



Rethinking Hand Hygiene in the Retail and Foodservice Industries: Are Recommended Procedures Based on the Best Science and Practical under Real-world Conditions?

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INTRODUCTION

The U.S. Centers for Disease Control and Prevention (CDC) estimate that human noroviruses (HuNoV) are responsible for most (58%) cases of foodborne illness of known etiology (20). The U.S. Food and Drug Administration (FDA) has classified human noroviruses (HuNoV), hepatitis A virus, *Salmonella* Typhi, enterohemorrhagic and shiga toxin-producing *Escherichia coli*, and *Shigella* spp. as “the big five” microorganisms of greatest concern in retail and foodservice establishments (27). These microorganisms, as well as most other common enteric pathogens, frequently make their way into food through the poor hygiene practices of infected or colonized food workers during the many touch points along the farm-to-fork continuum.

At present, training is the primary method used to improve food worker hand-hygiene practices, with hundreds if not thousands of programs currently available through government health agencies, universities, food industry, and other professional groups. Many of these programs are driven by the provision that the person-in-charge of a foodservice operation shall demonstrate knowledge about food safety practices, as detailed in section 2–101.11 of the FDA Food Code (28). However, in spite of the plethora of programs available, the overall public health impact of interventions designed to improve hand hygiene related food handling practices, including hand washing, remains a controversial topic (3, 4).

Observational studies of foodservice worker behavior have shown varied and relatively poor compliance with recommended hand hygiene practices. For example, some studies have indicated that 0 to 61% of restaurant workers, 6 to 73% of workers in institutional settings, and 2 to 82% of workers in deli operations properly follow recommended handwashing procedures (2, 8, 12, 23, 27, 33) (Table 1). These low compliance rates suggest that current hand hygiene recommendations have not translated well into practice.

To understand why this is the case, it is important to identify underlying factors that might be driving such low compliance rates. Evidence from the literature suggests that training as a means of improving practices has had a limited effect. One reason is that interventions primarily focus on knowledge gain and often do not address underlying environmental and institutional factors contributing to successful outcomes (3). Perhaps another factor contributing to low compliance rates is the recommended hand hygiene procedures used as the basis for most training interventions. More specifically, are the recommended hand hygiene procedures for the foodservice industry based on the best published science, and are they practical for food handlers under real-world conditions? We maintain that it is necessary to explore these two questions in a systematic, science-based manner in an effort to identify optimal, sustainable hand hygiene practices for the foodservice industry.

TABLE 1. Compliance rates of adequate, proper handwashing assessed by direct observation in institutional foodservice, restaurants, retail food and catering businesses

Type of facility	Setting	Overall compliance rate (%)	Source
Institutional foodservice	Assisted-living	7 ^a	Strohbehn et al. (23)
	Childcare centers	16 ^a	Strohbehn et al. (23)
	Hospitals	64 ^b	FDA (27)
	Nursing homes	66 ^b	FDA (27)
	Elementary schools	73 ^b	FDA (27)
	Schools	6 ^a	Strohbehn et al. (23)
Restaurants	Fast food restaurants	61 ^b	FDA (27)
	Full service restaurants	24 ^b	FDA (27)
	Restaurants	0 ^a	Strohbehn et al. (23)
	Restaurants	27 ^c	Green et al. (8)
	Restaurants	32 ^c	York et al. (34)
Retail food	Deli departments, chain stores	17 ^a	Lubran et al. (12)
	Deli departments, independent stores	2 ^a	Lubran et al. (12)
	Deli shops	48 ^b	FDA (27)
	Meat and poultry shops	82 ^b	FDA (27)
	Produce stores	75 ^b	FDA (27)
	Seafood stores	78 ^b	FDA (27)
Catering businesses	Cafes, restaurants, residential homes, hotels, public houses, function caterings and work canteens	31 ^c	Clayton and Griffith (2)

^aCompliance with 2005 US FDA Food Code

^bCompliance with 1997 US FDA Food Code

^cCompliance with self-validated checklist

HAND HYGIENE IN THE HEALTH CARE SECTOR

As in the foodservice sector, staff hand hygiene compliance rates in health care are also low, often less than 40% (9, 32). It is interesting, and perhaps not surprising, that the individual, environmental, and institutional factors influencing hand hygiene compliance in health care are very similar to those factors influencing compliance in the foodservice sector (Table 2). Thus, the foodservice industry can learn much by reviewing the evolution of hand hygiene guidelines for health care.

Historically speaking, some of the first guidelines for handwashing in health care emerged in a training film produced by the U.S. Public Health Service (U.S. PHS) over fifty years ago. The recommended protocol was for healthcare workers to wash their hands with soap and water for 1–2 minutes before and after contact with their patients. Because rinsing hands with an antiseptic agent was believed to be less effective at that time, this strategy was to be used only in emergencies or when sinks were not available (1). In 1975, and again in 1985, the CDC published updated written hand hygiene guidelines, effectively reducing the wash time to 10–15 seconds (1). It is important to note that

the total duration of the recommended handwashing procedure is significantly longer when one includes the steps of finding a sink, rinsing, drying, and returning to the point of care. Also, washing with antimicrobial soap was to be reserved for when one was performing an invasive procedure or was caring for high-risk patients. This recommendation was based on the undesirable effects, most notably excessive skin drying and irritation of hands, associated with most antiseptic hand washes available at that time. Use of alcohol-based handrub formulation was recommended only when hand sinks were not available (6, 21). Meanwhile, the positive experience and evidence base for application of alcohol-based handrubs in health care was growing in Europe. The breakthrough occurred at the University of Geneva Hospitals between 1993 and 1998, where strong evidence for a successful multimodal hand hygiene promotion strategy including the systematic change to alcohol-based handrubs as the standard of care to increase health-care worker compliance rates, directly reduced health-care acquired infection rates, and was a sustainable intervention over time (16).

The Association of Professionals in Infection Control (APIC) published in 1988, and updated in 1995, handwashing recommendations incorporating

TABLE 2. Factors influencing hand hygiene practices in health care and foodservice settings

Health-Care Settings	Foodservice Settings
<p>Individual Factors</p> <ul style="list-style-type: none"> ∞ Position ∞ Gender ∞ Shift ∞ No role model ∞ Wearing personal protective equipment (e.g., gowns, gloves, etc.) Belief that glove use obviates need for hand hygiene ∞ Irritation and dryness caused by some handwashing agents ∞ Lack of active participation in hand hygiene promotion ∞ Lack of knowledge of guidelines/protocols ∞ Not thinking about it/forgetfulness ∞ Disagreement with the recommendations ∞ Belief that lack of scientific information of definitive impact of improved hand hygiene on health care-associated infection rates 	<p>Individual Factors</p> <ul style="list-style-type: none"> ∞ Position ∞ Gender ∞ Shift ∞ Poor role-modeling and peer support ∞ Wearing gloves ∞ Belief that glove use obviates need for hand hygiene ∞ Irritation and dryness caused by some handwashing agents ∞ Lack of interest ∞ Low educational levels ∞ Language barriers / communication gaps ∞ Negative attitude toward food safety programs ∞ Disagreement with the recommendations ∞ Lack of time and expertise by managers
<p>Environmental Factors</p> <ul style="list-style-type: none"> ∞ Work Unit (e.g., intensive care unit) ∞ Sinks inconveniently located/shortage of sinks ∞ Automated equipment (e.g., sinks, paper towel dispensers, etc.) ∞ Low risk of acquiring infection from patients ∞ Supply (i.e., Lack of soap and paper towels) ∞ Often too busy/insufficient time ∞ Skepticism regarding value of hand hygiene ∞ Activities with high risk of cross-transmission ∞ High number of opportunities for hand hygiene per hour of patient care ∞ Acuity (i.e., level of severity of the illness) for the patient population of care 	<p>Environmental Factors</p> <ul style="list-style-type: none"> ∞ Work Unit (e.g., food preparation) ∞ Sinks inconveniently located/shortage of sinks ∞ Automated equipment (e.g., sinks, paper towel dispensers, etc.) ∞ Low risk of acquiring infection from food ∞ Large number of complex meals ∞ Short preparation periods due to high demand during mealtime ∞ Inadequate or neglected handwashing facilities and equipment ∞ High turnover of staff
<p>Institutional Factors</p> <ul style="list-style-type: none"> ∞ Understaffing/overcrowding ∞ Lack of administrative sanction of non-compliers/rewarding compliers ∞ Patient needs take priority ∞ Hand hygiene interferes with health care worker relationships with patients ∞ Lack of institutional priority for hand hygiene ∞ Lack of institutional safety climate 	<p>Institutional Factors</p> <ul style="list-style-type: none"> ∞ Understaffing ∞ Lack of administrative sanction of non-compliers/rewarding compliers ∞ Insufficient training, access and promotion of hand hygiene ∞ Lack of management support ∞ Lack of institutional safety climate

procedures similar to the 1985 CDC guidelines (1). As was the case for the CDC guidelines, APIC also recommended the use of alcohol-based rubs on hands that were not visibly soiled and detergent-containing

towelettes for heavily soiled hands (11). In 1996, the Healthcare Infection Control Practices Advisory Committee (HICPAC), which provides advice and guidance to the CDC, recommended using either

FIGURE 1. Excerpt of handwashing procedure from the 2009 Food Code (27)

2-301.12 Cleaning Procedure.

(A) Except as specified in ¶ (D) of this section, FOOD EMPLOYEES shall clean their hands and exposed portions of their arms, including surrogate prosthetic devices for hands or arms for at least 20 seconds, using a cleaning compound in a HANDWASHING SINK that is equipped as specified under § 5-202.12 and Subpart 6-301.^P

(B) FOOD EMPLOYEES shall use the following cleaning procedure in the order stated to clean their hands and exposed portions of their arms, including surrogate prosthetic devices for hands and arms:

- (1) Rinse under clean, running warm water;^P
- (2) Apply an amount of cleaning compound recommended by the cleaning compound manufacturer;^P
- (3) Rub together vigorously for at least 10 to 15 seconds while:
 - (a) Paying particular attention to removing soil from underneath the fingernails during the cleaning procedure,^P and
 - (b) Creating friction on the surfaces of the hands and arms or surrogate prosthetic devices for hands and arms, finger tips, and areas between the fingers;^P

antimicrobial soap or a waterless antiseptic agent when working with patients infected with multi-drug resistant pathogens (5).

As thinking progressed and the evidence became irrefutable, the CDC, under the leadership of recognized international experts, including J. Boyce, E. Larson, and D. Pittet, published their most recent guidelines for hand hygiene in healthcare settings in 2002, recommending the use of alcohol-based handrubs as the primary mode of hand hygiene for health-care providers except when hands are visibly soiled. In 2006 in draft format and in 2009 in final format, the World Health Organization (WHO) launched an updated global program built upon a multi-modal hand hygiene guideline (30, 31). This effort called upon all the world's health-care hand hygiene experts to examine the evidence, conduct global pilot tests and multiple validation studies, and issue recommendations, all intended to provide a sound scientific foundation to support the use of alcohol-based handrubs as the standard-of-care to bypass time constraints, improve infection prevention, and improve hand hygiene compliance in health-care settings, for both developed and developing countries.

In summary, the best approach in health-care settings to improve and sustain hand hygiene

compliance rates employs a five element multi-modal strategy that focuses on system change, staff education, monitoring and performance feedback, reminders in the workplace, and promotion of an institutional safety climate (16). As part of system change, easy and facilitated access to alcohol-based handrub at the point of patient care has been identified as a prerequisite for success if integrated with the overall strategy. In addition, a major element of staff education has been the development and promotion of a patient zone concept directing critical time for hand hygiene.

HAND HYGIENE IN FOODSERVICE ESTABLISHMENTS

Unlike the situation in the healthcare sector where hand hygiene guidelines have been routinely reviewed and alternatives established, recommendations for the foodservice industry have remained relatively unchanged. The FDA, a primary source of science-based information for the retail, foodservice, and vending industries, publishes recommendations on hand hygiene practices in the Food Code, currently in its seventh edition (2009) (28). The only differences in hand hygiene recommendations between the

FIGURE 2. Excerpt on hand antiseptics from the 2009 Food Code (27)

2-301.16 Hand Antiseptics.

(A) A hand antiseptic used as a topical application, a hand antiseptic solution used as a hand dip, or a hand antiseptic soap shall:

(1) Comply with one of the following:

(a) Be an APPROVED drug that is listed in the FDA publication **Approved Drug Products with Therapeutic Equivalence Evaluations** as an APPROVED drug based on safety and effectiveness;^{PF} or

(b) Have active antimicrobial ingredients that are listed in the FDA monograph for OTC Health-Care Antiseptic Drug Products as an antiseptic handwash,^{PF} and

(2) Comply with one of the following:

(a) Have components that are exempted from the requirement of being listed in federal FOOD ADDITIVE regulations as specified in 21 CFR 170.39 - Threshold of regulation for substances used in food-contact articles;^{PF} or

(b) Comply with and be listed in:

(i) 21 CFR 178 – Indirect Food Additives: Adjuvants, Production Aids, and Sanitizers as regulated for use as a FOOD ADDITIVE with conditions of safe use,^{PF} or

(ii) 21 CFR 182 – Substances Generally Recognized as Safe, 21 CFR 184 – Direct Food Substances Affirmed as Generally Recognized as Safe, or 21 CFR 186 – Indirect Food Substances Affirmed as Generally Recognized as Safe for use in contact with food,^{PF} and

1993 edition (1st edition) of the Food Code and the 2009 edition are the length of wash time (decreased from 20 seconds to 10–15 seconds) and addition of a ninth handwashing action (before donning gloves for working with food). Furthermore, in May 2003 the FDA prepared a written response to the 2002 *CDC Guidelines for Hand Hygiene in Healthcare*, making it clear that the CDC guidelines could not be applied to foodservice establishments (26). The underlying logic for this position was that (1) pathogens commonly transmitted by hands in health-care settings differ from those transmitted in foodservice settings; (2) the use of alcohol-based handrubs in place of handwashing has not been shown to reduce important foodborne pathogens on food workers' hands; and (3) the types and levels of soil on the hands of health-care workers differ from those on the hands of foodservice and retail food handlers.

As a consequence, FDA's position is that the use of alcohol-based handrubs as an alternative to handwashing in foodservice will not adequately reduce important foodborne pathogens on food workers' hands. The following three reasons were cited to justify this position:

- Alcohols have very poor efficacy against bacterial spores, protozoan oocysts, and certain non-enveloped (nonlipophilic) viruses.
- If alcohol-based handrubs were to be used in the foodservice sector, they and their ingredients must be approved as additives compliant with the Federal Food, Drug, and Cosmetic Act, or alternatively, approved through the New Drug Application (NDA) process.

FIGURE 3. Excerpt on when to wash to hands from the 2009 Food Code (27)

2-301.14 When to Wash.

FOOD EMPLOYEES shall clean their hands and exposed portions of their arms as specified under § 2-301.12 immediately before engaging in FOOD preparation including working with exposed FOOD, clean EQUIPMENT and UTENSILS, and unwrapped SINGLE-SERVICE and SINGLE-USE ARTICLES^P and:

- (A) After touching bare human body parts other than clean hands and clean, exposed portions of arms;^P
- (B) After using the toilet room;^P
- (C) After caring for or handling SERVICE ANIMALS or aquatic animals as specified in ¶ 2-403.11(B);^P
- (D) Except as specified in ¶ 2-401.11(B), after coughing, sneezing, using a handkerchief or disposable tissue, using tobacco, eating, or drinking;^P
- (E) After handling soiled EQUIPMENT or UTENSILS;^P
- (F) During FOOD preparation, as often as necessary to remove soil and contamination and to prevent cross contamination when changing tasks;^P
- (G) When switching between working with raw FOOD and working with READY-TO-EAT FOOD;^P
- (H) Before donning gloves for working with FOOD;^P and
- (I) After engaging in other activities that contaminate the hands^P

- There is a high probability that foodservice worker hands will be wet and soiled, effectively reducing the efficacy of alcohol in inactivating pathogens (26).

However, it is unclear how much published evidence actually supports these statements. By way of background, the most recent version of the Food Code (2009) provides three sections that address hand hygiene (See Fig. 1–3) (27). The provisions in section 2–301.11 (Fig. 1), which detail how hands should be cleaned, are based primarily on one article published in 1999 that focused on preventing, removing, or killing *protozoan* (not bacterial or viral) contaminants (18). Secondly, the provisions outlined in section 2–301.14 (Fig. 2) are primarily based on a paper published in 1980 that addressed disinfection methods in health care, not foodservice (15). Moreover, the use of the 1980 Ojajarvi study conflicts with FDA’s position that one cannot apply hand hygiene guidelines established for health care to the foodservice sector. Finally, only one of the eleven citations supporting the provisions regarding hand antiseptics (section 2.301.16–Fig. 3) is based on a controlled laboratory study, which was conducted in a meat processing plant (22). This study is 25 years old and focuses on germicidal handwashing agents rather than hand antiseptics.

The scientific basis upon which the FDA Food Code provisions related to hand hygiene is clearly limited. A tremendous amount of information has been learned in the past 20 years, which could increase our understanding of hand hygiene. Some key new

information includes: (1) the emergence of HuNoV as the most common cause of foodborne disease (22); (2) the identification of poor hand hygiene practices as a leading contributing factor for the transmission of enteric viruses to food (9); (3) the availability of newly formulated alcohol-based handrubs; and (4) the introduction of many more peer-reviewed publications consistently demonstrating poor compliance with recommended hand hygiene practices in foodservice settings (7, 8, 16, 17, 24). This new information provides great opportunity for the retail and foodservice industries to move forward by reviewing the science informing regulatory guidelines on hand hygiene in the retail and foodservice sectors and making improvements where needed.

PRACTICALITY OF CURRENT HAND HYGIENE RECOMMENDATIONS

In addition to reviewing the science, it is also important to determine whether current recommendations, or changes that might become recommendations in the future, are relevant and practical under real-world food handling and preparation conditions. Current hand hygiene recommendations emphasize the need for very frequent handwashing. The 2009 FDA Food Code lists nine actions that shall prompt food handlers to clean their hands and exposed portions of their arms (Fig. 3). Foodhandlers are typically taught that all of these actions could result in equal levels of contamination with

TABLE 3. Number of recommended and actual handwashing (HW) episodes per hour and estimated handwashing time needed to comply with frequency recommendations in selected institutional and commercial foodservice establishments

Setting	Number of recommended handwashing episodes ¹	Number of actual handwashing episodes performed ¹	Estimated minutes/hour to perform recommended number of HW episodes	Source
Institutional Foodservice				
Assisted-living facilities	7	1	6	Strohbehn et al. (23)
Childcare centers	9	2	8	Strohbehn et al. (23)
Schools	11	1	9	Strohbehn et al. (23)
Commercial Foodservice				
Restaurants	9	2	8	Green et al. (8)
Restaurants	29	0	24	Strohbehn et al. (23)
Catering businesses ²	17	5	14	Clayton and Griffith (2)
Deli departments, chain stores	27 ³	4 ³	23	Lubran et al. (12)
Deli departments, independent stores	17 ³	1 ³	14	Lubran et al. (12)

¹Handwashing episodes per hour or observed work activity, rounded to the nearest integer

²Includes cafes, restaurants, residential homes, hotels, public houses, function caterings and work canteens

³An observation period of 0.5 h was assumed for estimation purposes

pathogenic microorganisms. In reality, however, the risk of contamination is likely significantly elevated for only a few of these actions (although further laboratory evidence is needed to confirm this hypothesis). Furthermore, the likelihood that the current recommended frequency of handwashing is impractical in the day-to-day food preparation environment provides a good argument that this might be a key factor driving the low compliance rates that have been reported in the literature.

To illustrate the impracticality of the current recommendations, four observational studies were evaluated to assess handwashing behavior in both institutional and commercial foodservice establishments. In these studies, the number of *recommended* handwashing episodes per hour per employee was compared to the number of handwashing episodes *actually performed* per hour per employee (Table 3). For example, food workers in institutional foodservice settings (assisted living facilities, child care centers, and schools) should have washed their hands an average of nine times per hour, but they washed their hands only three times per hour on average (23). Similarly, Green et al. (8) reported that, in restaurants, each food handler should have completed at least nine handwashing episodes per hour, but they did so only 30% of the time. Strohbehn et al. (27) reported that restaurant food handlers washed their hands twice per hour; none of those observed were in compliance with 2005 Food Code recommendations. Deli workers

at chain-operated retail deli departments should have washed their hands at least 27 times in one hour; not surprisingly, their compliance was only 17%, whereas compliance of workers at independently owned and operated deli operations was only 2% (12). While these compliance rates are truly abysmal, they are not surprising. One has to ask how practical it is for any employee to wash his/her hands 27 times in one hour, for a school foodservice worker to do so nine times per hour.

It is not merely an issue of the number of times workers must wash their hands, but also the length of time it takes to wash hands properly. In the ServSafe® curriculum, one of the most commonly used food safety training curricula in the U.S., it states “The whole process [to wash hands] should take about 20 seconds” (14). However, the time to wash hands is not limited to just scrubbing, rinsing, and drying; it includes many other steps to complete the action. A conservative estimate of the length of time it might take to complete one handwashing episode properly is approximately 50 seconds, as detailed in Table 4. The length of every handwashing episode would increase even more if one also considered the size of the work area and the availability and location of handwashing sinks and supplies. If the 2009 FDA Food Code hand hygiene provisions were strictly followed, the average food worker could spend between 10 and 30 minutes *per hour* performing handwashing activities alone (Table 3), just as intensive care unit

TABLE 4. Estimated time to complete each step of a single handwashing episode

Step	Time (s)
Leave work station and walk to nearest handwashing station	10
Turn on water and adjust temperature	2
Rinse	2
Put soap on hands	2
Lather and rub vigorously	15
Rinse	5
Dry until most residual moisture is removed	4
Return to work station	10
TOTAL	50

nurses would need to dedicate 30 minutes per hour of patient care to clean their hands during daily practice (29). This is neither practical nor feasible, particularly in an industry expected to prepare and serve food rapidly, frequently, and in a cost-effective manner, with a limited and frequently temporary labor pool.

A RISK-BASED APPROACH?

Green et al. (8), Lubran et al. (12), and Strohhenn et al. (23) reported that nearly all employees they observed in the foodservice sector failed to wash hands after handling raw animal products and after handling soiled equipment, utensils, or dishware, arguably two higher risk practices. These studies also reported low compliance rates with handwashing after eating or drinking, after touching clothing or aprons, and after touching bare skin. If the stringency of handwashing were reduced for these latter activities, while promoting adherence to strict hand hygiene practices for the former, it might be possible to increase compliance in situations that present the greatest risk of contamination. This provides a good foundation to support a better “risk-based” approach to managing hand hygiene in the foodservice sector. In short, it should be possible to differentiate between times when a traditional full handwash (10–15-second scrub followed by rinsing under warm water and drying) must be performed, and when alternative methods, such as a brief hand rinse under warm water, use of a disposable alcohol-based hand wipe, or use of an alcohol-based handrub, might suffice. It is not logical to treat all actions as equally risky and prescribe the same degree of rigor in hand hygiene across all tasks when some are clearly more risky than others.

A CALL TO ACTION

Over the years, food safety stakeholder groups have strongly advocated improvement of recommended hand hygiene practices in foodservice and retail, along with more effective education and training programs (13). During the past two decades, millions of dollars have been invested by private industry and state and local governments to develop effective contamination interventions through food safety training. Since 2000, the USDA Cooperative Research, Education and Extension Service, through extramural granting programs like the National Research Initiative (NRI), the National Integrated Food Safety Initiative (NIFSI), and the National Institute of Food and Agriculture (NIFA), has awarded 278 grants to study food safety training and education within the retail/foodservice sector, investing over \$40 million (25). Even though millions of dollars have gone into funding initiatives that seek to improve compliance, we still find that compliance with proper hand hygiene practices is far lower than what is needed. We assert that one of the important underlying reasons for such poor compliance is that current recommendations are impractical under real-world food handling conditions. In addition, the science upon which these recommendations are based is outdated. This is an ideal time to readdress these issues; it is critical that we, as food safety professionals, promote hand hygiene procedures that are supported by good science, relevant to the most important foodborne pathogens transmitted by poor hygiene practices of food handlers, and practical to use. Some important criteria for consideration in rethinking hand hygiene in the retail and foodservice industries are as follows:

1. Verify which actions in the food preparation environment pose the greatest risk for pathogen contamination via hand and human contact. Consideration of basic food

microbiological principles, along with conducting of observational studies of food handler behavior and production of quantitative risk models, could help to identify hand hygiene “critical control points.” Such findings could be used to prioritize hand hygiene actions based on potential public health risks.

2. Engage in studies to understand motivations associated with the lack of food handler compliance with hand hygiene, recommendations, perhaps capitalizing on lessons learned from the health care sector. For example, just as health care now has its *Five Moments for Hand Hygiene*, a similar type of tool could be undertaken by the foodservice sector, such as the *Five Moments for Hand Hygiene at the Point of Food Contact*. In summary, a multi-model strategy to improve food handler compliance with hand hygiene practices should be developed, tested, validated and implemented at large scale.
3. Study the efficacy and overall risk-benefit of the use of alternative hand antiseptics. Alcohol-based handrubs, especially, should be studied as a replacement for rigorous hand washing when hands are not soiled or likely to be contaminated with parasites or bacterial spores or in cases after a worker has engaged in less risky practices such as touching clothing or eating, before contacting ready-to-eat foods, and before or between gloving.
4. Help to identify how hand antiseptic products can be created with broad-spectrum antibacterial efficacy and specific activity against HuNoV, including identification of the means by which to rapidly validate their efficacy and facilitate their approval for use by the foodservice sector.
5. Revise education and training materials to reflect changes in recommended hand hygiene procedures based on sound science, risk, and practicality for food handlers.

The ultimate goal of “best practices” for hand hygiene procedures is to reduce the risk of foodborne disease. However, food workers must also be able to perform their jobs in an efficient manner, and food establishments also need the opportunity to remain functional and profitable. In an effort to move forward with this important public health challenge, it will be important to find a balance between science, regulations, and the practical considerations associated with providing safe, affordable foods produced and prepared by the foodservice and retail food industries. This can be best accomplished when all stakeholders are engaged in the process, motivated and willing to

make changes that make sense for public health and industry as a whole. Improved hand hygiene is clearly needed; we all need to make it happen!

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