hierarchy since the interaction between gender and place of birth was insignificant for all scales assessing work environment conditions and health (Table 3 – interaction column). Only a small and borderline significant interaction between gender and place of birth was suggested for *recognition* ($F = 3.6$; $p = 0.06$, $\eta_p^2 = 0.09$) where FB♂ reported the best *recognition*, followed by FB♀, then SB♀, and finally SB♂ (Table 2, Fig. 1).

At baseline, there were few main effects of gender on work environment conditions and no gender effect on self-reported health. A meaningful and significant main effect of gender was only evident in *quantitative demands*, where men reported higher demands than women (Table 3). Women reported higher *emotional demands* than men and the difference even exceeded the MCID, but it was only borderline significant ($p = 0.07$). Finally, men reported a significantly higher *social inclusiveness* score than women ($p = 0.05$), however the magnitude of the difference was just below the MCID.

At baseline, we found clear main effects of place of birth on work environment conditions and health. FB workers reported better work environment conditions than SB workers in terms of meaningful

Table 1

Descriptive data for the study population, i.e. workers with both baseline and follow-up measurements ($n = 41$), as well as for the total laundromat population ($N = 62$). Data for the study population are shown both at the group level and stratified by gender and place of birth, i.e., Swedish-born men - SB δ , Swedish-born women - SB φ , Foreign-born men - FB δ , Foreign-born women - FB φ .

	Study population (N = 41)	Study population stratified by group				Total laundromat population (N = 62)
		SB δ (N = 9)	SB φ (N = 11)	FB δ (N = 12)	FB φ (N = 9)	
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
# employees	δ : 21(51%) φ : 20(49%) SB: 20(49%) FB: 21 (51%)	9 (22%)*	11 (27%)*	12 (29%)*	9 (22%)*	δ : 37(60%) φ : 25(40%) SB: 31(50%) FB: 31(50%)
Single	17 (42%)	4 (44%)	5 (42%)	5 (42%)	3 (38%)	24 (39%)
Relationship	3 (7%)	1 (11%)	0 (0%)	2 (17%)	0 (0%)	3 (5%)
Married/living together	21 (51%)	4 (44%)	7 (58%)	5 (42%)	5 (63%)	35 (57%)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Age (yrs)	42.1 (11.5)	34.9 (11.4)	49.7 (11.1)	37.1 (9.4)	46.1 (6.3)	41.3 (11.9)
BMI (kg/m ²)	25.5 (4.5)	26.2 (5.4)	26.1 (4.9)	23.6 (4.1)	25.9 (3.6)	25.3 (4.6)
Children at home	0.34 (0.62)	0.00 (0.00)	0.58 (0.90)	0.33 (0.49)	0.34 (0.62)	0.48 (0.80)
Seniority (yrs)	10.1 (11.1)	5.2 (4.2)	20.8 (14.7)	5.1 (4.9)	7.8 (7.7)	9.0 (10.5)
Workers per task type	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Low-training	23 (56%)	3 (33%)	5 (46%)	8 (67%)	7 (78%)	33 (53%)
Mid-training	11 (27%)	2 (22%)	4 (36%)	3 (25%)	2 (22%)	19 (31%)
High-training	7 (17%)	4 (44%)	2 (18%)	1 (8%)	0 (0%)	10 (16%)

δ : men φ : women; SB: Swedish-born. FB: foreign-born. *N and percentages of study population group.

differences and significantly better scores for: *meaning of work, commitment to the workplace, predictability, role clarity, social support from supervisors, recognition, job satisfaction, trust regarding management, mutual trust between employees, justice, social inclusiveness, and general health* (Table 3). For *commitment to the workplace, predictability, recognition, job satisfaction, justice, and social inclusiveness*, the mean difference between FB and SB workers was twice as large as the MCID.

3.2. Work environment conditions and health at follow-up, and changes related to the first wave of the pandemic

In general, a decline in work environment conditions and health between baseline and follow-up was seen for the total study population, including clinically meaningful declines in *influence* [follow-up minus baseline, $\Delta = -6.1$ points], *predictability* [$\Delta = -10.5$ points], *job satisfaction* [$\Delta = -10.5$ points], *work-family conflict* [$\Delta = 15.3$ points], *stress* [$\Delta = 14.4$ points] and *sleeping troubles* [$\Delta = 19.9$ points] (Table 2).

At follow-up the only significant interaction between gender and place of birth was for *emotional demands* ($F = 4.0$; $p = 0.05$, $\eta_p^2 = 0.10$; Table 4), with SB φ reporting the most strenuous emotional demands, followed by SB δ , FB δ , and then FB φ (Table 2, Fig. 1). Thus, we did not find consistent evidence for an inequality hierarchy at follow-up. Given that differences in work environment conditions and health between groups were already present at baseline (c.f. Tables 2 and 3), we assessed the effect of the pandemic by assessing differences in COPSOQ-II change scores between baseline and follow-up. The change score analyses (Table S2) showed that, when taking differences already present at baseline into consideration, significant interactions between gender and place of birth occurred during the first wave of the pandemic for *burnout* and *sleeping troubles* (Table S2). For both factors, SB φ reported the most marked decline between baseline and follow-up, while FB φ reported little or no change (Fig. 1).

At follow-up, we found some evidence of gender differences in demands at work, however the difference between men and women was in *work pace* (Table 4) and not in *quantitative demands* as seen at baseline. Change score analyses (Table S2) showed a significant gender difference in *work pace* changes over the first wave of the pandemic: men reported a decrease and women an increase in *work pace* (Fig. 1, Table 2). A

meaningful and significant gender difference in *mutual trust between employees* had also developed by follow up (Table 4), with women having lower trust scores than men, although the change score analysis (Table S2) did not show any significant gender effect.

Many of the main effects found at baseline related to place of birth remained at follow-up, including meaningfully and significantly better scores for FB than SB workers in *meaning of work, commitment to the workplace, predictability, social support from supervisors, recognition, job satisfaction, trust regarding management, mutual trust between employees, justice, social inclusiveness, and general health*. At follow-up, FB workers also reported better scores for *quantitative demands* (reversed score), *emotional demands* (reversed score), *variation, social support from colleagues* (reversed score), *work-family conflict* (reversed score), *stress* (reversed score), and *burnout* (reversed score) (Table 4). Change score analyses (Table S2) revealed that most of the differences at follow-up occurred due to differences between FB and SB workers that were already present at baseline. Thus, change score differences were, in general, not meaningfully and significantly different. The only exceptions were for *quantitative demands, emotional demands, and social support from colleagues* (Table S2) where FB workers reported better scores at follow-up than baseline, while SB workers reported a decline in conditions compared to baseline (Fig. 1).

4. Discussion

Our study evaluated the extent to which differences in self-reported work environment conditions and health based on gender and place of birth were evident in commercial laundromat workers, before the COVID-19 pandemic, at the end of the first wave of the pandemic, and in the changes that occurred over the first wave of the pandemic. Prior to the pandemic, there were few gender differences in this population, although men reported higher quantitative demands. More pronounced differences were found based on place of birth with foreign-born workers generally reporting better work environment conditions than Swedish-born workers. By the end of the first wave of the COVID-19 pandemic, work environment conditions and health had generally declined for all workers. Similar to baseline, we found few differences between men and women, although there was again some evidence of

Table 2

Mean (standard deviation) values for each COPSOQ-II scale at baseline and at the end of the first wave of the COVID-19 pandemic (follow-up) for the total study population (N = 41), the study population stratified by gender and place of birth, and the total laundromat population (N = 62). Minimum clinically important differences (MCID) were calculated from baseline data.

	MCID	Baseline					Follow-up					Baseline Laundromat population (N = 62)
		Study population (N = 41)	SB♂ (N = 9)	SB♀ (N = 12)	FB♂ (N = 12)	FB♀ (N = 8)	Study population (N = 41)	SB♂ (N = 9)	SB♀ (N = 12)	FB♂ (N = 12)	FB♀ (N = 8)	
Demands at work												
Quantitative demands	6.5	36.3 (21.7)	44.4 (22.6)	30.7 (12.9)	41.7 (25.2)	26.6 (22.6)	40.3 (23.4)	51.4 (25.3)	46.6 (23.1)	36.5 (19.6)	25.0 (21.1)	38.1 (25.5)
Work pace	11.2	65.5 (22.5)	75.0 (17.7)	65.6 (15.2)	56.3 (27.4)	68.8 (26.7)	70.4 (24.7)	70.8 (21.7)	82.5 (10.5)	53.4 (33.1)	78.1 (16.0)	64.5 (23.7)
Emotional demands	11.9	34.4 (23.8)	29.2 (16.5)	45.5 (23.9)	26.0 (25.8)	37.5 (25.0)	38.8 (22.9)	37.5 (19.8)	59.1 (21.0)	28.4 (19.4)	26.6 (15.6)	30.7 (22.3)
Work organization and job content												
Influence	4.6	46.9 (22.9)	37.5 (19.3)	52.5 (15.8)	46.7 (30.7)	50.0 (22.2)	40.7 (24.7)	36.8 (20.4)	33.5 (22.6)	52.1 (30.9)	38.0 (19.0)	49.5 (23.0)
Variation	13.8	75.0 (27.6)	61.1 (25.3)	77.3 (23.6)	82.5 (26.5)	78.6 (36.6)	76.9 (24.3)	69.4 (24.3)	68.2 (25.2)	83.3 (24.6)	87.5 (18.9)	70.2 (30.0)
Meaning of Work	7.5	83.9 (15.1)	72.2 (16.7)	86.8 (11.5)	87.5 (17.6)	87.5 (7.7)	77.8 (23.4)	61.1 (28.6)	76.5 (25.2)	85.6 (16.3)	87.5 (14.1)	80.7 (19.9)
Commitment to the workplace	11.4	72.1 (22.7)	51.9 (30.0)	71.2 (15.2)	80.6 (18.9)	83.3 (14.1)	66.6 (27.2)	51.9 (30.0)	56.4 (21.2)	77.1 (27.3)	81.3 (20.3)	70.6 (27.7)
Interpersonal relations and leadership												
Predictability	6.8	66.5 (22.6)	45.8 (19.8)	55.2 (12.5)	84.4 (18.6)	79.7 (13.3)	55.9 (29.2)	40.3 (25.6)	36.3 (20.8)	70.5 (26.4)	78.1 (20.9)	72.8 (20.9)
Role clarity	7.8	84.2 (15.6)	74.1 (16.4)	81.3 (13.4)	90.6 (16.9)	90.6 (9.4)	78.5 (19.0)	71.3 (17.7)	74.2 (23.4)	84.1 (18.4)	84.4 (13.7)	83.7 (15.0)
Social support from supervisors	14.8	70.0 (21.2)	56.5 (26.6)	63.9 (19.2)	81.3 (15.9)	78.6 (11.6)	68.9 (26.5)	44.8 (28.5)	63.3 (28.4)	84.1 (18.0)	79.2 (10.0)	68.7 (21.4)
Social support from colleagues	5.5	71.9 (18.2)	71.3 (16.2)	66.7 (16.2)	74.3 (23.7)	76.0 (14.4)	70.5 (20.8)	59.3 (16.9)	57.5 (23.7)	82.6 (14.0)	81.3 (13.9)	70.4 (19.6)
Recognition	9.9	75.8 (19.9)	57.4 (25.8)	69.4 (11.4)	91.0 (13.0)	83.3 (7.7)	66.7 (26.0)	50.0 (30.3)	54.5 (20.2)	81.1 (20.8)	82.3 (15.1)	72.6 (23.0)
Social community at work	7.2	82.1 (14.4)	79.6 (12.6)	79.5 (15.1)	86.8 (17.6)	81.3 (10.7)	77.1 (17.4)	75.9 (15.3)	68.9 (17.1)	85.4 (15.5)	77.1 (19.8)	82.5 (14.8)
Work individual interface												
Job satisfaction	7.3	71.9 (18.1)	54.9 (21.1)	69.8 (11.9)	80.7 (16.1)	82.1 (9.1)	61.4 (19.7)	48.1 (13.0)	53.3 (21.2)	69.7 (18.0)	75.0 (13.4)	68.9 (21.2)
Work-family conflict	13.3	26.8 (26.6)	37.0 (26.1)	29.2 (30.3)	18.1 (26.1)	25.0 (21.8)	42.1 (34.4)	48.1 (29.4)	63.3 (39.9)	30.3 (34.8)	25.0 (15.4)	29.8 (30.0)
Values at workplace												
Trust regarding management	9.4	69.8 (18.8)	60.4 (22.5)	67.0 (15.1)	76.0 (19.9)	76.2 (14.2)	67.8 (22.9)	52.8 (24.0)	61.9 (21.9)	75.0 (20.2)	82.0 (16.2)	69.3 (18.2)
Mutual trust between employees	10.2	67.5 (20.4)	63.9 (17.2)	58.3 (16.3)	75.7 (25.0)	73.8 (17.6)	64.5 (19.8)	69.4 (16.7)	47.5 (14.2)	72.7 (20.8)	68.8 (17.7)	67.2 (20.3)
Justice	9.8	69.3 (19.5)	54.2 (23.4)	62.3 (11.8)	82.8 (17.5)	77.7 (6.9)	60.5 (24.6)	48.6 (27.6)	43.8 (14.7)	76.1 (21.3)	73.4 (15.6)	67.6 (21.0)
Social inclusiveness	10.6	76.6 (21.2)	66.7 (17.7)	61.5 (16.4)	95.8 (8.1)	82.1 (22.7)	72.7 (23.8)	65.6 (17.4)	62.5 (25.0)	86.4 (17.2)	75.0 (29.1)	76.4 (20.2)
Health and wellbeing												
General health perception	14.3	62.8 (28.6)	50.0 (30.6)	56.3 (21.7)	77.1 (22.5)	66.7 (40.8)	55.9 (26.9)	50.0 (25.0)	43.2 (27.6)	62.5 (27.0)	71.9 (20.9)	62.4 (27.1)
Stress	11.7	28.9 (23.3)	36.8 (14.5)	31.3 (24.7)	21.0 (24.4)	28.3 (28.6)	43.3 (23.6)	52.8 (19.5)	52.3 (18.4)	35.2 (26.1)	31.3 (25.0)	29.1 (26.4)
Burnout	11.1	31.9 (22.3)	41.7 (24.0)	32.3 (20.4)	26.0 (24.3)	28.9 (20.0)	40.1 (25.4)	43.1 (24.3)	58.8 (20.5)	31.8 (28.2)	25.0 (13.4)	33.9 (25.5)
Sleeping troubles	11.4	25.6 (22.7)	38.9 (18.7)	24.5 (24.8)	17.2 (15.8)	25.0 (29.1)	45.5 (26.8)	44.4 (20.8)	56.8 (31.8)	47.7 (20.8)	28.1 (28.1)	29.1 (26.4)

SB: Swedish-born. FB: foreign-born. ♂: men ♀: women.

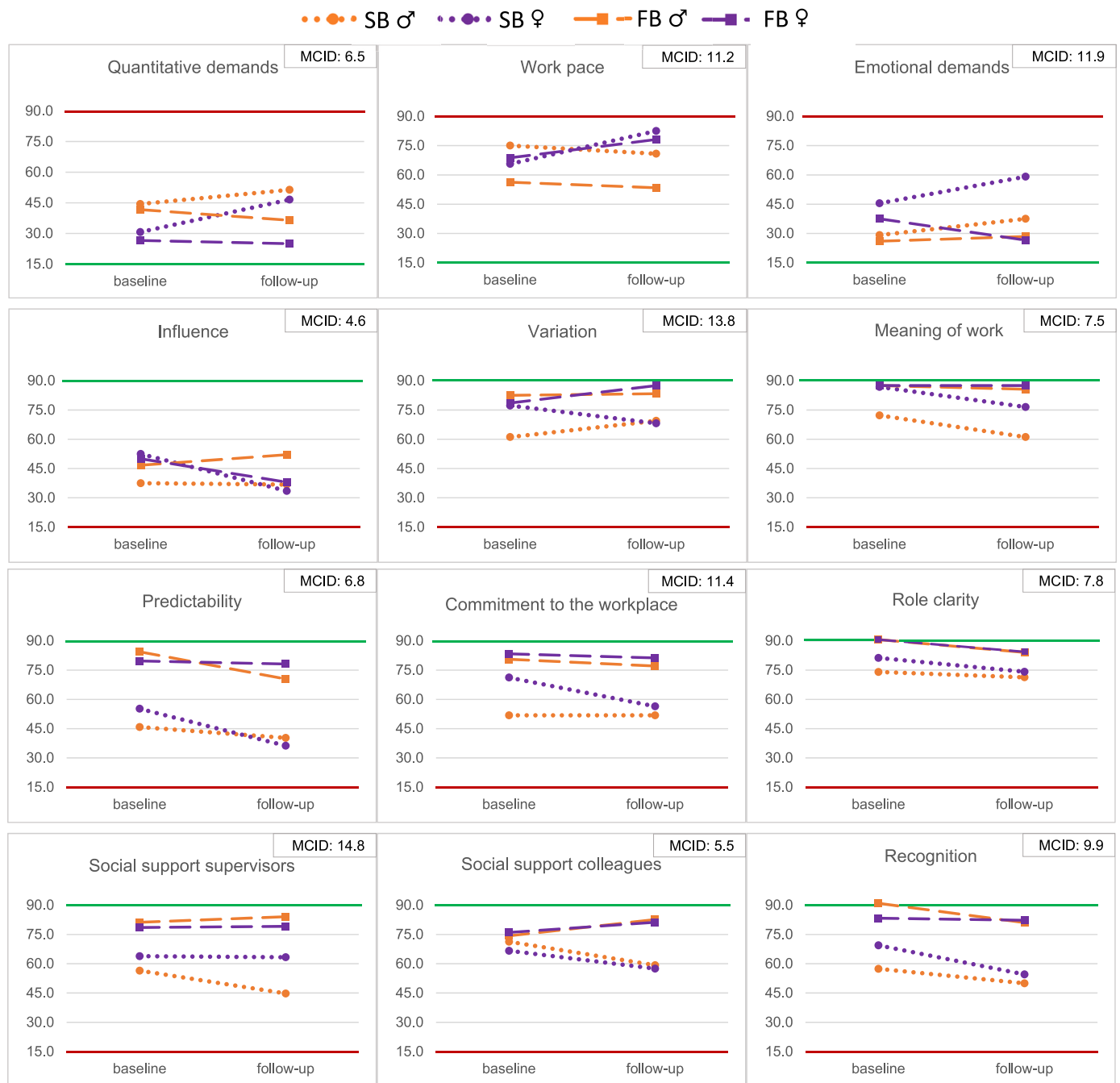


Fig. 1. Mean scores for COPSOQ-II scales prior to the pandemic (baseline) and at the end of the first wave of the COVID-19 pandemic (follow-up). Orange and purple lines represent men (σ) and women (ρ), respectively; dotted and dashed lines represent Swedish-born (SB) and foreign-born (FB) workers, respectively. Green (positive) and red (negative) horizontal lines show whether differences in COPSOQ-II scores (between groups or over time) are representative of better/worse work environment conditions. MCID: minimum clinically important difference. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

differences in the demands at work with women reporting a higher *work pace*. Scales that differed by place of birth at baseline generally remained different at follow-up and change score analyses showed that this was primarily due to the already existing differences at baseline. Differences between SB and FB groups in self-reported COPSOQ-II scores may represent actual differences in work environment conditions or they may reflect differences in how the two groups interpreted the COPSOQ-II questions, and how inclined they were to report negative aspects of their work environment, including how the conditions related to

previous (work) experiences. By considering change scores between baseline and follow-up, we were able to assess the extent to which different groups of workers experienced changes in work environment conditions to the same extent during the pandemic. We did not find evidence of an inequality hierarchy at baseline, at follow-up or in change scores over the first wave of the pandemic.

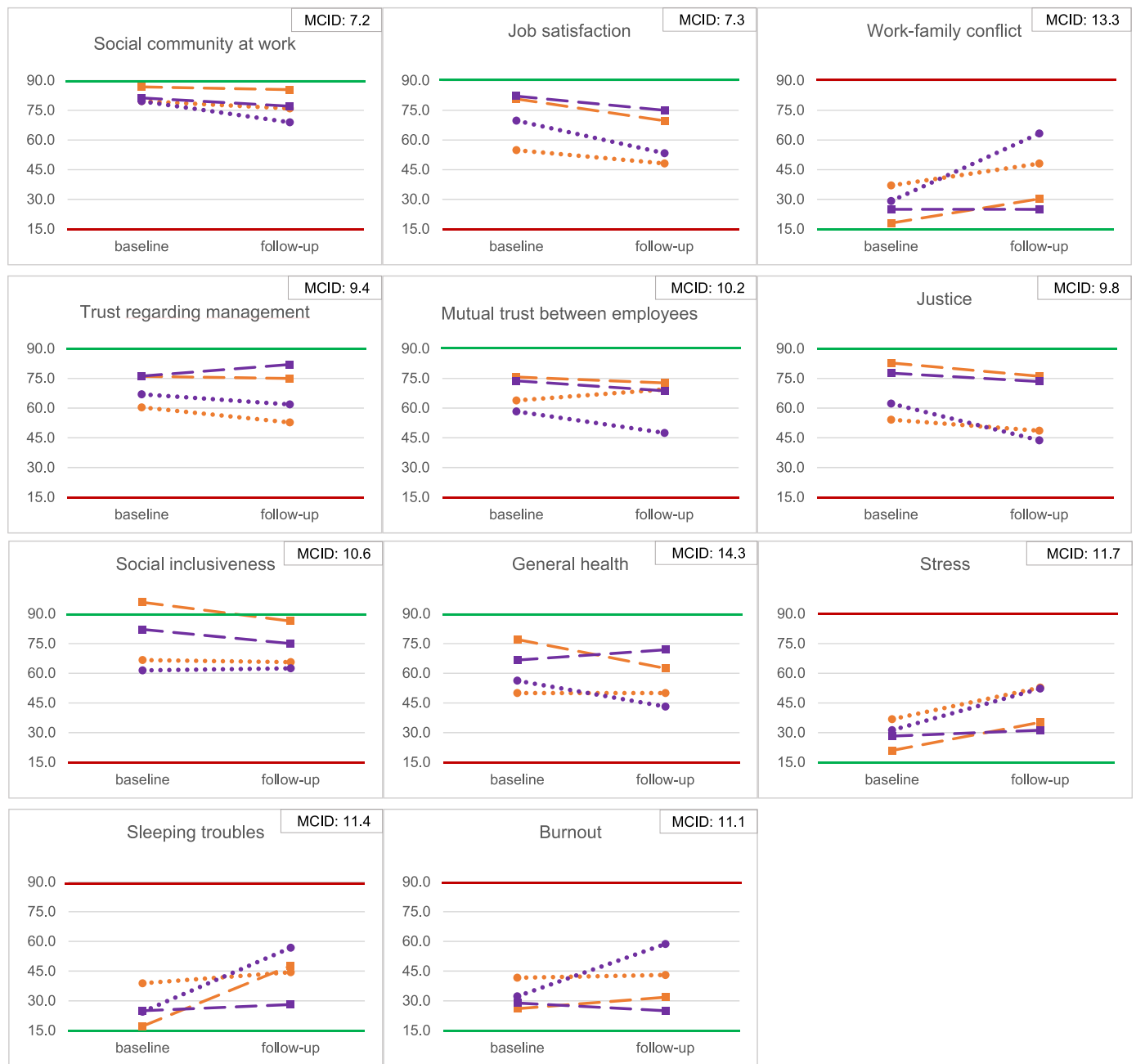


Fig. 1. (continued).

4.1. Work environment conditions and health prior to the pandemic

By assessing work environment conditions and health of commercial laundromat workers before the pandemic, we were able to evaluate aspects of inequality in ‘normal’ times. Previous literature has established that gender inequalities are present in the work environment, with women reporting higher demands, lower social support, higher effort–reward imbalance and higher job insecurity than men (Johannessen and Sterud, 2017; Sterud, 2014). Contrary to this, we could not confirm clear gender inequalities prior to the pandemic in our population; we only found a gender difference in demands at work (specifically *quantitative demands* and *emotional demands*).

It is possible that gender differences in prior studies may, to a considerable extent, be a consequence of the gender-segregated labor market (Sterud, 2014), while our results deal with workers within the same organization. Consistent with our results, another Swedish study

on men and women performing identical tasks in an industrial company did not find gender differences in work environment conditions (Persson et al., 2009). The company we studied also has policies and work arrangements that prioritize gender equality in the division of labor, and the lack of a gender difference at baseline may indicate the extent of their success.

On the other hand, clear differences were found at baseline based on place of birth. Contrary to previous literature (Dunlavy and Rostila, 2013; Jönson and Giertz, 2013; Sundin et al., 2011; Sundquist et al., 2003), our population of FB workers reported better work environment conditions and health than their SB co-workers, both at baseline and follow-up. Again, we believe that the divergence between the literature and our own findings may be a result of labor market segregation contaminating previous results. Even a systematic review of studies, mainly evaluating the general work population, suggested that FB workers generally report worse psychosocial work environment

Table 3

Mean differences (MD) and ANOVA test results for COPSOQ-II dimension scores at baseline by gender (MD = men - women) and place of birth (MD = Swedish-born [SB] - foreign-born [FB]). Right-most set of columns: interaction between gender and place of birth.

	Gender (♂ - ♀)				Place of birth (SB - FB)				Interaction		
	MD	F	p	η_p^2	MD	F	p	η_p^2	F	p	η_p^2
Demands at work											
Quantitative demands	14.4	4.48	0.04*	0.11	3.4	0.26	0.62	<0.01	0.01	0.92	<0.01
Work pace	-1.4	0.04	0.85	<0.01	8.3	1.40	0.24	0.04	2.22	0.14	0.06
Emotional demands	-13.9	3.44	0.07	0.09	5.5	0.55	0.46	0.01	0.10	0.75	<0.01
Work organization and job content											
Influence	-9.1	1.52	0.23	0.04	-3.4	0.21	0.65	<0.01	0.62	0.44	0.02
Variation	-6.1	0.44	0.51	0.01	-11.3	1.52	0.23	0.04	1.19	0.28	0.03
Meaning of Work	-7.4	2.74	0.11	0.07	-9.3	4.32	0.04*	0.10	1.80	0.19	0.05
Commitment to the workplace	-10.5	2.80	0.10	0.07	-21.4	11.56	<0.01*	0.24	1.34	0.25	0.03
Interpersonal relations and leadership											
Predictability	-1.2	0.05	0.81	<0.01	-32.1	40.86	<0.01*	0.52	1.61	0.21	0.04
Role clarity	-3.3	0.52	0.47	0.01	-14.3	10.16	<0.01*	0.21	0.24	0.62	<0.01
Social support from supervisors	-1.4	0.05	0.83	<0.01	-18.2	8.51	<0.01*	0.19	1.10	0.30	0.03
Social support from colleagues	1.4	0.06	0.81	<0.01	-6.2	1.08	0.30	0.03	0.28	0.59	<0.01
Recognition	-1.6	0.10	0.75	<0.01	-24.4	25.03	<0.01*	0.40	3.57	0.06	0.09
Social community at work	2.8	0.36	0.55	0.01	-4.4	0.89	0.35	0.02	0.34	0.56	<0.01
Work individual interface											
Job satisfaction	-7.8	2.68	0.11	0.07	-20.9	19.82	<0.01*	0.35	1.07	0.30	0.03
Work-family conflict	0.4	<0.01	0.96	<0.01	12.6	2.26	0.14	0.06	0.58	0.45	0.01
Values at workplace											
Trust regarding management	-3.0	0.27	0.60	<0.01	-13.4	5.25	0.03*	0.13	0.15	0.70	<0.01
Mutual trust between employees	4.4	0.49	0.49	0.01	-14.5	5.36	0.03*	0.13	0.18	0.67	<0.01
Justice	-0.8	0.02	0.88	<0.01	-22.4	18.74	<0.01*	0.34	1.45	0.24	0.04
Social inclusiveness	10.5	4.26	0.05*	0.11	-25.1	24.25	<0.01*	0.40	0.64	0.43	0.02
Health and well being											
General health perception	1.7	0.04	0.85	<0.01	-23.1	6.87	0.01*	0.16	0.20	0.65	<0.01
Stress	-0.6	<0.01	0.93	<0.01	11.9	2.54	0.12	0.07	0.27	0.60	<0.01
Burnout	3.4	0.24	0.63	<0.01	12.6	3.27	0.08	0.08	0.19	0.66	<0.01
Sleeping troubles	3.5	0.25	0.62	0.01	12.5	3.12	0.08	0.08	1.75	0.19	0.04

♂: men. ♀: women. PoB: place of birth. SB: Swedish-born. FB: foreign-born. η_p^2 : partial eta squared. Bold values show values surpassing the minimum clinically important difference. The * show significant differences [p ≤ 0.05].

Table 4

Mean differences (MD) and ANOVA test results for COPSOQ-II dimension scores at follow-up by gender (MD = men - women) and place of birth (MD = Swedish-born [SB] - foreign-born [FB]). Right-most set of columns: interaction between gender and place of birth.

	Gender (♂ - ♀)				Place of birth (SB - FB)				Interaction		
	MD	F	p	η_p^2	MD	F	p	η_p^2	F	p	η_p^2
Demands at work											
Quantitative demands	8.1	1.30	0.26	0.03	18.3	6.57	0.01*	0.15	0.22	0.64	0.01
Work pace	-18.2	6.02	0.02*	0.15	10.9	2.16	0.15	0.06	0.77	0.39	0.02
Emotional demands	-11.6	3.59	0.07	0.09	21.3*	12.18	<0.01*	0.26	4.00	0.05*	0.10
Work organization and job content											
Influence	9.1	1.37	0.25	0.04	-6.1	0.62	0.44	0.02	1.39	0.25	0.04
Variation	-1.5	0.04	0.85	<0.01	-16.6	4.78	0.04*	0.12	0.13	0.72	<0.01
Meaning of Work	-8.6	1.48	0.23	0.04	-17.7	6.23	0.02*	0.15	0.90	0.35	0.03
Commitment to the workplace	-4.4	0.30	0.59	0.01	-25.0	9.65	<0.01*	0.21	0.00	0.98	<0.01
Interpersonal relations and leadership											
Predictability	-1.8	0.06	0.82	<0.01	-36.0	21.60	<0.01*	0.39	0.57	0.46	0.02
Role clarity	-1.6	0.07	0.80	<0.01	-11.5	3.47	0.07	0.09	0.04	0.84	<0.01
Social support from supervisors	-6.8	0.82	0.37	0.02	-27.6	13.47	<0.01*	0.29	2.44	0.13	0.07
Social support from colleagues	1.6	0.08	0.78	<0.01	-23.6	17.09	<0.01*	0.33	<0.01	0.97	<0.01
Recognition	-2.9	0.16	0.69	<0.01	-29.4	16.70	<0.01*	0.32	0.05	0.82	<0.01
Social community at work	8.1	2.28	0.14	0.06	-9.0	2.83	0.10	0.07	0.01	0.93	<0.01
Work individual interface											
Job satisfaction	-5.2	0.89	0.35	0.03	-21.6	15.03	<0.01*	0.31	<0.01	0.99	<0.01
Work-family conflict	-4.9	0.22	0.64	0.01	28.1	7.17	0.01*	0.17	0.96	0.34	0.03
Values at workplace											
Trust regarding management	-8.1	1.39	0.25	0.04	-21.2	9.61	<0.01*	0.22	0.02	0.88	0.00
Mutual trust between employees	13.0	5.08	0.03*	0.13	-12.3	4.55	0.04*	0.12	2.44	0.13	0.07
Justice	3.8	0.32	0.58	0.01	-28.6	18.29	<0.01*	0.35	0.03	0.87	<0.01
Social inclusiveness	7.2	0.96	0.33	0.03	-16.6	5.04	0.03*	0.13	0.31	0.58	0.01
Health and well being											
General health perception	-1.3	0.02	0.88	<0.01	-20.6	6.08	0.02*	0.15	0.94	0.34	0.03
Stress	2.2	0.10	0.76	<0.01	19.3	7.07	0.01*	0.17	0.06	0.81	<0.01
Burnout	-4.4	0.36	0.56	0.01	22.5	9.12	<0.01*	0.21	2.28	0.14	0.06
Sleeping troubles	3.6	0.19	0.67	0.01	12.7	2.31	0.14	0.06	3.65	0.06	0.09

♂: men. ♀: women. PoB: place of birth. SB: Swedish-born. FB: foreign-born. η_p^2 : partial eta squared. Bold values show values surpassing the minimum clinically important difference. The * show significant differences [p ≤ 0.05].

conditions, general health and mental health compared to domestic-born workers (Sterud et al., 2018), but the review did not consider that FB workers were over-represented in occupations with a low status where both FB workers and domestic-born workers experience precarious work environment conditions. Similar to our results, a study of FB and domestic born cleaners in Denmark (i.e. workers in the same occupation), found that foreign-born workers reported the psychosocial work environment to be better than their Danish peers (Olesen et al., 2012a). Our study contributes with within-occupation data on differences in self-reported working conditions due to place of birth, which is an important modification of results obtained in the general work population.

Differences between Swedish-born and foreign-born workers may reflect actual differences in work environment conditions, possibly related to the type of work performed, or they may reflect that FB workers bring in other experiences and attitudes than domestic-born workers in terms of cultural, educational, socio-economical, linguistic, and even general life factors that may all influence how a specific work environment is experienced (Diaz-Serrano, 2013; Eurofound, 2019; Gorodzeisky and Semyonov, 2017; Simmons et al., 2021). As an example, during semi-structured interviews with the present workers conducted at baseline and during the pandemic (unpublished data), some SB workers stated improvements in work environment conditions were necessary, while some FB workers said they were satisfied with the work environment since the current conditions were better than they had ever experienced in their native country, which in some cases included being involved in armed conflicts. In our study, FB workers were predominantly from East African and South-East Asian countries. Another important consideration is the possible difference in the likelihood of reporting negative work environment conditions between workers of different origins. Workers coming from countries with more strict hierarchical structures, higher levels of job insecurity or even abuse may tone down or avoid reporting criticisms of the work environment, or may not participate in surveys (Aktas et al., 2021). In our study, we believe the latter was not a problem, considering that 97% of the workforce answered the baseline questionnaire, and that the proportion of FB and SB respondents participating both at baseline and follow-up were similar.

4.2. Effect of the first wave of the COVID-19 pandemic on work environment conditions and health

For a few COPSOQ-II scales, we observed a significant interaction between gender and place of birth. For example, at the end of the first wave of the pandemic, SB women reported the highest emotional demands while foreign-born women reported the lowest emotional demands. Evidence of intersectionality was also found in the changes between the baseline and the follow-up during the COVID-19 pandemic, as seen in the significant interaction of gender and place of birth in the health indicators *burnout* and *sleeping troubles*. Swedish-born women reported the most marked decline between baseline and follow-up, while foreign-born women reported little or no change. While we did not find consistent evidence across work environment conditions and health scales, the suggestion of SB women having the worst work environment conditions contradicts our initial hypothesis that foreign-born women would report the worst conditions. To our knowledge, no other study has considered the intersectionality of gender and place of birth in work environment conditions and health in the context of an external crisis, such as the pandemic. Further considerations to the potential for an inequality intersectionality in work environment and health are required.

While we did not find evidence of a clear difference between men and women at the end of the first wave of the COVID-19 pandemic, we found some evidence of improved work environment conditions compared with baseline for men, for example for *work pace*, while women more often reported declining conditions during the pandemic,

for example, decreased *mutual trust between employees*. This trend in our results agrees to some extent with previous COVID-19 literature, reporting that women had worse mental health at work than men during the pandemic (Chowdhury et al., 2022). However, we emphasize that we investigated gender differences not only considering conditions during the pandemic, as most other studies have done, but also in terms of changes between baseline and the pandemic. The marked decline between baseline and follow-up for SB women compared to all other groups in emotional demands, commitment to the workplace, social community at work, job satisfaction, work-family conflict, mutual trust between employees, justice, stress, sleeping troubles, burnout and general health together describe a wide-reaching impact of the pandemic affecting both work and leisure for this group. While the COPSOQ dimensions do not directly assess mental health, high emotional demands and low meaning of work have been shown to predict poor mental health (Burr et al., 2010) and thus our findings are in line with prior research showing the pandemic negatively impacted women's mental health (Blundell et al., 2020). Given that women workers were significantly older than the men and that SB women had worked more years than the other three groups of workers, it is possible that effects of age and/or seniority influenced the experience of the SB women group compared to the other groups. We did not assess the division or extent of responsibilities for labour at home and childcare; however, research during the pandemic suggests that traditional gender patterns with women shouldering a larger share of household work were amplified (Andrew et al., 2022; Borah Hazarika and Das, 2021; Zamberlan et al., 2022). The role of age, seniority and division of unpaid labour at home should be considered in future studies assessing the impact of external stressors on work environment and health.

In general, FB workers reported better work environment conditions and health than SB workers, both at baseline and follow-up, even if the conditions generally declined over the first wave of the pandemic for all workers. Further, the decline in work environment conditions was generally smaller for FB- than for SB-workers. This finding is in contrast to previous literature on the impact of the pandemic on foreign-born workers (Fasani and Mazza, 2020; Reid et al., 2021), but we believe that divergences between previous literature and our findings may be a result of other studies not compensating for the labor market segregation, while our study is focused on workers within a specific organization. To our knowledge, no other study has considered effects of the COVID-19 pandemic on inequalities due to place of birth within the same occupation.

4.3. Methodological considerations

The major strength of the present study is the within-subject repeated measures design allowing us to investigate work environment conditions in the same workers both before and during the COVID-19 pandemic. Since differences due to place of birth were present already at baseline, we used change scores between baseline and follow-up to determine the effect of the pandemic, which to our knowledge very few prior studies have practiced. The fact that we had access to data collected prior to the pandemic allowed us to address changes occurring due to the first wave of the COVID-19 pandemic without relying on workers' post-hoc memories of conditions during 'normal' times, which could be prone to bias. Previous studies have considered potential inequalities in the effects of the pandemic due to gender (Blundell et al., 2020; Chowdhury et al., 2022) or place of birth (Amoako and MacEachen, 2021; The Lancet, 2020) but, to our knowledge, no other study has considered the interaction between these factors, i.e. the intersectionality of gender and place of birth (Acker, 2006). Finally, differences between the four groups (SB♂, SB♀, FB♂, FB♀) were evident in the proportion of workers performing low-, medium- and high-training tasks. Given these differences were present already prior to the pandemic (Table 1) and did not change during the first wave of the pandemic, a change in tasks performed is unlikely to underlie the

observed changes in perceived work environment conditions and health during the first pandemic wave. However, differences in the extent to which workers were affected by the pandemic based on the specific tasks performed by the workers may have contributed to between-group differences. Given the tendency for SB workers to perform higher-training (i.e. higher responsibility) tasks, it is possible that the effects of the pandemic were felt more strongly by SB workers. Further investigation is needed to confirm the impact of seniority and task type on changes in perceived work environment and health during an external crisis. Finally, a limitation of our self-reported data at follow-up is that we are unable to determine whether the time spent performing each individual task within the group of tasks assigned to an individual worker changed over the pandemic.

Some limitations should also be noted. We considered a broad selection of factors related to work environment conditions and health and analyzed all aspects independently. The resulting large number of tests increases the risk that type I errors may occur. To minimize this risk, we used a combination of statistical significance tests and a check for minimum clinically important difference when interpreting the results. We were thus able to better interpret the size and importance of an effect than had we based our results only on statistical significance. Twenty workers who answered the survey at baseline did not participate during the pandemic, and the eventual population included in the present study may have differed from the baseline population in terms of work environment conditions during the pandemic, even if the demographic characteristics were quite similar and the response rate at follow-up was still quite high, i.e., 68%. Several differences were evident between groups in this study, but given the limited sample size, the extent of generalizability of the findings is difficult to predict. Our findings may be representative of other laundromats, and even more widely of blue-collar, worker assembly or operations facilities. Further studies including comparisons of the perceived work environment across sectors are warranted to clarify this.

Finally, the investigated company was actively working towards equality based on gender and place of birth and may therefore represent a best-case scenario for the effect of the pandemic on a diverse worker population.

5. Conclusions

Differences in work environment conditions and health based on place of birth and, to a minor extent, gender were evident in the investigated Swedish commercial laundromat, with foreign-born workers reporting better conditions than Swedish born workers. At the end of the first wave of the COVID-19 pandemic, both Swedish-born and foreign-born workers generally reported worse work environment conditions and health than at baseline, but again, foreign-born workers reported better conditions and also reported smaller declines from baseline than their Swedish-born peers. Differences between groups may represent actual differences in work environment conditions or may reflect differences in how SB and FB workers interpreted survey questions, how inclined they were to report negative aspects of their work environment, or how the conditions related to previous (work) experiences. Further research is required that compares questionnaire answers across groups with different cultural norms. We considered inequality from the perspective of intersectionality between gender and place of birth and did not find evidence of a consistent inequality hierarchy at baseline, at follow-up nor in change scores over the first wave of the pandemic. However, further investigation is required to investigate the potential role of seniority and task on this intersectionality. While our case study included workers experiencing concerns regarding the risk of infection both from colleagues and contaminated hospital laundry, we believe our results can be applicable for other occupations engaging essential workers closely related to healthcare, such as hospital cleaners, people involved in the transportation of sick people, and general staff in nursing homes. In spite of our findings raising methodological issues

related to workers from different countries responding differently to questionnaires, our study offers insights into the impacts of a global crisis such as the COVID-19 pandemic on already existing social inequalities in the workplace, which may contribute to guiding management and policy makers in future global crises.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The authors would like to thank the commercial laundromat management team for the collaboration, all participants who agreed to join this study and Afa Försäkring (grant number 200243) for the financial support.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.apergo.2023.104113>.

References

- Acker, J., 2006. Inequality regimes: gender, class, and race in organizations. *Gen. Soc.* 20, 441–464. <https://doi.org/10.1177/0891243206289499>.
- Aktas, E., Bergbom, B., Godderis, L., Kreshpaj, B., Marinov, M., Mates, D., McElvenny, D. M., Mehlm, I.S., Milenkova, V., Nena, E., Glass, D.C., 2021. Migrant workers occupational health research: an OMEGA-NET working group position paper. *Int. Arch. Occup. Environ. Health*. <https://doi.org/10.1007/s00420-021-01803-x>.
- Amoako, J., MacEachen, E., 2021. Understanding the blended impacts of COVID-19 and systemic inequalities on sub-Saharan African immigrants in Canada. *Can. J. Public Health* 112, 862–866. <https://doi.org/10.17269/s41997-021-00558-9>.
- Andrew, A., Cattán, S., Costa Dias, M., Farquharson, C., Kraftman, L., Krutikova, S., Phimister, A., Sevilla, A., 2022. The gendered division of paid and domestic work under lockdown. *Fisc. Stud.* 43, 325–340. <https://doi.org/10.1111/1475-5890.12312>.
- Bergsten, E.L., Mathiassen, S.E., Vingård, E., 2015. Psychosocial work factors and musculoskeletal pain: a cross-sectional study among Swedish flight baggage handlers. *BioMed Res. Int.* <https://doi.org/10.1155/2015/798042>, 2015.
- Blundell, R., Costa Dias, M., Joyce, R., Xu, X., 2020. COVID-19 and inequalities. *Fisc. Stud.* 0, 1–29. <https://doi.org/10.1111/1475-5890.12232>.
- Borah Hazarika, O., Das, S., 2021. Paid and unpaid work during the Covid-19 pandemic: a study of the gendered division of domestic responsibilities during lockdown. *J. Gen. Stud.* 30, 429–439. <https://doi.org/10.1080/09589236.2020.1863202>.
- Borg, M.A., Portelli, A., 1999. Hospital laundry workers - an at-risk group for hepatitis A? *Occup. Med. (Chic. Ill)*. 49, 448–450. <https://doi.org/10.1093/occmed/49.7.448>.
- Brabant, C., Bédard, S., Mergler, D., 1989. Cardiac strain among women workers in an industrial laundry. *Ergonomics* 32, 615–628. <https://doi.org/10.1080/00140138908966136>.
- Burr, H., Albertsen, K., Rugulies, R., Hannerz, H., 2010. Do dimensions from the Copenhagen Psychosocial Questionnaire predict vitality and mental health over and above the job strain and effort-reward imbalance models? *Scand. J. Publ. Health* 38, 59–68. <https://doi.org/10.1177/1403494809353436>.
- Burr, H., Berthelsen, H., Moncada, S., Nübling, M., Dupret, E., Demiral, Y., Oudyk, J., Kristensen, T.S., Llorens, C., Navarro, A., Lincke, H.J., Bocéran, C., Sahan, C., Smith, P., Pohrt, A., 2019. The third version of the Copenhagen psychosocial questionnaire. *Saf. Health Work* 10, 482–503. <https://doi.org/10.1016/j.shaw.2019.10.002>.
- Chowdhury, N., Kainth, A., Godlu, A., Farinas, H.A., Sikdar, S., Turin, T.C., 2022. Mental health and well-being needs among non-health essential workers during recent epidemics and pandemics. *Int. J. Environ. Res. Publ. Health* 19. <https://doi.org/10.3390/ijerph19105961>.
- Diaz-Serrano, L., 2013. Immigrants, natives and job quality: evidence from Spain. *Int. J. Manpow.* 34, 753–775. <https://doi.org/10.1108/IJM-01-2012-0002>.
- Dunlavy, A.C., Rostila, M., 2013. Health inequalities among workers with a foreign background in Sweden: do working conditions matter. <https://doi.org/10.3390/ijerph10072871>.
- Eng, A., Mannetje, A., McLean, D., Ellison-Loschmann, L., Cheng, S., Pearce, N., 2011. Gender differences in occupational exposure patterns. *Occup. Environ. Med.* 68, 888–894.
- Eurofound, 2019. How Your Birthplace Affects Your Workplace. <https://doi.org/10.2806/51897>. Luxembourg.
- Fasani, F., Mazza, J., 2020. A Vulnerable Workforce: Migrant Workers in the COVID-19 Pandemic. <https://doi.org/10.2760/316665>.

- Game, A., Pringle, R., Grace, H., 2020. *Gender at Work*. Routledge. <https://doi.org/10.4324/9781003115779>.
- Goldenfeld, M., Zuckerman, N., Amit, S., Tal, I., Hasson, S., Gefen-Halevi, S., Biber, A., Mor, O., Regev-Yochay, G., 2022. First reported nosocomial SARS-CoV-2 outbreak in a hospital-based laundry facility. *Epidemiol. Infect.* 150, 1–6. <https://doi.org/10.1017/S0950268821002016>.
- Gorodzeisky, A., Semyonov, M., 2017. Labor force participation, unemployment and occupational attainment among immigrants in West European countries. *PLoS One* 12, e0176856. <https://doi.org/10.1371/journal.pone.0176856>.
- Gruchmann, T., Mies, A., Neukirchen, T., Gold, S., 2021. Tensions in sustainable warehousing: including the blue-collar perspective on automation and ergonomic workplace design. *J. Bus. Econ.* 91, 151–178. <https://doi.org/10.1007/s11573-020-00991-1>.
- Hooftman, W.E., van der Beek, A.J., Bongers, P.M., van Mechelen, W., 2005. Gender differences in self-reported physical and psychosocial exposures in jobs with both female and male workers. *J. Occup. Environ. Med.* 47.
- Hoppe, A., 2011. Psychosocial working conditions and well-being among immigrant and German low-wage workers. *J. Occup. Health Psychol.* 16, 187–201. <https://doi.org/10.1037/a0021728>.
- Hoppe, A., Heaney, C.A., Fujishiro, K., 2010. Stressors, resources, and well-being among Latino and White warehouse workers in the United States. *Am. J. Ind. Med.* 53, 252–263. <https://doi.org/10.1002/ajim.20752>.
- Houdmont, J., Kerr, R., Addley, K., 2012. Psychosocial factors and economic recession: the Stormont study. *Occup. Med. (Chic. Ill.)* 62, 98–104. <https://doi.org/10.1093/occmed/kqr216>.
- Ijzelenberg, W., Molenaar, D., Burdorf, A., 2004. Different risk factors for musculoskeletal complaints and musculoskeletal sickness absence. *Scand. J. Work. Environ. Health* 55–63.
- International Labour Organisation, 2014. Global job crisis observatory. The global economic crisis and the impact on migrant workers [WWW Document]. URL. <http://www.ilo.org/public/english/support/lib/financialcrisis/features/stories/story11.htm>.
- Jackson, J.A., Sund, M., Barlari Lobos, G., Melin, L., Mathiassen, S., 2023. Assessing the efficacy of a job rotation for improving occupational physical and psychosocial work environment, musculoskeletal health, social equality, production quality, and resilience at a commercial laundromat: protocol for a longitudinal case study. *BMJ Open* 13. <https://doi.org/10.1136/bmjopen-2022-067633>.
- Johannessen, H.A., Sterud, T., 2017. Psychosocial factors at work and sleep problems: a longitudinal study of the general working population in Norway. *Int. Arch. Occup. Environ. Health* 90, 597–608. <https://doi.org/10.1007/s00420-017-1222-2>.
- Johansson, B., Vingård, E., 2012. *Kunskapsöversikt - migration, arbetsmiljö och hälsa. Rapport 4*, 2012.
- Jönson, H., Giertz, A., 2013. Migrant care workers in Swedish elderly and disability care: are they disadvantaged? *J. Ethnic Migrat. Stud.* 39, 809–825. <https://doi.org/10.1080/1369183X.2013.756686>.
- Jordhus-Lier, D., Underthun, A., Zampoukos, K., 2019. Changing workplace geographies: restructuring warehouse employment in the Oslo region. *Environ. Plann.* 51, 69–90. <https://doi.org/10.1177/0308518X18787821>.
- Landén, A.S., Olofsdotter, G., Bolin, M., 2015. *Sprickor, Öppningar Och Krackeleringar: Nya Perspektiv På Arbetsmiljö*. Sundsvall.
- Messing, K., Tissot, F., Saurel-Cubizolles, M.J., Kaminski, M., Bourguine, M., 1998. Sex as a variable can be a surrogate for some working conditions: factors associated with sickness absence. *J. Occup. Environ. Med.* 40, 250–260. <https://doi.org/10.1097/00043764-199803000-00007>.
- Mohammadi, A., Ibrahim Ghavamabadi, L., Silavi, M., Dehaghi, B.F., 2022. Cognitive functions and anxiety among blue-collar workers in hospitals during COVID-19 pandemic. *Front. Public Health* 10. <https://doi.org/10.3389/fpubh.2022.869699>.
- Newton, P., Bristoll, H., 2013. *PESTLE Analysis. Strategy Skills*. Free Management eBooks.
- Nordander, C., Ohlsson, K., Åkesson, I., Arvidsson, I., Balogh, I., Hansson, G.Å., Stromberg, U., Rittner, R., Skerfving, S., 2009. Risk of musculoskeletal disorders among females and males in repetitive/constrained work. *Ergonomics* 52, 1226–1239. <https://doi.org/10.1080/00140130903056071>.
- Nordic Council of Ministers, 2019. Integrating Immigrants into the Nordic Labour Markets, Integrating Immigrants into the Nordic Labour Markets. <https://doi.org/10.6027/nord2019-024>.
- Nussbaumer-Streit, B., Mayr, V., Dobrescu, A.I., Chapman, A., Persad, E., Klerings, I., Wagner, G., Siebert, U., Ledinger, D., Zachariah, C., Gartlehner, G., 2020. Quarantine alone or in combination with other public health measures to control COVID-19: a rapid review. *Cochrane Database Syst. Rev.* 9, CD013574. <https://doi.org/10.1002/14651858.CD013574.pub2>.
- Olesen, K., Carneiro, I.G., Jørgensen, M.B., Flyvholm, M.A., Rugulies, R., Rasmussen, C. D.N., Sogaard, K., Holtermann, A., 2012a. Psychosocial work environment among immigrant and Danish cleaners. *Int. Arch. Occup. Environ. Health* 85, 89–95. <https://doi.org/10.1007/s00420-011-0642-7>.
- Olesen, K., Carneiro, I.G., Jørgensen, M.B., Rugulies, R., Rasmussen, C.D.N., Søgaard, K., Holtermann, A., Flyvholm, M.A., 2012b. Associations between psychosocial work environment and hypertension among non-Western immigrant and Danish cleaners. *Int. Arch. Occup. Environ. Health* 85, 829–835. <https://doi.org/10.1007/s00420-011-0728-2>.
- Owen, L., Laird, K., 2020. The role of textiles as fomites in the healthcare environment: a review of the infection control risk. *PeerJ* 8. <https://doi.org/10.7717/peerj.9790>.
- Pejtersen, J.H., Bjørner, J.B., Hasle, P., 2010a. Determining minimally important score differences in scales of the Copenhagen Psychosocial Questionnaire. *Scand. J. Publ. Health* 38, 33–41. <https://doi.org/10.1177/1403494809347024>.
- Pejtersen, J.H., Kristensen, T.S., Borg, V., Bjørner, J.B., 2010b. The second version of the Copenhagen Psychosocial Questionnaire. *Scand. J. Publ. Health* 38, 8–24. <https://doi.org/10.1177/1403494809349858>.
- Persson, R., Hansen, A.-M., Ohlsson, K., Balogh, I., Nordander, C., Orbaek, P., 2009. Physiological and psychological reactions to work in men and women with identical job tasks. *Eur. J. Appl. Physiol.* 105, 595–606. <https://doi.org/10.1007/s00421-008-0939-8>.
- Reid, A., Rhonda-Perez, E., Schenker, M.B., 2021. Migrant workers, essential work, and COVID-19. *Am. J. Ind. Med.* 64, 73–77. <https://doi.org/10.1002/ajim.23209>.
- Rydström, K., Jackson, J.A., Johansson, K., Mathiassen, S.E., 2023. A systematic review of work organization, work environment and employment conditions in warehousing in relation to gender and race/ethnicity. *Ann. Work Expo. Heal.* <https://doi.org/10.1093/annweh/wxac098>.
- Sacouche, D.A., Morrone, L.C., Silva-Júnior, J.S., 2012. Impact of ergonomics risk among workers in clothes central distribution service in a hospital. *Work* 41, 1836–1840. <https://doi.org/10.3233/WOR-2012-0394-1836>.
- Sañudo, B., Fennell, C., Sánchez-Oliver, A.J., 2020. Objectively-assessed physical activity, sedentary behavior, smartphone use, and sleep patterns preand during-COVID-19 quarantine in young adults from Spain. *Sustain. Times* 12, 1–12. <https://doi.org/10.3390/SU12155890>.
- Simmons, C., Rodrigues, R., Szebehely, M., 2021. Working Conditions in the Long-Term Care Sector: A Comparative Study of Migrant and Native Workers in Austria and Sweden. *Heal. Soc.* <https://doi.org/10.1111/hsc.13657>. *Care Community* 1–12.
- Sterud, T., 2014. Work-related gender differences in physician-certified sick leave: a prospective study of the general working population in Norway. *Scand. J. Work. Environ. Health* 40, 361–369. <https://doi.org/10.5271/sjweh.3427>.
- Sterud, T., Tynes, T., Mehlum, I.S., Veiersted, K.B., Bergbom, B., Airila, A., Johansson, B., 2018. A Systematic Review of Working Conditions and Occupational Health Among Immigrants in Europe and Canada 1–15.
- Sundin, Ö., Soares, J., Grossi, G., Macassa, G., 2011. Burnout among foreign-born and native Swedish women: a longitudinal study. *Women Health* 51, 643–660. <https://doi.org/10.1080/03630242.2011.618529>.
- Sundquist, J., Östergren, P.-O., Sundquist, K., Johansson, S.-E., 2003. Psychosocial working conditions and self-reported long-term illness: a population-based study of Swedish-born and foreign-born employed persons. *Ethn. Health* 8, 307–317. <https://doi.org/10.1080/1355785032000163939>.
- The Lancet, 2020. The plight of essential workers during the COVID-19 pandemic. *Lancet.* [https://doi.org/10.1016/S0140-6736\(20\)31200-9](https://doi.org/10.1016/S0140-6736(20)31200-9).
- Torá, I., Martínez, J.M., Benavides, F.G., Leveque, K., Ronda, E., 2015. Effect of economic recession on psychosocial working conditions by workers' nationality. *Int. J. Occup. Environ. Health* 21, 328–332. <https://doi.org/10.1080/10773525.2015.1122369>.
- Wands, S.E., Yassi, A., 1993. Modernization of a laundry processing plant: is it really an improvement? *Appl. Ergon.* 24, 387–396. [https://doi.org/10.1016/0003-6870\(93\)90170-E](https://doi.org/10.1016/0003-6870(93)90170-E).
- Welfare, S. National S.B. of H, 1995. *SoS-Rapport 1995:5. Invandrarernas hälsa och sociala förhållande. Underlag till folkhälsorapport 1994 och social rapport 1994. Immigrants' Health and Social Situation. Basis for Public Health Report, 1994 and Social Report 1994*.
- Zamberlan, A., Gioachin, F., Gritti, D., 2022. Gender inequality in domestic chores over ten months of the UK COVID-19 pandemic: heterogeneous adjustments to partners' changes in working hours. *Demogr. Res.* 46, 565–580. <https://doi.org/10.4054/DEMRES.2022.46.19>.