



“I wouldn’t really believe statistics” – Challenges with influenza vaccine acceptance among healthcare workers in Singapore



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ABSTRACT

Background: Influenza vaccine acceptance among healthcare workers (HCWs) is a worldwide problem, but relatively little research has focussed on Asia, including Singapore. Despite widespread access and recommendations from public health authorities, influenza vaccine uptake remains suboptimal among HCWs.

Methods: Our qualitative study used focus group discussions to identify and explain factors limiting influenza vaccine acceptance among HCWs in Singapore. A total of 73 doctors, nurses, allied health and ancillary staff across three public hospitals were included.

Results: Challenges identified include a fear of contracting influenza from vaccination exacerbated by negative anecdotes regarding vaccine safety and efficacy, distrust of published efficacy data, uncertainty regarding relevance of existing data for Singapore, reluctance to introduce chemicals or overmedicate, pain from injection, low risk attributed to influenza and limited awareness of influenza transmission with a preference for alternatives in patient protection. Differences in attitudes were observed across vocational groups. Lack of overt promotion by hospital leadership in some institutions, perceived vaccine hesitancy among doctors, access, and work culture that implicitly encourages working through illness were further barriers.

Conclusion: Our findings highlight a combination of misperceptions about influenza vaccination and cognitive biases at the individual level, and challenges at the institutional level limiting uptake. Findings indicate an urgent need to provide targeted education and communication. Rather than providing more data, we recommend a widely-disseminated, locally-compiled synthesis addressing specific concerns of hesitant HCWs. Tailoring interventions to specific vocational groups should be considered. Institutional norms and culture may have a powerful influence in setting default behaviours: more effort is needed in improving influenza vaccine promotion and priority at some institutions, integrating vaccine-related communication with other infection control communication and addressing influenza vaccine hesitancy among doctors as a priority. Finally, further study of strategies to address cognitive biases affecting influenza vaccine acceptance in Singapore is desirable.

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Abbreviations: HCW, health care worker; SARS, severe acute respiratory syndrome.

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1. Introduction

Influenza vaccination is recommended for health care workers (HCWs) as they are at increased risk of exposure to influenza virus and may play a key role in transmission to patients [1,2]. In addition to infection prevention and decreased staff absenteeism [3], improving influenza vaccine acceptance enhances hospital pandemic response, as seasonal influenza vaccine uptake has consistently been shown to predict pandemic influenza vaccine uptake [4–7]. Despite presumably higher knowledge of infectious diseases, poor uptake among HCWs has been noted worldwide [8,9]. Issues with access to influenza vaccine have been highlighted [10], acceptance, however, requires equal attention.

A number of factors limit influenza vaccine uptake among HCWs: perception of influenza as a mild disease, a lack of perceived personal risk, concerns regarding vaccine safety and efficacy and inconvenient access [8,9]. The behavioural economics literature provides additional insights regarding the role of cognitive biases in vaccination decision-making [11]. Most of these studies, however, have been conducted outside of Asia. The few studies in Asia have found similar reasons affecting influenza vaccine acceptance such as perception of influenza as not serious and concerns with vaccine safety and efficacy among others [12–14]. However, a deeper exploration of themes underlying these reasons and a more nuanced understanding of vaccine hesitancy beyond the acceptance-rejection dichotomy is lacking.

Vaccine hesitancy as defined by the SAGE Working Group on Vaccine Hesitancy refers to a “delay in acceptance or refusal of vaccination despite availability of vaccination services” [15]. It is believed to be influenced by factors such as complacency, convenience and confidence and is formulated as a behavioural phenomenon which is vaccine and context specific [15]. However, this definition is limited insofar as it does not adequately address the link between attitudinal factors and behaviour [16,17]. In our study, in addition to exploring psychological aspects of vaccine hesitancy, we explore institution-based cultural factors, social factors and potential access-related barriers. We seek to identify and explain factors of practical utility that may limit influenza vaccine acceptance among HCWs in Singapore.

As a tropical country, Singapore does not have well-defined influenza seasons, but faces a substantial influenza burden with an estimated 20% of the population infected each year and mortality comparable to that in the United States [18,19]. Vaccination rates among HCWs in Singapore are less than desired [20] and vary considerably (39–66%) across different healthcare institutions and time periods [14,20,21]. Past experience with the 2003 SARS epidemic, continuing vulnerability to emerging infectious diseases as a highly-connected travel hub and committed leadership have together ensured efficient handling of disease outbreaks and a population that is largely responsive to recommended public health measures [22–25]. Seasonal influenza vaccine uptake, however, remains an exception despite Ministry of Health recommendations for HCW vaccination [26,27] and provision of vaccines to HCW for free in all major healthcare institutions.

Vaccine hesitancy and acceptance among HCWs is especially important to understand and address as HCWs directly influence public opinion, community vaccine acceptance and decision-making on vaccination [28,29]. Our research is formulated as a case study for Singapore that aims to identify and explain factors that limit influenza vaccine acceptance among HCWs through an in-depth qualitative study of doctors, nurses, allied health and ancillary staff across hospitals in Singapore.

2. Methods

2.1. Study setting and design

Qualitative focus group discussions (FGDs) explored perceptions of influenza and influenza vaccines, and facilitators and barriers to influenza vaccine acceptance across three of sixteen public hospitals and specialty centres in Singapore [30] in a case study design. These three organizations were selected to cover general tertiary care and infectious disease in adult and paediatric settings, to ensure a wide representation of patient-facing, hospital-based HCW. This research is part of a larger mixed-methods study of influenza vaccine uptake in Singapore. Ethical approval: NUS-IRB, NUS2204.

2.2. Participant selection

Separate FGDs were conducted with hospital-based HCWs from four vocational categories – doctors, nurses, allied health and ancillary staff. Participants were randomly selected using staff lists while ensuring a mix of departments/specialities. For example, an allied health FGD would have one physiotherapist, occupational therapist, dietitian, pharmacist, medical technician, social worker, etc. A mix of more junior and senior staff, from different departments, was maintained. Participants were contacted through human resources or directly by research staff, as per hospital policy.

2.3. Instrument and data collection

FGD guide construction was guided by a literature review, discussion with experts to identify areas of interest and key informant interviews with persons involved in vaccine policy and delivery. The FGD guide was pilot-tested and refined before implementation. Topics covered included perceptions of influenza, participant priority for preventing influenza and methods used for prevention, views and experience with influenza vaccine and facilitators and barriers to vaccine acceptance. The topic guide was used to lead the discussion in a semi-structured approach, allowing for flexibility, elaboration and a natural flow of conversation to elicit rich and valid data. Facilitators presented themselves without any titles or authority and efforts were made to ensure all participants felt comfortable speaking freely. FGDs were facilitated by NS or KD, accompanied by a note-taker. Written informed consent was obtained prior to interview and participants were provided a token reimbursement. FGDs were audio recorded with permission.

2.4. Data management and approach to analysis

Data was transcribed verbatim from voice records into MS Word and enhanced with notes taken and observations made during interviews. Transcripts were managed and analysed with qualitative data analysis software, MAXQDA 11. Thematic analysis was performed based on the research question concerning identifying and explaining factors that may limit influenza vaccine acceptance among HCWs. For first-level coding, text was coded thematically using a deductive approach based on topics covered in the FGD guide and on relevant topics from the influenza vaccine acceptance literature. Second-level coding made use of an inductive approach to identify new themes from the data. NS coded the data, which was reviewed and discussed with JY. NS and JY then jointly developed a list of themes used for analysis.

Table 1
Overview of participant characteristics.

Focus group number	Professional category	Site	Number of participants	Percentage of men	Mean age (years)	Influenza vaccine receipt (number) ^a
1	Doctors	1	7	71%	30.9	5
2	Nurses	1	5	0%	34.0	4
3	Allied health staff	1	7	29%	34.9	3
4	Ancillary staff	1	7	100%	54.9	6
5	Doctors	2	7	86%	31.9	4
6	Nurses	2	9	0%	36.1	9
7	Allied health staff	2	5	20%	31.4	2
8	Doctors	3	5	20%	27.3	0
9	Nurses	3	8	0%	46.5	5
10	Allied health staff	3	8	13%	31.3	6
11	Ancillary staff	3	5	0%	49.0	5
<i>Total</i>			73	32%	37.2	49

Ancillary staff included porters, patient care assistants, housekeepers, general service and security personnel.

^a Refers to number of participants who mentioned having taking the influenza vaccine in the past year.

Table 2
Analysis of concerns related to the perception that influenza vaccination causes influenza as a side-effect.

List of sub-themes for the perception that influenza vaccination causes the flu and resulting vaccine hesitancy	Illustrative quotes
Perception that flu is a guaranteed side-effect of vaccination, while one may not necessarily catch influenza if not vaccinated	<p><i>"The first two years when I went for the vaccination, after the vaccination I felt really sick. I usually don't get flu at all, like I can't think of the last time I got flu before I got the vaccination. But after the vaccination I got really sick - there was flu, there was cough and there was fever. Then last year when I didn't get the vaccination I didn't have anything like that"</i> [Allied health, FGD7]</p> <p><i>"I remember around 2006 when Singapore started encouraging people to have the flu vaccine. Those who had it, about half of them got flu. I didn't take the flu vaccine, nothing happened to me."</i> [Nurses, FGD9]</p>
Perception that flu after vaccination is more severe than naturally-acquired influenza	<p><i>"The last few years I have actually found that when I take vaccine I'm sick for two to four weeks after the vaccine. It can be quite bad and the symptoms seem to be more than the typical kind of flu symptoms I usually get."</i> [Allied health, FGD10]</p> <p><i>"The last time I got the vaccine was five years ago and after that I had flu anyway. And even worse [reference to degree of flu]. I had myalgia everywhere, I was really sick after that. So it didn't work for me."</i> [Doctors, FGD5]</p>
Concerns regarding absence from work due to flu perceived to be caused by influenza vaccination	<p><i>"You may get the actual flu after vaccination, which is severe enough for you to drop work for a couple of days and that puts people off."</i> [Doctors, FGD1]</p> <p><i>"From what I have heard the feedback isn't very good. Most people get sick. My friends get sick after the vaccination. This side effect causes them to think: "oh! I don't want to get sick these few days. I have a heavy work load, so I will not go for it"</i> [Allied health, FGD3]</p>

3. Results

Seventy-three healthcare workers—19 doctors, 22 nurses, 20 allied health and 12 ancillary staff—participated in eleven focus group discussions across three sites (Table 1) conducted between June 2014 and March 2015. Influenza vaccine was generally considered a low priority and was ranked below other occupational vaccines such as hepatitis B or varicella. The exceptions were FGDs ancillary staff and nurses at site 2, who considered influenza vaccine as important as other vaccines. Although ancillary staff from site 3 and nurses from site 2 considered the vaccine compulsory, they reported enthusiasm towards receiving it.

Challenges associated with vaccine uptake were categorized into three broad domains of vaccine-related, disease-related and institution-related factors. Each domain covered several themes as follows:

Vaccine-related factors

3.1. Perception that vaccination causes influenza as a side-effect

A frequently mentioned barrier was fear of contracting influenza from vaccination. This belief was widespread among vaccine acceptors and non-acceptors alike. Acceptors, however, rationalized that this unavoidable side-effect was offset by protection

the vaccine provided against serious influenza. For others, anticipated illness from vaccination disqualified vaccine use for a number of reasons (illustrative quotes, Table 2): (a) influenza following vaccination was considered a certainty, while naturally catching influenza was not, (b) influenza resulting from vaccination was considered more severe than naturally-acquired influenza, (c) influenza following vaccination would result in inability to work which was of particular concern to doctors and allied health staff who did not wish to be absent for what they perceived to be an avoidable reason. Furthermore, such absence was unlikely to be viewed kindly by superiors and some believed they might be blamed for it: *"If you get the vaccine and you get sick, it's your fault"* [FGD1]. The perception that the vaccine causes influenza was mentioned in all groups except for those with ancillary staff, who noted no concerns about illness from vaccination even on probing.

3.2. Concerns regarding vaccine efficacy

Belief that the vaccine did not work was explained in two main ways as follows (Table 3).

3.2.1. Efficacy data considered unreliable or inadequate

Insufficient local data supporting efficacy of Northern or Southern hemisphere vaccines in tropical Singapore with year-round influenza circulation was a concern. Particularly vaccine hesitant

Table 3

Analysis of concerns regarding the ability of influenza vaccine to prevent illness.

	Illustrative quotes
Efficacy data unreliable or inadequate	
Evidence for vaccine efficacy perceived as unconvincing	<i>"It is not something that you can within your mind usually justify the impact on a) your patient and b) yourself. . .and you know the potential controversies surrounding the efficacy, it's all of that which holds us back" [Doctors, FGD5]</i> <i>"I cannot see any evidence coming up where somebody is going to shove a piece of paper and say this is the best study ever done, it should convince you. It's unlikely" [Doctors, FGD5]</i>
Distrust of published data	<i>"We know evidence really does not matter. You can tweak anything that you want. We publish you know. . .Unless data is pure and clear cut, but most of the time evidence-based medicine is as good as who is in it to do it actually" [Doctors, FGD1]</i>
Lack of relevant efficacy data for the Singapore context and a presupposition that such data is unattainable	<i>"I think it would be great to have that evidence. But, I just cannot see it happening. I think it is not feasible because it is a captive audience, that is within a very small subset of a much bigger population, and to show that this is what is happening in [site 2] and if you [take the vaccine] it is going to make a difference, it is not true because no one lives in [site 2]. They all go out and interact in Singapore and they all interact with Asia-Pacific and the rest of the world." [Doctors, FGD5]</i>
Negative anecdotal or personal experience with the vaccine	
All flu-like episodes not prevented following vaccination	<i>"I took the vaccination the previous time they gave it. It did not really work for me. I don't feel there is any difference before and after taking the vaccine" [Allied health, FGD3]</i> <i>"I don't really buy into the benefits of this because I still fall sick after taking the jab. I don't see any value that is added to me except it has brought me pain and I still fall sick you know." [Allied health, FGD10]</i>

Table 4

Reluctance to introduce what are perceived to be non-natural chemicals in the body as a reason for influenza vaccine non-acceptance.

Sub-theme	Illustrative quotes
Reluctance to introduce substances perceived to be non-natural in one's body	<i>"There are some people who believe that they don't want chemicals in their body. They want everything to be natural" [Allied health, FGD3]</i> <i>"I am not very pro-drugs, pro-injections. So if I can avoid taking medication as long as I possibly can, I will" [Doctors, FGD5]</i>
Reliance on other ways of protecting oneself that are perceived to be natural	<i>"I think there are other ways to protect myself. . .other natural ways you know—exercise, eat well, sleep well—instead of getting the jab" [Allied health, FGD10]</i> <i>"I find having a cold a year might help because it actually boosts your immunity" [Doctors, FGD8]</i>

doctors mentioned unconvincing evidence for vaccine efficacy, distrust of published scientific data and a belief that relevant efficacy data for Singapore can never be obtained (Table 3) as reasons for non-acceptance. Although discussions regarding questionable or insufficient evidence were unique to doctors, nurses and allied health staff also expressed distrust of numeric data: *"I wouldn't really believe statistics. They just show me another number and try to cheat me"* [FGD7].

3.2.2. Negative anecdotal or personal experience with vaccine effectiveness

On the other hand, anecdotes were a generally trusted information source, and often more salient evidence of efficacy (or lack thereof) than research studies. Stories about getting 'the flu' despite vaccine receipt were frequently mentioned while explaining vaccine inefficacy. Unmet expectations of the influenza vaccine preventing all flu-like illnesses contributed to the perception that the vaccine was ineffective, mostly among doctors and allied health staff. Conversely, some nurses and ancillary staff appreciated the protection offered by vaccination, while acknowledging that it may not prevent all flus. While explaining how people decide to take an influenza vaccine, a participant explained: *"[Through] knowledge of past stories, stories of other people; so more testimonials than statistics"* [FGD7]. Participants often stated that their "gut feeling" influenced their decision-making.

3.3. Reluctance to introduce non-natural substances into the body

Another reason for hesitancy was reluctance to introduce substances perceived as unnatural ("chemicals") and a general avoidance of medication (Table 4). This theme was mentioned by

doctors, nurses and allied health, but not ancillary staff (Supplementary Table). Other perceived natural means of enhancing one's immunity were often preferred instead, such as getting a cold every year, a healthy lifestyle or vitamin C supplementation.

3.4. Annual vaccination, inconvenient and painful

Fear of needles or pain from injection was mentioned as a potential barrier in FGDs, across all vocational categories. Having to take the vaccine every year was considered troublesome and also prevented uptake for some. On the other hand, nurses at one site mentioned valuing receipt of a vaccine tailor-made by scientists each year and ancillary staff considered yearly vaccination useful for general health promotion.

Disease-related factors

3.5. Influenza not considered a serious disease

Vaccination was not a priority for some doctors, nurses and allied health staff who perceived influenza as a routine illness causing temporary inconvenience but no lasting harm. Some did not consider influenza serious enough to be absent from work, and took pride in "powering through it". A doctor explained: *"Influenza to me is one of many viruses we catch every day. It is routine. Vaccinating against one of many possible things we may catch seems illogical to me. Whether I have four episodes of flu or ten, we just work through it; life carries on"* [FGD5]. This view was not held by all. Those who worked in intensive care units or emergency, those who had witnessed influenza-related mortality, those who had suf-

Table 5
Reasons healthcare workers do not consider themselves vulnerable to influenza.

Reasons	Illustrative quotes
Personal immunity perceived to be high	<i>"I would like to think my reserves [reference to immunity] are reasonable at the moment". [Doctors, FGD5]</i>
Do not work with patients perceived to transmit infections	<i>"Personally I don't take it because I am a neonatologist so I don't meet with coughing children" [Doctors, FGD8]</i>
Consider selves too young to be at-risk of catching influenza or suffering serious consequences from it	<i>"I don't feel vulnerable because I am at an age group where I am still healthy, so I don't take up the vaccination because I just don't feel the need". [Doctors, FGD8]</i> <i>"If an elderly family member gets the flu, I will be very worried for them because in their age group there is a higher morbidity and mortality rate. So I would strongly advise them to go for vaccination. But personally for myself I don't see the need for it because I don't get serious side effects from the flu... so personally we are not very worried but are more worried for other people" [Allied health, FGD3]</i>

Table 6
Reasons why the goal of patient protection does not currently motivate influenza vaccine uptake.

Sub-theme	Illustrative quotes
Not aware that vaccinating oneself could protect patients	<i>"It never crossed my mind so far"[Allied health, FGD10]</i>
Use of alternate means of patient protection such as facemasks or avoiding contact with patients when ill	<i>"There could be other ways of being responsible other than taking vaccination. So if we know we are sick then we either wear a mask or don't come in to work or we try not to go to high risk areas like ICU" [Allied health, FGD10]</i> <i>"If I am sick I avoid contact with patients. That is my way of being responsible." [Allied health, FGD7]</i>
Belief that vaccinating oneself would not prevent transmission to patients	<i>"If I believed that it helped it would help prevent me spreading it then I would take it. But I don't believe it so that is why." [Allied health, FGD7]</i>
Influenza not perceived to be a major cause of morbidity among patients encountered	<i>"I cannot justify in my mind that me getting influenza vaccination is going to help my patients. If my patients are going to go downhill there are 101 other reasons for it. Influenza is probably not going to be the in top 100 - not in my patient cohort." [Doctors, FGD5]</i>
Belief that patients have a responsibility to protect themselves	<i>"They pass it [reference to infections] to us. Patients must have the flu vaccine." [Allied health, FGD7]</i> <i>"I think it is not just about the health care workers but about the patients who come to us. So it might be good to have a vaccination policy in place for patients in high risk groups" [Allied health, FGD3]</i>

ferred from a bad case of influenza themselves and ancillary staff, considered influenza serious and were supportive of vaccination.

3.6. Do not consider oneself vulnerable to influenza

A doctor succinctly noted: *"I don't think we see ourselves as a very vulnerable population"* [FGD1]. Reasons for not considering oneself vulnerable were varied (Table 5): (a) perceived high personal immunity against influenza, (b) not working with patients perceived to transmit infections and (c) considering oneself too young to be at risk. This was mentioned in all FGDs with doctors, and in some FGDs with nurses, allied health and ancillary staff.

3.7. Limited saliency of vaccination in preventing influenza transmission and patient protection

Those who were positively-inclined towards influenza vaccination mentioned protecting oneself or one's family as a key factor in vaccination decision-making. Patient protection as a reason for occupational influenza vaccination was seldom mentioned (Table 6). Some who did consider influenza transmission to patients focused on transmission from symptomatic individuals and mentioned alternate means (than vaccination) of preventing transmission such as masks and avoiding patient contact. A physician said: *"Why I don't take it is because I feel that my little neonates don't infect me. When I am unwell I wouldn't expose myself to the children"* [FGD8]. When specifically asked whether professional responsibility would motivate uptake, many did not see the value of vaccinating themselves in preventing transmission and some doctors cited questionable evidence from recent studies. Particularly vaccine hesitant doctors did not believe influenza-related morbidity in patients was a concern, while some allied health staff felt patients ought to be vaccinated instead as they primarily transmit infections to HCWs. Ancillary staff, however, mentioned

patient protection spontaneously as a reason for vaccination at both FGDs. Vaccinating oneself for patient safety was also cited more frequently among nurses than allied health staff or doctors.

Institution-related factors

3.8. Access

Access was in general not a frequently mentioned barrier. Inadequate vaccine stock, short campaign duration and absence of a hospital clinic to get the vaccine outside of a campaign were barriers mentioned in one site. No particular concerns were noted in the other two sites. Doctors in all sites thought making access more convenient would improve uptake, while ancillary staff in both sites considered the existing delivery process highly convenient.

3.9. Insufficient institutional endorsement and leadership by example

In sites 1 and 3, lack of official, explicit promotion by institutional or departmental leadership was cited for vaccine non-acceptance among doctors and allied health staff. Some viewed it as an indication of poor efficacy: *"Maybe they also recognize that it is not really 100% proven that is why they are not pushing everyone to go for it"* [FGD10]. Poor uptake among doctors, who are perceived as knowledgeable role-models, made nurses in site 3 suspicious of vaccine safety: *"Is there an effect that we are not being told about or maybe one that will affect us 10 years down the road"* [FGD9]. Conversely, an official recommendation was considered difficult to reject and likely to motivate uptake.

Participants also seemed to infer the priority place on vaccination by their employers from institutional communications. Participants from two sites mentioned use of other means of influenza prevention, namely handwashing and facemasks, which they

perceived as alternative options with higher priority than influenza vaccination, based on their presentation as high-publicity campaigns by their institutions.

4. Discussion

Vaccines, including influenza vaccines, are considered a key enabler for the global community's aspirations to a grand convergence in health [31,32]. It is, however, predicted to be accompanied by an increase in vaccine hesitancy [33]. Vaccine confidence among HCWs in particular is important not just for provider and patient protection, but as an indicator of attitudes in society at large [34]. Unique to this study was eliciting meaning underlying influenza vaccine hesitancy among HCWs and uncovering challenges specific to an Asian context.

Findings highlight some common misperceptions about influenza and influenza vaccine among HCWs. A striking finding was both vaccine acceptors and refusers believed that influenza was a near certain consequence of vaccination, although adverse effects of fever, malaise and myalgia are known to affect only 5% of young children and even fewer adults [1]. A recent study in Germany found that only 2% of hospital workers reported work-time lost from adverse events following influenza vaccination [36]. An explanation for the widely-held perception that the vaccine causes influenza among Singaporean HCWs could be the availability heuristic [37], or the tendency to ascribe a high probability to side effects from influenza vaccination since they are easy to recall and are often discussed. Various misconceptions about potential severity of influenza and one's susceptibility to it also prevented vaccine uptake. Doctors in particular were subject to overconfidence or optimism bias, which refers to a cognitive bias of believing that the risk of suffering from influenza is greater for others than for oneself [11].

In a recent correspondence, Goldstein et al. ask if the way to decrease anti-vaccine sentiment is by "citing more data?" [41]. The answer in this context may be no. Concerns regarding efficacy and safety are widely documented in the HCW influenza vaccine hesitancy literature [4,42,43]. In this study, further exploration revealed that efficacy estimates were less of a concern for doctors than deeper issues surrounding trust in the scientific enterprise and relevance of existing data to the local context. Insufficient trust in scientific evidence was mentioned by the particularly vaccine hesitant who perhaps used overt criticism of vaccine data to rationalize their hesitancy. Improving uptake among this group is likely very challenging. Simply reiterating information in the face of resistance may lead to a "backfire effect", whereby challenging strongly-held beliefs can further strengthen those beliefs. Relevance of existing international data for tropical Singapore, however, was mentioned by doctors with legitimate concerns around choice of Northern or Southern hemisphere vaccines in equatorial Singapore and uncertainty around the efficacy of influenza vaccines for patient protection in long-term care institutions as highlighted in recent meta-analyses [44,45].² Although not directly related to scientific evidence, generalised uncertainty about influenza vaccines prevailed among other groups of HCW too. We hypothesize that even among HCW who are supportive of other occupational vaccines, uncertainty around influenza vaccines exac-

erbates cognitive biases of omission bias and ambiguity aversion [11] and they may choose to not take influenza vaccine despite proven benefits relative to remaining unprotected. Omission bias refers to the tendency to choose a potentially harmful inaction (in this case to remain unvaccinated and have greater risk of disease) over a potentially less harmful action (to vaccinate but potentially suffer from vaccine side-effects), while ambiguity aversion manifests as a preference for known risk (a greater risk of disease if unvaccinated) to an unknown risk (side-effects from vaccination not well-understood).

What may be required therefore is not necessarily more data, but more transparency—including a locally-compiled, simple and widely-disseminated, professional synthesis, specifically targeting doctors. Such a synthesis should explicitly acknowledge and address uncertainties around quality of evidence with an explanation for why influenza vaccines are nevertheless recommended, along with an explanation of the consequences of cognitive biases. Presenting similar syntheses to other vocational groups, such as allied health staff, with less emphasis on evidence, may also be useful.

Although education has improved influenza vaccine uptake among HCWs in other studies [38,39], our findings suggest that an effective strategy for Singapore may involve education incorporating vivid evidence through stories from individuals who have witnessed serious influenza personally or in others; especially as our findings suggest that anecdotes are considered universally compelling evidence, while numbers and statistics were less convincing and on the contrary often viewed with suspicion. As identified in other vaccine communication research, these stories should communicate a clear gist or bottom-line message in order to be compelling [40].

Shunning influenza vaccines for being "unnatural" or a form of overmedication was noted in this study. Following from this theme, prophylactic vitamin C supplements were widely preferred as a natural prevention method, despite the proven ability of only vaccines to prevent influenza by producing a "natural" immune response. Again while education is required, efforts to rebrand influenza vaccine as a natural way to reduce unnecessary prescription and antibiotic use, may be a worthwhile approach and aligned with tackling the global problem of antibiotic overuse [48].

In their review, Hollmeyer et al. found that self-protection was the most important reason for influenza vaccination reported by HCWs [9]. We find that HCWs in Singapore differ. Those who were positively inclined to influenza vaccination prioritized protecting one's family in addition to oneself (consistent with findings previously reported for pandemic influenza vaccine acceptance [39]). Emphasising the benefits of vaccinating oneself to potentially protect one's family may improve uptake in Singapore.

Protecting patients was often not considered and some, including doctors working with vulnerable patients, did not consider asymptomatic transmission (a recent study showed that a large proportion of HCWs with laboratory-confirmed influenza were afebrile [49]). This may be a reflection of institutional influenza vaccine promotion that focuses on self-protection perhaps because the evidence for patient protection is not yet conclusive. However, evidence for use of masks in patient protection is not conclusive either [50], yet masks appeared to be prioritized at some institutions leading some HCW to believe they were a superior alternative. Adoption of one seemingly more visually-powerful behaviour to protect patients seems to impede adoption of others such as vaccination. Institutions thus need to be mindful of how they communicate with their HCWs: vertical programme-based communication may be less effective than a more integrated, comprehensive approach. Finally, very hesitant HCWs thought that patients should be responsible for their own health and patients should be vaccinated instead - tackling this issue requires further

² Unfortunately, conclusions of these meta-analyses are based on unavailability of high quality evidence from placebo-controlled trials. However, such evidence is very difficult to collect as they would generally be considered unethical to conduct among a high-risk group of HCWs for whom vaccination is recommended (Ortiz JR, Jackson, ML, Hombach J. Announcing the Publication of a WHO Guide to the Design and Interpretation of Observational Influenza Vaccine Effectiveness Studies, Clinical Infectious Diseases, 2017;65:352). Therefore, recommendations are largely-based on observational studies which provide good evidence of the benefits of influenza vaccination not only for HCWs but also for their patients.

study and would likely require inculcating sensitivity towards patient protection perhaps earlier on during professional training [51].

Institution-related factors of problems with access identified in one site requires resource investment - specifically, establishing a hospital clinic offering the vaccine beyond the campaign duration. Improving convenience of access has been shown to improve influenza vaccination rates among HCW [21]. However, inconvenient access is not the only problem: some HCWs were unwilling to even try the vaccine (which they believed would cause influenza) due to a culture of heavy workloads, superiors disapproving of flu-related absence and taking pride in powering through illness. This finding highlights aspects of Singaporean work culture affecting vaccine uptake, especially as influenza vaccination has been shown to reduce illness-related absenteeism [20] and other research has found that such 'presenteeism' or going to work when sick can significantly increase workplace influenza transmission [52].

More fundamentally, institutional culture and norms have a strong influence in setting default behaviours. Perceived lack of priority for influenza vaccination in some institutions serve as a 'cue to inaction', while the attitudes and behaviour of doctors or senior HCWs towards influenza vaccination indirectly influence behaviour of other HCWs. This finding is supported by studies conducted elsewhere [35,53]. A study in England found that early career doctors were likely to "copy" behaviours of a senior doctor, even when they were aware that such behaviour conflicts with infection control procedures [53]. Research in other settings have found that understanding of such cultural and social norms can be used to design interventions such as having lead advocates for influenza vaccine promotion and physician recommendation of the vaccine to other HCW, which have been effective in improving influenza vaccine uptake among HCW [54–56]. A study in Spain found that a high level of institutional support with hospital management making a public and personal commitment to be vaccinated improved vaccination rates along with other strategies [57]. In order to build influenza vaccine confidence among staff in Singapore it is critical that institutions themselves do not appear hesitant and provide public leadership. Doctors in particular hold a critical position as role-models to other staff and it is imperative that influenza vaccine hesitancy among doctors is addressed as a priority.

In general, systematic reviews evaluating interventions to improve influenza vaccine uptake among HCW have found that interventions with multiple components are much more effective than single strategy intervention at improving influenza vaccine uptake [46,47] and they merit evaluation in Singapore. Further consideration of cognitive biases affecting influenza vaccine acceptance is also relevant, especially as research on strategies to alleviate these biases affecting vaccine uptake is scarce in Singapore. Strategies aiming to address these biases in other settings have included use of incentives, securing commitment with reminders and various social norm approaches such as tailored gain or loss message framing to improve vaccine uptake [11].

Distinct subcultures were observed among HCWs, which may be influenced by the relatively hierarchical nature of the Singaporean setting. Ancillary staff were least critical, consistent with previous research where ancillary staff in Singapore had higher influenza vaccination rates than other staff [14]. Notwithstanding large social and cultural differences between ancillary staff in their role as hospital cleaners and porters, compared to other groups of HCW, they represent a notable example of positive attitudes towards influenza vaccination worth further study. Extrinsic motivators of believing the vaccine as compulsory or emphasis by managers may be relevant, but intrinsic motivators including professional pride in the HCW privilege of receiving influenza vaccine should not be overlooked. Nurses at one institution had simi-

larly positive views on influenza vaccination, while ancillary staff and nurses at all institutions seemed more conscious of the concept of patient protection than other vocational groups. Research in other settings point to large differences in attitudes concerning influenza vaccination among HCW worker vocational groups [35,58,59] and doctors have been found to have higher trust in influenza vaccines than nurses [59]. Our findings suggest that regardless of their actual uptake, doctors were not necessarily less prone to misperceptions about influenza vaccination. In fact doctors and allied health staff were more likely to more vocally express concerns with influenza vaccination. There is evidence to suggest that tailoring content of educational material and interventions for specific HCW groups can improve uptake [46]. The approach to tackling hesitancy in Singapore may benefit from catering to attitudes and beliefs of different staff groups rather than assuming that 'one-size fits all' in vaccine promotion.

A strength of our FGDs were that participants felt comfortable expressing their concerns with occupational influenza vaccination, a fairly sensitive topic, and group dynamics enabled sharing of negative views in addition to the positive. However, a methodological consideration to bear in mind is that irrespective of actual behaviour, holding a vaccine-sceptic view seemed to be more attention-grabbing. Care thus needs to be taken to ensure that the research process does not negatively influence future vaccination behaviour.

Notwithstanding efforts to ensure random selection, potential selection bias among participants attending FGDs is a study limitation. Comparisons across vocational groups should therefore be made sparingly. The study design does not allow for assessing frequency of reasons generalized to the larger HCWs population and included only HCWs from public hospitals. Nevertheless, a relatively large number of participants included in this qualitative study, representation of views from a wide range of patient-facing HCWs from three hospitals in an Asian country and an in-depth understanding of reasons HCWs may not take an influenza vaccine are key strengths of this exploratory study.

5. Conclusion

This study identified a number of challenges affecting influenza vaccine acceptance among HCW in Singapore. To increase vaccine uptake we recommend a multi-component strategy: On an individual level, education programmes should incorporate stories and other vivid forms of evidence, while rebranding influenza vaccine as a natural way to reduce reliance on antibiotics, and emphasizing the benefits of vaccination for protecting one's family. At an institutional level the following are recommended: public leadership endorsing influenza vaccines, engaging physicians as lead advocates in vaccine recommendation, changing some institutional norms regarding working through illness and integrating vaccine communication with other infection control communication. Finally, further research is needed to tailor interventions to specific vocational groups and to explore strategies to address cognitive biases that may affect influenza vaccine acceptance in Singapore.

Conflict of interest

The authors have no conflicts of interest to declare.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.vaccine.2018.02.102>.

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