VACCINE DELIVERY RESEARCH DIGEST

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

REPORT TO THE BILL & MELINDA GATES FOUNDATION

PRODUCED BY: ARAKAKI L, BABIGUMIRA JB

OCTOBER 2018

Want the Vaccine Delivery Research Digest delivered directly to your inbox?
Subscribe on the Digest website: http://uwstartcenter.org/publication-digests/vaccine-digest/

START CENTER
STRATEGIC ANALYSIS, RESEARCH & TRAINING CENTER
Department of Global Health | University of Washington

List of Articles

1 Progress Toward Poliovirus Containment Implementation - Worldwide, 2017-2018
{Abstract & START Commentary} {Full article}

- A report describing progress to increase compliance with the WHO Global Action Plan and limit facilities retaining poliovirus material in an effort to minimize the risk of polio outbreaks.

2 Type 2 Poliovirus Detection after Global Withdrawal of Trivalent Oral Vaccine
{Abstract & START Commentary} {Full article}

- A study using global acute flaccid paralysis surveillance and environmental surveillance data to examine the prevalence of wild serotype 2 poliovirus, Sabin-2 poliovirus (i.e., vaccine virus), and vaccine-derived serotype 2 poliovirus in 118 countries after the global withdrawal of trivalent oral poliovirus vaccine.

3 Successes and challenges of expansion of environmental poliovirus surveillance in the WHO South-East Asia Region
{Abstract & START Commentary} {Full article}

- A report describing the expansion of environmental poliovirus surveillance (ES) in the WHO South-East Asia Region and resulting polioviruses detected. This report also includes a discussion about the role of ES in polio eradication and current challenges.

4 Human Papillomavirus Vaccine Introduction in South Africa: Implementation Lessons From an Evaluation of the National School-Based Vaccination Campaign
{Abstract & START Commentary} {Full article}

- A cross-sectional, mixed-methods evaluation of administration of the first dose of a national school-based HPV vaccination campaign in South Africa to identify successes and challenges that may inform administration of the second dose.

5 Prevention of Cervical Cancer in Sub-Saharan Africa: The Advantages and Challenges of HPV Vaccination
{Abstract & START Commentary} {Full article}

- A review of cervical cancer in sub-Saharan Africa and case study of HPV vaccine implementation from Rwanda.

6 Measles outbreak risk in Pakistan: exploring the potential of combining vaccination coverage and incidence data with novel data-streams to strengthen control
{Abstract & START Commentary} {Full article}

- A study examining the ability of population-susceptibility data and novel connectivity data to predict the 2012–2013 measles outbreak in Pakistan.

7 Individual- and community-level determinants of child immunization in the Democratic Republic of Congo: A multilevel analysis
{Abstract & START Commentary} {Full article}

- A cross-sectional study using a multilevel model to assess the association of individual- and community-level factors and child immunization completeness.

8 Longitudinal characterization of nasopharyngeal colonization with Streptococcus pneumoniae in a South African birth cohort post 13-valent pneumococcal conjugate vaccine implementation
{Abstract & START Commentary} {Full article}

- A longitudinal study characterizing pneumococcal carriage among 137 South African infants in their first year of life.

9 Dual-chamber injection device for measles-rubella vaccine: The potential impact of introducing varying sizes of the devices in 3 countries
{Abstract & START Commentary} {Full article}

- A modeling study that examines the impact of using a measles-rubella dual-chamber injection device on the cold chain compared to 10-dose vials.

10 Reported incidence and risk factors of childhood pneumonia in India: a community-based cross-sectional study
{Abstract & START Commentary} {Full article}

- A cross-sectional community-based survey to assess the prevalence of and factors associated with childhood pneumonia in two districts of Maharashtra state, India in 2015.

Appendix

Details of Articles

1. Progress Toward Poliovirus Containment Implementation - Worldwide, 2017-2018

Fournier-Caruana J, Previsani N, Singh H, Boualam L, Swan J, Llewellyn A, et al.

MMWR Morb Mortal Wkly Rep. 2018 Sep 7;67(35):992–995.

PubMed ID: 30188884

ABSTRACT

Substantial progress has been made since the World Health Assembly (WHA) resolved to eradicate poliomyelitis in 1988. Among the three wild poliovirus (WPV) types, type 2 (WPV2) was declared eradicated in 2015, and type 3 (WPV3) has not been reported since 2012. In 2017 and 2018, only Afghanistan and Pakistan have reported WPV type 1 (WPV1) transmission. When global eradication of poliomyelitis is achieved, facilities retaining poliovirus materials need to minimize the risk for reintroduction of poliovirus into communities and reestablishment of transmission. Poliovirus containment includes biorisk management requirements for laboratories, vaccine production sites, and other facilities that retain polioviruses after eradication; the initial milestones are for containment of type 2 polioviruses (PV2s). At the 71st WHA in 2018, World Health Organization (WHO) Member States adopted a resolution urging acceleration of poliovirus containment activities globally, including establishment by the end of 2018 of national authorities for containment (NACs) to oversee poliovirus containment. This report summarizes containment progress since the previous report and outlines remaining challenges. As of August 2018, 29 countries had designated 81 facilities to retain PV2 materials; 22 of these countries had established NACs. Although there has been substantial progress, intensification of containment measures is needed.

WEB: 10.15585/mmwr.mm6735a5

IMPACT FACTOR: 12.89

CITED HALF-LIFE: n/a

START COMMENTARY

Containment of poliovirus from facilities is a crucial step to ensure virus retained at facilities are not released into the community, especially as polio eradication is close to achievement. Countries were requested to evaluate their designated poliovirus-essential facilities (PEFs) as minimizing the number of PEFs reduces the risk of potential release of virus into the community. Last year, 86 PEFs within 30 countries were reported compared to 81 PEFs within 29 countries this year. Furthermore, a

higher number of National Authorities for Containment (NACs), which are authorities for auditing facilities and issuing containment certificates, were reported this year than last year (22 vs. 18). While progress has been made towards poliovirus containment in facilities, there is a sense of urgency to bring countries up to full compliance with WHO Global Action Plan (GAPIII) standards in time as the world works towards polio eradication.

Return to List of Articles

2. Type 2 Poliovirus Detection after Global Withdrawal of Trivalent Oral Vaccine

Blake IM, Pons-Salort M, Molodecky NA, Diop OM, Chenoweth P, Bandyopadhyay AS, et al.
N Engl J Med. 2018 Aug 30;379(9):834–845.
PubMed ID: 30157398

ABSTRACT

BACKGROUND:
Mass campaigns with oral poliovirus vaccine (OPV) have brought the world close to the eradication of wild poliovirus. However, to complete eradication, OPV must itself be withdrawn to prevent outbreaks of vaccine-derived poliovirus (VDPV). Synchronized global withdrawal of OPV began with serotype 2 OPV (OPV2) in April 2016, which presented the first test of the feasibility of eradicating all polioviruses.
METHODS:
We analyzed global surveillance data on the detection of serotype 2 Sabin vaccine (Sabin-2) poliovirus and serotype 2 vaccine-derived poliovirus (VDPV2, defined as vaccine strains that are at least 0.6% divergent from Sabin-2 poliovirus in the viral protein 1 genomic region) in stool samples from 495,035 children with acute flaccid paralysis in 118 countries and in 8528 sewage samples from four countries at high risk for transmission; the samples were collected from January 1, 2013, through July 11, 2018. We used Bayesian spatiotemporal smoothing and logistic regression to identify and map risk factors for persistent detection of Sabin-2 poliovirus and VDPV2.
RESULTS:
The prevalence of Sabin-2 poliovirus in stool samples declined from 3.9% (95% confidence interval [CI], 3.5 to 4.3) at the time of OPV2 withdrawal to 0.2% (95% CI, 0.1 to 2.7) at 2 months after withdrawal, and the detection rate in sewage samples declined from 71.0% (95% CI, 61.0 to 80.0) to 13.0% (95% CI, 8.0 to 20.0) during the same period. However, 12 months after OPV2 withdrawal, Sabin-2 poliovirus continued to be detected in stool samples (<0.1%; 95% CI, <0.1 to 0.1) and sewage samples (8.0%; 95% CI, 5.0 to 13.0) because of the use of OPV2 in response to VDPV2 outbreaks. Nine outbreaks were reported after OPV2 withdrawal and were associated with low coverage of routine immunization (odds ratio, 1.64 [95% CI, 1.14 to 2.54] per 10% absolute decrease) and low levels of population immunity (odds ratio, 2.60 [95% CI, 1.35 to 5.59] per 10% absolute decrease) within affected countries.
CONCLUSIONS:
High population immunity has facilitated the decline in the prevalence of Sabin-2 poliovirus after OPV2 withdrawal and restricted the circulation of VDPV2 to areas known to be at high risk for transmission. The prevention of VDPV2 outbreaks in these known areas before the accumulation of

substantial cohorts of children susceptible to type 2 poliovirus remains a high priority. (Funded by the Bill and Melinda Gates Foundation and the World Health Organization.).

WEB: 10.1056/NEJMoa1716677
IMPACT FACTOR: 79.26
CITED HALF-LIFE: 8.40

START COMMENTARY

Blake et al. measured the prevalence of wild, vaccine (Sabin-2), and vaccine-derived poliovirus serotype 2 (VDPV2) in 118 countries using global surveillance data of stool samples from children with acute flaccid paralysis and sewage samples from four high-risk countries after the global withdrawal of the trivalent oral poliovirus vaccine (OPV) in 2016. The strategy recommended by the World Health Organization was devised after outbreaks of vaccine-derived poliovirus (defined as >6% difference from the Sabin-2 virus in the viral protein 1 genomic region) were identified. Authors described how withdrawing serotype 2 oral poliovirus vaccine (OPV2) places the global community in a precarious position. Both use and withdrawal of OPV2 can lead to outbreaks of VDPV2. Figure 2 showed declines in Sabin-2 poliovirus after the withdrawal of OPV2 in both AFP stool samples and sewage samples, with some presence detected after 12 months due to continued OPV2 use for outbreak control of VDPV2. Authors noted that with only the first two years of observation, it may still be too early to see the impact of the withdrawal since most of the subsequent outbreaks were linked to viruses that were in circulation pre-withdrawal. A few limitations of the study included the inability to obtain data from the Americas or western Pacific regions, inconsistency with AFP reporting, and not accounting for seasonality. Ongoing monitoring of serotype 2 poliovirus after global withdrawal of OPV2 is important to ensure global eradication of polio.

Return to List of Articles

3. Successes and challenges of expansion of environmental poliovirus surveillance in the WHO South-East Asia Region

Garg A, Pattamadilok S, Bahl S.

WHO South East Asia J Public Health. 2018 Sep;7(2):122–128.

PubMed ID: 30136671

ABSTRACT

The last decade has witnessed an exponential expansion of environmental surveillance (ES) of poliovirus in sewage samples in the World Health Organization (WHO) South-East Asia Region. This has grown from only three sites in Mumbai, India in 2001 to 56 sites in 2017 in Bangladesh, India, Indonesia, Myanmar, Nepal and Thailand. ES is critical to the region in providing evidence of silent transmission of vaccine-derived poliovirus and Sabin-like poliovirus type 2 - especially since the global "switch" to cease use of oral polio vaccine type 2 - and for monitoring the effectiveness of containment activities. This targeted expansion of ES to supplement surveillance for acute flaccid paralysis (AFP) required quality assurance in ES procedures, improvements in the sensitivity of the laboratory-based surveillance system, and establishment of real-time data analysis for evidence-based programmes. ES in the region has provided documentary evidence for the absence of indigenous wild poliovirus in circulation and no importations via international travellers. Post-switch, while no vaccine-derived poliovirus was detected from AFP cases, ES identified five ambiguous vaccine-derived polioviruses in 2016 and early 2017, with no evidence of circulation. Future challenges include monitoring for vaccine-derived poliovirus strains shed for a prolonged time by immunodeficient individuals, and expanding ES to areas lacking sewage networks. To maintain the polio-free status of the WHO South-East Asia Region and achieve a world free of poliomyelitis, critical evaluation of immunization coverage, continued performance of surveillance for acute flaccid paralysis, and enhanced analysis of sewage samples to detect any breach in containment are essential.

WEB: 10.4103/2224-3151.239424

IMPACT FACTOR: n/a

CITED HALF-LIFE: n/a

START COMMENTARY

Serving as a supplement to acute flaccid paralysis surveillance, environmental surveillance (ES) detects transmission of poliovirus in a community from symptomatic and asymptomatic cases.

Without ES, transmission of poliovirus from asymptomatic cases may go undetected as only 0.1% to 1% of infected cases are symptomatic. With the expansion of ES, 2567 sewage samples were collected from 56 sites, India representing about 75% of sites, from April 2016 to December 2017. Figure 1 summarizes the polioviruses detected from each location, depicting the last wild type virus detection of the World Health Organization (WHO) South-East Asia Region in 2010. Authors highlight the role of ES in coordination with other surveillance and risk assessment efforts to appropriately respond to Sabin-like PV2 detection after the 2016 global withdrawal of serotype 2 oral poliovirus vaccine. Additional challenges the authors discuss are responding to the dynamic nature of risk status that dictates ES expansion, ensuring data quality meets rapidly evolving protocols, and preventing facility-associated transmission from laboratories not included in the WHO-accredited Regional Polio Laboratory Network.

Return to List of Articles

4. Human Papillomavirus Vaccine Introduction in South Africa: Implementation Lessons From an Evaluation of the National School-Based Vaccination Campaign

Delany-Moretlwe S, Kelley KF, James S, Scorgie F, Subedar H, Dlamini NR, et al.

Glob Health Sci Pract. 2018 Aug 24 [Epub ahead of print].

PubMed ID: 30143561

ABSTRACT

BACKGROUND:

In April 2014, a national school-based human papillomavirus (HPV) vaccination program was rolled out in South Africa, targeting Grade 4 girls aged ≥9 years. A bivalent HPV vaccine with a 2-dose (6 months apart) schedule was used. At the request of the National Department of Health (NDoH), we conducted an external assessment of the first-dose phase of the vaccination program to evaluate program coverage and vaccine safety and identify factors that influenced implementation.

METHODS:

We based our cross-sectional and mixed-methods approach on a process evaluation framework, which included a review of key planning and implementation documents and monitoring data; observation at vaccination sites; key informant interviews (N=34); and an assessment of media coverage and content related to the campaign.

FINDINGS:

There was overall success in key measures of coverage and safety. Over 350,000 Grade 4 girls were vaccinated in more than 16,000 public schools across South Africa, which translated to 94.6% of schools reached and 86.6% of age-eligible learners vaccinated. No major adverse events following immunization were detected. We attributed the campaign's successes to careful planning and coordination and strong leadership from the NDoH. The primary challenges we identified were related to obtaining informed consent, vulnerabilities in cold chain capacity, and onsite management of minor adverse events. While campaign planners anticipated and prepared for some negative media coverage, they did not expect the use of social media for spreading misinformation about HPV vaccination.

CONCLUSIONS:

The first phase of the national school-based HPV vaccination campaign was successfully implemented at scale in this setting. Future implementation will require improvement in the storage and monitoring of vaccine doses, better communication of role expectations to all stakeholders, and streamlined consent processes to ensure program sustainability.

WEB: 10.9745/GHSP-D-18-00090
IMPACT FACTOR: n/a
CITED HALF-LIFE: n/a

START COMMENTARY

In an evaluation of a national school-based human pampillomavirus (HPV) vaccination campaign in South Africa, Delany-Moretlwe et al. concluded that the first phase of the campaign was an overall success. As part of the relaunched Integrated School Health Program, the campaign reached 86.6% of eligible girls, exceeding the target goal of 80% coverage. To monitor and evaluate the campaign, the National Department of Health (NDoH) created a data subset linked to the District Health Information System (DHIS) and vaccination teams kept registers of vaccinated girls and reported adverse events to the NDoH. Delany-Moretlwe et al. identified challenges in data management, a crucial component of ongoing monitoring and evaluation of vaccination coverage, citing discrepancies between records in DHIS and those in parallel systems. Authors also reported a discrepancy between number of single-dose vials of vaccine used (369,542) and number of learners vaccinated (353,564), suggesting high vaccine wastage. Authors noted limitations to the evaluation including potential bias introduced based on limited sampling of data sources (e.g., key informants, direct observations, etc.) and inability to check reliability of document reviewers because only one researcher conducted the review. While the current study was not designed to assess parental, learner, and/or health care professional perceptions of HPV vaccine, a future study may help elucidate how media coverage, including anti-vaccination content, may influence HPV uptake.

Return to List of Articles

5. Prevention of Cervical Cancer in Sub-Saharan Africa: The Advantages and Challenges of HPV Vaccination

Black E, Richmond R.

Vaccines (Basel). 2018 Sep 8;6(3).

PubMed ID: 30205561

ABSTRACT

Cervical cancer is a critical public health issue in sub-Saharan Africa (SSA), where it is the second leading cause of cancer among women and the leading cause of female cancer deaths. Incidence and mortality rates are substantially higher than in high-income countries with population-based screening programs, yet implementing screening programs in SSA has so far proven to be challenging due to financial, logistical, and sociocultural factors. Human Papillomavirus (HPV) vaccination is an effective approach for primary prevention of cervical cancer and presents an opportunity to reduce the burden from cervical cancer in SSA. With a number of SSA countries now eligible for Global Alliance for Vaccines and Immunization (GAVI) support for vaccine introduction, it is timely to consider the factors that impede and facilitate implementation of vaccine programs in SSA. This article describes epidemiological features of cervical cancer in SSA and the current status of HPV vaccine implementation in SSA countries. Rwanda's experience of achieving high vaccination coverage in their national HPV immunization program is used as a case study to explore effective approaches to the design and implementation of HPV vaccination programs in SSA. Key factors in Rwanda's successful implementation included government ownership and support for the program, school-based delivery, social mobilization, and strategies for reaching out-of-school girls. These findings might usefully be applied to other SSA countries planning for HPV vaccination.

WEB: 10.3390/vaccines6030061

IMPACT FACTOR: n/a

CITED HALF-LIFE: n/a

START COMMENTARY

Black et al. summarized the burden of cervical cancer in sub-Saharan Africa (SSA) in Table 1, with Eastern Africa having the highest age-standardized incidence rate (42.7 per 100,000 women) compared to Central, Western, and Southern Africa (see Appendix A for country designations). HPV prevalence in SSA was 18.6% compared to global prevalence of 4.1%. With GAVI support of the HPV vaccine, countries in SSA are adopting national HPV immunization programs, mostly school-

based (see Table 2). Black et al. summarized key features of Rwanda's success implementing an HPV vaccination program in Table 3. Some of these features included employing a sensitization campaign prior to vaccine delivery, leveraging high (>98%) school enrollment as a platform to administer vaccine, and an agreement with Merck to secure future vaccine supply. Black et al. also identified challenges of the program, including reaching out-of-school girls, especially in areas where school attendance is low, and lack of knowledge or misconceptions of HPV vaccines that have been reported in other SSA countries. Understanding potential challenges and barriers, as well as proactively planning and coordinating with key stakeholders, could aid other countries successfully implement an HPV vaccination program.

Return to List of Articles

6. Measles outbreak risk in Pakistan: exploring the potential of combining vaccination coverage and incidence data with novel data-streams to strengthen control

Wesolowski A, Winter A, Tatem AJ, Qureshi T, Engø-Monsen K, Buckee CO, et al.
Epidemiol Infect. 2018 Sep;146(12):1575–1583.
PubMed ID: 29860954

ABSTRACT

Although measles incidence has reached historic lows in many parts of the world, the disease still causes substantial morbidity globally. Even where control programs have succeeded in driving measles locally extinct, unless vaccination coverage is maintained at extremely high levels, susceptible numbers may increase sufficiently to spark large outbreaks. Human mobility will drive potentially infectious contacts and interact with the landscape of susceptibility to determine the pattern of measles outbreaks. These interactions have proved difficult to characterise empirically. We explore the degree to which new sources of data combined with existing public health data can be used to evaluate the landscape of immunity and the role of spatial movement for measles introductions by retrospectively evaluating our ability to predict measles outbreaks in vaccinated populations. Using inferred spatial patterns of accumulation of susceptible individuals and travel data, we predicted the timing of epidemics in each district of Pakistan during a large measles outbreak in 2012-2013 with over 30 000 reported cases. We combined these data with mobility data extracted from over 40 million mobile phone subscribers during the same time frame in the country to quantify the role of connectivity in the spread of measles. We investigate how different approaches could contribute to targeting vaccination efforts to reach districts before outbreaks started. While some prediction was possible, accuracy was low and we discuss key uncertainties linked to existing data streams that impede such inference and detail what data might be necessary to robustly infer timing of epidemics.

WEB: 10.1017/S0950268818001449
IMPACT FACTOR: 2.04
CITED HALF-LIFE: 6.60

START COMMENTARY

Wesolowski et al. used measles susceptibility and connectivity data to create an estimation of measles incidence during the 2012–2013 outbreak in Pakistan and compared the estimate to

observed incidence. Susceptibility data were based on vaccination coverage rates from UNICEF and WHO for routine and supplementary immunization activities, as well as expected immunity acquired due to infection. Three connectivity scenarios were included: 1) assumed equal connectivity in all locations, 2) the gravity model and 3) inferred location based on cell phone data. Incidence data were based on national historic data reported to WHO, province level case count data from Weekly Epidemiological Reports during the 2012–2013 outbreak, and district level alerts (see Figure 1 for reported cases per week by province). The susceptibility and connectivity data were used to determine the order in time of provinces experiencing outbreaks and compared the estimates with observed incidence of outbreaks by province. Authors found cell phone data best predicted the outbreak, though accuracy was low (only estimated 20% of cases after 6 months). Authors highlighted the complexity in interpreting results due to potential biases in all data sources. Surveillance completeness on finer geographic levels and timeliness may be an issue. Authors reasoned, however, that the resource-rich province of Punjab would likely have a robust surveillance system, so the observed delay in outbreak is probably not due to poor reporting. Susceptibility may be subject to dynamics on finer scales of vaccination than what was reported or factors other than vaccination coverage (e.g., herd immunity or lack thereof). Cell phone data, the best data to estimate order of outbreaks, can be subject to biases based on cell phone ownership/subscribership. Authors noted that measles burden was highest in children. While adults were the primary phone owners, children were unlikely to travel without adults. It is unclear, however, whether travel patterns differ between adults with children or adults who interact with children compared to those who do not have or interact with children. Another limitation was the inability to measure international travel patterns (e.g., the migratory patterns between Pakistan and Afghanistan). This paper presents a framework to potentially predict ordering of outbreaks across districts, but warrants further research to understand its limits and potential to inform vaccination targeting.

Return to List of Articles

7. Individual- and community-level determinants of child immunization in the Democratic Republic of Congo: A multilevel analysis

Acharya P, Kismul H, Mapatano MA, Hatløy A.

PLoS One. 2018 Aug 23;13(8):e0202742.

PubMed ID: 30138459

ABSTRACT

Understanding modifiable determinants of full immunization of children provide a valuable contribution to immunization programs and help reduce disease, disability, and death. This study is aimed to assess the individual and community-level determinants of full immunization coverage among children in the Democratic Republic of Congo. This study used data from the Demographic and Health Survey 2013-14 from the Democratic Republic of Congo. Data regarding total 3,366 children between 12 and 23 months of age were used in this study. Children who were immunized with one dose of BCG, three doses of polio, three doses of DPT, and a dose of measles vaccine was considered fully immunized. Descriptive statistics were calculated for the prevalence and distribution of full immunization coverage. Two-level multilevel logistic regression analysis, with individual-level (level 1) characteristics nested within community-level (level 2) characteristics, was used to assess the individual- and community-level determinants of full immunization coverage. This study found that about 45.3% [95%CI: 42.02, 48.52] of children aged 12-23 months were fully immunized in the DRC. The results confirmed immunization coverage varied and ranged between 5.8% in Mongala province to 70.6% in Nord-Kivu province. Results from multilevel analysis revealed that, four Antenatal Care (ANC) visits [AOR: 1.64; 95%CI: 1.23, 2.18], institutional delivery [AOR: 2.37; 95%CI: 1.52, 3.72], and Postnatal Care (PNC) service utilization [AOR: 1.43; 95%CI: 1.04, 1.95] were statistically significantly associated with the full immunization coverage. Similarly, children of mothers with secondary or higher education [AOR: 1.32; 95%CI: 1.00, 1.81] and from the richest wealth quintile [AOR: 1.96; 95%CI: 1.18, 3.27] had significantly higher odds of being fully immunized compared to their counterparts whose mothers were relatively poorer and less educated. Among the community-level characteristics, residents of the community with a higher rate of institutional delivery [AOR: 2.36; 95%CI: 1.59, 3.51] were found to be positively associated with the full immunization coverage. Also, the random effect result found about 35% of the variation in immunization coverage among the communities was attributed to community-level factors. The Democratic Republic of Congo has a noteworthy gap in full immunization coverage. Modifiable factors-particularly health service utilization including four ANC visits, institutional delivery, and postnatal visits-had a strong positive effect on full immunization coverage. The study underlines the importance of promoting immunization programs tailored to the poor and women with little education.

WEB: 10.1371/journal.pone.0202742
IMPACT FACTOR: 2.77
CITED HALF-LIFE: 2.70

START COMMENTARY

Acharya et al. used the cross-sectional Demographic and Health Survey 2013–2014 from the Democratic Republic of Congo to conduct a multilevel analysis of factors associated with child immunization. They found only 45.3% of children were fully immunized, with large regional variation. Acharya et al. discussed potential underlying reasons for regional variation in immunization coverage, including civil unrest and poor health infrastructure, as well as factors identified from other studies, such as cultural beliefs and elements of the vaccine supply chain. As the authors mentioned, the cross-sectional nature of the study limits any causal inference. Furthermore, other unmeasured factors could potentially confound the relationship between the identified health utilization factors and full immunization (e.g., mother's desire and ability to utilize health services).

Return to List of Articles

8. Longitudinal characterization of nasopharyngeal colonization with Streptococcus pneumoniae in a South African birth cohort post 13-valent pneumococcal conjugate vaccine implementation

Dube FS, Ramjith J, Gardner-Lubbe S, Nduru P, Robberts FJL, Wolter N, et al.

Sci Rep. 2018 Aug 21;8(1):12497.

PubMed ID: 30131607

ABSTRACT

Monitoring changes in pneumococcal carriage is key to understanding vaccination-induced shifts in the ecology of carriage and impact on health. We longitudinally investigated pneumococcal carriage dynamics in infants. Pneumococcal isolates were obtained from nasopharyngeal (NP) swabs collected 2-weekly from 137 infants enrolled from birth through their first year of life. Pneumococci were serotyped by sequetyping, confirmed by Quellung. Pneumococci were isolated from 54% (1809/3331) of infants. Median time to first acquisition was 63 days. Serotype-specific acquisition rates ranged from 0.01 to 0.88 events/child-year and did not differ between PCV13 and non-PCV13 serotypes (0.11 events/child-year [95% CI 0.07-0.18] vs. 0.11 events/child-year [95% CI 0.06-0.18]). There was no difference in carriage duration between individual PCV13 and non-PCV13 serotypes (40.6 days [95% CI 31.9-49.4] vs. 38.6 days [95% CI 35.1-42.1]), however cumulatively the duration of carriage of non-PCV13 serotypes was greater than PCV13 serotypes (141.2 days (95% CI 126.6-155.8) vs. 30.7 days (95% CI 22.3-39.0). Frequently carried PCV13 serotypes included 19F, 9V, 19A and 6A, while non-PCV13 serotypes included 15B/15C, 21, 10A, 16F, 35B, 9N and 15A. Despite high immunization coverage in our setting, PCV13 serotypes remain in circulation in this cohort, comprising 22% of isolates. Individual PCV13 serotypes were acquired, on average, at equivalent rate to non-PCV13 serotypes, and carried for a similar duration, although the most common non-PCV13 serotypes were more frequently acquired than PCV13 serotypes.

WEB: 10.1038/s41598-018-30345-5

IMPACT FACTOR: 4.12

CITED HALF-LIFE: 1.70

START COMMENTARY

Dube et al. conducted a longitudinal study to characterize pneumococcal carriage among South African infants in their first year of life. Infants were sampled at birth and every other week through their first year of life. Authors found that the median time to first acquisition of pneumococci was 63 days, longer than in other studies conducted prior to PCV13 introduction. Authors also note that sampling frequency could impact carriage measures. A couple limitations Dube et al. described were the inability to capture multiple pneumococcal carriage strains and not performing genomic characterization of isolates, which could allow researchers to distinguish different strains of bacteria with the same serotype.

Return to List of Articles

9. Dual-chamber injection device for measles-rubella vaccine: The potential impact of introducing varying sizes of the devices in 3 countries

Wedlock PT, Mitgang EA, Siegmund SS, DePasse J, Bakal J, Leonard J, et al.

Vaccine. 2018 Sep 18;36(39):5879–5885.

PubMed ID: 30146404

ABSTRACT

INTRODUCTION:

By pairing diluent with vaccines, dual-chamber vaccine injection devices simplify the process of reconstituting vaccines before administration and thus decrease associated open vial wastage and adverse events. However, since these devices are larger than current vaccine vials for lyophilized vaccines, manufacturers need guidance as to how the size of these devices may affect vaccine distribution and delivery.

METHODS:

Using HERMES-generated immunization supply chain models of Benin, Bihar (India), and Mozambique, we replace the routine 10-dose measles-rubella (MR) lyophilized vaccine with single-dose MR dual-chamber injection devices, ranging the volume-per-dose (5.2-26 cm^3) and price-per-dose ($0.70, $1.40).

RESULTS:

At a volume-per-dose of 5.2 cm^3, a dual-chamber injection device results in similar vaccine availability, decreased open vial wastage (OVW), and similar total cost per dose administered as compared to baseline in moderately constrained supply chains. Between volumes of 7.5 cm^3 and 26 cm^3, these devices lead to a reduction in vaccine availability between 1% and 14% due to increases in cold chain storage utilization between 1% and 7% and increases in average peak transport utilization between 2% and 44%. At the highest volume-per-dose, 26 cm^3, vaccine availability decreases between 9% and 14%. The total costs per dose administered varied between each scenario, as decreases in vaccine procurement costs were coupled with decreases in doses administered. However, introduction of a dual-chamber injection device only resulted in improved total cost per dose administered for Benin and Mozambique (at 5.2 cm^3 and $0.70-per-dose) when the total number of doses administered changed <1% from baseline.

CONCLUSION:

In 3 different country supply chains, a single-dose MR dual-chamber injection device would need to be no larger than 5.2 cm^3 to not significantly impair the flow of other vaccines.

WEB: 10.1016/j.vaccine.2018.08.026
IMPACT FACTOR: 3.29
CITED HALF-LIFE: 5.50

START COMMENTARY

Wedlock et al. developed a stochastic, discrete-event model simulating the vaccine supply chain using the Highly Extensible Resource for Modeling Supply Chains (HERMES) software to identify the optimal (defined as having improved or zero impact on vaccine availability, vaccine wastage, and supply chain costs of the existing program) size of a dual-chamber injection device. The model included all storage facilities, refrigerators and freezers, shipping routes, vehicles, personnel, and vaccines in supply chains of Benin, Bihar, and Mozambique and used data ranging from 2012 to 2014. The measles-rubella (MR) vaccines were modeled in the context of country-specific standard Expanded Programme on Immunization (EPI) vaccines relevant to the year of data (see Table 1). Figures 1, 2, and 3 demonstrate several outcome measures (e.g., total vaccine availability, total doses administered, total liters procured, etc.) by country and MR volume per dose; 2.1 cm^3 represents the 10-dose vial and volume per dose ranging from 5.2 cm^3 to 26 cm^3 represents the various dual-chamber injection device sizes. Wedlock et al. found the main benefit of the dual-chamber injection device was the reduction in open vial wastage from nearly half of MR doses wasted using the 10-dose vials compared to zero open vial wastage using the dual-chamber injection device. Limitations of the study included the inability to account for all aspects of the vaccine supply chain, using data that may be outdated or using expert opinion for data not yet available (e.g., pricing characteristics), and not including all benefits of the dual-chamber injection device, such as reduction in adverse events. Wedlock et al. also comment on the value of conducting a similar analysis in the context of outreach or door-to-door campaigns versus the standard EPI. In an unconstrained supply chain, the dual-chamber injection device has the potential to increase number of doses administered, reduce open vial wastage, and reduce total costs, but without changes to the supply chain those benefits may not be actualized, an important consideration for low- and middle-income countries where supply chain constraints are especially challenging.

Return to List of Articles

10. Reported incidence and risk factors of childhood pneumonia in India: a community-based cross-sectional study

Gothankar J, Doke P, Dhumale G, Pore P, Lalwani S, Quraishi S et al.

BMC Public Health. 2018 Sep 11;18(1):1111.

PubMed ID: 30200933

ABSTRACT

BACKGROUND:

Pneumonia is responsible for high morbidity and mortality amongst children under five year of age. India accounts for one-third of the total WHO South East Asia burden of under-five mortality. There is a paucity of epidemiological studies indicating the true burden of pneumonia. Identification of the risk factors associated with pneumonia will help to effectively plan and implement the preventive measures for its reduction.

METHODS:

It was a descriptive cross-sectional study conducted in 16 randomly selected clusters in two districts of Maharashtra state, India. All mothers of under-five children in the selected clusters were included. A validated pretested interview schedule was filled by trained field supervisors through the house to house visits. WHO definition was used to define and classify clinical pneumonia. Height and weight of children were taken as per standard guidelines. Quality checks for data collection were done by the site investigators and critical and noncritical fields in the questionnaire were monitored during data entry. For continuous variables mean and SD were calculated. Chi-square test was applied to determine the association between the variables. Level of significance was considered at 0.05.

RESULTS:

There were 3671 under five-year children, 2929 mothers in 10,929 households. Unclean fuel usage was found in 15.1% of households. Mean birth weight was 2.6 kg (SD;0.61). Exclusive breastfeeding till 6 months of age was practiced by 46% of mothers. Reported incidence of ARI was 0.49 per child per month and the reported incidence of pneumonia was 0.075 per child per year. It was not associated with any of the housing environment factors ($p > 0.05$) but was found to be associated with partial immunization ($p < 0.05$). Poor practices related to child feeding, hand hygiene and poor knowledge related to signs and symptoms of pneumonia amongst mother were found.

CONCLUSIONS:

Very low incidence of pneumonia was observed in Pune and Sangli districts of Maharashtra. Partial immunization emerged as a most important risk factor. Reasons for low incidence and lack of association of pneumonia with known risk factors may be a better literacy rate among mothers and better immunization coverage.

TRIAL REGISTRATION:
Registration number of the trial- CTRI/2017/12/010881 ; date of registration-14/12/2017.

WEB: 10.1186/s12889-018-5996-2
IMPACT FACTOR: 2.42
CITE HALF-LIFE: 3.09

START COMMENTARY

A cross-sectional survey was administered to mothers of children under the age of 5 years to assess the prevalence (not incidence since participants were not followed over time) of pneumonia and identify associations with factors commonly-associated with pneumonia in rural and urban areas of Pune and Sangli districts of Maharashtra, India. Authors measured low levels of pneumonia, which they hypothesized may be due to high literacy levels among mothers and high vaccination coverage. However, an episode of pneumonia within the past year was assessed by mother's report of diagnosis from a doctor or health care provider or by a field supervisor's IMNCI classification of a mother's report of signs and symptoms. Report of pneumonia may be subject to recall bias, issues with access to care (i.e., mother's with low access to care may not receive a diagnosis from a health care provider), and lack of knowledge of pneumonia symptoms to inform IMNCI classification—52.1% of mothers were not aware of any symptoms of pneumonia. Furthermore, survey administration was limited to mothers with children under 5 years of age. Selection bias may be present if mothers who would have been included in the study were excluded because their child under 5 years died of pneumonia. No details were provided for any adjustment for clustering (i.e., within community and/or household). The knowledge, attitudes, and perceptions portion of the survey identified gaps in mothers' knowledge about symptoms and risk factors of pneumonia, which could have implications in prevention and treatment of pneumonia.

Return to List of Articles

Appendix

The literature search for the October 2018 Vaccine Delivery Research Digest was conducted on September 27, 2018. We searched English language articles indexed by the US National Library of Medicine and published between August 15, 2018 and September 14, 2018. The search resulted in 235 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]) ("2018/8/15"[PDAT] : "2018/9/14"[PDAT]))