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

APRIL 2019

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 Parasitic infections during pregnancy need not affect infant antibody responses to early vaccination against *Streptococcus pneumoniae*, diphtheria, or *Haemophilus influenzae* type B {Abstract & START Commentary} {Full article}

- A prospective cohort study in Kenya assessing the impact of maternal infection of malaria, *S. haematobium*, intestinal helminths, and/or lymphatic filariasis on infant immune response to vaccination against bacterial pathogens.

2 Projections of Ebola outbreak size and duration with and without vaccine use in Équateur, Democratic Republic of Congo, as of May 27, 2018
{Abstract & START Commentary} {Full article}

- A modeling study utilizing three methods conducted mid-outbreak to estimate the size and duration of the April to July 2018 Ebola outbreak in the Democratic Republic of Congo.

3 Sero-Prevalence Surveillance to Predict Vaccine-Preventable Disease Outbreaks; A Lesson from the 2014 Measles Epidemic in Northern Vietnam
{Abstract & START Commentary} {Full article}

- A study comparing serum protection against measles from a serum biobank project and vaccine coverage from the UNICEF Multiple Indicators Clustered Survey in Vietnam in 2014.

4 Predicting the Impact of Typhoid Conjugate Vaccines on Antimicrobial Resistance
{Abstract & START Commentary} {Full article}

- A modeling study using a deterministic transmission dynamic model to assess the impact of Typhoid Conjugate Vaccines on antimicrobial-resistant typhoid infections in a hypothetical cohort.

5 Accelerating Typhoid Conjugate Vaccine Introduction: What Can Be Learned From Prior New Vaccine Introduction Initiatives?
{Abstract & START Commentary} {Full article}

- A summary of lessons learned from MenAfriVac, Japanese Encephalitis, Pneumococcal Vaccines Accelerated Development and Introduction Plan, the Rotavirus Vaccine Project, and the Haemophilus influenzae type b Initiatives to help inform Typhoid Conjugate Vaccine introduction.

6 Redefining vaccination coverage and timeliness measures using electronic immunization registry data in low- and middle-income countries
{Abstract & START Commentary} {Full article}

- A commentary on the value and challenges of using electronic immunization registry data to provide timely, accurate, and detailed vaccination measures.

7 Effectiveness of pneumococcal conjugate vaccines against invasive pneumococcal disease among children under five years of age in Africa: A systematic review
{Abstract & START Commentary} {Full article}

- A systematic review capturing eight studies on the implementation of 10-valent or 13-valent pneumococcal conjugate vaccine in African countries.

8 Completeness and timeliness of diphtheria-tetanus-pertussis, measles-mumps-rubella, and polio vaccines in young children with chronic health conditions: A systematic review
{Abstract & START Commentary} {Full article}

- A systematic review capturing 21 studies on completeness and timeliness of childhood vaccinations among children under 5 years with chronic health conditions.

9 Determinants of delayed or incomplete diphtheria-tetanus-pertussis vaccination in parallel urban and rural birth cohorts of 30,956 infants in Tanzania
{Abstract & START Commentary} {Full article}

- A prospective cohort study assessing factors associated with delayed or incomplete diphtheria-tetanus-pertussis vaccination in Tanzania.

10 Analysis of State-Specific Differences in Childhood Vaccination Coverage in Rural India
{Abstract & START Commentary} {Full article}

- A study examining the relationship between state-specific characteristics, such as religion, and childhood immunizations in 26 Indian states.

Appendix

Details of Articles

1. Parasitic infections during pregnancy need not affect infant antibody responses to early vaccination against *Streptococcus pneumoniae*, diphtheria, or *Haemophilus influenzae* type B

McKittrick ND, Malhotra IJ, Vu DM, Boothroyd DB, Lee J, Krystosik AR, et al.

PLoS Negl Trop Dis. 2019 Feb 28;13(2):e0007172.

PubMed ID: 30818339

ABSTRACT

BACKGROUND:

Globally, vaccine-preventable diseases remain a significant cause of early childhood mortality despite concerted efforts to improve vaccine coverage. One reason for impaired protection may be the influence of prenatal exposure to parasitic antigens on the developing immune system. Prior research had shown a decrease in infant vaccine response after *in utero* parasite exposure among a maternal cohort without aggressive preventive treatment. This study investigated the effect of maternal parasitic infections on infant vaccination in a more recent setting of active anti-parasitic therapy.

METHODOLOGY/PRINCIPAL FINDINGS:

From 2013-2015, 576 Kenyan women were tested in pregnancy for malaria, soil-transmitted helminths, filaria, and *S. haematobium*, with both acute and prophylactic antiparasitic therapies given. After birth, 567 infants received 10-valent *S. pneumoniae* conjugate vaccine and pentavalent vaccine for hepatitis B, pertussis, tetanus, *H. influenzae* type B (Hib) and *C. diphtheriae* toxoid (Dp-t) at 6, 10, and 14 weeks. Infant serum samples from birth, 10 and 14 weeks, and every six months until age three years, were analyzed using a multiplex bead assay to quantify IgG for Hib, Dp-t, and the ten pneumococcal serotypes. Antenatal parasitic prevalence was high; 461 women (80%) had at least one and 252 (43.6%) had two or more infections during their pregnancy, with the most common being malaria (44.6%), *S. haematobium* (43.9%), and hookworm (29.2%). Mixed models comparing influence of infection on antibody concentration revealed no effect of prenatal infection status for most vaccine outcomes. Prevalences of protective antibody concentrations after vaccination were similar among the prenatal exposure groups.

CONCLUSIONS/SIGNIFICANCE:
These findings are in contrast with results from our prior cohort study performed when preventive anti-parasite treatment was less frequently given. The results suggest that the treatment of maternal infections in pregnancy may be able to moderate the previously observed effect of antenatal maternal infections on infant vaccine responses.

WEB: 10.1371/journal.pntd.0007172
IMPACT FACTOR: 3.95 (2015)
CITED HALF-LIFE: 3.20

START COMMENTARY

Following their 2006–2009 study that found an association between filaria and *S. haematobium* infections during pregnancy and reduced infant immune responses to diphtheria toxoid and *H. influenzae* type B polyribitol phosphate, McKittrick et al. conducted a prospective, cohort study to reassess the relationship between parasitic infection during pregnancy and infant immune response to bacterial vaccines. The study adds to the current literature by being the first to assess the impact of maternal parasitic infections in the context of a 10-valent pneumococcal vaccine. While a few studies similarly found no significant difference between infants with infected mothers compared to infants with uninfected mothers, the study's findings (see Figures 2 to 4 and supplementary figures for longitudinal IgG levels against antigens of interest) contradicted a number of other studies, including their 2006–2009 study. Authors stated, "[…] nearly all mothers received more aggressive anti-parasitic therapy for malaria and intestinal helminths during pregnancy, whereas this was not the case in the previous 2006–2009 cohort," a possible explanation for the differences in results. Potential sources of bias and study limitations were mentioned, including the low sample of infants with uninfected mothers due to the high prevalence of parasitic infections during pregnancy and losses to follow-up. Differential loss to follow-up may bias results and low numbers may provide unstable estimates. Authors also stated that multiple comparisons were not accounted for, so significant differences may be due to chance. This study highlighted the complexity of immune development as questions about parasite-specific and disease severity impacts remain unanswered.

Return to List of Articles

2. Projections of Ebola outbreak size and duration with and without vaccine use in Équateur, Democratic Republic of Congo, as of May 27, 2018

Kelly JD, Worden L, Wannier SR, Hoff NA, Mukadi P, Sinai C, et al.

PLoS One. 2019 Mar 7;14(3):e0213190

PubMed ID: 30765172

ABSTRACT

As of May 27, 2018, 6 suspected, 13 probable and 35 confirmed cases of Ebola virus disease (EVD) had been reported in Équateur Province, Democratic Republic of Congo. We used reported case counts and time series from prior outbreaks to estimate the total outbreak size and duration with and without vaccine use. We modeled Ebola virus transmission using a stochastic branching process model that included reproduction numbers from past Ebola outbreaks and a particle filtering method to generate a probabilistic projection of the outbreak size and duration conditioned on its reported trajectory to date; modeled using high (62%), low (44%), and zero (0%) estimates of vaccination coverage (after deployment). Additionally, we used the time series for 18 prior Ebola outbreaks from 1976 to 2016 to parameterize the Thiel-Sen regression model predicting the outbreak size from the number of observed cases from April 4 to May 27. We used these techniques on probable and confirmed case counts with and without inclusion of suspected cases. Probabilistic projections were scored against the actual outbreak size of 54 EVD cases, using a log-likelihood score. With the stochastic model, using high, low, and zero estimates of vaccination coverage, the median outbreak sizes for probable and confirmed cases were 82 cases (95% prediction interval [PI]: 55, 156), 104 cases (95% PI: 58, 271), and 213 cases (95% PI: 64, 1450), respectively. With the Thiel-Sen regression model, the median outbreak size was estimated to be 65.0 probable and confirmed cases (95% PI: 48.8, 119.7). Among our three mathematical models, the stochastic model with suspected cases and high vaccine coverage predicted total outbreak sizes closest to the true outcome. Relatively simple mathematical models updated in real time may inform outbreak response teams with projections of total outbreak size and duration.

WEB: 10.1371/journal.pone.0213190

IMPACT FACTOR: 3.29

CITED HALF-LIFE: 5.50

START COMMENTARY

In this modeling study, Kelly et al. employed three methods, “a stochastic branching process model, statistical regression based on prior outbreaks, and Gott’s Law” to estimate the size and duration of the Ebola outbreak in the Democratic Republic of Congo (DRC) in 2018 using historic Ebola outbreak data. While authors concluded that their study demonstrated that relatively simple models updated in real time could inform outbreak response teams, they also highlighted a number of considerations which warrant cautious interpretation of their results. Kelly et al. noted that the regression methods were solely based on counts of past Ebola outbreaks and do not account for control measures and vaccination. Authors also noted that some data inputs originated from regions outside of DRC, suggesting modeling assumptions may not hold true for DRC, such as vaccine effectiveness. Log Likelihood calculations were presented (see Table 4) comparing the various models. This study would have benefitted from a discussion of absolute performance of the models to project size and duration of outbreaks. Finally, other additional parameters, such as spatial spread, urban settings, and conflict zone, which may be of interest in outbreak response were not included. Despite these limitations, Kelly et al. make the case for real time use of data to inform outbreak response.

Return to List of Articles

3. Sero-Prevalence Surveillance to Predict Vaccine-Preventable Disease Outbreaks; A Lesson from the 2014 Measles Epidemic in Northern Vietnam

Choisy M, Trinh ST, Nguyen TND, Nguyen TH, Mai QL, Pham QT, et al.

Open Forum Infect Dis. 2019 Jan 24;6(3):ofz030.

PubMed ID: 30863786

ABSTRACT

BACKGROUND:

During the first half of 2014, a severe outbreak of measles occurred in northern Vietnam, causing 15 033 confirmed cases and 146 deaths.

METHODS:

To evaluate the population-level seroprevalence of protection against measles in the period before the outbreak, we made use of an existing age-stratified serum bank, collected over the year before the outbreak, between November 2012 and December 2013, from 4 sites across the country (Hanoi, Hue, Dak Lak, and Ho Chi Minh City). Data from the UNICEF's Multiple Indicator Clustered Surveys (MICS), carried out in Vietnam during the first quarter of 2014, were used to assess the vaccine coverage in 6 ecological regions of Vietnam.

RESULTS:

Results revealed a large discrepancy between levels of protection, as estimated from the serology and vaccine coverage estimated by UNICEF's MICS. Variation in seroprevalence across locations and age groups corresponded with reported numbers of measles cases, most of which were among the 0-2-year-old age group and in the northern part of the country.

CONCLUSIONS:

Our study presents a strong case in favor of a serosurveillance sentinel network that could be used to proactively tune vaccination policies and other public health interventions.

WEB: 10.1093/ofid/ofz030

IMPACT FACTOR: 3.24

CITED HALF-LIFE: not available

START COMMENTARY

A total of 3662 serum samples were used from the biobank. Specimen sampling was informed by the European Sero-Epidemiology Network, which recommends at least 50 samples per gender at 1-

year age bands for individuals younger than 20 and 5-year age bands for those older than 20 years. For the purposes of the current study, 50 samples per gender at 1-year age bands for children under 10 years were tested, as well as 50 samples per 1-year age bands from women 16 to 20 years and 100 samples per 5-year age bands from women 20 to 35 years. Interestingly, vaccination coverage estimates from MICS were aligned with population protection estimates for the 0–1-year age group, but estimates differed for other age groups. Authors noted that seroprevelance assessments may provide value in low-incidence contexts. Additional study into reasons for the discrepancy between vaccination coverage and population protection, as well as cost-benefit analyses for ongoing serosurveillance are warranted.

Return to List of Articles

4. Predicting the Impact of Typhoid Conjugate Vaccines on Antimicrobial Resistance

Kaufhold S, Yaesoubi R, Pitzer VE.

Clin Infect Dis. 2019 Mar 7;68(Supplement_2):S96-S104.

PubMed ID: 30845324

ABSTRACT

BACKGROUND:

Empiric prescribing of antimicrobials in typhoid-endemic settings has increased selective pressure on the development of antimicrobial-resistant *Salmonella enterica* serovar Typhi. The introduction of typhoid conjugate vaccines (TCVs) in these settings may relieve this selective pressure, thereby reducing resistant infections and improving health outcomes.

METHODS:

A deterministic transmission dynamic model was developed to simulate the impact of TCVs on the number and proportion of antimicrobial-resistant typhoid infections and chronic carriers. One-way sensitivity analyses were performed to ascertain particularly impactful model parameters influencing the proportion of antimicrobial-resistant infections and the proportion of cases averted over 10 years.

RESULTS:

The model simulations suggested that increasing vaccination coverage would decrease the total number of antimicrobial-resistant typhoid infections but not affect the proportion of cases that were antimicrobial resistant. In the base-case scenario with 80% vaccination coverage, 35% of all typhoid infections were antimicrobial resistant, and 44% of the total cases were averted over 10 years by vaccination. Vaccination also decreased both the total number and proportion of chronic carriers of antimicrobial-resistant infections. The prevalence of chronic carriers, recovery rates from infection, and relative fitness of resistant strains were identified as crucially important parameters.

CONCLUSIONS:

Model predictions for the proportion of antimicrobial resistant infections and number of cases averted depended strongly on the relative fitness of the resistant strain(s), prevalence of chronic carriers, and rates of recovery without treatment. Further elucidation of these parameter values in real-world typhoid-endemic settings will improve model predictions and assist in targeting future vaccination campaigns and treatment strategies.

WEB: 10.1093/cid/ciy1108

IMPACT FACTOR: 9.12

CITED HALF-LIFE: 7.00

START COMMENTARY

The compartmental model is diagramed in Figure 1, with equations outlined in the supplementary material. Tables 1 and 2 provide fixed and variable parameter estimates, respectively. Kaufhold et al. modeled a hypothetical population reflecting a typhoid-endemic setting as opposed to specific census data. Due to uncertainty around parameter estimates, the authors noted the most important takeaway from their findings was not the proportion of resistant cases, but rather the identification of key parameters in their model—recovery rates, fractions of chronic carriers, and relative fitness of resistant strains. Key assumptions that might limit the interpretation of the study was that treatment was held constant throughout the burn-in and study periods and that introduction of antimicrobial resistant strains from outside areas was not modeled.

Return to List of Articles

5. Accelerating Typhoid Conjugate Vaccine Introduction: What Can Be Learned From Prior New Vaccine Introduction Initiatives?

Jamka LP, Simiyu KW, Bentsi-Enchill AD, Mwisongo AJ, Matzger H, Marfin AA, et al.

Clin Infect Dis. 2019 Mar 7;68(Supplement_2):S171-S176.

PubMed ID: 30770224

ABSTRACT

The health consequences of typhoid, including increasing prevalence of drug-resistant strains, can stress healthcare systems. While vaccination is one of the most successful and cost-effective health interventions, vaccine introduction can take years and require considerable effort. The Typhoid Vaccine Acceleration Consortium (TyVAC) employs an integrated, proactive approach to accelerate the introduction of a new typhoid conjugate vaccine to reduce the burden of typhoid in countries eligible for support from Gavi, the Vaccine Alliance. TyVAC and its partners are executing a plan, informed by prior successful vaccine introductions, and tailored to the nuances of typhoid disease and the typhoid conjugate vaccine. The iterative process detailed herein summarizes the strategy and experience gained from the first 2 years of the project.

WEB: 10.1093/cid/ciy1118

IMPACT FACTOR: 9.12

CITED HALF-LIFE: 7.00

START COMMENTARY

The Typhoid Vaccine Acceleration Consortium (TyVAC) was designed around a strategic framework informed from experiences of prior vaccine acceleration programs. The main components of the framework included: evidence to support introduction; adequate, stable supply of affordable PQ vaccine; global policy recommendations and financing; country willingness and readiness to introduce; and local update and sustainability (see Figure 1). TyVAC drew from experiences from MenAfriVac, Japanese encephalitis (JE) Project, Pnuemococcal Vaccines Accelerated Development and Introduction Plan (PneumoADIP), Rotavirus Vaccine Project (RVP), and the *Haemophilus influenzae* type b (Hib) Initiative. Common themes from these programs was the importance of surveillance and research to establish disease burden and vaccine impact as well as communication and advocacy around uptake of vaccination. TyVAC and the Coalition Against Typhoid are building upon existing efforts with the "Take on Typhoid" initiative. Resources are available on the website "to

ensure partners are informed, empowered, and ready to fight for global, regional, and national prioritization of integrated typhoid control solutions."

Return to List of Articles

6. Redefining vaccination coverage and timeliness measures using electronic immunization registry data in low- and middle-income countries

Dolan SB, Carnahan E, Shearer JC, Beylerian EN, Thompson J, Gilbert SS, et al.

Vaccine. 2019 Mar 22;37(13):1859-1867. Epub 2019 Feb 23.

PubMed ID: 30808566

ABSTRACT

Vaccine coverage is routinely used as a performance indicator for immunization programs both at local and global levels. For many national immunization programs, there are challenges with accurately estimating vaccination coverage based on available data sources, however an increasing number of low- and middle-income countries (LMICs) have begun implementing electronic immunization registries to replace health facilities' paper-based tools and aggregate reporting systems. These systems allow for more efficient capture and use of routinely reported individual-level data that can be used to calculate dose-specific and cohort vaccination coverage, replacing the commonly used aggregate routine health information system data. With these individual-level data immunization programs have the opportunity to redefine performance measures to enhance programmatic decision-making at all levels of the health system. In this commentary, we discuss how measures for assessing vaccination status and program performance can be redefined and recalculated using these data when generated at the health facility level and the implications of the use and availability of electronic individual-level data.

WEB: 10.1016/j.vaccine.2019.02.017
IMPACT FACTOR: 3.29
CITED HALF-LIFE: 5.50

START COMMENTARY

Table 1 provides a summary of vaccine measures, translating current reporting measures to new measures using individual-level routine health information system data. The value of the proposed measure and measurement considerations are also included in the table. Table 2 outlines strengths and weaknesses of electronic immunization registry data, aggregate routine health information system data, and survey data. In Figures 1 to 4, Dolan et al. demonstrate differences in indicator values based on redefined measures. Measures applied to individual-level data can provide more accurate estimates of vaccination coverage and drop-outs, as well as better identify gaps. Dolan et

al. also highlight challenges, including issues with data quality and completeness and burdensome investment in data cleaning and maintenance, especially for systems newly transitioning to electronic immunization registries or health information systems. Despite these challenges, the advent of these data systems has the potential to provide timely, accurate, and detailed information to better inform implementation of vaccination programs on regional and national levels.

Return to List of Articles

7. Effectiveness of pneumococcal conjugate vaccines against invasive pneumococcal disease among children under five years of age in Africa: A systematic review

Ngocho JS, Magoma B, Olomi GA, Mahande MJ, Msuya SE, de Jonge MI, et al.

PLoS One. 2018 Feb 13 [Epub ahead of print].

PubMed ID: 30779801

ABSTRACT

BACKGROUND:

Despite the widespread implementation of the pneumococcal conjugate vaccine, *Streptococcus pneumoniae* remains the leading cause of severe pneumonia associated with mortality among children less than 5 years of age worldwide, with the highest mortality rates recorded in Africa and Asia. However, information on the effectiveness and prevalence of vaccine serotypes post-roll out remains scarce in most African countries. Hence, this systematic review aimed to describe what is known about the decline of childhood invasive pneumococcal disease post-introduction of the pneumococcal conjugate vaccine in Africa.

METHODS:

This systematic review included articles published between 2009 and 2018 on the implementation of the pneumococcal conjugate vaccine in Africa. We searched PubMed, Scopus and African Index Medicus for articles in English. Studies on implementation programmes of pneumococcal conjugate vaccine 10/13, with before and after data from different African countries, were considered eligible. The review followed the procedures published in PROSPERO (ID = CRD42016049192).

RESULTS:

In total, 2,280 studies were identified through electronic database research, and only 8 studies were eligible for inclusion in the final analysis. Approximately half (n = 3) of these studies were from South Africa. The overall decline in invasive pneumococcal disease ranged from 31.7 to 80.1%. Invasive pneumococcal diseases caused by vaccine serotypes declined significantly, the decline ranged from 35.0 to 92.0%. A much higher decline (55.0-89.0%) was found in children below 24 months of age. Of all vaccine serotypes, the relative proportions of serotypes 1, 5 and 19A doubled following vaccine roll out.

INTERPRETATION:

Following the introduction of the pneumococcal conjugate vaccine, a significant decline was observed in invasive pneumococcal disease caused by vaccine serotypes. However, data on the effectiveness in this region remain scarce, meriting continued surveillance to assess the

effectiveness of pneumococcal vaccination to improve protection against invasive pneumococcal disease.

WEB: 10.1371/journal.pone.0212295
IMPACT FACTOR: 2.77
CITED HALF-LIFE: 2.70

START COMMENTARY

A total of 2,001 pneumococcal vaccine strains were isolated from the eight eligible studies. Several methods were used to isolate strains, with culture listed as a common method. Culture methods, however, have demonstrated low sensitivity in previous studies and so may underestimate vaccine effectiveness. Serotype 19A, known for vaccine failure, was the most prevalent serotype and a significant proportion of invasive pneumococcal disease cases were caused by non-vaccine serotypes. Differences in the decline of invasive pneumococcal disease may be a result of different vaccination coverage rates. Ngocho et al. the heterogeneity of studies made any pooled analysis difficult and the limited number of studies, with three of the eight coming from South Africa, may limit the generalizability to other African countries. The authors call for “more and larger studies in difference parts of Africa” to “thoroughly assess the effectiveness of PCV vaccination.”

Return to List of Articles

8. Completeness and timeliness of diphtheria-tetanus-pertussis, measles-mumps-rubella, and polio vaccines in young children with chronic health conditions: A systematic review

Walker EJ, MacDonald NE, Islam N, Le Saux N, Top KA, Fell DB.

Vaccine. 2019 Mar 22;37(13):1725-1735. Epub 2019 Feb 25.

PubMed ID: 30814030

ABSTRACT

OBJECTIVE:

To systematically review literature on uptake and timeliness of diphtheria-tetanus-pertussis, measles-mumps-rubella, and/or polio-containing vaccines in infants who were born preterm, with a low birth weight, and/or with chronic health conditions that were diagnosed within the first 6 months of life.

METHODS:

Using a standardized search strategy developed by a medical librarian, records were extracted from MEDLINE, Embase, Database of Abstracts of Reviews of Effects, and CINAHL up to May 8, 2018.

RESULTS:

Out of the 1997 records that were screened, we identified 21 studies that met inclusion criteria. Eleven studies assessed vaccine coverage and/or timeliness in preterm infants, 6 in low birth weight infants, and 7 in children with chronic health conditions. Estimates of coverage in these populations were highly variable, ranging from 40% to 100% across the vaccines and population groups.

CONCLUSIONS:

There is a lack of studies reporting coverage and timeliness of routine immunizations in special populations of children.

POLICY IMPLICATIONS:

Our review suggests a need for improved surveillance of immunization status in special populations of infants, as well as a need for standardization of reporting practices.

WEB: 10.1016/j.vaccine.2019.02.031

IMPACT FACTOR: 3.29

CITED HALF-LIFE: 5.50

START COMMENTARY

Studies of children with immunodeficiencies were excluded because of contraindications to live vaccines. Table 1 provides a high-level summary of the 21 studies eligible for this review. Tables 2 through 4 summarize coverage and/or timeliness for diphtheria-tetanus-pertussis vaccines, measles-mumps-rubella vaccines, and polio-containing vaccines, respectively. Walker et al. noted a strength of the study was the thorough review of literature to capture relevant studies. Limitations included the small number of studies and heterogeneity prevented any meta-analysis of coverage and timeliness estimates. Authors described coverage and timeliness estimates varied by a number of factors including study setting and year of study. Importantly, estimates also varied by methodology of assessment. Methodology of coverage and timeliness assessment would have been an interesting data point to include in summary tables.

Return to List of Articles

9. Determinants of delayed or incomplete diphtheria-tetanus-pertussis vaccination in parallel urban and rural birth cohorts of 30,956 infants in Tanzania

Nadella P, Smith ER, Muhihi A, Noor RA, Masanja H, Fawzi WW, et al.

BMC Infect Dis. 2019 Feb 26;19(1):188.

PubMed ID: 30685588

ABSTRACT

BACKGROUND:

Delayed vaccination increases the time infants are at risk for acquiring vaccine-preventable diseases. Factors associated with incomplete vaccination are relatively well characterized in resource-limited settings; however, few studies have assessed immunization timeliness.

METHODS:

We conducted a prospective cohort study examining Diphtheria-Tetanus-Pertussis (DTP) vaccination timing among newborns enrolled in a Neonatal Vitamin A supplementation trial (NEOVITA) conducted in urban Dar es Salaam (n = 11,189) and rural Morogoro Region (n = 19,767), Tanzania. We used log-binomial models to assess the relationship of demographic, socioeconomic, healthcare access, and birth characteristics with late or incomplete DTP1 and DTP3 immunization.

RESULTS:

The proportion of infants with either delayed or incomplete vaccination was similar in Dar es Salaam (DTP1 11.5% and DTP3 16.0%) and Morogoro (DTP1 9.2% and DTP3 17.3%); however, the determinants of delayed or incomplete vaccination as well as their magnitude of association differed by setting. Both maternal and paternal education were more strongly associated with vaccination status in rural Morogoro region as compared to Dar es Salaam (p-values for heterogeneity < 0.05). Infants in Morogoro who had fathers and mothers with no education had 36% (95% CI: 22-52%) and 22% (95% CI: 10-34%) increased risk of delayed or incomplete DTP3 vaccination as compared to those with primary school education, respectively. In Dar es Salaam, mothers who attended their first antenatal care (ANC) visit in the 3rd trimester had 1.55 (95% CI: 1.36-1.78) times the risk of delayed or not received vaccination as compared to those with a 2nd trimester booking, while there was no relationship in Morogoro. In rural Morogoro, infants born at home had 17% (95% CI: 8-27%) increased risk for delayed or no receipt of DTP3 vaccination. In both settings, younger maternal age and poorer households were at increased risk for delayed or incomplete vaccination.

CONCLUSION:
We found some risk factors for delayed and incomplete vaccination were shared between urban and rural Tanzania; however, we found several context-specific risk factors as well as determinants that differed in their magnitude of risk between contexts. Immunization programs should be tailored to address context-specific barriers and enablers to improve timely and complete vaccination.

WEB: 10.1186/s12879-019-3828-3
IMPACT FACTOR: 2.62 (2016)
CITED HALF-LIFE: 3.80

START COMMENTARY

Nadella et al. noted a few limitations to their study, including only including facility births and not examining vaccination status of infants at high-risk. However, based on supplementary data, these numbers were small, so bias was expected to be minimal. This study had several strengths including being the largest birth cohort to study vaccination timing in both rural and urban settings. The prospective nature of the study allowed the authors to assess vaccination status among infants who died during follow-up, which is a limitation found in cross-sectional data.

Return to List of Articles

10. Analysis of State-Specific Differences in Childhood Vaccination Coverage in Rural India

Shrivastwa N, Wagner AL, Boulton ML.

Vaccines (Basel). 2019 Feb 24;7(1).

PubMed ID: 30772069

ABSTRACT

There is little research on state-level differences in child health outcomes in India. The aim of this study was to identify state-level characteristics that relate to childhood immunizations. Most state-level characteristics came from the 2011 Indian Census. Individual-level data and other state-level characteristics were obtained from the 2007–2008 District Level Household and Facility Survey. Predictors of full vaccination were assessed with logistic regression models. Among 86,882 children 12–36 months, 53.2% were fully vaccinated. Children living in bigger households (≥7 members), born in non-institutional settings, and female had lower odds of complete vaccination. Individuals living in states in the mid-range of poverty had lower odds of full vaccination compared to those in lower or higher poverty states (3rd vs. 1st quintile: odds ratio [OR]: 0.36, 95% confidence interval [CI]: 0.30, 0.42). Greater average population per primary health center was associated with decreased odds of full vaccination (5th vs. 1st quintile: OR: 0.37, 95% CI: 0.30, 0.47). Vaccination coverage in India can be explained by a complex interplay of individual- and state-level factors. Solutions to increasing vaccination must be multisectoral and acknowledge the cultural and socio-economic diversity that influences an individual child's vaccination coverage along with within-state disparities.

WEB: 10.3390/vaccines7010024

IMPACT FACTOR: not available

CITED HALF-LIFE: not available

START COMMENTARY

Figure 1 shows the percentage of fully-vaccinated children by religion and state. Adjusted odds ratios are described in Table 3. This study is the first to examine state-differences as they relate to vaccination coverage rates. Since the DLHS3 prioritizes rural areas, the study was powered to assess this population. However, results may not be generalizable to urban populations. A limitation of the study is the age of the data, though authors believe coverage has remained stable over time.

Return to List of Articles

Appendix

The literature search for the April 2019 Vaccine Delivery Research Digest was conducted on March 18, 2019. We searched English language articles indexed by the US National Library of Medicine and published between February 15, 2019 and March 14, 2019. The search resulted in 207 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]) ("2019/02/15"[PDAT] : "2019/03/14"[PDAT]))