



# INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES



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To Link this Article: <http://dx.doi.org/10.6007/IJARBSS/v8-i17/5236>

DOI: 10.6007/IJARBSS/v8-i17/5236

*Received: 06 Sept 2018, Revised: 30 Oct 2018, Accepted: 13 Dec 2018*

Published Online: 31 Dec 2018

**In-Text Citation:** (Ahmad, Abidin, Mahyudin, & Rashid, 2018)

**To Cite this Article:** Ahmad, I. A.-Z., Abidin, U. F. U. Z., Mahyudin, N. A., & Rashid, N. K. M. @ A. (2018). A Structural Analysis of Behavioral Determinants Affecting Food Handlers' Proper Hand Washing Practices in School Canteen. *International Journal of Academic Research in Business and Social Sciences*, 8(17), 324–339.

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Special Issue on Revisiting Foodservice and Gastronomy Intersection: Business, People and Performance,  
2018, Pg. 324 - 339

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[www.hrmar.com](http://www.hrmar.com)

ISSN: 2222-6990

## A Structural Analysis of Behavioral Determinants Affecting Food Handlers' Proper Hand Washing Practices in School Canteen

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### Abstract

Hand washing is an essential practice in the foodservice industry because hands are the primary pathway of transmitting pathogens, toxins, or chemicals to the prepared food. Despite that, prior studies highlighted that most food handlers in Malaysia do not apply proper hand washing practice. It is pivotal to address potential factors that are beyond the knowledge on food safety, to induce proper hand washing practice among food handlers and prevent the outbreak of foodborne diseases. To date, studies on multifaceted factors that influence food handlers' hand washing practice remain scarce. Hence, this study surveyed a convenience sample of food handlers (n=88) to identify factors that affect their intention to perform proper hand washing practice. Samples were selected from public school canteens in Klang Valley area. A survey questionnaire was developed based on the Theory of Planned Behavior. Data were analyzed using SmartPLS 3.0 to test the hypothesized relationships among study constructs. The results of PLS-SEM found that attitude and perceived behavior control fail to predict intention and only subjective norm significantly influence the food handlers to perform proper hand washing practices. The findings were expected to assist the business owners and school administration in improving the food safety practices among food handlers at the school canteen. This study contributed essential information for future research on food safety practices to address the prevalent issue of foodborne diseases.

**Keywords:** Hand washing, Theory of Planned Behavior, Food safety, Food handlers, School canteen.

## Introduction

Food borne diseases are growing public health problem worldwide and has significant impact on health and economic especially in developing countries (WHO, 2015). It can cause nausea, stomach cramps, vomiting or diarrhea. In more severe cases, it even leads to severe illness or death especially in the elderly, people with weakened immune systems, pregnant women and young children. In developed countries such as United States, it is estimated that each year, foodborne disease has caused 48 million people falls sick, 128,000 hospitalized and 3,000 deaths (CDC, 2018). Similarly, a total of 5,251 foodborne and waterborne outbreak cases were reported involving 45,665 cases with 6,438 hospitalized and 27 deaths in the European Union (Barjaktarović-Labović et al., 2017). The Ministry of Health Malaysia recorded about 55.21 of food poisoning incidence rate per 100,000 population in 2016 (MOH, 2016). As many cases in the developing countries often goes unreported or un-investigated, the real incident rate maybe higher than the official record (Gupta, Dudeja, & Minhas, 2017; WHO, 2015).

Providing safe food to customers is important in all sectors of foodservice operation, but institutional foodservice bears a heavy responsibility because it usually serves large groups of people who are highly vulnerable to food borne diseases such as children, elderly and the ill. In fact, the outbreak of food borne diseases in Malaysia occurred most frequently in academic institutions. For example, between 1996 to 1997, 66.5 percent of food poisoning cases reported occurred in school, only 0.4 per cent of the cases occurred in other public food outlets (Meftahuddin, 2002; Nik Husain, Wan Muda, Noor Jamil, Nik Hanafi, & Abdul Rahman, 2016). In 2014, report indicated that schools contributed to 43 percent of the total food poisoning incidents (Lee, Halim, Thong, & Cha, 2017). Between January to September 2016, 153 cases of food poisoning involving 6,000 students were reported ((Malaysian Digest, 2017).

Previous studies associate foodborne diseases with poor safe food handling (Barjaktarović-Labović et al., 2017; Thaivalappil, Waddell, Greig, Meldrum, & Young, 2018; Yu, Neal, Dawson, & Madera, 2018). In Malaysia, MOH annual report in 2007 stated that 50 percent of food poisoning cases occurred were contributed by food handler's poor sanitation and food handling practices (MOH, 2007). Mishandling that resulted in food poisoning outbreaks listed include contaminated raw food, inadequate temperature control (improper cold holding of potentially hazardous food, inadequate date marking of refrigerated food reheating), unsafe food from supplier, inappropriate food storage, contaminated equipment, improper cleaning and sanitizing and personal hygiene (Barjaktarović-Labović et al., 2017; Nørrung & Buncic, 2008; Sharif, Obaidat, & Al-Dalalah, 2013; Yu et al., 2018).

Poor personal hygiene has been identified as one of the major risk factors of foodborne diseases (FDA, 2009; Smigic et al., 2016; Tóth, Koller, Illés, & Bittsánszky, 2017; Woh et al., 2017). Food handlers are at risk of being the main carrier for harmful microorganisms as human body parts can transmit these microorganisms directly to food products (Abdul-Mutalib et al., 2012; Barjaktarović-Labović et al., 2017; Tóth, Koller, Illés, & Bittsánszky, 2017; Woh et al., 2017). It has

been reported that malpractices of hand hygiene practices such as bare contact with food, improper hand washing practices after hand contact with raw food, faeces, nose, or skin can increase the risk of pathogen transmission from food handlers to food product and consumer (Smigic et al., 2016; Woh et al., 2017). To reduce the occurrence of infections caused by foodborne pathogen, personal hygiene practices such as hand hygiene practices is important.

Malaysian government implemented various efforts to overcome the food poisoning outbreaks such as inspection in canteen and boarding school kitchen, a mandatory food handler training, and implementation of intervention programs. To reduce foodborne diseases and improve food handlers hand washing behavior, it is very important to address the factors that beyond food safety knowledge such as motivational, personal, social and environment factors. By identifying these factors, an effective intervention targeting the factors to improve hand washing behavior can be developed. Educational training alone may not be sufficient to improve hand washing practices. Many food safety studies in Malaysia have focused more on knowledge, attitude, and practice model as well as microbial assessment instead of identifying the factors that influence food handlers' hand washing behavior. To date, very little research has been conducted to identify food handlers' multiple factors affecting hand washing practices. Drawing from the theory of planned behavior, this study aims to identify the factors affecting food handlers' hand washing practices in school canteen.

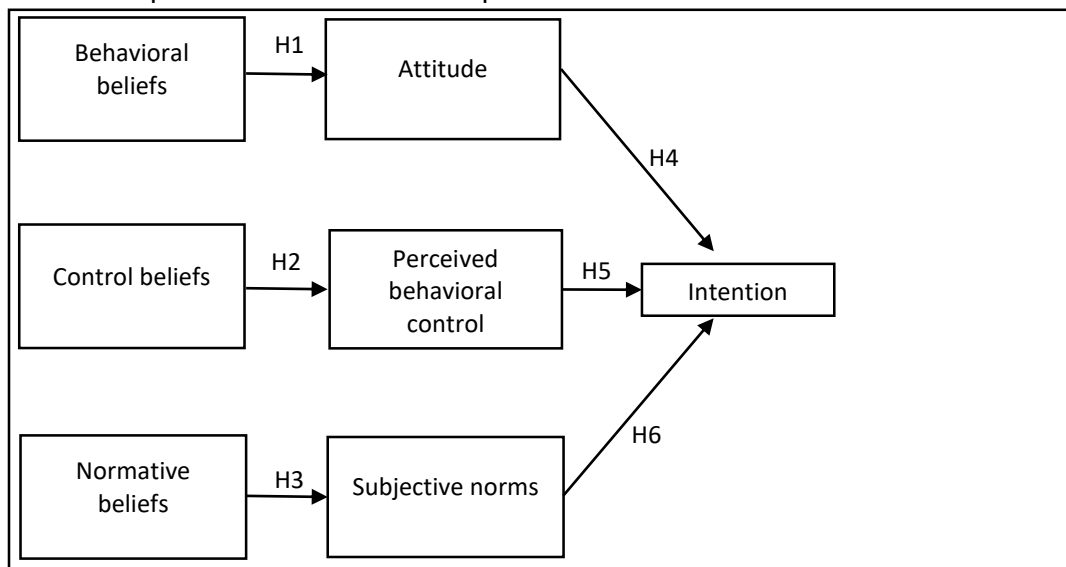
## Literature Review

Hands are the main pathway for germ transmissions and hand hygiene is known as basic precautionary in health setting as well as in food industry to prevent the transmission of harmful pathogens (WHO, 2009a). Hand hygiene is a general term referring to "any action of hand cleansing" (WHO, 2009b). There are a number of published studies that described the link between the hand hygiene practices and the decrease rate of foodborne diseases outbreak (Lee et al., 2017; Tóth et al., 2017; Woh et al., 2017). Previous studies concluded that hand hygiene is the indicator for food handlers' safe food handling during food preparation, while poor hand hygiene practices has been recognized as one of the significant risk factors of food cross-contamination that can lead to foodborne diseases outbreak (Lee et al., 2017; Pragle et al., 2007; Woh et al., 2017).

Inadequate hand washing practices is still identified as the main contributing factor to foodborne diseases although the standard hand washing practices have been long established (Clayton, 2004; Green et al., 2006; Robertson, Boyer, Chapman, Eifert, & Franz, 2013). Despite the knowledge and awareness on the importance of proper hand washing practices, many studies demonstrated low rate of compliance with hand washing of food handlers in food service sectors. For example, study by Roberts (2008) reported that as many as 60% of food handlers did not wash their hands properly or often enough. Most observational studies also demonstrated the low hand washing compliance by food handlers in foodservice operations (Yu et al., 2018). The efforts to increase the compliance of hand hygiene among food handlers do not lasting for a long period and only temporarily effective (Jeong & Kim, 2016). Similarly, studies carried out in Malaysia showed that most of food handlers neglected the basic elements in food safety especially on hand washing practices (Abdul-Mutalib et al., 2012; Tan, Bakar, et al., 2013; Tan, Cheng, Soon, Ghazali, & Mahyudin, 2013).

Previous studies on foodservice operations that assessed the potential use of social cognition models typically focused on the healthcare setting. A social cognition model, or also commonly known as a theoretical model, is designed to identify the cognitive determinants of a specific behavior. There are several factors that may influence individual health-related behaviors, such as biological, psychological, and social factors. However, a social cognition model focuses on a rather limited subcategory of cognitive elements (i.e. supposed to be the most proximal to a specific behavior) (Sutton, 2004). Over the recent years, the application of Theory of Planned Behavior (TPB) in studies on food safety has increased. Fundamentally, the TPB is extended from Theory of Reason Action (TRA) (Ajzen & Fishbein, 1980). The TRA assumes that attitude and social norms guide the intention towards behavior. The TPB incorporates perceived behavioral control into TRA (Ajzen, 1991). In general, the TPB predicts the antecedents of behavior that prompt certain behavioral changes. The theory assumes that intention is the immediate antecedent to the behavior, which is influenced by attitude, subjective norms and perceived behavioral control. These three factors are influenced by different beliefs that drive the individual behavior.

The research framework for this study is based on the TPB (Figure 1.0). This theory proposes that the best determinant of behavior is intention which is influenced by three factors: attitude, subjective norm and perceived behavioral control (Mullan & Wong, 2010). The TPB is typically discussed in terms of indirect measures and direct measures (Roberts, 2008). The indirect measures involve the modal salient beliefs of a behavior. The behavioral beliefs refer to a set of individual beliefs on the positive or negative consequences in performing a given behavior, which determines one's attitude. Meanwhile, the attitude refers to the extent of favorable or unfavorable evaluation one has towards the assessed behavior (Ajzen, 1991; Roberts, 2008). Accordingly, it is assumed that those who embrace negative attitude towards the targeted behavior are less likely to perform the behavior compared to those who have positive attitude.



(Adapted: Ajzen, 1991)

Note:

H1: Behavioral beliefs influences the attitude about the intention of food handlers to perform proper hand washing practices

H2: Control beliefs influences the perceived behavioral control about the intention of food handlers to perform proper hand washing practices

H3: Normative beliefs influence the subjective norm about the intention of food handlers to perform proper hand washing practices

H4: Attitude influence the intention of food handlers to perform proper hand washing practices

H5: Perceived behavioral control influence the intention of food handlers to perform proper hand washing practices

H6: Subjective norms influence the intention of food handlers to perform proper hand washing practices

The control beliefs refer to a set of individual beliefs on the presence of factors that may either ease or hinder the performance of a given behavior, which determine perceived behavioral control. These factors include both internal factors (e.g., the individual differences, knowledge or information, skills, and emotion) and external factors (e.g., financial limitation, resources, and time) (Ajzen, 1985; Roberts, 2008). Those who have the perception that they are not capable to perform the given behavior do not have the intention to perform the behavior. However, those who have the intention to perform the behavior that they are incapable of performing reflects the case of direct influence of behavioral control (Ajzen, 1991; Roberts, 2008). On the other hands, the subjective norms are determined by normative beliefs. Accordingly, the normative beliefs refer to a set of individual beliefs of whether the important referents (e.g. family, friends, spouse, or superior) approve or disapprove the given behavior (Ajzen & Madden, 1986; Roberts, 2008; White et al., 2015). The subjective norms include normative beliefs (others' opinion on how one should respond in a given situation) and motivation to comply (willingness to comply with others' opinion) (Ajzen & Fishbein, 1980). In this study, the TPB model was used as ways of evaluating the impact of indirect measure on food handlers' direct measure (attitude, perceived behavioral control and subjective norms) towards the proper hand washing practices, and the influence of direct measure on the intention of food handlers to perform proper hand washing practices.

## **Methodology**

### ***Sample***

The targeted population for this study was food handlers from school canteens in Klang Valley areas. A total of 88 food handlers from school canteen were recruited using a convenience sampling technique. Convenience sampling was chosen because of the costs, time and workforce issues in this research. Convenience sampling often choose as sampling techniques in previous studies because it is affordable, easy to conduct and subject are readily available for researcher (Etikan, Musa, & Kasim, 2016). According to Etikan et al. (2016) the main objective of convenience sampling is to obtain information form readily available and accessible respondents, however, it is necessary to describe the subjects who might include and excluded from the study (Etikan et al., 2016). There are two

selection criteria included in the sample for the study participation: a) food handlers who had job task involving food handling (i.e. food preparation and serving) and b) age 18 years old and older.

### **Data Collection**

Quantitative approach using survey data collection was applied for the study. Drawn from the Theory of Planned Behavior (TPB) as framework, a questionnaire was developed to identify specific factors affecting food handlers in school canteen. According to TPB, behavior is influenced by intention and perceived behavior control. Consecutively, an intention to perform any behavior are predicted by attitudes, subjective norms and perceived behavioral control. These three predictors are influenced by a set of beliefs: a) individual attitude is influence by behavioral beliefs (outcome beliefs multiplied outcome evaluations), b) individual perceived behavioral control is influenced by control beliefs (control beliefs strength i.e. likelihood of occurrence] multiplied by control beliefs power), and c) individual subjective norms (normative beliefs multiplied by motivation to comply) (Ajzen, 1991). Items questionnaire in this study were designed to measure each of TPB constructs described above.

The questionnaire was divided into two sections that cover demographic information and the key questions about all factors affecting food handlers' hand washing practices in school canteen. Each question consists of items for direct measure (attitude, perceived behavior control and subjective norm) and indirect measures (behavioral beliefs, control beliefs and normative beliefs). The questionnaire comprised a total of 57 items assessing the following constructs: attitude (4 items), perceived behavioral control (4 items), subjective norms (4 items), intention (3 items), behavioral beliefs strength and outcome evaluation (12 items each), control beliefs strength and control beliefs power (20 items each), and normative beliefs strength and motivation to comply (10 items each). Content validity of the questionnaire was examined by experts in the field of foodservice and food safety. A pre-test study was conducted to evaluate the instrument developed. Specifically, the questionnaire was pre-tested to identify any s and to make sure the questions are clearly articulated, relevant and comprehensive.

Data collection at school canteen was arranged at mutually agreed time and date with the food handlers and must not interfere with school and students' activities. Food handlers in school canteen were asked to fill the letter of consent and assured that their responses and identity would remain confidential. Face-to-face survey approach was used to collect the data. All the questionnaires were returned to researchers after respondents completed it. Although this method of data collection was more costly and time consuming compared to email or postal survey, the method assured that respondents a) filled out the questionnaire by themselves, b) were able to ask directly to researcher about the questionnaire, and c) researcher were able to collect food handlers individual responses without any influence from their superior (i.e. canteen manager or canteen owner).

**Data Analysis**

Structural Equation Modeling-Partial Least Square (SEM-PLS) was employed as the main statistical procedure to test the hypothesized relationships. Assessment of the measurement model and parameter estimation of the structural model for predicting the specific factors that affect hand washing practices of food handlers were done using SmartPLS 3.0. The SEM-PLS offers path analysis allowing the researcher to test the hypothesized relationships between behavioral beliefs, normative beliefs, control beliefs, attitude, subjective norm, perceived behavioral control, and intention of hand washing behavior.

**Result and Discussion****Respondents Profile**

As shown in Table 1.0, most of the respondents in the sample were male (59%) and age between 19 to 29 years old (38.4%). Food handlers involved in the survey mostly are local people (65%) with 77% of the total respondents were Malay. The food handlers' educational level was varying but most of the respondent finished their secondary school. Even though majority of the respondent have attended food handlers training courses (74.7%), quarters of the respondents still do not attend the food handlers training courses (24.1%) and received the typhoid injection (19%).

Table 1: The demographic profiles of the survey respondents

Characteristics		Frequency (n)	%
Sex	Male	49	59
	Female	33	39.8
Age	18 & under	5	6
	19-29	32	38.4
	30-39	17	20.4
	40-49	19	22.8
	50 & over	7	8.4
Country	Malaysia	54	65
	Indonesia	25	30
	Thailand	2	2
Race	Malay	64	77
	Chinese	1	1
	Indonesian	16	19
Education level	Informal education	3	3.6
	Primary school	9	10.8
	Secondary school	50	60.2
	Certificate	4	4.8
	Diploma	11	13.3
Food handlers training	Higher education	5	6
	Yes	62	74.7
Typhoid injection	No	20	24.1
	Yes	66	79.5
	No	16	19.3



Note: Some variables do not add up to 100% because of missing value

### ***Measurement Model Evaluation***

Internal consistency reliability and validity of reflective measurement model must be assessed first before performing the data analysis (Hair, Hult, Ringle, & Sarstedt, 2014). For this study, composite reliability was used to measure the internal reliability due to limitation of the Cronbach alpha and its sensitivity to the number of items in scale. The composite reliabilities for all the factors in the measurement model meet the recommended threshold value of 0.70, which range from 0.8 to 0.93, indicating a strong reliability (Nunnally & Bernstein, 1994; Hair et al., 2017). The average variance extracted (AVE) values for all constructs are well above the required minimum level of 0.50, which ranged from 0.52 to 0.78, demonstrated that all latent variables were able to explain more than half of the variance and indicates all the measures of reflective constructs have sufficient convergent validity (Hair et al., 2017). The heterotrait-monotrait (HTMT) was used to assess discriminant validity. All the HTMT values are below values of 0.90 supporting the discriminant validity of study scales. HTMT values above 0.90 suggest a lack of discriminant validity (Hair et al., 2017).

### ***Structural Model Evaluation***

The criterion for structural model evaluation was the coefficient of determination of the endogenous constructs ( $R^2$ ). According to (Henseler, Ringle, & Sinkovics, 2009), the coefficients of determination ( $R^2$ ) values of 0.75, 0.50 and 0.25 are described as substantial, moderate and weak, accordingly. The  $R^2$ s for food handlers' intention recorded is 0.540, which is moderate; subjective norm  $0.45 > 0.25$ , which is weak; attitude  $0.184 > 0.25$ , and perceived behavioral control  $0.105 < 0.25$ , which are not significant at all. According to Falk & Miller (1992), for the variance explained of particular endogenous construct to be considered adequate, the  $R^2$  values should equal to or greater than 0.10. Table 2.0 summarizes the hypotheses testing results including the standardized path coefficient and path significance. These results obtained through the bootstrapping assessment in (SEM-PLS). First, H1 examined the effects of behavioral beliefs towards food handlers' attitude. Results showed that behavioral beliefs positively affect food handlers' attitude ( $b=0.429$ ,  $t$ -value= $4.961$ ,  $p<0.000$ ), which explained 18% of the variance in food handlers' attitude. Thus, the hypothesis was supported and accepted. Next, H2 examined the effects of control beliefs towards food handlers perceived behavioral control, results found that control beliefs have positively effects food handlers' perceived behavioral control ( $b=0.324$ ,  $t$ -value= $3.798$   $p<0.000$ ), which explained 11% of the variance in food handlers perceived behavioral control. Therefore, H2 was supported and accepted.

Table 2: Hypotheses testing results (the path coefficient of structural model)

Hypotheses	Path coefficient t	t-Statistics ( O/STDEV  )	p-value	Result	
H1: Behavioral beliefs influences the attitude about the intention of food handlers to perform proper hand washing practices	0.429	4.961**	0.000	Significant (Accepted)	
H2: Control beliefs influences the perceived behavioral control about the intention of food handlers to perform proper hand washing practices	0.324	3.798**	0.000	Significant (Accepted)	
H3: Normative beliefs influence the subjective norm about the intention of food handlers to perform proper hand washing practices	0.670	9.697**	0.000	Significant (Accepted)	Note. t-value of
H4: Attitude influence the intention of food handlers to perform proper hand washing practices	-0.064	1.052	0.293	Not significant (Rejected)	
H5: Perceived behavioral control influence the intention of food handlers to perform proper hand washing practices	-0.054	0.603	0.547	Not significant (Rejected)	
H6: Subjective norms influence the intention of food handlers to perform proper hand washing practices	0.748	10.012**	0.000	Significant (Accepted)	

significance is 1.645 for one-tailed test\* and 1.95 for two tailed test (5%)\*\*

Results showed that normative beliefs have a positive effect on food handlers' subjective norms ( $b=0.670$ ,  $t\text{-value}=9.697$ ,  $p<0.000$ ), which explained 45% of the variance in food handlers' subjective norms. Thus, H3 was strongly supported and accepted. Regarding the intention of food handlers to perform proper hand washing at their workplace, H4 and H5 are rejected while H6 is

strongly supported. The results illustrate that intention to perform proper hand washing practices at school canteen can be explained by subjective norm as it significantly and positively influence the intention ( $b=0.748$ ,  $t\text{-value}=10.012$ ,  $p<0.000$ ). The construct accounted for 54% of the variance in food handlers' intention to perform proper hand washing at their workplace, which is typical fit and acceptable in TPB studies and behavioral sciences. Previous food safety studies using TPB or extended TPB often found the variance of intention between 42% and 66% (Borges, Tauer, & Lansink, 2016; Mullan & Wong, 2009). However, both construct of attitude ( $b=-0.064$ ,  $t\text{-value}=1.052$ ,  $p<0.293$ ) and perceived behavioral control ( $b=-0.054$ ,  $t\text{-value}=0.603$ ,  $p<0.547$ ) are not significant predictors of food handlers' intention to perform proper hand washing.

In evaluating food handlers' intention towards hand washing practices at school canteen, perceived social pressure to perform hand washing practices significantly influence their intention ( $p<0.001$ ). In contrast, perceived behavioral control and attitude do not significantly influence food handlers' intention. Similarly, Phillip and Anita (2010) found that subjective norms as the most significant factors affecting the intention of food handlers from food service establishment to perform safe food handling practices. Pattarapong (2011) reported subjective norm is also the significant predictor of intention to engage in the hand washing behavior. The authors mentioned the role of collectivistic society to influence foodservice workers in Taiwan. On a related point, Malaysian also known as collectivistic society (with 26 score) as cite in Hofstede's national culture values (Insight, 2018). The collectivistic society tend to make decision based on their social norms, situation and environment. Similarly, respondents in this study regards the opinion from their manager, school administration, co-workers, customers and health officers as crucial factors in their decision to perform proper hand washing practices.

Accordingly, attitude and perceived behavior control are positively influenced by behavioral beliefs and control beliefs. However, the former has no significant effect on the intention of food handlers to perform proper hand washing practices. Only subjective norms influence the intention of food handlers to perform hand washing practices. The result of insignificant relationship between attitude and intention is consistent with previous study where attitude was found as the weakest and non-significance predictor on food safety behavior (Fulham & Mullan, 2011; Mullan, Allom, Sainsbury, & Monds, 2015; Mullan & Wong, 2009; Pattarapong Burusnukul, 2011; Phillip & Anita, 2010). One unanticipated finding was that the perceived behavioral control as non-significant predictor for intention to perform proper hand washing. The finding contradicts with previous study where perceived behavioral control was found significantly influence food safety behavior (Mullan et al., 2015; Pattarapong, 2011; Pilling et al., 2008). As stated by Ajzen and Fishbein (2004), "the relative importance of attitudes, subjective norms, and perceptions of behavioral control for the prediction of intentions is expected to vary from behavior to behavior and population to population".

## Conclusion

In conclusion, the results of PLS-SEM found that attitude and perceived behavior control fail to predict food handlers' intention and only subjective norm significantly influence the intention of food handlers to perform hand washing practices. This result justified that, social pressure from food

handlers' important referents (e.g. managers/owners, school administrator, customer, health officer) have a positive influence on an individual's intention to perform hand washing behavior. The finding can be used by managers/business owners and school authority to improve food safety practices of food handlers in school canteen. Managers or business owners were identified as food handlers' most important referents and can influence their food safety behavior at the workplace. Thus, management in school canteen has the responsibility to promote food safety. For example, managers/business owners can improve the working condition of food handlers by providing them with suitable workplace, sufficient facilities and resources, support system through suitable work routine/schedules, training and policies. Furthermore, management staff can motivate their workers through rewards and punishment and acts as a role model for food handlers.

Several limitations to this study need to be acknowledged. First, the sample size of the survey was relatively small. Nonetheless, the sample size was sufficient to conduct the SEM-PLS analysis and predict the intention of food handlers. It may not represent all the food handlers from school canteens in Malaysia. Second limitation is the convenience sampling used in data collection making it harder to generalize this study. Future research could obtain a larger sample size from each state in Malaysia to make regional comparison and generalize to the population of Malaysia. The use of convenience sampling may not represent the average food handlers working in Malaysian public-school canteen. Therefore, future research could employ random sampling technique to obtain a range of sample with individual targets in term of demographic information or other characteristics. Overall, the TPB was able to elicit food handlers' beliefs about hand washing behaviors and predict the intention to perform the behavior. However, future research should consider including more constructs that represents the complex interplay among multi-level factors (i.e. social influence, attitude, self-efficacy, risk perception, knowledge, support system, policy and procedures) influencing food handlers' safety practices.

### **Acknowledgement**

The authors would like to thank all participating schools for their time and cooperation. Funding for the study was provided by the University Grant.

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