Applying the theory of planned behavior: examining how communication, attitudes, social norms, and perceived behavioral control relate to healthy lifestyle intention in Singapore

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This study investigates the extent to which communication variables, namely, interpersonal communication and attention to mass media, as well as the key components in the theory of planned behavior (TPB), including, attitudes, social norms, and perceived behavioral control, are associated with healthy lifestyle intention in Singapore. Healthy lifestyle intention was conceptualized and operationalized in terms of individuals' proclivity for physical activity and healthy diet. Data came from a nationally representative computer-assisted telephone interview (CATI) of 1,055 Singaporeans aged 21 years and above . Hierarchical regression analysis was conducted. Results show that both communication and planned behavior variables were positively related to behavioral intention. The study is important for both theory and practice. Theoretically, it demonstrates the possibility to extend the TPB with two more variables: interpersonal communication and attention to mass media. On the practical front, the results inform health authorities and marketers on ways to promote public adoption of healthy lifestyle in Singapore.

Keywords: Healthy lifestyle; Interpersonal communication; Media consumption; Theory of planned behavior; Singapore.

Background

Healthy lifestyle refers to the integration of physical activity and healthy diet into the lives of individuals, communities, and neighborhoods [1,2]. Promoting physical activity and healthy diet have become key priorities for healthcare marketing campaigns given their well-established benefits for public health [3-5].

Efforts to disseminate healthy lifestyle messages notwithstanding, physical inactivity and unhealthy diet are common [4]. Unsurprisingly, more than one-third of the U.S. adults are obese [6]. The situation is hardly any better in Asian countries such as Singapore. Singaporeans are about 3 kg heavier today than they were 15 years ago with a median body mass index for adults beyond the healthy range [7,8]. This suggests a pressing need to promote healthy lifestyle intention among Singaporeans.

The theory of planned behavior (TPB) [9,10] has often been used to explain behavioral intention. It posits that individuals' intention is shaped by their attitudes, social norms, and perceived behavioral control. Besides, communication aspects in terms of interpersonal communication and attention to health information in the mass media are also known to dictate people's health awareness [11,12]. Hence, building on the TPB, this study investigates how the communication variables—interpersonal communication and attention to mass media—as well as the TPB components— attitudes, social norms and perceived behavioral control—relate to healthy lifestyle intention in Singapore.

The study is significant for both theory and practice. Theoretically, it demonstrates the possibility to extend the TPB with two more variables: interpersonal communication and attention to mass media. These were inspired by the two-step flow theory and the agenda-setting theory respectively. On the practical front, the results

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inform local health authorities and marketers on ways to promote public adoption of healthy lifestyle.

The context of Singapore

Singapore, a densely populated city-state in Southeast Asia where obesity is a growing problem [13], was the study context. Ranking among the top 20 globalized cities in the world [14], the country has a land area of 716.1 sq km; a population density of 7,540 per sq km; and a multiracial population of about 5.7 million comprising Chinese, Malays, Indians, and other minorities. With a literacy rate of 96.4% [15], Singapore has a highly developed free-market economy and enjoys a gross domestic product per capita close to US$53,000 [16]. The political system is characterized by a parliamentary structure governed by a dominant ruling party since independence.

A study of healthy lifestyle intention in Singapore is timely. For one, health communication scholars have often emphasized the urgent need to conduct research in Southeast Asia given its rising population [17]. Meanwhile, Singapore boasts of one of the world's best healthcare systems, and is a popular medical tourism destination [18,19,20]. Yet, it has been witnessing a population-wide shift toward obesity, which is usually vestige of people's lifestyle. In seven years' time, the nation is poised to hit an obesity rate of 15%—the tipping point after which obesity swelled rapidly in the U.S. and turned into an epidemic [8]. Singapore's health expenses have been surging northward in recent years. The government health expenditure grew from S$7,221.3 million in 2014 to S$8,610.4 million in 2015. If nothing is done, the health budget will soon become comparable with that of defence [21,22].

The medical inflation can possibly be attributed to Singaporeans' physical inactivity and unhealthy diet. The most common reason given by Singaporeans for

refusing to workout is the lack of time. Although many of them walk, the pace and the duration for most are insufficient to reap any health benefits [23]. While Singaporeans consumed an average of some 2,000 calories per day with about 33% exceeding the recommended intake in 1998, they were consuming more than 2,600 calories per day with 60% exceeding the threshold by 2010 [8]. Therefore, examining factors influencing healthy lifestyle intention in Singapore is imperative.

Communication variables are also important to take into consideration in this context. After all, Singapore is known for its limited press freedom [24]. Mass media in Singapore is mostly state-owned, and news information flow is firmly regulated by the government [25]. Therefore, compared with mass media, interpersonal communication in the country is conceivably expected to reflect a greater degree of candor and openness. Hence, the possible roles played by mass media and interpersonal communication in shaping intention to adopt healthy lifestyle among Singaporeans may manifest differently from those of previous studies conducted in western countries with more liberal media systems.

The role of communication

Interpersonal communication can be an antecedent of healthy lifestyle intention. Discussions with friends, family members, and coworkers allow socially integrated individuals to discuss about healthy lifestyle [26]. The resulting peer-influence can at times be more powerful than the mass media. This is underpinned by the two-step flow theory. It asserts that the mass media shape the views of opinion leaders, who in turn, influence the behaviors of individuals [27]. Interpersonal communication particularly with opinion leaders could therefore have a bearing on individuals' intention to adopt a healthy lifestyle. Moreover, interpersonal communication is already leveraged in

Singapore for health marketing. For example, the Health Ambassador Program established by the Singapore Health Promotion Board is a peer-to-peer program that promotes healthy living by appointing opinion leaders and role models [28]. Hence, we hypothesize the following:

H1: Interpersonal communication will be positively related to healthy lifestyle intention.

Besides interpersonal communication, the mass media help the public stay abreast of health-related issues [29]. This is undergirded by the agenda-setting theory, which explains how the mass media can influence the prominence of issues among the audience [30]. Several studies consistently highlighted that the mass media not only facilitate information transmission but also shape public behavior [31]. Most pertinently, mass media can catalyze intention for physical activity [32], and healthy eating [33]. In Singapore, healthy lifestyle messages had often been disseminated on the mass media through the likes of the "Conversations with PM Lee" weekly television series, which is framed as a dialogue between Singaporeans and the Singapore Prime Minister. Bearing the foregoing, we hypothesize the following:

H2: Attention to the mass media will be positively related to healthy lifestyle intention.

The role of attitudes, social norms, and perceived behavioral control

The use of the TPB to explain behavioral intention is widespread in the literature [34,35]. In fact, over the years, several meta-analytic reviews have lent support to the theory in the context of health-related behavioral intention [36,37,38]. Informed by these works, this study applies the theory to examine healthy lifestyle intention, which

is conceptualized as individuals' proclivity for physical activity and healthy diet [1,2].

According to the TPB, behavioral intention is predicted by attitudes, social norms, and perceived behavioral control. Attitude refers to an individual's positive or negative evaluation of performing a given behavior [9]. Social norms highlight the perceived social pressure regarding the performance of a behavior [10]. There are of three types: injunctive, subjective and descriptive. Injunctive norms refer to individuals' perceived social guidelines related to attitudinal approval or disapproval of their behavior by families, peers, or the wider communities [39]. Subjective norms refer to individuals' beliefs on the degree to which important others would prefer them to perform a behavior [40]. Descriptive norms refer to individuals' notion of what is commonly done in their social community [41]. Perceived behavioral control refers to individuals' judgments on the degree to which they have the capability to engage in a behavior [10,42].

Studies examining the TPB in the US have mostly shown positive associations between each TPB component and health-related intentions [41,43]. However, those in Asia have often yielded inconsistent findings. Positive relations were identified in one of the early attempts [44]. However, [45] found positive relationship for social norms yet negative relationship for attitudes and perceived behavioral control. In a study with cross-national Asian samples [46], attitudes were positively related to intention regardless of nationality. However, social norms turned out to be non-significant. More interestingly, perceived behavioral control was positively related among Japanese but negatively related among Korean participants.

Such conflicting findings call for further inquiry of the TPB in Asia. In addition, this study argues that when the communication aspects of interpersonal communication and attention to mass media are controlled for, the TPB could provide additional

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explanation toward healthy lifestyle intention in Singapore. Hence, we hypothesize the following:

H3: Attitude will be positively related to healthy lifestyle intention after controlling for the communication variables.

H4a: Injunctive norms will be positively related to healthy lifestyle intention after controlling for the communication variables.

H4b: Subjective norms will be positively related to healthy lifestyle intention after controlling for the communication variables.

H4c: Descriptive norms will be positively related to healthy lifestyle intention after controlling for the communication variables.

H5: Perceived behavioral control will be positively related to healthy lifestyle intention after controlling for the communication variables.

Methods

Data

After obtaining ethics approval, data were collected in a large public university in Singapore from a nationally representative computer-assisted telephone interview (CATI) of Singaporeans aged 21 years and above. Since the target population included adults, there was no need to obtain parental consent.

The telephone interviews were conducted in English, Mandarin or Malay, which are the three most commonly spoken languages in Singapore [15]. This ensured that responses were obtained from a wide range of Singaporeans. The questionnaire was back-translated and pre-tested to ensure translation validity.

During fieldwork, the interviewers first requested to speak to "the youngest male, who is at least 21 years old." If unavailable, they requested to speak to "the oldest

female, who is at least 21 years old." This youngest male / oldest female technique is effective in generating representative samples [47].

Altogether, 11,797 phone numbers were available. A total of 5,454 calls were randomly made, resulting in 1,101 complete interviews. To minimize systematic non-response, efforts were invested in call-backs and refusal conversions. The response rate was 30.5% (calculated using AAPOR Formula 3), with a +/-3% margin of error at the 95% confidence level. The response rate formulation is as follows:

$$\frac{I}{(I + P) + (R + NC + O) + e\,(UH + UO)}\;,$$

where

- *I* denotes the number of complete interviews in which participants answered all the questions except those on demographic details (1,101).

- *P* denotes the number of partial interviews in which participants started and were willing to complete but could not be reached to complete (309).

- *R* measures refusals / break-offs after starting the interview (1,295).

- *NC* stands for non-contacts such that phone numbers were selected as eligible but participants were never available to start the interview (0).

- *O* denotes other cases where participants could not be interviewed due to unforeseeable circumstances such as physical and / or mental inability (90).

- *e* is the estimated proportion of cases of unknown eligibility that are eligible (0.306 as calculated using AAPOR's eligibility estimates).

- *UH* stands for Unknown households to which calls always resulted in telecommunication hindrances such as no answer or call-blocking (2,659).

- *UO* stands for unknown others to which calls reached participants whose eligibility could not be determined (0).

From the 1,101 complete interviews, 46 responses were deleted listwise during the analysis. These participants did not respond to all of the demographic questions. Thus, 1,055 responses were subjected to the analysis.

Measures

The dependent variable, *healthy lifestyle intention*, was operationalized in terms of two domains: physical activity and healthy diet. For physical activity, participants were asked about their degree of agreement on a seven-point scale from 1 (strongly disagree) to 7 (strongly agree) with the following five statements: (a) "In the next 12 months, I intend to be physically active to the best of my abilities;" (b) "In the next 12 months, I intend to do mild physical activity;" (c) "In the next 12 months, I intend to do moderate-to-vigorous physical activity;" (d) "In the next 12 months, I intend to do physical activity regularly;" and (e) "In the next 12 months, I intend to do 30 minutes of physical activity a day." For healthy diet, participants were asked to rate their degree of agreement on a seven-point scale from 1 (strongly disagree) to 7 (strongly agree) with the following five statements: (a) "In the next 12 months, I intend to eat healthy food;" (b) "In the next 12 months, I intend to increase my intake of fruit and vegetables;" (c) "In the next 12 months, I intend to decrease the amount of fat in my diet;" (d) "In the next 12 months, I intend to avoid foods that are high in cholesterol;" and (e) "In the next 12 months, I intend to maintain a balanced diet." These ten items, which were informed by previous studies [48,49], were averaged to create a composite index with higher scores indicating a higher healthy lifestyle intention (*M*=5.25, *SD*=1.06, Cronbach's *α*=.86).

Demographic variables were used as controls in this study. They included age (*M*=43.00, *SD*=14.51), gender (1=male, 0=female; 57.3% female), education (ranged from 1=no formal education to 10=postgraduate) (*Mdn*=6.00 or "A level," *SD*=2.18) and race. The racial distribution was 75.90% Chinese, 10.50% Malay, 9.10% Indian, 1.20% Eurasian, and 3.30% other racial groups.

Interpersonal communication was measured by asking participants on a seven-point scale from 1 (never) to 7 (very often) how frequently they discussed (a) "the benefits of regular physical activity" and (b) "the benefits of a healthy diet" with people close to them. Next, they were inquired how often they discussed the same content with acquaintances. These were adapted from [11]. The four items were averaged to create a composite index with higher scores indicating more frequent interpersonal communication (*M*=3.52, *SD*=1.52, Cronbach's *α*=.84).

Attention to mass media was measured by six items using a seven-point scale from 1 (no attention at all) to 7 (very close attention) that asked participants how much attention they paid to content related to (a) "the benefits of regular physical activity" and (b) "the benefits of a healthy diet" on newspapers, television, and the internet. These were informed by [50]. The six items were averaged to create a composite index with higher scores indicating closer attention paid to mass media (*M*=3.13, *SD*=1.22, Cronbach's *α*=.75).

Attitude was measured by three items using a seven-point scale from 1 (strongly disagree) to 7 (strongly agree) that asked participants to rate how much they agreed that leading a healthy lifestyle was (a) "good," (b) "beneficial," and (c) "pleasant." These were drawn from [51]. The three items were averaged to create a composite index with higher scores indicating a more positive attitude (*M*=6.22, *SD*=0.93, Cronbach's *α*=.75).

Injunctive norms were measured by four items using a seven-point scale from 1 (strongly disagree) to 7 (strongly agree) that asked participants to rate their degree of agreement with the statements: (a) "People close to me would approve of me doing regular physical activity;" (b) "Most Singaporeans would approve of me doing regular physical activity;" (c) "People close to me would approve of me having a healthy diet;" and (d) "Most Singaporeans would approve of me having a healthy diet." The four items, which were informed by [52], were averaged to create a composite index with higher scores indicating higher levels of injunctive norms (M=5.52, SD=1.21, Cronbach's α=.85).

Subjective norms were measured by two items using a seven-point scale from 1 (strongly disagree) to 7 (strongly agree) that asked participants to rate their degree of agreement with the statements: (a) "People close to me expect me to engage in regular physical activity," and (b) "People close to me expect me to have a healthy diet." The two items, which were informed by [53], were averaged to create a composite index with higher scores indicating higher levels of subjective norms (M=4.95, SD=1.48, r=.69, p<.001).

Descriptive norms were measured by four items using a seven-point scale from 1 (strongly disagree) to 7 (strongly agree) that asked participants to rate their degree of agreement with the statements: (a) "People close to me engage in regular physical activity;" (b) "Most Singaporeans engage in regular physical activity;" (c) "People close to me have a healthy diet;" and (d) "Most Singaporeans have a healthy diet." The four items, which were informed by [40], were averaged to create a composite index with higher scores indicating higher levels of descriptive norms (M=4.42, SD=1.11, Cronbach's α=.75).

Perceived behavioral control was measured by four items using a seven-point scale from 1 (strongly disagree) to 7 (strongly agree) that asked participants how much they agreed that leading a healthy lifestyle was (a) "Something I am confident in doing;" (b) "Easy;" (c) "Something I have a lot of control over;" and (d) "Completely up to me." These were adapted from [54]. The four items were averaged to create a composite index with higher scores indicating greater perceived behavioral control (M=5.02, SD=1.25, Cronbach's α=.79).

We would like to point out that the questionnaire items used Likert scales instead of semantic differential scales. Semantic differential scales are more suitable for self-administered surveys than telephone interviews because participants have to visualize the bipolar adjectives at the opposite ends of the scale [55]. Given the absence of the visual cue in CATI, Likert scales represent an easier format for participants to respond to questions.

Analytical approach

A hierarchical regression analysis based on ordinary least squares estimate was conducted to test the hypotheses. The dependent variable was healthy lifestyle intention. The independent variables were entered into the regression model according to their assumed causal order. Demographic variables were entered in the first block, followed by the communication variables in the second block. The TPB variables were entered in the final block.

Results

The results are shown in Table 1. Among the demographic variables, education had statistically significant relationship with behavioral intention. More educated individuals had stronger intention to adopt a healthy lifestyle than less educated

individuals (β=.09, p<.01). The demographic variables explained 3.20% of variance in the dependent variable.

[Insert Table 1 around here.]

With respect to the communication variables, individuals who engaged more frequently in interpersonal communication had a stronger healthy lifestyle intention than those who engaged less frequently (β=.07, p<.01). Hence, H1 was supported. Likewise, individuals who paid more attention to health-related information in the mass media had stronger healthy lifestyle intention compared with those who paid less attention (β=.13, p<.001), lending support for H2. The communication variables accounted for 14.40% of variance in the dependent variable.

When the two communication variables were controlled, attitude was positively related to healthy lifestyle intention (β=.20, p<.001). Therefore, H3 was supported. Among the three types of social norms, injunctive norms were not associated with behavioral intention. Hence, H4a was not supported. Nonetheless, subjective norms (β=.14, p<.001), and descriptive norms (β=.09, p<.01) showed positive associations. Thus, H4b and H4c were supported. Finally, individuals who had greater perceived behavioral control had stronger healthy lifestyle intention than those who had less perceived behavioral control (β=.32, p<.001), thereby supporting H5. The TPB variables accounted for a further 27.20% of variance in the dependent variable. Overall, the model explained 44.80% of variance in healthy lifestyle intention.

Discussion and Conclusion

This study investigated how communication variables, namely interpersonal communication and attention to mass media, as well as the key components in the TPB, including, attitudes, social norms, and perceived behavioral control, could predict

healthy lifestyle intention in Singapore. Interpersonal communication and mass media attention as well as attitude, subjective norms, descriptive norms, and perceived behavioral control were positively related to the dependent variable. Specifically, perceived behavioral control emerged as the strongest predictor, followed by attitudes.

Consistent with the TPB [9,10], attitudes, social norms and perceived behavioral control were positively related to healthy lifestyle behavioral intention among Singaporeans. Thus, the present study generally demonstrates the applicability of the TPB in predicting health-related behaviors in Asian countries despite some conflicting results in prior studies [44-46]. The findings provide evidence on the use of the TPB components even after controlling for the communication variables. Therefore, this study demonstrates the possibility to extend the TPB with two more variables— interpersonal communication and attention to mass media.

As indicated earlier, perceived behavioral control and attitudes were the two strongest predictors of healthy lifestyle intention in Singapore. The two positive associations were expected given the extensive evidence of their role in shaping health-related behaviors. However, that these two determinants had moderate positive relationship (β=.32 and β=.20 respectively) even when communication variables were controlled for is an interesting finding. It suggests that health marketers should enhance people's perceived behavioral control and attitudes to promote their willingness to lead a healthy life. Health authorities could persuade the public that a healthy lifestyle is not only good but also achievable. Personal anecdotes of how healthy behaviors are good and achievable should be included in health promotion and mass media messages. Health authorities should assist in reinterpreting possible inconveniences and difficulties in adopting a healthy lifestyle as minor challenges that can be easily mitigated.

Among the three types of social norms, the association between injunctive norms and behavioral intention was statistically non-significant. A plausible explanation is that different social norms manifest uniquely in different contexts [56]. In the health domain, Singaporeans' injunctive norms are perhaps disparate from their subjective norms and descriptive norms, which were significantly related to behavioral intention. It seems that even though Singaporeans are concerned about what is commonly done in the society as well as what important others prefer them to do, they are indifferent to perceived social pressures related to attitudinal approval of behavior by families, peers, or the wider communities. Therefore, it is important for health authorities to convey to the public that most Singaporeans commonly engage in healthy lifestyle, a behavior that is widely approved by important others.

Besides, the study shows that individuals who engaged in higher levels of interpersonal communication indicated stronger intention to adopt healthy lifestyle, consistent with prior research. Higher level of interpersonal communication has been shown to encourage information repetition and exposure [11], promote engagement with intervention information from targeted groups [57], and amplify the effects of mass media promotion or campaign [58]. Future health promotion efforts may consider enhancing discourse on healthy lifestyle in social groups. Efforts that utilize interpersonal communication such as the Health Ambassador peer-to-peer program seems to be a step in the right direction [28]. Such efforts could be further proliferated via extensions through online and mobile platforms as well as social media.

The study also demonstrates that individuals who paid a higher degree of attention to health information in the mass media were more likely to adopt healthy lifestyle. This is consistent with prior research [29]. As discussed earlier, the mass media can set the public agenda on health issues and amplify the benefit of corrective

actions that ought to be taken [30]. Repeated exposure to well-framed mass media messages that emphasize the importance of corrective health-seeking behaviors is likely to persuade individuals to engage in such behaviors [59]. Weekly television series in Singapore such as "Conversations with PM Lee" often include healthy lifestyle messages to enhance the effectiveness of health promotion efforts. Besides continuing with such efforts, health authorities should leverage on other forms of mass media such as newspapers and the internet to further promote health awareness and adoption of healthy lifestyle among the public. The implications offered to Singapore's healthcare marketing campaigns are summarized in Table 2.

[Insert Table 2 around here.]

These implications notwithstanding, the findings of this study should be interpreted in light of two constraints, which could be overcome in future research. First, given the cross-sectional nature of the study, causal inference could not be made. Future research should examine these effects using panel studies to establish causal order. Interested scholars could pick up from where we left off by examining the effect of communication and the TPB components on healthy lifestyle intention in other developed Asian countries such as Japan and Korea. Conceptual frameworks such as the media dependency theory could also be incorporated [31,60].

Second, behavioral intention to adopt healthy lifestyle was measured on the basis of individuals' desire to engage in physical activity and healthy diet. However, it is possible that there exist other dimensions of healthy lifestyle such as people's tendency to maintain personal hygiene, or refrain from smoking and drinking. Thus, the dependent variable of this study was not measured exhaustively. Future research should shed light on such other dimensions of healthy lifestyle in order to broaden the understanding of this research theme.

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Table 1. Regression results predicting healthy lifestyle intention in Singapore.

	Predictors	Zero-order	Model 1	Model 2	Model 3
Block 1: Demographics	Age	.06	.12**	.07*	.01
	Gender	-.09**	-.09**	-.03	-.04
	Education	.04	.11**	.04	.09**
	Race 　Malay Singaporeans	.07*	.09**	.03	.01
	Indian Singaporeans	.05	.06*	.01	.04
	Eurasian Singaporeans	.03	.04	.03	.02
	Other Racial Groups	.04	.05	.02	.01
Incremental R^2 (%)			**3.20*****		
Block 2: Communication	Interpersonal Communication	.37**		.26***	.07**
	Attention to Mass Media	.33**		.20***	.13***
Incremental R^2 (%)				**14.40*****	
Block 3: TPB	Attitudes	.45**			.20***
	Injunctive Norms	.34**			.03
	Subjective Norms	.38**			.14***
	Descriptive Norms	.40**			.09**
	Perceived Behavioral Control	.54**			.32***
Incremental R^2 (%)					**27.20*****
Total R^2 (%)					**44.80*****

Note. N=1,055. Chinese Singaporeans were treated as a reference category among the dummy variables for race. For zero-order correlations of categorical variables, Spearman's correlation coefficients are reported. Pearson's correlation coefficients are reported otherwise.
$^{*}p<.05,$ $^{**}p<.01,$ $^{***}p<.001$

Table 2. Recommendations for Singapore's healthcare marketing campaigns.

Variables	Healthcare marketing campaigns should
Perceived Behavioral Control (β=.32)	• Communicate to the public that healthy lifestyle intention is not too difficult to achieve because inconveniences and difficulties are possible to be mitigated.
Attitude (β=.20)	• Communicate to the public that healthy lifestyle intention is beneficial.
Subjective Norms (β=.14)	• Communicate to the public that engaging in healthy lifestyle intention will be approved by their important others.
Attention to Mass Media (β=.13)	• Use different forms of mass media to communicate to the public about the importance of healthy lifestyle intention.
Descriptive Norms (β=.09)	• Communicate to the public that Singaporeans commonly engage in healthy lifestyle intention.
Interpersonal Communication (β=.07)	• Enhance discourse and develop communities among Singaporeans around healthy lifestyle practices.

Note. The variables are arranged in decreasing order of their standardized β.