

Observation of hand hygiene behaviour during production at a sandwich-making factory.

Abuzar I.A. Mohamed¹ and Ellen W. Evans^{2*}

¹Cardiff School of Sport and Health Sciences, Cardiff Metropolitan University, Cardiff, United Kingdom.

²ZERO2FIVE Food Industry Centre Food and Drink Research Unit, Cardiff Metropolitan University, Cardiff, United Kingdom.

*Corresponding authors: abuzaragabna@gmail.com¹ & elevans@cardiffmet.ac.uk²

Introduction

Transmission of pathogens to food remains a significant concern to public health¹.

Inadequate hand hygiene by food workers has been often cited as a contributory factor in foodborne diseases². Thus, there is a need to have a clear understanding of the employees' behavioural practices within the food manufacturing industry³, particularly during production.

Unlike cognitive data which is subject to biases and does not equate to behaviour, covert observation method can provide comprehensive data analysis for measuring the actual food safety practices of food handlers⁴.

Although a few studies conducted covert observation to assess food safety behaviour prior to and/or exiting production areas in manufacturing environments, research to observe food handlers' compliance with hand hygiene during production, to date, has not been undertaken.

Purpose

The purpose of this study is to assess food handlers' hand hygiene compliance during production at a sandwich-making factory using covert observation.

Methods

Observation setting- Hand hygiene practices for 12 food handlers working in a production area at a sandwich factory were observed utilizing pre-recorded footage that has been captured using closed-circuit television (CCTV) cameras over the course of 16 hours in two shifts from one working day.

Observation checklist- Qualtrics database was used to design an observation checklist based upon the company's hand-hygiene protocol. The adapted tool of this study was previously used in ZERO2FIVE Food Industry Centre research^{5,6}.

Data entry, analysis- All entered data was checked against any missing data. Cronbach's Alpha values were obtained to test inter and intra-operator reliability. All Alpha values were > 0.80 which suggested the obtained data are highly reliable⁷. Furthermore, SPSS Statistics package 28 was used to obtain frequencies of the variables as well as determine significant differences in the implementation of handwashing when entering and exiting the production area.

Acknowledgments

The research group wish to acknowledge the company for providing the footage to conduct the observation study.

References

1. Kamboj, S., Gupta, N., Bandral, J.D., Gandotra, G. and Anjum, N. (2020) 'Food safety and hygiene: A review', *International Journal of Chemical Studies*, 8(2), pp. 358-368.
2. Kadariya, J.; Smith, T.C and Thapaliya, D. (2014) 'Staphylococcus aureus and Staphylococcal Food-Borne Disease: An Ongoing Challenge in Public Health', *BioMed Research International*, 2014, pp.827-965.
3. McFarland, P., Sielaff, A.C., Rasco, B., & Smith, S. (2019) 'Efficacy of Food Safety Training in Commercial Food Service', *Journal of Food Science*, 84 (6), pp. 1239-1246.
4. Powell, D.A., Jacob, C.J., Chapman, B.J. (2011) 'Enhancing food safety culture to reduce rates of foodborne illness', *Food control*, 22(6), pp. 817-822.
5. Evans, E.W. and Redmond, E.C. (2019) 'Video Observation of Hand-Hygiene Compliance in a Manufacturer of Ready-To-Eat Pie and Pastry Products', *International Journal of Environmental Health Research*, 29(6), pp. 593-606.
6. Evans, E.W., Samuel, E.J. & Redmond, E.C. (2020) 'A case study of food-handler hand hygiene compliance in high-care and high-risk food manufacturing environments using covert-observation', *International Journal of Environmental Health Research*, 7(1), pp. 1-14.

Results

This study has explored the hand hygiene practices of food handlers during production in a sandwich manufacturing business based in the UK. The business had unique hand-hygiene protocols with variable details. A pre-recorded CCTV video footage that has been captured while the food handlers were in the production area was used to observe food handlers' hand hygiene practices. The cameras were utilized throughout the factory for a prolonged time for the purpose of safety and monitoring work productivity.

Observed hand hygiene compliance during production

A total of 588 occasions that required implementation of hand hygiene practices were observed over a period of 16 hours, of which on 187 (31%) occurrences hands were not washed in events when handwashing was required (Table 1).

Table 1. Observed occurrences that required handwashing and percentage of failed attempts (n=187).

Observed occurrences	n	% Failed to Attempt hand hygiene
Upon entry to production	79	11
Before or after any cleaning procedure	109	15
After contact with floor, or handling bin, trolley wheels	35	46
After touching any part of the body	24	71
During production activities (e.g., during assembling the sandwiches or between handling different varieties of products)	232	12
Before Line cleaning procedure	58	100
Exiting production	51	92

Food handlers were observed implementing hand hygiene practices significantly more frequently when entering (89%) than exiting (8%) the production area ($X^2(1, n=130) = 61.598, p < 0.001, phi = 0.70$) (Table 1).

Table 2 illustrates the frequencies of observed handwashing practices. Of the 401 occasions where hand hygiene practices were implemented before or after performing various tasks during production, only 1% of attempts were compliant with the company hand hygiene protocol.

Table 2. Frequencies of observed handwashing practices in the production area (n= 401).

Observed Hand hygiene practices	%
Wet hands before applying soap	84
Dispense soap	95
Vigorous and various actions when lathering – rubbing all parts of hands, palms, fingers and wrists likely to be adequate due to restricted view	19
Vigorous and various actions when lathering – rubbing all parts of hands, palms, fingers and wrists likely to be inadequate due to restricted view	81
Hands dried using disposable paper towels	99
Dispense sanitizer	38
Sanitizer used and rubbed over all parts of the hands	34

Consequently, the vast majority of attempts (99%) were not in line with the hand hygiene procedure specified by the sandwich manufacturer's protocol

Observed hand hygiene malpractices

Table 3 provides a summary of the observed hand hygiene malpractices by the food handlers during production. Food workers were observed readjusting their hairnet after completing handwashing on 22 occasions and touching their face/hair on 34 occasions. Although sanitizer was used after handwashing, on 66% of attempts sanitizer were not rubbed all over the hands.

Table 3. Observed malpractices

Malpractices	%
Hands dried on PPE	0.2
Touched face/hair	8
Touched floor	0.7
Touched footwear	0.2
Readjusted hairnet after handwashing attempt	5
Sanitizer wiped on PPE	0.7
Sanitizer used but not rubbed all over the hands	66

Duration of handwashing practices

Washing hands for a period of 20 seconds or more is required for the handwashing attempt to be determined as compliant.

The duration of observed hand hygiene attempts ranged from 1 to 29 seconds as presented in Figure 1, only 5% of handwashing attempts were determined to be compliant with the recommended duration (≥ 20 seconds) for hand hygiene practices as presented in Figure 1.

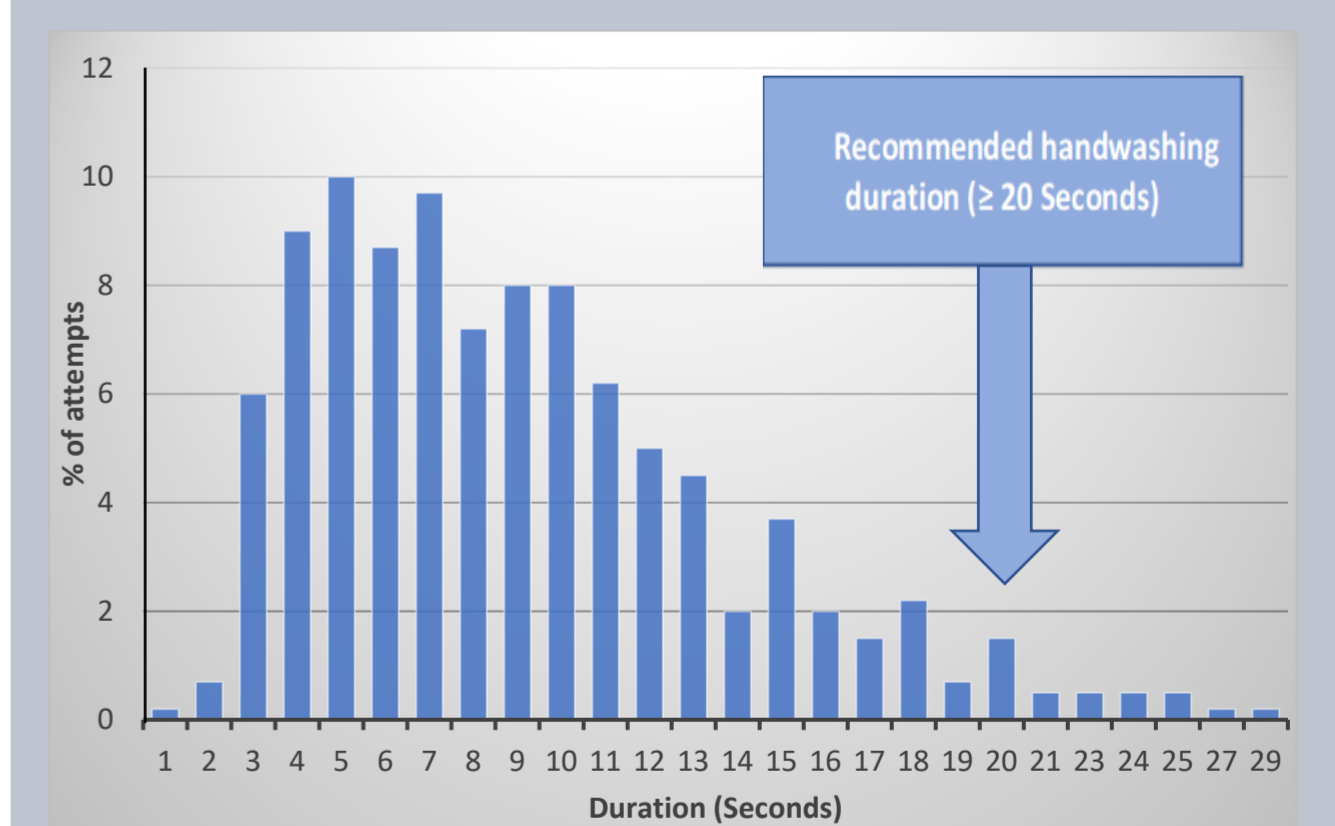


Figure 1. Hand washing duration in the production area (n=401)

Significance of study

- Covert observation data provided an in-depth insight into hand-hygiene compliance during production and thus illustrated an important resource for the food manufacturers to review company policy and improve the hand hygiene training/ education programs.
- The results from this study have identified a number of hand hygiene process malpractices during production that could have significant consequences for food safety in the food manufacturing business.
- There is a need for further research studies to assess hand hygiene compliance to allow comparisons and to fully understand food handlers' food safety behaviour in the production areas.
- Cognitive research such as surveys and interviews is required within the production area to explore the barriers that exist for food handlers in implementing appropriate hand hygiene.