

Cleaning and Disinfection in Home Healthcare

Integrating Qualitative and Quantitative Methods to Assess Caregivers' Exposure to Cleaning and Disinfection Products

Pia Markkanen^a, Margaret Quinn^a, Nancy Goodyear^b, Catherine Galligan^a, David Kriebel^a, Susan Sama^a, Rebecca Gore^a, John Lindberg^a, Christian Beato-Melendez^b, Nicole Karlsson^a, Hagir Mohamed^b, Noor Sheikha^a, Alexis Parker-Vega^c

Safe Home Care Project, www.uml.edu/safehc, University of Massachusetts Lowell, USA

INTRODUCTION

Home care (HC) aide is one of the fastest growing jobs in the United States. Aides perform personal care and homemaking tasks in clients' homes; our earlier study showed 80% of HC visits involved cleaning and disinfection (C&D) of a bathroom or kitchen.¹ C&D is performed increasingly for infection prevention, yet scientific evidence shows asthma and other respiratory irritation are associated with C&D work.² The Safe Home Care Project used mixed methods research to investigate the nature of C&D work and health-related exposures and outcomes in typical HC settings.

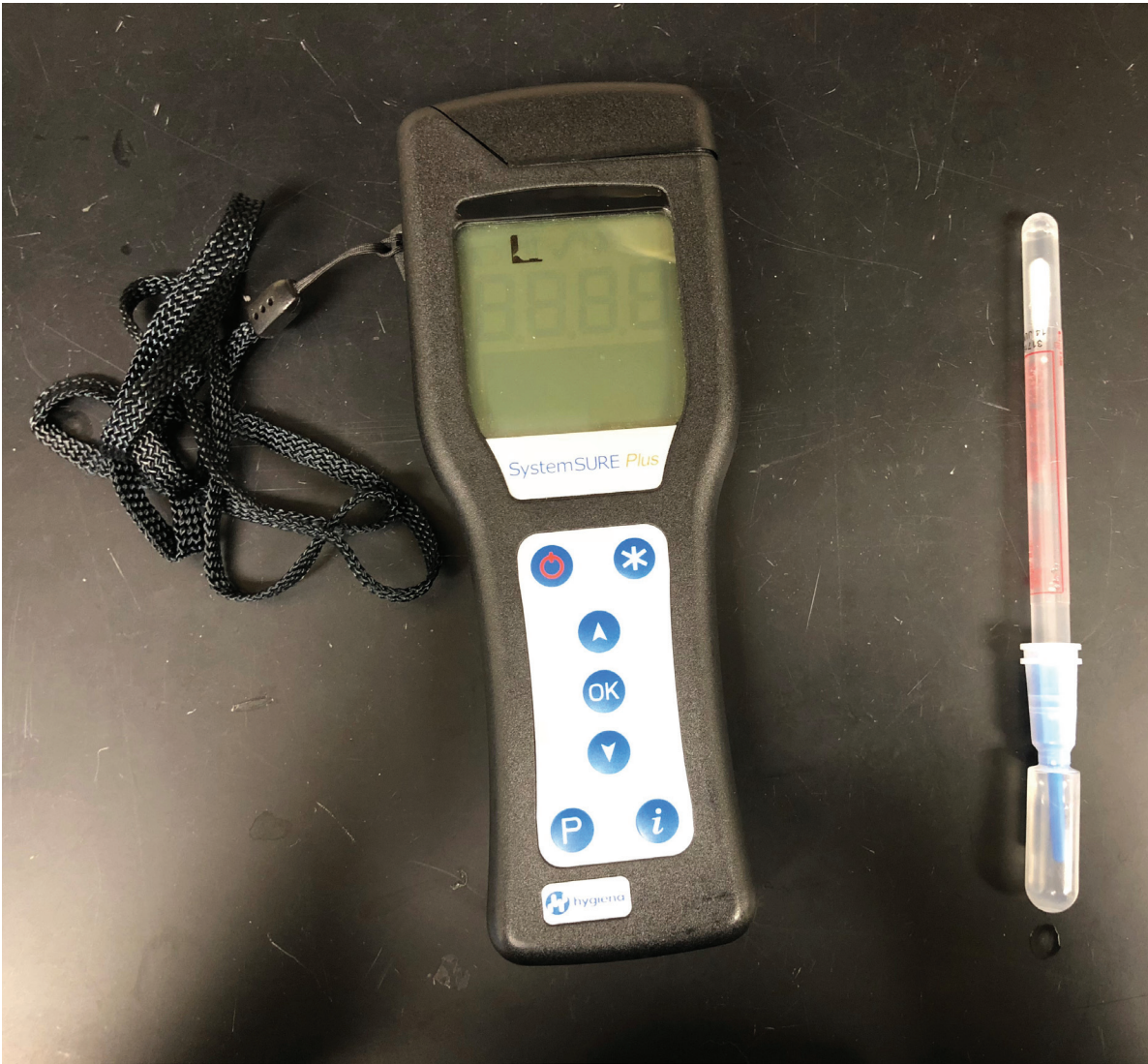
OBJECTIVES

1. Characterize qualitatively aides' C&D practices and related safety and health exposures.
2. Evaluate two products for C&D effectiveness in senior citizens' homes.
3. Assess airborne exposures and short-term respiratory effects of bathroom cleaning.

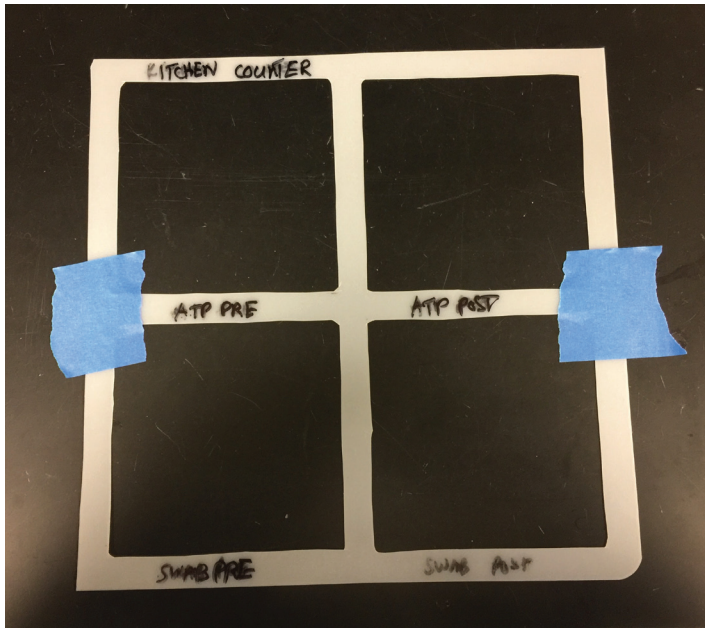
METHODS

QUALITATIVE STUDY. Nine focus groups comprising 80 HC aides and five in-depth interviews with HC employers' and workers' representatives were conducted to understand the nature of C&D practices and to characterize C&D-related exposures and safety and health hazards. Sessions were audio-recorded and transcribed, followed by computer-assisted thematic analysis.

MICROBIOLOGY STUDY. Soil and microorganisms were measured before and after cleaning of 4 kitchen and 4 bathroom surfaces in 46 seniors' homes. A bleach-containing (BC) product and environmentally preferable (EP) cleaner were used in random order, at least one week apart. The study team performed organic soil bioluminometer measurements on surfaces and collected cotton swab and wipe samples for total bacteria count, *Staphylococcus aureus*, and *Clostridium difficile* identification in the microbiology laboratory.



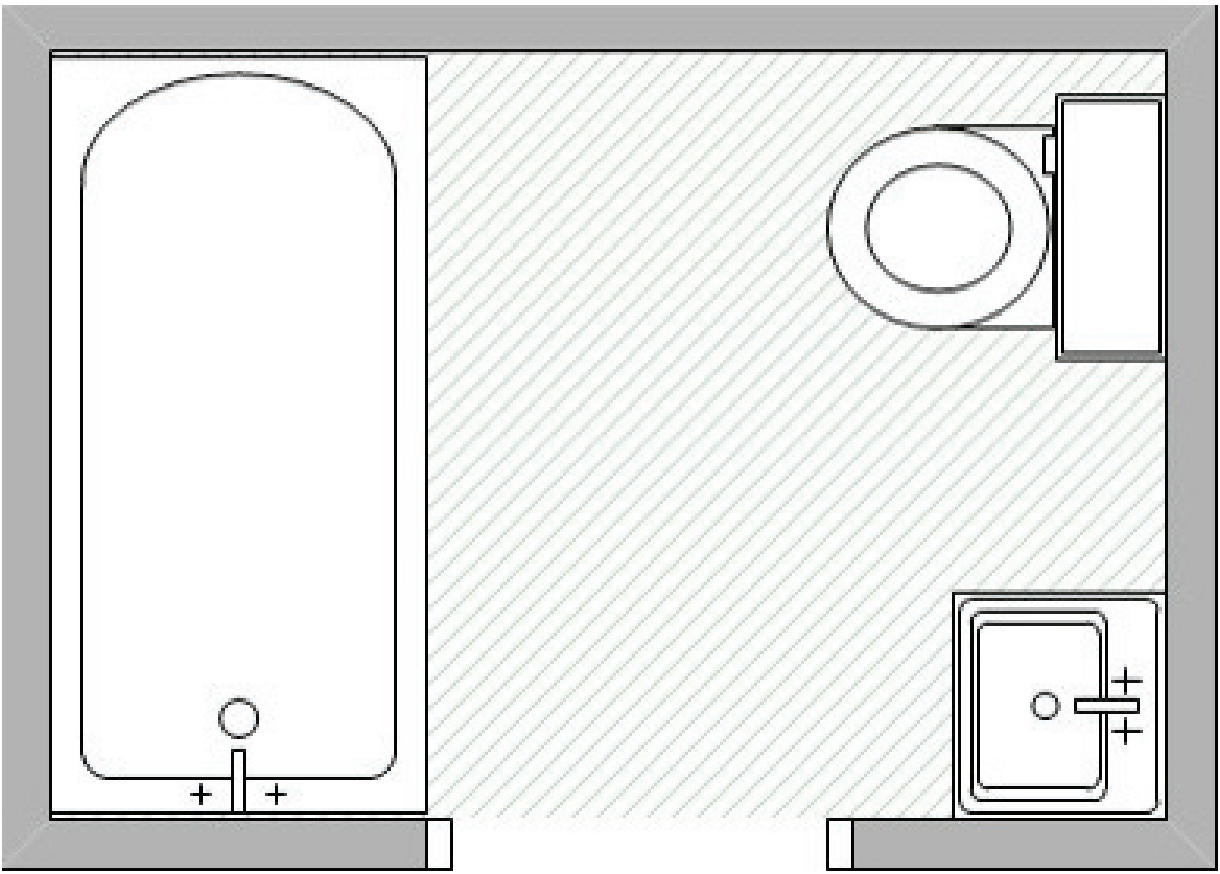
Bioluminometer to measure organic soil.



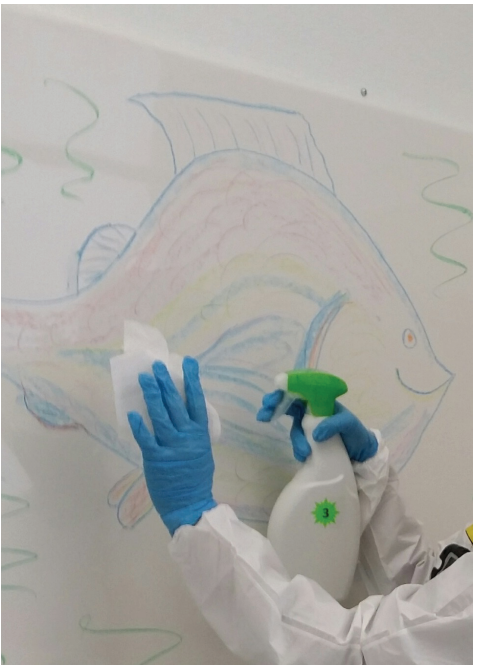
Microbiology sampling in the home.



ENVIRONMENTAL AIR MONITORING STUDY. A bathroom lab was used to measure airborne exposures and respiratory health effects during two consecutive 20-minute C&D sessions. HC aides (n=20) did four lab visits each, using randomly ordered spray cleaners: BC product, EP product, quaternary ammonium product, and distilled water. Spirometry and exhaled nitric oxide were measured before and after cleaning to assess respiratory effects. A health symptom questionnaire was administered before, during and after cleaning. Instruments measured total volatile organic compounds, chlorine, and other selected ingredients in the breathing zone.



Bathroom lab (3.5 m²) with tub, sink and toilet.



Cleaning technique employed in the lab.



Airborne exposure sampling gear.

REFERENCES CITED

1. Quinn M, Markkanen P, Galligan G, et al. (2016). Occupational health of home care aides: results of the safe home care survey. *Occupational and Environmental Medicine*. Vol.73: 237–245 doi:10.1136/oemed-2015-103031 (Open access)
2. Goodyear N, Markkanen P, Beato-Melendez C, et al. (2018). Cleaning and disinfection in home care: A comparison of two commercial products with potentially different consequences for respiratory health. *American Journal of Infection Control*. Vol.45(4):410-461.doi: 10.1016/j.ajic.2017.09.033. (Open access)

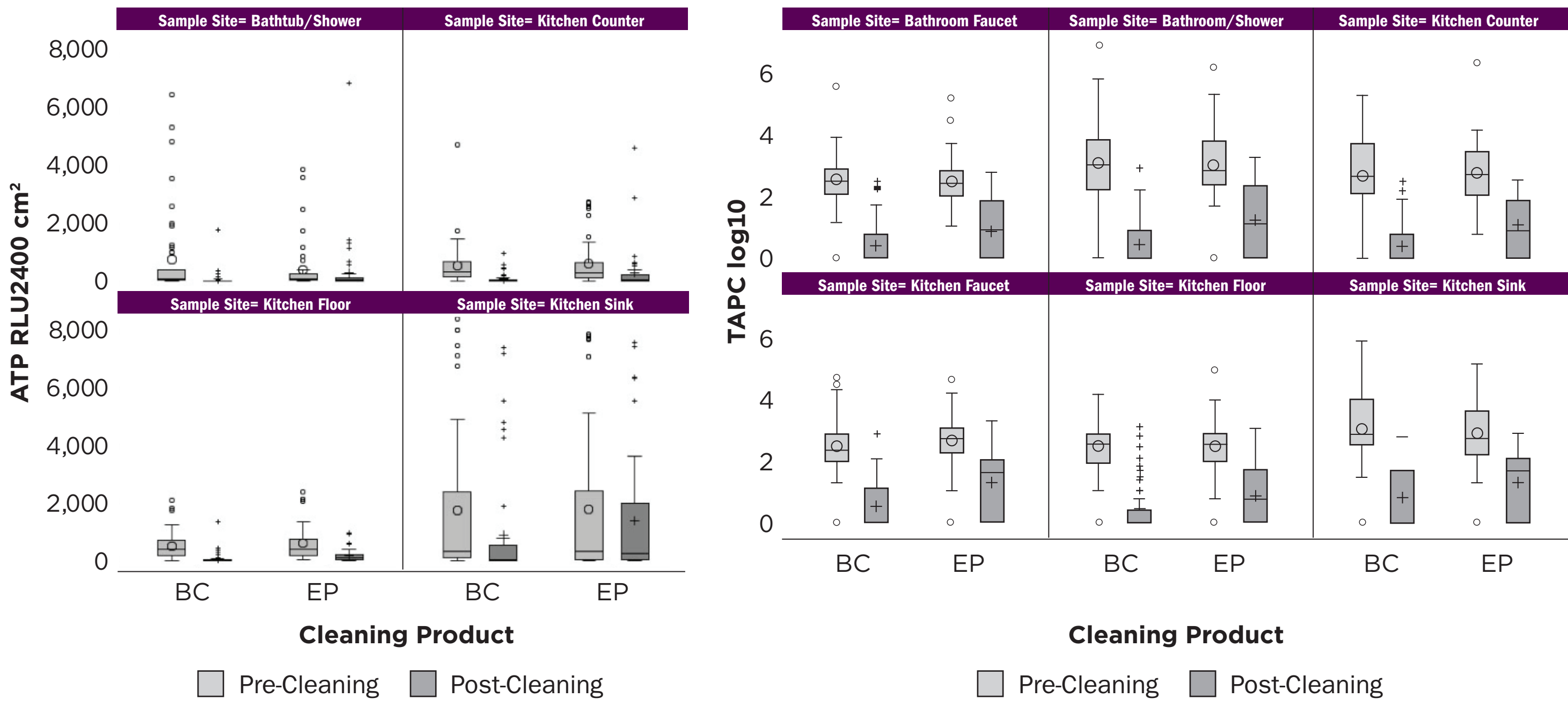
KEY FINDINGS: QUALITATIVE STUDY

Most HC visits include cleaning using client-provided cleaning products. Price strongly influences product choice and bleach-containing products are common. In focus groups, aides reported:

- Strong smelling C&D products bother them; affecting allergies, asthma, sinuses, breathing.
- Products irritate eyes and skin. Gloves help prevent skin irritation.
- Ventilation during C&D tasks helps reduce discomfort.
- Aides have concerns about bringing home germs, pests (e.g. bedbugs).
- Aides experience back pain from C&D tasks (vacuuming, mopping).

KEY FINDINGS: MICROBIOLOGY STUDY

The bleach-containing (BC) product was somewhat better at removing soil than the environmentally preferable (EP) product. Both products removed microorganisms, as judged by total bacteria count. *Staphylococcus aureus* was found in seven homes (one strain was methicillin-resistant) and both products removed it. *Clostridium difficile* was found only once.



Organic soil levels: BC versus EP products (measured as ATP relative light units of bioluminescence/400 cm² of surface).

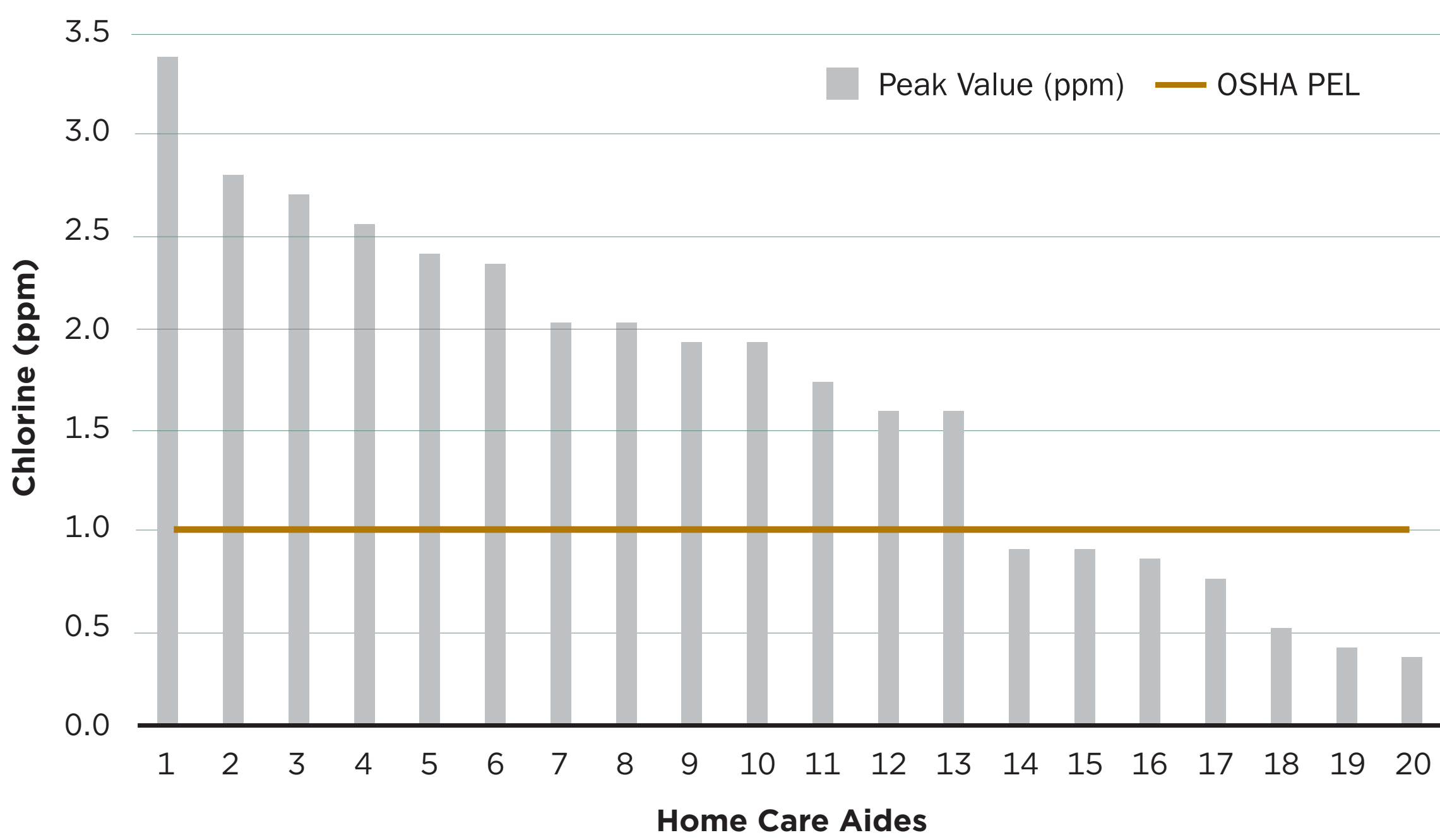
Source: published in AJIC Vol. 46(4), 2018, p.414.

Total aerobic plate counts (TAPC): BC versus EP products.

Source: published in AJIC Vol. 46(4), 2018, p.415.

KEY FINDINGS: ENVIRONMENTAL AIR MONITORING STUDY

During use of the BC product, chlorine exposures exceeded the U.S. Occupational Safety and Health Administration's (OSHA's) permissible exposure limit (PEL=1 ppm, ceiling) in over 60% of cleaning sessions. The EP product generated volatile organic compounds, but aides experienced fewer irritant symptoms than with BC and quaternary ammonium products.



Peak chlorine exposures during bathroom cleaning.

CONCLUSIONS & RECOMMENDATIONS

- C&D affects both HC aides and clients. Products and practices should maximize respiratory health and infection prevention. Trading off one for the other should be avoided.
- Unless bleach is essential for infection prevention, a less irritating product should be used.
- Minimizing aerosol generation and increasing ventilation may reduce inhalation exposures.
- Mixed methods research is effective for assessing and characterizing C&D-related exposures in HC.
- More research is recommended to understand inhalation exposures and improve C&D practices in HC.

^a Department of Public Health, UMass Lowell

^b Department of Biomedical & Nutritional Sciences, UMass Lowell

^c Office of Environment, Health and Safety, University of California San Francisco