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Influenza in the Asia-Pacific region: Findings and recommendations from the Global Influenza Initiative

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Abstract

The fourth roundtable meeting of the Global Influenza Initiative (GII) was held in Hong Kong, China, in July 2015. An objective of this meeting was to gain a broader understanding of the epidemiology, surveillance, vaccination policies and programs, and obstacles to vaccination of influenza in the Asia-Pacific region through presentations of data from Australia, Hong Kong, India, Indonesia, Malaysia, New Zealand, the Philippines, Taiwan, Thailand, and Vietnam.

As well as a need for improved levels of surveillance in some areas, a range of factors were identified that act as barriers to vaccination in some countries, including differences in climate and geography, logistical challenges, funding, lack of vaccine awareness and education, safety concerns, perceived lack of vaccine effectiveness, and lack of inclusion in national guidelines. From the presentations at the meeting, the GII discussed a number of recommendations for easing the burden of influenza and

overcoming the cu[1]rrent challenges in the Asia-Pacific region. These recommendations encompass the need to improve surveillance and availability of epidemiological data; the development and publication of national guidelines, where not currently available and/or that are in line with those proposed by the World Health Organization; the requirement for optimal timing of vaccination programs according to local or country-specific epidemiology; and calls for advocacy and government support of vaccination programs in order to improve availability and uptake and coverage.

In conclusion, in addition to the varied epidemiology of seasonal influenza across this diverse region, there are a number of logistical and resourcing issues that present a challenge to the development of optimally effective vaccination strategies and that need to be overcome to improve access to and uptake of seasonal influenza vaccines. The GII has developed a number of recommendations to address these challenges and improve the control of influenza.

Abbreviations: CDC, US Centers for Disease Control and Prevention; COPD, chronic obstructive pulmonary disease; GII, Global Influenza Initiative; GISRS, Global Influenza Surveillance and Response Systems; HCW, healthcare worker; ILI, influenza-like illness; IMR, Institute of Medical Research; NH, Northern Hemisphere; NIP, National Immunization Program; RITM, Research Institute for Tropical Medicine; SAGE, World Health Organization Strategic Advisory Group of Experts on Immunization; SARI, severe acute respiratory infection; SHIVERS, Southern Hemisphere Influenza and Vaccine Effectiveness Research and Surveillance; WHO, World Health Organization.

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1. Introduction

Seasonal influenza is an acute viral infection caused by an influenza virus of type A, B, or C [1]. Globally, annual influenza attack rates are estimated to be 5–10% in adults and 20–30% in children, resulting in 3 to 5 million cases of severe illness and up to half a million deaths each year [1]. Surveillance data suggest that most influenza cases are caused by influenza A, followed by influenza B, which accounts for 23% of laboratory detections [2]. Type C is far less common [1] and therefore not included in seasonal vaccine programs. The epidemiology of influenza, however, changes markedly from year to year and from location to location.

Vaccination is well accepted as being the most effective form of seasonal influenza prevention and hence is a critical component in decreasing the burden of disease. Vaccination is particularly important for those at higher risk of serious influenza complications (e.g., the elderly, pregnant women, infants and young children, patients with chronic illnesses, etc.) as well as for those who live

Abbreviations: CDC, US Centers for Disease Control and Prevention; COPD, chronic obstructive pulmonary disease; GII, Global Influenza Initiative; GISRS, Global Influenza Surveillance and Response Systems; HCW, healthcare worker; ILI, influenza-like illness; IMR, Institute of Medical Research; NH, Northern Hemisphere; NIP, National Immunization Program; RITM, Research Institute for Tropical Medicine; SAGE, World Health Organization Strategic Advisory Group of Experts on Immunization; SARI, severe acute respiratory infection; SHIVERS, Southern Hemisphere Influenza and Vaccine Effectiveness Research and Surveillance; WHO, World Health Organization.

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with or work with such individuals (e.g., healthcare workers [HCWs]) [1,3]. In addition to these groups, the World Health Organization (WHO) Strategic Advisory Group of Experts on Immunization for influenza vaccination recommends that countries should decide which other risk groups should be included in their own vaccination programs, based on disease burden, costeffectiveness, feasibility, and other appropriate considerations (Table 1) [4].

According to published data, the burden of influenza in some tropical and subtropical zones in the Asia-Pacific region appears to be similar to that of temperate countries, in terms of hospitalization and mortality, although data are lacking for many Asia-Pacific countries [5,6]. In contrast, the percentage of countries with a national seasonal influenza vaccination policy in the Asia-Pacific is considerably lower (26%) than in Europe and North America (76%), Central America and South America (90%), and the MiddleEast (62%) [7]. Although awareness of influenza within the region is increasing [8–11], a number of challenges to effective introduction of seasonal influenza vaccination programs remain. These include the year-round circulation of influenza viruses in some tropical areas, the frequent emergence or re-emergence of strains within the region, considerable variations in income and climate, the lack of vaccination guidelines and programs in some countries [8–10,12], and the lack of surveillance data from many areas of large landmass countries like India, in the face of contrasting seasonalities from neighboring locations [13].

[Table 1]

The Global Influenza Initiative (GII; http://www.globalinfluenzainitiative. org/) is a global expert scientific forum comprising scientists, researchers, and clinicians with expertise in epidemiology, infectious diseases, immunology, and public health. It was founded in 2012 with the objective of strengthening and communicating scientific evidence on the epidemiology and disease burden attributable to influenza. The mission of the GII is 3-fold: (1) to prevent seasonal influenza worldwide through vaccination, education, and international cooperation, as informed by virologic, epidemiologic, public health, and health economic data. (2) As a priority, to establish the scientific evidence on the worldwide burden of disease attributable to influenza, and to raise the profile of influenza as an important preventable disease that warrants greater public health attention and improved vaccination strategies. (3) To make recommendations on seasonal influenza vaccine strategies, on how influenza vaccines should be delivered, and on which groups should be vaccinated [14]. Due to the paucity of data regarding influenza in the Asia-Pacific region, one of the specific objectives of the fourth GII Roundtable Committee Meeting in Hong Kong in July 2015 was to gain a broader understanding of influenza epidemiology, surveillance, vaccination policies and programs, and obstacles to vaccination in the region. This was achieved through presentation and discussion of data from Australia, China, Hong Kong, India, Indonesia, Malaysia, New Zealand, the Philippines, Taiwan, Thailand, and Vietnam, as a broadly representative selection of locations in the region. This article summarizes the findings of the meeting in relation to the Asia-Pacific region.

2. Influenza surveillance and seasonal patterns

2.1. Surveillance

Together, the WHO South-East Asia and Western Pacific regions include almost 40 countries, with influenza data for approximately 23 of these submitted via national epidemiological institutions and the Global Influenza Surveillance and Response Systems (GISRS) (Fig. 1 [15,16]). Countries not submitting data included Myanmar, the Democratic People's Republic of Korea, and East Timor, and some smaller Pacific Island countries. Where surveillance is available, however, the extent and type varies across the region.

[Figure 1]

In Australia, surveillance is carried out through the National Notifiable Disease Surveillance System, the Australian Sentinel Practice Research Network, and the online FluTracking system. Similarly, New Zealand has had a national, general-practice, sentinel-based surveillance program in place since the early 1990 s and additional outpatient and hospital-based programs in recent years [17,18]. In India, surveillance has also been conducted through cooperative agreements between the US Centers for Disease Control and Prevention (CDC) and the Indian Council of Medical Research. An integrated disease surveillance program under the National Centre for Disease Control (NCDC) conducts outbreak surveillance. However, there are few regional surveillance centers in this large and populous country. National surveillance in Indonesia was set up in collaboration with the US CDC in 2006, with monitoring of influenza-like illnesses (ILI) via 26 centers and severe acute respiratory infection (SARI) via six hospitals, as well as regional testing facilities for seasonal and avian influenza. An influenza surveillance system has been in place in Malaysia since 2003 for ILI, and more recently for SARI as well, with capacity for laboratory testing of samples. In Hong Kong, Taiwan, and Thailand, there are national surveillance programs for ILI that include sentinel sites, and weekly status reports are produced. A similar program in Vietnam consists of 15 sentinel sites and distributes monthly bulletins in the northern, central, highland, and southern regions of the nation. In 2004, the Research Institute for Tropical Medicine established the National Influenza Centre in the Philippines, consisting of 2 sentinel sites in 12 of the 17 administrative regions [19], and in 2006, a clinic- and hospital-based sentinel influenza surveillance system was implemented with support from the US CDC.

2.2. Seasonality

The seasonal pattern in Taiwan is that of a temperate Northern Hemisphere country, while in Australia and New Zealand in the Southern Hemisphere, a converse pattern is seen with peaks occurring during May to September. Countries in tropical and subtropical regions often show activity throughout the year, although more complex patterns of influenza activity may occur. In Thailand, seasonal influenza follows a pattern typical of areas with a tropical climate, with activity year-round, although there is a midyear peak in influenza activity and ILI cases during the rainy season (June to September) [20]. The situation in Vietnam is similar with yearround influenza, and the disease occurs slightly more often in February to March and June to September, coinciding with the rainy seasons [21]; there is no clear difference in influenza activity between the north and south of the country. In Indonesia and Malaysia, influenza activity is also present year-round. In Malaysia, seasonal influenza peaks in the dry (April to June) and wet (October to January) seasons; however, there appears to be a trend for more activity in the later and earlier months of the year in Indonesia (i.e., a pattern typical of the Northern Hemisphere). Although the Philippines is located in the Northern Hemisphere, the seasonal influenza activity follows a pattern typical of the Southern Hemisphere. In Hong Kong, the picture is more complex: there are distinct winter (e.g., January–March) [22] and summer (e.g., June–August) peaks [23]. The size and climatic diversity of India is reflected in the pattern of seasonal influenza. Peaks in the number of cases in India mostly coincide with the monsoon season (i.e., July to September), except in the most northern states, where influenza is most prevalent between January and March [24,25]. Available surveillance data show that peaks in type B strain activity seem to follow similar seasonal patterns to influenza A within the region. Both type A and B are present, although the relative prevalence of type B varies from year to year [2].

In China, 3 distinct seasonal patterns have been identified that are aligned with climactic zones: Northern provinces (latitudes >33°N) experience winter peaks (January); Southern provinces (latitudes <33°N) experience Spring peaks (April–June); provinces in intermediate latitudes experience semi-annual peaks in March and October. Consequently, vaccination campaigns would have to be timed regionally to the appropriate seasonal pattern [7].

2.3. Presence of influenza A and B in the Asia-Pacific region

In general, as in the other regions of the globe, influenza A remains the predominant influenza type in circulation in the Asia-Pacific region, followed by type B and then type C. Influenza B accounted for 23.2% of all influenza cases in New Zealand (12 seasons, 2000–2012), and 23.5% in Australia (11 seasons, 2001–2012) [21]. Data from the Southern Hemisphere Influenza and Vaccine Effectiveness Research and Surveillance (SHIVERS) for the 2012–2015 season show that, in regard to ILI and SARI, influenza A was consistently dominant [26–30]. In Thailand, influenza data from 2007–2013 showed 35.4% of cases were attributable to influenza B [31], whilst published data from 2009–2014 showed 18.2% of samples obtained from patients with ILI tested positive for influenza B viruses [20]. However, the circulating influenza strains based on data from sentinel sites between November 2014 and January 2015, type B only accounted for 14% of cases (50% of which were of the Massachusetts [Yamagata] lineage) [32]. Data from the Taiwan CDC show that in regard to ILI, there are periods in which influenza B is dominant [33–35]. According to data obtained from the WHO's Global Influenza Surveillance and Response System (GISRS; covering the period 2007–2013), the proportion of influenza cases attributable to type B was 37.8% in India, 28.9% in Malaysia, and 16.2% in the Philippines [31]. Influenza surveillance data from India show a similar pattern over the period 2004–2008, with influenza A being the predominant type detected [36]. However, sentinel data show that in certain years and regions of India, type B was dominant. Additional data for the Philippines obtained from FluNet shows that over the time period 2003–2013, influenza B was the dominant type in 2005, 2008, and 2013 [37]. Furthermore, in Malaysia, data from the Institute of Medical Research (IMR), a part of the Ministry of Health, show that influenza B was dominant in 2005, 2012, and 2013 during the 2003–2014 period [Institute of Medical Research (IMR), Ministry of Health, Malaysia]. In Indonesia, data from the Indonesian National Influenza Centre indicate that between 2010 and 2014, influenza A was generally the predominant type, although type B was dominant during some weeks [38]. Data from the WHO GISRS show similar results for the period 2014–2015 [37]. In Hong Kong, data covering the period 1998–2011 indicate that type A was dominant, as seen in most other Asia Pacific countries [23,39]. Vietnam data differ from these regions, with influenza B accounting for 72.4% of influenza cases over 7 influenza seasons (2006–2013) [21]. the predominant type, although type B was dominant during some weeks [38]. Data from the WHO GISRS show similar results for the period 2014–2015 [37]. In Hong Kong, data covering the period 1998–2011 indicate that type A was dominant, as seen in most other Asia Pacific countries [23,39]. Vietnam data differ from these regions, with influenza B accounting for 72.4% of influenza cases over 7 influenza seasons (2006–2013) [21].

2.4. Timing of vaccination

Annual vaccination is required to protect against constantly evolving influenza viruses. Development of seasonal influenza vaccines is based on data obtained through the GISRS, and technical consultations using these data are organized by the WHO in February and September each year to recommend which strains should be included in the Northern and Southern hemisphere vaccine formulations, respectively. As their names suggest, vaccines developed primarily for use in temperate locations are designed against strains anticipated in the following Northern Hemisphere autumn (Northern Hemisphere vaccine) and the following Southern Hemisphere autumn (Southern Hemisphere vaccine) [40].

An overview of vaccination timings in the region is given in Table 2 [9,22,24,25,41,42]. In countries such as Taiwan, where there is a typical Northern Hemisphere pattern, the Northern formulation and vaccination timings are employed. In Australia and New Zealand, the Southern formulation and timings are employed. As might be expected, the situation in tropical and subtropical countries is less clear-cut. Although patterns of disease are broadly similar in Thailand and Vietnam, for example, Southern Hemisphere vaccines are used for vaccination between June and August in Thailand,

whereas Northern Hemisphere formulations are employed in Vietnam and administered year-round. The latter is also the case in Malaysia; whereas in Indonesia, Northern and Southern hemisphere vaccines have been used, depending on availability at the time of vaccination (Table 2).

Due to the timing of the January–March peak in disease, Northern Hemisphere vaccines and scheduling had been employed effectively in Hong Kong [22,23]; however, apparent poor vaccine effectiveness in 2014/2015 led to recommendations for additional vaccination in the spring of 2015 using the Southern Hemisphere formulation for the elderly and all those living in residential care homes for the elderly, to protect against the summer influenza peak (Table 2). Although the Philippines also lies north of the equator, Southern Hemisphere vaccines, ideally administered in May, are recommended to match the observed Southern Hemisphere–type seasonal pattern of influenza. In India, vaccination timing is also governed by response to local conditions. In most of the country, vaccination in April and May is recommended to protect against influenza during the monsoon period; however, in the far north of the country, where more temperate climatic conditions prevail, vaccination in the Northern Hemisphere autumn is recommended to protect against peak activity in the winter months (Table 2).

[Table 2]

3. Burden of illness

In Vietnam, where the disease burden is highest in infants and children, two-thirds of influenza cases are in those aged < 14 years (data from 2010–2014). Similarly, in the Philippines, during the period 2009–2011, the highest disease burden was reported in young children [43]. Meanwhile, the highest proportion of deaths occurred at the extremes of age, with 42% in adults agedP60 years and 27% in children aged <5 years [43]. Further data from the Philippines, covering a wider, and more recent period (2005–2015), support these earlier findings; the proportion of influenza-positive specimens reported from the National Influenza Centre showed two-thirds of all positive specimens in the 2-month to 4-year age group, and one-quarter in the 5–14-year age group (data from 2005–2015; RITM surveillance data, data on file). Also, in Indonesia, young children are most affected in terms of pneumonia from SARI, while the elderly are most affected in terms of deaths from SARI (followed by those aged <1 year) [44]. Meanwhile, in Malaysia, influenza is responsible for >80% of respiratory viral infections in infants aged <6 months and 20% in children aged 1–5 years. In contrast, influenza with complications in Taiwan is most common in adults aged P65 years (27.6/100,000) versus adults aged 25–50 years (2.6/100,000). A study in India of 266 patients with ILI or SARI illustrates the burden in pregnant women. Fifty patients (18.8%) tested positive for influenza, 9 required admission (5 for respiratory failure), and 4 died (3 with the illness developing in the third trimester) [45].

4. Current vaccination recommendations

Current recommendations from countries within the Asia-Pacific region regarding who should receive seasonal influenza vaccination are outlined in Table 3 [8,9,24,25,42,46–52]). According to a 2011 survey of national influenza guidelines from 36 countries in the Western Pacific Region, 50% of countries had established seasonal vaccination policies, 19% had recommendations for risk groups, and the remainder (30%) had no policies or recommendations in place [8]. Among the countries with no policy in place were Cambodia, Lao People's Democratic Republic, Myanmar, and many small island nations; this was also reported in another survey for Southeast Asia [8,9].

Countries in the region that have recommendations in place typically cover key risk groups proposed by the WHO; however, uptake varies and barriers remain. Australia recommends vaccination for all individuals aged P6 months but funds vaccination only for some groups

recommended by the WHO (pregnant women, adults aged P65 years, and those with certain chronic illnesses), plus aboriginal children aged 6 months to <5 years and aged P15 years found to be at higher risk of influenza-related complications and mortality [46]. In contrast, Vietnam recommends influenza vaccination for children aged 6 months to 8 years, the elderly, those deemed at high risk due to certain medical conditions, and HCWs [9]; however, there is currently no vaccination funding in place. Thailand recommends vaccination of infants and toddlers, the elderly, pregnant women, those with certain chronic diseases, and HCWs [9]. Vaccines are supplied via the Ministry of Public Health, and vaccination coverage in HCWs is very high (99%), but remains low in the elderly (29%) [53]. In Taiwan, routine vaccination is recommended and free of charge for children aged 6 months to 12 years, elderly people aged P65, HCWs, and also poultry workers [54]. Again, coverage in HCWs is good (>80%), but less so (about 40%) in poultry workers and the elderly, and is lower in young children (50%) compared with children aged >6 years (>75%) [55]. Vaccination recommendations from the Pediatric Infectious Disease Society of the Philippines [51] and the Philippine Society for Microbiology and Infectious Diseases are shown in Table 3 [52], with vaccination available free of charge for some risk groups.

Recommendations encompassing various risk groups have also been published for Hong Kong [22,42]; and for many in these groups, vaccination is available free of charge via public medical facilities. School-based vaccination is also being considered for children due to the recent high incidence in this group. Uptake in children has been low in recent years (<10%), and in 2014 was <30% in HCWs and 40% in the elderly (aged P65 years) [56]. Uptake in children has also remained low in New Zealand, although it is provided free of charge for children aged <5 years with significant respiratory illness (but not all young children), pregnant women, those aged P65 years, and HCWs [49].

In Malaysia [9], vaccination of infants and children is optional but vaccination is recommended and publicly funded for Hajj pilgrims, the elderly, institutionalized individuals, household contacts/caregivers of children at high risk, patients with chronic obstructive pulmonary disease, and HCWs. Vaccination of Hajj pilgrims is recommended and publicly funded in Indonesia [9] and, although no recommendations are in place for other groups, infants and HCWs are also often vaccinated.

Guidelines have recently been published by the Indian Ministry of Health and Family Welfare and include vaccination of young children (6 months to 8 years of age), the elderly (P65 years of age), pregnant women, patients with some chronic illnesses, and HCWs [50]. However, vaccination uptake has been poor in at-risk patients and key target groups (e.g., <10% in patients with diabetes, as low as 0% in patients with COPD and pregnant women, and 10% of obstetricians) [57–59], and in healthcare workers [60]. Furthermore, influenza vaccination has not been adopted in the universal immunization program of the Ministry.

[Table 3]

China has established technical guidelines recommending seasonal influenza vaccination for pregnant women and family members of infants <6 months old, children aged 6 months to 5 years, adults aged P60 years, persons with specific chronic illness, and healthcare workers [48]. However, China has not included influenza vaccine in its National Immunization Program (NIP). Despite several cities having established funding for free vaccination of some high priority populations, absence of influenza vaccine from the NIP guidelines is thought to contribute strongly to China's low influenza vaccination rate of 1.5–2.2% of the general population (2004–2014 data) [61].

5. Barriers to vaccination

A range of factors act as barriers to vaccination in different countries within the region, including geography/logistics, funding, lack of vaccine awareness and education, safety concerns, perceived lack of vaccine effectiveness, and lack of inclusion in national guidelines. Geography and vaccination logistics are barriers to vaccination in countries such as Vietnam, where most vaccinated patients are located in urban areas. Similarly, in India, the logistics associated with the need to vaccinate at specific times in different areas hamper national vaccination programs. Insufficient or absent public funding are barriers in India, the Philippines, and Vietnam, particularly when there is a need to import seasonal influenza vaccines. The need for improved local surveillance and vaccine effectiveness data may hamper effective rollout programs, as noted for India and the Philippines.

The benefits of vaccine awareness and education are illustrated by the ongoing HCW education programs in Thailand, where uptake rates of >99% among HCWs have been attained. Lack of HCW awareness and education have been cited as barriers to uptake in Hong Kong and India. In India, for example, 32% of HCWs were not aware of the vaccine, and 18% did not perceive vaccination as effective [60]. Lack of communication about vaccination was also noted in the Philippines. In India, patients with diabetes appeared to have a lack of knowledge about vaccination [58], and pregnant women frequently cited lack of knowledge about vaccination, perceived lack of vaccine effectiveness, and belief that the disease is not as severe as reasons for not being vaccinated [59].

Safety of seasonal influenza vaccines for children was noted as a concern in Hong Kong and Australia. In Australia, vaccine reaction/safety issues in children are reported via a specific surveillance system in an attempt to allay safety concerns [62]. Safety concerns were also noted as a reason for not vaccinating by HCWs in Hong Kong. In Taiwan, 21% of influenza vaccine refusals in the elderly were due to safety concerns [63].

Lack of inclusion of groups within national guidelines or lack of national guidelines could also be an obstacle to organizing seasonal influenza vaccination programs. Finally, the reasons for low uptake may not always be apparent.

In China, patients do not receive national insurance reimbursement for the cost of receiving the influenza vaccine. Although a few large cities have established local funding for the vaccination of seniors and school-age children, lack of national funding was assessed as an important barrier to vaccination uptake. Only 1.9% of the overall population and 4.3% of urban residents aged >60 years received the influenza vaccine in the 2008–2009 and 2011–2012 influenza seasons. In locations where free influenza vaccination was introduced, uptake increased substantially (e.g. 43% of elderly Beijing residents accepted free vaccinations in 2010, whereas only 1.7% paid to receive vaccinations in 1999). However, the cost of adding influenza to the NIP will be high, considering that there is a priority population of over 400 million (i.e. the elderly, those with chronic illness, children aged 6–59 months, and pregnant women) and the total population is over 1.4 billion. Assuming only 20% of the priority population accepted free vaccination, the cost is estimated to be US$757 (95% confidence interval 726–789) annually. Additional challenges are the capability to produce adequate supplies of vaccine and to ensure cold-chain distribution throughout the country [7,61].

6. GII recommendations

From the presentations and discussions at this roundtable meeting, the GII has developed a number of recommendations for easing the burden of influenza and overcoming the current challenges in the Asia-Pacific region. These are outlined in Table 4 and encompass the need to improve surveillance and availability of epidemiological data; the development and publication of national guidelines, where not currently available, that are in line with those proposed by the WHO; the requirement for optimal timing of vaccination programs according to local or country-specific epidemiology; as well as calls for advocacy and government support of vaccination programs in order to improve uptake and coverage.

7. Discussion

The presentations given at the fourth GII Roundtable Committee Meeting provide a great insight into the situation of influenza in the Asia-Pacific region and show a highly complex picture of seasonal influenza. From these presentations and the published data, it is clear that there are a number of issues and barriers relating to vaccination in the region that need to be addressed if improvements are to be made. What is most apparent is that the importance of understanding and preventing seasonal influenza in the region cannot be understated, as these are central to the allocation of preventive and supportive resources, guide implementation of the optimal vaccination strategies for that area, allow identification of the emergence and re-emergence of active influenza strains, and also provide the basis on which future seasonal vaccines are developed. These data also contribute to a better understanding of the true global picture of influenza.

To overcome a number of the practical and logistical barriers, the WHO Global Action Plan for Influenza Vaccines was initiated to increase seasonal vaccine use, vaccine production capacity, and research and development for better vaccines [64]. Additionally, the Asia-Pacific Alliance for the Control of Influenza was set up to raise awareness of influenza, its impact, and the mechanisms for controlling influenza; establish and provide ongoing support to national influenza foundations or similar groups; identify the burden of disease in the Asia-Pacific region, and ensure best practice in prevention and treatment of influenza [10].

Influenza surveillance is variable across the Asia-Pacific region, with sophisticated, rapid-reporting networks in some countries, and patchy or limited coverage in others. As would be expected for a region that spans the Northern and Southern hemispheres as well as temperate, subtropical, and tropical regions, timing of seasonal influenza peaks differs across the region, with various factors influencing epidemic patterns [7,25]. Determining the optimum timing of seasonal vaccination in the region is not a simple undertaking, given the variances in a number of factors that appear to drive the timing of influenza peaks within the region, not all of by-country basis [25,41,65]. This is an issue that needs to be addressed in some detail and requires underpinning by better quality local surveillance than is currently available across the region [7,25].

[Table 4]

Influenza B is slightly more common in tropical regions than in temperate zones [2]. Findings from the Global Influenza B Study suggest that influenza A and B circulate independently within the inter-tropical belt, and in general (but not in all countries) have small epidemic peaks throughout the year and a longer season than in temperate countries [2]. In general, influenza A is predominant in the Asia-Pacific region, although influenza B often breaks through (both in specific years and weeks, as well as in specific subregions). Determining optimal time for vaccination in countries across the region will therefore require increased local surveillance and further data for both influenza A and B [21].

The data presented suggest that children are the group with the greatest rates of hospitalization due to seasonal influenza. The burden of influenza in pregnant women was noted for India; however, data on influenza in pregnant women are lacking for many countries in the region. Childhood vaccination was previously noted as of less priority in most Southeast Asian countries [10]. National guidelines have been developed by governmental or professional bodies in a number of countries in the region; however, recommendations do not always mean that free-of-charge or subsidized vaccines are available. Also, a few countries still have no guidelines or recommend vaccination only for highly specific groups, but these often include such WHO-recommended key risk groups as young children, those at high risk of complications due to medical illnesses, pregnant women, and older patients. Where guidelines are incomplete or lacking, there is a need to ensure that they become available in order to support introduction and uptake of seasonal vaccination consistent with WHO

aims. Successful projects in various countries, such as Thailand, have shown that with the right resources and governmental support, education and advocacy in support of seasonal influenza vaccination can be effective in increasing uptake.

8. Conclusions

The picture of seasonal influenza vaccination across the Asia-Pacific region is complex. There are a number of logistical and resourcing issues to be overcome to improve access to and uptake of seasonal influenza vaccines, including surveillance systems. Indeed, surveillance systems differ markedly across the region, both in terms of type implemented and of robustness of data generated. Enhanced and continued surveillance remains critical if we wish to further understand the epidemiology of influenza and regional differences in influenza seasonality at the regional and subregional level, especially in countries with wide latitude spans. The diverse epidemiology of seasonal influenza across multiple climatic and geographic areas also presents a challenge to the development of optimal vaccination strategies in the Asia-Pacific region. Based on the presentations and discussions at this roundtable meeting and the available data, the GII has developed a number of recommendations for reducing the burden of influenza and overcoming the current challenges in the region, which focus on enhancing the understanding of influenza in the region through better collation of data, education of the public, vaccination guidelines development, and improving access to vaccination.

Conflict of interest

BJC has received research funding from Sanofi Pasteur for a study of influenza vaccination effectiveness in China. SC, QSH, PIL, SD, and ARM have no conflicts of interest to declare. TC has received research funding from Thailand-United State Collaboration (TUC) for study of influenza epidemiology among children and vaccine effectiveness network in Thailand, and honoraria as a speaker for Sanofi Pasteur (Thailand). PAK has received research funding from Sanofi Pasteur for an investigator-initiated study of influenza in pregnancy and in diabetes in India. SRG has been a speaker for Sanofi Pasteur. SP is a paid consultant to Sanofi Pasteur, Merck & Co, and GlaxoSmithKline Biologicals.

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Tables and figures

Table 1 Recommended target populations for influenza vaccination from the World Health Organization Strategic Advisory Group of Experts (SAGE) on Immunization [4].

Most important risk group	• Pregnant women
Other recommended groups[a]	• Healthcare workers • Children aged 6–59 months • The elderly • Those with high-risk conditions
Additional	In addition to the above, countries "should decide which other risk groups to prioritize for vaccination based on burden of disease, cost-effectiveness, feasibility, and other appropriate considerations." [4]

[a] No particular priority is recommended for these groups.

Figure 1 Countries in the World Health Organization (WHO) South-East Asia[a] and Western-Pacific[b] regions that report influenza to the WHO FluNet and/or FluID programs using data from national epidemiologic institutions and the Global Influenza Surveillance and Response System (GISRS). Figure based on the WHO Influenza Reporting Global Map[c] and additional WHO country data.[a] WHO Western Pacific region data submitted from Australia, Cambodia, China, Fiji, Japan, Lao People's Democratic Republic, Malaysia, Mongolia, New Zealand, Papua New Guinea, Philippines, Republic of Korea, Singapore, Vietnam; data not submitted from Brunei Darussalam, Cook Islands, Kiribati, Marshall Islands, Micronesia, Nauru, Niue, Palau, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu.[b] WHO South-East Asia region data submitted from Bangladesh, Bhutan, India, Indonesia, Maldives, Nepal, Sri Lanka, Thailand; data not submitted from Democratic People's Republic of Korea, Myanmar, East Timor.[c] Data as of March 7, 2016.

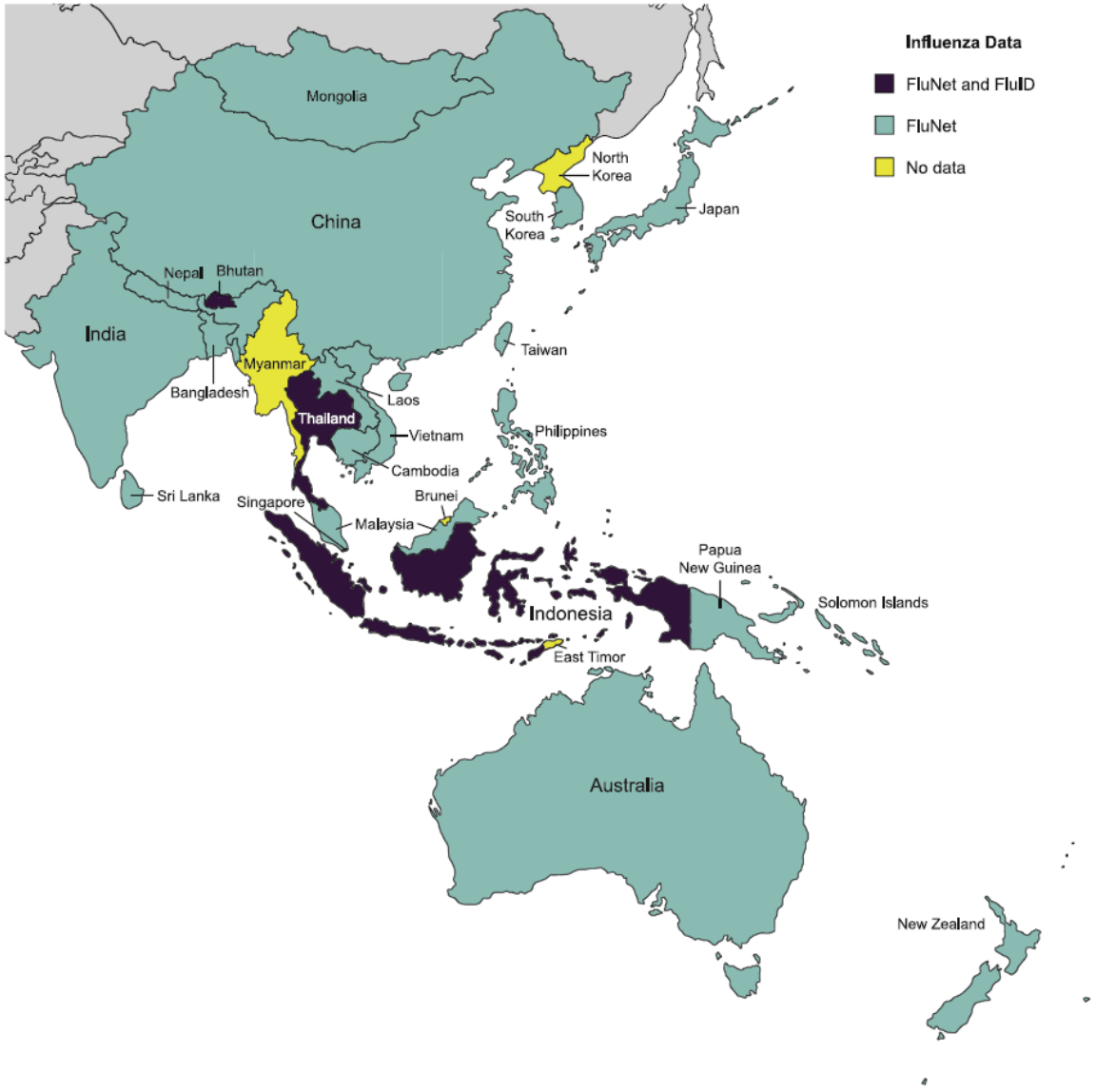

Table 2 Existing schedules for influenza vaccination in accordance with influenza activity patterns in the Asia-Pacific Region. Based on Saha et al. [24] with additional data [9,21,23,40,41]. These schedules are not necessarily associated with national policies or guidelines.

Country	Current vaccination schedule
Countries with seasonal influenza peaks	
Australia	April to June
Bangladesh	Before Hajj
Cambodia	No policy
Hong Kong	October to November (NH vaccine) May/June to August (SH vaccine)[a]
India	October to November in northern areas with temperate geography and NH-type seasonality (April to May recently recommended based on influenza seasonality dynamics [23]).
Lao People's Democratic Republic	April to May
New Zealand	March to July/August
Philippines	April to June
Taiwan	October to March/April
Countries with year-round influenza	
Indonesia	Before traveling for Hajj
Malaysia	All year
Thailand	June to August
Singapore	All year
Vietnam	All year (private market)

NH, Northern Hemisphere; SH, Southern Hemisphere.
[a] For at-risk groups as per Hong Kong government recommendations [41].

Table 3 Influenza vaccination recommendations for WHO risk groups in the Asia-Pacific region; based on data from two regional surveys [8,9] plus additional data [24,25,42,46–52]

Country	National guideline(s) available	WHO risk groups				
		Pregnant women	Children (age) and younger adults	Elderly (age)	Chronic illness	HCW
American Samoa[a]	N	Y	Y (6 m–18 y)	Y (>40 y)	Y	Y
Australia	Y	Y	Y (⩾6 m)[b]	Y (⩾65 y)	Y	Y
Brunei Darussalam	Y	Y	Y (6 m–23 y)	Y (>60 y)	N	Y
Cambodia	N	–	–	–	–	–
China[c]	Y	Y	Y (6 m–5 y)	Y (>60 y)	Y	Y
Cook Islands[a]	N	Y	N	Y (>60 y)	N	Y
Fiji	N	Y	N	Y	Y	Y
French Polynesia (France)	Y	Y	N	Y (>60 y)	Y	Y
Guam	Y	Y	Y (6 m–18 y)	Y (⩾50 y)	Y	Y
Hong Kong (China)	Y	Y	Y (6 m–5 y)	Y (⩾50 y)	Y	Y
India[d]	Y	Y	Y (6 m–8 y)	Y (⩾60 y)	Y	Y
Indonesia	Y	–	–	–	–	–
Japan	Y	N	N	Y (>65 y)	N	N
Kiribati	N	–	–	–	–	–
Lao People's Democratic Republic	N	Y	Y	Y (>50 y)	Y	Y
Macau (China)	Y	Y	Y (6 m–18 y)	Y (>60 y)	Y	Y
Malaysia	Y	N	N	Y[e]	Y	Y
Marshall Islands[a]	N	Y	Y	Y	–	Y
Micronesia (Federated States of)[a]	N	Y	Y (6 m–18 y)	Y (>50 y)	Y	Y
Mongolia	Y	N	N	Y (>60 y)	N	Y
Myanmar	N	–	–	–	–	–
Nauru	N	–	–	–	–	–
New Caledonia	Y	N	N	Y (>65 y)	Y	Y
New Zealand	Y	Y	(Y)[f]	Y (⩾65 y)	Y	Y
Niue	Y	N	N	Y (>65 y)	Y	Y
Northern Mariana Islands (Commonwealth of the)	N	–	–	–	–	–
Palau	Y	Y	Y (⩾6 y)	Y (>50 y)	Y	Y
Papua New Guinea	N	–	–	–	–	–
Philippines	Y	Y	Y (6 m–18 y)	Y (⩾50 y)	Y	Y
Pitcairn Islands	N	–	–	–	–	–
Republic of Korea	Y	Y	Y (6 m–60 y)	Y (>50 y)	Y	Y
Samoa	N	–	–	–	–	–
Singapore	Y	Y	Y (6 m–60 y)	Y (>65 y)	Y	Y
Solomon Islands	N	–	–	–	–	–
Taiwan	Y	Y	Y (6 m–12 y)	Y (⩾65 y)	Y	Y
Thailand	Y	Y	Y (6 m–2 y)	Y	Y	Y
Tokelau	N	–	–	–	–	–
Tonga	N	–	–	–	–	–
Tuvalu	N	–	–	–	–	–
Vanuatu	N	–	–	–	–	–
Vietnam	Y	N	Y (6 m–8 y)	Y (>65 y)	Y	Y
Wallis and Futuna	Y	Y	Y (6 m–60 y)	Y (>65 y)	Y	Y

HCW, healthcare worker, N, no recommendation in guideline; Y, recommendation; –, no recommendation, as no guideline available.

[a] Reported as having recommendations for seasonal influenza vaccination, but no established national policy.

[b] Vaccination funded only for individuals aged ⩾6 months with medical conditions or aboriginal status.

[c] China has technical guidelines for seasonal influenza vaccination but has not included the influenza vaccine in its National Immunization Program.

[d] India has a national vaccination policy; however, influenza vaccination has not been adopted in the universal immunization program.

[e] Elderly with chronic conditions only (i.e. those who are immunocompromised, or who have chronic cardiovascular, pulmonary, or metabolic or renal disease).

[f] Children aged ⩽4 years who have been hospitalized for respiratory illness or have a history of significant respiratory illness.

Table 4: GII Recommendations for Improving the Situation of Influenza in the Asia-Pacific Region.

- The picture of seasonal influenza across the region is complex and the surveillance systems in the Asia-Pacific region are lacking or suboptimal in many countries. The GII recommends therefore that individual countries work on improving their systems. Improved data collection may assist with strengthening the understanding of the epidemiology of influenza and assist policy makers regarding wider/increased influenza vaccination implementation
- Where vaccination guidelines/recommendations are incomplete or lacking, there is a need to ensure that they become available in order to support introduction and uptake of seasonal vaccination in line with WHO aims
- Guidelines for the vaccination of key risk groups such as young children, those at high risk of complications due to medical illnesses, pregnant women, and older patients should be developed, if not already in place
- Where possible, in order to maximize vaccine access and uptake, influenza vaccination should be made free of charge – with the key risk WHO groups the main priority for vaccination
- Individual countries need to determine the optimal time for vaccination based on their surveillance and climate data. Furthermore, countries located in the tropics and subtropics will need to determine if vaccination should be made available year-round (with NH and SH formulations) or only at specific times of the year
- The GII calls for governmental support of vaccination in the region, as this can be effective in increasing uptake
- The GII recommends increased advocacy and education of the community concerning the importance of influenza and the need for vaccination

NH, Northern Hemisphere; SH, Southern Hemisphere.