

Food Worker Handwashing Practices: An EHS-Net Observation Study

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1. Introduction

A substantial proportion of foodborne illness outbreaks are caused by food worker hand contact with food (1). The U.S. Food and Drug Administration included guidelines in the Food Code for retail establishments on methods to prevent food contamination from food workers' hands (1, 2). These methods include handwashing and the prevention or minimization of bare hand contact with food.

Proper handwashing can significantly reduce pathogen transmission from hands to food (1, 3, 4). The Food Code provides guidance on when hands should be washed, such as before food preparation and after preparing raw animal product. The Food Code also specifies that handwashings should last 20 seconds and include running warm water, soap, friction between hands, rinsing, and drying with clean towels or hot air.

The Food Code also specifies that barriers such as disposable gloves, tissue, or tongs should be used to prevent or minimize bare hand contact with food. Anecdotal evidence suggests that food service establishments frequently use disposable gloves as barriers. Proper glove use can be effective in decreasing pathogen transmission from hands to food (3, 5), although some have argued that glove use may promote poor handwashing practices (1, 6, 7).

Proper handwashing and glove use are critical to the prevention of food contamination through worker hands (1, 2). Improving these hand hygiene practices is dependent upon a clear understanding of their current use. To that end, this study collected descriptive observational data on food worker handwashing and glove use in restaurants.

2. Method

This study was conducted by the Environmental Health Specialists Network (EHS-Net). EHS-Net is a network of environmental health specialists focused on the investigation of contributing factors to foodborne illness, including food preparation practices. It is a collaborative project of:

- the Centers for Disease Control and Prevention (CDC),
- the Food and Drug Administration (FDA),
- the U.S. Department of Agriculture (USDA), and
- nine states (California, Connecticut, New York, Georgia, Iowa, Minnesota, Oregon, Rhode Island, and Tennessee; Colorado also participated until 2005).

Restaurant sample

The sample comprises randomly selected restaurants located in the catchment areas of six EHS-Net states (Colorado, Connecticut, Georgia, Minnesota, Oregon, and Tennessee). Only one restaurant from regional or national chains was included per catchment area.

Data collection

In each restaurant, data collectors observed one worker for approximately an hour and recorded each instance in which the worker engaged in a work activity that required handwashing (either before or after the activity) (2). These work activities are described in Table 1.

2. Method (Cont'd)

Table 1. Work activities requiring handwashing for which observational data were collected

Work Activity	Description	Handwashing should occur:
Food preparation	Engaging in food preparation, including working with exposed food, clean equipment and utensils, and unwrapped single-use articles	Before the activity
Putting on gloves for food preparation	Putting on gloves to engage in food preparation (see above)	Before the activity
Eating, drinking, tobacco	Eating, drinking, or using tobacco (drinking is acceptable from a closed beverage container if the container is handled to prevent contamination of hands)	After the activity
Coughing, sneezing, tissue	Coughing, sneezing, or using a handkerchief or disposable tissues	After the activity
Preparing raw animal product	Preparing raw animal product (animal products that have not been cooked or processed; uncooked eggs, meat, poultry, and fish)	After the activity
Handling dirty equipment	Handling dirty equipment, utensils, or cloths	After the activity
Touching body	Touching human body parts other than clean hands and clean, exposed arms	After the activity

2. Method (Cont'd)

Data were also collected on the handwashing behaviors that occurred along with each of the observed work activities, including whether workers wore and removed gloves, placed their hands under running water, used soap, and dried their hands.

Data analysis

The proportion of work activities in which appropriate handwashing occurred was calculated.

Appropriate handwashing was defined as:

- removing gloves, if worn at the point handwashing should occur,
- placing hands under running water,
- using soap, and
- drying hands with paper or cloth towels, or some other appropriate method.

We also conducted *t*-tests to identify differences in appropriate handwashing by work activity and glove use. Workers were treated as individual clusters and work activities within each worker/cluster were treated as repeated measures. These analyses were conducted with the SUDAAN software package (RTI International, Research Triangle Park, NC).

3. Findings

Restaurant sample

- 1,073 establishments were contacted about study participation.
- 808 were eligible to participate (i.e., were open for business and did not belong to a chain that already had a participating restaurant).
- 333 agreed to participate, yielding a response rate of 41%.

Work activities

- Observed workers conducted 2,195 work activities falling into one of the work activity categories.
- Workers engaged in an approximate median of 8.6 work activities per hour.
- Due to small numbers, the categories of eating, drinking and using tobacco and coughing, sneezing, and using a tissue were combined into one category (eating/coughing) for remaining analyses.

Handwashing (Table 2)

- Workers washed their hands appropriately in 27% of all observed work activities.
- Appropriate handwashing rates were significantly:
 - larger before food preparation than with any other activity,
 - larger before putting on gloves for food preparation than after handling dirty equipment, and
 - smaller after touching the body than with any other activity.

3. Findings (Cont'd)

Table 2. Number and percentage of work activities in which workers washed their hands appropriately

Work Activity	N	n	%
Food preparation*	514	209	41 ^a
Putting on gloves for food preparation*	224	67	30 ^b
Eating/coughing	90	23	26 ^{bc}
Preparing raw animal product	384	89	23 ^{bc}
Handling dirty equipment	786	181	23 ^c
Touching body	197	19	10 ^d
<i>All activities</i>	<i>2,195</i>	<i>588</i>	<i>27</i>

*Figures refer to handwashing *before* the activity; for all other work activity types, figures refer to handwashing *after* the activity.

^a Percentages with different letters within a column are significantly different, $P \leq 0.01$.

3. Findings (Cont'd)

- Handwashing and glove use (Table 3)
- Workers washed their hands appropriately in conjunction with:
 - 16% of the work activities in which gloves were worn at the point handwashing should occur (i.e., glove work activities); and
 - 30% of the work activities in which gloves were *not* worn at the point handwashing should occur (i.e., nonglove work activities).
- This difference in appropriate handwashing rates between glove and nonglove work activities was significant, $P < 0.01$.
- The differences in appropriate handwashing rates between glove and nonglove work activities were also significant for the work activity types of food preparation, handling dirty equipment, and preparing raw animal product, $P_s < 0.01$.
- In glove activities, appropriate handwashing rates were significantly:
 - larger before food preparation and putting on gloves for food preparation than after handling dirty equipment and touching the body;
 - larger before putting on gloves for food preparation than after preparing raw animal product; and
 - larger after preparing raw animal product than after touching the body.
- In nonglove activities, appropriate handwashing rates were significantly:
 - larger before food preparation than in conjunction with any other activity;
 - smaller after touching the body than in conjunction with any other activity.

3. Findings (Cont'd)

Table 3. Number and percentage of glove and nonglove work activities in which workers washed their hands appropriately

Work Activity	Glove work activities			Nonglove work activities		
	N	n	%	N	n	%
Food preparation*	104	24	23 ^{ac}	410	185	45 ^a
Putting on gloves for food preparation*	95	24	25 ^{ab}	129	43	33 ^b
Eating/coughing	6	1	17 ^{bcde}	84	22	26 ^b
Preparing raw animal product	104	14	13 ^{cd}	280	75	27 ^b
Handling dirty equipment	166	19	11 ^{de}	620	162	26 ^b
Touching body	57	2	4 ^e	140	17	12 ^c
<i>All activities</i>	<i>532</i>	<i>84</i>	<i>16</i>	<i>1,663</i>	<i>504</i>	<i>30</i>

* Figures refer to handwashing *before* the activity; for all other activity types, figures refer to handwashing *after* the activity.

^a Percentages with different letters within a column are significantly different, $P \leq 0.01$.

4. Discussion

- Appropriate handwashing occurred in less than a third of activities in which it should have, suggesting that workers either do not know when to wash their hands or choose not to wash their hands when they should.
- Appropriate handwashing occurred more frequently with food preparation than with other work activity types, suggesting that at least some workers may be aware that food needs to be protected from their hands.
- Appropriate handwashing occurred less frequently after touching the body than in conjunction with other activities. Workers may not consider it feasible to stop their work to wash their hands after they have touched themselves or may not even realize when they have touched themselves.
- Appropriate handwashing occurred after less than a third of raw animal product activities. This is disturbing, as this activity is arguably one of the riskiest food preparation practices.

4. Discussion (Cont'd)

- Appropriate handwashing occurred less frequently when gloves were worn than when gloves were not worn, suggesting that glove use may reduce handwashing.
- The required handwashing rate found in this study, 8.6 an hour, translates to almost 3 minutes of handwashing an hour (assuming 20-second handwashes). Time pressure has been identified as a substantial barrier to handwashing (8, 9); devoting this much time to handwashing may seem unfeasible to food workers. Restaurants may wish to consider re-designing their food preparation activities to reduce the number of activities that require handwashing (10).
- Given the potential value of the data collected from the extended observations conducted for this study, food safety programs may wish to consider incorporating extended observations of food workers into their restaurant food safety activities.

5. Acknowledgements

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