

Using a model domestic kitchen to link observed food safety malpractices with bacterial contamination

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Introduction

The home kitchen is important in relation to food safety, as data suggest the majority of foodborne illness is not associated with outbreaks and may result from unsafe practices in the home^{1,2}.

Due to age-associated weakened immune function³ older adults are more susceptible to foodborne illness than the general population⁴, incidence among older adults in Europe has increased by 50 – 80% over the last decade⁵, the reasons for which are unknown.

Knowledge and self-report data suggest older adults lack awareness of food safety and may implement unsafe practices; however, actual behaviour data are lacking⁶.

Therefore, observation of older adults food safety practices are needed to determine the potential microbiological risk.

Purpose

This study aims to determine food safety behaviours implemented by older adults using observation and compare observed food handling practices with actual microbiological contamination of the food preparation environment.

Methods

Adults aged over 60 years ($n=100$) prepared a set meal (chicken and ham salad and a selection of sandwiches) in a model domestic kitchen (Figure 1).

A behavioural checklist was used to record food safety practices. Surfaces were cleaned according to a validated protocol⁷ pre-food preparation session, and immediately swabbed post-food preparation to determine contamination (Aerobic Plate Count (APC) *Enterobacteriaceae* and *Staphylococcus aureus*).

ZERO2FIVE Food Industry Centre Model Domestic Kitchen

This typical domestic kitchen with the addition of ceiling mounted digital cameras is a valuable and innovative facility which allows for the observation of actual behaviour.

Less than a third of consumer food safety studies determine actual consumer behaviour⁶. Such studies are predominantly conducted in consumer homes, in which variables are not controllable. Furthermore, in such direct observation the presence of the researcher may result in reactivity bias as consumers change their behaviour as a result of being observed.

The model domestic kitchen enables observation in a controlled setting. Variables considered important for food safety can be controlled and enables direct comparison between participants. The method enables a direct interpretation of actual consumer behaviour. Observed behaviours in model domestic kitchens have been determined to be representative of those implemented in consumer homes, and the reliability of the technique has been established.

References

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Results



Figure 1: The fields of vision from the ceiling mounted digital cameras in the model domestic kitchen at the ZERO2FIVE Food Industry Centre.

Observed food safety practices

During food preparation sessions ($n=100$) a total of 639 hand cleaning attempts such as before starting food preparation, after handling raw chicken or handling raw chicken packaging, were observed. Data presented in Figure 2 indicates malpractices implemented by older adults when washing/drying hands during food preparations and Figure 3 indicates the occasions which older adults failed to implement adequate hand washing/drying practices.

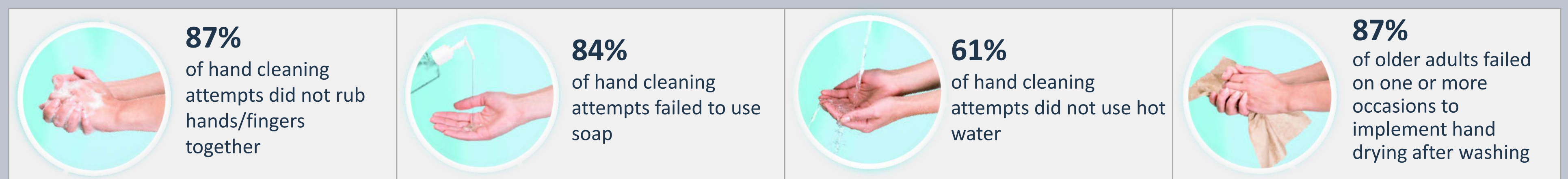


Figure 2. Hand washing / drying malpractices ($n=639$)



Figure 3. Occasions which older adults failed or inadequately implemented hand cleaning ($n=100$)

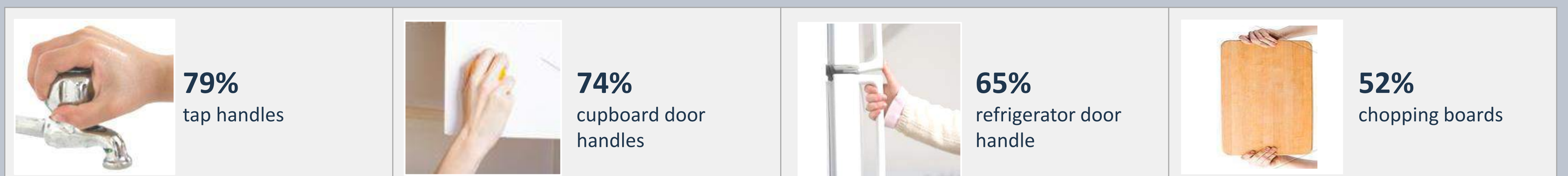


Figure 4. Surfaces touched with inadequately cleaned hands after handling/preparing raw chicken ($n=100$)

Linking observed behaviour with microbial contamination

Inadequate hand washing and/or drying after handling foods such as raw chicken may result in contamination of surfaces subsequently touched. The surfaces most frequently touched with inadequately cleaned hands (Figure 4) were contamination with ACC $<6.32 \log_{10}$ CFU, *Enterobacteriaceae* $<5.68 \log_{10}$ CFU and *S. aureus* $<5.41 \log_{10}$ CFU.

In this study, 20% of the participants were observed washing raw chicken breast meat before preparation and cooking by rinsing the meat under running cold water or allowing the meat to soak in the sink. *S. aureus* contamination of the refrigerator door handle was significantly higher ($p<0.05$) when participants were observed washing raw chicken.

Furthermore, during food preparation sessions 696 attempts to wash and dry food preparation equipment such as chopping boards and knives were observed. The majority of chopping boards (82%) and knives (85%) used to prepare ingredients during food preparation were inadequately washed and/or dried. Post food-preparation microbiological analysis of these surfaces resulted in contamination with ACC $< 6.24 \log_{10}$ CFU, *Enterobacteriaceae* $< 4.26 \log_{10}$ CFU *S. aureus* $< 3.24 \log_{10}$ CFU.

Statistical analysis also suggest that older adults that implemented a greater number of adequate hand decontamination attempts had significantly lower ($p<0.001$) microbiological contamination of the kitchen following the food preparation session.

Conclusion

- Observational findings indicates that a considerable proportion of older adults implement unsafe food handling practices during food preparation.
- Microbial findings indicate older adults' do not implement sufficient washing/drying practices of food handling equipment and hands.
- Food handling malpractices have been compared to microbial contamination of kitchen surfaces and suggests that older adults food handling practices may impact on food safety.
- Findings suggest a need for targeted risk communication and has implications for future consumer food safety education initiatives.