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Short report

# Multi-centre study on cultural dimensions and perceived attitudes of nurses towards influenza vaccination uptake

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SUMMARY

This study explored how cultural values affected Health Belief Model (HBM) components and the influenza vaccine uptake among nurses across three Asian populations using a survey conducted in 2017 ($N = 3971$). The vaccination coverages were 33.5% (Brunei), 35.6% (Hong Kong) and 69.5% (Singapore). Three HBM components (perceived susceptibility, perceived benefits and cues to action) were positively associated with vaccination. A direct negative link and an indirect positive link via HBM were observed between collectivism and vaccination, whereas a negative indirect link via HBM between power distance and vaccination was observed. Cultural values, notably collectivism, advanced HBM to study nurses' vaccination.


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## Introduction

Despite high-exposure risk of contracting influenza, low seasonal influenza vaccination uptake rates have been observed among healthcare workers [1]. The Health Belief Model (HBM) posits that vaccination can be explained by an individual's perception of susceptibility and severity of influenza infection, together with the perceived benefits and barriers [2]. Advanced models using HBM components with additional components provided a successful framework to improve prediction on vaccination uptake [3].

Cultural values may influence the health behaviours of healthcare workers. Human groups are organized into hierarchies [4]. Relevant to these hierarchies is a cultural value called power distance, defined as the extent to which less powerful members of society accept and expect that power is distributed unequally [5]. The 'group' is fundamental to human societies. Some groups expect individuals to build strong bonds with their in-groups and to put group interest over self-interest, defined as being collectivistic, whereas some groups allow individuals to cultivate independence and have a loose relationship with their in-groups, defined as being individualistic [6].

Although many studies adopted the HBM framework to investigate influenza vaccination uptake and intention, few have focused on healthcare workers and nurses [2]. Little is known about how cultural factors shape HBM components and hence vaccination. To our knowledge, no multi-centre study has ever been conducted in Asia. This study explored how power distance and collectivism varied across populations and how they affect HBM components and influenza vaccination among nurses in three Asian populations.

## Methods

A cross-sectional multi-centre survey on nurses from Hong Kong, Singapore, and Brunei was conducted using an online self-administered questionnaire. The questionnaire included demographics, history of influenza vaccination, statements measuring HBM components, and individual-level cultural dimensions (Supplementary Table S1). This multi-centre study was approved by the Survey and Behaviour Research Ethics Committee of the Chinese University of Hong Kong (023–18), Singapore National Health Group Research Development Office Domain Specific Review Board (2016/01344), and Brunei Medical and Health Research and Ethics Committee (MHREC/MOH/2017/2/4).

### *Participants*

In Hong Kong, collaborating with the Association of Hong Kong Nursing Staff, we recruited registered nurses, enrolled nurses, nursing students, and trainees working in both public and private sectors in February–April 2017. In Singapore, registered nurses and enrolled nurses from Khoo Teck Puat Hospital (an acute hospital) and Yishun Community Hospital (a community hospital) were recruited in March 2017. In Brunei, nurses registered with the Brunei Nursing Board in both public and private sectors were recruited in April–June 2017. Participants were invited via e-mail and mail and indicated their consent in the online survey. Participants in Hong Kong were given a food coupon worth 20 Hong Kong dollars, whereas there was no incentive for participants in Singapore and Brunei.

### *Measures*

The following were measured: (i) power distance and collectivism; and (ii) four HBM domains (perceived susceptibility, perceived benefits, perceived severity, and cues to action) on vaccination uptake among nurses. Vaccine uptake was measured by self-report of influenza vaccination in 2016/17. Power distance and collectivism as described in Supplementary Table S1 were used to measure the individual-level cultural values. Each item was rated on a five-point Likert scale (1 = strongly disagree; 5 = strongly agree). Average scores were computed with higher scores indicating higher levels of the cultural values. Participants rated 14 questions based on HBM (Supplementary Table S1) on the same Likert scale. Average scores of items under each domain were computed, with higher scores indicating higher levels of the constructs.

### *Analysis*

A multi-mediator model (Supplementary Figure S1) controlled for potential confounders (age and gender) was analysed. A backward selection approach was used with the criterion of $P < 0.2$ to include variables to develop multivariate models. $P < 0.05$ was considered statistically significant. The model with the smallest sample size-adjusted Bayesian information criterion (SABIC) was considered as final. All analyses were performed using R version 3.4.1 and M*plus* version 8.

## Results

A total of 5066 participants were recruited, of whom 113 were full-time student nurses and 22 were no longer in the nursing profession at the time of the survey. Upon excluding 960 subjects without complete data, 3971 cases were analysed. Sample sizes of 1082 (Brunei), 1386 (Hong Kong), and 1503 (Singapore) for a 95% confidence interval (CI) detected margins of error of 2.8%, 2.5%, and 2.3%, respectively.

The vaccination uptake rates were 33.5%, 35.6%, and 69.5% in Brunei, Hong Kong, and Singapore, respectively. Sample characteristics are shown in Table I, descriptive statistics on the variables studied in Supplementary Table S1, univariate analysis of data by study site and combined data in Supplementary Tables S2 and S3, and the mechanism for the selection of the final model in the Supplementary Appendix.

Demographic variables were significantly different across the three populations (Table I). Most participants were aged <39 years (70.7%), had <16 years in nursing (70.6%), were female (88.8%), were staff nurses (69.8%), without chronic diseases (88.1%), and were in contact with patients almost all the time at work (72.7%).

Path analyses (Table II) revealed a positive indirect effect of collectivism on vaccine uptake via perceived susceptibility (adjusted odds ratio (aOR): 1.037; 95% bootstrapped confidence interval (bCI): 1.016, 1.062), benefits (aOR: 1.071; 95% bCI: 1.040, 1.108), and cues to action (aOR: 1.165; 95% bCI: 1.121, 1.214). However, the total effect of collectivism was not significant. For power distance, its indirect effect on vaccination uptake was mediated negatively by perceived

**Table I**
Characteristics of subjects with complete data

| Characteristics | No. of participants (%) | | | | *P*-value[a] |
|---|---|---|---|---|---|
| | Combined ($N = 3971$) | Brunei ($N = 1082$) | Hong Kong ($N = 1386$) | Singapore ($N = 1503$) | |
| Age (years) | | | | | |
| 18–29 | 1435 (36.1) | 186 (17.2) | 400 (28.9) | 849 (56.5) | <0.001 |
| 30–39 | 1373 (34.6) | 491 (45.4) | 418 (30.1) | 464 (30.9) | |
| 40–49 | 672 (16.9) | 250 (23.1) | 311 (22.4) | 111 (7.4) | |
| ≥50 | 491 (12.4) | 155 (14.3) | 257 (18.5) | 79 (5.3) | |
| Gender | | | | | |
| Female | 3528 (88.8) | 913 (84.4) | 1240 (89.7) | 1375 (91.5) | <0.001 |
| Male | 443 (11.2) | 169 (15.6) | 146 (10.3) | 128 (8.5) | |
| No. of years spent in nursing profession | | | | | |
| <6 | 1352 (34.0) | 161 (14.9) | 430 (31.0) | 761 (15.7) | <0.001 |
| 6–10 | 955 (24.1) | 252 (23.3) | 249 (18.0) | 454 (30.2) | |
| 11–15 | 496 (12.5) | 252 (23.3) | 113 (8.2) | 131 (8.7) | |
| 16–20 | 417 (10.5) | 181 (16.7) | 174 (12.6) | 62 (4.1) | |
| >20 | 751 (18.9) | 236 (21.8) | 420 (30.3) | 95 (6.3) | |
| Current work position | | | | | |
| Management level/senior nursing staff | 351 (8.8) | 55 (5.1) | 219 (15.8) | 77 (5.1) | <0.001 |
| Staff nurse | 2773 (69.8) | 800 (74.0) | 878 (63.3) | 1095 (72.9) | |
| Assistant nurse and others | 847 (21.3) | 227 (21.0) | 289 (20.9) | 331 (22.0) | |
| Work time contacting patients | | | | | |
| Minimal or no contact | 134 (3.4) | 29 (2.7) | 96 (6.9) | 9 (0.6) | <0.001 |
| Less than half of the time | 149 (3.8) | 33 (3.0) | 100 (7.2) | 16 (1.1) | |
| Half of the time | 212 (5.3) | 65 (6.0) | 101 (7.3) | 46 (3.1) | |
| More than half of the time | 590 (14.9) | 183 (16.9) | 240 (17.3) | 167 (11.1) | |
| Almost all the time | 2886 (72.7) | 772 (71.3) | 849 (61.3) | 1265 (84.2) | |
| Presence of chronic diseases | | | | | |
| No | 3498 (88.1) | 902 (83.4) | 1162 (83.8) | 1434 (95.4) | <0.001 |
| Yes | 368 (9.3) | 156 (14.4) | 162 (11.7) | 50 (3.3) | |
| Not sure | 105 (2.6) | 24 (2.2) | 62 (4.5) | 19 (1.3) | |
| Vaccination uptake | | | | | |
| Yes | 1901 (47.9) | 363 (33.5) | 494 (35.6) | 1044 (69.5) | <0.001 |
| No | 2070 (52.1) | 719 (66.5) | 892 (64.4) | 459 (30.5) | |

[a] $\chi^2$-Test for independence.

susceptibility (aOR: 0.988; 95% bCI: 0.976, 0.997) and perceived benefits (aOR: 0.983; 95% bCI: 0.970, 0.993). However, the total effect of power distance on vaccination uptake was not statistically significant.

There were geographical discrepancies in vaccination uptake and the underlying cultural values among the three study sites. The final model suggested that nurses were less likely to receive vaccination in Brunei (aOR: 0.509; 95% bCI: 0.411, 0.631) but were more likely in Singapore (aOR: 3.435; 95% bCI: 2.904, 4.146) when compared to those in Hong Kong. In terms of cultural values, nurses in Singapore had significantly higher power distance than those in Hong Kong and Brunei (aOR: 1.058; 95% CI: 1.006, 1.116), whereas nurses in both Singapore (aOR: 1.290; 95% CI: 1.235, 1.350) and Brunei (aOR: 1.751; 95% CI: 1.669, 1.850) were significantly more collectivistic than their Hong Kong counterparts. The results of sub-group analysis are presented in Supplementary Table S4.

## Discussion

This was the first study examining perception of nurses towards influenza vaccination uptake in three Asian populations. No similar studies on nurses in any single population were found. Understanding the cultural and behavioural factors that shape influenza vaccination coverage among study populations would help policymakers in Asia to adjust vaccination strategies.

The direct and indirect effect of power distance and collectivism on nurses' influenza vaccination was explicitly examined. Interestingly, competing mechanisms on vaccination were found in the effects of collectivism. This suggested the importance of both self-interest (indicated by the negative direct effect) and group interests (by the positive indirect effect) towards vaccine uptake. Specifically, this collectivistic nature may drive individuals to be more influenced by groups and enhance the translation of cues to action into vaccination decisions.

An insignificant total effect and direct effect of power distance on vaccination uptake was observed. However, there was negative indirect effect of power distance on vaccination via perceived benefit and perceived susceptibility. Nurses with high degree of power distance were inclined to obey recommendations by authorities and therefore felt less empowered to make their own decision, which decreased their perception of perceived benefits and thus vaccination uptake. The

**Table II**
Results of mediation model ($N = 3971$)

| Variable | Outcome specified in the model (aOR (95% bCI)) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Collectivism | Power distance | Perceived susceptibility | Perceived benefits | Perceived severity | Cues to action | Vaccination |
| Age group (years) | | | | | | | |
| 18–29 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 30–39 | 1.003 (0.955, 1.054) | 1.054 (0.994, 1.116) | 0.960 (0.908, 1.019) | 0.970 (0.922, 1.025) | 0.897 (0.944, 0.952)[a] | 0.875 (0.830, 0.929)[a] | 0.966 (0.820, 1.151) |
| 40–49 | 1.002 (0.945, 1.066)[a] | 1.078 (1.008, 1.154)[a] | 0.945 (0.877, 1.011) | 1.029 (0.964, 1.099) | 0.992 (0.924, 1.066) | 0.863 (0.802, 0.929)[a] | 0.996 (0.800, 1.229) |
| ≥50 | 1.119 (1.050, 1.195) | 1.124 (1.039, 1.223)[a] | 0.834 (0.773, 0.909)[a] | 0.982 (0.915, 1.060) | 0.888 (0.818, 0.970)[a] | 0.867 (0.798, 0.946)[a] | 1.476 (1.143, 1.881)[a] |
| Gender | | | | | | | |
| Men | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Women | 0.951 (0.890,1.020) | 0.963 (0.894, 1.043) | 0.969 (0.901, 1.042) | 0.947 (0.888, 1.013) | 0.969 (0.900, 1.034) | 1.034 (0.962, 1.120) | 0.902 (0.713, 1.129) |
| Current work position | | | | | | | |
| Management level/senior nursing staff | 1.190 (1.097, 1.290)[a] | 0.904 (0.835, 0.972)[a] | 0.921 (0.833, 1.008) | 0.992 (0.906, 1.080) | 0.922 (0.841, 1.008) | 0.953 (0.862, 1.058) | 1.632 (1.252, 2.151)[a] |
| Staff nurse | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Assistant nurse/others | 1.085 (1.033,1.138)[a] | 1.094 (1.029, 1.161)[a] | 0.993 (0.934, 1.052) | 0.993 (0.940, 1.048) | 0.994 (0.940, 1.057) | 0.946 (0.891, 1.003)[a] | 1.242 (1.062, 1.470)[a] |
| Study site | | | | | | | |
| Brunei | 1.751 (1.669, 1.850)[a] | 1.037 (0.979, 1.101) | 1.358 (1.274, 1.452)[a] | 1.398 (1.322, 1.477)[a] | 0.979 (0.920, 1.047) | 2.096 (1.958, 2.234)[a] | 0.509 (0.411, 0.631)[a] |
| Hong Kong | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Singapore | 1.290 (1.235,1.350)[a] | 1.058 (1.006, 1.116)[a] | 1.233 (1.166, 1.307)[a] | 1.208 (1.148, 1.273)[a] | 1.075 (1.014, 1.137)[a] | 1.531 (1.438, 1.626)[a] | 3.435 (2.904, 4.146)[a] |
| Collectivism | | | 1.182 (1.133, 1.231)[a] | 1.270 (1.223, 1.320)[a] | 1.174 (1.127, 1.221)[a] | 1.285 (1.229.1.342)[a] | 0.854 (0.759, 0.959)[a] |
| Power distance | | | 0.946 (0.916, 0.981)[a] | 0.942 (0.914, 0.972)[a] | 0.945 (0.915, 0.978)[a] | 1.003 (0.969, 1.041) | 1.070 (0.966, 1.184) |
| Perceived susceptibility | | | | | | | 1.241 (1.101, 1.392)[a] |
| Perceived benefits | | | | | | | 1.334 (1.176, 1.511)[a] |
| Perceived severity | | | | | | | 0.943 (0.834, 1.073) |
| Cues to action | | | | | | | 1.839 (1.655, 2.056)[a] |
| Indirect effects of collectivism via | | | | | | | |
| Perceived susceptibility | | | | | | | 1.037 (1.016, 1.062)[a] |
| Perceived benefits | | | | | | | 1.071 (1.040, 1.108)[a] |
| Perceived severity | | | | | | | 0.991 (0.971, 1.011) |
| Cues to action | | | | | | | 1.165 (1.121, 1.214)[a] |
| Total effect of collectivism | | | | | | | 1.095 (0.976, 1.232) |

| | |
|---|---|
| Indirect effects of power distance via | |
| Perceived susceptibility | 0.988 (0.976, 0.997)[a] |
| Perceived benefits | 0.983 (0.970, 0.993)[a] |
| Perceived severity | 1.003 (0.996, 1.012) |
| Cues to action | 1.002 (0.979, 1.024) |
| Total effect of power distance | 1.045 (0.937, 1.157) |

aOR, adjusted odds ratio; bCI, bootstrapped confidence interval.
[a] Alpha level of 0.05 by using bias-corrected bootstrapped confidence intervals.
Total indirect effect is the sum of the two specific indirect effects for power distance and collectivism, respectively.

dependent behaviour of nurses on managerial staff to protect themselves from influenza infection may reduce their beliefs about their risk of becoming infected. A discussion on the subgroup analysis is presented in the Supplementary Appendix.

This study has several limitations. First, convenient sampling was used, leading to a potentially biased estimation. In Singapore, nurses were from two government-based hospitals, with a vaccination rate higher than those of previous studies [7]. There may be well-established influenza vaccination policies in effect in the study population. Also, this high rate may be due to the Zika virus outbreak in August 2016, driving nurses to be vaccinated. Second, Cronbach's alpha value marginally below 0.7 for perceived susceptibility and severity indicated insufficient reliability of the scores, despite using a standard tool [8]. We can only find one similar study using HBM on healthcare workers in a hospital in Singapore but the reliability test for each HBM component was not reported [9]. Third, the provision of incentive was inconsistent across sites. However, considering the small monetary value, this potential bias should be minimal. Fourth, we did not ask whether participants had attended doctor consultation before they joined the survey and level of contacts with influenza patients. Such information would have been useful in assessing physicians' recommendations to nurses and their self-evaluation about receiving seasonal influenza vaccination.

In conclusion, provision of training and education on evidence-based medicine to nurses towards influenza infection to increase their perceived susceptibility, benefits, and cues to action may improve vaccination rates. Although collectivism and power distance were double-edged swords, they provided policymakers more insights to design interventions to cater for those with different cultural backgrounds. We may include both personal and social benefits when designing promotional programmes. Interventions should be designed to increase the perceived susceptibility and benefits among individuals with higher power distance.

In the future, researchers should design longitudinal studies to investigate possible behavioural factors of future influenza infection and intervention studies of managerial nursing staff to increase their recommendation to their subordinates to change cultural beliefs. Besides nurses, similar studies should be extended to other HCWs such as pharmacy staff, medical doctors and allied healthcare professionals as the current World Health Organization immunization recommendation for influenza defines them as an important target group [10].

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**Conflict of interest statement**
None declared.

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## Appendix A. Supplementary data

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