

Received:  
8 August 2017

Revised:  
3 May 2018

Accepted:  
27 September 2018

Cite as: Show-Yu Lin,  
Chen-Yung Lin,  
Ming-Chin Hsin. Comparison  
of social and culture based  
risk perception of personal  
hygiene behaviours.  
Heliyon 4 (2018) e00839.  
doi: [10.1016/j.heliyon.2018.e00839](https://doi.org/10.1016/j.heliyon.2018.e00839)



# Comparison of social and culture based risk perception of personal hygiene behaviours

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## Abstract

This study investigated students' risk perceptions with respect to personal hygiene behaviours (PHBs) from a sociocultural perspective along three dimensions: oral intake, physical contact, and preventative. A framework for an ecological system incorporates personal-social-cultural schemata shaping one's PHBs was proposed. A questionnaire survey and interview were administrated to 113 Taiwanese undergraduates who rated their risk concerns regarding 22 PHBs items; interviews were also conducted post-questionnaire to solicit opinions regarding item responses. A descriptive analysis, t-test, ANOVA, and post hoc comparison were performed for quantitative data analysis while qualitative data quoting students' elaboration on their responses were presented. This study reached three main conclusions. First, there is a significant difference between the risk perception scores of oral intake PHBs compared to physical contact PHBs. Second, the risk perception scores between this study and the American survey differ significantly. Furthermore, 13 of the items are considered to be socioculturally-embedded PHBs, differing substantially between the two study populations. Therefore, this study suggests that, in order to promote health policy and education, biology, society and culture levels need to be considered.

Keywords: Education, Public health, Psychology

## 1. Introduction

Personal hygiene behaviours (PHBs) include behaviours that people perform in daily lives to avoid some diseases. Hygiene risks are considered mainly along three dimensions: oral intake, physical contact and preventative (Esrey et al., 1991; Heinzl, 2001). Risk perception, viewed as subjective estimates of the probability of the occurrence of negative events which may shape personal behaviours (Oltedal et al., 2004), is often considered the core concept of health behaviour (Brewer et al., 2007; Rousseau et al., 2013). Research suggests that risk perceptions relate not only to personal cognition but also to social learning and cultural adherence (Bandura, 1986, 1989; Douglas, 1979; Douglas and Wildavsky, 1983; Piaget and Inhelder, 1969); thus, the development of risk perceptions is connected to personal, social, and cultural influences. Therefore, examining individual, social, and cultural influences on risk perception is essential to understanding their effect on perspectives regarding PHBs (Foster, 1976; Hui, 2006; Jones and Rua, 2008).

The purpose of this study was to examine Taiwanese' risk perceptions regarding PHBs. Here "oral dimension" refers to food intake, "touch dimension" refers to physical contact, while "preventative dimension" refers to protective actions. An international comparison between results obtained in Taiwan and the United States of America was also conducted since the Taiwanese government tends to use US. policy as a reference while running its campaign in Taiwan (Su, 2015).

## 2. Theory

### 2.1. PHBs embedded personal, social, and cultural schemata

Given the evidence that risk perceptions are influenced by cognitive, social, and cultural factors, we took guidance from the following theories to inform our understanding of how these factors may interact to influence risk perception:

#### 2.1.1. Piaget's cognitive theory

Piaget suggested that an individual's thoughts and behaviours must be adapted to one's environment in a dynamic equilibrium that includes the processes of assimilation and accommodation (Piaget and Inhelder, 1969).

#### 2.1.2. Bandura's social learning theory and social cognitive theory

Bandura (1986) advocated a model positing mutual interactions among personal factors, external environmental factors, and overt behaviours. Bandura's model highlights the effect of social cognition on modifying PHBs (Rosenstock et al., 1988).

### 2.1.3. Douglas' cultural theory

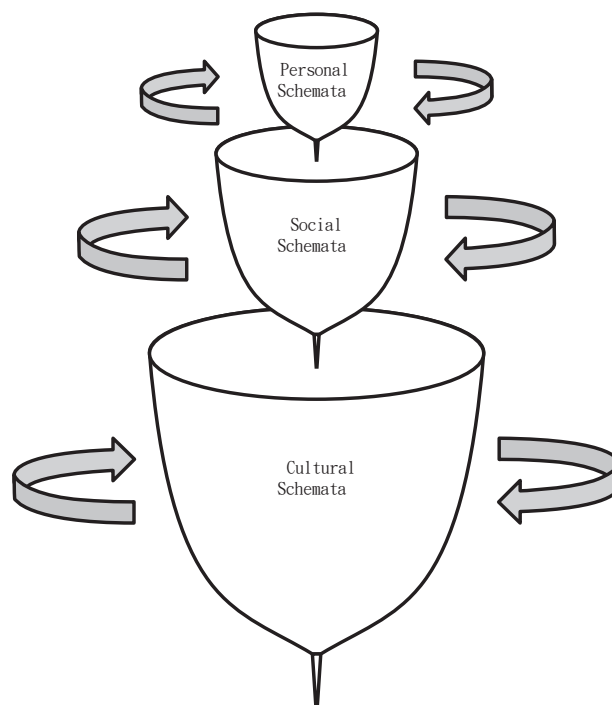
Douglas' theory explains how people perceive and act from their cultural influences; it specifically stresses that individuals' risk perceptions and behaviours are largely determined by social aspects and cultural adherence, such as the conceptions of "dirt" versus "earth" (Douglas, 1979, 2003).

### 2.1.4. Bronfenbrenner's ecological systems theory

Bronfenbrenner (1977) used ecological systems theory to describe how individuals interact with environmental systems. Sallis et al. (2008) and Golden and Earp (2012) applied this model to illustrate ways an individual's health behaviour can be modified.

## 3. Model

The theories discussed above provide for personal, social and cultural dimensions of human behaviour that can be utilised when analysing PHBs. However, these theories do not clearly explain the relationship between these three dimensions. This study proposes an ecological system of personal, social, and cultural schemata (Fig. 1).



**Fig. 1.** The ecological system of personal-social-cultural schemata.

### 3.1. Interaction of personal, social, and cultural schemata

A schema is a structure or system of perceiving and organizing new information that is used to organize thoughts and guide individual behaviours (Piaget and Inhelder, 1969). The proposed framework considers personal, social, and cultural schemata, in concert with processes of assimilation or accommodation, can affect individual's perceptions that facilitate formation of new habits or customary behaviours. These three schemata form the structure of ecology in which people's thoughts and behaviours (such as PHBs) are conditioned by systemically derived perceptions of information; thus risk perceptions are embedded in personal, social, and cultural schemata (Curtis et al., 2011; Douglas, 2003).

### 3.2. Sociocultural specificity and the commonality of PHBs

Some PHBs vary among societies and cultures (sociocultural-specific-PHBs) while some PHBs are found universally (sociocultural-common-PHBs). For example, the avoidance of contact with pathogens is taken as a common feature, while food preference and the perception of various things as being disgusting (or not) may differ across various cultures (Curtis et al., 2011).

Sociocultural-specific-PHBs have been investigated from many perspectives for both Chinese and North America culture such as greeting behaviours, handling and consumption food (Frijhoff, 1991; Hubbard, 2013; Lin, 1998; Ma, 2015). Therefore, sociocultural perspectives are fundamental to various health risk perceptions and PHBs. PHBs shared among many cultures can be at least partially attributable to human nature (Curtis et al., 2011). A universal set shows that people from various sociocultural backgrounds seek to preserve their health by avoiding physical contact with sources of infection or the consumption of rotten or dirty food (Curtis et al., 2011). Thus, PHBs are deeply embedded in the personal, social, and cultural framework inherent in different settings. This study examined people's risk perceptions of PHBs in the oral, touch, and preventative dimensions and investigated relevant socioculturally-embedded factors.

## 4. Methods

The research is principally concerned with the following questions:

1. What are people's risk perceptions regarding PHBs?
2. What are people's risk perceptions regarding PHBs for each dimension?
3. Do risk perceptions of PHBs vary between Taiwanese and Americans?

This study includes qualitative data from interviews and quantitative data from questionnaire. A questionnaire originally developed by Jones et al. (2012) was

administered to 113 Taiwanese undergraduates who enrolled in a natural science course as part of the general education in a private university in the north area of Taiwan. A total of 113 students completed the surveys in late 2013 (45 females and 68 males, mean age 19 years) with the ethnic origins of 112 Han (Chinese) and 1 indigenous student. Informed consents were given to all participants for obtaining their approval joining the survey. The ethical approval of NTU-REC No. 201404ES021 was issued by the Research Ethics Office of National Taiwan University. However, the sampling of this study does not apply to the whole population which is discussed in limitation. Moreover, the results of the current study were compared with the results of a pretest in the study by Jones et al. (2012) in the south-eastern area of the USA. The study conducted in the USA adapted purposive sampling for its participants were students enrolled in an undergraduate microbiology course in two public universities and one community college in the south-eastern region of the USA. A total of 132 students completed the surveys (107 females and 25 males, mean age 21 years) with the ethnic diversity of 101 European American, 14 African American, 12 Asian and 5 others.

Twenty-two items are listed in the questionnaire consisting of three sections: oral behaviours, touch behaviours, and preventative behaviours. A Likert scale, with 5 points ranging from most to least concern, was employed in the questionnaire. For example, one item given is “Someone you just met kisses your cheek” and participants are invited to rate this scenario from “concerned all the time” (score 5) to “never concerned” (score 1). Since this study aims to be directly comparable with the US survey, Taiwanese undergraduate students were sampled – the same age-group as in the other study. The questionnaire was translated into a Chinese version which was examined by a biologist, a science educator, two undergraduates, and two graduate students (master’s program) to ensure its validity. They were invited to check both the wording of the statements and the accuracy of the translation. The Cronbach’s Alpha of the Chinese version of the questionnaire was high ( $\alpha = 0.92$ ), indicating its high internal consistency and reliability.

Participants were given 10 minutes to respond to the written questionnaire, noting their degrees of concern regarding their risk perceptions of PHBs. A descriptive analysis, an ANOVA, and post hoc comparisons were performed for the three dimensions. A t-test was performed on the differences between the results of this study and those from USA.

Interviews were carried out after respondents completed the questionnaire, and the transcriptions are presented as excerpts in discussion for explaining Taiwanese participants’ opinions regarding their risk perception of PHBs.

## 5. Results

### 5.1. Risk perceptions of PHBs

The Taiwanese participants showed various degrees of concern regarding their risk perceptions of PHBs. Among the 22 items (Table 1), the five items with average scores above 4 are listed in the following order: ‘Soup stirred with a used flyswatter’, ‘Eating seven-week-old leftovers’, ‘Working in the dirt without gloves’, ‘Restaurant cook had a cold’, ‘Finding a hair in your food while eating’. These five PHBs were considered to be the behaviours with the highest transmittance risks among the 22 items; the majority were from the oral dimension.

Table 2 presents the Taiwanese’ risk perceptions of PHBs for the three dimensions. Their concern was the highest in the oral dimension (3.72) and the lowest in the touch dimension (3.35), with concern in the preventative dimension (3.54) falling in the middle. A significant difference ( $p < .005$ ) was found through the post hoc analysis between the Taiwanese participants’ concerns in the oral dimension and the touch dimension.

**Table 1.** The risk perception of the PHBs in Taiwan and in USA.

Dimension	Items	Taiwan (n = 113)		USA (n = 132)		t-value (n = 245)	Taiwan vs. USA
		mean	(SD)	mean	(SD)		
Oral	1. Soup stirred by a used flyswatter	4.50	0.77	4.21	1.05	2.467*	T > U
	2. Restaurant cook had a cold	4.04	0.93	4.13	0.90	-0.732	
	3. Eating seven-week-old leftovers	4.29	0.90	4.03	1.01	2.125*	T > U
	4. Finding a hair in your food while eating	4.00	0.90	4.00	1.02	0.000	
	5. Shaking hands and then eating	2.98	1.10	3.13	1.07	-1.061	
	6. Sip a soda from someone else’s cup	2.98	1.22	3.12	1.07	-0.939	
	7. Eating off of other people’s plates	3.27	1.19	2.92	1.11	2.351*	T > U
Touch	8. Part of your body touches a public toilet seat	3.95	1.02	3.83	1.13	0.898	
	9. Touching a door handle in a public bathroom	3.32	1.02	3.64	1.07	-2.395*	T < U
	10. Teammate borrows your deodorant	2.90	1.18	3.37	1.30	-2.926**	T < U
	11. Touching the bottom of your shoes	3.24	1.24	3.18	1.17	0.395	
	12. Using a public telephone	2.90	1.14	3.17	1.16	-1.812	
	13. Spit lands on your arm during a conversation	2.96	1.20	3.01	1.21	-0.351	
	14. Touching a faucet in a public bathroom	3.05	1.05	2.92	1.04	-0.995	
	15. Taking out the trash	3.75	1.06	2.83	1.12	6.543***	T > U
	16. Handling money	3.07	1.22	2.68	1.16	2.562*	T > U
	17. Borrowing soap from a friend while camping	3.05	1.19	2.67	1.26	2.428*	T > U
	18. Someone you just met kisses your cheek	3.69	1.19	2.51	1.17	7.811***	T > U
	19. A dog licking your hand	3.66	1.22	2.39	1.19	8.213***	T > U
	20. Working in the dirt without gloves	4.05	1.01	2.35	1.81	8.817***	T > U
Preventative	21. Frequency of hand washing	3.80	0.90	4.68	0.56	-9.375***	T < U
	22. Use of sanitizing items	3.29	1.11	2.73	1.05	4.072***	T > U

\* $t > 1.960$ ,  $p \leq 0.05$ ; \*\* $t > 2.576$ ,  $p \leq 0.01$ ; \*\*\* $t > 3.291$ ,  $p \leq 0.001$ .

**Table 2.** The risk perception of the PHBs amongst three dimensions, between genders and between Taiwanese and Americans.

Attributes	Oral		Touch		Preventative		Total		Post hoc <sup>#</sup>
	mean	(SD)	mean	(SD)	mean	(SD)	mean	(SD)	
Taiwan (N = 113)	3.72	1.00	3.35	1.14	3.54	1.00	3.49	1.08	oral > touch*
USA (N = 132)	3.65	1.03	2.97	1.21	3.71	0.81	3.25	1.12	prevent > touch*** oral > touch***
t-value	0.580		2.569*		-1.391		1.692		

\* $p \leq 0.05$ ; \*\* $p \leq 0.01$ ; \*\*\* $p \leq 0.001$ .

<sup>#</sup> Comparison by Scheffe test.

## 5.2. Risk perceptions of PHBs between Taiwanese and American participants

A comparison of the results for the Taiwanese and American participants is presented in Table 2. First, the results for the Americans differed from the results for the Taiwanese because Americans expressed the most concern in the preventative dimension (3.71) rather than the oral dimension (3.65). Furthermore, the Americans were least concerned with the touch dimension (2.97); the oral dimension fell in the middle of the results. Among the Americans, a significant difference ( $p < .001$ ) in concern was evident between the preventative dimension and the touch dimension, and, a significant difference ( $p < .001$ ) was found between the oral dimension and the touch dimension. Moreover, the Taiwanese displayed a higher concern regarding the touch dimension in comparison with Americans ( $t = 2.569$ ,  $p < .05$ ).

Table 3, a summary of Table 1, presents thirteen PHBs in which significant differences between the concerns expressed by Taiwanese and Americans were observed. In the oral dimension, the Taiwanese showed more concern than the Americans did for the following three items: ‘Soup stirred with a used flyswatter’ ( $p < .05$ ), ‘Eating seven-week-old leftovers’ ( $p < .05$ ), and ‘Eating off of other people’s plates’ ( $p < .05$ ). In the touch dimension, the Americans showed higher concern for ‘Touching a door handle in a public bathroom’ ( $p < .05$ ) and ‘Teammate borrows your deodorant’ ( $p < .01$ ) compared to Taiwanese participants. However, the Taiwanese were more concerned about ‘Taking out the trash’ ( $p < .001$ ), ‘Handling money’ ( $p < .05$ ), ‘Borrowing soap from a friend while camping’ ( $p < .05$ ), ‘Someone you just met kisses your cheek’ ( $p < .001$ ), ‘A dog licking your hand’ ( $p < .001$ ), and ‘Working in the dirt without gloves’ ( $p < .001$ ) compared to Americans. Furthermore, in the preventative dimension, Americans were significantly ( $p < .001$ ) more concerned about the ‘Frequency of hand washing’ than were Taiwanese respondents. However, the Taiwanese were more significantly concerned about the ‘Use of sanitizing items’ than the Americans ( $p < .001$ ).

**Table 3.** The sociocultural-embedded PHBs.

Dimension	Items	USA > Taiwan	Taiwan > USA
Oral	1. Soup stirred by a used flyswatter		✓*
	3. Eating seven-week-old leftovers		✓*
	7. Eating off of other people's plates		✓*
Touch	9. Touching a door handle in a public bathroom	✓*	
	10. Teammate borrows your deodorant	✓**	
	15. Taking out the trash		✓***
	16. Handling money		✓*
	17. Borrowing soap from a friend while camping		✓*
	18. Someone you just met kisses your cheek		✓***
	19. A dog licking your hand		✓***
	20. Working in the dirt without gloves		✓***
Preventative	21. Frequency of hand washing	✓***	
	22. Use of sanitizing items		✓***

\* $p \leq 0.05$ ; \*\* $p \leq 0.01$ ; \*\*\* $p \leq 0.001$ .

## 6. Discussion

### 6.1. Risk perceptions of PHBs related to the oral dimension

Both Taiwanese and American participants displayed substantial concern for items within the oral dimension, which reflects the oral PHBs related to food intake that may cause a life-threatening risk. The results reflect an old saying in Taiwanese culture that “illness comes in through the mouth”. Also, according to the US CDC, one in every six Americans has experienced foodborne illness through the consumption of contaminated food (Tsao, 2016).

### 6.2. Socioculturally-embedded PHBs

Sociocultural factors in PHBs have been recognised by organizations such as WHO. Clarke et al. (2009) also highlighted the complexity of cultural diversity in health promotion. Table 3 presents the PHBs for which the Taiwanese and American participants had significantly different risk perceptions. These PHBs were considered ‘socioculturally-embedded PHBs’. Thirteen of the 22 PHBs were considered socioculturally-embedded PHBs, showing that more than half of the risk perceptions of the PHBs were closely connected to sociocultural values.

#### 6.2.1. The oral dimension

In the oral dimension, three PHBs were rated significantly higher by the Taiwanese participants than the American participants. First, the Taiwanese were more concerned about ‘soup stirred with a used flyswatter’ than the Americans. In Taiwan,



flyswatters are frequently used because insects are active and gather quickly in the humid and warm weather (average yearly relative humidity 72.4% and temperature 24.2 °C) (Shiu et al., 2009), particularly in the kitchen. Because of the frequency of their use, their unsanitary nature gains prominence in Taiwanese thought. However, flyswatters are seldom used in Carolina, perhaps in part because insects are less active in its relatively drier and cooler weather. Its average humidity (around 45%) and temperature (8–21 °C) are quite different from conditions in Taiwan. Second, the Taiwanese participants were more concerned about ‘eating seven-week-old leftovers’ than their American counterparts. Foods may need to be disposed of much more quickly in Taiwan, where the humidity is relatively higher than that found in the US. Third, the Taiwanese were significantly more concerned than the Americans regarding ‘eating off of other people’s plates’. Taiwanese decline to eat food from other people’s plates, sharing food only with family and close friends (Zhao, 2003). Mahajan and Chunawala (1999) also indicated that the youth in India have a similar issue regarding the use of common utensils which was labelled an unhygienic practice. Additionally, Taiwanese eat around large tables and use their own utensils rather than public chopsticks or spoons to share food (Lin, 1998; Ma, 2015; Zhao, 2003). Participants’ comments also revealed several opinions about the oral dimension:

“Flyswatter is so dirty, very filthy, because there are so many germs on the flies.”

“The seven-week-old leftover will cause diarrhoea.”

“We don’t eat from other people’s plates except from close friends and family.”

### 6.2.2. *The touch dimension*

In the touch dimension, two PHBs were rated significantly higher by the Americans than by the Taiwanese, and six PHBs were rated significantly higher by the Taiwanese than by the Americans. First, the Americans were significantly more concerned than the Taiwanese with ‘Touching a door handle in a public bathroom’ and ‘Teammate borrows your deodorant’. The design of public bathrooms may shape people’s health behaviours. For example, some public bathrooms in western countries are equipped with two adjacent doors to reduce unpleasant odours and noise as well as to maintain privacy (Evans, 2017). In Taiwan, however, public bathrooms frequently include closing doors only for individual toilet stalls, while the restroom itself is entered through an open doorway for improved ventilation (M.-H. Wu, 2012). Public bathroom door handles being touched by many people are recognized as a source of germs, which can cause contact infections. Kampf (2003) pointed out that individuals’ hands may be contaminated with various kinds of germs through physical contact. Similar to the way that the unsanitary nature of flyswatters becomes prominent in Taiwanese thought, Americans more frequently encounter door handles in public

bathrooms and thus give more thought to the diseases that can be spread through contact with these handles (M.-H. Wu, 2012). Finally, deodorants are frequently used by Americans as a social courtesy, and deodorants are considered personal grooming items in the United States (Louis, 2010). Many Americans use deodorants as a part of their daily personal grooming routine. Taiwanese people, on the other hand, seldom use deodorants and do not consider the use of this product a daily PHB (Ministry of Health and Welfare, 2015). Our participants also explained that:

“Touching a door handle is alright since we always wash our hands afterwards.”

“We don’t use deodorant. If some do, I think they prefer to use their own and reluctant to borrow.”

The PHBs rated higher among the Taiwanese than the Americans were ‘Taking out the trash’, ‘Handling money’, ‘Borrowing soap from a friend while camping’, ‘Someone you just met kisses your cheek’, ‘A dog licking your hand’ and ‘Working in the dirt without gloves’. Regarding ‘Taking out the trash’, in USA, most households have small and large garbage cans, and residents can gather together the trash from small garbage cans into larger ones and take it outside at any time before it is collected by sanitation workers (Barthelette, 2016); therefore, discarding trash is convenient. However, in Taiwan, the Department of Environmental Protection posts mandatory garbage collection routes and schedules, and garbage cannot be disposed of in proscribed manners or times (Department of Environmental Protection, 2018). One of the participants added that “trash is extremely filthy.”

Regarding ‘Handling money’, cash is more frequently used in Taiwan than in USA. Money is considered filthy (Douiery, 2014). Furthermore, Taiwanese banknotes become dirty and wrinkled because of the textures and heavy usage of these notes (Chen, 2006; Lin, 2007). However, American banknotes are used less frequently and have textures that are different from those of Taiwanese banknotes. Additionally, in Taiwan, new banknotes are gifted to friends and family members in red envelopes as a symbol of a new start only when the Chinese New Year is approaching. Some participants explained that, “many shop owners touch the food and also handle the money, and the money has been touched by so many people, of course it is dirty”.

Regarding ‘Borrowing soap from a friend while camping’, the Taiwanese were more concerned than the Americans. Soaps are considered intimate products by Taiwanese because the use of soap requires direct contact with the skin. Therefore, Taiwanese are reluctant to borrow or lend soap. One participant added that “soap will directly touch my body, of course I do mind. I don’t want other people’s germ come to my body through the soap”.

‘Kissing on the cheek’ is often considered in Western societies as an affirmative physical gesture and social ritual (Frijhoff, 1991; Hubbard, 2013; R. Wu, 2012). However, in Chinese culture, people rarely kiss – in public or in private – as

they are considerably less comfortable expressing emotion (Gao, 1996). These cultural differences are reflected in the results. Therefore, a significant difference between the concerns of the Americana and Taiwanesea was observed in this category. One of the participant also added that “we don’t have the kissing culture, and it is neither necessary nor hygiene”.

Taiwanese participants had a higher risk perception than the Americans did regarding ‘A dog licking your hand’. Traditionally, Taiwanese do not take dogs, cats, or other animals into their families and avoid physical contact with them because many people worry about zoonotic diseases, for example, infections from dogs’ parasites and fleas. In USA, many people live with pets and treat them as family members with strong attachment (Albert and Bulcroft, 1988). They interact with their pets, kiss them, and hold them to show their affection. Some participants explained that “dog’s saliva contains so many germs and it is sticky”.

‘Working in the dirt without gloves’ was a concern for the Taiwanese. Taiwanese parents worry about children touching soil because it contains germs which can cause illness (Chen, 2017; Zeng, 2016). However, western scientists have indicated that a little dirt is good for health (Finlay and Arrietta, 2016; Hamilton, 1998) and Chen (2017) also shared his observation that children in the US are encouraged to touch the dirt and soil in the playground, while children in Taiwan are kept in the sterilized space. Participants added that “working in the dirt surely require gloves and tools. Dirt is not safe; it might be polluted”.

### 6.2.3. *The preventative dimension*

For the preventative dimension, one PHB was rated significantly higher by the Americans than the Taiwanese, and one was rated significantly higher by the Taiwanese than the Americans. First, ‘Frequency of hand washing’ concerned the Americans. However, many Taiwanese neglect hand washing for disease prevention; only 1/4 of the surveyed students washed their hands before meals (Ministry of Health and Welfare, 2017). Therefore, authorities in Taiwan have encouraged ‘the five steps of hand washing’ and ‘washing hands before meals’ at schools as well as in public. Some participants explained that, “I don’t care about how many times I wash hands. I wash my hands when I think I need to.” Second, the ‘Use of sanitizing items’ is common in Taiwan, and these items, including hand gels, are widely available. The popularity of these items in Taiwan is partly attributable to public health incidents in recent memory, such as the frequent sterilisation of escalator handrails, elevator buttons, and public seats after the SARS outbreak in 2003 (Wang, 2016). Chen (2017) also point out that Taiwanese parents and school authorities are making effort to create a germ-free and absolutely-clean environment for our children, thus, sanitizing products are widely applied in quantity. Many participants added that “it is better to use the sanitizing products to make sure it is clean”.

## 7. Conclusion

### 7.1. Strength

The study highlighted the relationships between three schemata (personal, social and cultural) where behaviour learning may take place. Different countries may feature a local culture which provides a different ecological system shaping one's risk perceptions of PHBs. Further, three dimensions (oral, touch and preventive) are noted for their unique characteristics. These are closely related to the social and cultural backgrounds of participants, namely sociocultural-embedded PHBs.

### 7.2. Limitation

The limitations of the study include purposive sampling, research instrument, and inference. First, for the convenience of sampling and to restrict respondents to the same generation as those in the study conducted on US college students, purposive sampling was employed. The questionnaire as a research instrument was translated from the English-language original. Finally, the study can only present the current situation and mainstream cultures in Taiwan and in the USA due to the fact that both countries have experienced immigration and culture infusions. Despite the multicultural nature of both the USA. and Taiwan, only the mainstream Chinese and Western cultures were discussed in the study; results were extended by inference. Similarly, the study can only discuss the society and culture levels with respect to the ecological system of PHBs. The development of three levels and the dynamic evolutions in the ecological system of PHBs still needs further investigation, perhaps featuring a longitudinal or cohort research design.

### 7.3. Implication

The study proposes a framework for an ecological system of PHBs, using personal-social-cultural schemata. The implications shed light on each component separately and their mutual interactions, as well as on the application of the framework within the context of hygiene education.

#### 7.3.1. Cultural schemata

Although [Douglas \(2003\)](#) has argued that one's risk perceptions and behaviours are largely determined by cultural adherence, culture also holds great power in shaping one's PHBs. For example, in the 1980s, Taiwan's government advocated 'serving chopsticks and spoons', 'using disposable utensils', and 'serving Chinese food in Western style' to prevent diseases ([Lin, 1998](#)). The result of the current study shows a meaningful difference between the two countries as a result of adherence to different cultural practices. Thus, in order to achieve a greater efficiency in hygiene

education, local cultural characteristics need to be considered, and the approach adapted accordingly.

### 7.3.2. *Social schemata*

Bandura's model highlights the effect of social cognition on modifying one's behaviour (Bandura, 1986, 1989). The authorities in Taiwan have launched several hygiene campaigns in the society. For example, the study indicated that money banknotes are considered filthy, so people are concerned about touching them. The government has encouraged people to exchange old banknotes for new ones, and to pay with credit cards or mobile payment. The latter two have become popular consumption patterns.

### 7.3.3. *Personal schemata*

Piaget suggested that individuals adapt behaviours to their surroundings, reaching a dynamic equilibrium through processes including assimilation and accommodation (Piaget and Inhelder, 1969). For example, Taiwanese participants in the study were concerned about touching dirt without gloves; however, nowadays people have begun to realise the advantages of touching soil after assimilating information received from research papers and expert advocacy. Young students are encouraged to touch the soil, stand barefoot on the soil and play with soil (Chaing and Chen, 2015). This example illustrates behaviours shaped through accommodation to input that conflicts with previously-held beliefs.

### 7.3.4. *Dynamic evolution*

This study highlighted the fact that learning occurs within personal, social and cultural schemata and that assimilation and accommodation contribute to shape people's risk perceptions of PHBs. The result also echoes Piaget's, Bandura's, and Douglas' theories that learning is closely connected to the self and its surroundings. It is also suggested that science learning, such as everyday scientific concepts, is often connected to and mediated by sociocultural settings (Adams, 2015; Teo, 2013; van Eijck and Roth, 2010). Therefore, all three schemata need to be considered when devising any government campaign for more effective hygiene education. Furthermore, time is a key factor in dynamic evolution. Culture changes over time, and is essential for understanding human behaviour (Gifford, 2008). For social evolution taking place over time (Campbell, 1975), population behaviours can be observed. At the personal schemata, one's behaviour learning is established and adapted with information received from one's surroundings.

In summary, hygiene behaviours and risk perception at the personal schemata can be adapted and shaped in interaction with the social and cultural schemata. These

interactions are mutual and unique to different settings and dynamic evolution which consists of a continual, active and dynamic mechanism that adjusts itself recursively.

In summary, hygiene behaviours and risk perception at the personal schemata can be adapted and shaped in interaction with the social and cultural schemata. These interactions are mutual and unique to different settings and dynamic evolution which consists of a continual, active and dynamic mechanism that adjusts itself recursively.

## Declarations

### Author contribution statement

Ming-Chin Hsin, Show-Yu Lin, Chen-Yung Lin: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

### Funding statement

This work was partially supported by the Ministry of Science and Technology, R.O.C. (MOST 102-2511-S-156-001; MOST 103-2511-S-156-001-MY3).

### Competing interest statement

The authors declare no conflict of interest.

### Additional information

No additional information is available for this paper.

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