*Mini Review*

# Nudge tools: Are they effective to improve hygiene behavior of food handlers?

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## Abstract

**Foodborne diseases represent an important public health challenge. Improper food handling can cause food contamination at any stage of the food supply chain. Food safety knowledge and training alone cannot be effective enough to change food handler's hygiene behavior in practice. Employees' behavior is significantly influenced by various factors at both individual (knowledge, practice, motivation) and organizational levels (food safety culture). If the factors are positively oriented and under control, food handlers have a better attitude and awareness of the importance to ensure food safety by observing all hygiene requirements. Companies that deal with people as a risk factor use nudge tools which can, through their different approaches, significantly influence behavioral changes. Nudge tools that change people's behavior in a predictable way, can be used to improve hygiene behavior also in food establishments. In the studies so far, the most commonly used nudge tools are priming (for example, signs, words, smell) and affect (for example, disgust). Nudging may represent an important tool for improving hygiene behavior among food handlers. Food handlers are one of important risk factors, however, they are too often given insufficient attention.**

**Keywords:** Food handler, Hygiene behavior, Nudge tool, Food safety.

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## Introduction

The inability to effectively improve the situation regarding Foodborne Diseases (FBD) is a matter of major concern despite many resources allocated to the problem. Food safety field combines both the technical and the social sciences, which provide a possibility to maintain complete food safety. The human factor is undoubtedly the trigger of Food Safety Culture (FSC) within food networks. Furthermore, this issue includes some essential elements. Firstly, the large majority of advanced processing solutions in current manufacturing practice is run by processing equipment and technologies with a reduced number of workers. Secondly, people are excluded as major players in this concept, since all crucial tasks are planned and controlled by computerized solutions. Thirdly, the food supply chain counts on employees with reasonably low education and corresponding salaries, which are not the most attractive to retain skilled and knowledgeable workers for long periods. Consequently, employee turnover is high, and there is no time to build strong relations in terms of friendly cooperation, trust and long-lasting dedication towards the work and operational tasks [1]. Proper food hygiene and food safety starts with properly educated, trained and motivated food handlers. Griffith emphasized that food handlers' knowledge of food safety is critical: they cannot behave hygienically if they do not know how to behave and why [2]. This has led to increased emphasis on training; however, knowledge of food safety and hygiene does not always translate into the implementation of food safety practices [3]. Training provides people with the knowledge allowing them to handle food safety when they are motivated to be hygienic [2,4]. Unmotivated employees who do not develop commitment to ensuring food safety may, in spite of knowing the correct hygienic behavior, cause FBD through its inconsistent implementation. However, it is difficult to motivate employees for long-term behavioral changes [5]. The food handlers' lack of adherence to hygienic practices is one of the most critical problems in the food production chain [6]. Yiannas [7] states that if the food safety performance in the food supply chain is to be improved, the way people do things must be changed. Or, even simpler, he states that food safety equals behavior and this represents the meaning of FSC. FSC is complex, and many interlinking factors are at play. The analysis of FSC literature showed that researchers emphasized the importance of food handlers' behavior at all levels in the food supply chain and management system. Nyarugwe et al. [8] emphasize that major elements to be considered in FSC research include organisational and administrative characteristics (i.e. food safety vision, communication, commitment, leadership, training), technical facilities/resources (i.e., food hygiene/safety tools, equipment, and facilities), employee characteristics (i.e., attitudes, knowledge, perceptions and risk awareness), group characteristics, crucial FSMS characteristics, and actual food safety performance. Together with traditional training methods to improve hygiene behavior, food industry should use alternative methods, based on the motivation of behaviors [5] and the establishment of FSC [9]. The most commonly investigated theories of behavior change are the Theory of Planned behavior and the Health Belief Model. The latter model is based on persons' perception of the severity of consequences, related to their behavior [10]. Yu et al. [4] found out that training, based on behavior change, effectively influences hand hygiene. Behavior change can be achieved with the use of various primers that influence our senses (sight, hearing, smell) or emotions (e.g. evoke disgust)

[5]. To improve employees' hygiene behavior in food establishments, it is also necessary, together with improving their knowledge, to take into account other psycho-social and organizational factors [10]. Hygiene behavior is additionally influenced by optimistic bias, which allows employees in food establishments to believe that employee hygienic behavior in other establishments is worse than theirs and that they can never cause FBD [11]. Employees in food establishments in Slovenia were tested for their knowledge of viruses that present food safety risk. It was found out that in spite of their qualifications for work with food, they did not recognize viruses as a risk factor. Employees with higher education have more knowledge than those less educated, which proves that education is important to improve food safety knowledge and awareness [12]. For this very reason, encouraging the desired hygiene behavior should not be used as an independent activity, but as support when optimizing hygiene behavior [13]. The weak food safety knowledge of food handlers was also found out by Barjaktarović-Labović et al. [6] and by Bou-Mitri et al. [14]. The fact that trained food handlers in a food establishment have insufficient knowledge about the sources of food contamination, temperature chain and high-risk foods was found by Martins et al. [15], and that the same is true for food handlers in retirement homes and kindergartens, also by Martins et al. [16].

## Nudging Tools

Nudging was defined by Thaler and Sunstein [17] as any choice architecture which changes human behavior in a predictable way, but without forbidding any option to choose. The theory, which is the basis of many policy suggestions, is the result of long-term research in the area of behavior, particularly behavioral economy. Vallgårda [18] defined nudging as liberal paternalism that helps people make better decisions and tactfully changes their behavior with the intention to improve their health and well-being. Paternalism is seen particularly as somehow depriving people of the freedom of choice, but at the same caring for the decisions of the weaker and those incapable of taking their own decisions. On the other hand, liberalism is evident in free choice, since people can still decide regardless of the choice architecture. Dolan et al. [19] defined the strongest nine influences on behavior and joined them into the so-called MINDSPACE framework. MINDSPACE is an acronym, consisting of English words messenger, incentives, norms, defaults, salience, priming and affect. Some elements of this framework explain six principles of choice architecture, also defined by Thaler and Sunstein [17]. The strongest influences that predominantly appear in changing hygiene behavior are priming and affect [19].

## Signs, Pictures, Words and Sound

Primers are certain signs, words or feelings which can subconsciously influence our behavior. Associations we have to certain words, pictures or events can influence our emotional experiencing or our feelings and consequently strongly influence our behavior [19]. Rashidi et al. [20] used a primer for desired hygiene behavior in the form of a sign that attracts attention. In hospital setting, sanitizer dispensers were equipped with flashing lights and it was found out that the hand hygiene of employees and visitors improved by 8.9%. It turned out that hand hygiene was additionally influenced by the intensity of light emitted by flashing lights. Improved hand hygiene among medical workers due to the introduction of flashing lights on sanitizer dispensers was established also by Nevo et al. [21].In a retirement home, Mlakar et al. [22] used pictures of male eyes, which were fitted above sanitizer dispensers, as nudge tools. After introducing the behavior primer, the hand hygiene of nurses who were going to take care of residents improved by 20%.To improve hand hygiene of hospital visitors, Aarestrup et al. [23] used nudge tools that impact emotions or feelings. Above a free-standing sanitizer dispenser a red sign saying »Here we use hand disinfectant to protect our loved ones.« was placed. After fixing the sign above the free-standing dispenser, the hand disinfection of observed visitors improved by almost 50%. Porzig-Drummond et al. [24] found out that emotional experience influences our behavior, since playing a video which evoked disgust, improved hand hygiene in comparison to an educational video. Among others, a study with a nudge tool which encouraged hygiene behavior by influencing the hearing was performed. For that purpose, a soap dispenser with dosing which was followed by a song that lasted 18 seconds was used. These 18 seconds of music were supposed to encourage study participants to wash their hands. The dispenser with music influenced the participants' frequency of hand washing, i.e., on average they performed 44 more repetitions of hand washing than before this behavior was encouraged [4].

## Smell

Our behavior can be subconsciously influenced by a primer in the form of scent [19]. The process of smelling starts with volatile molecules entering the nasal cavity with the inhaled air. These molecules in the nose activate receptors in the olfactory epithelium. Electrical signal travels through olfactory bulb along the olfactory nerve to the brain [25]. Olfactory information travels to the limbic system in the brain, also responsible for emotional reactions and memory. A scent can thus strongly influence emotions and memory and consequently a person's behavior [26]. It was established that the scent of citruses, often added to various cleaning products, is subconsciously related to hygiene and cleanliness [27]. Birnbach et al. [28] identified the positive impact of fresh scent of citruses on washing hands in simulated hospital setting. Study participants who were exposed to the fresh scent, washed their hands by 29% more often than participants in the control group. The study confirmed that smell can subconsciously influence behavior, which however differs among individuals. The impact of smell on the behavior of health care workers and hospital visitors was confirmed by King et al. [29]. The hand hygiene of the observed participants who were exposed to the scent of citruses, was almost by 32% better than of those who were not exposed to this scent.

## Nudge Tools for Hygienic Behavior in Food Establishments

Chapman et al. [30] were researching whether a nudge tool in the form of a poster improves hygiene behavior of employees in food establishments. In this study, posters presented media news on an outbreak of a FBD, a shocking or a funny image and information on correct food handling. Through observing it was found out that posters positively influenced the behavior of employees in food establishments, which was evident in more frequent hand washing and fewer cases of cross-contamination. Despite the positive effect, there was no dramatic improvement of hygiene behavior. Li et al. [31] tested a new type of behavior priming, the so-called decoy effect, in food establishments. The decoy effect is a phenomenon where an additional, albeit worse option, encourages the current possibility to be chosen. In three parallel experiments two new ways of disinfecting hands were used, but they were less handy than the current spray sanitizer. The possibility to choose between the worse way of disinfecting hands (squeezing disinfectant from a plastic container and soaking hands in disinfectant) and the use of spray disinfectant improved hygiene behavior of employees by 10% and by additional 10% in the next 20 days. In their case study, Štefančič and Jevšnik [32] tested the effectiveness of four nudge tools to promote the desired hygienic behavior among 12 food handlers in the kitchen of the selected retirement home in Slovenia. During the research, four different nudge tools for analyzing hygiene behavior among food handlers were introduced. Namely: true stories about FBD outbreaks, the images of a probe thermometer, citrus scent and in the last observation, two nudge tools were combined: the inscription “Citrus scent has a positive effect on hand hygiene.” was added to the essential oil diffuser. Using nudge tools to encourage the desired hygiene behavior, Štefančič and Jevšnik [32] found that these improve the hygiene behavior of food handlers when they were preparing foods. Through observations before the introduction of nudge tools, they found out that the employees in a selected kitchen did not always respect all criteria of hygienic behavior. After introducing nudge tools, they found that stories on FBD as a nudge tools had no significant impact on the hygiene behavior of employees; what was detected was improved hand washing when handling raw foods and before handling prepared dishes. Essentially improved hand hygiene (washing hands at the transition from unclean to clean works, washing hands before handling raw foods, washing hands before handling prepared dishes, washing hands before starting work, washing hands after using telephone) was observed after the citrus scent with an inscription was introduced. Food handlers in the selected kitchen also fail to consistently perform the control of critical control points (CCPs). A picture of a probe thermometer as a nudge tool essentially improved the observance of CCPs (using and cleaning the thermometer, measuring the centre temperature of a dish, measuring air in cooling/refrigerating appliances, filling-in record sheets on CCPs) by confectioners. A picture of a probe thermometer also influenced the behavior of diet cooks, but there was no proper control of CCP carried out. In spite of introducing nudge tools they [32] found out that increased workload of employees influences their hygiene behavior during food handling. With a study [32] it was established that nudge tools in food establishments can be important tool to improve hygiene behavior, but they have to be used jointly with employee education and training. The use of pictures and short inscriptions according the results [32,33] proved to be the most effective in the encouragement of a particular hygienic behavior of employees.

## Discussion and Conclusion

Together with education, training and motivation of employees and the establishment of FSC, nudge tools for desired hygiene behavior can be an important contribution to improved hygiene behavior and observance of food safety requirements. Nudging tools may represent an important tool for improving hygiene behavior among food handlers. Further research is needed to statistically confirm the effectiveness of different nudge tools in food establishments. We need qualified, motivated, and satisfied food handlers and companies that will recognize FSC as a basic cornerstone to ensure effective food safety. In the food domain it is essential to combine natural and social sciences, since we should be aware that people who enter food safety systems are an important risk factor, although they often receive too little attention. Nudge tools may play an important role in promoting hygiene behavior and achieving better food safety.

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