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

FEBRUARY 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   Characterizing the impact of spatial clustering of susceptibility for measles elimination
{Abstract & START Commentary} {Full article}

- A description of methods accounting for spatial clustering when estimating effective reproductive number and threshold vaccination coverage. Authors demonstrate the impact of clustering using measles data from Tanzania.

2   Effect and cost-effectiveness of pneumococcal conjugate vaccination: a global modelling analysis
{Abstract & START Commentary} {Full article}

- A modeling study assessing the health impact and cost-effectiveness of the pneumococcal conjugate vaccine among children less than 5 years in 180 countries.

3   Current challenges and proposed solutions to the effective implementation of the RTS, S/AS01 Malaria Vaccine Program in sub-Saharan Africa: A systematic review
{Abstract & START Commentary} {Full article}

- A summary of 8 studies on challenges and solutions to malaria vaccine implementation in sub-Saharan Africa.

4   Projected impact, cost-effectiveness, and budget implications of rotavirus vaccination in Mongolia
{Abstract & START Commentary} {Full article}

- A modeling study assessing the health impact and cost-effectiveness of the introduction of rotavirus vaccines into the national immunization program in Mongolia.

5   Oral cholera vaccination strategy: Self-administration of the second dose in urban Dhaka, Bangladesh
{Abstract & START Commentary} {Full article}

- An assessment of a self-administration strategy for the second dose of the oral cholera vaccine in a high risk, low socioeconomic population in Bangladesh.

6   Documentation of vaccine handling and service delivery at outreach immunization sessions across 27 districts of India
{Abstract & START Commentary} {Full article}

- A study documenting vaccine delivery processes, including supply availability, vaccine handling behaviors, and counseling services, in 27 districts across three states in India.

7 Coverage and timeliness of vaccination and the validity of routine estimates: Insights from a vaccine registry in Kenya

{Abstract & START Commentary} {Full article}

- A study comparing vaccination estimates derived from a vaccine registry and from surveys and administrative reports.

8 The use of eHealth with immunizations: An overview of systematic reviews

{Abstract & START Commentary} {Full article}

- A summary of 6 systematic reviews conducted on eHealth and immunizations topics.

9 Toward economic evaluation of the value of vaccines and other health technologies in addressing AMR

{Abstract & START Commentary} {Full article}

- A commentary on the value of incorporating antimicrobial resistance to analyses that assess the impact of vaccines.

10 Hybrid prevalence estimation: Method to improve intervention coverage estimations

{Abstract & START Commentary} {Full article}

- A description of methods that combine administrative and probability survey data to better estimate vaccination coverage.

Appendix

Details of Articles

1. Characterizing the impact of spatial clustering of susceptibility for measles elimination

Truelove SA, Graham M, Moss WJ, Metcalf CJE, Ferrari MJ, Lessler J.

ABSTRACT

Measles elimination efforts are primarily focused on achieving and maintaining national vaccination coverage goals, based on estimates of the critical vaccination threshold (V_c): the proportion of the population that must be immune to prevent sustained epidemics. Traditionally, V_c estimates assume evenly mixing populations, an invalid assumption. If susceptible individuals preferentially contact one another, communities may remain vulnerable to epidemics even when vaccination coverage targets are met at the national level. Here we present a simple method to estimate V_c and the effective reproductive number, R, while accounting for spatial clustering of susceptibility. For measles, assuming $R_0 = 15$ and 95% population immunity, adjustment for high clustering of susceptibility increases R from 0.75 to 1.29, V_c from 93% to 96%, and outbreak probability after a single introduction from <1% to 23%. The impact of clustering remains minimal until vaccination coverage nears elimination levels. We illustrate our approach using Demographic and Health Survey data from Tanzania and show how non-vaccination clustering potentially contributed to continued endemic transmission of measles virus during the last two decades. Our approach demonstrates why high national vaccination coverage sometimes fails to achieve measles elimination, and that a shift from national to subnational focus is needed as countries approach elimination.

START COMMENTARY

Truelove et al. present a method to account for clustering of non-vaccination, a phenomenon that may, in part, explain outbreaks of disease, despite meeting country-level vaccination coverage thresholds. Clustering adjustment was based on the probability of contact at a given spatial distance and probability of susceptibility at a given distance relative to the probability of susceptibility of anyone in the population (represented as $g(r)$ and $\tau(r)$, see equation 3). Variation in several

parameters, including level of clustering, contact patterns, and vaccination coverage levels, were simulated to demonstrate the impact of different levels of clustering in different settings. An interesting finding, illustrated in Figure 4, was the shifting impact of clustering on the probability of an outbreak based on different vaccination coverage levels. This finding has implications on vaccination targeting strategies, suggesting that the impact of clustering is minimal in countries with low vaccination coverage whereas countries with high vaccination coverage may benefit from addressing non-vaccination clustering. Several assumptions were made in this study and violations of these assumptions may impact the validity of the study results. Assumptions include not accounting for naturally-acquired immunity and correctly specifying the contact patterns. As with any modeling study, authors note the accuracy of the clustering adjustment (and other parameters) is contingent upon the quality of the data from which it is derived. Truelove et al. outline an approach that could improve vaccination strategies as countries reach disease elimination.

Return to List of Articles

2. [Effect and cost-effectiveness of pneumococcal conjugate vaccination: a global modelling analysis](#)

Chen C, Cervero Liceras F, Flasche S, Sidharta S, Yoong J, Sundaram N, et al.

ABSTRACT

BACKGROUND:

Introduction of pneumococcal conjugate vaccines (PCVs) has substantially reduced disease burden due to Streptococcus pneumoniae, a leading cause of childhood morbidity and mortality globally. However, PCVs are among the most expensive vaccines, hindering their introduction in some settings and threatening sustainability in others. We aimed to assess the effect and cost-effectiveness of introduction of 13-valent PCV (PCV13) vaccination globally.

METHODS:

We assessed the incremental cost-effectiveness ratio of PCV13 introduction by integrating two models: an ecological model (a parsimonious, mechanistic model validated with data from post-seven-valent PCV introduction in 13 high-income settings) to predict the effect of PCV on childhood invasive pneumococcal disease, and a decision-tree model to predict a range of clinical presentations and economic outcomes under vaccination and no-vaccination strategies. The models followed 30 birth cohorts up to age 5 years in 180 countries from 2015 to 2045. One-way scenario and probabilistic sensitivity analyses were done to explore model uncertainties.

FINDINGS:

We estimate that global PCV13 use could prevent 0·399 million child deaths (95% credible interval 0·208 million to 0·711 million) and 54·6 million disease episodes (51·8 million to 58·1 million) annually. Global vaccine costs (in 2015 international dollars) of $15·5 billion could be partially offset by health-care savings of $3·19 billion (2·62 billion to 3·92 billion) and societal cost savings of $2·64 billion (2·13 billion to 3·28 billion). PCV13 use is probably cost-effective in all six UN regions. The 71 countries eligible for support from Gavi, the Vaccine Alliance, account for 83% of PCV13-preventable deaths but only 18% of global vaccination costs. The expected cost of PCV vaccination globally is around $16 billion per year.

INTERPRETATION:

Our findings highlight the value of Gavi's support for PCV introduction in low-income countries and of efforts to improve the affordability of PCVs in countries not eligible for, or transitioning from, Gavi support.

START COMMENTARY

Chen et al. present the first multi-country study to more robustly analyze herd protection and serotype replacement in assessing the health and economic impact of PCV. The primary limitation of the study was the lack of data or knowledge, resulting in the use of simplifying assumptions. Authors assumed vaccine serotypes will be eliminated through vaccination, vaccine serotypes will be replaced in carriage by non-vaccine serotypes, and the probability of causing invasive disease will be the same as in the post introduction of PCV. It was also assumed that levels of coverage for elimination were attained. Chen et al. advise "model predictions should be treated as estimates of the maximum reduction in IPD that can be achieve through vaccination, rather than necessarily predictions of vaccine impact." Pricing assumptions may over or underestimate true price. Lifetime meningitis sequelae costs were not included in the analysis due to lack of treatment cost data (though sensitivity analyses still suggest PCV is cost-effective). Furthermore, the analysis focused on children under 5 and, therefore, may underestimate the full impact of PCV through herd immunity among older individuals. Chen et al. highlight high vaccine introduction costs and potential challenges for middle income countries that have not yet introduced and do not qualify for financial support.

Return to List of Articles

3. [Current challenges and proposed solutions to the effective implementation of the RTS, S/AS01 Malaria Vaccine Program in sub-Saharan Africa: A systematic review](#)

Dimala CA, Kika BT, Kadia BM, Blencowe H.

ABSTRACT

BACKGROUND:

The Malaria Vaccine Implementation Program, coordinated by the World Health Organization, intended to initiate the roll-out of the RTS, S/AS01 malaria vaccine in 3 sub-Saharan African countries in 2018. With sub-optimal implementation, the effectiveness of this vaccine in routine clinical use could be significantly lower than its measured efficacy in randomized trials. This study had as objectives to systematically review and summarize published studies addressing the challenges faced during the implementation phase of malaria vaccination programs and randomized trials conducted in sub-Saharan Africa. The review also sought to report proposed solutions to the challenges identified.

METHOD:

This was a systematic review of studies published between 1947 and 2017. Medline, Embase and the Cochrane library databases were searched. Of the 365 studies retrieved, 8 eligible studies reported on challenges of implementing a malaria vaccine in sub-Saharan Africa and possible solutions to these challenges. Data were abstracted from the eligible studies and a qualitative synthesis was done.

RESULTS:

The 8 studies included in the review had a total of 6189 participants and used a variety of methodologies (3 qualitative, 1 quantitative, 3 mixed method studies and 1 clinical trial review). There was an overall positive acceptance towards the new malaria vaccine (n = 6/8 studies), with a mean acceptance rate of 86.1% (95% CI: 62.0-110.2, n = 2). The main challenges to vaccine receptivity were: inadequate community engagement due to lack of information about the vaccine (n = 6), fear of the vaccine's side effects (n = 5), inefficient delivery of vaccination services to children (n = 4), and sub-optimal quality of the health services (n = 3). Main themes identified from the proposed solutions consisted of the following: using dynamic communication models and trusted sources for delivering vaccine-related health information to the communities (n = 6), community

engagement at both national and district level (n = 6), implementing the new vaccine services alongside the existing health services already delivered (n = 6).

CONCLUSION/RECOMMENDATIONS:

Effective implementation of the malaria vaccine program requires careful consideration of the socio-cultural context of each community. The RTS, S/AS01 malaria vaccine acceptance and uptake may be significantly enhanced if caregivers' perceptions about vaccines and their importance are adequately fine-tuned. In order to achieve these, community participation and the provision of adequate information in an acceptable form via reliable communication channels seem to be imperative.

WEB: 10.1371/journal.pone.0209744
IMPACT FACTOR: 2.77
CITED HALF-LIFE: 2.70

START COMMENTARY

Dimala et al. conducted a systematic review of the published literature on potential barriers and solutions to malaria vaccine implementation. They used PRISMA and appraised the quality of the studies. Authors state a limitation of the study was only including studies reported in English, which could introduce selection bias. Furthermore, the studies represent a small number of countries and, given the heterogeneity of malaria, may not be representative of sub-Saharan Africa. Additionally, solutions presented in the study may have been gathered from author commentary and not formally evaluated in the studies. Despite, these limitations and small number of studies, authors identified some common themes that may prove useful in vaccine implementation.

Return to List of Articles

4. [Projected impact, cost-effectiveness, and budget implications of rotavirus vaccination in Mongolia](#)

Lusvan ME, Debellut F, Clark A, Demberelsuren S, Otgonbayar D, Batjargal T, et al.

ABSTRACT

INTRODUCTION:

Rotavirus disease in Mongolia is estimated to cause more than 50 deaths yearly and many more cases and hospitalizations. Mongolia must self-finance new vaccines and does not automatically access Gavi prices for vaccines. Given the country's limited resources for health, it is critical to assess potential new vaccine programs. This evaluation estimates the impact, cost-effectiveness, and budget implications associated with a nationwide rotavirus vaccine introduction targeting infants as part of the national immunization program in Mongolia, in order to inform decision-making around introduction.

METHODS:

The analysis examines the use of the two-dose vaccine ROTARIX®, and three-dose vaccines ROTAVAC® and RotaTeq® compared to no vaccination from the government and the societal perspective. We use a modelling approach informed by local data and published literature to analyze the impact and cost-effectiveness of rotavirus vaccination over a ten-year time period starting in 2019, using a 3% discount rate. Our main outcome measure is the incremental cost-effectiveness ratio (ICER) expressed as US dollar per DALY averted. We assessed uncertainty around a series of parameters through univariate sensitivity analysis.

RESULTS:

Rotavirus vaccination in Mongolia could avert more than 95,000 rotavirus cases and 271 deaths, over 10 years. Averted visits and hospitalizations represent US$2.4 million in health care costs saved by the government. The vaccination program cost ranges from $6 to $11 million depending on vaccine choice. From the governmental perspective, ICER ranged from $412 to $1050 and from $77 to $715 when considering the societal perspective. Sensitivity analysis highlights vaccine price as the main driver of uncertainty.

CONCLUSION:

Introduction of rotavirus vaccination is likely to be highly cost-effective in Mongolia, with ICERs estimated at only a fraction of Mongolia's per capita GDP. From an economic standpoint, ROTAVAC® is the least costly and most cost-effective product choice.

START COMMENTARY

Lusvan et al. demonstrate introduction of rotavirus vaccine into Mongolia's national immunization program would be cost-effective. Authors use the UNIVAC model, which was developed based on the TRIVAC model. Authors only model direct impact of the rotavirus vaccines, and, thus, present conservative estimates. Tables 1–3 outlines model input parameters. Sensitivity analyses examined incidence of severe rotavirus gastroenteritis (RVGE) hospitalizations, incidence of RVGE deaths, vaccine efficacy, vaccine coverage, vaccine price per dose, incremental health system cost per dose, inpatient admission costs, outpatient visit costs, and discount rate. The main driver of the sensitivity analyses was vaccine price (see Figure 4). Limitations of the study include the lack of data on non-severe rotavirus cases and uncertainty around cost estimations.

Return to List of Articles

5. [Oral cholera vaccination strategy: Self-administration of the second dose in urban Dhaka, Bangladesh](#)

Khan AI, Islam MS, Islam MT, Ahmed A, Chowdhury MI, Chowdhury F, et al.

ABSTRACT

Cholera remains a major public health problem in many developing countries including Bangladesh. The oral cholera vaccine (OCV) is now considered a key component of the public health response to cholera. Although maintaining cold chain and organizing human resource are the major challenges of vaccine delivery to the community. Here we applied an innovative approach to second dose OCV delivery to minimize financial and logistic burdens. The purpose of this study was to assess the feasibility and compliance of second dose self-administration when the second dose was provided in a plastic bag to first dose vaccine recipients as OCV is stable for up to 42 days at ambient temperatures. We aimed to deploy vaccines (N = 112,000) left over from other studies to 56,000 people aged ≥ one year living in Mirpur, Dhaka to see the feasibility of self-administration strategy. During vaccination, the first OCV dose (OCV1) was given from fixed sites and the second dose (OCV2) was provided in a plastic zip-lock bag for the participant to take the vaccine two weeks later at home. Participants were instructed to keep the vaccine away from light and in a dry cool place. Empty vials were collected following the end date of the scheduled second vaccination. Of the targeted population, 41,694 (74%) received the first OCV dose whereas an estimated 38,852 (93% of those receiving the first dose) received the second dose which represents a 7% drop out rate from OCV1 to OCV2. However the average two dose coverage was 69%. A survey of a subsample 2990 (from 8551) randomly selected households revealed that almost all respondents (98.75%) appreciated this new self-administration strategy and considered the strategy to be more practical and convenient than the usual method. This simplified, self-administered delivery strategy provides an ideal alternative for second-dose OCV delivery in hard-to-reach populations and resource-poor settings.

START COMMENTARY

In an effort to alleviate logistic challenges of implementing a second dose of oral cholera vaccine (OCV), Khan et al. conducted a study of self-administered second dose OCV. Using excess OCV from prior vaccination studies, Khan et al. targeted high-risk, low socioeconomic populations in Mirpur, Dhaka, Bangladesh. Authors found overall high coverage (93%) among respondents receiving the first dose of OCV and acceptability of self-administration (99%). Authors noted challenges of the study was time constraint due to Ramadan and missing factory workers due to long working hours. While authors assessed storage and vaccine vial monitor color of the second dose OCV, further study of effectiveness and costing would be beneficial. The self-administration strategy could provide a solution to low-resource or hard-to-reach populations.

Return to List of Articles

6. [Documentation of vaccine handling and service delivery at outreach immunization sessions across 27 districts of India](#)

Das MK, Arora NK, Mathew T, Vyas B, Sindhu M, Yadav A.

ABSTRACT

BACKGROUND:

Outreach sessions constitute a major share of routine immunization service under national program in India.

OBJECTIVE:

To document the organisation, logistics, vaccine handling and services delivered during outreach sessions in India.

METHOD:

This cross-sectional study was undertaken at 136 outreach sessions across 27 districts in three states (Bihar-62, Gujarat-43 and Kerala-31). Data was collected on session organization, vaccine supply, handling, beneficiary interaction, documentation, and waste handling.

RESULTS:

All essential items and vaccines were available at 52.2% and 59.7% of sessions. The overall beneficiary turnout was 72.6%. Matching diluents were available for 94.4% of lyophilised vaccine vials. All four messages were given to 58.8% beneficiaries and 40% were advised to wait for 30 minutes. Few sites received vaccine vials with unusable vaccine vial monitors and frozen free-sensitive vaccine vials.

CONCLUSION:

Program attention is needed to improve organisation, logistics and vaccine handling at the outreach sessions to ensure optimal service delivery and beneficiary experience. The supportive supervision and monitoring must be strengthened focusing on updated beneficiary list, vaccine handling, counselling and waste handling.

START COMMENTARY

Das et al. highlight gaps in effective vaccine and service delivery. Districts were randomly selected from each state. Figure 1 shows the sampling scheme based on distance from the vaccination sites. The tables summarize the outcomes measured, disaggregated by state. Variation was observed between states for a number of outcomes, including availability of HBV vaccine and being asked to wait 30 minutes for assessing acute adverse events. Authors noted that they did not assess knowledge and satisfaction of vaccinators and recipients, potential limitations.

Return to List of Articles

7. Coverage and timeliness of vaccination and the validity of routine estimates: Insights from a vaccine registry in Kenya

Adetifa IMO, Karia B, Mutuku A, Bwanaali T, Makumi A, Wafula J, et al.

ABSTRACT

BACKGROUND:

The benefits of childhood vaccines are critically dependent on vaccination coverage. We used a vaccine registry (as gold standard) in Kenya to quantify errors in routine coverage methods (surveys and administrative reports), to estimate the magnitude of survivor bias, contrast coverage with timeliness and use both measures to estimate population immunity.

METHODS:

Vaccination records of children in the Kilifi Health and Demographic Surveillance System (KHDSS), Kenya were combined with births, deaths, migration and residence data from 2010 to 17. Using inverse survival curves, we estimated up-to-date and age-appropriate vaccination coverage, calculated mean vaccination coverage in infancy as the area under the inverse survival curves, and estimated the proportion of fully immunised children (FIC). Results were compared with published coverage estimates. Risk factors for vaccination were assessed using Cox regression models.

RESULTS:

We analysed data for 49,090 infants and 48,025 children aged 12-23 months in 6 birth cohorts and 6 cross-sectional surveys respectively, and found 2nd year of life surveys overestimated coverage by 2% compared to birth cohorts. Compared to mean coverage in infants, static coverage at 12 months was exaggerated by 7-8% for third doses of oral polio, pentavalent (Penta3) and pneumococcal conjugate vaccines, and by 24% for the measles vaccine. Surveys and administrative coverage also underestimated the proportion of the fully immunised child by 10-14%. For BCG, Penta3 and measles, timeliness was 23-44% higher in children born in a health facility but 20-37% lower in those who first attended during vaccine stock outs.

CONCLUSIONS:

Standard coverage surveys in 12-23 month old children overestimate protection by ignoring timeliness, and survivor and recall biases. Where delayed vaccination is common, up-to-date coverage will give biased estimates of population immunity. Surveys and administrative methods also underestimate FIC prevalence. Better measurement of coverage and more sophisticated analyses are required to control vaccine preventable diseases.

START COMMENTARY

Population estimates for the registry are derived from the 2000 census, updated of births, deaths, and migration events by enumeration visits by fieldworkers to every participating household at 4 month intervals. Adetifa et al. define "up-to-date vaccination coverage" as the proportion of children vaccinated by their first birthday and define "age-appropriate vaccination coverage" as the proportion of children vaccinated within 4 weeks of the age of the vaccine eligibility in the Kenya routine childhood immunization schedule. Strengths to using the vaccine registry is the ability to measure vaccination timeliness and account for survivor bias. Limitations of the study include the inability to account for migratory populations and inability to capture true population immunity, which seroepidemiological surveys are more apt to capture. Furthermore, it is unclear why there are differences in coverage by vaccine type. Despite these limitations, Adetifa et al. demonstrate the added benefit of using vaccine registry to better estimate vaccination coverage through more accurate numerator and denominator estimates.

Return to List of Articles

8. The use of eHealth with immunizations: An overview of systematic reviews

Dumit EM, Novillo-Ortiz D, Contreras M, Velandia M, Danovaro-Holliday MC.

ABSTRACT

BACKGROUND:

eHealth interventions may help increase vaccination uptake and health literacy related to immunization and improve immunization program efficiency.

OBJECTIVES:

To see where and how eHealth technologies have had a positive impact on immunization practices-using eHealth strategies to increase vaccination uptake, improve immunization program efficiency and advance heath literacy related to immunizations.

METHODS:

An overview of systematic reviews was conducted, searching PubMed, Scopus, Embase, and Web of Science for systematic reviews published through August 2017 for eHealth and immunizations (using pre-determined concepts for each). Two independent reviewers selected studies based on a priori criteria; disagreement was resolved by consensus. The quality of the included studies was evaluated using the Measurement Tool to Assess Systematic Reviews (AMSTAR).

RESULTS:

The primary search identified 198 results. After eliminating duplicates 158 remained. Upon applying the a priori set criteria to these, six articles were left to analyze. Four articles showed a positive relationship (a demonstrated benefit, improvement, increase in vaccination uptake, etc. when using eHealth technologies for immunization), one showed a promising relation / with potential, and one showed unknown effects as it focused on the difficulty of analyzing cost-benefits of immunization information systems (IIS).

CONCLUSION:

The review leads to a recommendation of using eHealth technologies to encourage immunizations and increase vaccination adherence and uptake and to continue assessing and documenting the use of eHealth for immunization.

START COMMENTARY

Dumit et al. conduct summarize the beneficial impact of eHealth on immunizations from systematic reviews. Six reviews were identified, primarily from high income countries, and an assessment of their quality via the AMSTAR scale was summarized in Table 1. While Dumit et al. generally find positive relationships between the use of eHealth and immunizations, recommending continued use and documentation of effects, there are potential limitations of this study. Studies referred to as electronic immunization registries (EIR) may have been excluded if they were not cross-referenced as electronic health/medical records (EHR/EMR) or immunization information system (IIS). Authors also highlight that the search exclusion criteria may have limited the scope of articles, excluding potentially relevant articles. Namely, the restriction to systematic reviews is likely limiting. Finally, this study is subject to publication bias. Studies reporting positive results are more likely to be published and, therefore, included in this review.

[Return to List of Articles](#)

9. [Toward economic evaluation of the value of vaccines and other health technologies in addressing AMR](#)

Sevilla JP, Bloom DE, Cadarette D, Jit M, Lipsitch M.

ABSTRACT

We discuss the need to make economic evaluations of vaccines antimicrobial resistance (AMR)-sensitive and ways to do so. Such AMR-sensitive evaluations can play a role in value-for-money comparisons of different vaccines within a national immunization program, or in comparisons of vaccine-centric and non-vaccine-centric technologies within an anti-AMR program. In general terms, incremental cost-effectiveness ratios and rates of return and their associated decision rules are unaltered by consideration of AMR-related value. The decision metrics need to have their various health, cost, and socioeconomic terms disaggregated into resistance-related subcategories, which in turn have to be measured carefully before they are reaggregated. The fundamental scientific challenges lie primarily in quantifying the causal impact of health technologies on resistance-related health outcomes, and secondarily in ascertaining the economic value of those outcomes. We emphasize the importance of evaluating vaccines in the context of other potentially complementary and substitutable nonvaccine technologies. Complementarity implies that optimal spending on each set of interventions is positive, and substitutability implies that the ratio of spending will depend on relative value for money. We exemplify this general point through a qualitative discussion of the complementarities and (especially the) substitutability between pneumococcal conjugate vaccines and antimicrobial stewardship and between research and development (R&D) of a gonorrhea vaccine versus R&D of a gonorrhea antibiotic. We propose a roadmap for future work, which includes quantifying the causal effects of vaccination and other health technologies on short-term and long-term resistance-related outcomes, measuring the health-sector costs and broader socioeconomic consequences of resistance-related mortality and morbidity, and evaluating vaccines in the context of nonvaccine complements and substitutes.

START COMMENTARY

Sevilla et al. present the case to incorporate antimicrobial resistance (AMR) considerations in analyses that assess that value of vaccines. Authors explore both economic and health impacts of AMR pathogens and their relationship with vaccinations. The authors present a roadmap which summarizes the benefits of incorporating AMR into vaccine impact assessments as well as future work. Table 1 nicely summarizes how AMR analyses can be built into cost-effectiveness analyses; Table 2 summarizes AMR considerations into cost-benefit analyses. Excluding AMR in vaccine assessments could be result in undervaluing the impact of vaccines.

Return to List of Articles

10. Hybrid prevalence estimation: Method to improve intervention coverage estimations

Jeffery C, Pagano M, Hemingway J, Valadez JJ.

ABSTRACT

Delivering excellent health services requires accurate health information systems (HIS) data. Poor-quality data can lead to poor judgments and outcomes. Unlike probability surveys, which are representative of the population and carry accuracy estimates, HIS do not, but in many countries the HIS is the primary source of data used for administrative estimates. However, HIS are not structured to detect gaps in service coverage and leave communities exposed to unnecessary health risks. Here we propose a method to improve informatics by combining HIS and probability survey data to construct a hybrid estimator. This technique provides a more accurate estimator than either data source alone and facilitates informed decision-making. We use data from vitamin A and polio vaccination campaigns in children from Madagascar and Benin to demonstrate the effect. The hybrid estimator is a weighted average of two measurements and produces SEs and 95% confidence intervals (CIs) for the hybrid and HIS estimators. The estimates of coverage proportions using the combined data and the survey estimates differ by no more than 3%, while decreasing the SE by 1-6%; the administrative estimates from the HIS and combined data estimates are very different, with 3-25 times larger CI, questioning the value of administrative estimates. Estimators of unknown accuracy may lead to poorly formulated policies and wasted resources. The hybrid estimator technique can be applied to disease prevention services for which population coverages are measured. This methodology creates more accurate estimators, alongside measured HIS errors, to improve tracking the public's health.

START COMMENTARY

Jeffery et al. present methods to better estimate intervention coverage with the use of both administrative and probability survey data. Authors utilized the lot quality assurance sampling (LQAS) methodology to conduct their probability survey, though surveys such as the Demographic and Health Surveys or Multi Indicator Cluster Surveys can be used as well. In addition to more

accurate estimates, this method allows for the measure of errors. Authors state that this method has value in the use of DHIS2 administrative data, widely used in low-resource countries.

Return to List of Articles

Appendix

The literature search for the February 2019 Vaccine Delivery Research Digest was conducted on January 17, 2019. We searched English language articles indexed by the US National Library of Medicine and published between December 15, 2018 and January 14, 2019. The search resulted in 192 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]) ("2018/12/15"[PDAT] : "2019/01/14"[PDAT]))