Occupation Health and Safety Among Brazilian Immigrant Women: A Cross-Sectional Survey

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Article

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ABSTRACT: The Brazilian population in the United States is growing, and many Brazilian workers are employed in settings that lack oversight or regulatory controls related to occupational health and safety (OHS). In this study, we documented two domains of OHS (measured by the Occupational Health and Safety Vulnerability Survey), including Workplace Hazards (potential dangers that may result in injury or illness) and Workplace Vulnerability (inadequate occupational health and safety resources), and examined associated health and demographic characteristics. Eligible participants were women ages 18 and over, born in Brazil, currently residing in the U.S., and employed. A cross-sectional online survey was conducted between July and August 2020. Recruitment occurred through community partnerships and social media. Among N=271 women in the sample, multilinear regression models showed that those who had more significant exposure to Workplace Hazards and greater Workplace Vulnerability when working in private household services (childcare, housecleaning). Increased hazard and vulnerability risk was associated with low income, low educational attainment, and having public insurance. Our findings highlight the need to examine workplace structures and OHS protections for immigrant women.

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INTRODUCTION

Brazilian migration has increased over the past two decades due to Brazil's economic and political turmoil. While initial waves of immigration to the U.S. primarily consisted of single males, more recently, there has been a rise in the number of families making the journey [1,2]. Once in the U.S., many Brazilians assume insecure employment, characterized by high-risk, low-wage jobs that may lack regulation or occupational health and safety protocols and policies [3]. The fact that an estimated 71% of Brazilians living in the U.S. are undocumented [4,5] often leaves these individuals vulnerable to poor working conditions (Flynn et al., 2015; Hall & Greenman, 2015), as does limited English language proficiency [8]. Research has consistently demonstrated that immigrants in the U.S. are at increased risk of occupational health and safety issues, resulting in a variety of adverse physical health outcomes [9–12].

Occupational health and safety (OHS) includes both the prevention of illness and injury, as well as protection of workers' health. In this study, we look at two OHS domains: exposure to workplace hazards and vulnerability. *Workplace Hazards* are potential dangers in the work environment that may result in illness or harm from injury [13]. *Workplace Vulnerability* refers to those working in settings lacking safety policies and procedures and training, and awareness of rights and responsibilities. Both Workplace Hazards and Vulnerability place workers at an increased risk of physical and mental harm [14].

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In this study, we examine the working conditions of Brazilian women living in the US, two-thirds of whom are employed [8]. Of those employed, about 39% hold service jobs, often in housecleaning or childcare [15], compared to employed men (12.5%) [2] . Many of these jobs are informal and as a result, have insufficient oversight or regulatory measures, exposing women to ergonomic hazards (e.g., heavy lifting, rapid work pace without adequate breaks) [16,17] and chemical exposures from cleaning products and vapors [18–20]. In this study, we focus on documenting the Workplace Exposures and Workplace Vulnerability of Brazilian women employed in Massachusetts, the state with the second-largest Brazilian immigrant community in the US [5].

MATERIALS AND METHODS

We conducted a cross-sectional online survey between July and August 2020 and recruited women over 18 years old born in Brazil and currently living in the U.S. We collaborated with local groups and advocacy organizations serving the Brazilian community and conducted outreach via Facebook and WhatsApp groups to recruit participants. Those interested in participation accessed a link to the study to learn about study procedures and gave informed consent before completing the survey. On average, the survey took 18.5 minutes to complete. Participants chose to complete the online survey in either English or Portuguese and received a link upon completion to provide contact information for a $20 Amazon gift card. We restructured these analyses to women employed at the time of the survey.

Measures

We assessed OHS using eight items from the Occupational Health and Safety (OHS) Vulnerability Measure developed by the Institute for Work and Health [21]. Specifically, Workplace Hazards assess the presence and frequency of physical, chemical, or ergonomic risks. Items inquire about the frequency with which workers were required to "manually lift, carry or push items heavier than 20kg at least ten times a day", "do repetitive movements with [your] hands or wrists," and "Interact with hazardous substances." Participants reported frequency of occurrence and work requirements as "never," "once a year," "every 6 months," "every 3 months," "every month," "every week," or "every day." Workers were considered 'exposed to workplace hazards' if they experienced a hazard weekly or more often. In analysis, we collapsed this into two categories: 1) every day and every week, and 2) less than every week. A summative score was calculated, such that higher scores reflected more frequent exposures (range 0-3). The internal reliability of these items was good (Cronbach's alpha=0.72).

For Workplace Vulnerability, we included questions regarding workplace policies and procedures, awareness of rights and responsibilities, and worker empowerment (i.e., ability to advocate for themselves). Regarding policies and procedures, participants were asked about their agreement/disagreement with the following statements: "Everyone receives the necessary workplace health and safety training" and "systems are in place to identify, prevent, and deal with hazards." To assess worker awareness, we asked participants about the extent of agreement with the following statements: "I am clear about my rights and responsibilities about workplace health and safety" and "I know what the necessary precautions are that I should take while doing my job." We presented one statement about worker empowerment: "I feel free to voice concerns or make suggestions about workplace health and safety." Each item was reported on a scale from strongly agree to disagree strongly. We combined 'strongly agree' and 'agree' as one category, while the responses 'not sure/neutral,' 'disagree,' and 'strongly disagree' were collapsed as a second category. A summative score (range 0-5) was calculated. The internal reliability of these items was acceptable (Cronbach's alpha = 0.60) [22].

We used items from the Brazilian census [23] to assess sociodemographic characteristics, including race and ethnicity (categorized as White, Black, Pardo (mixed race), Indigenous, Multiracial, and another race (including Asian). Educational attainment was classified as "complete primary and incomplete secondary," "complete secondary and incomplete tertiary," and "complete

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tertiary." We collected information about age (continuous years), and household income (<$25,000/$$25,001-$50,000/$50,001-$75,000/$75,000-$100,000/> $100,001). Questions to assess health insurance status (yes/no) and health insurance type (public/private/don't know) were taken from the Behavioral Risk Factor Surveillance System or BRFSS [24]. We also asked if participants had a primary care provider (yes/no), were married or not married, and the number of years they lived in the U.S. We asked how many hours participants usually work per week (1-10, 10-20, 20-30, 30-40, 40-50, 50-60, 60+). Workplace items included occupation type (private household services/administrator or manager/teacher or other professional/administrative support/sales or retail/or other). Occupation type was dichotomized into "private household services" and "other occupations." We also collected employment type (employed for wages/self-employed), number of hours worked (< 20/20-39/40 or greater), perceptions of overall health reported by respondents (excellent, good, fair, poor), languages spoken at home or with friends (Portuguese only, English only, some Portuguese and English, other).

Analysis

A total of 446 women born in Brazil initiated the survey. Of those, n=64 (14.3%) had greater than 70% missing data from the 24 questions of interest for this analysis, and n=111 (24.9%) were not working, including employed students. These groups were excluded, leaving a final analytic sample of N=271 for analysis.

Descriptive analyses were performed to examine the sample's sociodemographic characteristics. Data are presented as means and standard deviations for continuous variables and percentages for categorical variables. Mean scores for Worksite Hazards and Worksite Vulnerability were calculated in addition to the frequency and percentage of questions within each subscale. For each scale, measures of association with demographic characteristics were completed using linear regression for continuous variables and Pearson correlation for categorical variables. Variables with a p-value of < 0.10 were included in the multivariable analyses. A multivariable linear regression model was used to assess Workplace Hazards and Workplace Vulnerability, controlling for significant demographic characteristics. Data are presented as beta coefficients (B) at a 95% level of significance (p-value < 0.05). All data analysis was conducted using STATA version SE [25].

RESULTS

Sample Characteristics

Descriptive statistics are presented in Table 1. The mean age was 22 (SD=11), and the mean number of years living in the U.S. was 13 (SD = 9). The majority identified their race as White (59%), with 23% identifying as Pardo (mixed-race). More than two-thirds (69%) were married or living as married, and 46% had household incomes of $50,000 or below. Approximately 48% had completed tertiary education (U.S. college degree equivalent). Most (81%) had health insurance, with more than one-third (35%) having public insurance. Most (58%) respondents worked more than 40 hours a week and were employed for wages (46%) or were self-employed (42%). The 44% were employed in private households.

Table 1. Health and Sociodemographic Characteristics among Study Sample, N=271, Brazilian Women's Health Study.

Characteristics	**Mean**	**SD**
Age in years	23	11
Years in US	13	9
Racial identity	**N**	**%**
Black	17	6

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Indigenous	3	1
Multiracial	11	4
Another race	14	6
Pardo	63	23
White	159	59
Married/living as married	186	69
Household income		
< $25,000	67	25
$25,001 - $50,000	58	21
$50,0001- $75,000	48	18
$75,001-$100,000	37	14
> $100,001	41	15
Don't know	20	7
Education		
Complete primary education and incomplete secondary education	50	19
Complete secondary and incomplete tertiary education	90	33
Complete tertiary education	129	48
Don't know	1	0.4
Missing	1	0.4
Occupation		
Private household services (e.g. housecleaner, childcare)	102	44
Other Occupations*	131	56
Missing	38	14
Employment Type		
Employed for wages	125	52
Self-employed	114	48
Missing	32	12
Health insurance		
Yes	215	81
No	44	17
Don't know	7	3
Missing	5	2
Health insurance type		
Public	96	44
Private	109	50
Don't know	15	7
Missing	51	19
Number of hours worked		
< 20 hours	39	17
20-39	40	17

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≥ 40 hours	158	67
Missing	34	13
Overall health		
Poor	1	0.4
Fair	25	9
Good	162	61
Excellent	78	29
Missing	5	1.9
Languages spoken at home		
Portuguese only	119	46
English only	25	9
Some English and Portuguese	124	46
Other	3	1
Languages spoken with friends		
Portuguese only	82	30
English only	4	2
Some English and Portuguese	183	68
Other	2	1

*Totals may not sum to 100% due to rounding

**Other Occupations" include: Administrator (manager), n=14; Teacher, n=19; Professional, n=42; Administrative support (clerical), n=19; Sales (retail), n=12; Other, n=25

Occupational Health and Safety

The mean Workplace Hazards score was 1.0 (SD 1.0). Most participants (80%) indicated they lifted heavy materials at work less than every week compared to every day or every week. More than half (59%) of participants engaged in repetitive movements at work daily or weekly. Most respondents (65%) interacted with hazardous materials infrequently at work. Most (86%) agreed or strongly agreed that they knew precautions to take at work if necessary. Mean scores were significantly associated with racial identity (p=0.05), annual household income (p=0.02), educational level (p=0.1), employment type (p=0.06), occupation (p<0.001), insurance type (p<0.001), self-perceived health (p=0.02), and languages spoken at home (p=0.01) and with friends (p=0.007). See Table 2.

Table 2. Workplace Hazards Scores by Health and Sociodemographic Characteristics, N=228[§], Brazilian Women's Health Study.

Total Score: Workplace Hazard	**Mean**				**(SD)**
	1.0				(1.0)
Workplace Hazard Scores by Response Level					
Sample size	**0** (N=83)	**1** (N=84)	**2** (N=36)	**3** (N=25)	**P-value***
	Mean (SD)				

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Age in years	24 (11)	22 (11)	23 (10)	22 (7)	0.7
Years in US	14 (9)	13 (10)	10 (8)	11 (7)	0.2
	N (%)				
Racial identity					**0.05**
Black	4 (5)	6 (7)	2 (6)	2 (8)	
multiracial	3 (4)	4 (5)	4 (11)	0 (0)	
Indigenous	2 (2)	0 (0)	1 (3)	0 (0)	
Another race	7 (8)	3 (4)	2 (6)	1 (4)	
Pardo	11 (13)	15 (18)	13 (36)	10 (40)	
White	56 (68)	56 (67)	14 (39)	12 (48)	
Marital status					0.5
Unmarried	22 (27)	26 (31)	9 (25)	10 (40)	
Married	61 (74)	58 (69)	27 (75)	15 (60)	
Annual household income					**0.02**
< $25,000	12 (15)	20 (24)	13 (36)	9 (36)	
$25,001-$50,000	15 (18)	18 (21)	10 (28)	9 (36)	
$50,001-$75,000	21 (25)	14 (17)	5 (14)	2 (8)	
$75,001-$100,000	13 (16)	13 (16)	4 (11)	2 (8)	
> $100,001	15 (18)	17 (20)	0 (0)	2 (8)	
Don't know/missing	7 (8.4)	2 (2.4)	4 (11)	1 (4)	
Educational level					**0.1**
Complete primary education and incomplete secondary education	8 (9.6)	15 (18)	7 (19)	9 (36)	
Complete secondary and incomplete tertiary education	26 (31)	22 (26)	15 (42)	7 (28)	
Complete tertiary education	49 (59)	46 (55)	14 (39)	9 (36)	
Don't know/missing	0 (0)	1 (1.2)	0 (0)	0 (0)	
Employment type					**0.06**
Employed for wages	45 (54)	49 (58)	18 (50)	7 (28)	
Self-employed	38 (46)	35 (42)	18 (50)	18 (72)	
Occupation					**<0.001**
Private household services	20 (24)	26 (31)	31 (86)	21 (84)	
Other occupations**	63 (76)	58 (69)	5 (14)	4 (16)	
Weekly hours					0.5
< 20 hours	16 (20)	12 (14)	7 (19)	3 (12)	
20 to 30 hours	16 (20)	10 (12)	8 (22)	3 (12)	
> 40 hours	50 (61)	62 (74)	21 (58)	19 (76)	
Health Insurance					0.4
No	14 (17)	12 (14)	4 (11)	7 (28)	
Yes	67 (81)	68 (81)	32 (89)	18 (72)	

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Don't know/missing	2 (2.4)	4 (4.8)	0 (0)	0 (0)	
Insurance type					**<0.001**
Public	19 (28)	29 (40)	20 (63)	15 (83)	
Private	45 (65)	39 (54)	8 (25)	3 (17)	
Don't know	5 (7.2)	4 (5.6)	4 (13)	0 (0.0)	
Self-perceived health					**0.02**
Excellent	28 (34)	29 (35)	8 (22)	5 (20)	
Fair	6 (7.2)	3 (3.6)	6 (17)	5 (20)	
Good	49 (59)	52 (62)	22 (61)	14 (56)	
Poor	0 (0)	0 (0)	0 (0)	1 (4.0)	
Languages spoken at home					**0.01**
Portuguese only	24 (29)	38 (45)	24 (67)	14 (56)	
English only	11 (13)	7 (8)	2 (6)	1 (4)	
Some English and Portuguese	45 (54)	39 (46)	10 (28)	10 (40)	
Other language	3 (4)	0 (0)	0 (0)	0 (0)	
Languages spoken with friends					**0.007**
Portuguese only	15 (18)	21 (25)	17 (47)	12 (48)	
English only	2 (2)	0 (0)	0 (0)	1 (4)	
Some English and Portuguese	64 (77)	63 (75)	19 (53)	12 (48)	
Other language	2 (2)	0 (0)	0 (0)	0 (0)	

§Sample size reduced from 271 to 228 due to missing data. *Linear regression used for continuous variables, age and year in US; Pearson correlation used for categorical variables, income, education, insurance, insurance type, hours, employment, occupation, perceived health and language spoken at home and with friends.**Other Occupations: Administrator (manager), n=14; Teacher, n=19; Professional, n=42; Administrative support (clerical), n=19; Sales (retail), n=12; Other, n=25 .

The mean Workplace Vulnerability was 1.6 (SD 1.7). Almost half (44%) of participants strongly disagreed, disagreed, or were neutral about receiving workplace health and safety training. Most (57%) respondents either agreed or strongly agreed that there were systems in place at work to identify hazards. Clear rights and responsibilities for health and safety at work were in place for 73% of participants. Mean scores were significantly associated with having health insurance (p=0.003), employment type (p=0.01), occupation (p=0.03), and languages spoken at home (p=0.1). See Table 3.

Table 3. Workplace Vulnerability Scores, by Health and Socio-demographic Characteristics, N=227§, Brazilian Health Women's Study.

Total Workplace Vulnerability Score	**Mean**				**(SD)**		
	1.6				(1.7)		
Workplace Vulnerability Scores by Response level							
	0	**1**	**2**	**3**	**4**	**5**	**P-value***
Sample size	(N=93)	(N=42)	(N=16)	(N=39)	(N=17)	(N=20)	
	Mean (SD)						

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Age (mean, SD)	23 (11)	25 (12)	19 (11)	24 (9.6)	23 (9)	20 (9)	0.4
Years in US (mean, SD)	13 (8)	13 (10)	9 (7)	14 (11)	11 (8)	11 (9)	0.4
	N (%)						
Race							0.3
White	63 (68)	26 (62)	8 (50)	23 (59)	6 (35)	10 (50)	
Black	8 (9)	3 (7)	1 (6)	0 (0)	2 (12)	0 (0)	
multiracial	5 (5)	3 (7)	0 (0)	1 (3)	0 (0)	2 (10)	
Indigenous	1 (1)	1 (2)	0 (0)	0 (0)	0 (0)	1 (5)	
Pardo	12 (13)	7 (17)	5 (31)	13 (33)	7 (41)	6 (30)	
Other	4 (4)	2 (5)	2 (13)	2 (5)	2 (12)	1 (5)	
Marital status							0.9
Unmarried	31 (33)	10 (24)	4 (25)	12 (31)	5 (29)	7 (35)	
Married	62 (67)	32 (76)	12 (75)	27 (69)	12 (71)	13 (65)	
Annual household income							0.2
< $25,000	22 (24)	8 (19)	3 (19)	10 (26)	4 (24)	8 (40)	
$25,001-$50,000	23 (25)	5 (12)	3 (19)	9 (23)	7 (41)	5 (25)	
$50,001-$75,000	21 (23)	6 (14)	4 (25)	6 (15)	2 (12)	3 (15)	
$75,001-$100,000	8 (9)	12 (29)	1 (6)	7 (18)	2 (12)	1 (5)	
> $100,001	14 (15)	9 (21)	2 (13)	6 (15)	2 (12)	1 (5)	
Don't know	5 (5)	2 (5)	3 (19)	1 (3)	0 (0)	2 (10)	
Education							0.5
Complete primary education and incomplete secondary education	13 (14)	3 (7)	4 (25)	9 (23)	2 (12)	7 (35)	
Complete secondary and incomplete tertiary education	25 (27)	16 (38)	4 (25)	13 (33)	6 (35)	6 (30)	
Complete tertiary education	54 (58)	23 (55)	8 (50)	17 (44)	9 (53)	7 (35)	
Health Insurance							
No	13 (14)	6 (14)	1 (6)	9 (23)	5 (29)	4 (20)	**0.003**
Yes	79 (85)	35 (83)	12 (75)	30 (77)	12 (71)	16 (80)	
Don't know	1 (1)	1 (2)	3 (19)	0 (0)	0 (0)	0 (0)	
Insurance type							0.2
Public	30 (38)	11 (31)	10 (67)	16 (53)	8 (67)	7 (44)	
Private	44 (55)	24 (67)	4 (27)	12 (40)	4 (33)	7 (44)	
Don't know	6 (8)	1 (3)	1 (7)	2 (7)	0 (0)	2 (13)	
Weekly hours							
< 20 hours	18 (20)	5 (12)	4 (25)	5 (13)	2 (12)	3 (15)	0.3
20 to 30 hours	14 (15)	7 (17)	0 (0)	10 (26)	1 (6)	6 (30)	
≥ 40 hours	60 (65)	30 (71)	12 (75)	24 (62)	14 (82)	11 (55)	
Employment type							**0.01**

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Employed for wages	58 (62)	26 (62)	7 (44)	14 (36)	7 (41)	6 (30)	
Self-employed	35 (38)	16 (38)	9 (56)	25 (64)	10 (59)	14 (70)	
Occupation							**0.03**
Private household services	29 (31)	19 (45)	9 (56)	18 (46)	11 (65)	12 (60)	
Other occupations**	64 (69)	23 (55)	7 (44)	21 (54)	6 (35)	8 (40)	
Self-perceived health							0.4
Excellent	31 (33)	13 (31)	5 (31)	12 (31)	4 (24)	4 (20)	
Fair	7 (8)	4 (10)	1 (6)	4 (10)	1 (6)	3 (15)	
Good	55 (59)	25 (60)	10 (63)	23 (59)	11 (65)	13 (65)	
Poor	0 (0)	0 (0)	0 (0)	0 (0)	1 (6)	0 (0)	
Languages spoken at home							**0.1**
Portuguese only	37 (40)	16 (38)	11 (69)	16 (41)	10 (59)	10 (50)	
English only	10 (11)	3 (7)	3 (19)	1 (3)	1 (6)	3 (15)	
Some English and Portuguese	46 (50)	22 (52)	2 (13)	20 (51)	6 (35)	7 (35)	
Other language	0 (0)	1 (2)	0 (0)	2 (5)	0 (0)	0 (0)	
Languages spoken with friends							0.8
Portuguese only	24 (26)	12 (29)	5 (31)	15 (39)	3 (18)	6 (30)	
English only	1 (1)	0 (0)	0 (0)	1 (3)	0 (0)	1 (5)	
Some English and Portuguese	67 (72)	30 (71)	11 (69)	22 (56)	14 (82)	13 (65)	
Other language	1 (1)	0 (0)	0 (0)	1 (3)	0 (0)	0 (0)	

§Sample size reduced from 271 to 221 due to missing data. *Linear regression was used for continuous variables, age and year in the US; Pearson correlation was used for categorical variables, income, education, insurance, insurance type, hours, employment, occupation, and perceived health.**Other Occupations: Administrator (manager), n=14; Teacher, n=19; Professional, n=42; Administrative support (clerical), n=19; Sales (retail), n=12; Other, n=25.

Multivariable Analyses

In the multivariable linear regression, Workplace Hazard score was significantly associated with household income, health insurance type, languages spoken at home and with friends and occupations in private household services. Compared to women making less than $25,000, women making between $75,000 - $100,000 had a significant increase of 0.5 units in hazard score, all else equal. Compared to women with public insurance, having private insurance was associated with a 0.46 unit decrease in Workplace Hazard scores, all else equal. Being employed in private households, compared to other occupations, was associated with a 0.7 unit increase in exposure to worksite hazards, all else equal. Speaking other languages at home, compared to speaking Portuguese, was associated with a 1.6 unit decrease in exposure to worksite hazards, all else equal. Speaking some English and Portuguese with friends, compared to speaking Portuguese only, was associated with a 0.3 unit decrease in exposure to worksite hazards, all else equal. Reporting excellent health, compared to poor health, was marginally associated with a 0.3 unit decrease in exposure to worksite hazards, all else equal. See Table 4.

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Table 4. Multivariable Linear Regression Model: Workplace Hazards, Health and Socio-Demographic Characteristics, N=191§, Brazilian Women's Health Study.

Characteristic	B	p-value*
Education		
Complete primary education and incomplete secondary education	--	--
Complete secondary and incomplete tertiary education	0.1	0.5
Complete tertiary education	0.3	0.1
Don't know/missing	0.6	0.5
Racial identity		
White	--	--
Black	-0.01	1
Multiracial	0.4	0.2
Indigenous	-0.7	0.2
Pardo	0.1	0.5
Other	-0.2	0.4
Household income		
< $25,000	--	--
$25,001-$50,000	0.2	0.4
$50,001-$75,000	0.06	0.8
$75,001-$100,000	0.5	**0.05**
> $100,001	0.1	0.6
Don't know/missing	-0.5	0.1
Health insurance type		
Public	--	--
Private	-0.4	**0.03**
Don't know/missing	-0.2	0.5
Employment Type		
Employed for Wages	--	--
Self-employed	-0.2	0.2
Occupation		
Other occupations**	--	--
Private household services (e.g. housecleaner, childcare)	0.7	**<0.001**
Self-perceived health* **		

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Poor	--	--
Fair	0.3	0.2
Excellent	-0.3	0.06
Languages spoken at home		
Portuguese only	--	--
English only	0.08	0.8
Some English and Portuguese	-0.2	0.1
Other language	-1.6	**0.02**
Languages spoken with friends		
Portuguese only	--	--
English only	-0.7	0.4
Some English and Portuguese	-0.3	**0.04**
Other language	0.4	0.7

§Sample size reduced from 271 to 191 due to missing data. *Linear regression was used for continuous variables, age and year in the US; Pearson correlation was used for categorical variables, income, education, insurance, insurance type, hours, employment, occupation, and perceived health.**Other Occupations: Administrator (manager), n=14; Teacher, n=19; Professional, n=42; Administrative support (clerical), n=19; Sales (retail), n=12; Other, n=25.*** "Good" self-reported health category excluded due to collinearity with "excellent" self-reported health category.

Employment type was significantly associated with Workplace Vulnerability scores (Table 5). Being self-employed, compared to being employed for wages, was associated with a 0.6 unit increase in Worksite Vulnerability scores, all else equal. Being employed in private household services was marginally associated with a 0.4 unit increase in Workplace Vulnerability scores, all else equal.

Table 5. Multivariable Linear Regression Model: Workplace Vulnerability Score, Health and Socio-Demographic Characteristics, N=227§, Brazilian Women's Health Study.

Characteristic	**B**	**p-value***
Health insurance		
No	--	--
Yes	-0.3	0.3
Don't know/not sure	-0.5	0.5
Employment Type		
Employed for wages	--	--
Self-employed	0.6	**0.01**
Occupation		
Other occupations**	--	--
Private household services (e.g. housecleaner, childcare)	0.4	0.07

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§Sample size reduced from 271 to 227 due to missing data. *Linear regression was used for continuous variables, age and year in the US; Pearson correlation was used for categorical variables, income, education, insurance, insurance type, hours, employment, occupation, and perceived health.**Other Occupations: Administrator (manager), n=14; Teacher, n=19; Professional, n=42; Administrative support (clerical), n=19; Sales (retail), n=12; Other, n=25.

DISCUSSION

Our study contributes to what is known about the occupational health and safety of Brazilian women working in the US. We found that women working in private household services were more likely to be exposed to ergonomic or chemical risks and were less likely to have workplace health and safety training, be aware of their rights, have systems to deal with exposures, or to feel confident expressing their concerns or suggestions. Those with lower incomes and public insurance were also likely to report exposure to hazards, while self-employed women were less likely to have adequate health and safety measures.

Our findings are generally consistent with the available literature on occupational and safety issues among Brazilian workers in the U.S. In 2012, **Siqueira & Jansen conducted a study of more than 500 Brazilian immigrant workers** in Eastern Massachusetts, most of whom were employed in the **construction, housecleaning, and food services sectors. They found that a large proportion were exposed to chemical, physical, and psychosocial hazards.** Many workers **lacked adequate training** on workplace safety and reported **limited access to protective equipment.** Work-related **injuries and illnesses were common,** but **many did not report them** due to fear of job loss or immigration concerns [20]. Similar issues were found in a smaller sample (n=50) of Brazilian immigrant housecleaners conducted by Siqueira and Roche in 2013[26]. A more recent study conducted in 2016 that included 198 Brazilian (predominantly) domestic women workers found that those with low English language and non-legalized status reported poor working environments compared to those with documented legal status (55.6% vs. 34.3%). Working conditions included less access to personal protective equipment and difficulty negotiating pay and contracts due to low English proficiency [27]. Other quantitative [28] and qualitative studies [18,29,30] have emphasized similar results. These studies highlight the importance of concerns about training gaps in workplace safety, a lack of protective equipment, and exposure to hazards among Brazilian immigrant women. Additionally, many are hesitant to raise these issues due to fears.

Before discussing the study's implications, we must acknowledge its limitations. First, this was a convenience sample since obtaining a sampling frame of Brazilian women was not feasible. Therefore, results must be interpreted with appropriate caution. Second, these are cross-sectional data, so we cannot infer causality. Moreover, working conditions were self-reported, and there is potential for bias in either direction. There may be social desirability related to fears about losing employment. On the other hand, there could be an underestimate of exposures or hazards as workers generally underestimate job risk and their ability to self-protect from harm [31]. Brazilian women may have been willing to accept more hazardous jobs with inadequate protections to relieve their family's economic insecurity during the COVID-19 pandemic. The consistency of our findings with prior studies some reassurance about the importance of OSH in preserving worker health. Future research should address the preceding limitations and questions that our study cannot.

Despite these limitations, our findings suggest that concerted efforts are needed to improve the working conditions of Brazilian immigrant women. A combination of workplace health and safety protocols, employee training, and active engagement in health and safety initiatives are needed to reduce workers' vulnerability and exposure to hazards that could lead to illness and injury. This will likely require interventions at multiple levels of the socioecological model, including at the individual, interpersonal, community, and policy levels [32].

At the individual level, worker training at the workplace can be effective in promoting knowledge, awareness, and practices [33]. However, this will be challenging for this population, as

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many are doing domestic work. Further, nearly half of the women in our sample spoke only Portuguese. Thus, there is a need to develop centralized community locations for training and to ensure that they are culturally and linguistically appropriate and tailored for different types of work. Alternatively, given the high rates of social media use in the population, e-training is effective [34]. They are flexible, cost-effective, and can boost workers' knowledge and skills [34]. However, interventions focusing solely on the individual level is that they put the responsibility for OHS on the worker rather than the employer.

At the employer level, interventions should focus on improving work environments, establishing realistic expectations, worksite safety training, and enhancing surveillance and cooperation with regulatory authorities [35]. A review of existing studies of organization-level interventions finds evidence supporting the effectiveness of this approach in more traditional work settings [36]. However, we could not locate studies on the effectiveness of employer-level interventions for domestic workers. Reports of exploitation among Brazilian women in domestic worker roles underscore the need for additional interventions to attain these goals[37].

Community-level interventions can also play a key role in creating systems to provide broader support for immigrant communities. Investment in local immigrant-led organizations and collaboratives for workers' rights can and do provide guidance and support for advocacy and education for immigrant women. An excellent example is the Grupo Mulher Brasileira (Brazilian Women's Group). The center originated in 1995 as a non-profit organization dedicated to supporting immigrant workers, primarily Brazilians, in the Greater Boston area, focusing on advocating for their labor and immigration rights; its mission has been to empower immigrants with knowledge about their workplace rights and promote social justice through education and organizing efforts. Additionally, the Vida Verde Women's Co-Op, also in the Boston area, supports safe working conditions and education on workplace hazards often faced by Brazilian immigrant women [38]. Both groups were part of a coalition that brought the Domestic Workers Bill of Rights to Massachusetts in 2015 [39,40]. Collaborative initiatives led by immigrant organizations should be fully funded and expanded to conduct this vital work. While this study was conducted in Massachusetts with these extraordinary organizations, our findings suggest that more should be done.

Intervention on the societal and policy levels is also essential. Fundamental efforts are required to combat anti-immigrant xenophobia and racism in the U.S., which is rapidly escalating in the US [41]. Murray and colleagues provide an excellent review of the necessary work to address xenophobia and discrimination immigrants [42]. Policy makers need to address the exploitation of immigrant workers by instituting and enforcing worker protections and rights. Social, economic, and labor policies on occupational health at the state and federal levels lack sufficient protections for immigrant workers, including OSHA coverage in private homes, increased federal minimum wage laws, and legal protections for immigrant workers regardless of immigration status [3].

CONCLUSION

This study demonstrates that Brazilian immigrant women experience greater workplace hazards and vulnerability, which may be further compounded by socioeconomic factors. These results highlight the need for improved occupational health and safety regulation and oversight, particularly for those in informal work settings. Further research and policy change are needed to mitigate workplace risks and ensure safer and supported working conditions for immigrant women.

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