

Assessment of Chemical Exposures During Cleaning

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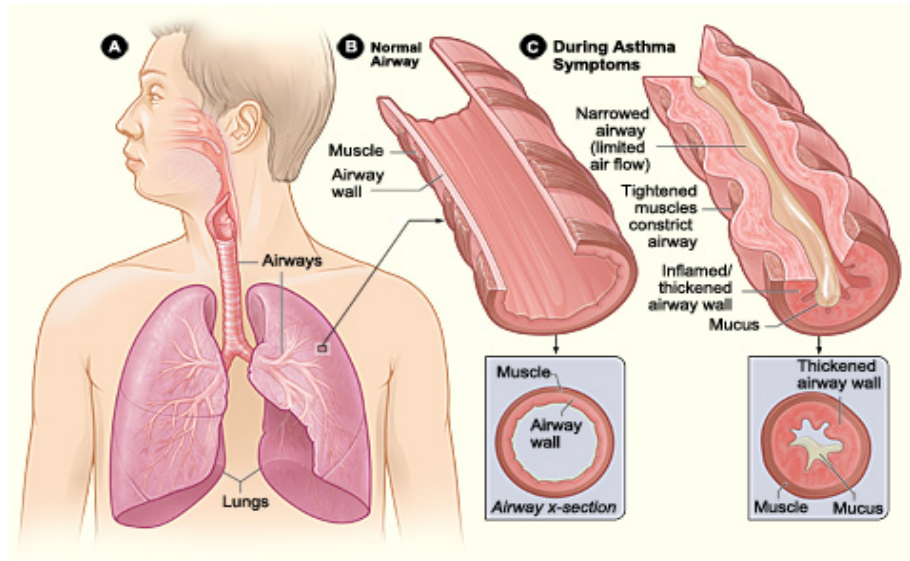


Which healthcare staff get exposed?

- Environmental Services Employees
- Food service workers
- Clinicians
 - Nurses
 - Technicians
 - Physicians

What types of exposures can occur?

Respiratory



Dermal



Musculoskeletal



Photo by Earl Dotter

Methods

- Identified products used in hospitals & researched toxicology of ingredients
- Observed cleaning tasks in hospitals & other healthcare settings
- Conducted cleaning under controlled environmental & task conditions
 1. Measured airborne chemical exposures
 2. Assessed potential for dermal exposures
 3. Evaluated work & environmental conditions that contribute to exposure

Cleaning products are mixtures of many chemicals with a range of physico-chemical properties

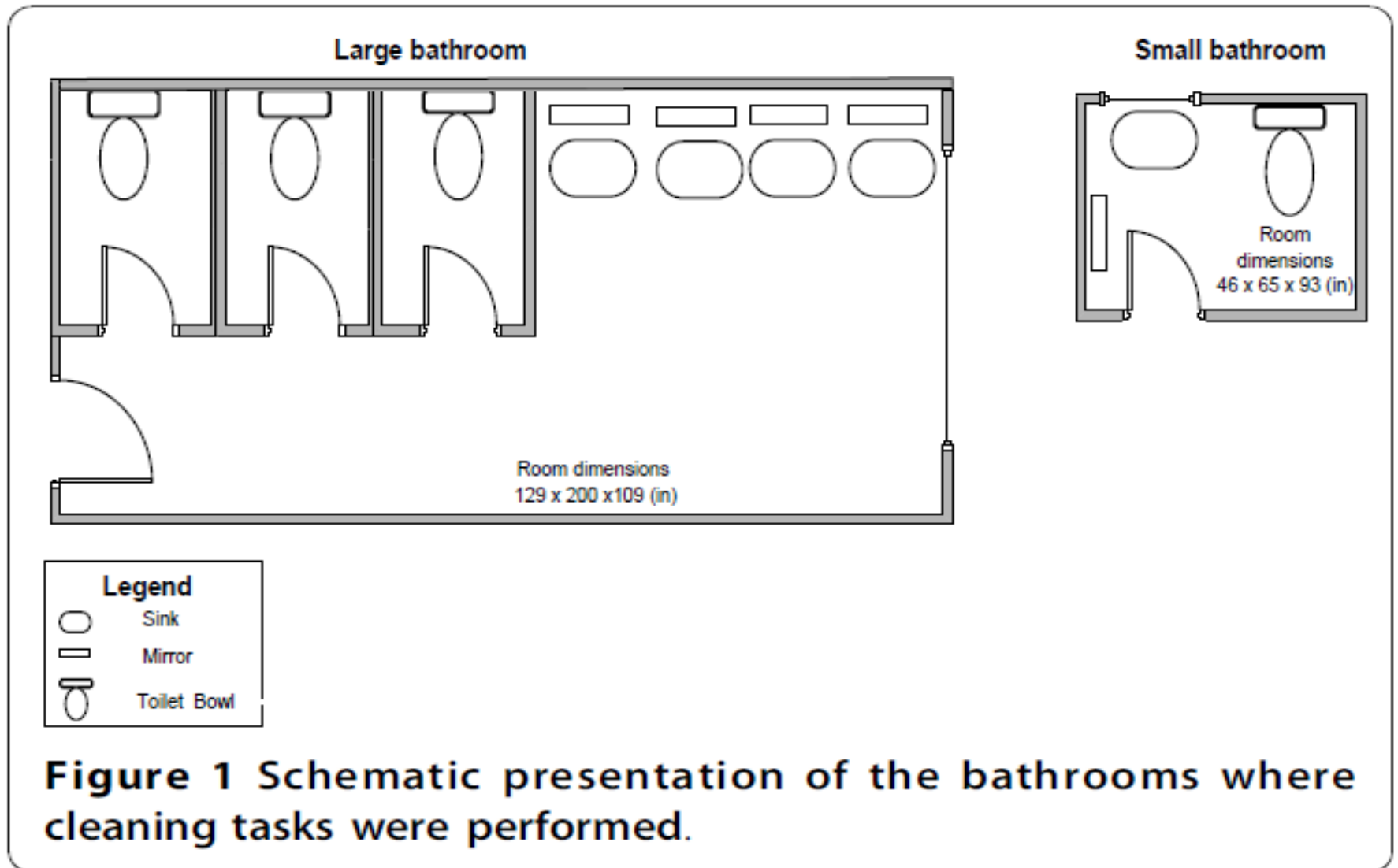


Challenging to measure quantitatively because specific ingredients require different sampling methods

Some products contain respiratory & dermal irritants & sensitizers

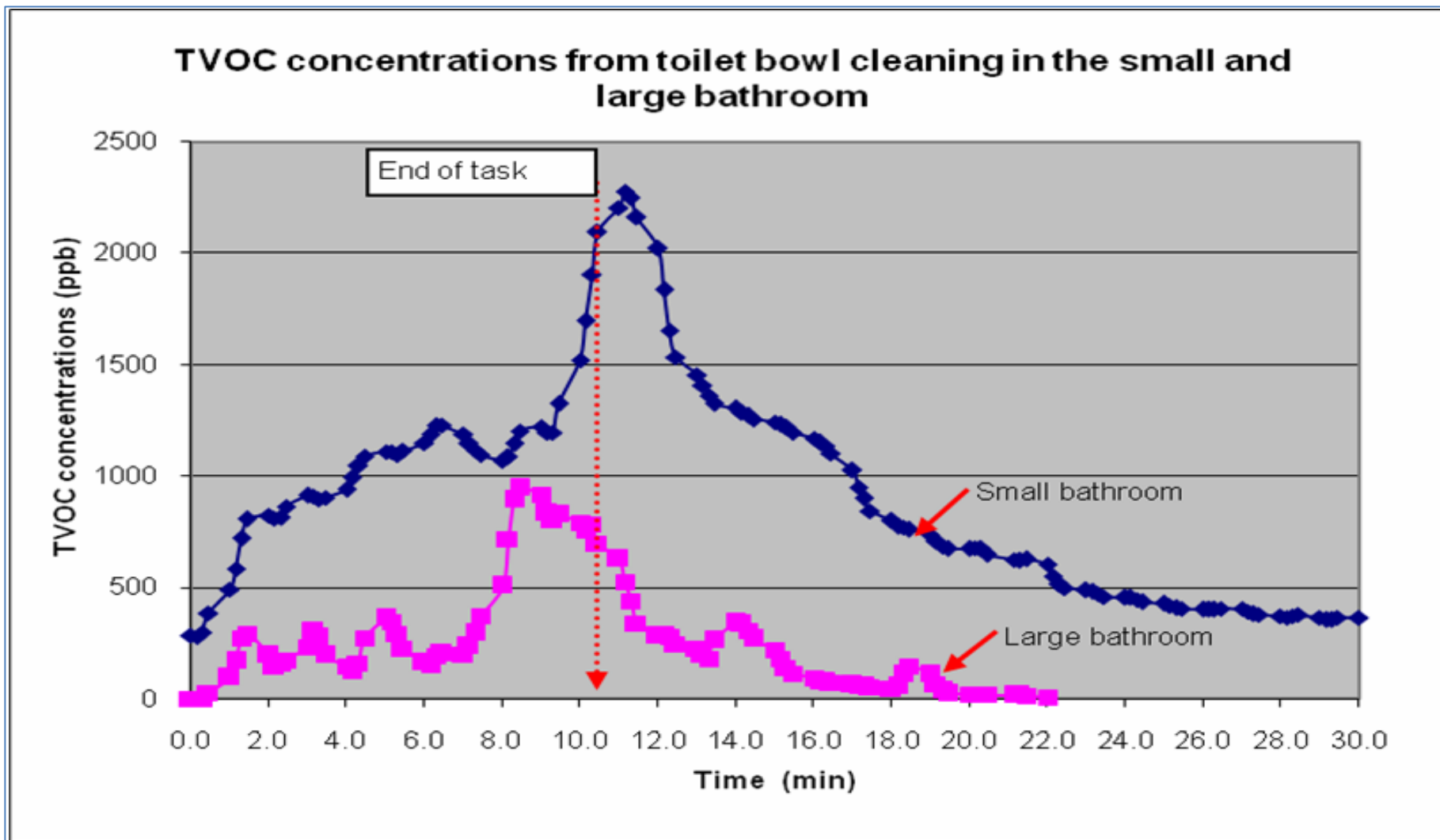
Product	Material Safety Data Sheet (MSDS) ingredients	
<p>Glass cleaner</p> <p>1) concentrate</p> <p>2) ready to use</p>	<p>2- Butoxyethanol, Propylene glycol monomethyl ether, Alcohol ethoxy sulfate, Ammonium hydroxide, Tetrasodium ethylenediamine tetraacetate, Ethyl alcohol</p>	
<p>General Purpose Cleaner</p> <p>1)concentrate</p> <p>2) ready to use</p>	<p>2-Buthoxyethanol, Ethanolamine, Sodium hydroxide, Mono-ethanolamine</p> <p>2-Buthoxyethanol</p>	
<p>Bathroom cleaner</p> <p>1) concentrate</p> <p>2) ready to use</p>	<p>2-Buthoxyethanol Secondary alcohol ethoxylate, Ethanolamine, Fragrance, Tetrasodium ethylenediamine tetraacetate , N-Alkyl dimethyl benzyl ammonium chloride, Didecyl dimethyl ammonium chloride</p> <p>2-Buthoxyethanol</p>	

Assessment of airborne chemical exposures during cleaning



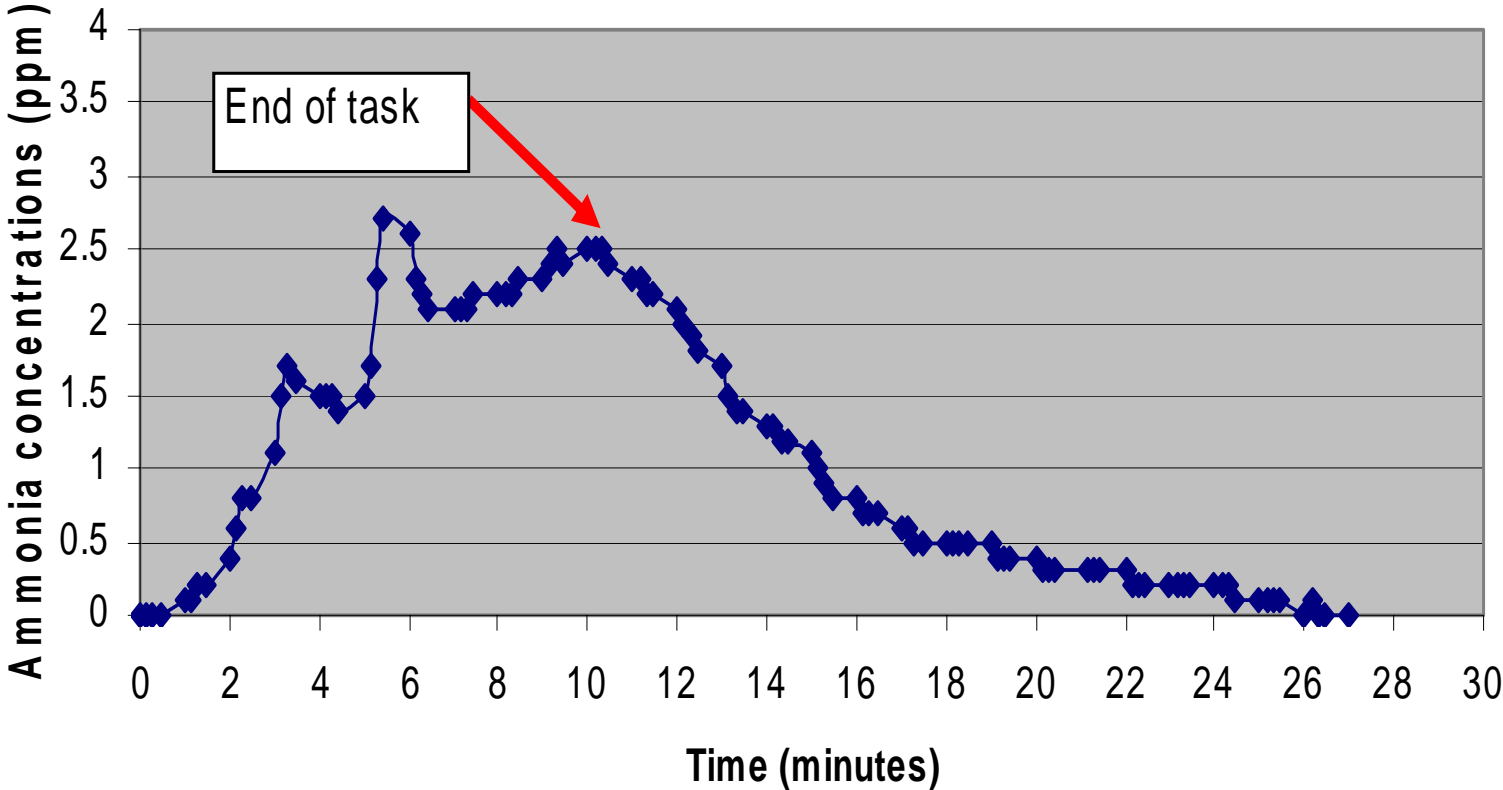
Total Volatile Organic Compounds (TVOC) during & after cleaning in a small & large bathroom

Bello, Quinn et al., 2010



Ammonia concentration during and after mirror cleaning in the small bathroom

Bello, Quinn et al., 2010



Concentrations of 2-butoxyethanol (2-BE) measured during 10 minutes of cleaning tasks

Small Bathroom, Volume =740 ft³

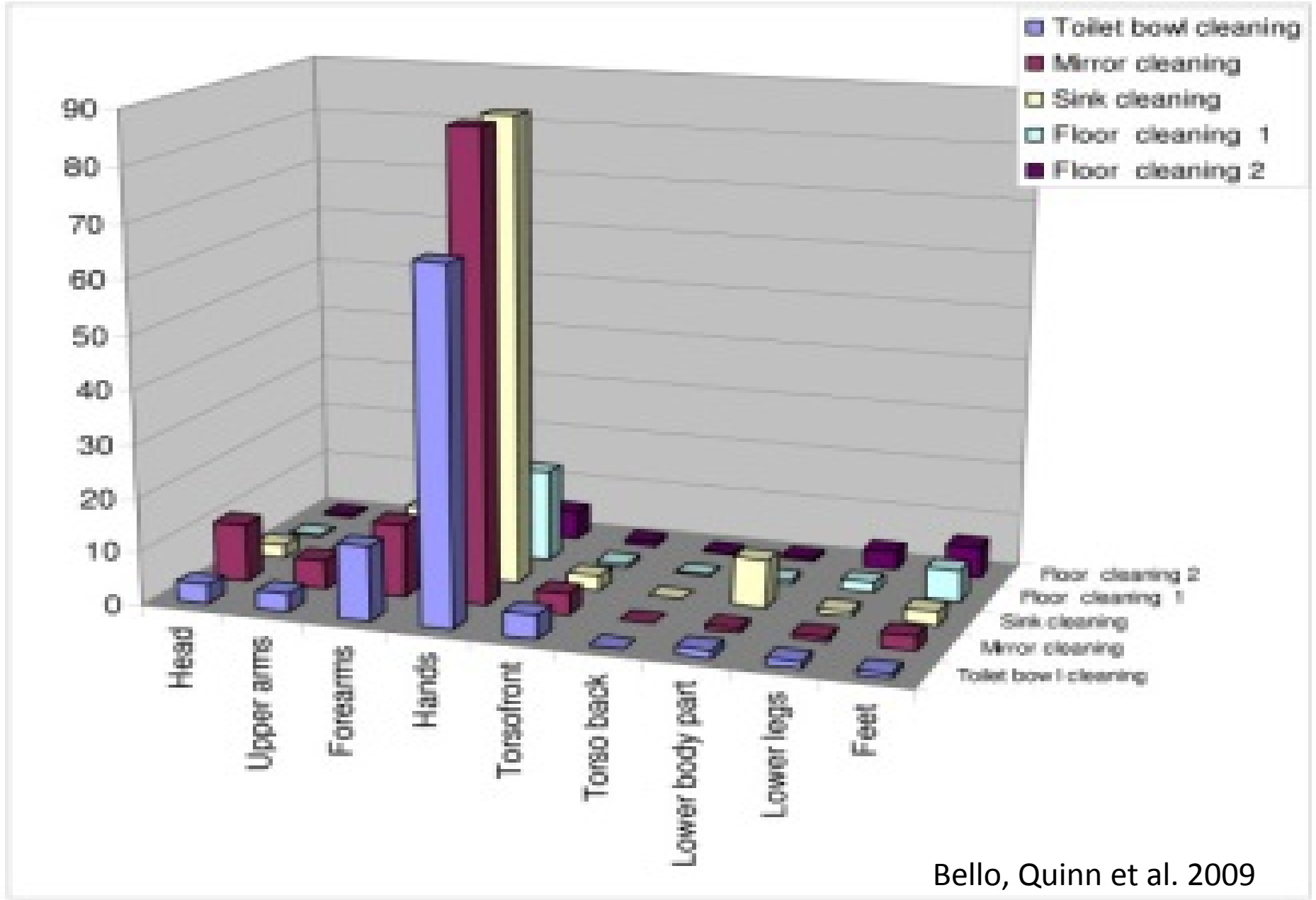
Task	Product type	2-BE in the product % by weight	Average 2-BE air concentrations in ppm (sd)
Sink cleaning	General purpose	5-7	21.27 (2.96)
Sink cleaning	General purpose	2.5-3.5	13.32 (2.54)
Mirror cleaning	Glass cleaner	6-10	13.08 (1.45)
Mirror cleaning	Glass cleaner	1-2	2.96 (0.23)
Toilet bowl cleaning	Bathroom cleaner	1-3	3.74 (0.36)
Toilet bowl cleaning	Bathroom cleaner	0.5-1.5	2.70 (0.34)

Concentrations of 2-butoxyethanol (2-BE) measured during 10 minutes of cleaning tasks

Large Bathroom, Volume =1808 ft³

Task	Product Type	2-BE in the product % by weight	Average 2-BE air concentrations in ppm (sd)
Sink cleaning	General purpose	5-7	6.27 (0)
Sink cleaning	General purpose	2.5-3.5	3.30 (0.1)
Mirror cleaning	Glass cleaner	6-10	1.98 (0.12)
Mirror cleaning	Glass cleaner	1-2	0.32 (0.01)
Toilet bowl cleaning	Bathroom cleaner	1-3	3.05 (0.81)
Toilet bowl cleaning	Bathroom cleaner	0.5-1.5	2.76 (0.45)

Cleaning tasks can generate dermal exposures



Cleaning exposures are a function of the way that tasks are performed and environmental conditions, as well as product formulations

Significant predictors of airborne chemical exposure were:

- product type, 2-BE product concentration in product
- task type (spraying vs wiping)
- room volume
- room ventilation

As we develop preventive interventions, consider the occupational & environmental hierarchy of hazard controls

1. Elimination
2. Substitution
3. Equipment controls
4. Administrative controls
- training & procedures
5. Personal protective
equipment

most effective



least effective