Environmental Health Needs Among Latinas in Cleaning Occupations: A Mixed Methods Approach

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Erin Speiser[1], Genevieve Pinto Zipp[2], Deborah A. DeLuca[2], Ana Paula Cupertino[3], Evelyn Arana-Chicas[3], Elli Gourna Paleoudis[4], Traci N. Bethea[5], Benjamin Kligler[1] and Francisco Cartujano-Barrera[3]

[1]The Deirdre Imus Environmental Health Center®, Hackensack Meridian Health, Hackensack University Medical Center, Hackensack, NJ, USA. [2]Department of Interprofessional Health Sciences & Health Administration, School of Health and Medical Sciences, Seton Hall University, Nutley, NJ, USA. [3]James P. Wilmot Cancer Institute, University of Rochester Medical Center, Rochester, NY, USA. [4]Office of Research Administration, Hackensack Meridian Health, Department of Medical Sciences, Hackensack Meridian School of Medicine, Nutley, NJ, USA. [5]Office of Minority Health and Health Disparities Research and Cancer Prevention and Control Program, Georgetown Lombardi Comprehensive Cancer Center, Washington, DC, USA.

ABSTRACT: In the U.S., approximately half of maids and housekeeping cleaners are Latino or Hispanic, while the vast majority are women (88.3%). This largely immigrant, underserved workforce faces complex factors, which may contribute to adverse health outcomes. To understand relevant barriers and challenges, this mixed-methods study explored the environmental health needs of a heterogeneous group of Latinas in New Jersey (NJ) who clean occupationally, and consisted of 3 focus groups (N = 15) with a cross-sectional survey (N = 9), both conducted in Spanish. Participants were recruited from community-based English as a Second Language classes in Hackensack, NJ. Analysis of focus group audio recordings included descriptive and in vivo coding followed by inductive coding to explore thematic analysis. The survey responses were evaluated using descriptive statistics. As per the survey results, the environmental health needs of this population include sore muscles, back problems, asthma, other respiratory issues, migraine or headache, and skin issues (rash, etc.). In the group discussions, the roles of genetics, food, and chemical exposures in cancer etiology were of great interest and a variety of opinions on the topic were explored. Both the focus group discussions and survey responses suggested that this population also faces barriers including lack of training, chemical exposures and inadequate personal protective equipment (PPE). These barriers are compounded by daily environmental exposures from personal home cleaning practices. The development of culturally- and linguistically-appropriate interventions are warranted to better protect the health of essential occupational cleaners who keep homes, businesses and schools clean.

KEYWORDS: Environmental health, occupational exposures, cleaning, Latina, cancer, endocrine disruption, population health, environmental justice, health disparities

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CORRESPONDING AUTHOR: Erin Speiser, The Deirdre Imus Environmental Health Center®, Hackensack Meridian Health, Hackensack University Medical Center, 30 Prospect Ave., Hackensack, NJ 07601-1914, USA. Email: Erin.Speiser@hmhn.org

Background

Environmental health risks of cleaning occupations

Central to the health concerns of cleaning occupations are the common pathways for multiple exposures and the potential health effects of chemicals when used alone or in combinations.[1] Cleaning products may not be selected for safer ingredients and may contain chemicals linked to respiratory issues, cancer and endocrine disruption, increasing job-related health risks. The presence of ingredients that may lead to adverse health effects[2-4] is in addition to other work hazards such as physically intense, repetitive tasks leading to job injuries among custodians and cleaning staff working in hotels and private homes.[5-7] The nature of this occupation often results in "low social and legal protection. . .without proper contracts or insurance" which makes professional cleaners "likely to escape from control such as regulations, health surveillance, and risk prevention"[8(p 581)]. Underreporting of injuries among underserved workers via U.S. surveillance systems such as the Occupational Health and Safety Administration (OSHA) has been well documented.[9,10]

The working conditions of low-wage cleaners, explored as part of this study and detailed elsewhere,[39] include long hours between cleaning occupationally and at home, and use of products chosen for affordability that contain harsh chemicals linked to asthma and other adverse health outcomes. Products for work use may be purchased by the cleaning professional or by the boss/employer. While occupational exposures represent the majority of time spent cleaning for the study participants, cleaning at home may contribute to health issues and environmental health needs as described by participants.

There is a small but growing body of research on cancer risk and mortality rates among workers in the cleaning industry. These studies often utilize established databases such as the Occupational Disease Surveillance System in Ontario, which reflected an increased risk for breast cancer diagnosis among female and male janitorial/cleaning personnel.[11] A study utilizing the Belgian census to evaluate health risks of the cleaning industry via cause-specific mortality, found respiratory and cardiovascular deaths to be significantly higher for cleaning professionals than those in non-manual occupations.[12] Similarly, a study comparing histologically confirmed thyroid cancer cases with controls found increased risk associated with certain occupations, including building and grounds cleaners and maintenance workers, janitors and cleaners (except maids and housekeeping cleaners), which could be partly attributable to exposure to petrochemicals and solvents.[13]

In the U.S., nearly 90% percent of maids and housekeeping cleaners are female, with underserved minorities overrepresented: 46.1% are Latino/a or Hispanic, 17.3% are Black or African American and 4.1% are Asian.[14] To date in the U.S., there are no federal laws requiring safety testing for cleaning products[15] and only a few 100 of over 80 000 commercial chemicals have been tested for safety.[16] Factors such as the timing of exposure, exposure site, mode of transmission, and developmental stage of the person affected (ie, infant, adolescent or older adult) combine to affect health outcomes and severity.[17] These products commonly contain ingredients known to cause health effects, including fragrance/parfum, glycol ethers, surfactants and solvents, and, when used in combination, may give rise to still other health issues.[18]

In particular, human-made chemicals called xenoestrogens are estrogen mimickers, and found in some cleaning products. They interfere with the body's endocrine system and cause adverse health effects by damaging the correct functioning of natural estrogens.[19] This process can affect the timing of puberty,[19,20] and play a role in estrogen-dependent cancers such as breast cancer.[21-23] Specifically, phthalates[24] and triclosan[25,26] have been associated with endocrine disruption and triclosan has been linked to breast cancer.[27,28] Parabens, a common preservative in a range of products, are also xenoestrogens.[29] As cleaning professionals may have language and education barriers, there may not be sufficient knowledge of the health effects of these chemicals, or of ways to mitigate exposures and report those which occur.

Occupational and environmental health exposures for Latinas

As Latina women comprise approximately half of the employees in cleaning occupations in the U.S.,[30] this group may face higher work exposures than other racial and ethnic groups, while potentially affected by social factors including low literacy, language barriers, poverty, discrimination, segregation, immigration status, and lack of access to healthcare and resources in the community and beyond.[2,3] These factors, individually or in combination, may impact not only physical health outcomes but mental wellbeing as well.[31]

It must be noted that, while unionized hotel workers are included in the U.S. workforce covered by the Occupational Safety and Health Act of 1970, self-employed professionals—including those cleaning homes—are not.[32] These OSHA standards and guidelines help ensure safe and healthy work practices and worker protections. Additionally, some states have additional laws in place for workers in the cleaning industry. NJ only has state-specific safety protocols in place for workers employed by state/local government,[32] which did not apply to any of this study's participants. This study includes both women who are employed by a cleaning company and those who are self-employed.

Data from the European Community Respiratory Health Survey showed adverse health effects from both cleaning at work and at home even 10 to 20 years later, including accelerated lung function decline in females.[7] Moreover, the effect size was comparable to that of 10 to 20 pack-years of tobacco smoking. A U.S. study of short-term effects among 43 female domestic cleaners with asthma and/or chronic bronchitis found increased respiratory complications on working days and days with greater hours spent cleaning—including cleaning at home—particularly from the use of diluted bleach, degreasing sprays and air fresheners.[4]

Exposure research specifically among Latinas includes a study of 56 domestic workers in San Antonio, Texas which surveyed participants regarding the types of routine cleaning tasks at work, the cleaning products used and respiratory symptoms experienced.[33] The study on a hard-to-reach, understudied female population found that upper respiratory symptoms were common, along with "frequent use of potentially toxic cleaning products (eg, bleach, toilet bowl cleaners)" while 39.3% reported not using PPE.[33] The lack of access to PPE and use of hazardous cleaning chemicals was echoed in the "Safe and Just Cleaners" study among female domestic cleaners (N = 52) in the New York City area.[34]

Such body burden is compounded by "background" exposures from the environment, including surface water and groundwater, air and soil,[35] which combine with exposures from products and everyday practices on the job and at home, creating a "chemical soup" of exposures that may affect health outcomes.

It is currently not well understood how these environmental health factors, especially within the Latina cleaning community, may contribute to occupational exposures and potentially related adverse health outcomes including allergies and dermatologic and respiratory issues.[2,3,5] These gaps in the literature need to be addressed in order to develop effective interventions via community-based participatory research (CBPR) for a future epidemiological study to address this population's

concerns about toxic exposures associated with the cleaning profession and barriers to accessing safety measures and health care. This study serves as a first stage to engaging workers in assessing their needs, focusing on Latinas in the cleaning industry. Environmental health needs which are explored include health symptoms, use of personal protective equipment (PPE), general rating of personal health, health insurance status, time since last routine checkup, and history of illness (including those that could be linked to occupational cleaning) and lastly, medication use. The Social Cognitive Theory (SCT) is employed as the framework for designing instruments and analyzing data.

Methods

This is a mixed-methods[36-38] study consisting of semi-structured focus groups and a closed-ended survey[36] regarding cleaning practices at work and at home. It focuses on the environmental health needs of Latinas from different countries of origin, who work in the cleaning industry in New Jersey. The present study was part of a larger research project which also explored knowledge, attitudes and beliefs of this population, and its study design is described in detail elsewhere.[39] The pilot phase consisted of FG #1 and #2. After the pilot phase, one survey question (# 38, detailed under separate publication[39]) was re-written for clarity while all other study processes remained the same.

The social cognitive theory (SCT) served as the guiding theoretical framework, and was instrumental in the creation of the focus group guide's open-ended questions and probes and the 43-question survey. Philosophical assumptions were incorporated into the interpretive framework and theory that framed the theoretical lens of the study.[36] The SCT attributes human behavior to the recurrent interaction of environmental factors, personal factors, and individual behavior.[46] The SCT was chosen for this study as an essential lens in exploring environmental influences on Latinas' work practices, specifically because it allows for a holistic analysis of the continual interaction of health and safety factors on the job and in cleaning at home, as well as influences of family, co-workers, culture, and the community. In this way, the mixed-methods study design further allows for a broad, holistic exploration of this population, by combining a quantitative survey and qualitative focus groups.

Participant recruitment

Participants were recruited from English as a Second Language (ESL) classes offered in Hackensack, New Jersey, where 2 of the team members volunteer, as these classes serve as a community resource for Latina women. Class attendees who had agreed to be contacted were approached by the study team and were provided with the information included in the recruitment flyer. The snowballing technique was also employed to increase enrollment. To facilitate recruitment, the flyer in English was designed at a fourth grade level on the Flesch-Kincaid scale and was then translated into Spanish.[40]

Sample

This research utilized purposive sampling. The study allowed for up to 5 focus groups, until thematic saturation was reached.[41] The variables for study inclusion were: adult Latinas who worked in a cleaning occupation and spoke Spanish and/or English. The ESL students who also participated in the focus groups attended voluntarily and did not receive any class credit or grade. They did receive a $25 gift card for their time.

Data collection

Questions for the focus group guide and survey were created by the first author to align with the SCT and research questions. They were then reviewed for cultural and linguistic relevance by Latino investigators/team members with diverse subject matter expertise. The research question pertaining to environmental health needs was: For a bicultural population of Latina women from different countries of origin and acculturation levels who work in cleaning occupations, what are the environmental health needs of these cleaning professionals? Corresponding questions in the focus group guide included:

- Do you think there's a connection between use of cleaning products *at home* and health?
- Tell me about a time you may have experienced health concerns related to using cleaning products *at home*.
- Do you think there's a connection between use of cleaning products *at work* and health?
- Tell me about a time you may have experienced health concerns related to using cleaning products *at work*.
- How do you deal with these health concerns? (discussed as part of cleaning at home and cleaning at work)
- Facilitator prompt (if this is not already discussed): Are any long-term health effects such as cancer a concern when using cleaning products? (discussed as part of cleaning at home and cleaning at work)

The study translation method followed the U.S. Census Bureau's *committee approach* (consensus method) for translating data collection instruments and related materials.[42] For the focus group guide, survey, recruitment flyer and eligibility checklist, 2 qualified translators conducted a translation of the documents independently while a third qualified translator compared the 2 documents and arrived at the final document. This third translator also translated all the write-in responses on the surveys from Spanish to English for analysis. All focus group transcripts were translated by a language service serving hospital systems and government agencies and provided letters of accuracy for each transcript. The consent form was translated by Hackensack University Medical Center's translation

service, which provided a letter of accuracy, as per guidelines for all patient signed forms.

Three focus groups with a total of 15 participants were conducted until saturation was reached, as determined in consultation with the second author. Thematic saturation included repeating information from participants on working conditions, products used, lack of training, lack of consistent PPE use, and a variety of health factors potentially linked to occupational and home cleaning. After each focus group discussion, participants were asked to complete an interviewer-administered survey exploring socio-demographic information (age, gender, education level, language use, country of origin, etc.), cleaning practices and the use of cleaning products.

Focus group procedures. The focus groups met in July 2019 (FG #1), November 2019 (FG #2), and February 2020 (FG #3). At the time that eligibility was confirmed, participants were asked whether they preferred participating in Spanish or English and all indicated a preference for Spanish. A certified bilingual translator served as the focus group moderator for the focus groups while the first author served as note-taker. Focus group sessions were scheduled at the participants' convenience and each session lasted approximately 90 minutes, beginning with the informed consent process, followed by the focus group discussion (~40-45 minutes). One of the 2 ice breakers for the focus groups asked participants their thoughts on the use of cell phones to get health information., which served to gage acceptability of using cell phones to deliver any needed resources in the future, as determined by the focus groups. The FG discussions were followed by a written paper and pencil survey (~15-20 minutes). Each session was audio recorded with participants' permission and light refreshments were provided. At the end of each session, participants were given a $25 gift card and were offered a tip sheet on safer cleaning practices, available in Spanish or in English, published by OSHA and other federal agencies.[3]

During FG #1, participants' unfamiliarity with written surveys and literacy challenges were barriers to filling out the survey. To address this for FG#2 and #3, 3 bilingual survey assistants from Latin American countries were added to administer the survey. The survey results presented include only survey data from FG #2 and #3 (n = 9) and are included in the paper to describe the characteristics of the FG participants. The focus group discussion results are from all 3 focus groups (n = 15).

The study was conducted according to the International Conference on Harmonization (ICH), Good Clinical Practice (GCP), the Declaration of Helsinki, Institutional Review Boards (IRB) and in accordance with the U.S. Code of Federal Regulations on Protection of Human Rights (21 CFR 50). It was approved by the Hackensack Meridian Health (HMH) Institutional Review Board (IRB) under Pro# 2019-0015. Written informed consent was obtained from each participant prior to entering the study.

Data analysis

Transcriptions. A bilingual translator transcribed and translated each of the focus group audio recordings verbatim into English for analysis, and provided a certificate of language accuracy.

Coding. The first author utilized an inductive approach that employed a multi-step coding process in analysis of the transcripts. The first step in the process of qualitative data analysis was to read and re-read all transcriptions to form a general understanding of the text prior to more in-depth analysis of identifying categories across the focus groups and then organizing the categories by color-coding the text.[36,43,44] More in-depth review of the transcriptions resulted in the identification of emergent codes and sub-codes, using in vivo and descriptive coding descriptors. Codes presented in the first author's codebook were reviewed by the second author for accuracy and to establish consensus reaching and ensure trustworthiness using an audit trail process.[36,46] Intercoder agreement served as an external check during the coding process to help come to a full consensus on the thematic analysis generated. Codes and themes in which consensus was not achieved were not moved forward in the data analysis. Additionally, the SCT was used as a framework for further interpretation and forming conclusions about the focus groups, as described in the Discussion.

Quantitative data. The survey collected quantitative data on country of origin, household income and health issues experienced. Participants' survey responses were entered into a data capture and management tool, Research Electronic Data Capture (REDCap), in a password-protected account accessible only by the investigator team.[45] The responses were analyzed using descriptive statistics generated by REDCap.

Validity, credibility, and reliability: Focus group guide and survey. Validity of the focus group guide and survey was achieved through review by 3 co-authors who evaluated each question for clarity and appropriateness. The Delphi process consisted of 3 faculty members and was used seeking majority consensus for each question. As previously mentioned, questions were also reviewed for cultural and linguistic relevance by Latino members of the study team. Reliability of the 2 study tools were assessed during the pilot phase which consisted of the first 2 focus groups.[38] Additionally, the first author compared pilot phase findings to the literature reviewed and identified overarching consistencies.

Results

Demographic characteristics of participants

The first section of the participant survey consisted of 16 social/demographic questions as summarized in Table 1 and previously described under a separate publication.[39] The demographic information from the qualitative results are presented

Table 1. Demographics (N = 9).

CHARACTERISTIC	N (%)
Country of origin	
Ecuador	4 (44.4)
Dominican Republic	2 (22.2)
Mexico	1 (11.1)
Peru	1 (11.1)
El Salvador	1 (11.1)
Age range of participants	
40-45 y	3 (33.3)
46-50	3 (33.3)
51-60	2 (22.2)
61-70	1 (11.1)
Mean = 48.78 y with standard deviation = 6.72 y	
Number of years living in the U.S.	
<10	2 (22.2)
10-20 y	4 (44.4)
21-30	2 (22.2)
31-40	1 (11.1)
Marital status	
Married or cohabitating	5 (55.6)
Divorced/separated	3 (33.3)
Never been married	1 (11.1)
Highest level of education completed	
Elementary school (fifth grade)	3 (33.3)
Junior high/middle school (eighth grade)	1 (11.1)
High school or equivalent (12th grade)	2 (22.2)
Technical school	1 (11.1)
Bachelor's degree (4 y college)	2 (22.2)
Total household income (before taxes)	
<$20 000	2 (22.2)
$20 000-39 000	4 (44.4)
$40 000-59 000	1 (11.1)
$60 000-79 000	1 (11.1)
⩾$80 000	1 (11.1)

first to give an overview of the characteristics of this population. All 9 survey respondents in FG #2 and FG #3 indicated being first generation, meaning that they were born outside the U.S. and immigrated to their new country. The median number of years living in the U.S. was 17.0 years, while the mean was 18.8 years (standard deviation = 7.9 years).

Participants were also asked to identify the language in which they: read and speak, use at home, think, speak with friends, use for text messages, and use on social media (Facebook, Instagram, etc.). The majority of responses for each of the 6 questions were either Only Spanish or More Spanish than English.

Qualitative data

Recurring themes from all 3 focus groups included types of training received, products used, environmental health needs/health issues and use of personal protective equipment (PPE). The first 2 themes are discussed in detail under separate publication.[39]

Environmental health needs

For Environmental Health Needs, participants described experiencing a range of symptoms from their cleaning occupation including asthma, skin irritation, headaches, muscle soreness and pain and vision issues. Those buying their own products include self-employed and those who were employees. One participant said "I have asthma. . .when you breathe it [bleach] in or something, you feel it here in the chest. . .but it's good because it whitens things. . ." (FG #1). Other comments on bleach from the same focus group were: "Bleach is very bad. . .because it's strong. . .it reaches the lungs." and "It [bleach] even gives you a headache." A FG #2 participant similarly stated: ". . .bleach does give me a headache. . ." and one Latina from FG #3 stated, ". . .so 1 day when my tongue started losing sensation [from using bleach]."

Another ingredient of concern—ammonia—was discussed in the second focus group: "sometimes they'll use ammonia and you can't even breathe. . ." and "I agree with her. . . because it's very harmful. . .and that goes straight to your lungs. . ." Dry cleaning chemicals were discussed in the same group: ". . .I worked at the, at a cleaner. . . but where we did the ironing, the machines where they did the dry cleaning were right there. . . so the whole time there was that smell (breathes in dryly). . . the whole time I was dizzy. . . my head would ache. . . no, no. . . it was terrible. . . and I lasted 11 years there. . ." The complete list of products used by participants from the 3 focus groups was previously published.[39]

Throughout the focus groups, the topic of cancer (a facilitator prompt in both the Cleaning at Home and Cleaning at Work sections) supported the theme of health concerns. For example, a mother discussed the breast cancer diagnosis of her young adult daughter, who also cleans occupationally and was present: "She had breast cancer because. . .my daughter doesn't drink, doesn't smoke, has never smoked, and you'd say, but it must be the chemicals you use at home, what she eats, the deli meats you eat. . ." (FG #1). Her daughter stated, ". . . it could

Table 2. Summary of codes: environmental health needs.

PREDOMINANT CODES	RESPIRATORY IRRITATION, CANCER, AND HEADACHE
Category	Effects of cleaning chemicals
Thematic analysis	Cleaning affects worker health both short and long-term and combines with exposures from home.

Table 3. Summary of codes: use of PPE.

PREDOMINANT CODES	GLOVES OFTEN, MASKS SOMETIMES, NEED BETTER, NEED MORE
Category	PPE on the job
Thematic analysis	Use of proper PPE is inadequate and often not supplied on the job, resulting in multiple barriers.

be that many years back, it could be that it affected me, the product, or the chemical. . . or that it was genetic. . .” Another participant shared her belief that “no matter how many detergents and chemicals a cleaning product might have” they do not contribute to cancer. The perceived link between cancer and product ingredients was also discussed in the third focus group: “. . .on the label it says it’s very prohibited. . .that over the course of years it causes cancer (. . .) the head, the eyes, all of that. . .you have to be very careful.” The predominant codes are summarized in Table 2.

Qualitative data—emergent theme: Use of PPE

For the second emergent theme, use of PPE, participants reported varied practices (eg, “normally we don’t use masks or gloves” at home but use gloves at work; “normally 90 percent of us don’t use masks [at work]”). Some participants purchased their own PPE (eg, “so I bring, I buy [my own gloves]” and “I had to bring a mask. . .for. . .the smell”), if they were self-employed or if their boss/employer did not purchase what was needed. One reported that institutions provide “these crappy materials for their employees.” Although 2 other women noted they were given a mask at work, one noted it “doesn’t help us with the smell. . .it’s for the dust.” One participant said at the end of the FG #3 session “products over the long term are harmful to anything in the body. . .that’s why the masks are very important. . .I believe. . .right?” In addition to access issues for PPE, the results highlighted an overall lack of clarity on when to use masks, gloves and other protective equipment and how often to change PPE. The predominant codes are summarized in Table 3.

Quantitative data

In addition to demographics, the survey collected data on 3 sections: Health Information, Cleaning Routine at Work and Cleaning Routine at Home. The results of Health Information are detailed in (Table 4), and the latter 2 sections are detailed elsewhere.[39]

Table 4. Health information (N = 9).

HEALTH INFORMATION VARIABLE	N (%)
General rating of personal health	
Excellent	1 (11.1)
Very good	0
Good	4 (44.4)
Fair	4 (44.4)
Poor	0
Type of health insurance	
I don’t have health insurance	5 (55.6)
Medicaid	2 (22.2)
Private insurance	1 (11.1)
Employer insurance	1 (11.1)
ACA/Obamacare/Marketplace	0
Medicare	0
Both Medicaid and Medicare	0
Time since last doctor’s visit for a routine checkup (general physical exam, not exam for injury, illness, or specific condition)	
Less than 1 y	5 (55.6)
More than 1 y but less than 2 y ago	2 (22.2)
More than 2 y but less than 5 y ago	2 (22.2)
5 or more years	0
History of illness (diagnosed by doctor or other health care provider)	
High cholesterol	3 (33.3)
Chronic lung disease such as asthma, emphysema, or chronic bronchitis	1 (11.1)
Depression	2 (22.2)
Other—write-in	2 (22.2)
Pre-diabetes	1 (11.1)
Arthritis/legs	1 (11.1)
Diabetes or high blood sugar	0
Hypertension or high blood pressure	0
Stroke (ischemic or hemorrhage)	0
Heart disease	0
Cancer (other than skin cancer)	0
HIV/AIDS	0
None	3

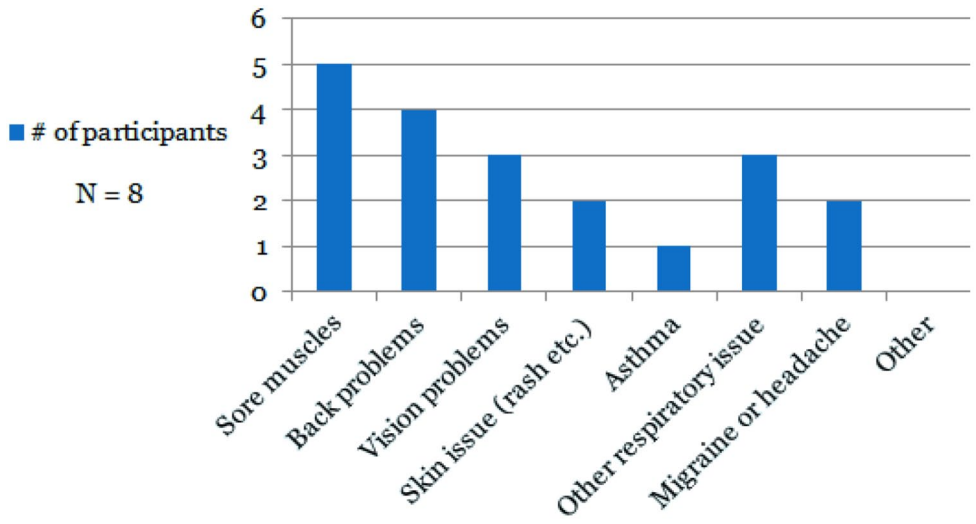

Figure 1. Illnesses caused by cleaning profession.

When asked about illnesses that could be caused by their cleaning profession, the most frequent illness noted was sore muscles (5 respondents, 62.5%), followed by back problems (4 respondents, 50.0%), and respiratory issues other than asthma (3 participants, 37.5%) (Figure 1).

Similarly, 8 women also responded to "Do you use any medication (prescribed, over the counter, or herbal products) to deal with work-related health issues?" with 4 (50.0%) stating Yes and the others replying No. The specific medications identified were "Melocytan paraddores" (refers to Parador, a type of acetaminophen), pain killer, and allergy pill + Tylenol. One participant also noted that she uses shoulder acupuncture for work-related health issues.

Discussion

Together with the focus group transcripts, both the quantitative and qualitative data complemented each other to help form a comprehensive picture of the environmental health needs of the Latinas participating in the study. In this way, the findings of the qualitative focus groups supplemented the findings of the quantitative survey. Taken together, the data show that the environmental health needs of this population are complex and varied.

This unique group of occupational cleaners, first generation ESL adult learners and mothers of students in the district had defining characteristics due to the recruitment location. Motivation to connect with the community in learning another language suggests a commitment to adult learning, which is also reflected in the womens' desire for ongoing job training as voiced in the focus groups. As mothers to children in the district, they may have had a desire for flexible work which may have motivated their choice in occupation.

Also consistent with the literature were the respiratory and dermal issues reported, as well as other concerns such as sore muscles and back problems. Cancer was discussed by participants several times, with much confusion as to what, if anything, may cause cancer. The roles of genetics, food, and chemical exposures were of great interest and a variety of opinions on the topic were discussed, suggesting a need for further education. In this way, the focus group discussions expanded upon, and brought to life, information captured via the survey. Another example of the ways the survey and group discussions complimented each other was the use of PPE. While participants reported in the survey, the types of PPE used, it was the focus groups that elicited details about the inconsistent availability of PPE on the job, and the lack of training regarding its proper use.

Furthermore, the 6 constructs of the SCT (reciprocal determinism, behavioral capability, expectations, self-efficacy, observational learning (modeling) and reinforcements) helped frame both the survey and focus group guide. The construct of reciprocal determinism applied most to the research question regarding environmental health needs. Reciprocal determinism is defined as an interaction between an individual, his or her environment, and behavior.[46] This construct was exemplified by participants via the many health effects they experienced, and the ways they interacted with their environment at work and at home in cleaning, training, using products and PPE in a continuous cycle where each influenced the next.

Additionally, one participant in FG #3 provided insights on social justice for Latinas in the cleaning industry, emphasizing the need for training and empowerment: "spread the word to many people. . .raise awareness. . .that we have to love ourselves a bit more." According to community-based participatory research (CBPR), when the community identifies and advocates for their health problems, research becomes more valuable. This principle speaks to the community's interest in improving their health and the effectiveness of CBPR. This research study lays the foundation for the development of a culturally and linguistically appropriate intervention to empower Latinas in cleaning occupations to advocate for and/or create a healthier work environment. Such an intervention

may be particularly critical for self-employed workers who are not covered by OSHA and are self-reliant for their own cleaning training, with limited resources and access. A mobile, text-based intervention may be accessible but, as found in this study, literacy barriers may make it necessary to build in alternate methods of content delivery for those with limited literacy. Involving cleaning professionals and community advocates in the development of an intervention would help ensure that it effectively meets the needs of this population of essential workers.

Strengths and Limitations

Due to the limited sample size, this study has limited generalizability to other Latinas who clean occupationally, particularly to those who live outside of northern NJ. It can, however, offer meaningful insight and be used to inform the design of a larger prospective study with participants from a broader geographic area allowing for more diverse data. Although participants' acculturation was not assessed in this study, participants all spoke Spanish as their primary language, suggesting low-acculturation. Future research should consider assessing the environmental needs of Latinas in the cleaning industry with varied acculturation levels. Notably, some of the participants worked together occupationally and studying these social networks may be promising for environmental health research, as well as studying Latino men working in cleaning occupations such as janitorial roles.

Social desirability bias may have impacted the data collected, though rapport with the study team helped to minimize its impact. Opting not to video record the sessions helped to protect the participants' anonymity and perhaps help them feel more comfortable, but made it challenging to consistently identify which participant was speaking. Additionally, seasonal considerations seemed to influence recruitment for those without personal transportation, impacting the number of women who attended focus groups during the fall and winter. Finally, data on PPE use may drastically differ after the COVID-19 pandemic. Even with these limitations, the findings offer valuable insights into the environmental health needs of Latinas in cleaning occupations.

Conclusion

Latinas in cleaning occupations in northern NJ experience a range of environmental health needs which are influenced by diverse social barriers including low literacy (as seen with the survey issues that were found in FG #1), financial issues (as seen in the demographic section of the survey) and language barriers (as discussed during the FGs and seen in the Spanish language chosen for FG participation). The development of a tailored, culturally, and linguistically appropriate health intervention is warranted to provide training and resources for improving the environmental health of Latina cleaning professionals.

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Author' Contributions

ES conceptualized and designed the study, participated in study activities, and drafted and revised the manuscript. GPZ provided oversight for the study from design to publication and detailed review of the manuscript. FCB participated in conceptualizing the study, reviewed the focus group guide and survey, conducted recruitment with ES, facilitated the focus groups in Spanish, and conducted detailed manuscript review. EAC participated in reviewing the focus group guide and survey, administering the survey for participants, and reviewed the manuscript. APC provided study oversight from conceptualization to completion, expertise in conducting a linguistically and culturally appropriate study, and detailed manuscript review. DD participated in study design and contributed expertise on data preparation and statistical analysis. TNB provided detailed manuscript review and environmental health expertise for the completed analysis and discussion. BK and EGP provided guidance on protocol development, offered regulatory support and contributed to the manuscript write-up and review.

Availability of Data and Materials

The datasets used for this study are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

The study was conducted according to the International Conference on Harmonization (ICH), Good Clinical Practice (GCP), the Declaration of Helsinki, Institutional Review Boards (IRB) and in accordance with the U.S. Code of Federal Regulations on Protection of Human Rights (21 CFR 50) and was approved by the Hackensack Meridian Health (HMH) Institutional Review Board (IRB) under Pro# 2019-0015. Written consent was obtained from each participant prior to entering the study.

Consent for Publication

All authors read and approved the final manuscript.

Standards of Reporting

The STROBE Checklist for Cross-Sectional Studies was consulted during the review of this manuscript.

ORCID iDs

Erin Speiser https://orcid.org/0000-0002-3306-0873
Traci N. Bethea https://orcid.org/0000-0003-3205-2078
Francisco Cartujano-Barrera https://orcid.org/0000-0001-8069-1750

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