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Do inequalities exist in housing and working conditions among local and migrant industrial workers in Vietnam? Results from a multi-site survey

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ABSTRACT

Background: While internal migrants in Vietnam have been a key driving force in the country's rapid economic development, they also face many vulnerabilities. Our study seeks to explore possible inequalities in housing and working conditions between local and internal migrant industrial workers in Vietnam.

Methods: Cross-sectional surveys were conducted with 1200 industrial workers in four regions of Vietnam. Dependent variables included housing conditions (satisfaction with convenience of accommodation, sanitation and water of accommodation, and accommodation in general) and working conditions (satisfaction with income, monthly income, number of hazardous working conditions, and work-related stress measured through the modified Effort-Reward Imbalance Questionnaire). The primary independent variable is migrant status. Covariates included region, gender, education, marital status, accommodation status, living arrangements, industry, age, monthly income, experience, and working hours.

Results: Of the sample, 24.7% (n = 296) were migrants. Overall, no differences were found regarding housing conditions by migrant status. In adjusted regression models, migrants reported higher numbers of hazardous working conditions (β = 0.07, 95 %CI = 0.01–0.13, p = 0.01) and higher monthly income (β = 0.05, 95 %CI = 0.01–0.09, p = 0.02).

Discussion: Recent state-level changes in the Vietnamese household registration system may explain the lack of differences in housing conditions by migrant status. Future research should utilize longitudinal designs to examine impacts over time of state policy on migrants' housing conditions as well as well-being. Regarding working conditions, findings highlight the need for stronger social protection policy and better information

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channels on occupational health and safety for migrants. Further research, including qualitative studies, is needed to explore why migrants face more hazardous working conditions.

1. Introduction

International organizations, governmental bodies, and researchers have increasingly called for the recognition of migrant health as a global public health priority and attention to migration-related conditions (Castañeda et al., 2015; Chung and Griffiths, 2018; Davies et al., 2006; International Organization for Migration, World Health Organization, Government of Sri Lanka, 2017; Portal, 2020; Wickramage et al., 2018; World Health Organization, 2020). In recent years much attention has been paid to international migration, particularly the flows from Global South to Global North countries (Connor, 2016; International Organization for Migration, 2019; International Organization for Migration's Global Migration Data Analysis Centre, 2015). Less research has emphasized domestic or internal migration, despite the fact that the number of internal migrants globally (763 million) are about three times the number of those moving internationally (244 million) (Kumar et al., 2018; United Nations Population Division, 2016). Particularly within Southeast Asia, including Vietnam, internal migration is growing rapidly and is acknowledged as a huge transformational social and economic force (Kumar et al., 2018), necessitating a closer examination of the phenomenon.

Since Vietnam first embarked on market reforms in 1986 and moved away from a centrally-planned economy, the country has experienced substantial economic growth (World Bank, 2019; World Bank Group, Ministry of Planning and Investment of Vietnam, 2016). Industrial workers, many of them internal migrants (Oxfam in Vietnam, 2020; Taylor, 2011), have been a key driving force of Vietnam's rapid industrialization and integration into the global economy (Arnold, 2013). Industrialized zones in Vietnam, which are often found in urban or *peri*-urban areas (Coxhead et al., 2019), attracted a large number of internal migrants (Dang et al., 1997). From 2000 to 2013, the number of industrial zones in Vietnam grew from 61 to 324 (United Nations Industrial Development Organization (UNIDO) Office in Vietnam, 2015). In particular, the increase in foreign investment following Vietnam's accession to the World Trade Organization in 2007 has contributed to the growth of industrial zones (Coxhead et al., 2019). In 2013, approximately 2.28 million people worked in these industrial zones in Vietnam (United Nations Industrial Development Organization (UNIDO) Office in Vietnam, 2015). Additionally, an estimate of 13.6% of Vietnam's 94 million people are internal migrants, with employment-related purposes being the primary reason driving migration (General Statistics Office, United Nations Population Fund, 2016; United Nations Educational, Scientific and Cultural Organization, United Nations Development Programme, International Organization for Migration, United Nations-Habitat, 2018).

Internal migrant workers in Vietnam face vulnerabilities and risks in their housing and working conditions (Le et al., ,2011). A part of the issue stems from state policy; since the 1960 s, Vietnam has implemented a system of administration management based on household book (Hardy, 2001; Liu and Dang, 2019). The system has traditionally differentiated local residents from temporary residents and remained a key factor in determining a person's access to housing ownership, healthcare, and public social services (Le et al., ,2011; Liu and Dang, 2019). For example, prior to 2008, short-term migrants in Ho Chi Minh City were barred from using social services in the city (Siu and Unger, 2020). A 2011 study with migrants in Hanoi and Ho Chi Minh City found that the household book imposed several limitations on migrants' ability to find adequate employment, leading to poor working conditions, low payment, and poor welfare (Le et al., ,2011). Migrants also had to pay more than locals for electricity, piped water, and other utilities; most migrants ended up living in low-quality housing with poor physical infrastructure (Le et al., ,2011). In recent years, Vietnam has taken steps to delink the household book from access to essential services (United Nations Educational, Scientific and Cultural Organization, United Nations Development Programme, International Organization for Migration, United Nations-Habitat, 2018; Forum, 2018); however, migrants still face difficulties and barriers in using public services (United Nations Educational, Scientific and Cultural Organization, United Nations Development Programme, International Organization for Migration, United Nations-Habitat, 2018).

Several studies have shown that internal migrant workers in Vietnam experience poor housing and working conditions. Qualitative studies with rural-to-urban migrant laborers in Hanoi found that most migrants had to rent housing far from city centers, shared crowded spaces, and were exposed to unsafe water, extreme temperatures, odors, and pests; additionally, migrants had to work long hours and endured risky working conditions with no or few safety measures (Dang, 2016; Le et al., 2016; Van Huy et al., 2010). A survey with female factory workers in Hung Yen, Da Nang, and Dong Nai (i.e. regions in Vietnam with high numbers of industrial zones and migrant workers) showed that compared to non-renters, a higher proportion of renters indicated unstable and insufficient income along with unsuitable living conditions (Nguyen et al., 2016). Survey with migrants in Hanoi and Ho Chi Minh city showed that 70% worked in so-called "3D" jobs (dirty, dangerous, and difficult) (Le et al., ,2011).

While adding important knowledge on inadequate living and working conditions that migrant workers faced, the existing literature has been largely restricted to examining migrants in one area of Vietnam as opposed to several different regions (Pham et al., 2019; Dang, 2016; Le et al., 2016; Van Huy et al., 2010), thus limiting the generalizability of its findings. The few studies that did include migrants from different regions have not either incorporated comparisons between migrants and non-migrants or explicitly distinguished between migrants and non-migrants (Le et al., ,2011; Nguyen et al., 2016). Additionally, little research has explored comprehensively Vietnamese migrants' working conditions, in particular possible occupational hazards they face. This study seeks to fill these gaps in the literature. Our objective is to explore possible inequalities in housing and working conditions among a sample of local and migrant industrial workers recruited from different geographical locations in Vietnam.

2. Materials and methods

2.1. Setting, participants, and data collection procedures

A cross-sectional survey was conducted from January to December 2019 in industrial zones of four Vietnamese provinces: Hanoi (northern region), Quang Ngai (southern central region), Dong Nai (southern region), and Can Tho (southern western region). Factories in these zones manufactured products such as electronics, control devices, shoes, and clothes. Three hundred industrial workers per province, or 1200 workers in total, were invited to participate in this study. Participants were eligible if they were 18 years old or older at the time of the interview. A random sampling method was used to recruit participants. First, we obtained a list of all workers in these industrial zones with the support from factory managers. Using a computer software, we randomly chose 300 workers in each province. We then contacted them through the introduction of factory managers and visited their residence to conduct the research. The research team made efforts to contact the workers when the workers were available and answered any questions or concerns they had prior to study participation. Our response rate was 100%.

We informed each participant of the purpose of the study and obtained informed consent. Participants then filled out an anonymous, self-administered, paper-based questionnaire in a private room in their residence. Participants were given opportunities to clarify any questions that they could not understand clearly with the data collectors. The protocol of this study was approved by the Institutional Review Board of Youth Research Institute (Code: 01a-QD/VNCTN).

2.2. Measurements

2.2.1. Dependent variables

2.2.1.1. Housing conditions. Participants reported the extent to which they were satisfied with (1) convenience of their accommodation; (2) sanitation and water of their accommodation; and (3) their accommodation in general. Each question used an 11-point Likert scale (0 = Complete dissatisfaction to 10 = Complete satisfaction). We based these questions on a previous study on Vietnamese female factory workers' satisfaction with living conditions (Nguyen et al., 2016).

2.2.1.2. Working conditions. Participants reported their satisfaction with income, monthly income, and working hours per day. In addition, we provided a list of 15 hazardous working conditions and asked participants to indicate all categories that they may have experienced. We created this list of hazardous working conditions based on a previous study (Lay et al., 2016) and after consulting with several experts in the field of industrial workers. Furthermore, we asked participants to rate their satisfaction with their income using an 11-point Likert scale (0 = Complete dissatisfaction to 10 = Complete satisfaction).

In addition, to measure work-related stress, we used a modified short version of the Effort-Reward Imbalance Questionnaire (Siegrist et al., 2009). The original instrument contained 16 items, each with four response options (1 = Strongly agree, 2 = Agree, 3 = Disagree, and 4 = Strongly disagree). The scale reflected three aspects of work-related stress: "Effort" (i.e. stressful work due to high effort, 3 items), "Reward" (i.e. stressful work due to low reward, 7 items), and "Overcommitment" (i.e. stressful work due to high level of overcommitment, 6 items) (Siegrist et al., 2009). The scale was originally validated in a sample of employed men and women in Germany.

After consulting with experts in the field of industrial workers, we adapted this instrument. First, we removed the item "Considering all my efforts and achievements, my job promotion prospects are adequate," which was suggested to be very similar to another item "My job promotion prospects are poor." We extracted the factors using principal component analysis (PCA) (Abdi and Williams, 2010) with an eigenvalue of 1.2 set as a threshold based on the scree plot. We used Orthogonal Varimax rotation with Kaisers' normalization to reorganize the items. We used a value of 0.4 as a cut-off point for factor loadings. One item, "my job security is poor," was excluded after the analysis. The result of PCA is presented in Table A.1.

After PCA, three new domains were established: "Responsibility and Effort" (5 items, score range of 5 to 20, a higher score means a higher level of stress due to high responsibility and efforts); "Reward" (4 items, score range of 4 to 16, a higher score means a lower level of stress due to high reward); and "Overcommitment" (6 items, score range of 6 to 24, a higher score means a higher level of stress due to high overcommitment). Based on EFA results, two items, "My job promotion prospects are poor" and "When I get home, I can easily relax and 'switch off' work," were moved from the original "Reward" and "Overcommitment" subscales, respectively, to the new "Responsibility and Effort" subscale. The overall Cronbach's alpha of this tool was 0.78. The Cronbach's alpha for the "Responsibility and Effort," "Reward," and "Overcommitment" subscale was 0.65, 0.68 and 0.73, respectively.

Table 1
Sociodemographic characteristics of participants by migrant status.

Characteristics	Locals		Migrants		p-value
	n	%	n	%	
Total	904	75.3	296	24.7	
Region					
Hanoi	216	23.9	84	28.4	<0.01
Quang Ngai	248	27.4	52	17.6	
Dong Nai	204	22.6	96	32.4	
Can Tho	236	26.1	64	21.6	
Gender					
Male	398	44.0	132	44.6	0.86
Female	506	56.0	164	55.4	
Education					
Less than high school	159	17.6	58	19.6	0.03
High school	399	44.1	110	37.2	
Vocational training/college	183	20.2	54	18.2	
University	163	18.0	74	25.0	
Marital status					
Single	392	43.4	138	46.6	0.33
Married	512	56.6	158	53.4	
Accommodation status					
Non-renter	649	71.8	133	44.9	<0.01
Renter	255	28.2	163	55.1	
Living arrangements					
Parents	447	49.5	99	33.5	<0.01
Spouse	455	50.3	131	44.3	0.07
Children	232	25.7	33	11.2	<0.01
Siblings	40	4.4	13	4.4	0.98
Relatives	23	2.5	21	7.1	<0.01
Colleagues	40	4.4	34	11.5	<0.01
Others	19	2.1	18	6.1	<0.01
Type of industry					
Textile/Shoe-making	459	50.8	123	41.6	<0.01
Mechanical/metallurgy	122	13.5	59	19.9	
Electronics	146	16.2	54	18.2	
Food processing	119	13.2	27	9.1	
Other	58	6.4	33	11.2	
	Mean	SD	Mean	SD	
Age, years (range 20–50)	30.7	6.3	30.2	5.6	0.28
Monthly income (million VND) (range 1–20)	5.2	1.9	5.4	2.0	0.11
Years of experience, years (range 1–21)	4.1	3.8	3.1	2.2	<0.01
Working hours per day, hours (range 8–12)	8.2	0.6	8.3	0.6	0.04

2.2.2. Independent variable

Participants indicated their migrant status (local worker or migrant worker) by answering the question "Are you a local worker or a migrant worker from another province?"

2.2.3. Covariates

Sociodemographic covariates included: Region, gender, education, marital status, accommodation status (non-renter versus renter), living arrangements (i.e. who they lived with), type of industry, age, monthly income, years of experience, and working hours per day.

2.3. Statistical analysis

STATA software (version 15.0) was used for all analyses. Alpha level for statistical significance was set at 0.05. Two-tailed Chi-squared and Mann-Whitney tests were performed to examine differences in sociodemographic characteristics, housing conditions, and working conditions between local and migrant workers. Cohen's D and Cramer's V effect sizes were calculated to examine the size of differences for continuous and categorical variables, respectively. Ordinary least squares (OLS) linear regression models were conducted to examine the associations between the independent variable (migrant status) and the following dependent variables: satisfaction with convenience of

Table 2
Satisfaction with housing conditions by migrant status.

Housing conditions	Locals		Migrants		Effect size (Cramer's V)	p-value
	n	%	n	%		
Complete satisfaction with convenience of accommodation	183	20.2	65	22.0	<0.1	0.53
Complete satisfaction with sanitation and water of accommodation	161	17.8	53	17.9	<0.1	0.97
Overall complete satisfaction with accommodation	159	17.6	55	18.6	<0.1	0.70
	Mean	SD	Mean	SD	Effect size (Cohen's D)	p-value
Satisfaction with convenience of accommodation (range 0–10)	7.5	1.8	7.5	2.0	<0.1	0.68
Satisfaction with sanitation and water of accommodation (range 0–10)	7.3	1.9	6.9	2.2	0.2	0.04
Overall satisfaction with accommodation (range 0–10)	7.5	1.8	7.3	2.1	0.1	0.30

accommodation; satisfaction with sanitation and water of accommodation; overall satisfaction with accommodation; satisfaction with income; monthly income (log-transformed due to non-normal distribution of data); working hours per day; and summed scores on the Responsibility and Effort, Reward, and Overcommitment subscales of the Effort-Reward Imbalance Questionnaire. Poisson regression models were conducted to examine the association between migrant status and the number of hazardous working conditions. We first performed univariate regression models, followed by multivariate regression models adjusting for sociodemographic covariates.

3. Results

Among the sample of 1200 industrial workers, 24.7% (n = 296) were migrants. Table 1 displays sociodemographic characteristics of local and migrant workers. Distributions of local and migrant workers varied by region ($p < 0.01$). Compared to migrant workers, a higher proportion of local workers had a high school education ($p = 0.03$), lived with their parents ($p < 0.01$), lived with their children ($p < 0.01$). On average, local workers had more years of experience than migrant workers ($p < 0.01$). Compared to local workers, a higher proportion of migrant workers had a university degree ($p = 0.03$), was renters ($p < 0.01$), lived with relatives ($p < 0.01$), lived with colleagues ($p < 0.01$), and lived with others ($p < 0.01$). We also found differences in type of industry ($p < 0.01$). On average, migrants had a slightly higher number of working hours per day than locals ($p = 0.04$).

Table 2 displays local and migrant workers' levels of satisfaction with housing conditions. Overall, we did not find differences between local and migrant workers regarding levels of satisfaction with housing conditions, except for that migrants indicated lower average scores for satisfaction with sanitation and water of accommodation ($p = 0.04$).

Table 3 displays local and migrant workers' working conditions. On average, migrant workers were exposed to a higher number of hazardous working conditions (mean = 7.7) compared to local workers (mean = 6.8) ($p < 0.01$). More migrant workers indicated carrying out work tasks/methods they were not comfortable with ($p < 0.01$), working in a bended/twisted posture ($p = 0.03$), working in extremely hot/cold places ($p = 0.02$), insufficient lighting ($p < 0.01$), exposure to various types of smoke ($p < 0.01$), exposure to chemicals and toxic substances ($p < 0.01$), contact with flammable substances ($p < 0.01$), and contact with components such as rubber or plastic products ($p < 0.01$). No difference was found regarding scores on the three subscales of the Effort-Reward Imbalance Questionnaire.

Table 4 displays associations between migrant status and living and

Table 3
Working conditions by migrant status.

Working conditions	Locals		Migrants		Effect size (Cramer's V)	p-value
	n	%	n	%		
Complete satisfaction with income	107	11.8	33	11.2	<0.1	0.75
Exposure to hazardous working conditions						
Carry loads heavier than 20 kg at least 10 times a day	387	42.8	132	44.6	<0.1	0.59
Perform repetitive movements with your hand or wrist at least 3 h a day	583	64.5	197	66.6	<0.1	0.52
Carry out work tasks or use work methods that you are not comfortable with	508	56.2	192	64.9	<0.1	<0.01
Work in a bended, twisted posture	299	33.1	119	40.2	<0.1	0.03
Work at a height of 2 m or more above the ground or floor	304	33.6	115	38.9	<0.1	0.10
Work at a noisy environment	437	48.3	146	49.3	<0.1	0.77
Work in extremely hot or cold places	363	40.2	142	48.0	<0.1	0.02
Insufficient lighting	393	43.5	159	53.7	<0.1	<0.01
A dusty work environment	515	57.0	163	55.1	<0.1	0.57
Must stand or sit continuously for more than 2 h	500	55.3	163	55.1	<0.1	0.94
Work night shift	337	37.3	117	39.5	<0.1	0.49
Exposure to various types of smoke	373	41.3	147	49.7	<0.1	<0.01
Exposure to chemicals (pigments, paints), toxic substances (pesticides …)	355	39.3	145	49.0	<0.1	<0.01
Contact with flammable substances (gas, diesel …)	384	42.5	165	55.7	0.1	<0.01
Contact with components such as rubber and plastic products	424	46.9	168	56.8	<0.1	<0.01
	Mean	SD	Mean	SD	Effect size (Cohen's D)	
Satisfaction with income (range 0–10)	5.6	2.9	5.2	3.1	0.1	0.11
Number of hazardous working conditions (range 0–15)	6.8	4.3	7.7	4.3	0.2	<0.01
Effort-Reward Imbalance Questionnaire						
Responsibility and Effort score (range 5–20)	12.2	1.5	12.2	1.4	<0.1	0.56
Reward score (range 4–16)	10.1	1.7	10.1	1.8	<0.1	0.93
Overcommitment (range 5–20)	11.9	3.0	11.8	3.1	<0.1	0.98

Table 4
Associations between migrant status and housing and working conditions.

Outcome variables	Unadjusted models (Local = 0 / Migrant = 1)			Adjusted models (Local = 0 / Migrant = 1)		
	Coef.	95 %CI	p-value	Coef.	95 %CI	p-value
Housing conditions						
Satisfaction with convenience of accommodation[a]	−0.08	−0.33–0.16	0.51	0.11	−0.15–0.37	0.40
Satisfaction with sanitation and water of accommodation[a]	−0.34	−0.61–−0.08	0.10	−0.10	−0.37–0.17	0.47
Overall satisfaction with accommodation[a]	−0.21	−0.46–0.03	0.08	−0.12	−0.38–0.14	0.37
Working conditions						
Log(monthly income)[b]	0.04	−0.01–0.08	0.11	0.05	0.01–0.09	0.02
Satisfaction with income[a]	−0.39	−0.78–0.001	0.048	−0.17	−0.55–0.21	0.37
Working hours per day[c]	0.04	−0.03–0.12	0.26	0.04	−0.05–0.12	0.37
Number of hazardous working conditions[a]	0.12	0.07–0.17	<0.01	0.07	0.01–0.13	0.01
Responsibility and Effort score[a]	0.08	−0.11–0.27	0.40	0.17	−0.12–0.46	0.25
Reward score[a]	−0.00	−0.22–0.23	0.99	0.23	−0.02–0.47	0.07
Overcommitment score[a]	−0.16	−0.56–0.24	0.43	−0.26	−0.67–0.16	0.22

[a] Model was adjusted for region, gender, education, marital status, accommodation status, living arrangements, type of industry, age, monthly income, years of experience, and working hours per day.
[b] Model was adjusted for region, gender, education, marital status, accommodation status, living arrangements, type of industry, age, years of experience, and working hours per day.
[c] Model was adjusted for region, gender, education, marital status, accommodation status, living arrangements, type of industry, age, monthly income, years of experience, and working hours per day.

working conditions. In unadjusted models, migrant workers had significantly lower satisfaction with income (β = -0.39, 95% confidence interval or 95% CI = −0.78–−0.001, p = 0.048) and were exposed to a significantly higher number of hazardous working conditions (β = 0.12, 95% CI = 0.07–0.17, p < 0.01). In adjusted models, only the association between migrant status and exposure to hazardous working conditions remained significant (β = 0.07, 95% CI = 0.01–0.13, p = 0.01). Additionally, in an adjusted model, migrant workers had higher monthly income compared to local workers (β = 0.05, 95% CI = 0.01–0.09, p = 0.02).

4. Discussion

Our study explores inequalities in housing and working conditions by migrant status among 1200 Vietnamese industrial workers from four different regions in the country. Overall, we did not find any differences regarding levels of satisfaction with housing conditions by migrant status. Regarding working conditions, we found that migrants reported higher income but also higher numbers of hazardous working conditions. Our results have implications for researchers and practitioners interested in improving housing and working conditions of migrant industrial workers.

Past research has reported on poor housing conditions of migrant workers in Vietnam (Le et al., ,2011; Dang, 2016; Le et al., 2016; Van Huy et al., 2010; Nguyen et al., 2016). Our study, however, did not find any differences between local and migrant workers regarding satisfaction with convenience of accommodation, satisfaction with sanitation and water of accommodation, and overall satisfaction with accommodation. Traditionally, the hộ khẩu system in Vietnam has created barriers for migrants in accessing quality housing and social services. Starting in 2018, however, Vietnam has officially moved away from the household registration books towards creating a national population database, hoping that this new system can create more equality of opportunities and access for its citizens (United Nations Educational, Scientific and Cultural Organization, United Nations Development Programme, International Organization for Migration, United Nations-Habitat, 2018; Forum, 2018). Given that our survey data were collected in 2019, it is possible that we are seeing the effects of such policy shift on housing conditions for migrants. On the other hand, it may also be possible that years of having to endure poor housing conditions have reduced the level of expectation migrant workers have regarding their housing condition, leading them to be satisfied with even worse housing (compared to that of local workers). Future research should incorporate longitudinal data to explore the impact of hộ khẩu in particular and other state policy in general on migrants' health and well-being, as well as the expectation of migrant workers toward their living condition.

One notable finding is that migrant workers in our sample reported higher income. This finding is in contrast to reports from the 2013 Rural-Urban Migration Survey and the 2015 National Internal Migration Survey in Vietnam, both of which found migrants to have lower income than non-migrants (General Statistics Office, United Nations Population Fund, 2016; Liu, 2019). We did not find differences in satisfaction with income between local and migrant workers. We also did not find any differences regarding subscale scores on the modified Effort-Reward Imbalance Questionnaire.

Moreover, much of existing literature that compares occupational health risks and injuries by migration status has focused on global migration (Ahonen et al., 2007; Hargreaves et al., 2019; Sterud et al., 2018). Studies have found that compared to local workers, migrant workers were exposed to higher levels of physical factors (e.g., vibrations, noise and heat) and mechanical factors (e.g., painful positions, heavy loads, and standing or walking) (Pérez et al., 2012), higher physical demands (Diaz-Serrano, 2013; Dunlavy and Rostila, 2013; Premji and Lewchuk, 2014), and dust (Diaz-Serrano, 2013). While several past studies have reported on poor working conditions that Vietnamese internal migrants faced (Le et al., ,2011; Liu and Dang, 2019; Dang, 2016; Le et al., 2016), to our knowledge, our study is the first to directly compare hazardous working conditions between local and internal migrant workers in Vietnam. In our sample, compared to local workers, migrant workers reported a higher number of hazardous working conditions. This relationship remained significant even after controlling for other relevant factors, such as education, type of industry, income, and years of experience.

A few possible explanations exist for these findings. For example, a study about Bangladeshi garment factory workers hypothesized that migrants may have been less informed compared to locals about hazardous working conditions in certain jobs or factories prior to accepting employment; additionally, migrants may also have greater relative preference for income over working conditions (Boudreau et al., 2018). It may be the case that migrant workers in our study also did not have as much knowledge about working conditions as locals did before commencing employment. Furthermore, since employment is generally the primary reason for internal migration in Vietnam (General Statistics Office, United Nations Population Fund, 2016), it is plausible that migrants would accept more hazardous working conditions in exchange for a better income. This preference may also explain why migrant workers have higher income than local workers in our sample. A previous study

Table A1
Factor loadings for the modified short version of the Effort and Reward Imbalance Questionnaire.

Original Component	Item	Factor		
		Responsibility and Effort	Reward	Overcommitment
Effort	I have constant time pressure due to a heavy workload.	0.5856		
	I have many interruptions and disturbances while performing my job.	0.4115		
	Over the past few years, my job has become more and more demanding.	0.7234		
Reward	I receive the respect I deserve from my superior or a respective relevant person.		0.8408	
	My job promotion prospects are poor **(reverse coding)**	0.8297		
	I have experienced, or I expect to experience an undesirable change in my work situation. **(reverse coding)**		0.7118	
	Considering all my efforts and achievements, I receive the respect and prestige I deserve at work.		0.7565	
	Considering all my efforts and achievements, my salary/ income is adequate.		0.8231	
Overcommitment	I get easily overwhelmed by time pressures at work.			0.5912
	As soon as I get up in the morning, I start thinking about work problems.			0.6551
	When I get home, I can easily relax and 'switch off' work. **(reverse coding)**	0.8589		
	People close to me say I sacrifice too much for my job.			0.7055
	Work rarely lets me go, it is still on my mind when I go to bed.			0.5066
	If I postpone something that I was supposed to do today, I'll have trouble sleeping at night.			0.6393
Item removed from original scale	Considering all my efforts and achievements, my job promotion prospects are adequate **(removed after consulting with experts)**			
	My job security is poor **(removed based on PCA results)**			
	Cronbach's alpha	0.648	0.679	0.732
	Mean	7.2	8.1	11.3
	SD	1.7	1.4	1.6

with intra-continent migrants (e.g., Eastern European migrants working in Western European countries) found that even when faced with poor housing and working conditions, migrants did not want to return home empty-handed and therefore put up with these unsafe conditions (Guldenmund et al., 2013). A third explanation is possible discrimination or exploitation directed towards migrant workers, whereby employers would place migrant workers in jobs with more hazardous working conditions. Such discrimination has been noted in a review of migrant workers in a global context (Moyce and Schenker, 2018). Future research, particularly qualitative studies, is needed to further explore this hypothesis in the context of Vietnam.

Hazardous working conditions can lead to a number of negative health problems and outcomes. For example, exposure to chemicals or toxic substances is associated with cancer and reproductive dysfunction (Kumar, 2004; Snedeker, 2006). Working in extreme heat can introduce increased heart rates, higher blood pressures, and heat-related injuries such as heat stroke (Luttmann et al., 2003; Rodahl, 2003), while working in extreme cold can lead to frostbite, hypothermia, or respiratory and circulatory issues (Rodahl, 2003; Piedrahita et al., 2008). Insufficient lighting can lead to increased risks of stumbling or falling (Luttmann et al., 2003).

Our findings highlight the need for stronger social protection policy and better information channels on occupational health and safety for internal migrants in Vietnam. Officially, the Vietnamese government has issued policy such as the 2012–2020 Social Protection Strategy that identifies migrant workers as one of the vulnerable populations in need of social protection (Le et al., 2015). A report by Oxfam in Vietnam, however, has pointed out that many aspects of social protection policy related to migrant workers in Vietnam are not sufficiently relevant and concrete, lack guidance and resources for implementation and practices, and are not aligned with realities and characteristics of migrant workers (Le et al., 2015). Migrants also currently face hindrances in obtaining information about social protection policy, social insurance, and labor laws (Le et al., 2015). Relatedly, while several Vietnamese state-sponsored institutions are technically responsible for supplying migrants with information the job market, including job conditions, so far many migrants have found these institutions inadequate (Le et al., ,2011). These challenges regarding policy enactment and information provision need to be overcome in order to improve working conditions and occupational health for migrants in Vietnam. Moreover, past research has also discussed the importance of empowerment in occupational health and safety for migrants (i.e., ability to voice concerns about unsafe conditions or to choose to stop working in such conditions), though the focus has largely been on international or intra-continent migrants (Injury Vulnerability in Spain, 2019; Piper, 2004; Ishii, 2019). In Southeast Asia in particular (Piper, 2004), including Vietnam, non-profit or non-governmental organizations can play a critical role in advocating for and empowering workers, pointing to the need for additional resources supporting such organizations.

Strengths of our study include the use of random sampling, high response rates, and inclusion of local and migrant workers from four different regions of Vietnam, all of which increase the generalizability of our findings. Our measurements were developed and adapted based on both past literature and discussion with experts, ensuring relevance to our target population. We also included multiple outcomes related to housing and working conditions. Nevertheless, our design is a cross-sectional survey, which limits our ability to interpret temporal relationships between variables. The involvement of factory managers may have influenced the decision of participants about taking part in our study, leading to a high response rate. We also relied on self-reported data, which can be subjected to social desirability and recall bias. Future study should incorporate longitudinal designs and multiple data sources (e.g., participant observation). The large number of dependent variables may have increased the likelihood of type I errors. While our research found statistically significant differences in some outcomes between groups, the effect sizes were for the most part small. Due to the lack of a guideline for clinical significance of these outcomes, the interpretation of the importance of the differences is limited. Future research should benchmark clinical significance for variables similar to those used in our study.

5. Conclusion

Our study found that migrant workers reported higher numbers of hazardous working conditions compared to local workers. Our findings highlight the need for stronger social protection policy and better information channels on occupational health and safety for internal migrants in Vietnam. Future studies can incorporate qualitative research to further understand why migrants faced more hazardous conditions and utilize longitudinal designs to examine impacts over time of state policy

on migrants' housing and working conditions as well as their overall well-being.

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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.

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Appendix

See Table A1.

References

Abdi, H., Williams, L.J., 2010. Principal component analysis. WIREs Comput. Stat. 2 (4), 433–459.

Ahonen, E.Q., Benavides, F.G., Benach, J., 2007. Immigrant populations, work and health–a systematic literature review. Scand J Work Environ Health. 33 (2), 96–104.

Arnold, D., 2013. Social margins and precarious work in Vietnam. Am. Behav. Sci. 57 (4), 468–487.

Boudreau, L., Heath, R., McCormick, T., 2018. Migrants, Information, and Working Conditions in Bangladeshi Garment Factories [Internet]. International Growth Centre. Available from: https://www.theigc.org/wp-content/uploads/2018/06/Boudreau-et-al-2018-Working-paper.pdf.

Castañeda, H., Holmes, S.M., Madrigal, D.S., Young, M.-E.-D., Beyeler, N., Quesada, J., 2015. Immigration as a Social Determinant of Health. Annu. Rev. Publ. Health 36 (1), 375–392.

Chung, R.Y., Griffiths, S.M., 2018. Migration and health in the world: a global public health perspective. Publ. Health 1 (158), 64–65.

Connor, P., 2016. International migration: Key findings from the U.S., Europe and the world [Internet]. Pew Research Center. 2016 [cited 2020 Mar 31]. Available from: https://www.pewresearch.org/fact-tank/2016/12/15/international-migration-key-findings-from-the-u-s-europe-and-the-world/.

Coxhead, I., Nguyen, V.C., Vu, H.L., 2019. Internal Migration in Vietnam, 2002–2012. In: Liu, A.Y.C., Meng, X., (Eds.). Rural-Urban Migration in Vietnam [Internet]. Cham: Springer International Publishing. [cited 2021 Mar 31]. pp. 67–96. (Population Economics). Available from: https://doi.org/10.1007/978-3-319-94574-3_3.

Dang, A., Goldstein, S., McNally, J., 1997. Internal migration and development in Vietnam. Int. Migrat. Rev. 31 (2), 312–337.

Dang, T.T.T., 2016. Understanding the lived experiences and identities of young rural to urban migrant workers in Vietnam [Internet] [PhD Thesis]. The University of Queensland. [cited 2020 Mar 31]. Available from: http://espace.library.uq.edu.au/view/UQ:399044.

Davies, A.A., Basten, A., Frattini, C., 2006. Migration: A Social Determinant of the Health of Migrants. International Organization for Migration, Geneva, Switzerland.

Diaz-Serrano, L., 2013. Immigrants, natives and job quality: evidence from Spain. Int. J. Manpower 34 (7), 753–775.

Dunlavy, A.C., Rostila, M., 2013. Health inequalities among workers with a foreign background in Sweden: do working conditions matter? Int. J. Environ. Res. Publ. Health 10 (7), 2871–2887.

Vietnam Law & Legal Forum, 2018. No more household registration books: a move to reduce administrative burden [Internet]. [cited 2020 Mar 31]. Available from: http://vietnamlawmagazine.vn/no-more-household-registration-books-a-move-to-reduce-administrative-burden-6129.html.

General Statistics Office, United Nations Population Fund, 2016. The 2015 national internal migration survey: major findings [Internet]. Ha Noi: Vietnam News Agency Publishing House. [cited 2020 Apr 5]. Available from: https://vietnam.unfpa.org/sites/default/files/pub-pdf/PD_Migration%20Booklet_ENG_printed%20in%202016.pdf.

Guldenmund, F., Cleal, B., Mearns, K., 2013. An exploratory study of migrant workers and safety in three European countries. Saf. Sci. 1 (52), 92–99.

Hardy, A., 2001. Rules and Resources: Negotiating the Household Registration System in Vietnam under Reform. Sojourn: J. Soc. Issues Southeast Asia 16 (2), 187–212.

Hargreaves, S., Rustage, K., Nellums, L.B., McAlpine, A., Pocock, N., Devakumar, D., et al., 2019. Occupational health outcomes among international migrant workers: a systematic review and meta-analysis. Lancet Global Health 7 (7), e872–e882.

Injury Vulnerability in Spain, 2019. Examination of risk among migrant and native workers. Safe. Sci. 115, 36–41.

International Organization for Migration, 2019. World Migration Report 2020 [Internet]. pp. 1–477. Available from: https://www.un.org/sites/un2.un.org/files/wmr_2020.pdf.

International Organization for Migration, World Health Organization, Government of Sri Lanka, 2017. Health of Migrants: Resetting the Agenda - Report of the 2nd Global Consultation (Colombo, Sri Lanka, 21-23 February 2017) [Internet]. Geneva, Switzerland: International Organization for Migration; 2017 [cited 2020 Apr 3], pp. 1–100. Available from: https://www.iom.int/sites/default/files/our_work/DMM/Migration-Health/GC2_SriLanka_Report_2017_FINAL_22.09.2017_Internet.pdf.

International Organization for Migration's Global Migration Data Analysis Centre, 2015. Global Migration Trends Factsheet [Internet]. [cited 2020 Mar 31]. Available from: https://gmdac.iom.int/global-migration-trends-factsheet.

Ishii, M., 2019. Empowerment of Migrant Domestic Workers: Muslim Filipinas in the United Arab Emirates. In: Lian, K.F., Hosoda, N., Ishii, M., (Eds.), International Labour Migration in the Middle East and Asia: Issues of Inclusion and Exclusion [Internet]. Singapore: Springer. [cited 2021 Apr 6]. p. 37–54. (Asia in Transition). Available from: https://doi.org/10.1007/978-981-13-6899-8_3.

Kumar, S., 2004. Occupational exposure associated with reproductive dysfunction. J. Occupat. Health 46 (1), 1–19.

Kumar, A.X., Baxter, C.T., Compas, C., Murphy, A.M., 2018. Internal Migration in Southeast Asia: Towards Better Inclusion of Internal Migrants [Internet]. UNESCO Office Bangkok and Regional Bureau for Education in Asia and the Pacific; United Nations Development Programme; International Organization for Migration; & United Nations Human Settlements Programme. [cited 2020 Mar 29] p. 1–15. Available from: https://bangkok.unesco.org/sites/default/files/assets/article/Social%20and%20Human%20Sciences/publications/keyMessage-02.pdf.

Lay, A.M., Saunders, R., Lifshen, M., Breslin, C., LaMontagne, A., Tompa, E., et al., 2016. Individual, occupational, and workplace correlates of occupational health and safety vulnerability in a sample of Canadian workers. Am. J. Ind. Med. 59 (2), 119–128.

Le, D.B., Tran, L.G., Nguyen, T.P.T.,2011. Social Protection for Rural-Urban Migrants in Vietnam: Current situation, Challenges and Opportunities [Internet]. Hanoi, Vietnam: Institute for Social Development Studies. [cited 2020 Mar 31] p. 1–20. Available from: https://www.ids.ac.uk/download.php?file=files/dmfile/ResearchReport08REVISE.pdf.

Le, T.M., Nguyen, T.-A., Nguyen, H.N., 2016. Poor living and working conditions, social isolation, and coping strategies of migrant laborers in Hanoi, Vietnam. In: Migrant Workers: Social Identity, Occupational Challenges and Health Practices (Social Issues, Justice and Status). Nova Science Pub Inc. pp. 95–112.

Le, T.S., Nguyen, T.M.C., Huynh, T.N.T., 2015. Brief Report: Legal and Practice Barriers for Migrant Workers in the Access to Social Protection. Oxfam in Vietnam, Hanoi, Vietnam, pp. 1–51.

Liu, A.Y.C., 2019. Segregated and not equal? Occupation, earnings gap between urban residents and rural migrants in Vietnam. Int. Manpower. 40 (1), 36–55.

Liu, A.Y.C., Dang, D.A., 2019. Rural–Urban Migration in Vietnam: Trend and Institutions. In: Liu, A.Y.C., Meng, X., (Eds.), Rural-Urban Migration in Vietnam [Internet]. Springer International Publishing. [cited 2020 Mar 31]. pp. 1–30. (Population Economics). Available from: https://doi.org/10.1007/978-3-319-94574-3_1.

Luttmann, A., Jäger, M., Griefahn, B., Caffier, G., Liebers, F., Steinberg, U., 2003. Preventing Musculoskeletal Disorders in the Workplace – Risk Factor Information and Preventive Measures for Employers, Supervisors and Occupational Health Trainers [Internet]. World Health Organization, Berlin, Germany. Available from: https://apps.who.int/iris/bitstream/handle/10665/42651/924159053X.pdf.

Moyce, S.C., Schenker, M., 2018. Migrant workers and their occupational health and safety. Annu. Rev. Public Health 39 (1), 351–365.

Nguyen, Q.T., Tran, T.T.T., Phan, C.T.T., Pham, T.C., 2016. Housing for female factory workers: the association between renting accommodation and satisfaction with income and living conditions. AIMS Publ. Health 3 (4), 837–848.

Oxfam in Vietnam, 2020. Workers' Rights [Internet]. [cited 2020 Mar 31]. Available from: https://vietnam.oxfam.org/workers%E2%80%99-rights.

Pérez, E.R., Benavides, F.G., Levecque, K., Love, J.G., Felt, E., Rossem, R.V., 2012. Differences in working conditions and employment arrangements among migrant and non-migrant workers in Europe. Ethnicity Health 17 (6), 563–577.

Pham, K.T.H., Nguyen, L.H., Vuong, Q.-H., Ho, M.-T., Vuong, T.-T., Nguyen, H.-K.T., et al., 2019. Health inequality between migrant and non-migrant workers in an industrial zone of Vietnam. Int. J. Environ. Res. Publ. Health 16 (9), 1502.

Piedrahita, H., Oksa, J., Malm, C., Rintamäki, H., 2008. Health problems related to working in extreme cold conditions indoors. Int. J. Circumpolar Health 67 (2–3), 279–287.

Piper, N., 2004. Gender and migration policies in Southeast and East Asia: legal protection and sociocultural empowerment of unskilled migrant women. Singap. J. Trop. Geogr. 25 (2), 216–231.

Migration Data Portal, 2020. Migration and health [Internet]. [cited 2020 Apr 3]. Available from: http://migrationdataportal.org/themes/migration-and-health.

Premji, S., Lewchuk, W., 2014. Racialized and gendered disparities in occupational exposures among Chinese and white workers in Toronto. Ethn Health. 19 (5), 512–528.

Rodahl, K., 2003. Occupational health conditions in extreme environments. Ann Occup Hyg. 47 (3), 241–252.

Siegrist, J., Wege, N., Pühlhofer, F., Wahrendorf, M., 2009. A short generic measure of work stress in the era of globalization: effort–reward imbalance. Int. Arch. Occup. Environ. Health 82, 1005–1013.

Siu, K., Unger, J., 2020. Work and family life among migrant factory workers in China and Vietnam. J. Contemporary Asia 50 (3), 341–360.
Snedeker, S.M., 2006. Chemical exposures in the workplace: effect on breast cancer risk among women. AAOHN J. 54 (6), 270–281.
Sterud, T., Tynes, T., Mehlum, I.S., Veiersted, K.B., Bergbom, B., Airila, A., et al., 2018. A systematic review of working conditions and occupational health among immigrants in Europe and Canada. BMC Publ. Health 18 (1), 770.
Taylor, W., 2011. Vietnam's Migrant Workers: Greatest Advantage, Greatest Challenge [Internet]. The Asia Foundation. [cited 2020 Mar 31]. Available from: https://asiafoundation.org/2011/09/28/vietnams-26-million-migrant-workers-greatest-advantage-greatest-challenge/.
United Nations Educational, Scientific and Cultural Organization, United Nations Development Programme, International Organization for Migration, United Nations-Habitat, 2018. Overview of Internal Migration in Viet Nam [Internet], pp. 9. Available from: https://bangkok.unesco.org/sites/default/files/assets/article/Social%20and%20Human%20Sciences/publications/vietnam.pdf.
United Nations Industrial Development Organization (UNIDO) Office in Vietnam, 2015. Economic zones in the ASEAN: Industrial parks, special economic zones, eco industrial parks, innovation districts as strategies for industrial competitiveness [Internet]. [cited 2020 Mar 31] p. 1–111. Available from: https://www.unido.org/sites/default/files/2015-08/UCO_Viet_Nam_Study_FINAL_0.pdf.
United Nations Population Division, 2016. International migrant stock 2015 [Internet]. [cited 2020 Apr 3]. Available from: https://www.un.org/en/development/desa/population/migration/data/estimates2/estimates15.asp.
Van Huy, N., Dunne, M., Debattista, J., An, D., 2010. Stress and coping among migrant labourers in urban Vietnam: an adaptation cycle and health vulnerabilities. Int. J. Migrat. Health Soc. Care 6 (2), 15–30.
Wickramage, K., Vearey, J., Zwi, A.B., Robinson, C., Knipper, M., 2018. Migration and health: a global public health research priority. BMC Publ. Health 18 (1), 987.
World Bank Group, Ministry of Planning and Investment of Vietnam, 2016. Vietnam 2035 – Toward Prosperity, Creativity, Equity, and Democracy. Washington, DC: World Bank, pp. 1–368.
World Bank, 2019. Overview – Vietnam [Internet]. World Bank. [cited 2020 Apr 2]. Available from: https://www.worldbank.org/en/country/vietnam/overview.
World Health Organization, 2020. Migration and health: key issues [Internet]. World Health Organization. [cited 2020 Apr 3]. Available from: http://www.euro.who.int/en/health-topics/health-determinants/social-determinants/news/news/2015/09/population-movement-is-a-challenge-for-refugees-and-migrants-as-well-as-for-the-receiving-population/migration-and-health-key-issues.