VACCINE DELIVERY RESEARCH DIGEST

UNIVERSITY OF WASHINGTON STRATEGIC ANALYSIS, RESEARCH & TRAINING (START) CENTER

REPORT TO THE BILL & MELINDA GATES FOUNDATION

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List of Articles

1 Vaccine supply chain coordination using blockchain and artificial intelligence technologies.

{Abstract & START Commentary} {Full Article}

- A modeling assessing AI and blockchain technologies as a solution for vaccine supply chain challenges.

2 Modeling vaccination and control strategies for outbreaks of monkeypox at gatherings.

{Abstract & START Commentary} {Full Article}

- A compartmental modeling study simulating monkeypox infection dynamics and prevention strategies.

3 Immunization programs to support primary health care and achieve universal health coverage.

{Abstract & START Commentary} {Full Article}

- This review discusses strategies to improve immunization service delivery and primary health care coverage.

4 The Future of Infodemic Surveillance as Public Health Surveillance.

{Abstract & START Commentary} {Full Article}

- A CDC report discussing strategies to monitor and address the spread of misinformation.

5 CDC's COVID-19 International Vaccine Implementation and Evaluation Program and Lessons from Earlier Vaccine Introductions.

{Abstract & START Commentary} {Full Article}

- A CDC report discussing guidance, tools, and policies for global COVID-19 vaccine implementation.

6 Comparisons in the Health and Economic Assessments of Using Quadrivalent Versus Trivalent Influenza Vaccines: A Systematic Literature Review.

{Abstract & START Commentary} {Full Article}

- This systematic review synthesizes economic and health outcomes of influenza vaccines in low- and middle- income countries.

7 COVID-19 Vaccination in Migrants and Refugees: Lessons Learnt and Good Practices.

{Abstract & START Commentary} {Full Article}

- A review describing best practices in equitable COVID-19 vaccine delivery among migrant and refugee populations.

8 Fielding vaccines-challenges and opportunities in outbreaks, complex emergencies, and mass gatherings.

{Abstract & START Commentary} {Full Article}

- This review discusses the general process and barriers to vaccine delivery in emergency settings.

9 Implementation of EACS vaccination recommendations among people living with HIV.

{Abstract & START Commentary} {Full Article}

- A cross-sectional study evaluating the implementation of European AIDS Clinical Society vaccination guidelines for people living with HIV.

10 Now or later: Health impacts of delaying single-dose HPV vaccine implementation in a high-burden setting.

{Abstract & START Commentary} {Full Article}

- A modeling study evaluating immediate and delayed introduction of single-dose HPV vaccination using two models.

Appendix

Details of Articles

1. Vaccine supply chain coordination using blockchain and artificial intelligence technologies.

Gao Y, Gao H, Xiao H, Yao F.

Comput Ind Eng. 2023 Jan 03;175:108885.

PubMed ID: 36505091

ABSTRACT

Currently, the global spread of COVID-19 is taking a heavy toll on the lives of the global population. There is an urgent need to improve and strengthen the coordination of vaccine supply chains in response to this severe pandemic. In this study, we consider a vaccine supply chain based on a combination of artificial intelligence and blockchain technologies and model the supply chain as a two-player dynamic game with inventory level as the dynamic equation of the system. The study focuses on the applicability and effectiveness of the two technologies in the vaccine supply chain and provides management insights. The impact of the application of the technologies on environmental performance is also considered in the model. We also examine factors such as the number of people vaccinated, positive and side effects of vaccines, vaccine decay rate, revenue-sharing/cost-sharing ratio, and commission ratio. The results are as follows: the correlation between the difficulty in obtaining certified vaccines and the profit of a vaccine manufacturer is not monotonous; the vaccine manufacturer is more sensitive to changes in the vaccine attenuation rate. The study's major conclusions are as follows: First, the vaccine supply chain should estimate the level of consumers' difficulty in obtaining a certified vaccine source and the magnitude of the production planning and demand forecasting error terms before adopting the two technologies. Second, the application of artificial intelligence (AI) technology is meaningful in the vaccine supply chain when the error terms satisfy a particular interval condition.

WEB: http://doi.org/10.1016/j.cie.2022.108885

IMPACT FACTOR: 7.180

CITED HALF-LIFE: 4.0

START COMMENTARY

In this modelling study, Gao et al., examine blockchain and AI technologies as a solution for vaccine supply chain challenges, particularly in the context of continued Covid booster doses. Blockchain technology is a platform used for tracking and managing shipments without the involvement of intermediaries or third parties; in the context of vaccines, the technology ensures the validity of

vaccine information in circulation, increasing traceability and reliability of vaccines, improving supply monitoring, and addressing vaccine record fraud. AI is used in this scenario to eliminate the production planning and demand forecasting errors attributable to unexpected epidemic events, reducing the risk of stock-outs and inventory issues. This study's results show that blockchain and AI technologies used in coordination have the potential to enhance supply chain efficiency and improve coordination.

Return to List of Articles

2. Modeling vaccination and control strategies for outbreaks of monkeypox at gatherings.

Yuan P, Tan Y, Yang L, Aruffo E, Ogden N, Bélair J, et al.

Front Public Health. 2022 Dec 16;10:1026489.
PubMed ID: 36504958

ABSTRACT

BACKGROUND: The monkeypox outbreak in non-endemic countries in recent months has led the World Health Organization (WHO) to declare a public health emergency of international concern (PHEIC). It is thought that festivals, parties, and other gatherings may have contributed to the outbreak.

METHODS: We considered a hypothetical metropolitan city and modeled the transmission of the monkeypox virus in humans in a high-risk group (HRG) and a low-risk group (LRG) using a Susceptible-Exposed-Infectious-Recovered (SEIR) model and incorporated gathering events. Model simulations assessed how the vaccination strategies combined with other public health measures can contribute to mitigating or halting outbreaks from mass gathering events.

RESULTS: The risk of a monkeypox outbreak was high when mass gathering events occurred in the absence of public health control measures. However, the outbreaks were controlled by isolating cases and vaccinating their close contacts. Furthermore, contact tracing, vaccinating, and isolating close contacts, if they can be implemented, were more effective for the containment of monkeypox transmission during summer gatherings than a broad vaccination campaign among HRG, when accounting for the low vaccination coverage in the overall population, and the time needed for the development of the immune responses. Reducing the number of attendees and effective contacts during the gathering could also prevent a burgeoning outbreak, as could restricting attendance through vaccination requirements.

CONCLUSION: Monkeypox outbreaks following mass gatherings can be made less likely with some restrictions on either the number and density of attendees in the gathering or vaccination requirements. The ring vaccination strategy inoculating close contacts of confirmed cases may not be enough to prevent potential outbreaks; however, mass gatherings can be rendered less risky if that strategy is combined with public health measures, including identifying and isolating cases and contact tracing. Compliance with the community and promotion of awareness are also indispensable to containing the outbreak.

WEB: 10.3389/fpubh.2022.1026489
IMPACT FACTOR: 2.483
CITED HALF-LIFE: 3.0

START COMMENTARY

In this compartmental modeling study, Yuan et al. simulated monkeypox infection dynamics within a hypothetical metropolitan city with a low-risk population group (LRG) and a high-risk population group (HRG). LRG individuals were those whose risk of infection was reduced by their behaviors; HRG individuals were those whose behavior makes them at higher risk of acquiring monkeypox infection. For the purposes of the simulation, the two groups interacted between and within groups, but there was no movement between the risk groups unless there were a gathering event in which LRG individuals may become part of the HRG. *Figure 1* is a schematic diagram and flow chart of the transmission dynamics of LRG and HRG individuals, with the following states: Susceptible, Exposed, Infectious, Prodromal Phase, infectious, acute phase with rash symptom, recovered, quarantined, quarantined and vaccinated, quarantined and susceptible, and partially vaccinated. The model also included parameters for demographic data, monkeypox transmission scenarios, testing and isolation, vaccination, and gathering events (5 scenarios). *Figures 3 & 4* show the impact of Post-Exposure Prophylaxis with contact tracing (PEPCT) and Pre-Exposure Prophylaxis in HRG (PrEPH) prevention strategies in the scenarios of a mass gathering with 100,000 attendees. The authors found the PEPCT strategy to be beneficial in the control of monkeypox outbreaks. However, there are limitations to these findings as PEPCT relies on contact tracing and isolation after exposure, which may be associated with major challenges.

Return to List of Articles

3. Immunization programs to support primary health care and achieve universal health coverage.

Blanc D, Grundy J, Sodha S, O'Connell T, von Mühlenbrock H, Grevendonk J, et al.

Vaccine. 2022 Dec 12.

PubMed ID: 36503857

ABSTRACT

Gains in immunization coverage and delivery of primary health care service have stagnated in recent years. Remaining gaps in service coverage reflect multiple underlying reasons that may be amenable to improved health system design. Immunization systems and other primary health care services can be mutually supportive, for improved service delivery and for strengthening of Universal Health Coverage. Improvements require that dynamic and multi-faceted barriers and risks be addressed. These include workforce availability, quality data systems and use, leadership and management that is innovative, flexible, data driven and responsive to local needs. Concurrently, improvements in procurement, supply chain, logistics and delivery systems, and integrated monitoring of vaccine coverage and epidemiological disease surveillance with laboratory systems, and vaccine safety will be needed to support community engagement and drive prioritized actions and communication. Finally, political will and sustained resource commitment with transparent accountability mechanisms are required. The experience of the impact of COVID-19 pandemic on essential PHC services and the challenges of vaccine roll-out affords an opportunity to apply lessons learned in order to enhance vaccine services integrated with strong primary health care services and universal health coverage across the life course.

WEB: 10.1016/j.vaccine.2022.09.086

IMPACT FACTOR: 3.143

CITED HALF-LIFE: 7.3

START COMMENTARY

In this paper, Chang Blanc et al. discuss strategies to improve vaccine service delivery and primary health care services with universal health coverage. Although access to primary health care services have improved, utilization of immunization services have remained stagnant since 2010, and equity gaps in coverage remain for vaccines and primary health care availability. Authors provide guidance on how to align efforts to the Immunization Agenda 2030 (IA2030) though integrating primary health care and universal health coverage, staying consistent with the WHO operational framework for primary health care. Potential challenges, risks, and opportunities are addressed in the following areas: leadership & management, skilled workforce shortages, disease control & surveillance, supply chain & logistics, data use & information systems, and vaccine safety and vaccine

confidence. Authors provide four main approaches for operationalizing the integrated approach of IA2030, to be revised based on country context: plan & design service delivery models with community input, utilize a people-centered service deliver approach, improve coordination of care across settings and sectors, and create an enabling environment through change management and workforce training. Authors hope to gain additional support for this agenda at a global scale through the World Health Assembly.

Return to List of Articles

4. The Future of Infodemic Surveillance as Public Health Surveillance.

Chiou H, Voegeli C, Wilhelm E, Kolis J, Brookmeyer K, Prybylski D.

Emerg Infect Dis. 2022 Dec 16;28(13):S121-S128.
PubMed ID: 36502389

ABSTRACT

Public health systems need to be able to detect and respond to infodemics (outbreaks of misinformation, disinformation, information overload, or information voids). Drawing from our experience at the US Centers for Disease Control and Prevention, the COVID-19 State of Vaccine Confidence Insight Reporting System has been created as one of the first public health infodemic surveillance systems. Key functions of infodemic surveillance systems include monitoring the information environment by person, place, and time; identifying infodemic events with digital analytics; conducting offline community-based assessments; and generating timely routine reports. Although specific considerations of several system attributes of infodemic surveillance system must be considered, infodemic surveillance systems share several similarities with traditional public health surveillance systems. Because both information and pathogens are spread more readily in an increasingly hyperconnected world, sustainable and routine systems must be created to ensure that timely interventions can be deployed for both epidemic and infodemic response.

WEB: 10.3201/eid2813.220696
IMPACT FACTOR: 6.259
CITED HALF-LIFE: 7.9

START COMMENTARY

In this paper, authors from the US Centers for Disease Control and Prevention, the COVID-19 State of Vaccine Confidence Insight Reporting System discuss strategies for surveilling and addressing the spread of infodemics defined as outbreaks of misinformation, disinformation, information overload, or information voids, all of which have occurred with the COVID-19 pandemic. Authors provide a vision of infodemic surveillance as a core public health function. They suggest an infodemic surveillance system perform the following functions: monitor information environment by person, place, and time; use digital media analytics to identify infodemic events, conduct offline community-based assessments, and generate timely routine reports to be used by the greater public health community. Of the many considerations of establishing a public health infodemic surveillance system, challenge of timeliness and legality privacy, and ethics may be the most critically important. Though similar monitoring has been included as a component of previous WHO evaluation guidelines and tools, these activities are often not considered part of routine public health

surveillance. With the ever-increasing availability of information online, it is clear this will continue to be a pressing issue.

Return to List of Articles

5. CDC's COVID-19 International Vaccine Implementation and Evaluation Program and Lessons from Earlier Vaccine Introductions.

Soeters H, Doshi R, Fleming M, Adegoke O, Ajene U, Aksnes B, et al.

Emerg Infect Dis. 2022 Dec 16;28(13):S208-S216.

PubMed ID: 36502382

ABSTRACT

The US Centers for Disease Control and Prevention (CDC) supports international partners in introducing vaccines, including those against SARS-CoV-2 virus. CDC contributes to the development of global technical tools, guidance, and policy for COVID-19 vaccination and has established its COVID-19 International Vaccine Implementation and Evaluation (CIVIE) program. CIVIE supports ministries of health and their partner organizations in developing or strengthening their national capacities for the planning, implementation, and evaluation of COVID-19 vaccination programs. CIVIE's 7 priority areas for country-specific technical assistance are vaccine policy development, program planning, vaccine confidence and demand, data management and use, workforce development, vaccine safety, and evaluation. We discuss CDC's work on global COVID-19 vaccine implementation, including priorities, challenges, opportunities, and applicable lessons learned from prior experiences with Ebola, influenza, and meningococcal serogroup A conjugate vaccine introductions.

WEB: 10.3201/eid2813.212123

IMPACT FACTOR: 6.259

CITED HALF-LIFE: 7.9

START COMMENTARY

In this article, authors from the US Centers for Disease Control and Prevention (CDC) discuss the guidance, tools, and policy for global COVID-19 vaccine implementation. The CIVIE program was established by the CDC in 2020 to help Ministries of Health effectively introduce, deploy, manage, and evaluate COVID-19 vaccines, and establish sustainable programs for vaccine delivery. *Table 1* provided examples of CDC-supported activities in the 7 priority areas CIVIE focuses on. Some challenges faced during the initial rollout of the COVID-19 vaccine were: insufficient manufacturing capacity, supply constraints, demand, equitable distribution and access, and staffing shortages, among many others. These challenges and the nature of the COVID-19 vaccine required countries to devise and communicate new strategies that were distinct from the typical childhood immunization programs. *Table 2* summarizes lessons learned from the previous global vaccine introductions of Ebola, Infuenza, and Meningococcal serogroup A. Despite its limitations, CIVIE builds on lessons from previous vaccine introductions, and can help to lay the groundwork for expanding sustainable

vaccine delivery programs.

Return to List of Articles

6. Comparisons in the Health and Economic Assessments of Using Quadrivalent Versus Trivalent Influenza Vaccines: A Systematic Literature Review.

Warmath C, Ortega-Sanchez I, Duca L, Porter R, Usher M, Bresee J, et al.

Value Health. 2022 Dec 25.

PubMed ID: 36436790

ABSTRACT

OBJECTIVES: Seasonal influenza vaccines protect against 3 (trivalent influenza vaccine [IIV3]) or 4 (quadrivalent influenza vaccine [IIV4]) viruses. IIV4 costs more than IIV3, and there is a trade-off between incremental cost and protection. This is especially the case in low- and middle-income countries (LMICs) with limited budgets; previous reviews have not identified studies of IIV4-IIV3 comparisons in LMICs. We summarized the literature that compared health and economic outcomes of IIV4 and IIV3, focused on LMICs.

METHODS: We systematically searched 5 databases for articles published before October 6, 2021, that modeled health or economic effects of IIV4 versus IIV3. We abstracted data and compared findings among countries and models.

RESULTS: Thirty-eight studies fit our selection criteria; 10 included LMICs. Most studies (N = 31) reported that IIV4 was cost-saving or cost-effective compared with IIV3; we observed no difference in health or economic outcomes between LMICs and other countries. Based on cost differences of influenza vaccines, only one study compared coverage of IIV3 with IIV4 and reported that the maximum IIV4 price that would still yield greater public health impact than IIV3 was 13% to 22% higher than IIV3.

CONCLUSIONS: When vaccination coverage with IIV4 and IIV3 is the same, IIV4 tends to be not only more effective but more cost-effective than IIV3, even with relatively high price differences between vaccine types. Alternatively, where funding is limited as in most LMICs, higher vaccine coverage can be achieved with IIV3 than IIV4, which could result in more favorable health and economic outcomes.

WEB: 10.1016/j.jval.2022.11.008
IMPACT FACTOR: 5.156
CITED HALF-LIFE: 7.3

START COMMENTARY

In this systematic review, Warmath et al. summarize economic evaluation literature to compare health and economic outcomes of trivalent and quadrivalent influenza vaccines in low- and middle-

income countries (LMICs). Authors included 38 studies in the review, with 37 studies scoring 17/24 points or higher, based on the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) guidelines. *Table 1* provides characteristics of the economic studies, including information like the declared study type, currency base year, time horizon, willingness-to-pay threshold, discount rate, and CHEERS score. Key model inputs are provided in *Tables 2, 3, and 4*, including vaccine efficacy, cost per dose, and vaccine coverage, hospitalization and death, and costs per case, respectively. *Tables 5 and 6* provide economic outputs for each of the included papers. Authors found the magnitude of the cost-saving to be highly variable, and found no difference in ICERs by income status of the country or population. Resource constraints of countries and vaccine type should be considered heavily in countries looking to optimize health and economic impact of influenza vaccination.

Return to List of Articles

7. COVID-19 Vaccination in Migrants and Refugees: Lessons Learnt and Good Practices.

Immordino P, Graci D, Casuccio A, Restivo V, Mazzucco W.

Vaccines (Basel). 2022 Nov 28;10(11).
PubMed ID: 36423059

ABSTRACT

The COVID-19 pandemic has exacerbated inequalities between low- and high-income countries. Within the latter, a greater impact is seen in the poorest and most vulnerable people, including refugees, asylum seekers, and migrants. They all may experience poor access to quality healthcare or have suboptimal health-seeking behavior, distrust of governments, or fear of detention and deportation if seeking healthcare. Some refugees and migrants may face multiple barriers to vaccination and access to health systems that are relevant to the administration of COVID-19 vaccines, despite the growing inclusion of these populations in public health policies. Several good practices have emerged to ensure the inclusion of these populations in vaccination and healthcare for COVID-19 globally. However, inequalities persist between high-income and low-/middle-income populations. The inequalities in COVID-19 vaccination reflect the already existing ones in common health services worldwide. Further efforts are necessary to reduce such disparities, to protect the vulnerable, and, by extension, the general population. The initiatives organized, both at global and local levels, to support vaccination campaigns represent a notable example of how complex multilevel structures, such as health systems, as well as limited resource health services, can successfully face, even during a health emergency, the challenges related to global health issues.

WEB: 10.3390/vaccines10111965
IMPACT FACTOR: 4.086
CITED HALF-LIFE: 3.4

START COMMENTARY

In this review, Immordino et al. describe practices to ensure more equitable COVID-19 vaccine coverage among migrants and refugees. In September 2022, an estimated 72.5% of the population in high-income countries had been vaccinated with at least one dose of COVID-19 vaccine, while in low-income countries, only 23.9% of the population had received at least one shot; this massive disparity offers a partial explanation of why the highest excess deaths attributed to COVID-19 are in South Asia, North Africa, and the Middle East. Both at the beginning of vaccine roll-out and in recent national COVID-19 vaccine plans, countries included refugees and regular migrants in campaigns, which the inclusion of irregular migrants in local vaccination planning are scarce. Refugees and

migrants face additional barriers to receiving COVID-19 vaccines, despite the growing inclusion of refugees and migrants in public health policies.

Return to List of Articles

8. Fielding vaccines-challenges and opportunities in outbreaks, complex emergencies, and mass gatherings.

Fischer L, Rains R, Brett-Major S, Senga M, Holden D, Brett-Major D.

Hum Vaccin Immunother. 2022 Dec 16;18(6):2104500.

PubMed ID: 35930505

ABSTRACT

With the recent COVID-19 pandemic, the importance of vaccine development, distribution, and uptake has come to the forefront of the public eye. Effectively fielding vaccines during an emergency-whether that emergency is a result of an infectious disease or not-requires an understanding of usual vaccine-related processes; the impact of outbreak, complex emergencies, mass gatherings, and other events on patients, communities, and health systems; and ways in which diverse resources can be applied to successfully achieve needed vaccine uptake. In this review, both the emergency setting and briefly vaccine product design are discussed in these contexts in order to provide a concise source of general knowledge from experts in fielding vaccines that can aid in future vaccine ventures and increase general awareness of the process and barriers in various settings.

WEB: 10.1080/21645515.2022.2104500

IMPACT FACTOR: 2.619

CITED HALF-LIFE: 3.9

START COMMENTARY

In this review, Fischer et al. discuss the general process and barriers to vaccine delivery in emergency settings, incorporating the impact of outbreak, complex emergencies, mass gatherings, and utilization of resources. When considering setting, the authors discuss access during routine vaccinations, access during complex emergencies, storage and distribution, and uptake issues. Authors also discuss vaccine access initiatives and partnerships, highlighting Global Alliance for Vaccines and Immunizations (GAVI), other public-private partnerships, The World Health Organization's (WHO) Pandemic Influenza Preparedness (PIP)- Framework, and most recently, COVAX. Purchasing or gifting are not the only mechanisms available to provide vaccines to low-resource countries, the authors also outline the WHO's prequalification process that allows eligibility for the essential medicines list and other procurement programming. Each emergency scenario is unique, so authors emphasize that consideration of relevant components of the setting should be incorporated in designing vaccine deployment. For example, if vaccine doses are limited, fractional dosing administered intradermally has been shown to have similar immunogenicity as full dose

intramuscular doses. In addition to robust health care access, vaccine access, adequate storage and distribution, and vaccine uptake, specific system support in emergency situations are also needed.

Return to List of Articles

9. Implementation of EACS vaccination recommendations among people living with HIV.

Breitschwerdt S, Schwarze-Zander C, Al Tayy A, Mutevelli J, Wasmuth J, Rockstroh J, et al.
Infection. 2022 Nov 30;50(6):1491-1497.
PubMed ID: 35522383

ABSTRACT

OBJECTIVES: With modern combination antiretroviral Treatment (cART) a normal life expectancy among people living with HIV (PLWH) has become reality if started early enough prior to the onset of more pronounced immunodeficiency. Therefore, prevention measures against other infectious diseases among this vulnerable group have gained increased attention. Indeed, the EACS guidelines recommend vaccinations against HAV, HBV, HPV, Influenza, Neisseria meningitidis, Streptococcus pneumoniae and VZV in HIV-infected adults.

METHODS: All PLWH under cART attending our ID outpatient clinic between April to June 2018, were assessed during consultation for vaccination status regarding pneumococcus, Hepatitis A and B, influenza, varicella, meningococcus and HPV using a pre-defined questionnaire, vaccination certificates and medical records. In addition, the cohort database was screened for Hepatitis A and B serology and HIV surrogate markers.

RESULTS: A total of 305 PLWH (82.3% male, 17.7% female) was included, median age was 48 years (IQR 47-51). Median CD4 + T cell count was 543 (IQR 304-770), and for 297 (97.4%) PLWH CD4 + T cell count was ≥ 200/ul. The viral load was undetectable (< 40 copies/ml) in 289 (94.8%) cases. Highest vaccination rates were observed for HAV (87.4%), Streptococcus pneumoniae (77.4%) and Influenza (76.5%). 64.3% PLWH got vaccinated against HBV, whereas VZV vaccination only played a minor role, in the context of the high rate of cleared infections (99.0%). Lowest vaccination rates were detected for HPV (0%) and Neisseria meningitidis (3.0%).

CONCLUSIONS: Our data suggest that vaccination rates among PLWH are higher compared to the general German population. Implementation of EACS guidelines into daily routine though is not fully executed and the need for improving vaccination rates has to be emphasized. Centrally organized vaccination registers as well as electronic medical records could be helpful tools to detect a lack of vaccination coverage and send digital vaccination reminders particularly among risk groups.

WEB: 10.1007/s15010-022-01827-6
IMPACT FACTOR: 7.455
CITED HALF-LIFE: 5.0

START COMMENTARY

In this cross-sectional study, Breitschwerdt et al. evaluated immunization status among people living with HIV (PLWH) in Germany to obtain data on the implementation of the European AIDS Clinical Society (EACS) vaccination guidelines. Overall, 305 PLWH were included, 251 male (82.3%). Participants were evaluated on the advised vaccinations from EACS guidelines: Hepatitis A and B (HAV, HBV), human papilloma viruses (HPV), seasonal Influenza, Neisseria meningitidis, Streptococcus pneumoniae and Varizella zoster virus (VZV). *Table 2* provides an overview of the vaccination rates for the 7 recommended vaccinations for PLWH. Most notably, 0% of participants were vaccinated against Human papillomavirus (HPV), 3% were vaccinated against Neisseria meningitidis, and 14% were vaccinated against Polysaccharide vaccine mono. *Figures 2, 3, and 4* describe the detected antibodies and vaccination status of participants for Hepatitis A, Hepatitis B, and *S. pneumonie*, respectively. Vaccination rates for most of the EACS recommendations have high vaccination coverage, but there is room to improve coverage for HPV, *Neisseria meningitidis,* and Varicella Zoster virus.

Return to List of Articles

10. Now or later: Health impacts of delaying single-dose HPV vaccine implementation in a high-burden setting.

Burger E, Laprise J, Sy S, Regan M, Prem K, Jit M, et al.

Int J Cancer. 2022 Sep 28;151(10):1804-1809.

PubMed ID: 35512109

ABSTRACT

We aimed to quantify the health impact of immediate introduction of a single-dose human papillomavirus (HPV) vaccination program in a high-burden setting, as waiting until forthcoming trials are completed to implement single-dose HPV vaccination may result in health losses, particularly for cohorts who would age-out of vaccination eligibility. Two mathematical models fitted to a high-burden setting projected cervical cancer incidence rates associated with (a) immediate implementation of one-dose HPV vaccination vs (b) waiting 5 years for evidence from randomized trials to determine if one- or two-doses should be implemented. We conducted analyses assuming a single dose was either noninferior or inferior to two doses. The models projected that immediate implementation of a noninferior single-dose vaccine led to a 7.2% to 9.6% increase in cancers averted between 2021 to 2120, compared to waiting 5 years. Health benefits remained greater with immediate implementation despite an inferior single-dose efficacy (80%), but revaccination of one-dose recipients became more important assuming vaccine waning. Under most circumstances, immediate vaccination avoided health losses for those aging out of vaccine eligibility, leading to greater health benefits than waiting for more information in 5 years.

WEB: 10.1002/ijc.34054

IMPACT FACTOR: 7.316

CITED HALF-LIFE: 8.6

START COMMENTARY

Burger *et al*. examined the impact of immediate vs. delayed introduction of a single-dose human papillomavirus (HPV) program in a high-burden setting using two models: the Harvard TH Chan and the HPV-ADVISE. Though guidelines recommend two doses of HPV vaccine for girls aged 9 to 14, single dose efficacy of HPV vaccination has been studied and appears to have preliminary evidence of noninferior efficacy in clinical trial results. These trials will be complete in 2026, so delaying single-dose vaccination of girls 9 -14 could miss a large cohort of individuals. Analysis 1 quantifies the health impacts of a 5-year delayed implementation of a noninferior single-dose HPV vaccine, assuming a loss of direct vaccine protection for girls aged 10 to 14 in 2021. Analysis 2 assumes the single-dose vaccine is ultimately found to be inferior (80% efficacy) in 2026 but implementation of a single-dose regimen had moved forward in 2021, resulting in routine programs reverting to a two-

dose schedule in 2026. Figures 1 and 2 show the age-standardized incidence per 100,000 women over time (until 2120) for the two scenarios. The model demonstrated that immediate implementation of a single-dose HPV vaccination schedule, even in the absence of confirmatory trials, is likely to yield greater health benefit than delaying vaccination by 5 years.

Return to List of Articles

Appendix

The literature search for the [MONTH] 2022 Vaccine Delivery Research Digest was conducted on [MONTH-1] [DATE], [YEAR]. We searched English language articles indexed by the US National Library of Medicine and published between [MONTH-2] 15, 2022 and [MONTH-1] 14, 2022. The search resulted in 624 items.

SEARCH TERMS

(((((vaccine[tiab] OR vaccines[tiab] OR vaccination[tiab] OR immunization[tiab] OR immunisation[tiab] OR vaccine[mesh] OR immunization[mesh]) AND (logistics[tiab] OR supply[tiab] OR “supply chain”[tiab] OR implementation[tiab] OR expenditures[tiab] OR financing[tiab] OR economics[tiab] OR “Cost effectiveness”[tiab] OR coverage[tiab] OR attitudes[tiab] OR belief[tiab] OR beliefs[tiab] OR refusal[tiab] OR “Procurement”[tiab] OR timeliness[tiab] OR systems[tiab])) OR (“vaccine delivery”[tiab])) NOT (“in vitro”[tiab] OR “immune response”[tiab] OR gene[tiab] OR chemistry[tiab] OR genotox*[tiab] OR sequencing[tiab] OR nanoparticle*[tiab] OR bacteriophage[tiab] OR exome[tiab] OR exogenous[tiab] OR electropor*[tiab] OR “systems biology”[tiab] OR “animal model”[tiab] OR cattle[tiab] OR sheep[tiab] OR goat[tiab] OR rat[tiab] OR pig[tiab] OR mice[tiab] OR mouse[tiab] OR murine[tiab] OR porcine[tiab] OR ovine[tiab] OR rodent[tiab] OR fish[tiab])) AND (English[LA]) (“2022/15/11”[PDAT] : “2022/14/12”[PDAT]))