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Review

Acceptance and uptake of influenza vaccines in Asia: A systematic review

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ABSTRACT

In Asia, the public health burden of influenza is significant despite the existence of efficacious influenza vaccines. Annual seasonal influenza vaccination can reduce the incidence of influenza significantly, yet influenza vaccination coverage remains low in this part of the world. As a densely populated region with varying climatic zones and a larger proportion of developing countries compared to the West, Asia is at increased risk of influenza. To provide a more comprehensive and nuanced understanding of the Asian region, the key objective of this systematic review is to examine the determinants of vaccination uptake in Asia, beyond that of existing studies that have largely been western-centric.

We carried out a systematic review of peer-reviewed scientific research, examining the key determinants, acceptance and uptake of influenza vaccinations across Asia. A comprehensive search strategy was defined to capture studies that met the inclusion criteria of articles published in English, from 2008 to 2018, focusing on adult populations within Asia. A total of 83 relevant studies were appraised in this review. Analyses of the extant data confirmed that vaccination rates within Asia are low, and that most countries lack scientific research on vaccination behaviours. Studies were categorised into four different population groups: healthcare workers, high risk groups, general population and uniform groups. The motivators and deterrents for vaccine uptake varied according to population groups and characteristics. Both general populations and healthcare workers were concerned with vaccine safety and efficacy, and recommendations from health authorities were influential in vaccine uptake within the other populations.

The findings suggest that further research is needed within a broader range of Asian countries to garner greater in-depth knowledge of vaccination behaviours in the region. In particular, influenza vaccination programs within Asia should focus on improving engagement more effectively, through greater relatability and transparency of data when educating the public.

Contents

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1. Background

In the age of global connectivity, influenza poses an increasingly significant and persistent threat to the public via transcontinental movements. According to the World Health Organisation, annually there are approximately three to five million cases of severe illnesses and 290,000–650,000 respiratory deaths associated with seasonal influenza [1]. Influenza is seasonal and culminates during the winter seasons of the Northern and Southern hemispheres. Due to its continuous antigenic drifts, influenza can evolve quickly between the two different hemispheres' winters and thus lead to varying influenza strains in each hemisphere [2]. However, countries located near the equator, such as Singapore, experience both strains of influenza all year-round, with no distinct seasonal peaks. The lack of a clear seasonal pattern not only complicates vaccine recommendations, but also vaccination timing [3]. As many Asia nations are geographically positioned within the tropical and subtropical zones, they bear considerable burdens of influenza.

Pandemic outbreaks of influenza can arise when a "new or novel" viral strain infects the human population who do not possess immunity against it. With low immunity, the contagious nature of the virus often results in a global outbreak that contributes to illness and morbidity and mortality. For example, the 2009 H1N1 pandemic led to nearly 19,000 laboratory confirmed deaths worldwide within a year. However, the actual number is thought to have been considerably higher [4]. Most people affected by H1N1 were under 65 years of age, and were disproportionately found in Southeast Asia and Africa [5].

The World Health Organisation (WHO) cites immunization as being the most effective influenza prevention method and it is highly recommended for high-risk groups such as pregnant women, children, elderly, health care workers (HCW) and those with chronic conditions [1]. Yet, despite the recommendation and availability of influenza vaccines, the burden of influenza continues to persist. Vaccine hesitancy is known to be a significant obstacle in increasing vaccine uptake. Vaccine hesitancy consists of a range of behaviours that either delay or refuse vaccinations for a variety of reasons undergirded in science, religion, culture and/or politics [6].

While the lack of engagement in vaccination has been studied extensively, much of the past research focused upon influenza vaccine uptake from a global or western perspective. For example, Bish et al. (2011) reviewed papers investigating factors associated with global pandemic influenza uptake and found only 3 Asian articles within the 37 relevant studies included [7]. Undoubtedly, studies on Asia's influenza vaccination uptake are often diminished when reviewed in a global context.

With 52% of the world's population in Asia, diverse climatic zones that provide constant circulation of different influenza strains in certain regions all year round [8], and a high proportion of developing states that lack the capacity to build strong health infrastructures to counter a pandemic attack [9], Asia is significantly susceptible to influenza and its accompanying consequences. By systematically reviewing studies, published between 2008 and 2018 that focused solely on Asia, this paper hopes to identify and the current gaps in the literature and highlight the main reasons and barriers behind the regions vaccination uptake by population groups.

Systematic reviews on Asia's vaccination uptake by population groups are scarce. The choice for seeking preventive healthcare is more than just a personal decision – social belonging and identity can interplay to influence attitudinal beliefs. For instance, a sociocultural study in rural India revealed that getting vaccinated was symbolic of one's high moral status and modernity [10]. This served as a motivator for individuals who sought to exact themselves from their rural identities. Therefore, as attachments to social groups come to shape one's own personal qualities and belief systems, this paper aims to paint an overview of how general populations, healthcare workers, high risk groups, and uniform groups in Asia come to iterate their main motivators and deterrents for getting vaccinated against influenza.

By focusing on Asia, this paper hope to fill a gap within the literature by collectively highlighting studies within the most populated region of the world, which is often underreported in global reviews. In addition, by elucidating the attitudinal inclinations, motivators and barriers towards vaccine uptake in Asia, this paper can lay the groundwork for engendering further research and guiding future policies towards improving vaccination rates in this region.

2. Methods

In order to fully elucidate the scope of motivators, barriers and nuances that are attached to the uptake of influenza vaccination, a mixed-method in-depth review of influenza vaccination within Asia is critical. Thus, papers with both qualitative and quantitative evidences were accounted for in this review. In conducting the systematic review, a two-part systematic search strategy of available studies was developed in October 2018. Firstly, inclusion and exclusion criteria were established. Articles that met the inclusion criteria were peer reviewed studies published in English, between January 2008 and October 2018, that focused on adults' (>18 years old) attitudes, knowledge and behaviours towards influenza vaccination in Asia. To concentrate on attaining a detailed review of influenza vaccination uptake in Asia, papers on Africa, United States, Europe and Middle East were excluded. Articles focusing on vaccine efficacy and production, children under the age of 18, grey literature and papers such as editorials, letters or modelling studies were also excluded.

Secondly, based on prior structured reviews, such as Bish et al. (2011) and Larson et al. (2014) [6,7], a detailed list of search terms were identified consisting of variations of words related to influenza, attitudes/beliefs, vaccines and policy (Table 1).

After the search strategy and search terms were decided, using the criteria mentioned, papers were identified in four stages. In accordance with PRISMA guidelines [11] and the search strategy that was developed, a total of 15,741 papers were identified using PubMed and LISTA EBSCO, and collated using Endnote in Stage 1. Duplicates (N = 4750) were removed and 10,991 papers remained (Fig. 1).

In Stages 2 and 3, titles and abstracts were read and those that did not meet the inclusion criteria (N = 10,372) were removed

papers. After the filtering of titles and abstracts in Stage 2 and 3, there were 619 eligible studies left.

Finally, in stage 4, full papers of the remaining articles were obtained by search through Endnote and screened for suitability. To obtain papers not available through Endnote, the authors' university library was accessed and searched. 536 full text studies were eventually removed for not meeting the established criteria. As a reliability check for missing data, a simple search using Google Scholar was also intermittently explored in the following two weeks, and the references of the included papers were also screened.

3. Results

Based on the review criteria, 83 studies originating from 11 Asian countries were included in the analysis. The largest number of studies came from East Asia, with Hong Kong having the greatest number of publications (N = 24 papers, 29%), followed by China with 14 papers (17%). East Asia countries has significantly more papers on influenza vaccinations than countries in South and Southeast Asia. Singapore, Malaysia, Indonesia and Thailand were the only Southeast Asian countries with publications, while India and Pakistan were the only South Asian countries identified with relevant studies pertaining to influenza vaccination uptake.

Table 1
Search terms.

Search term themes*	Terms used
(1) Influenza related	Influenza, Flu, H1N1, H5N*, H7N*, H9N*, H10N*
(2) Attitudes and beliefs	Knowledge, Ability*, Aware*, Educat*, Comprehend*, Belief*, Accept*, Assum*, Confiden*, Mindset, Percept*, Compulsory, Intent*, controvers*, misconception*, misinfortation, oppos*, delay, dilemma, objection, uptake, barrier*, choice*, mandatory, attitude*, perspective*, prejudice*, view*, stance, position, anxiety, behav*, criticis*, hesitanc*, concern*
(3) Vaccine terms	Vaccin*, immunis*, immuniz*, anti-vaccin*
(4) Policy	Policy, policies, guideline*, programme*, rate*, coverage*, inform*, safety, recommend*, interven*, communicat*, media, consent.

* Searches were run on combinations of 1/3, 1/2/3/4, 1/2/3, 1/3/4.

With reference to Fig. 2, there are a lack of studies on the attitudes and uptake of influenza vaccination in many Southeast Asia and South Asia countries with the comprehensive review being unable to identify studies within 15 out of the 26 Asian nations. Countries with large population sizes such as the Philippines (N = 104.9 million) and Bangladesh (N = 162 million), did not have relevant studies on adults' attitudes towards influenza vaccination.

For the Asian countries with relevant studies, the populations can be categorised into four major groups – general population, healthcare workers (HCW), high-risk groups and uniform groups, comprising of students and the military (see Fig. 2). The majority of the papers examined the outlook and uptake of the general population (N = 32 papers, 38%) towards influenza vaccinations. A significant proportion focused HCW (N = 24 papers, 29.6%) and high-risk groups (e.g. elderly, pregnant women, patients with chronic illness – N = 23 papers, 28.4%).

There were three papers on uniform groups (N = 3 papers, 3.7%), with one study from Singapore focusing on military personnel. 14 of the articles [12–25] contained data of more than one population group. Thus, those 14 studies were eventually categorized multiple times, resulting in a total of 35 papers with relevant information on HCW, 40 papers on high-risk groups, 31 papers on general population and eight papers on uniform groups (student/military).

While majority of the reviewed studies focused solely on seasonal influenza (N = 50 papers, 60%), there were also studies on H1N1 vaccines (N = 15 papers, 18%) and comparisons between H1N1 and seasonal influenza. (N = 14 papers, 17%). Papers were also found relating to H7N9, H3N2 and H5N1.

3.1. Vaccination rates

With reference to Fig. 3, HCWs were found to have the highest vaccination rates with a median of 37.4% over the 32 paper that investigated uptake. High-risk groups and uniform groups (students/military) had comparable median vaccination rates of 37.3% and 35.5% respectively. However, across 31 papers that included information on the vaccine uptake by general populations in Asia countries, the overall vaccination uptake in Asia remains low with a median of 14.3%, ranging from 0.8% to 45%. Compared to the median vaccination rates of HCWs, high-risk groups and

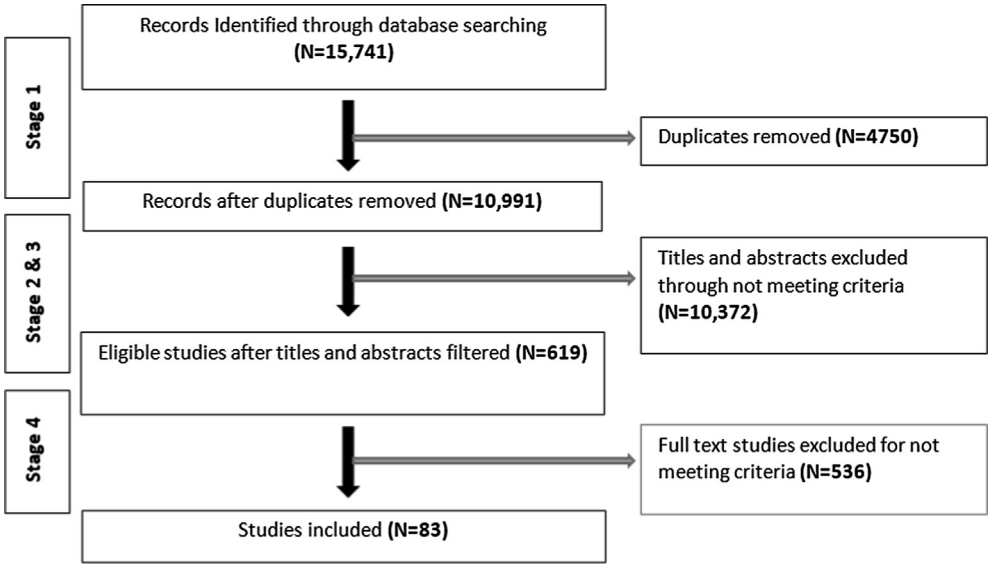
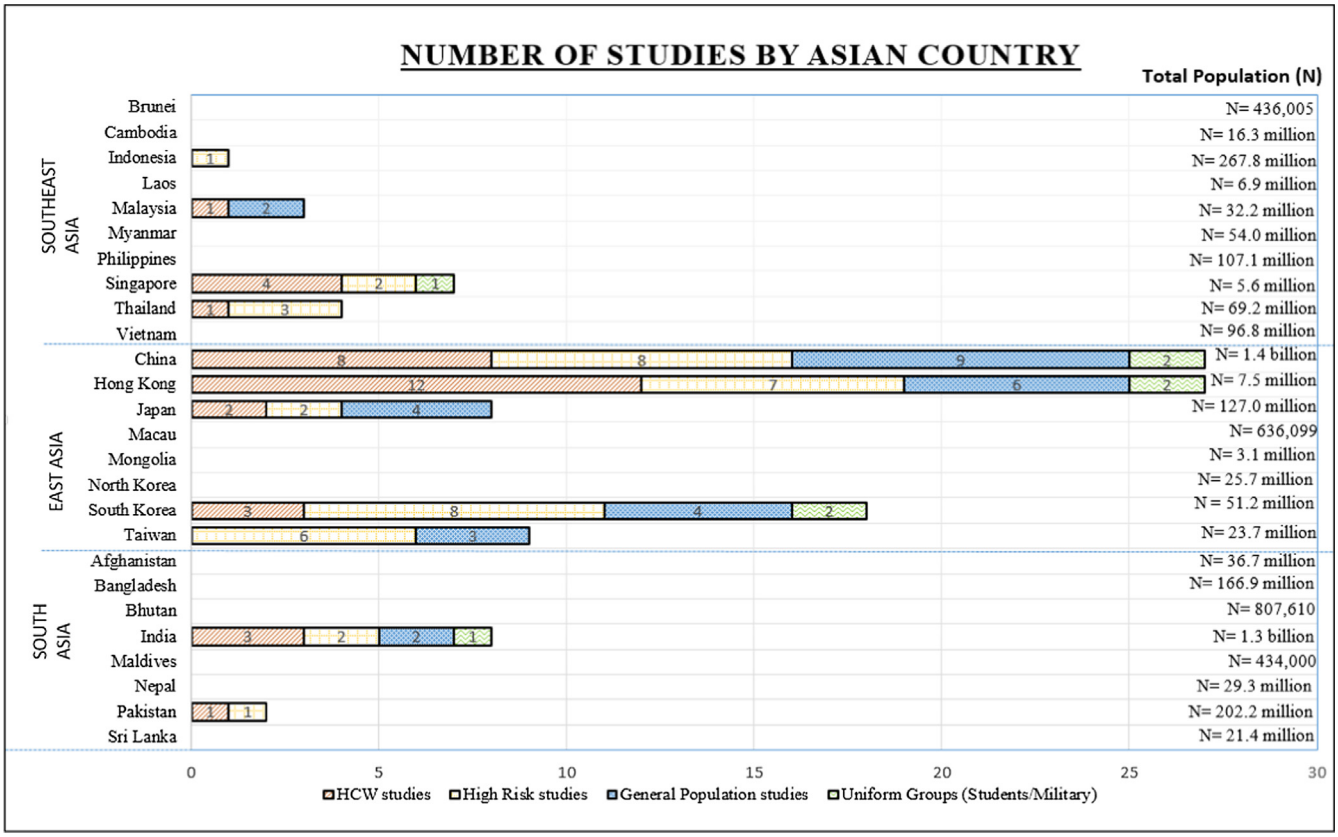


Fig. 1. Flow Diagram of Study Selection for Systematic Review *(Excluded papers consisted of articles focusing on non-Asian studies, vaccine efficacy and production, children under the age of 18, grey literature, editorials, letters, modelling studies, and papers published before January 2008).*



NB: More than 84 studies appear here as 14 studies [13-25] contain information of more than one population group and were categorized multiple times accordingly.

Fig. 2. Number of Studies by Country and Population Groups. NB: More than 84 studies appear here as 14 studies [12–24] contain information of more than one population group and were categorized multiple times accordingly.

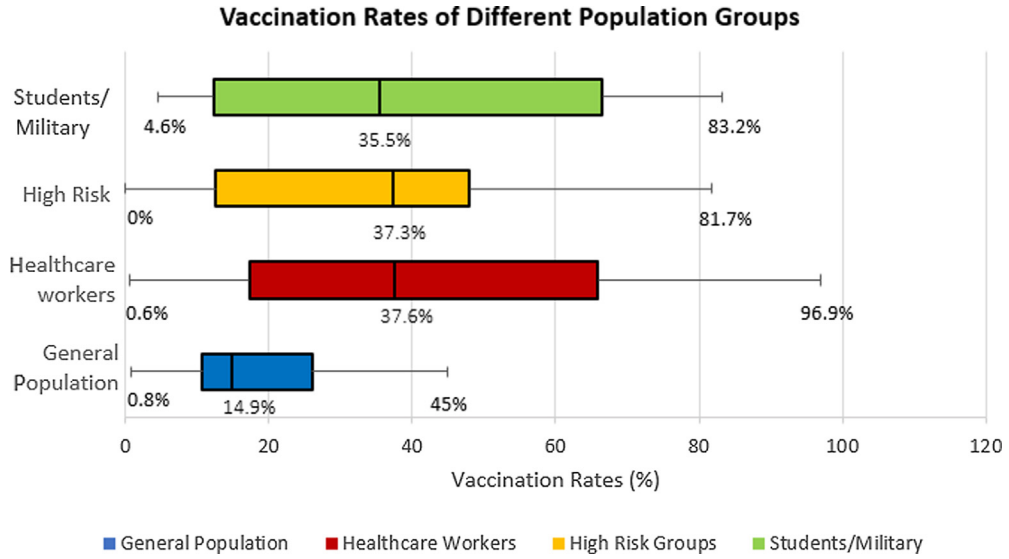


Fig. 3. Vaccination Rates of Different Population Groups.

uniform groups (students/military), general populations in Asia are the least inclined to receive influenza vaccine.

3.2. Factors affecting vaccine uptake

For each study, where possible, we examined the top three reasons for influenza vaccine uptake or refusal, with respect to the population group. The reasons were then categorized according to their themes and similarities (Fig. 4).

3.3. General population

With reference to Fig. 4, the main reasons for vaccinating against influenza within the general population was the belief in

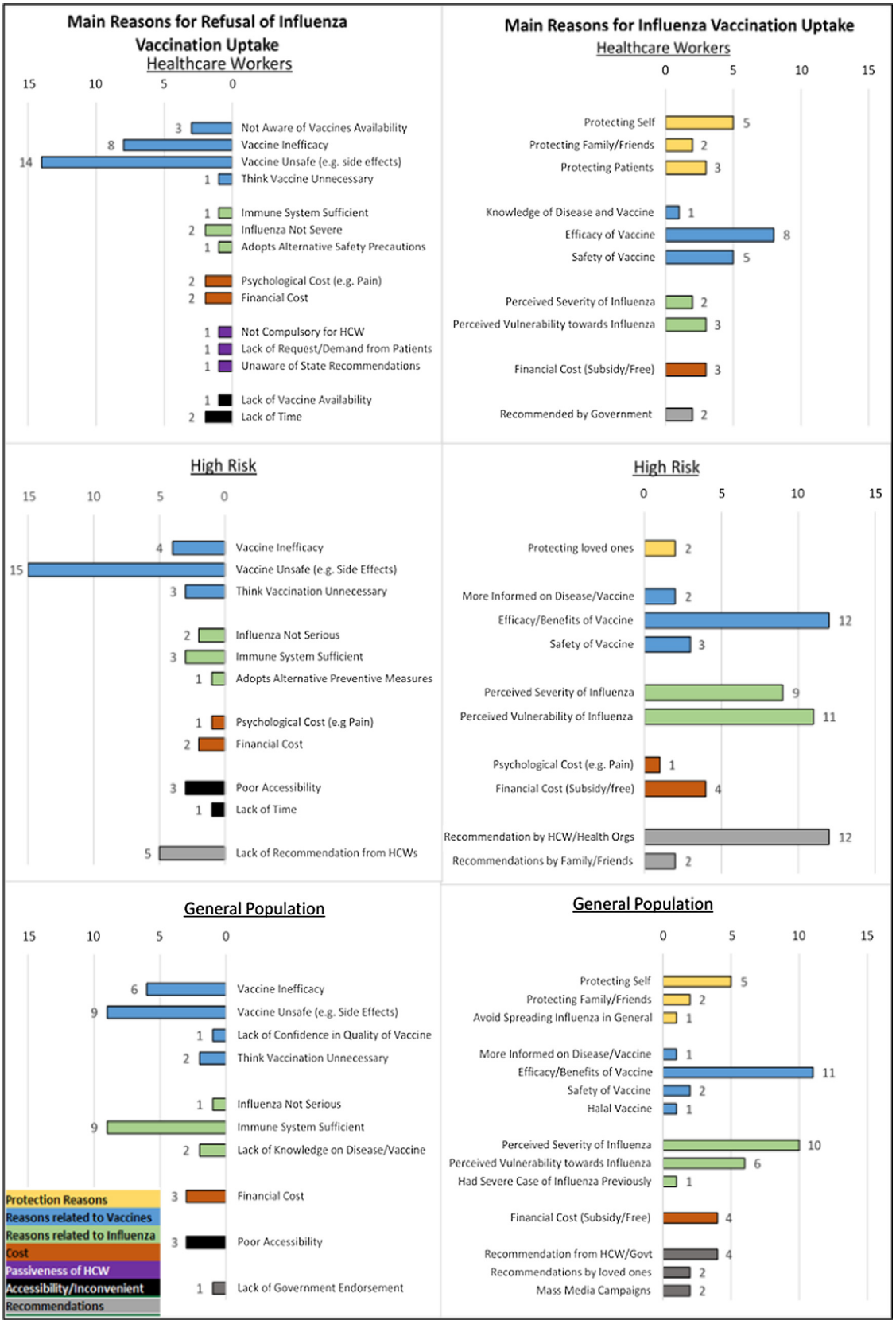


Fig. 4. Main Reasons for Vaccine Uptake and Refusal for each population group.

the efficacy of the vaccination (N = 11) and perceived severity of, and vulnerability to influenza (N = 10, N = 6). The belief in vaccine's effectiveness as a determinant for influenza vaccination uptake was highlighted in many studies [14–16,19,20,22,26–31]. For example, Yang et al. (2015) found that perceiving a new influenza vaccine to be more effective than the old one was one of the most common reason for intending to vaccinate against influenza [15].

The belief in the vaccine's efficacy as a main motivator for vaccination was also largely related to their perceptions of influenza's severity. Many of the studies that documented "vaccine's efficacy" as a main reason for vaccination, also captured respondents' fear of influenza. For instance, Liao et al. (2011) [27] found that vaccinated respondents who were fearful of swine flu, also believed in the vaccine's protective effects. However, those who were unvaccinated did not perceive H1N1 to be severe and had doubts on the vaccine's safety. Thus, fear and believe that the vaccine can alleviate their perceived risk were often cited together as major motivators for influenza vaccination acceptance.

In addition, vaccinated individuals within general populations are driven by influences from health authorities, community groups and the media (N = 8) [32–34]. In Hong Kong, during the 2005/2006 influenza season, a major reason for those who were vaccinated was due to the vaccination being arranged by community groups, such as home services, employers, community centres, elderly centres and religious groups [33]. In another study by Sundaram et al. (2015) in India, the major reasons for uptake included recommendations from a HCW or an affiliation with the health system [34].

For studies that mentioned "cost" as a major reason for vaccination acceptance [17,18,35–39], all of them cited "free vaccination" as the motivator for uptake. However, one qualitative study on India found that free vaccination was less valued by some respondents and led to hesitancy in uptake instead. This sentiment stemmed from a lack of trust in government services and doubts over the quality of the vaccines [40].

The main reasons for vaccination refusal within general populations, were their perceived vulnerability to influenza (N = 9), doubts over the vaccine's safety (N = 9) and efficacy (N = 6) Many did not perceive themselves to be vulnerable to influenza and thus did not see vaccination as necessary. The perception of low vulnerability towards influenza was described in terms of a good immune system or a low chance of getting influenza. For example, Heo et al. (2013) found that among the non-vaccinated, 32% felt that they were "healthy enough to not require vaccination" (p. 4) [41]. Furthermore, this perceived lack of vulnerability was also described as a "lack of concern about individual risk" (Yi et al., 2011, p. 6) [42].

Doubts over the vaccine's safety was also a major concern for those unwilling to accept influenza vaccination. The perception that there will be side effects or adverse reactions from the vaccination was a recurring belief across Asia. For instance, Tsai et al. (2014) found that in Taiwan, 30% of those unwilling to receive vaccination were concerned with the vaccine's safety [43]. In Hong Kong, general population's doubts on vaccine's safety were informed by news that reported on the side effects of influenza vaccines [15].

Just as confidence in the vaccine's effectiveness was a major reason for uptake, the lack of trust in vaccine's efficacy was also a significant deterrence in vaccination. Chan et al. (2015) found that those who refused vaccination felt that it was not effective and believe that they will still be infected despite vaccination [44].

3.4. Healthcare workers (HCWs)

32 papers had information on HCWs vaccination rates, and 25 of which examined HCWs reasons and/or barriers for influenza vaccination uptake.

Belief in the efficacy/benefits of influenza vaccine was most frequently cited by the relevant literature as a main factor in HCWs decision to get the influenza shot (N = 8) [45–47]. Mak et al. (2013), found that medical students not only had a higher vaccination rate than doctors, but also held stronger beliefs about the benefits of vaccines. Moreover, higher vaccination acceptance by medical students was also due to their stronger beliefs in the vaccine's efficacy to protect themselves and their patients (77.2%, 85.8%), as compared to doctors (58.7%, 52%) [46]. As seen in Fig. 4, the motivation to 'protect self and others' as a reason for vaccination uptake was also more frequently highlighted as a predictor of uptake [48–50]. Chor et al. (2011) found that HCWs willingness to accept pre-pandemic influenza vaccination was a main reason for their acceptance [47].

Perceived vaccine safety was also found to be a predictor of uptake amongst HCWs, both for themselves and as an indicator of whether they recommend vaccines to patients [43,47,51]. Praphasiri et al. (2017) found that amongst Thai physicians who recommend influenza vaccinations to pregnant women, a higher proportion of them (80.9%) perceive vaccination to be safe for pregnant women, as compared to non-recommending physicians (64.1%) [52].

Perceived severity (N = 2) and vulnerability to influenza (N = 3) were less frequently cited as a main motivator to get vaccinated, as compared to safety and efficacy of the vaccination. A qualitative study by Sundaram et al. (2018) had a doctor describe influenza as merely "one of the many viruses we catch every day. It is routine" (p. 1999) [53]. However, a few studies did worry about getting influenza [54].

Conversely, the main reasons for refusing the influenza among HCWs vaccine included the belief that influenza vaccine is unsafe (N = 14), followed by perceived vaccine inefficacy (N = 8). Literature suggests that HCWs are afraid of adverse reactions or side effects from the vaccination [16,18,50,51,53,55–69]. Sundaram et al. (2018) work, found that HCWs vaccine hesitancy was partly due to suspicions and distrust over statistical data on vaccine efficacy [53]. Bali et al. (2013) and Koul et al. (2014) reported that many HCWs in India held a belief that side effects were often under-reported and that vaccination programs were driven by profit [58,70]. Time issues were also cited as a reason for not getting vaccinated [71].

3.5. High-risk groups

With reference to Fig. 4, the main reasons for high-risk groups' uptake of vaccination is receiving 'recommendation from HCWs or government organizations' (N = 12), the belief in the 'efficacy/benefits of influenza vaccine' (N = 12) and their perceptions of the severity and vulnerability towards Influenza (N = 8, N = 11). The reliance and responsiveness across high-risk groups towards the recommendations from HCWs or health organizations was repeatedly cited in the literature reviewed [13,20,22,61,72–80]. For example, in Wu et al. (2017) and Yang et al. (2017) found that within Singapore and Hong Kong, the diabetic patients were more likely to get vaccinated when receiving advice from HCWs, with 78.5% and 42.9% participants citing it as a main factor, respectively [22,79]. High-risk groups also appear to be responsive to cues of actions from authoritative sources such as health and government organizations. Heo's et al. (2013) found that the most "triggering" event for high-risk groups to get vaccinated was obtaining a notice from a public health organization [13].

The belief in the effectiveness of influenza vaccine was also a recurring factor in influencing vaccine uptake (N = 12). Kwon et al. (2010) found that high-risk groups who believe in the vaccine's efficacy were 1.57 times more likely to get vaccinated [16].

In addition, the perceptions on the severity of influenza and their vulnerability to it was a major theme in high-risk focused literature. Yu et al. (2014) looked at diabetes patients in Taiwan, and found that individuals who believe that they are susceptible to contracting influenza, also believe that the infection will pose a more severe threat to their health [81]. This interactive dynamic between perceived susceptibility and perceived severity of influenza was also highlighted in Kwong et al. (2009) study [76] and several others, where perceived vulnerability to and perceived severity of influenza were often conjointly mentioned as main factors for high-risk groups' vaccine uptake [22,79,82–84]. Yuen et al. (2016) qualitatively found both factors as main themes in affecting vaccine uptake amongst pregnant women [83].

While the perceived threat to influenza was a main factor for vaccination uptake, perceptions about the vaccine were found to be main reasons for vaccine refusal. A large number of studies [13,14,16,18,20,61,64,73–75,79,81,85–87] reported that doubts on the safety of vaccines were the main barriers amongst high-risk groups. (N = 15) The fear of vaccine safety was most prominent in studies that examined pregnant women's attitudes towards influenza vaccination. Their fear was often twofold, as they believed that vaccination would pose harm to themselves and their foetus [61,73,75,85,87]. Individuals with chronic illness were also concerned with vaccine safety. Yang et al.'s (2017) and Yu et al.'s (2014) found that diabetes patients cited "side effects" as a main reason for not vaccinating [79,82]. However, for the elderly, Wu et al.'s (2017) paper on Beijing found that they were less likely to doubt vaccine safety as compared to the younger respondents [22].

Several studies [58,61,74,77,86,88] mentioned the lack of recommendations from HCWs as a main reason for not vaccinating. Song et al.'s (2017) found that 23% of unvaccinated elderly in China stated that it was because they did not receive any recommendations from HCWs. However, 78% of them were willing to get vaccinated if a HCW recommended it [61]. The same sentiment was also found in Koul et al. (2014)'s research on pregnant women in India – none were vaccinated, but all indicated willingness to receive vaccination if a HCW recommended it and assured them of the vaccine's safety [58].

In understanding the main barriers of high-risk groups, a few studies have also reported accessibility issues as a main reason for not getting vaccinated (N = 4). Matsui et al.'s (2011) found that elderly respondents in Japan described one of the inconveniences of getting vaccinated was due to their disability [20]. Cost was not found to be a predictor of uptake in several studies [89,90].

3.6. Uniform groups

Out of the literature with relevant information on students and military men's attitude towards influenza vaccination, the reasons for vaccination ranged from the belief in vaccine's efficacy, perceived severity of influenza, to recommendation from HCWs. Only 3 out of the 8 papers had attitudinal data, therefore graphs are not shown here [16,91,92]. The remaining literature consisted of data on vaccination rates and associations [17,18,21,93,94].

Kwon et al. (2010) found that the intention to get vaccinated was 2.46 times higher for Korean students and military men who had confidence in the vaccine's efficacy. The study also noted that the high vaccination rates of students and military men could be due to the convenient mass vaccination programs held in schools and military locations [16]. Suresh et al. (2011) looked at university students in India, and found that vaccinated students perceived influenza to be more serious, as compared to students who were unwilling to be vaccinated [92]. Rodas et al. (2012) found that higher knowledge of vaccination and receiving recommendation from HCWs were main determinants for vaccine uptake amongst university students in Hong Kong [91].

The main barriers for vaccine refusal amongst uniform groups were concerns over safety issues, vaccine's efficacy and the perception that they were not at risk. Suresh et al. (2011) and Rodas et al. (2012) found that the most common reasons students gave for refusing vaccination were doubts over the safety (20.5%) and efficacy (24.2%) of the vaccine and believed that they were not at risk (42%) [92].

4. Discussion

The objective of this study was to extensively investigate the literature pertaining to the attitudes, acceptance and uptake of the influenza within Asia, a continent with the largest population at risk from influenza and yet arguably less focused on within global literature searches than western countries. By focusing on Asia, this study attempted to identify important specific patterns within the continent that are missed in wider international studies and that fill a gap within the predominantly western focused literature. A comprehensive systematic review of articles published between 2008 and 2018 were searched, commencing with 15,741 articles and narrowing down to the relevant studies through methodical filtering and excluding of irrelevant content.

Findings suggest that despite Asia consisting of many countries, literature describing influenza vaccine behaviours is sorely lacking amongst several Asian countries. The majority of studies identified were not equally distributed throughout the region, but focused specifically on 11 countries, predominantly within East Asia. However, influenza continues to be a huge burden on many of the countries with limited or unavailable literature on influenza vaccine behaviours. For example, one study found that Bangladesh had an influenza-related mortality rate of 11 per 100,000 population in 2012, which was even higher in high-risk populations [95]. Yet this review found no articles exploring vaccine behaviours in Bangladesh, while much smaller, high income countries such as Singapore had several vaccine behaviour studies.

The analyses revealed that overall, consistent with existing literature, influenza vaccine uptake remains low across Asia. However, looking at the individual population groups, the reasons and barriers for influenza vaccine uptake vary. Therefore, filtering by population groups is an important consideration that sheds light on how identity, self-perception and structural barriers motivate or deter different individuals in vaccination uptake in different ways.

General populations within Asia had the lowest influenza vaccine rates among the populations reviewed. Many studies found that other groups such as HCWs were considered more critical to vaccinate and therefore subsidies were often provided to these groups, which could be a reason for lower vaccination rates in general populations. However, vaccination is important in all populations to provide herd immunity, making the chance of spreading influenza lower and therefore making the community more resilient against preventable pandemics. Across Asia, general populations are predominantly motivated by their belief in the vaccine's efficacy, perceived severity of and vulnerability towards influenza. Deterrents towards vaccine uptake within Asian general populations include risk perceptions towards influenza and concerns about vaccine efficacy. However, none of the literature on general populations explored the reasons why vaccinated and unvaccinated individuals tend to perceive severity and vulnerability differently. Further in-depth research may help complement existing literature in understanding how risk perceptions are formed to encourage general populations to be vaccinated against influenza. In today's media world, information can be made available almost instantaneously, through both legitimized sources of information and inadequate information sources. The exploration of the

literature suggests conflicting and inadequate news reports on vaccine safety and efficacy could be a contributor to the confusion and concern about vaccine efficacy for not only the general population, but all groups.

The main determinant for HCWs influenza vaccine uptake within Asia were found to be perceptions about vaccines. The analyses found that vaccinated HCWs were more confident in the vaccine's efficacy and safety, while unvaccinated HCWs were mostly deterred by safety concerns. Some HCWs were also suspicious of the healthcare industry's intention behind influenza vaccination programs. In addition, the literature has shown the effect vaccine recommendations from HCWs have on other population groups, especially the high-risk groups, and should be taken advantage of in a bid to improve vaccination rates across populations. However, despite the extensive amount of research that proves the safety of vaccines, HCWs in Asia lack confidence in influenza vaccines. As noted by Sundaram et al. (2018), it might be a misstep to merely educate and convince HCWs using statistical data on vaccine's efficacy and safety. Instead, it was suggested that effective communication requires providing HCWs with greater transparency and relatability [53]. This can be done by explaining the ambiguities surrounding the quality and synthesis of data, why vaccines continue to be recommended in spite of uncertainties and incorporating stories with evidence that can better resonate with HCWs. Thus, to increase vaccination rates amongst HCWs, strategies must customise according to HCWs unique perceptions, preferences for information, and culture. Future research should explore the root causes of HCWs distrust over vaccine's safety, with the hope of affecting a wider change in vaccination rates through recommendations to other populations.

The findings showed that many HCWs within Asia did not perceive influenza as a priority disease to be vaccinated against, believing that it is a "routine illness" that has high curability and occurs occasionally. Analysis also found that they felt they were not at risk. Yet, the nature of their occupation not only renders them more susceptible to contracting diseases, but also gives them a greater chance of infecting vulnerable patients who have higher risks of developing severe cases of influenza. Thus, changing the mind-set of HCWs towards influenza could improves both vaccination rates and their professional responsibility towards patients.

Amongst the literature reviewed, the main predictors of influenza vaccine uptake within the high-risk groups in Asia were HCWs recommendations and perceptions about influenza. This reliance and trust in health authorities may stem from their self-perceptions of poor health [96]. Indeed, analysis found that high-risk groups tend to perceive influenza as a greater threat, citing greater severity of and vulnerability to influenza as reasons for vaccine uptake. However, analysis showed that the major reason for vaccine refusal within Asia was not the lack of HCW advice, but the concern over vaccine safety. Thus, more than just a passive reliance on information from health authorities, high-risk groups also form their own opinions over the safety of vaccines. This not only highlights the greater importance of building vaccine confidence amongst HCWs to dispel the misperceptions of high-risk groups, but also a greater need to explore other information sources that high-risk groups use and how they relate to it, as compared to information from HCWs.

The findings suggest that students and the military within Asia share almost the same motivators and barriers as general populations. However, a key difference to note is that the influenza vaccination uptake for uniform groups is largely dependent on cues to actions and convenience. In Singapore, the Annual Influenza Vaccination Exercise for military personnel is mandatory and is reported to have reduced influenza infections by up to 80% [97]. While mandatory vaccination might seem to be a solution to increase vaccination rates, especially amongst HCWs, it is highly controversial and laden with ethical issues, such as the infringement of HCWs autonomy in exchange for patients' safety [98]. While it is not a problem in institutions such as the military, strategies differ based on the social group one belongs to. Thus, in addressing vaccination uptake, social structures and norms must be taken into consideration.

5. Limitations

The search strategy was restricted to papers written in English. Broadening the scope of the literature search to include other languages, especially in an Asian context, would have been useful. However, systematic reviews are a resource-intensive process, and with the large number of Asian languages available, finding resources to interpret various languages would not have been feasible. Most studies included collected data in the local language but published papers in English. English is the most widely language used in research and numerous sources were methodically explored to ensure the relevant paper were reviewed. The authors also chose to exclude sources that were not peer-reviewed and may have inadvertently missed unpublished studies that describe interventions within Asia.

In addition, this paper provided an aggregated review for all types of influenza, stratified by population groups due to the small sample size of many of the influenza subtypes. A comparison between seasonal, pandemic and other influenza types in the future would serve to further confirm or dispel the motivators/barriers towards each type of influenza vaccination.

The studies within this review vary in study designs, populations and measurements, however this is a problem facing all reviews. Nevertheless, despite variations, the studies all highlighted certain factors that were perceived as benefitting or hindering influenza vaccine uptake and call attention to the gaps within the literature that require further research.

6. Conclusions

By exploring vaccination uptake within Asia, this study identified many nuances from within the region. Influenza vaccination rates are low in all Asian populations. Across Asia, many countries lack literature regarding influenza vaccination behaviours despite being at high-risk of exposure to the disease. It is imperative that this gap within the literature is addressed in the future to garner information from underreported countries and yield a greater representative insight into Asian vaccination attitudes and behaviours. The main reasons for and deterrents against influenza vaccination uptake are relatively similar amongst different population groups, however each population group is positioned differentially in the spectrum of exposed risk towards influenza and their unique social settings that enable or disable them from accessing preventive health behaviours in different ways. Future influenza programs within Asia should attempt to communicate with HCWs and the public more effectively, with more transparency and relatability. Targeting HCWs as a group to increase confidence and knowledge of vaccines could encourage further promotion and uptake of vaccination through HCW guidance and recommendations. Educating the Asian public on legitimized media platforms and informational sources is also crucial to inform disease surveillance and policy specific to the region, to ultimately reduce the burden of the influenza.

7. Authors' contributions

Conceptualization: M.O.L., A.S., C.F.Y.; Methodology: M.O.L., A.S. Analysis: A.S., F.L.; Writing-Original Draft Preparation, A.S., F.L.;

Writing-Review & Editing, M.O.L., A.S., F.L., C.F.Y.; Funding Acquisition: M.O.L. All authors have read and approved the manuscript.

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Declaration of Competing Interest

The authors declare they have no conflict of interests.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.vaccine.2019.07.011.

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