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Healthcare personnel acceptance and recommendations for influenza vaccine in twelve low- and middle-income countries: A pooled analysis from 2018 to 2020

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Abstract

Background: Although healthcare personnel (HCP) are targeted for influenza vaccination they typically under-utilize vaccines especially in low- and middle-income countries. We explored knowledge, attitudes, and practices of HCP about seasonal influenza vaccines (SIV) to identify factors associated with and modifiable barriers to SIV uptake.

Methods: We pooled individual-level data from cross-sectional surveys about SIV conducted among health workers in 12 low- and middle- income countries during 2018–2020 (i.e., Albania, Armenia, Cote d'Ivoire, Kenya, Kyrgyzstan, Lao PDR, Lebanon, Morocco, North Macedonia, Tunisia, Tajikistan, and Uganda). Eleven countries used a standard protocol and questionnaire based on the Health Belief Model to measure perceptions of susceptibility and severity of influenza disease, benefits of, barriers to, and motivators for vaccination. We analyzed attitudes and perceptions among HCP, including acceptance of vaccine for themselves and willingness to recommend vaccines to patients, grouped by the presence/absence of a national influenza vaccination program. Models were adjusted for geographic region.

Results: Our analysis included 10,281 HCP from 12 countries representing four of the six World Health Organization regions: African, Eastern Mediterranean, European, and Western Pacific. The sample was distributed across low income (LIC) (3,183, 31 %), lower-middle (LMIC) (4,744, 46 %), and upper-middle income (UMIC) (2,354, 23 %) countries. Half (50 %) of the countries included in the analysis reported SIV use among HCP in both the year of and the year preceding data collection while the remainder had no influenza vaccination program for HCP. Seventy-four percent (6,341) of HCP reported that they would be willing to be vaccinated if the vaccine was provided free of charge. HCP in LICs were willing to pay prices for SIV representing a higher percentage of their country's annual health expenditure per capita (6.26 % [interquartile range, IQR: 3.13–12.52]) compared to HCP in LMICs and UMICs. HCP in countries with no SIV program were also willing to pay a higher percentage for SIV (5.01 % [IQR: 2.24–8.34]) compared to HCP in countries with SIV programs.. Most (85 %) HCP in our analysis would recommend vaccines to their patients, and those who would accept vaccines for themselves were 3 times more likely to recommend vaccines to their patients (OR 3.1 [95 % CI 1·8, 5·2]).

Conclusion: Increasing uptake of SIV among HCP can amplify positive impacts of vaccination by increasing the likelihood that HCP recommend vaccines to their patients. Successful strategies to achieve increased uptake of vaccines include clear guidance from health authorities, interventions based on behavior change models, and access to vaccine free-of-charge.

Keywords

Influenza; Vaccines; Seasonal Influenza; Vaccination; Respiratory disease; Health workers; Vaccine hesitancy; Vaccine demand

1. Background

The World Health Organization's Strategic Advisory Group of Experts (SAGE) recommends that healthcare personnel (HCP) receive seasonal influenza vaccines (SIV) annually.[1] However, use of SIV is not evenly distributed globally, with only 6% of SIV produced globally used in Africa, Southeast Asia, and the Middle East combined.[2] While SIV are widely used in high-income countries, access is sparse elsewhere, and efforts to expand access to vaccines in low- and middle-income countries[3] have often focused on introduction of vaccines in HCP because of their occupational risk and the potential transmission to their patients. Expanded vaccine programs can enhance pandemic preparedness by establishing a mechanism to vaccinate HCP in the event of a pandemic.[4]

HCP are a gateway to improving SIV uptake for other target groups; the presence or absence of a HCP recommendation may act as either a motivator or a barrier to vaccination in patients.[5] HCP in many low- and middle-income countries are hesitant to recommend SIV to their patients despite evidence of risks associated with influenza disease and of the safety and benefits of vaccines. [6,7] Hesitancy among HCP leads to reticence to offer vaccines to patients and hesitancy among patients to accept vaccines [8]; HCP who accept vaccines for themselves often recommend vaccines to their patients.[5,9] Understanding motivators for HCP acceptance of vaccines and their recommending practices can guide campaigns to address hesitancy and increase uptake of vaccines in all target groups.

We summarize data from surveys conducted in 12 low- and middle-income countries to describe the knowledge, attitudes, and practices of HCP regarding SIV and to identify factors associated with and barriers to SIV uptake in this key target group.

2. Methods

We pooled individual-level data from cross-sectional surveys about seasonal SIV conducted among HCP in 12 countries (Albania, Armenia, Cote d'Ivoire, Kenya, Kyrgyzstan, Lao PDR, Lebanon, Morocco, North Macedonia, Tajikistan, Tunisia, Uganda) during 2018–2020. Countries used standard or very similar protocols to explore HCP knowledge, attitudes, perceptions, and practices toward influenza vaccination. We created an aggregate set of survey data using questionnaires based on the Health Belief Model [10]. Questionnaires measured HCP perceptions of disease severity, their own susceptibility to infection, barriers and motivators for their own vaccination, and benefits of vaccination for themselves and for their patients; minor questionnaire modifications reflected local contexts.

Surveys were administered in the local language primarily used in health facilities. Data from all surveys were translated to English and aligned by matching questions and answer choices.

A purposive, nationally representative sample of health facilities was selected in each country. Survey respondents included any type with direct patient contact and were selected via random sampling from staff rosters, where possible, or convenience sampling of HCP within selected health facilities. Sample sizes for countries with existing SIV programs were determined using the Fleiss formula[11] to test for differences between vaccinated and unvaccinated respondents; countries without a SIV program selected from a table of standard sample sizes at three levels of precision included in the protocol. Study site type and selection criteria may differ in Kenya, which used a protocol with minor differences in content and methodology.

Our analysis included countries with and without SIV programs for HCP. Countries reporting introduction of SIV among HCP via the WHO/UNICEF Joint Reporting Form (JRF)[12] during the year before and year of data collection, were classified as those with SIV programs. Country income status was assigned using the World Bank (WB) income group classification [13] during the survey year. Questions about knowledge and perceptions about influenza illness and vaccination were measured using a 5-point Likert scale. From these data we calculated HCP risk, benefit, and patient scores by summing positive or negative responses or correct or incorrect responses to Likert-scale questions. Positive or correct questions were valued at 1, while negative or incorrect responses were given a value of 0. Scores represent the sum of relevant questions. The risk score was calculated using the following questions 1) influenza causes mild illness only, 2) influenza may result in severe illness or death, and 3) the influenza vaccine can cause a person to get sick with influenza. The benefit score was based on the survey questions: 1) healthcare workers can transmit influenza to their family members, 2) vaccinating healthcare workers is effective in reducing their risk of developing influenza, and 3) vaccinating healthcare workers may reduce work absenteeism. Finally, the patient score was generated from the survey questions: 1) it's important for healthcare workers to be vaccinated to prevent transmission of influenza to their ill patients and 2) vaccination of healthcare workers can reduce influenza including severe illness and/or deaths in patients.

We conducted multivariable regression analysis to understand differences in attitudes and perceptions among HCP in countries with and without publicly funded SIV programs. We computed the adjusted odds ratios (aORs) of SIV acceptance among HCP in both country groups. We also calculated aORs for HCP likelihood to recommend influenza vaccines to patients. Variables included in the models were HCP gender identity, occupation, education level, duration of employment and risk, benefit, and patient scores; in countries with SIV programs, previous SIV vaccination and availability of SIV free-of-charge were also included. We conducted univariate analyses to characterize major trends across both groups. Odds ratios were adjusted by WHO region based on an assumption of regional shared cultural norms and values.

Eleven of 12 countries asked how much respondents would be willing to pay (WTP) for the SIV if it were available for purchase. Responses were recorded in local currency, and converted to US dollars (US$) using the OANDA currency converter [14] using the last date the survey was administered to approximate the exchange rate at the time of the survey. WTP data were also presented as a percent of the country's health expenditure per capita (in USD) using WB dataset summarizing data from the WHO Global Health Expenditure database [15]. WTP was stratified by income classification, profession of HCP, and presence of a SIV during the study. WTP data were analyzed using descriptive statistics and bivariate non-parametric tests (Kruskal-Wallis, Wilcoxon rank sum). Analyses were conducted using SAS (version 9.4) and R (version 4.1.3).

Each implementing partner obtained ethical approvals in accordance with local regulations. The CDC human subjects review determined the activity to be a public health evaluation. All participants provided written informed consent to participate in the surveys.

3. Results

3.1. Study population

Our analysis included 10,281 HCP from 12 countries representing four of the six WHO regions: African (4,422 respondents, 43 %), Eastern Mediterranean (1,799, 18 %), European (3,545, 35 %), and Western Pacific (515, 5 %). The sample was distributed across low- (LIC) (3,183, 31 %), lower-middle (LMIC) (4,744, 46 %), and upper-middle income (UMIC) (2,354, 23 %) countries. Half (50 %) of the 12 countries had SIV programs at the time of data collection (Table 1).

Overall, 37 % (3,801) of respondents came from countries with SIV programs for HCP, while 63 % (6,471) came from countries without such programs (Table 1). Eighty-two percent of respondents in UMICs (i. e., Albania, Armenia, Lebanon) had access to SIVs, compared with 40 % in LMICs (i.e., Cote d'Ivoire, Kenya, Kyrgyzstan, Lao PDR, Morocco, Tunisia) and none in LICs (i.e., Tajikistan, Uganda) ($p < 0.001$). Respondents included medical doctors or assistant doctors (3,123, 31 %), nurses or assistant nurses (4,365, 43 %), midwives (827, 8 %), and other HCP (1,855, 18 %). Most respondents held a university degree or higher (university degree: 6,421, 65 %; masters degree: 952, 10 %; doctoral degree: 258, 3 %), while 22 % (2,165) had vocational training, secondary school education, or less.

3.2. Vaccine-related practices & intentions

Most HCP were willing to receive SIV if it was offered for free (6,341, 74 %); a larger proportion of surveyed HCP in countries without SIV programs were willing to receive SIV free-of-charge (4,559, 81 %) compared to HCP in countries with SIV programs (1,782, 61 %) (Table 2). HCP would accept recommendations to receive the vaccine from the Ministry of Health (3,729, 45 %), international organizations (e.g., WHO) (2,677, 33 %), other HCP (2,229, 27 %), or the facility where they worked (2,014, 25 %); recommendations from family members, friends, and local NGOs were of lower importance (Table 2).

Univariate analysis found that most respondents agreed or strongly agreed that influenza may result in severe illness or death (7,032, 72 %) (Fig. 1). The majority of HCP believed that SIV is effective in reducing their own risk of influenza (5,644, 69 %) and that it could reduce HCP absenteeism (4246, 52 %), although belief in vaccine effectiveness was lower in countries with SIV programs (2,018, 54 %) than in countries without programs (3,626, 83 %). Similarly, more than two thirds of respondents (5,857, 72 %) believed HCP should be vaccinated to protect their patients, but a smaller proportion of HCP in countries with SIV programs held this belief (2042, 54 %) compared to the proportion of HCP in countries without programs (3815, 87 %). More than half of respondents across all settings either believed that (3,132, 34 %) or were unsure whether (2,191, 24 %) SIV could cause influenza illness. When assessing the association between these beliefs and willingness to accept the influenza vaccine if it is provided for free, we found HCP were more likely to accept influenza vaccine free-of-charge if they believed influenza can cause severe illness (OR 1·5 [95 % confidence interval, 95 %CI: 1·3–1·7]) as compared to HCP who did not believe influenza causes severe illness. HCP who felt confident that the vaccine would protect them from getting sick with influenza were more than twice as likely to accept a vaccine for themselves (OR 2·2 [95 % CI: 2·0–2·5]) compared to those who were less confident in the vaccine. Those who believed that SIV could cause influenza illness were half as likely to accept the vaccine (OR 0·5 [95 % CI: 0·4–0·5]) than those who did not believe the vaccine could lead to illness.

Other factors that shaped HCP willingness to receive influenza vaccine in countries with and without SIV programs are presented in Table 3. In countries without a SIV program, vaccine acceptance decreased for every year of employment (aOR 0·9 [95 %CI: 0·8–0·9] per year), while no association was detected in countries with SIV programs. Male HCP were less likely to accept the influenza vaccine in countries without SIV programs compared to females (aOR 0·7 [95 % CI: 0·6–0·9]), with no association in countries with SIV programs. In countries with SIV programs, nurses (aORs 0·6 [95 % CI: 0·4–0·8]) and midwives (0·4 [95 % CI: 0·3–0·6]) were less likely to accept vaccines than doctors or assistant doctors, while in countries without SIV programs, nurses (aOR 1·4 [95 % CI: 1·0–1·8]) and midwives (aOR 1·9 [95 % CI: 1·1–3·3] were more likely to accept SIV than doctors or assistant doctors. In countries with SIV programs, HCP were less likely to accept the influenza vaccine if it was available free-of-charge in their workplace compared to HCP working in facilities where influenza vaccine was not available (aOR 0·4 [95 % CI: 0·3–0·6]).

For countries with SIV programs, the medians and IQRs of perceived risk score, benefit score, and patient score were 2 (IQR: 1–2), 2 (IQR: 0–3), and 1 (IQR: 0–2), respectively. For countries without SIV programs, the medians and IQRs of perceived risk score, benefit score, and patient score were 2 (IQR: 1–2), 2 (IQR: 2–3), and 1 (IQR: 1–2). For countries in African Region, the medians and IQRs of perceived risk score, benefit score, and patient score were 2 (IQR: 1–2), 2 (IQR: 2–3), and 2 (IQR: 1–2). For countries in the Eastern Mediterranean Region, the medians and IQRs of perceived risk score, benefit score, and patient score were 2 (IQR: 1–2), 2 (IQR: 1–3), and 1 (IQR: 1–2). For countries in the European Region, the medians and IQRs of perceived risk score, benefit score, and patient score were 2 (IQR: 1–2), 2 (IQR: 1–3), and 1 (IQR: 0–2). For countries in the Western

Pacific Region, the medians and IQRs of perceived risk score, benefit score, and patient score were 1 (IQR: 0–2), 0 (IQR: 0–1), and 0 (IQR: 0–0).

In our multivariable analysis on the association between HCP risk, benefit, and patient scores and the likelihood HCP would accept to receive the influenza vaccine, we found that in countries lacking a SIV program, HCP that had higher scores were more likely to accept to receive the vaccine as compared to HCP with lower scores (risk score: aOR 1.3 [95 %CI: 1.2–1.5]; benefit score: aOR 1.8 [1.6–2.1]; patient score: aOR 2.1 [95 % CI: 1.8–2.5]) (Table 3). In countries with a SIV program, only higher benefit scores were found to be associated with an increased likelihood to receive the influenza vaccine (aOR 1.2 [1.1–1.3]). In terms of the association between HCP scores and the likelihood they would recommend the influenza vaccine to their patients, in both countries with and without SIV programs, HCP with higher risk scores (with SIV program: aOR 1·6 [95 % CI: 1·4–1·9]; without SIV program: aOR 1·5 [95 % CI: 1·2–1·8]) and patient scores (with SIV program: aOR 2·6 [95 % CI: 2·1–3·1]; without SIV program: aOR 3·9 [95 % CI: 3·0–5·0]) were more likely to recommend influenza vaccination to their patients compared to HCP with lower scores (Table 4).

3.3. Likelihood of recommending vaccination and priority populations

Less than half of HCP in all countries had ever made a clinical (40 %) or laboratory (13 %) diagnosis of influenza. Even so, there was no significant difference in likelihood to vaccinate or recommend vaccines between HCP who had and had not made diagnoses of influenza in both countries with (clinical diagnosis: aOR 1·2 [95 %CI: 0·8–1·0]; laboratory-confirmed diagnosis: aOR 2.0 [95 % CI: 0.8–5.4]) and without SIV programs (clinical diagnosis: aOR 1·4 [95 % CI: 1.0–2·2]; laboratory-confirmed diagnosis: aOR 1·6 [95 % CI: 0.9–2·7]).

When asked to identify the top three groups to which HCP would recommend vaccines, HCP prioritized persons with chronic conditions (21 %), followed by those aged 65 years or older (19 %), and HCP (18 %). Healthy adults (3 %) and women of child-bearing age (3 %) were least frequently prioritized. Prioritization varied by WHO region (Fig. 2); HCP in the African Region prioritized children above all other groups for vaccination (39 %), while those in the Eastern Mediterranean Region prioritized persons with chronic conditions (39 %); HCP in the European Region prioritized older adults (21 %), persons with chronic disease (19 %), and CHP (19 %) equally highly. More HCP in the Western Pacific Region prioritized pregnant women to receive influenza vaccination (27 %) compared to other WHO region.

3.4. Willingness to pay for vaccines

HCP were asked how much they would be willing to pay for SIV if vaccines were available for purchase; 4,281) respondents provided a price > US$0, with a median of US$3·36 [interquartile range (IQR): 1·35–6·59] (Table 5).Of those respondents, 1,333 (31 %) were in countries with SIV programs for HCP, while 2,948 (69 %) were in countries without programs. HCP in UMICs reported higher median willingness to pay (US$6·83 [IQR: 4·20–9·10]), followed by LMICs (US $2·86 [IQR: 1·20–5·67]) and by LICs (US$2·70 [IQR: 1·35–5·40]) ($p < 0·001$). For HCP in LICs, this represented a higher percentage of their country's

annual health expenditure per capita relative to LMICs and UMICs ($p < 0{\cdot}001$). Doctors reported the highest willingness to pay (median US$4·13 [IQR: 1·89–7·16]). The amount HCP in countries lacking SIV programs were willing to pay represented a higher percentage of their country's health expenditure per capita (median 5·01 % [IQR: 2·24–8·34]) than the price HCP in countries with vaccination programs were willing to pay (median 1·97 % [IQR: 1.31–3·31]) ($p < 0{\cdot}001$).

4. Discussion

Most HCP in low- and middle-income countries were willing to be vaccinated against influenza, especially if the vaccine was subsidized or provided free-of-charge. While most HCP in all countries surveyed would accept SIV, HCP in lower income countries and those without vaccine programs were more willing to be vaccinated than those with access to free vaccines or in higher income countries; willingness was lowest in UMICs both with and without vaccine programs. Investment in vaccines for HCP in LMICs and LICs may be met with high uptake among HCP in those countries conferring protection to them, their patients, the community at large. HCP vaccination may also increase resiliency in the healthcare system by reducing absenteeism during epidemics and pandemics.[16] Indeed, in a 2021 systematic review, Li et al. found reduced absenteeism among HCP who had received an influenza vaccine.[16].

HCP who believed influenza could cause severe illness were more likely to accept an SIV. Our findings are consistent with previous studies, including a 2020 global review that found that high perceived risk of severe influenza illness was a motivator for vaccination in both the general population and among HCP [9] and a 2017 review that found that a lack of belief that influenza can cause severe influenza illness was a significant barrier to HCP uptake [17]. Those who had treated patients with influenza were more likely to recommend vaccination to their patients [18]. Raising HCP awareness of influenza illness and its severity could help improve HCP uptake and willingness to recommend vaccines to patients.

Many HCP believed that their own susceptibility to influenza illness was low, suggesting that while confidence in SIV is strong in our sample, motivation to be vaccinated might be tempered by one's perception of personal vulnerability to infection [19]. A 2022 study of HCP attitudes in Peru found that HCP who believed themselves to be susceptible to illness if they were not vaccinated were more likely to receive SIV.[19].

Belief in the benefits of influenza vaccination for oneself, patients, family, and community was found to be a consistent driver of vaccination in our findings, and in global reviews[17,20] and high-income countries.[21] Though data from low- and middle-income countries is sparse, a study from Lebanon found similar results.[22] Belief that SIV was effective in reducing the risk both of influenza and of absenteeism in HCP was found both in our study and consistently in the literature. [23,24] Similarly, HCP who believed in the effectiveness of SIVs were more likely to recommend vaccination to their patients.[18].

Notable barriers to vaccination included low belief in the social benefits (e.g., reduced absenteeism, protection of patients or family) of vaccination[20], lack of belief in

effectiveness of vaccination and/or concerns regarding the safety of vaccines.[17,22] HCP who did not believe that influenza vaccines were useful protection against illness were unlikely to accept or recommend SIV.[25] Low perceived risk and low perceived severity among HCP were found to be persistent barriers to vaccination in a global review of JRF data for all vaccines and for influenza specifically.[20].

Consistent with other findings, we found that HCP who were willing to accept a vaccine were three times more likely in countries with SIV programs and four times more likely in countries without to recommend vaccines to their patients[5,9,18,22,25] suggesting that efforts to reduce hesitancy and increase uptake among HCP could result in greater coverage among HCP themselves and among their patients.

Pregnant women are prioritized for vaccination by WHO because of substantial evidence of adverse pregnancy and birth outcomes associated with influenza illness[26] during pregnancy. Despite this recommendation and the well-documented safety of SIVs during pregnancy [27], HCP in our study placed vaccination of pregnant women as a relatively low priority compared to other priority groups, including persons with chronic conditions and older adults. Hesitancy to recommend vaccines to pregnant women may be associated with vaccine package inserts that suggest unknown or probable harm to the fetus, conflicting with current clinical guidance.[28] HCP may be more likely to recommend vaccination to pregnant women if package inserts were revised to reflect current evidence of safety and effectiveness in pregnant women and if greater efforts were made to raise awareness of the benefits of vaccination for pregnant women and their babies.

HCP in our survey were most likely to follow advice from MOHs and WHO, suggesting that an effective strategy to increase HCP uptake and recommending practices is strong guidance from national health authorities. HCP vaccination mandates are effective in increasing vaccine coverage[29] and clearly articulated national policies are important motivators for vaccination.[21] A 2021 systematic review by Lin et al. found that a lack of clear guidelines was a barrier to vaccine recommendation.[6].

We found that, in some locations, uptake or intended uptake was low despite high knowledge of influenza disease and its potential severity. This is consistent with findings in Dubai, where HCP are offered influenza vaccines free of charge[30] and with a 2016 systematic review of interventions to increase coverage among HCP which suggested that educational campaigns may have little effect on increasing uptake.[29] Several systematic reviews of interventions among HCP suggest that interventions based on psychological theories of behavior change and dialogue-based interventions[31], along with vaccine mandates[29] are promising methods to increase uptake of SIV among HCP.

HCP were willing to pay different amounts for SIV, based on country income. While HCP in UMICs were willing to pay a higher amount for SIV, the median price that HCP in LICs were willing to pay represented a higher percent of health expenditure per capita. The amount that countries without a national vaccine program were willing to pay represented a higher percent of health expenditure per capita. These results could be interpreted as indicating that willingness to pay is greater when the value of prevention is high because

of perceived increased risks associated with becoming ill. For example, HCP in LICs with fewer health resources may be willing to pay more for prevention measures like vaccines in the face of more limited resources available for treatment in the case of severe illness. A study in Indonesia found that having higher perceived risks of becoming infected with SARS-CoV-2 was associated with higher WTP.[32] Our willingness to pay findings suggest that subsidies for SIV might be an effective way to increase access to SIV where procurement of free-of-charge vaccines is cost prohibitive. Indeed, our findings suggest that HCP are willing to pay approximately half the cost of a vaccine at the current price.

Our study used a robust dataset collected from twelve low- and middle-income countries using semi-standardized methods, allowing for direct observation of trends rather than summarizing information gathered via systematic reviews; this is the only such study of trends in low-and middle-income countries that we have found. We found few multi-country studies in low- and middle-income countries, as well as few studies comparing behaviors and perceptions among HCP both with and without broad access to influenza vaccines. Our study has limitations. First, while countries used a standard protocol and questionnaires, these may have been adapted in ways that risk the stability of the constructs being evaluated and resulting in aggregating potentially disparate concepts. Surveys may have been subject to response bias, with respondents providing responses they perceive to be favorable to interviewers. There might be a strong association between being a higher income country and having an Influenza Vaccination program, causing potential confounding issue. Lastly, we did not conduct any data weighting or hierarchical modeling aside from inclusion of country as a covariate in the multiple regression models as our data were not collected with a weighted aggregate analysis plan in place. Consequently, countries with larger sample sizes may be overrepresented in our findings.

5. Conclusion

Our findings highlight influenza vaccination of HCP in low- and middle-income countries as both feasible and useful for building a program that successfully targets other priority groups. Increasing uptake of SIV among HCP is useful to also increase their likelihood of recommending vaccines to their patients. Successful strategies to achieve increased uptake of vaccines include clear guidance from health authorities and interventions based on behavior change models.

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Data availability

Data will be made available on request.

Abbreviations:

aOR	adjusted odds ratio
HCP	healthcare personnel
LIC	low-income country
LMIC	lower-middle income country
SIV	seasonal influenza vaccine
UMIC	upper-middle income country

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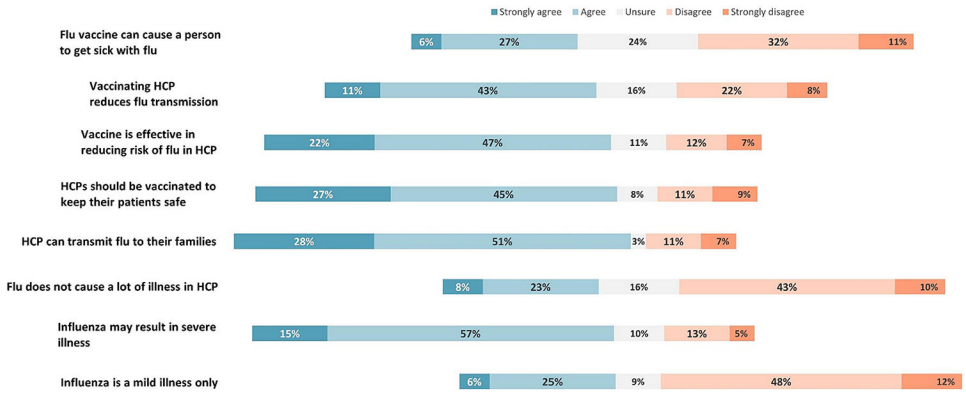

Fig. 1.

Reported beliefs and perceptions surrounding influenza and influenza vaccines among surveyed health workers (n = 12 countries).

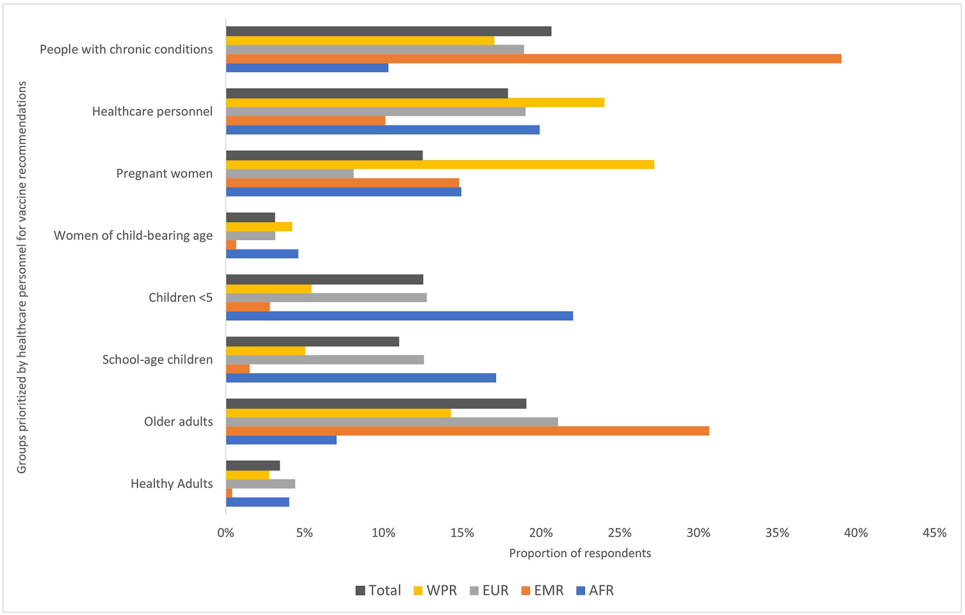

Fig. 2.

Patient populations reported by health workers as among their top three priority groups for recommendation, by World Health Organization Region (n = 12 countries).

Table 1

Description of surveyed health workers, among countries that do and do not have a national influenza vaccination program (n = 12 countries).

	Vaccine Program (n = 3,810)	No Vaccine Program (n = 6,471)	Total (n = 10,281)
Geographic Region, n (%)			
African	0 (0)	4422 (68)	4422 (43)
Eastern Mediterranean	1370 (36)	429 (7)	1799 (17)
European	1925 (51)	1620 (25)	3545 (34)
Western Pacific	515 (14)	0 (0)	515 (5)
World Bank Income Group			
Lower income	0 (0)	3183 (49)	3183 (31)
Lower-middle income	1885 (49)	2859 (44)	4744 (46)
Upper-middle income	1925 (51)	429 (7)	2354 (23)
Sex			
Female	3043 (80)	4226 (65)	7269 (71)
Male	741 (19)	2190 (34)	2931 (29)
Missing/not provided	26 (1)	55 (1)	81 (1)
Education level			
Secondary school or less	817 (21)	382 (6)	1199 (12)
Vocational training	271 (7)	695 (11)	966 (9)
College or university degree	1875 (49)	4546 (70)	6421 (62)
Master’s degree	677 (18)	275 (4)	952 (9)
Doctorate	81 (2)	177 (3)	258 (3)
Other	63 (2)	96 (1)	159 (2)
Missing/not provided	26 (1)	300 (5)	326 (5)
Position			
Doctor	1129 (30)	1994 (31)	3123 (30)
Nurse	1770 (46)	2595 (40)	4365 (42)
Midwife	259 (7)	568 (9)	827 (8)
Other	632 (17)	1223 (19)	1855 (18)
Missing/not provided	20 (1)	91 (1)	111 (1)

Table 2

Reported influenza vaccine practices among surveyed health workers, by whether countries have or do not have a vaccine program (n = 12 countries).

	Vaccine Program (n = 3,810)	No Vaccine Program (n = 6,471)	Total (n = 10,281)
Vaccine-related practices (self), n (%)			
Influenza is free to health workers at facility	2156 (69)	615 (14)	**2771 (37)**
Would accept vaccine for self if free	1782 (61)	4559 (81)	**6341 (74)**
Vaccinated last year	1211 (68)	410 (49)	**1621 (62)**
Vaccine-related practices (patients)			
Would recommend influenza vaccine to patients (n, %)	2550 (85)	5327 (86)	**7877 (85)**
Would recommend prioritizing vaccination to the following patient groups: *			
Healthy Adults	242 (6)	365 (6)	**607 (6)**
Older adults	2096 (55)	1089 (17)	**3185 (31)**
School-age children	626 (16)	1635 (25)	**2261 (22)**
Children < 5 years	700 (18)	1941 (30)	**2641 (26)**
Women of child-bearing age	188 (5)	505 (8)	**693 (7)**
Pregnant women	1134 (30)	1447 (22)	**2581 (25)**
Health workers	1361 (36)	2331 (36)	**3692 (36)**
People with chronic conditions	2383 (63)	1154 (18)	**3537 (34)**
Would accept recommendation to receive influenza vaccine from:			
Ministry of Health	1301 (34)	2428 (55)	**3729 (45)**
International organizations (e.g. WHO)	1112 (29)	1565 (35)	**2677 (33)**
Other health workers	1190 (31)	1039 (23)	**2229 (27)**
Facility where the participant works at	911 (25)	1103 (25)	**2014 (25)**
Family members	172 (5)	263 (6)	**435 (5)**
Friends	193 (6)	106 (2)	**299 (4)**
Local NGOs	25 (1)	140 (3)	**165 (3)**

* Based on response to question asking participants for the top three groups they would prioritize for vaccination

Table 3

Adjusted odds ratios of accepting influenza vaccine from logistic regression models among countries that do and do not have a national influenza vaccination program (n = 12 countries).

	Vaccine Program (n = 3,810)	No Vaccine Program* (n = 6,471)
Gender, (aOR, 95 % CI)		
Female	ref	ref
Male	1.2 (0.9, 1.5)	0.7 (0.6, 0.9)
Education level		
Completed secondary school or less	ref	ref
College/university or higher	1.1 (0.9, 1.4)	2.6 (1.8, 3.8)
Other (e.g., vocation training)	2.8 (1.7, 4.6)	3.7 (2.4, 5.7)
Occupation		
Doctor or assistant doctor	ref	ref
Nurse or nurse assistant	0.6 (0.4, 0.8)	1.4 (1.0, 1.8)
Midwife	0.4 (0.3, 0.6)	1.9 (1.1, 3.3)
Other	0.5 (0.4, 0.7)	1.1 (0.8, 1.6)
Duration of employment (years)	0.9 (0.9, 1.0)	0.9 (0.8, 0.9)
Perceived risk to self from influenza virus or vaccination (risk score) [a]	1.0 (0.9, 1.2)	1.3 (1.2, 1.5)
Perceived benefit of influenza vaccination to self (benefit score) [b]	1.2 (1.1, 1.3)	1.8 (1.6, 2.1)
Perceived risk and benefits to patients from influenza virus or vaccination (patient score)[c,d]	N/A	2.1 (1.8, 2.5)
Received influenza vaccine last year		
No	ref	
Yes	20.1 (11.3, 35.9)	N/A
Influenza vaccine available for free at health facility of employment		
No	ref	
Yes	0.4 (0.3, 0.6)	N/A

OR: Odds Ratio; CI: Confidence Interval.

USD: U.S. dollars; IQR: interquartile range.

[§]Countries were classified as having national influenza vaccination programs if they had a program during the time when KAP surveys were administered and during the year preceding survey administration.

[*]Model adjusted for WHO region of residence (African, European, Eastern Mediterranean).

[a]Score generated from the survey questions: 1) influenza causes mild illness only; it's not a serious disease, 2) influenza may result in severe illness or death, and 3) the influenza vaccine can cause a person to get sick with influenza.

[b]Score generated from the survey questions: 1) healthcare workers can transmit influenza to their family members, 2) vaccinating healthcare workers is effective in reducing their risk of developing influenza, and 3) vaccinating healthcare workers may reduce work absenteeism.

[c]Score generated from the survey questions: 1) it's important for healthcare workers to be vaccinated to prevent transmission of influenza to their ill patients and 2) vaccination of healthcare workers can reduce influenza including severe illness and/or deaths in patients.

[d]The patient score was excluded among HCP in countries with vaccine programs due to collinearity issues; patient score was found to be highly correlated to both risk and benefit scores in this group.

Table 4

Adjusted odds ratios of recommending influenza vaccines to patients from logistic regression models among all considered countries (n = 12 countries).

	Vaccine Program* (n = 3,810)	No Vaccine Program* (n = 6,471)
Gender, (aOR, 95 % CI)		
Female	ref	ref
Male	1.1 (0.7, 1.7)	1.1 (0.7, 1.6)
Education level		
Completed secondary school or less	ref	ref
College/university or higher	1.0 (0.6, 1.5)	5.8 (3.0, 11.4)
Other (e.g., vocation training)	0.8 (0.5, 1.5)	4.0 (2.0, 7.8)
Occupation		
Doctor or assistant doctor	ref	ref
Nurse or nurse assistant	1.2 (0.7, 1.9)	1.5 (0.9, 2.3)
Midwife	1.6 (0.8, 3.1)	2.0 (0.9, 4.6)
Other	0.5 (0.3, 0.9)	1.8 (1.0, 3.4)
Duration of employment (years)	1.1 (1.0, 1.1)	1.0 (0.9, 1.1)
Perceived risk to self from influenza virus or vaccination (risk score) [a]	1.6 (1.4, 1.9)	1.5 (1.2, 1.8)
Perceived risk and benefits to patients from influenza virus or vaccination (patient score) [c]	2.6 (2.1, 3.1)	3.9 (3.0, 5.0)
Ever made a laboratory confirmed diagnosis of influenza in a patient		
No	ref	ref
Yes	2.0 (0.8, 5.4)	1.6 (0.9, 2.7)
Ever made a clinical, non-laboratory confirmed, diagnosis of influenza in a patient		
No	ref	ref
Yes	1.2 (0.8, 1.9)	1.4 (1.0, 2.2)

OR: Odds Ratio; CI: Confidence Interval.

*model adjusted for WHO region of residence (African, European, Eastern Mediterranean).

[a]Score generated from the survey questions: 1) influenza causes mild illness only; it's not a serious disease, 2) influenza may result in severe illness or death, and 3) the influenza vaccine can cause a person to get sick with influenza.

[c]Score generated from the survey questions: 1) it's important for healthcare workers to be vaccinated to prevent transmission of influenza to their ill patients and 2) vaccination of healthcare workers can reduce influenza including severe illness and/or deaths in patients.

Table 5

Willingness to Pay (WTP) for influenza vaccines among health workers in 11 countries.

		n (%)*	WTP	WTP as % of health expenditure per capita†	
		Median USD [IQR]	*p*-value[a]	Median % [IQR]	*p*-value[a]
Overall	4281	3.36 [1.35–6.59]	–	3.13 [1.61–6.26]	–
Country income classification ‡					
Low (n = 2)	1760 (41)	2.70 [1.35–5.40]	<0.001	6.26 [3.13–12.52]	<0.001
Lower-middle (n = 5)	1588 (37)	2.86 [1.20–5.67]		2.62 [1.31–5.59]	
Upper-middle (n = 4)	933 (22)	6.83 [4.20–9.10]		1.66 [0.99–3.31]	
Profession					
Doctor	1173 (27)	4.13 [1.89–7.16]	<0.001	3.34 [1.61–8.03]	<0.001
Nurse	1782 (42)	3.30 [1.35–6.59]		3.13 [1.38–6.26]	
Midwife	452 (11)	2.70 [1.35–5.50]		3.13 [1.97–6.26]	
Other	850 (20)	3.78 [1.35–6.59]		3.21 [1.66–6.62]	
National vaccine program§					
Present (n = 5)	1333 (31)	5.50 [3.30–9.10]	<0.001	1.97 [1.31–3.31]	<0.001
Absent (n = 6)	2948 (69)	2.70 [1.35–5.40]		5.01 [2.24–8.34]	

*Inclusive of all healthcare workers who provided a price for how much they would be willing to pay for the influenza vaccine, excluding those reporting they would pay US$0.

[a]P-values were generated using Kruskal-Wallis tests.

†Health expenditure per capita used the most current World Bank data available at the time of analysis (2018) in USD.

‡Country income classifications were assigned based on World Bank classifications during the year the surveys were administered and the preceding year for each country.