

Occupational exposures among domestic and industrial professional cleaners

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Background	Despite being a large part of the workforce, cleaners remain a relatively understudied occupational group in the USA.
Aims	The aims of this focus group study were to identify and characterize occupational exposures, symptoms and job tasks among domestic and industrial professional cleaners.
Methods	Twelve focus group sessions were conducted in Lubbock, TX, and Houston, TX. Participants were asked about their job tasks, type of products they use to clean, bodily symptoms, job training and work environment.
Results	Out of 99 attendees, 79 domestic and industrial cleaners participated actively in the focus group sessions. Three general themes emerged regarding cleaning professionals' work experiences: (i) job training, (ii) chemical exposure and use and (iii) competence. Domestic cleaners demonstrated significant skills deficit across each of these three themes as compared to industrial cleaners. Domestic cleaners reported more frequent exposure to respiratory irritants and sensitizers and also reported adverse respiratory symptoms as compared to industrial cleaners.
Conclusions	The results from this qualitative study are consistent with earlier findings from quantitative studies placing domestic cleaners at risk of exposure to chemicals that are respiratory irritants and/or sensitizers.
Key words	Cleaners; focus group; janitors; occupational asthmagens; occupational health.

Introduction

Professional cleaners form a large part of the workforce in the USA. According to the US Bureau of Labor Statistics Current Population Survey [1] in 2006, there were 5.4 million persons, aged 16 and over, employed in cleaning and building service occupations. The potential adverse respiratory health effects of work-related exposure to cleaning agents have not been widely recognized. The majority of studies in cleaners have been conducted outside USA. In a community-based case-control study, conducted in Singapore, an almost 2-fold increased risk of asthma was found among cleaners (OR = 1.91, 95% CI 1.22–2.99) [2]. Recently, a high prevalence of occupational asthma (29%) was observed among female janitors,

housekeepers and cleaners in Sao Paulo. Occupational asthma among cleaners comprised 12% of all cases; cleaning agents were the most frequently reported exposure agents, comprising 20% of all agents mentioned [3]. Likewise, Zock *et al.* [4] reported frequent use of cleaning sprays during common household cleaning activities to be associated with higher incidence of asthma.

In the USA, relatively few studies have addressed the topic of asthma and cleaners. However, those that have done so have identified this occupational group as an at-risk group, consistent with studies from Europe and elsewhere. Based on Doctor's First Report data, the annual rate for work-related asthma was found to be highest among janitors and cleaners (625 per million workers) in California [5]. More recently, based on National Health and Nutrition Examination Survey III data, a 4-fold increased odds of work-related wheezing (OR = 4.1, 95% CI 1.4–12.1) in the lodging industry were reported [6], where the exposures of concern are often related to cleaning substances. Similarly, cleaners were found to have a >2-fold increased risk of work-related asthma (OR = 2.37, 95% CI 0.53–10.58) and >5-fold increased risk of work-related wheezing (OR = 5.44, 95% CI 2.43–12.18) in the USA [7].

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Despite their large numbers, cleaners as a work group have rarely been studied in detail in the USA. Furthermore, it is likely that this number is underestimated since many workers employed in private households may be undocumented, including a high proportion of Hispanic workers. The purpose of this study was to address the existing gap in the literature regarding better understanding of occupational exposures in this population. The objective of this focus group study was to identify and characterize occupational exposures, symptoms and job tasks among domestic and industrial cleaners.

Methods

Twelve separate focus group sessions, six in Lubbock, TX and six in Houston, TX, were conducted. Each focus group session was made up of 6–10 participants. One session in Houston, TX, was conducted entirely in Spanish to accommodate Spanish-speaking participants. Inclusion criteria for recruitment was (i) age between 18 and 70 years, (ii) working as a domestic or industrial professional cleaner for at least 1 year and (iii) willingness to participate. Study participants were recruited using a purposive and snowball sample approach from a focus group invitation list, prepared utilizing different sources, as follows: (i) identification of private domestic and/or industrial cleaning companies that employ cleaning workers, through word of mouth or yellow pages, (ii) contacting housekeeping services of the major hospitals and universities at the two proposed study sites, (iii) advertisement in the major Spanish language newspapers in Houston and Lubbock and (iv) approaching local chambers of commerce, churches, civic centers and community leaders for information regarding professional cleaning companies in Lubbock and the Greater Houston Metropolitan Area. Respondents who then contacted the research team underwent preliminary screening questions, asked by a bilingual member of the research team, to assure that they met the inclusion criteria. No questions regarding residence status, health or of a sensitive nature were asked. Once eligibility was determined, the participant was invited and scheduled to attend the focus group meeting.

Focus group sessions were held in community centers in Lubbock and in a conference hall belonging to The University of Texas Health Science Center at Houston. A bilingual study member of the research team experienced in conducting focus group interviews facilitated all 12 sessions. Sessions were audiotaped in order to maximize the capture of discussion content. As participants arrived, information about the general nature of the session, audiotaping and measures to preserve confidentiality were provided to each participant, an opportunity to ask questions was given and written informed consent to participate was obtained. Upon giving consent, respondents were asked to complete a brief one-page demographic questionnaire requesting informa-

tion on age, sex, race/ethnicity, income and educational level. The focus group session was informal, but guided, and lasted from 1.5 to 2 h. Each session began with an introduction by the facilitator, followed by an ‘opening’ question in which participants were asked to introduce themselves by first name only. The facilitator then continued with ‘transition’ questions that led into the central ‘key’ questions for this project. In the end, to bring closure to the discussion, some ‘ending’ questions were asked (Table 1). Focus group guiding questions were prepared in advance by the research team, which included an occupational physician, epidemiologist, communication and survey specialists. These questions were pilot tested in a selected group of cleaners for clarity and brevity.

The focus group data were analyzed using content analysis and open coding using the focus group as a unit of analysis instead of an individual. First, we categorized the frequency of chemicals and cleaning products reportedly used by the respondents using a content analysis approach. Second, we used an open-coding approach to synthesize experiences of respondents and the context of the phenomenon being observed [8]. Open-coding procedures for these data occurred on two levels of thematic inference. The first level—low inference—features themes derived from standard, concrete codes (e.g. equipment use). The second level—high inference—features themes derived from latent meanings [9]. Regardless of its level of abstraction, each theme was developed based on the content of the codes observed in the data. Since the professional experiences of domestic and industrial cleaning personnel are understudied, open coding allows for a descriptive and exploratory examination of their accounts. A theme was considered present based on its ‘recurrence, repetition and forcefulness’ [10].

We also abstracted a comprehensive list of chemicals and products reported by study participants. For each product, we then listed all active ingredients. For each active ingredient, the corresponding Chemical Abstract Service number was identified and the list was then reduced to those ingredients known to be respiratory irritants or sensitizers using NIOSTIC® and OSHLINE™ reference databases; frequency of products occurrence in the transcript text was then tabulated. Since this project involved a relatively large focus group population, the Nvivo version 2.0 qualitative analysis software (QSR

Table 1. Focus group questions

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1. Tell us what you do in a typical workday at the job?
 2. What type of cleaning products or solutions or chemicals do you use?
 3. What kind of supplies or equipment do you use?
 4. What do you wear when you clean?
 5. What kind of training did you receive that prepared you to handle cleaning solutions or whatever you use for cleaning?
 6. Describe your work environment?
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International, Victoria, Australia) was used for organizing, labeling, coding, indexing and cross-referencing data. Signed informed consent was obtained from each subject and the study protocol and survey instruments were approved by the Institutional Review Board at Texas Tech University Health Sciences Center and the Committee for the Protection of Human Subjects at the University of Texas School of Public Health at Houston.

Results

A total of 191 subjects responded to our recruitment efforts and were screened for study eligibility. Of these, 150 subjects were eligible and were invited to the focus group sessions. All initially agreed; ultimately, 99 subjects participated in 12 focus group sessions (43 in Lubbock and 56 in Houston) for an overall participation of 66%. Of those attending, 37% reported learning about the study from family/friends/coworkers and through word of mouth, 29% from flyers/brochures and 34% from newspaper ads. Mean age was 43.2 years (SD = 11.9). As expected, the majority were Hispanic (61%) and female (88%). Most were non-smokers (62%) and had worked as cleaners for a mean of 9.6 years (SD = 8.5). During the sessions, 79 of 99 study participants contributed actively to the discussion: 32 self-described themselves as working in domestic and 47 in industrial settings. Those who did not attend the focus group sessions, despite initially agreeing, were more likely to work in a domestic setting ($n = 33$) and more likely to be female ($n = 45$).

Participants reported using a total of 66 different products to clean residential, industrial and commercial zones. Of these, a total of 48 different respiratory irritants and sensitizers were identified; domestic cleaners reported more frequent exposure to respiratory irritants and sensitizers than industrial cleaners.

Three general themes emerged regarding cleaning professionals' work experiences: (i) job training, (ii) chemical exposure and use and (iii) competence. Typically, respondents working in domestic settings indicated receiving merely informal or no training. In most cases, their training occurred on-the-job, provided by a partner who in most cases was a relative or friend. Domestic cleaners described their training as not instructive, but as being trained through trial and error as exemplified in the following comments:

I learned in a trial and error way. My mother would just tell me which room she wanted me to clean and I would just use which solutions she had.

We go on the advice from others who have said they have used this product or that product and then we use it.

In contrast, industrial cleaners reported receiving various levels of formal training such as examinations, inspections of surfaces and rooms and would often be partnered initially with an experienced coworker.

We had to go through training . . . we had a written test on how to use the equipment and chemicals and about which chemicals clean which surfaces.

My cleaning would be inspected after I cleaned and I would just learn how to clean better each time the supervisor told me to redo it.

Although these participants described their training as thorough, they also described having to cut corners and frequently violate organization policy in order to do their jobs. They also expressed concern over the quality of equipment and clothing provided to them. The most common complaint among these industrial employees was poorly fitting protective clothing:

They have these suits, shoes, and gloves that they want us to wear but they don't fit most of us and there aren't enough to go around to the people who can wear them.

The shoes and the suits really don't fit me well. It would be easier if I just wore my own clothes.

Most domestic cleaners described lack of awareness regarding protective clothing.

Just as domestic and industrial cleaners' job training experiences differed, so did the self-reported effects of cleaning and chemical exposures. Generally, domestic cleaners reported experiencing more physical symptoms during and following a day of cleaning than industrial cleaners:

We did this one house and got rid of all those webs and did the real deep cleaning it was very dusty. I went home and I just didn't feel good and then my body started hurting. Normally I don't go to bed without dinner, but that day I didn't want to move.

We cleaned an empty house the other day when the people moved out and we got real sick after we got home we just hurt all over and we don't know what caused it.

However, industrial cleaners described organizational factors such as management, communication with other organizational personnel and equipment problems as contributing to their risk of exposure to chemicals. Most of the domestic cleaners reported nausea and dizziness in general, as well as more specific symptoms, during and after a day of cleaning. These included body ache (16 times versus 0 among industrial cleaners), allergy (13 versus 11), nasal congestion (15 versus 0), coughing (16 versus 4), nausea (22 versus 5) and trouble breathing (19 versus 3). No additional questions to describe 'trouble breathing' were asked during the focus group sessions. While domestic cleaners reported symptoms directly related to cleaning, the industrial cleaners reported that their symptoms and exposure risks were influenced more often by their interactions with other non-cleaning personnel and access to appropriate cleaning equipment.

Lastly, study participants also discussed their knowledge of the chemicals they used and their cleaning skills

in general. In most cases, industrial cleaners displayed moderate to high levels of knowledge about their jobs. However, the competence displayed by the domestic cleaners varied significantly. For example, some displayed an understanding for the need to avoid combining certain chemicals to prevent reactions:

You don't want to mix ammonia and bleach I really don't use these anymore because these chemical can cause cancer and damage your lungs. I have switched to natural cleaners like vinegar it's safer and works just as well.

In contrast, others displayed little competence when discussing cleaning skills and techniques. For example, it appeared that many do not consider exposure to their bodies as cleaning-related risks (although many reported respiratory and musculoskeletal symptoms during and following cleaning). Additionally, several domestic cleaners displayed little knowledge of which cleaning products were most appropriate for particular surfaces:

I just use whatever she has in her basket. If she has bleach I use bleach, if she has ammonia I use ammonia, if she has acid and so on, if she has nothing I'll just use soap and water, but I can usually find something to use.

Industrial cleaners displayed significantly more job and skill competence. Most remarked that each employee had a specific job he or she was assigned and they distinguished themselves based on these assignments:

You'll be given a job to do and you'll need to do that job mostly each and every day and you'll be doing that job in the same place like a building and you'll get to know that building and that job very well then you'll move on to another job and place.

I'm one of the only employees who clean floors. The others have their own jobs they're responsible for doing. If you're new you'll probably be picking up trash and emptying trash cans and sweeping. You'll get a different job when you get trained and have more experience . . . I know which days I'll be on floors and which days I'll be another job . . . it is organized.

Discussion

The results suggest that domestic professional cleaners lack appropriate skills in job training, use and knowledge of hazardous chemicals and report more respiratory symptoms as compared to industrial cleaners.

One limitation of this study was lack of involvement of employers and their perspective on workplace exposures. Also, there was little contribution from participants working in both the domestic and industrial setting, which could have confirmed differences and similarities in experiences of both cleaner groups. The few contributions made by these 'mixed environment' members simply confirmed themes already

identified by those working in one environment, but no new themes. Additionally, the focus group approach itself, while efficient, seeks to promote convergence among group members, which can miss important individual experiences, such as gender differences [11].

Workplace health hazards associated with cleaning chemicals have been recognized only recently [7,12]. This study finds that household and industrial cleaners use multiple products during their tasks. Many of the active ingredients in these products are established respiratory irritants or sensitizers and include 'solvents' (e.g. ammonia and ethanol), 'alkalis' (e.g. bleach), 'surfactants' (e.g. sodium laureth sulfate), 'builders' (e.g. acetic acid) and 'antimicrobials' (e.g. glutaraldehyde and dialkyl and dimethyl ammonium chlorides). Most are highly volatile and readily evaporate during cleaning, making them respirable. Furthermore, mixing certain cleaning agents (e.g. bleach and ammonia) can be particularly hazardous and are a frequent cause of emergency room visits and calls to poison centers [13,14].

Several participants, especially domestic cleaners, reported experiencing adverse symptoms during or following cleaning activities. These were mostly respiratory symptoms frequently associated with specific tasks. In a prospective study, Neilson and Bach [15] found an increased risk of upper respiratory symptoms among Danish female cleaners, especially in association with the use of sprayers. Using data from 10 European countries, Zock *et al.* [4] found more than twice the odds of physician-diagnosed asthma among adults frequently using hand-operated cleaning sprayers during common household cleaning activities. Medina-Ramon *et al.* [12] in a panel study of 43 female domestic cleaners, with a history of obstructive lung disease, reported significant associations between lower respiratory tract symptoms and specific tasks, including dusting, vacuuming and cleaning bathrooms and kitchens. Significant associations were also observed with exposure to diluted bleach, degreasing sprays, ammonia and air fresheners. As in this study, the most common respiratory symptom reported by study participants was cough. Similarly, among Spanish indoor cleaners, Zock *et al.* [16] reported a prevalence ratio of 1.7 (95% CI 1.1–2.6) among indoor cleaners when compared to a referent group of office workers. The prevalence ratio was highest among those cleaners who reported cleaning kitchens and polishing furniture.

Ammonia and bleach (sodium hypochlorite) are strong respiratory irritants and are present as active ingredient in disinfectants and stripper/stain/paint removers. In a recent nested case-control study of female domestic cleaners, exposures to diluted ammonia and bleach were associated with a 3- and >2-fold increased odds of lower respiratory symptoms, respectively [12]. Risk of acute exposure is especially high during mixing of these two chemicals, which generates chloramines.

Overexposures to chloramine gas have been linked with acute lung injury [17]. In this study, inappropriate mixing, because of lack of training, was evident among domestic cleaners.

In addition to identifying chemical hazards, this study also identified patterns of work experiences among domestic and industrial cleaners that clearly show how knowledge, competency and use of cleaning chemicals may contribute to their risk of overexposures. Additionally, several distinctions between the experiences of domestic and industrial cleaners were observed. Most notably, there appears to be a significant skills deficit among domestic cleaners across each of these three themes. This is concerning given that domestic cleaners are exposed to a greater number and variety of respiratory irritants and reported more physical symptoms than industrial cleaners.

In conclusion, this qualitative study revealed some interesting differences in workplace practices and exposures between domestic and industrial cleaners. These results are consistent with earlier findings from quantitative studies placing domestic cleaners at risk of exposure to chemicals, respiratory irritants and/or sensitizers. The use of qualitative research methods allowed a clearer understanding of work processes, which can lead to the development of better quantitative instruments as newer occupational epidemiological studies of cleaners, with stronger designs, are conceptualized.

Key points

- Domestic professional cleaners lack appropriate job training skills and knowledge of chemicals they use for cleaning purpose.
- Domestic professional cleaners reported rarely using personal protective gear and experiencing more respiratory symptoms during and following cleaning activities.
- The skills deficit observed among domestic professional cleaners place them at risk of exposure to potentially harmful cleaning chemicals that may have long-term respiratory health effects.

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Conflicts of interest

None declared.

References

1. Bureau of Labor Statistics. *Characteristics of the Employed: Employed Persons by Occupation, Sex, and Age Labor Force Statistics from the Current Population Survey*. <http://www.bls.gov/cps/cpsaat9.pdf> (30 October 2007, date last accessed).
2. Ng T, Hong C, Goh L, Wong M, Koh K, Ling S. Risks of asthma associated with occupations in a community-based case-control study. *Am J Ind Med* 1994;**25**:709–718.
3. Medina-Ramon M, Zock J, Kogevinas M, Sunyer J, Anto J. Asthma symptoms in women employed in domestic cleaning: a community based study. *Thorax* 2003;**58**: 950–954.
4. Zock J, Plana E, Jarvis D *et al*. The use of household cleaning sprays and adult asthma: an international longitudinal study. *Am J Respir Crit Care Med* 2007;**176**:735–741.
5. Reinisch F, Harrison R, Cussler S *et al*. Physician reports of work-related asthma in California, 1993–1996. *Am J Ind Med* 2001;**39**:72–83.
6. Arif A, Whitehead L, Delclos G, Tortolero S, Lee E. Prevalence and risk factors of work related asthma by industry among United States workers: data from the third national health and nutrition examination survey (1988–94). *Occup Environ Med* 2002;**59**:505–511.
7. Arif A, Delclos G, Whitehead L, Tortolero S, Lee E. Occupational exposures associated with work-related asthma and work-related wheezing among U.S. workers. *Am J Ind Med* 2003;**44**:368–376.
8. Strauss A, Corbin J. *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Thousand Oaks, CA: Sage Publications Inc., 1990.
9. Lindlof T, Taylor B. *Qualitative Communication Research Methods*. 2nd edn. Thousand Oaks, CA: Sage Publication Inc., 2002.
10. Owen W. Interpretive themes in relational communication. *Q J Speech* 1984;**70**:274–287.
11. Morgan D. *Focus Groups as Qualitative Research*. 2nd edn. Thousand Oaks, CA: Sage, 1997.
12. Medina-Ramon M, Zock J, Kogevinas M *et al*. Short-term respiratory effects of cleaning exposures in female domestic cleaners. *Eur Respir J* 2006;**27**:1196–1203.
13. Blanc P, Rempel D, Maizlish N, Hiatt P, Olson K. Occupational illness: case detection by poison control surveillance. *Ann Intern Med* 1989;**111**:238–244.
14. Attfield M, Bang KM, Castellan RM, Filios M, Rotunda CJ, Wood JM. *Work-related lung disease surveillance report 2002: asthma and COPD highlights. NORA Symposium 2003: Working Partnerships: Applying Research to Practice*. Arlington, VA: National Institute for Occupational Safety and Health, 2003.

15. Nielsen J, Bach E. Work-related eye symptoms and respiratory symptoms in female cleaners. *Occup Med (Lond)* 1999;**49**:291–297.
16. Zock J, Kogevinas M, Sunyer J *et al.* Asthma risk, cleaning activities and use of specific cleaning products among Spanish indoor cleaners. *Scand J Work Environ Health* 2001;**27**: 76–81.
17. Tanen DA, Graeme KA, Raschke R. Severe lung injury after exposure to chloramine gas from household cleaners. *N Engl J Med* 1999;**341**:848–849.