



Conference report

Factors and considerations for establishing and improving seasonal influenza vaccination of health workers: Report from a WHO meeting, January 16–17, Berlin, Germany

Thomas Cherian^a, Kathleen F. Morales^b, Carsten Mantel^{a,d}, Philipp Lambach^{c,*}, The Independent Expert Advisory Group (IEAG) for Health Worker Influenza Vaccination¹

^aMMGH Consulting, Zurich, Switzerland

^bSierra Strategy Group, Evian les Bains, France

^cDepartment of Immunization, Vaccines and Biologicals (IVB), World Health Organization, Geneva, Switzerland

^dImmunization Unit, Robert Koch Institute, Berlin, Germany

ARTICLE INFO

Article history:

Received 1 April 2019

Accepted 19 July 2019

Available online 6 September 2019

Keywords:

Influenza

Vaccination

Health workers

ABSTRACT

Health workers represent an important target group for seasonal influenza vaccination because of their increased risk of infection as well as the risk of transmitting infection to vulnerable patients in the health care setting. Moreover, seasonal vaccination of health workers contributes to pandemic preparedness. However, many countries, especially in Africa and Asia, do not have policies for health worker influenza vaccination. In countries where such policies exist, vaccination coverage is often low. The World Health Organization (WHO) is developing a manual to guide the introduction of seasonal influenza vaccination of health workers. An Independent External Advisory Group (IEAG) that is advising WHO on the content of the manual met to discuss issues that are relevant and often unique to health worker vaccination. This meeting report summarizes the main issues that were discussed and the outcomes of the discussion. The issues include policy considerations, including the evidence in support of health worker vaccination; categorization and prioritization of health workers; the choice of vaccination strategy; its integration into broader health worker vaccination and occupational health policies; planning and management of vaccination, particularly the approaches for communication and demand generation; and the challenges with monitoring and evaluation of health worker vaccination, especially in low and middle-income countries.

© 2019 World Health Organization; licensee Elsevier. This is an open access article under the CC BY-NC-ND IGO license (<http://creativecommons.org/licenses/by-nc-nd/3.0/igo/>).

1. Introduction

Health workers are at increased risk of influenza virus infection, which may be variable depending on their occupation or setting [1]. The World Health Organization (WHO) considers health workers to be an important priority group for influenza vaccination, not only to protect themselves and maintain essential health services during influenza epidemics, but also to reduce the spread of influenza to vulnerable patient groups with whom they may come into contact [2]. Health workers who have themselves been vaccinated are also more knowledgeable about vaccination and likely to promote vaccination to other target populations [3–5]. In addition,

protecting health workers from seasonal influenza through vaccination can contribute to maintaining health-care services during influenza epidemics and should thus be considered part of a broader infection control policy for health-care facilities [2]. Finally, seasonal vaccination of health workers would lead to the establishment of a platform for rapidly vaccinating health workers in the event of an influenza pandemic or even of other epidemics, e.g. Ebola, thereby protecting health services during this period [6,7].

The WHO Global Influenza Strategy 2019–2030 provides a framework for WHO, its Member States and partners to approach influenza holistically through tailored national programmes – from surveillance to disease prevention and control – with the goal of strengthening seasonal prevention and control and preparedness for future pandemics. It highlights the achievements made toward this goal since 2011 and re-focuses the strategic way forward toward filling two urgent gaps – the need for better tools to prevent and control influenza and the need for strong national

DOI of original article: <https://doi.org/10.1016/j.jvaxc.2019.100036>

* Corresponding author at: Philipp Lambach, Initiative for Vaccine Research, Department of Immunization, Vaccines and Biologicals, World Health Organization, 1211 Geneva 27, Switzerland.

E-mail address: lambachp@who.int (P. Lambach).

¹ Members listed at end of document.

<https://doi.org/10.1016/j.vaccine.2019.07.079>

0264-410X/© 2019 World Health Organization; licensee Elsevier.

This is an open access article under the CC BY-NC-ND IGO license (<http://creativecommons.org/licenses/by-nc-nd/3.0/igo/>).

capacities for preparedness and response against influenza [8]. Four strategic objectives and ten priorities form the basis for implementation of the strategy. Objective three explicitly highlights expanding prevention and control policies and programmes to improve health and serve the vulnerable through support to countries to develop and implement national, seasonal immunization policies for health workers and other high-risk groups.

The global adoption of the policy for seasonal vaccination has been slow. In 2017, 119 of 194 WHO Member States reported using influenza vaccine. Of these, 96 reported having a national influenza vaccination policy in place and an additional 23 included seasonal influenza vaccine in their schedules without a national policy. A national vaccination policy targeting health workers was in place in 102 countries. Coverage of influenza vaccination in health workers varies widely and is reported to be low in most countries where data are available. Generally, use of influenza vaccine is very low in the WHO African and Southeast Asian Regions [9,10]. In the European Region, 26 countries reported data on vaccine coverage in health workers, which ranged from 3% to 99%, with only three countries reporting coverage >75% [11]. A systematic review through compulsory reporting from all hospitals in the United Kingdom showed an uptake of 69% for the 2017–18 season [12]. Data from surveys in other regions reflect a similar range, though an internet survey of over 2000 health workers in the United States showed coverage of 78% during the 2017–18 season, with a higher uptake (95%) among those who were required by their employers to be vaccinated [13].

In 2018, as part of the coordinated WHO effort toward strengthening influenza programmes in its Member States, an Independent Expert Advisory Group (IEAG) was established to inform the development of an *Introduction Manual for Influenza Vaccination of Health Workers*. The manual is a decision-making aid for national policy-making bodies and programme managers of immunization, occupational health or influenza vaccine programmes. It serves as a resource and catalogue of available tools to help country officials decide on, plan, implement and monitor health worker influenza vaccination policies, with guidance on how to achieve optimal vaccination coverage. It articulates general principles and key considerations to support three areas: policy development; planning and management; and monitoring and evaluation.

The IEAG met on January 16–17, 2019 in Berlin to review the contents of the manual, share experiences, and discuss important aspects of the manual, taking into consideration the varying contexts, diverse priorities and capacities in countries around the world. This report briefly summarizes the discussions at this meeting.

2. The IEAG perspective – challenges and potential solutions

In introducing any new vaccine into a national immunization programme, several factors need to be considered, from making an informed decision to planning, implementing and monitoring vaccine introduction. These issues are generically covered in a WHO guidance document on vaccine introduction [14]. At this meeting, the IEAG discussions focused on a few selected issues that specifically relate to influenza vaccination of health workers, namely: (a) policy development; (b) planning and management of vaccination, in particular communication approaches and measures to increase demand; and (c) the challenges with monitoring and evaluation of health worker vaccination.

3. Policy development

The issues that were discussed on the development of policies for seasonal influenza vaccination included the evidence in support

of health workers vaccination, categorization and prioritization of health workers to be targeted for vaccination, the choice of mandatory versus voluntary vaccination policies and its integration into the broader health worker immunization and occupational health policies.

3.1. Evidence to support health worker vaccination

While the existing WHO recommendations on seasonal influenza vaccination are unequivocal about vaccination of health workers, there is an ongoing debate about the strength of the evidence to justify health worker vaccination in the first place [15]. The IEAG recognized the challenges in conducting studies to generate high-quality, conclusive evidence in support of health worker vaccination across all health worker categories. They acknowledged that risk of infection among health workers may vary between health worker categories and the transmission of infection from health workers to patients may also vary between different health care settings and patient types. The impact of vaccination would be influenced by several factors, including the risk of infection, rates of transmission in different health care settings, and the varying effectiveness of the vaccine in different seasons. Some of these factors may underlie the conflicting results observed in different studies. The IEAG noted that even though a recent *Rapid Evidence Appraisal* review commissioned by WHO (published in *Vaccine: X* [58]) indicates that health workers are at an increased risk of influenza infection compared to the general population (1), the evidence is stronger for asymptomatic infection rather than symptomatic infection [16]. However, asymptomatic infection in health workers heightens concerns about the risk of nosocomial transmission from health workers. Several studies have documented that health workers continue to work with influenza like illnesses (ILI), which has been referred to as “presenteeism” [17–19], with one study reporting subsequent nosocomial transmission in an oncology unit [20]. Studies have also shown that influenza vaccination reduces absenteeism and the incidence of laboratory-confirmed influenza among health workers [21] and reduces patient mortality and other non-specific indicators [22,23].

Despite the lack of high-quality evidence for some areas and conflicting findings in the published literature, the IEAG was comfortable that there was enough evidence in support of the existing WHO recommendation. However, they noted that evidence will be reconsidered in the coming year by the WHO *Strategic Advisory Group of Experts (SAGE) on Immunization* and recommendations revised, if necessary.

3.2. Categorization and prioritization of health workers for vaccination

Ideally, all health workers should be vaccinated. However, financing and vaccine supply may not allow this, especially in low- and middle-income countries (LMICs) and stratification of health workers by risk, occupation, or clinical area of work is a realistic part of policy development. There is wide variation in the health worker categories targeted for vaccination and often the definitions of those categories targeted for vaccination are unclear or difficult to define [24]. Meeting participants also noted that in some cases stratification is impractical as health workers may change risk categories as a result of task-shifting when the health worker to patient ratio is very low. The IEAG concluded that while vaccination of all health workers is ideal, this may not always be feasible. Simplification of the guidance for categorizing and targeting health workers for vaccination will be required, especially for use in LMICs.

3.3. Choice of vaccination policy/strategy

Policy development also involves deciding on the choice of mandatory or voluntary vaccination policies. Mandatory vaccination makes vaccination a legal or regulatory requirement, while allowing some exemptions, e.g. medical contraindications. Voluntary vaccination, on the other hand, leaves the choice up to the individual health worker. There is no WHO or other uniformly applied definition for mandatory vaccination. Infant or childhood vaccination programmes that are described as mandatory can vary widely, especially in terms of the exemptions allowed and the penalties for non-compliance [25]. No single intervention has been shown to rapidly and substantially increase health worker vaccination other than mandatory vaccination. Mandatory vaccination of health workers has resulted in close to 100% uptake in institutions in the United States where it has been applied [26–29]. However, mandatory vaccination has been difficult to implement in some countries because of ethical or legal considerations. Several experts have argued that mandatory immunization policies should be implemented against vaccine-preventable diseases that can be transmitted and cause significant morbidity to patients, as part of the principles of the professional ethics of health care providers [26,30–33]. Ensuring conditions for patient safety by minimizing the potential for transmission of communicable diseases in health care settings may represent the minimum ethical standards in health care facilities [31].

Mandatory vaccination can be part of the national policy or implemented at individual health facilities as part of institutional policies. In establishing a policy of mandatory vaccination, the justification for its use must be clearly communicated to the employees; state which employees it applies to; include the process and exemptions; advise on enforcement and consequences; and describe contingency plans, e.g. in case of vaccine shortage. Furthermore, liability issues will need to be addressed and consideration given to providing compensation in case of adverse events following immunization, which may not always be possible in resource-limited settings.

The alternative is voluntary vaccination, which also requires resources to ensure optimum uptake of vaccination, including a robust communications strategy, convenient access to vaccination (ideally free of charge), or the development and implementation of “soft mandates” like active declination, the obligation to wear masks, or reassignment of health workers to other lower risk areas if they decline vaccination.

3.4. Integration with broader health worker immunization and occupational health policies

Health workers are at increased risk for several infectious diseases, which they can also transmit to vulnerable patient groups in the health care setting. Furthermore, health workers often continue to work when they have infections, placing their patients and colleagues at risk. WHO currently recommends the use of ten vaccines in health workers [34]. While influenza is unique in that it requires annual vaccination, policy recommendations for influenza should be part of a broader policy on vaccination of health workers. This would bring about uniformity in how vaccination policies are applied, including mandatory vaccination policies. Vaccination policies should also be part of national occupational safety and health policies to avoid any potential conflicts between immunization and occupational health policies and allow access to free vaccination as mandated by the Occupational Safety and Health Convention of 1981 (Article 21) [35]. An integrated policy would also enable a more comprehensive approach to the control of influenza in the health care setting, where immunization is one of several infection control measures.

4. Planning and management

Factors which contribute to low uptake of influenza vaccination in health workers are multi-factorial, have been extensively studied [36] and are the focus of numerous public health program efforts to improve vaccine uptake [37]. Attitudes and behaviours towards influenza vaccination among health workers may be heterogeneous and may also vary across health worker categories [38,39].

4.1. Formative research

Formative research can help to better understand the local factors affecting uptake of vaccination and to take the findings into consideration in planning for vaccine introduction [40,41]. It may be either quantitative or qualitative, with the former being used to describe and quantify the main determinants of vaccine uptake and the latter being used to obtain more in-depth understanding of the complex issues underlying vaccine uptake. While formative research will inform the planning process, it may be time and resource intensive. The IEAG noted that if such research is not well-designed and executed, there is a risk of obtaining ambiguous results. The consensus was that while formative research is likely to be informative and would assist in the planning process, the lack of formative research should not delay the introduction of health worker vaccination. Available published information, supplemented by quantitative data from rapid surveys, could be used to inform the planning process in the absence of locally conducted formative research.

4.2. Communication strategy

Communication strategies are pivotal to the success of any vaccination approach, voluntary or mandatory, and a multi-dimensional, sustained, and evolving effort is required to ensure adequate vaccine uptake [42]. Personal beliefs, attitudes and perceptions about vaccination, rather than official recommendations often guide the actions of both those responsible for delivery of vaccination and the recipients [43,44]. This holds true also for health workers.

The IEAG discussed communication strategies, stressed the importance of developing locally-relevant communications customized to the individual health worker group being targeted, and taking the education levels and cultural context into consideration. However, message framing or how a message is best delivered is a critical part of communications [36,45], and will benefit from an understanding of vaccine psychology and cognitive decision-making [46].

Available evidence shows that there are often misperceptions about vaccination as well as a gap between knowledge and behaviours [46,47]. However, correcting myths about influenza does not always lead to changes in behaviour, and may even have a negative effect. For example, one study found that corrective information adapted from the Centers for Disease Control and Prevention (CDC) website significantly reduced belief in the myth that influenza vaccine can cause influenza disease as well as concerns about its safety. However, the correction also significantly reduced intent to vaccinate among respondents with high levels of concern about vaccine side effects - a response that was not observed among those with low levels of concern. [48]. Thus, simply improving knowledge about the risks and benefits of vaccination among health workers may not be enough to achieve optimal vaccination uptake. Rather a communications effort that is informed by a good understanding of the perception, motivators and barriers of

vaccine acceptance among health workers, both as providers of vaccination and as recipients is needed.

Communication methods can include customized mass communications or peer communications and proactive media engagements to avoid negative media coverage. The inclusion of information on influenza vaccination in the medical, nursing, and allied health, e.g. physiotherapy, or laboratory sciences curriculum may serve to instil the culture of vaccination and to ensure the right information is cultivated from the start.

4.3. Demand generation beyond communication

While effective communications may improve knowledge, change attitudes and result in an intention to get vaccinated, additional demand-generation strategies are necessary to convert the intentions into positive actions. These behavioural-science, nudge-based interventions can be implemented prior to vaccination to prime workers for vaccine delivery. They work by creating an environment that can influence behaviour in a predictable way without eliminating choice [49], which is a good option to encourage uptake when mandatory vaccination is not pursued. They have proven effective in a variety of healthcare settings [50] and can narrow the gap between the intention to be vaccinated and the actual vaccination behaviour. Additionally, these interventions frequently can be implemented for relatively low cost [51], which makes them particularly relevant in low- and middle-income countries. Nudge-based interventions include cues-to-action, which have been shown to be one of the strongest determinants of uptake [36], or text message reminders to vaccinators and vaccine recipients. Standing orders programmes, which authorize nurses and pharmacists to administer vaccinations according to an institution- or physician-approved protocol without the need for a physician's examination or direct order have also been shown to improve influenza vaccination rates, especially in long term care facilities and hospitals [52]. Additionally, front line vaccination staff responsible for health worker influenza vaccination need to be trained on the importance of vaccination, safety considerations, disease-specific data and advised on how to deal with vaccine hesitant health workers.

Additional methods to increase uptake include the use of “vaccination champions”, use of reward incentives for health worker groups who achieve certain vaccine targets, and the use of seasonal vaccination mass campaigns that emphasizes a festive atmosphere while practicing critical pandemic vaccination skills [53].

5. Monitoring and evaluation

The discussions on monitoring and evaluation centred on the complexity and feasibility of monitoring different outcomes, including what might be the minimum requirements for monitoring health worker vaccination programmes. It was suggested that all countries should have mechanisms in place to monitor vaccination coverage and Adverse Events Following Immunization (AEFI) and conduct at least one post-vaccine introduction programme evaluation. On the other hand, measurement of vaccine acceptance, vaccine effectiveness and impact may not be feasible in all countries. In addition, the IEAG noted the risk that studies to measure acceptance, effectiveness or impact, if not well designed and conducted, could produce misleading results.

5.1. Coverage monitoring

Several approaches for estimating influenza vaccine coverage among health workers are available. Ideally, coverage assessments should be done at some point after the influenza season, when

complete data are available and assessed and adjusted for any discrepancies. It may be necessary and feasible in only a representative number of settings within a country.

Health facility registers or other administrative data sources could be used to provide estimates of the target population and the numbers vaccinated each season to obtain coverage estimates. Alternatively, annual or periodic surveys in a representative sample of health workers may be used to estimate coverage. Examples of using health facility surveys [54] and online systems [55] were presented at the meeting.

5.2. Surveillance of adverse events following immunization

As for any vaccine and target group, a functioning AEFI monitoring system is a basic requirement of immunization programmes, all the more in view of possible knowledge gaps and misperceptions about influenza vaccine safety among health workers. The system to monitor and investigate possible AEFI when delivering influenza vaccine to health workers should ideally be integrated into existing AEFI surveillance systems in line with national regulations for the monitoring of vaccine safety. By establishing and enhancing AEFI systems, influenza vaccination can also be used to further improve the awareness of overall immunization safety in the health worker community.

5.3. Impact monitoring

After an influenza vaccine has been introduced in a population, additional studies may help in evaluating the impact of the immunization program. Data from vaccine effectiveness studies can be used to assess whether the objectives of vaccination were being met. However, studies to demonstrate vaccine effectiveness or impact are difficult to conduct for influenza, given that influenza vaccine effectiveness is modest and can vary considerably across influenza seasons [56]. Studies to evaluate the impact of seasonal influenza vaccination in health workers can be even more complex, given the varying risk of infection and transmission to patients among different categories of health workers. The challenges of accurately measuring certain outcomes unique to health worker vaccination, such as absenteeism and rates of nosocomial transmission, were highlighted. The IEAG cautioned that if studies are not appropriately designed with adequate sampling of different health worker categories, there is a risk of arriving at misleading conclusions. Such studies are not required in every country and should be limited to settings where the resources and capacities exist to conduct a rigorous assessment.

5.4. Post-introduction programme evaluation

National Immunization Program Reviews routinely assess the use of specific vaccines about every 5 years. However, following a new vaccine introduction, and in case of the need for change of current practice, a specific influenza-related Post-Introduction Evaluation (I-PIE) [57] tool should be used to rapidly identify problem areas needing correction and to provide valuable lessons for the continued and improved use of the vaccine. This tool, developed by CDC and WHO, provides a framework and standardized questionnaires to evaluate all the processes and programmatic impact of influenza vaccination, and provides guidance on data analysis and a template for making recommendations to corrective action. The tool has been pilot tested in three middle-income countries, Belarus, Morocco and Thailand, where valuable insights were gained that allowed for focussed programme improvements. [submitted to *Vaccine*]

6. Conclusions

Seasonal influenza vaccination in health workers is recommended by WHO not only to protect health workers, and to reduce spread of influenza to vulnerable patient groups but also to maintain health-care services during influenza epidemics and to put needed capacities in place to prepare for a pandemic outbreak. However, policies for health worker vaccination do not exist in many countries and where they do exist, vaccination coverage remains low. WHO is developing a manual to provide guidance to countries wishing to introduce seasonal influenza vaccination of health workers. The IEAG advising WHO on the contents of the manual discussed several difficult issues related to health worker vaccination to arrive at a consensus on how to deal with them in advising countries in vaccine implementation. Based on the guidance received, WHO will develop a field test version of the manual, which will be piloted in a few LMICs settings.

Disclaimer

Philipp Lambach works for the World Health Organization. The authors alone are responsible for the views expressed in this publication and they do not necessarily represent the decisions, policy or views of the World Health Organization.

Dr Salah Al Awaidey, Dr Joseph S. Bresee, Dr Thomas Cherian, Dr Supamit Chunsuttiwat, Dr Daouda Coulibaly, Dr Luzhao Feng, Dr Rachel Hale, Dr Philipp Lambach, Dr Helena C. Maltezou, Dr Carsten Mantel, Dr Kelly Moore, Ms. Kathleen Morales, Professor Dr Jonathan Nguyen-Van-Tam, Dr Saad Omer, declared that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Dr Gregory Poland is the chair of a Safety Evaluation Committee for novel investigational vaccine trials being conducted by Merck Research Laboratories. He offers consultative advice on vaccine development to Merck & Co. Inc., Avianax, Adjuvance, Sanofi Pasteur, GlaxoSmithKline, and Emergent Biosolutions. Dr. Poland holds two patents related to vaccinia and measles peptide research. These activities have been reviewed by the Mayo Clinic Conflict of Interest Review Board and are conducted in compliance with Mayo Clinic Conflict of Interest policies. This research has been reviewed by the Mayo Clinic Conflict of Interest Review Board and was conducted in compliance with Mayo Clinic Conflict of Interest policies.

Interests declared by participants of the aforementioned meeting were reviewed and conditionally approved by the meeting Secretariat before the meeting and publicly disclosed by the chair on the first day of the meeting (January 16, Berlin).

Independent Expert Advisory group (IEAG) for health worker influenza vaccination

Dr Salah Al Awaidey, Department of Communicable Diseases, Oman.

Dr Joseph S. Bresee (chair), Centers for Disease Control and Prevention, Atlanta, Georgia, USA.

Dr Supamit Chunsuttiwat, Division of Communicable Diseases, Ministry of Public Health, Bangkok, Thailand.

Dr Daouda Coulibaly, CDI, Côte d'Ivoire.

Dr Luzhao Feng, Chinese Center for Disease Control and Prevention, Beijing, China.

Dr Rachel Hale, Cardiff University, Cardiff, United Kingdom.

Dr Helena C. Maltezou, Hellenic Center for Disease Control and Prevention, Greece.

Dr Kelly Moore, Tennessee Immunization Program, Tennessee Department of Health, USA.

Professor Jonathan Nguyen-Van-Tam, Department of Health & Social Care, London, UK and University of Nottingham, UK.

Dr Saad Omer, Emory University, Atlanta, USA.

Dr Gregory Poland, Vaccine Research Group, Mayo Clinic and Foundation, Rochester, Minnesota, USA.

Dr Sabine Wicker, University Hospital, Frankfurt, Germany.

Rosanna Lagos, Hospital De Niños Roberto Del Río · Centro para Vacunas en Desarrollo.

Chile (not present at meeting) Prof Shabir Madhi, University of Witswatersrand, **South Africa** (not present at meeting).

Meeting participants

Dr Silvia Bino, Institute of Public Health, Albania.

Birte Bödeker, Robert Koch Institute, Berlin, Germany.

Dr Susan Y. Chu, Centers for Disease Control and Prevention, USA.

Dr Sara Hamid, Emory University, Atlanta, USA.

Dr Kathryn Lafond, Centers for Disease Control and Prevention, USA.

Julia Neufeind, Robert Koch Institute, Berlin, Germany.

Dr Susan Wang, Centers for Disease Control and Prevention, USA.

WHO Regional Offices' representative

Ms Phionah Lynn Atuhebe, African Regional Office, Brazzaville, Republic of Congo.

Dr Philip Gould, South East Asia Regional Office, New Delhi, India.

Dr James Heffelfinger, Western Pacific Regional Office, Manila, Philippines.

Ms Pernille Jorgensen, European Regional Office, Copenhagen, Denmark.

Ms Liudmila Mosina, European Regional Office, Copenhagen, Denmark.

Ms Alba Maria Roperio-Alvarez, Regional Office of the Americas, Washington DC, USA.

Dr Hassan Quamrul, Regional Office of the Eastern Mediterranean, Cairo; Egypt.

WHO Secretariat

Dr. Shalini Desai, Immunization, Vaccines and Biologicals, World Health Organization, Geneva, Switzerland.

Ms Rola Egloff, Initiative for Vaccine Research, World Health Organization, Geneva, Switzerland.

Shoshanna Goldin, Influenza Preparedness and Response, World Health Organization, Geneva, Switzerland.

Dr Ivan Ivanov, Public Health, Environment and Social Determinants, World Health Organization, Geneva, Switzerland.

Dr Melanie Marti, SAGE Secretariat, Immunization, Vaccines and Biologicals, World Health Organization, Geneva, Switzerland.

Dr Ann Moen, Chief, Influenza Preparedness and Response, World Health Organization, Geneva, Switzerland.

Mr Marc Perut, Initiative for Vaccine Research, World Health Organization, Geneva, Switzerland.

Ms Claudia Steulet, Immunization, Vaccines and Biologicals, World Health Organization, Geneva, Switzerland.

Consultant

Ms Kathleen Morales, Sierra Strategy Group, Evian les Baines, France.

Funding

This study was funded by a grant from the World Health Organization's Initiative for Vaccine Research. The authors would like to acknowledge the contributions of the Centers for Disease Control and Prevention (CDC), which provides financial support to the World Health Organization Initiative for Vaccine Research (U50CK000431).

Acknowledgements

The authors would like to acknowledge the contributions of the additional participants to the meeting and WHO staff providing additional inputs:

References

- Lietz J, Westermann C, Nienhaus A, Schablon A. The occupational risk of influenza A (H1N1) infection among healthcare personnel during the 2009 pandemic: a systematic review and meta-analysis of observational studies. *PLoS ONE* 2016;11(8):e0162061.
- Vaccines against influenza: WHO position paper November 2012. *Weekly Epidemiological Report*. 2012; 87(47):pp. 461–476.
- Wilson RJ, Paterson P, Jarrett C, Larson HJ. Understanding factors influencing vaccination acceptance during pregnancy globally: a literature review. *Vaccine* 2015;33(47):6420–9.
- Yuen CY, Tarrant M. A comprehensive review of influenza and influenza vaccination during pregnancy. *J Perinat Neonatal Nurs* 2014;28(4):261–70.
- Wiley KE, Massey PD, Cooper SC, Wood NJ, Ho J, Quinn HE, et al. Uptake of influenza vaccine by pregnant women: a cross-sectional survey. *Med J Australia* 2013;198(7):373–5.
- Zhang W, Hirve S, Kieny MP. Seasonal vaccines - critical path to pandemic influenza response. *Vaccine* 2017;35(6):851–2.
- Mihigo R, Torrealba CV, Coninx K, Nshimirimana D, Kieny MP, Carrasco P, et al. 2009 Pandemic influenza A virus subtype H1N1 vaccination in Africa—successes and challenges. *J Infect Dis* 2012;206(Suppl 1):S22–8.
- Organization WH. Global influenza strategy 2019–2030. World Health Organization. https://www.who.int/influenza/global_influenza_strategy_2019_2030/en/ (Accessed 31/03/2019).
- Carman WF, Elder AG, Wallace LA, McAulay K, Walker A, Murray GD, et al. Effects of influenza vaccination of health-care workers on mortality of elderly people in long-term care: a randomised controlled trial. *Lancet* 2000;355(9198):93–7.
- WHO/UNICEF. Joint Reporting Form. 2017. https://www.who.int/immunization/monitoring_surveillance/routine/reporting/en/ (Accessed 31/03/2019).
- Jorgensen P, Mereckiene J, Cotter S, Johansen K, Tsoлова S, Brown C. How close are countries of the WHO European Region to achieving the goal of vaccinating 75% of key risk groups against influenza? results from national surveys on seasonal influenza vaccination programmes, 2008/2009 to 2014/2015. *Vaccine* 2018;36(4):442–52.
- Seasonal influenza vaccine uptake in healthcare workers (HCWs) in England: winter season 2017 to 2018 London: Public Health England; 2018 [Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/710531/Seasonal_influenza_vaccine_uptake_HCWs_winter_season_2017_to_2018.pdf. (Accessed 31/03/2019).
- Black CL, Yue X, Ball SW, Fink RV, de Perio MA, Laney AS, et al. Influenza vaccination coverage among health care personnel - United States, 2017–18 influenza season. *MMWR Morb Mortal Wkly Rep* 2018;67(38):1050–4.
- Principles and considerations for adding a vaccine to a national immunization programme: from decision to implementation and monitoring. Geneva: World Health Organization; 2014. https://www.who.int/immunization/documents/general/ISBN_978_92_4_15068_92/en/ (Accessed 31/03/2019).
- De Serres G, Skowronski DM, Ward BJ, Gardam M, Lemieux C, Yassi A, et al. Influenza vaccination of healthcare workers: critical analysis of the evidence for patient benefit underpinning policies of enforcement. *PLoS ONE* 2017;12(1):e0163586.
- Kuster SP, Shah PS, Coleman BL, Lam PP, Tong A, Wormsbecker A, et al. Incidence of influenza in healthy adults and healthcare workers: a systematic review and meta-analysis. *PLoS ONE* 2011;6(10):e26239.
- Chiu S, Black CL, Yue X, Greby SM, Laney AS, Campbell AP, et al. Working with influenza-like illness: presenteeism among US health care personnel during the 2014–2015 influenza season. *Am J Infect Control* 2017;45(11):1254–8.
- Mossad SB, Deshpande A, Schramm S, Liu X, Rothberg MB. Working despite having influenza-like illness: results of an anonymous survey of healthcare providers who care for transplant recipients. *Infect Control Hosp Epidemiol* 2017;38(8):966–9.
- Rebmann T, Turner JA, Kunerth AK. Presenteeism attitudes and behavior among Missouri kindergarten to twelfth grade (K-12) school nurses. *J Sch Nurs* 2016;32(6):407–15.
- Wilson KE, Wood SM, Schaefer KE, Cromwell KB, Godich J, Knapp MH, et al. Nosocomial outbreak of influenza A H3N2 in an inpatient oncology unit related to health care workers presenting to work while ill. *Am J Infect Control* 2019. <https://doi.org/10.1016/j.ajic.2018.10.024>.
- Imai C, Toizumi M, Hall L, Lambert S, Halton K, Merellini K. A systematic review and meta-analysis of the direct epidemiological and economic effects of seasonal influenza vaccination on healthcare workers. *PLoS ONE* 2018;13(6):e0198685.
- Amodio E, Restivo V, Firenze A, Mammina C, Tramuto F, Vitale F. Can influenza vaccination coverage among healthcare workers influence the risk of nosocomial influenza-like illness in hospitalized patients?. *J Hosp Infect* 2014;86(3):182–7.
- Ahmed F, Lindley MC, Allred N, Weinbaum CM, Grohskopf L. Effect of influenza vaccination of healthcare personnel on morbidity and mortality among patients: systematic review and grading of evidence. *Clin Infect Dis* 2014;58(1):50–7.
- Ropero-Alvarez AM, El Omeiri N, Kurtis HJ, Danovaro-Holliday MC, Ruiz-Matus C. Influenza vaccination in the Americas: progress and challenges after the 2009 A(H1N1) influenza pandemic. *Hum Vaccin Immunother* 2016;12(8):2206–14.
- MacDonald NE, Harmon S, Dube E, Steenbeek A, Crowcroft N, Opel DJ, et al. Mandatory infant & childhood immunization: rationales, issues and knowledge gaps. *Vaccine* 2018;36(39):5811–8.
- Maltezos HC, Poland GA. Immunization of Health-Care Providers: Necessity and Public Health Policies. *Healthcare (Basel)*. 2016 Aug 1; 4(3). pii: healthcare4030047. doi: 10.3390/healthcare4030047.
- Maltezos HC, Poland GA. Immunization of healthcare providers: a critical step toward patient safety. *Vaccine* 2014;32(38):4813. <https://doi.org/10.1016/j.vaccine.2014.05.046>. Epub 2014 May 23.
- Maltezos HC, Poland GA. Vaccination policies for healthcare workers in Europe. *Vaccine* 2014;32(38):4876–80.
- Pitts SI, Maruthur NM, Millar KR, Perl TM, Segal J. A systematic review of mandatory influenza vaccination in healthcare personnel. *Am J Prev Med* 2014;47(3):330–40.
- Ottenberg AL, Wu JT, Poland GA, Jacobson RM, Koenig BA, Tilburt JC. Vaccinating health care workers against influenza: the ethical and legal rationale for a mandate. *Am J Public Health* 2011;101(2):212–6.
- Poland GA, Jacobson RM, Wicker S. Mandating influenza vaccination of health care workers: a patient safety, quality of care, and public trust issue. *Ann Respir Med* 2011;2(1).
- Sullivan SJ, Jacobson R, Poland GA. Mandating influenza vaccination for healthcare workers. *Expert Rev Vacc* 2009;8(11):1469–74.
- Tilburt JC, Mueller PS, Ottenberg AL, Poland GA, Koenig BA. Facing the challenges of influenza in healthcare settings: the ethical rationale for mandatory seasonal influenza vaccination and its implications for future pandemics. *Vaccine* 2008;26(Suppl 4):D27–30.
- Thomas RE, Jefferson T, Lasserson TJ. Influenza vaccination for healthcare workers who work with the elderly: systematic review. *Vaccine* 2010;29(2):344–56.
- Talbot TR, Babcock H, Caplan AL, Cotton D, Maragakis LL, Poland GA, et al. Revised SHEA position paper: influenza vaccination of healthcare personnel. *Infect Control Hosp Epidemiol* 2010;31(10):987–95.
- Schmid P, Rauber D, Betsch C, Lidolt G, Denker ML. Barriers of influenza vaccination intention and behavior - a systematic review of influenza vaccine hesitancy, 2005–2016. *PLoS ONE* 2017;12(1):e0170550.
- Butler R, MacDonald NE. Hesitancy SWGoV. Diagnosing the determinants of vaccine hesitancy in specific subgroups: the guide to tailoring immunization programmes (TIP). *Vaccine* 2015;33(34):4176–9.
- Maltezos HC, Gargalianos P, Nikolaidis P, Katerelos P, Tedoma N, Maltezos E, et al. Attitudes towards mandatory vaccination and vaccination coverage against vaccine-preventable diseases among health-care workers in tertiary-care hospitals. *J Infect* 2012;64(3):319–24.
- Maltezos HC, Katerelos P, Poufta S, Pavli A, Maragos A, Theodoridou M. Attitudes toward mandatory occupational vaccinations and vaccination coverage against vaccine-preventable diseases of health care workers in primary health care centers. *Am J Infect Control* 2013;41(1):66–70.
- A field guide to qualitative research for new vaccine introduction. Copenhagen: World Health Organization Regional Office for Europe; 2018. <http://www.euro.who.int/en/health-topics/disease-prevention/vaccines-and-immunization/publications/2017/field-guide-to-qualitative-research-for-new-vaccine-introduction> (Accessed 31/03/2019).
- Tailoring immunization programmes for seasonal influenza (TIP FLU): a guide for health care workers' uptake of seasonal influenza vaccination Copenhagen: World Health Organization Regional Office for Europe; 2015. <http://www.euro.who.int/en/health-topics/disease-prevention/vaccines-and-immunization/publications/2015/tailoring-immunization-programmes-for-seasonal-influenza-tip-flu-understanding-health-care-workers-uptake-of-seasonal-influenza-vaccination-in-montenegro-a-case-study-for-policy-makers-and-programme-managers> (Accessed 31/03/2019).

- [42] To KW, Lai A, Lee KC, Koh D, Lee SS. Increasing the coverage of influenza vaccination in healthcare workers: review of challenges and solutions. *J Hosp Infect* 2016;94(2):133–42.
- [43] Betsch C, Wicker S. Personal attitudes and misconceptions, not official recommendations guide occupational physicians' vaccination decisions. *Vaccine* 2014;32(35):4478–84.
- [44] Rhudy LM, Tucker SJ, Ofstead CL, Poland GA. Personal choice or evidence-based nursing intervention: nurses' decision-making about influenza vaccination. *Worldviews Evid Based Nurs* 2010;7(2):111–20.
- [45] Nyhan B, Reifler J, Richey S, Freed GL. Effective messages in vaccine promotion: a randomized trial. *Pediatrics* 2014;133(4):e835–42.
- [46] Poland CM, Poland GA. Vaccine education spectrum disorder: the importance of incorporating psychological and cognitive models into vaccine education. *Vaccine* 2011;29(37):6145–8.
- [47] Leask J. Target the fence-sitters. *Nature* 2011;473(7348):443–5.
- [48] Nyhan B, Reifler J. Does correcting myths about the flu vaccine work? an experimental evaluation of the effects of corrective information. *Vaccine* 2015;33(3):459–64.
- [49] Thaler RH, Sunstein CR. *Nudge: Improving Decisions About Health, Wealth and Happiness*. New York: Penguin Books; 2009.
- [50] Patel MS, Volpp KG, Asch DA. Nudge units to improve the delivery of health care. *N Engl J Med* 2018;378(3):214–6.
- [51] Patel MS. Nudges for influenza vaccination. *Nat Hum Behav* 2018;2:720–1.
- [52] Centers for Disease C, Prevention. Facilitating influenza and pneumococcal vaccination through standing orders programs. *MMWR Morb Mortal Wkly Rep*. 2003; 52(4):pp. 68–69.
- [53] Swift MD, Aliyu MH, Byrne DW, Qian K, McGown P, Kinman PO, et al. Emergency preparedness in the workplace: the Flulapalooza model for mass vaccination. *Am J Public Health* 2017;107(S2):S168–76.
- [54] Yang JS, Zhang LJ, Feng LZ, Zhao JH, Ma YY, Xu LL. Influenza vaccination and its influencing factors among clinical staff of the hospitals in 2016–2017 season, Xining, Qinghai province, China. *Zhonghua Liu Xing Bing Xue Za Zhi* 2018;39(8):1066–70.
- [55] Bödeker B, Neufeind J, Bichel Y, Wichmann O. OKaPII-Studie: Online-Befragung von Klinik-personal zur Influenza-Impfung Berlin: Robert Koch Intitut; [Available from: https://www.rki.de/DE/Content/Infekt/Impfen/Forschungsprojekte/OKaPII/OKaPII_Inhalt.html].
- [56] Evaluation of influenza vaccine effectiveness: a guide to the design and interpretation of observational studies. Geneva; 2017. <https://apps.who.int/iris/handle/10665/255203>.
- [57] Influenza vaccine post-introduction evaluation manual and tool. Geneva: World Health Organization; 2018 https://www.who.int/immunization/research/development/ipie_influenza_post_introduction_evaluation/en/.
- [58] D.C. Jenkin, H. Magoub, K.F. Morales, P. Lambach, J.-S. Nguyen-Van-Tam, A Rapid Evidence Appraisal of influenza vaccination in health workers: an important policy in an area of imperfect evidence. *Vaccine: X* 2 (C), 2019.