VACCINE DELIVERY RESEARCH DIGEST

UNIVERSITY OF WASHINGTON GLOBAL HEALTH START PROGRAM
REPORT TO THE BILL AND MELINDA GATES FOUNDATION

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PRODUCED BY: LEVINE GA, ROWHANI-RAHBAR A

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1. **Effects of Community Health Nurse-Led Intervention on Childhood Routine Immunization Completion in Primary Health Care Centers in Ibadan, Nigeria.**

Brown VB, Oluwatosin OA, Akinyemi JO, Adeyemo AA.

J Community Health. 2016 Apr;41(2):265-73.
PMID: 26395786

ABSTRACT

Immunization coverage of vulnerable children is often sub-optimal in many low- and middle-income countries. The use of a reminder/recall (R/R) system has been one of the strategies shown to be effective in improving immunization rates. In the resent study, we evaluated the effect of R/R and Primary Health Care Immunization Providers' Training (PHCIPT) intervention on routine immunization completion among 595 infants in Ibadan, Nigeria. The design was a group randomized controlled trial with Local Government Area (LGA) being the unit of randomization. Four randomly selected LGAs were randomized to receive a cellphone R/R only (A), a PHCIPT only (B); combined R/R and PHCIPT (C) intervention or serve as a control group (D). Children aged 0-12 weeks were consecutively recruited into each group and followed up for 12 months. The primary outcome measure was routine immunization completion at 12 months of age. At the study endpoint, immunization completion rates were: group A, 98.6 %; group B, 70 %; group C, 97.3 %; and group D, 57.3 %. Compared to the control group, the cellphone R/R group was 72 % (RR 1.72, 95 % CI 1.50-1.98) and the combined RR/PHCIPT group 70 % (RR 1.70, 95 % CI 1.47-1.95) more likely to complete immunization. In contrast, immunization completion in the PHCIPT group was marginally different from the control group (RR 1.22, 95 % CI 1.03-1.45). These findings remained robust to adjustment for potential predictors of immunization completion as covariates. In conclusion, cellphone reminder/recall was effective in improving immunization completion in this Nigerian setting. Its use is recommended for large scale implementation.

WEB: http://dx.doi.org/10.1007/s10900-015-0092-3
IMPACT FACTOR: 1.28
CITED HALF-LIFE: 6.70

UW EDITORIAL COMMENT: Reminder cell phone calls were conducted to listed caregivers two times before an appointment, and two recall calls were made for missed appointments. The PHCIPT intervention consisted of 2 days “refresher training” for Primary Health Care immunization providers (nurses, midwives, Community Health Officers (CHOs) and Community Health Extension Workers (CHEWs) who had not had training within the previous 3 months, using an adapted module from WHO immunization training manuals. None of the socio-demographic characteristics assessed were found to influence vaccine completion in a multivariable model adjusted for intervention type (Table 3), but authors didn’t assess whether the influence of the intervention depended on such socio-demographic characteristics. Methods for estimating the relative risk for the primary association between intervention group and vaccine completion without adjustment aren’t clearly described, but it doesn’t appear the confidence intervals were estimated using a variance adjustment that accounts for clustering, and thus may be incorrect. It should be noted that because the outcome of vaccine completion is not expected to be rare in the source population (completion proportion in control group was 57.3%), the odds ratios estimates in Table 3 should not be interpreted as risk ratios, as the ORs would be expected to grossly overestimate the relative risk.

2. **Hepatitis B vaccine stored outside the cold chain setting: a pilot study in rural Lao PDR.**

Kolwaite AR, Xeuatvongsa A, Ramirez-Gonzalez A, Wannemuehle K, Vongxay V, et al.

Vaccine. 2016 Mar 31. [Epub ahead of print]
PMID: 27040399

ABSTRACT

BACKGROUND: Hepatitis B vaccine birth dose (HepB-BD) was introduced in Lao People's Democratic Republic (Lao-PDR) to prevent perinatal hepatitis B virus transmission. HepB-BD, which is labeled for storage between 2 and 8°C, is not available at all health facilities, because of some lack of functional cold chain; however, previous studies show that HepB-BD is stable if stored outside the cold chain (OCC). A pilot study was conducted in Lao-PDR to evaluate impact of OCC policy on HepB-BD coverage.

METHODS: During the six month pilot, HepB-BD was stored OCC for up to 28 days in two intervention districts and stored in cold chain in two comparison districts. In the intervention districts, healthcare workers were educated about HepB-BD and OCC storage. A post-pilot survey compared HepB-BD coverage among children born during the pilot (aged 2-8 months) and children born 1 year before (aged 14-20 months).

FINDINGS: In the intervention districts, 388 children aged 2-8 months and 371 children aged 14-20 months were enrolled in the survey; in the comparison districts, 190 children aged 2-8 months and 184 children aged 14-20 months were enrolled. Compared with the pre-pilot cohort, a 27% median increase in HepB-BD (interquartile range [IQR] 58%, $p<0.0001$) occurred in the pilot cohort in the intervention districts, compared with a 0% median change (IQR 25%, $p=0.03$) in comparison districts. No adverse reactions were reported.

INTERPRETATION: OCC storage improved HepB-BD coverage with no increase in adverse reactions. Findings can guide Lao-PDR on implementation and scale-up options of OCC policy.

WEB: http://dx.doi.org/10.1016/j.vaccine.2016.03.080

IMPACT FACTOR: 3.62

CITED HALF-LIFE: 5.50

UW EDITORIAL COMMENT: In intervention districts staff were instructed to store all HepB vaccine at ambient temperatures for up to 28 days (regardless of access to refrigeration), to discard second dose, and discard after 28 days. The intervention also included training for health care workers about HepB burden and importance of vaccination, disease transmission, instructions on storage and discard practices, logistics of monthly ascertainment and vaccine acquisition, and instructions regarding proper documentation of vaccination and wastage. Authors note that no supply chain or logistics interventions were introduced. While coverage differences pre- vs. post-intervention in the treatment group may be due to OCC policy alone, it is also possible that other components of the intervention, such as the healthcare worker training and education about HepB in intervention districts may have influenced coverage, or that increased attention to documentation in treatment regions changed documentation practices, influencing coverage estimates in those regions. Table 3 and Figure 2 show pre- and post- coverage in intervention and control villages, stratified by whether the intervention was provided in a “fixed,” “outreach,” or “mobile” village.

3. **SMS text message reminders to improve infant vaccination coverage in Guatemala: A pilot randomized controlled trial.**

Domek GJ, Contreras-Roldan IL, O'Leary ST, Bull S, Furniss A, Kempe A, et al.

Vaccine. 2016 May 5;34(21):2437-43. Epub 2016 Mar 26.
PMID: 27026145

ABSTRACT

BACKGROUND: Patient reminder systems are an evidence-based way to improve childhood vaccination rates but are difficult to implement in low- and middle-income countries (LMICs). Short Message Service (SMS) texts may offer a potential low-cost solution, especially in LMICs where mobile phones are becoming more ubiquitous.
OBJECTIVE: To determine if an SMS-based vaccination reminder system aimed at improving completion of the infant primary immunization series is feasible and acceptable in Guatemala.
METHODS: A pilot randomized controlled trial was conducted at two public health clinics in Guatemala City. Infants aged 8-14 weeks presenting for the first dose of the primary immunization series were enrolled in March-April 2013. Participants randomized into the intervention received three SMS reminders one week before the second and third dose. A follow-up acceptability survey was administered to both groups.
RESULTS: The participation rate was 86.8% (321/370); 8 did not own a cell phone and 12 could not use SMS. 96.9% of intervention parents were sent at least one SMS reminder prior to visit 2 and 96.3% prior to visit 3. Both intervention and usual care participants had high rates of vaccine and visit completion, with a non-statistically significant higher percentage of children in the intervention completing both visit 2 (95.0% vs. 90.1%, p=.12) and visit 3 (84.4% vs. 80.7%, p=.69). More intervention vs. usual care parents agreed that SMS reminders would be helpful for remembering appointments (p<.0001), agreed to being interested in receiving future SMS reminders (p<.0001), and said that they would be willing to pay for future SMS reminders (p=.01).
CONCLUSION: This proof of concept evaluation showed that a new application of SMS technology is feasible to implement in a LMIC with high user satisfaction. Larger studies with modifications in the SMS system are needed to determine effectiveness.

WEB: http://dx.doi.org/10.1016/j.vaccine.2016.03.065
IMPACT FACTOR: 3.62
CITED HALF-LIFE: 5.50
UW EDITORIAL COMMENT: Authors report that feasibility and acceptability of the intervention was high, but it should be noted that the enrolled study population did not include those without a cell phone or unable to use SMS; those for whom the intervention would likely not be feasible nor acceptable, and likely those in the population at highest risk of not completing vaccination. It therefore seems likely that estimated feasibly and acceptability in the study population may be higher than in a more broad, generalizable population. The potential effectiveness of the intervention, as indicated by differences in point estimate for coverage completion between groups, can't be extrapolated to apply to a population of children for whom parents don't have phones and/or aren't able to SMS.

4. **Introduction of rubella-containing-vaccine to Madagascar: implications for roll-out and local elimination.**

Wesolowski A, Mensah K, Brook CE, Andrianjafimasy M, Winter A, et al.

J R Soc Interface. 2016 Apr;13(117).
PMID: 27122178

ABSTRACT

Few countries in Africa currently include rubella-containing vaccination (RCV) in their immunization schedule. The Global Alliance for Vaccines Initiative (GAVI) recently opened a funding window that has motivated more widespread roll-out of RCV. As countries plan RCV introductions, an understanding of the existing burden, spatial patterns of vaccine coverage, and the impact of patterns of local extinction and reintroduction for rubella will be critical to developing effective programmes. As one of the first countries proposing RCV introduction in part with GAVI funding, Madagascar provides a powerful and timely case study. We analyse serological data from measles surveillance systems to characterize the epidemiology of rubella in Madagascar. Combining these results with data on measles vaccination delivery, we develop an age-structured model to simulate rubella vaccination scenarios and evaluate the dynamics of rubella and the burden of congenital rubella syndrome (CRS) across Madagascar. We additionally evaluate the drivers of spatial heterogeneity in age of infection to identify focal locations where vaccine surveillance should be strengthened and where challenges to successful vaccination introduction are expected. Our analyses indicate that characteristics of rubella in Madagascar are in line with global observations, with an average age of infection near 7 years, and an impact of frequent local extinction with reintroductions causing localized epidemics. Modelling results indicate that introduction of RCV into the routine programme alone may initially decrease rubella incidence but then result in cumulative increases in the burden of CRS in some regions (and transient increases in this burden in many regions). Deployment of RCV with regular supplementary campaigns will mitigate these outcomes. Results suggest that introduction of RCV offers a potential for elimination of rubella in Madagascar, but also emphasize both that targeted vaccination is likely to be a lynchpin of this success, and the public health vigilance that this introduction will require.

WEB: http://dx.doi.org/10.1098/rsif.2015.1101
IMPACT FACTOR: 3.92
CITED HALF-LIFE: 4.40
UW EDITORIAL COMMENT: Authors estimate that the probability of rubella elimination in all 22 regions of Madagascar, assuming current vaccination coverage, after 20 years of vaccination, ranges between 8% and 15%. The probability of extinction is very sensitive to the estimates of "connectivity," or the remoteness of regions and expected incoming travel and mixing of populations. Areas that are more remote and less connected will have a higher average age of infection, increasing risk of first infection during childbearing years and thus increasing risk of congenital rubella infection. Authors identified communities that are smaller than the "critical community size" needed for maintaining immunizing infection without risk of complete extinction (which will result in risk of older first infection), and considered "connectivity" in each area, based on incoming travel, and used these measures to estimate average age of infection regionally. Figure 5 depicts the impact of vaccination for rubella in Madagascar on extinction, assuming vaccination over the next 20 years, by regional "connectivity," using either global or regionally targeted vaccination strategies, at a range of regional coverage levels.

Authors estimate that if coverage reaches 90%, probability of extinction is nearly 40%. If instead of focusing on all geographic regions, strategies concentrate on improving coverage in select regions that are "well-connected", elimination ranges between 20% at "low-connectivity" and 9% at "high connectivity.

5. **Impact of oral cholera vaccines in cholera-endemic countries: A mathematical modeling study.**

Kim JH, Mogasale V, Burgess C, Wierzba TF.

Vaccine. 2016 Apr 19;34(18):2113-20.
PMID: 26993337

ABSTRACT

BACKGROUND: Impact evaluation of vaccination programs is necessary for making decisions to introduce oral cholera vaccines (OCVs) in cholera-endemic countries.
METHODS: We analyzed data to forecast the future global burden of cholera. We developed a mathematical model of cholera transmission in three countries as examples: Nigeria, Uganda, and Indonesia. After fitting the model, we evaluated the impact of OCVs delivered in four vaccination strategies varying by target age group and frequency of vaccination over the period of 2015-2030.
RESULTS: Data suggest that the global annual incidence of cholera will increase from 3,046,238 in 2015 to 3,787,385 in 2030 with the highest burden in Asia and Africa where overall population size is large and the proportion of population with access to improved sanitation facilities is low. We estimate that OCV will reduce the cumulative incidence of cholera by half in Indonesia and >80% in Nigeria and Uganda when delivered to 1+ year olds every three years at a coverage rate of 50%, although cholera may persist through higher coverage rates (i.e., >90%). The proportion of person-to-person transmission compared to water-to-person transmission is positively correlated with higher vaccination impact in all three countries.
CONCLUSIONS: Periodic OCV vaccination every three or five years can significantly reduce the global burden of cholera although cholera may persist even with high OCV coverage. Vaccination impact will likely vary depending on local epidemiological conditions including age distribution of cases and relative contribution of different transmission routes.

WEB: http://dx.doi.org/10.1016/j.vaccine.2016.03.004
IMPACT FACTOR: 3.62
CITED HALF-LIFE: 5.50
UW EDITORIAL COMMENT: Authors used the model to evaluate the effectiveness of four different vaccination programs: 1+ year olds every 3 years; 1+ year olds every 5 years; 1-14 year olds every 3 years and 1-14 year olds every 5 years. Authors estimate that Africa and South Asia will account for approximately 85% of the global population at risk in 2015 and 2030, but estimate that only about 28% and 21% of global cases will originate from these regions in 2015 and 2030, respectively, due to the high incidence in Haiti and the Dominican Republic. Authors also note that burden is estimated to increase in high-mortality regions (due to growth in population size counteracting sanitation improvements) and decrease in low-mortality regions over time. Table 2 displays the country-specific estimates of cumulative number of cases expected from 2016-2013 assuming coverage rate of 50% of target, under each of the 4 different vaccination strategies.

Figure 4 shows expected reduction in cholera incidence in each country starting in 2016, using a strategy of vaccinating those over one every 3 years, assuming different model parameter inputs. Authors point out that while larger coverage proportions are associated with larger reductions in cases, even at very high coverage cases are expected to occur, and the extent to which cases persist depends on the age distribution and susceptibility of different age groups within the different countries. In all three countries, person-to-person transmissions are estimated to be responsible for more than 40% of transmissions. Figure 5 shows the influence of the proportion of transmissions due to person-to-person transmission on the estimated reduction in cases; the larger the proportion of cases due to person-to-person transmission in the setting, the larger the reduction in cases expected from mass vaccination of children over 1 year, every 3 years.

6. **Analysis of vaccination campaign effectiveness and population immunity to support and sustain polio elimination in Nigeria.**

Upfill-Brown AM, Voorman A, Chabot-Couture G, Shuaib F, Lyons HM.

BMC Med. 2016 Mar 30;14(1):60.
PMID: 27029535

ABSTRACT

BACKGROUND: The world is closer than ever to a polio-free Africa. In this end-stage, it is important to ensure high levels of population immunity to prevent polio outbreaks. Here, we introduce a new method of assessing vaccination campaign effectiveness and estimating immunity at the district-level. We demonstrate how this approach can be used to plan the vaccination campaigns prospectively to better manage population immunity in Northern Nigeria.

METHODS: Using Nigerian acute flaccid paralysis surveillance data from 2004-2014, we developed a Bayesian hierarchical model of campaign effectiveness and compared it to lot-quality assurance sampling data. We then used reconstructed sero-specific population immunity based on campaign history and compared district estimates of immunity to the occurrence of confirmed poliovirus cases.

RESULTS: Estimated campaign effectiveness has improved across northern Nigeria since 2004, with Kano state experiencing an increase of 40 % (95 % CI, 26-54 %) in effectiveness from 2013 to 2014. Immunity to type 1 poliovirus has increased steadily. On the other hand, type 2 immunity was low and variable until the recent use of trivalent oral polio vaccine. We find that immunity estimates are related to the occurrence of both wild and vaccine-derived poliovirus cases and that campaign effectiveness correlates with direct measurements using lot-quality assurance sampling. Future campaign schedules highlight the trade-offs involved with using different vaccine types.

CONCLUSIONS: The model in this study provides a novel method for assessing vaccination campaign performance and epidemiologically-relevant estimates of population immunity. Small-area estimates of campaign effectiveness can then be used to evaluate prospective campaign plans. This modeling approach could be applied to other countries as well as other vaccine preventable diseases.

WEB: http://dx.doi.org/10.1186/s12916-016-0600-z.
IMPACT FACTOR: 7.25
CITED HALF-LIFE: 3.10

UW EDITORIAL COMMENT: The modeling strategy consisted of first modeling “campaign effectiveness” based on the number of doses delivered during campaigns; estimating the number of doses per child, given the number of SIAs experienced; and estimated the immunity based age distribution of children 6 to 59 months, the number of doses for a given age, and vaccine effectiveness. Figure 4 shows the divergence between estimates generated from calculated campaign effectiveness and LQAS, demonstrating a substantial degree of bias in campaign effectiveness estimates compared with LAQS coverage estimates. Figure 5 shows the “reconstructed” sero-specific population immunity, based on model outputs. Figure 6 depicts the impact of different future campaign schedules of the change in type 1 and type 2 district-level immunity.

7. **Alternative administration routes and delivery technologies for polio vaccines.**

Kraan H, van der Stel W, Kersten G, Amorij JP.

Expert Rev Vaccines. 2016 Mar 16:1-12. [Epub ahead of print]
PMID: 26912100

ABSTRACT

Global polio eradication is closer than ever. Replacement of the live attenuated oral poliovirus vaccine (OPV) by inactivated poliovirus vaccine (IPV) is recommended to achieve complete eradication. Limited global production capacity and relatively high IPV costs compared to OPV spur the need for improved polio vaccines. The target product profile of these vaccines includes not only dose sparing but also high stability, which is important for stockpiling, and easy application important for (emergency) vaccination campaigns. In this review, the current status of alternative polio vaccine delivery strategies is given. Furthermore, we discuss the feasibility of these strategies by highlighting challenges, hurdles to overcome, and formulation issues relevant for optimal vaccine delivery.

WEB: http://dx.doi.org/10.1586/14760584.2016.1158650
IMPACT FACTOR: 3.46
CITED HALF-LIFE: 4.60
UW EDITORIAL COMMENT: Authors emphasize the need to further investigate alternative delivery strategies for IPV and for the need to more rigorously assess the mucosal immunity conferred by IPV. They emphasize the need to consider "heterologous" vaccination strategies, given that IPV has evidence of boosting mucosal immunity among those previously vaccinated with OPV. Table 1 provides target product profile criteria for polio vaccine given different global polio elimination status, and program aims (routine or outbreak control). The "ideal" vaccine has the following characteristics: "not able to revert to virulence, is stable during storage, affordable, easy to produce, and induces sterilizing immunity (eg. interrupts virus transmission)," but the relative importance of each specific criteria depends on elimination status and program aim. Figure 1 is an overview of approaches currently under development to improve affordability of inactivated poliovirus (IPV) for low-income settings, within the categories of adjuvants and delivery methods, including jet injectors, bio-needles, microneedle patch, and mucosal administration, which indicates for each approach, the expected level of improvement across market entry, ease of administration, stability, adverse effects, dose sparing, costs and protection. Tables 2 and 3 summarize pre-clinical and clinical trials of novel administration approaches.

8. **Seasonality and the effectiveness of mass vaccination.**

Chao DL, Dimitrov DT.

Math Biosci Eng. 2016 Apr 1;13(2):249-59.
PMID: 27105983

ABSTRACT

Many infectious diseases have seasonal outbreaks, which may be driven by cyclical environmental conditions (e.g., an annual rainy season) or human behavior (e.g., school calendars or seasonal migration). If a pathogen is only transmissible for a limited period of time each year, then seasonal outbreaks could infect fewer individuals than expected given the pathogen's in-season transmissibility. Influenza, with its short serial interval and long season, probably spreads throughout a population until a substantial fraction of susceptible individuals are infected. Dengue, with a long serial interval and shorter season, may be constrained by its short transmission season rather than the depletion of susceptibles. Using mathematical modeling, we show that mass vaccination is most efficient, in terms of infections prevented per vaccine administered, at high levels of coverage for pathogens that have relatively long epidemic seasons, like influenza, and at low levels of coverage for pathogens with short epidemic seasons, like dengue. Therefore, the length of a pathogen's epidemic season may need to be considered when evaluating the costs and benefits of vaccination programs.

WEB: http://dx.doi.org/10.3934/mbe.2015001
IMPACT FACTOR: 0.84
CITED HALF-LIFE: 5.60

UW EDITORIAL COMMENT: Figure 1 shows the impact of different serial intervals of 5, 10 or 15 days and limiting the duration of epidemic. Panel A explores the influence on the number of infected individuals over time, indicating that “the attack rate for an epidemic interrupted by seasonal forces is usually lower than the final size that one would expect for an uninterrupted epidemic.” Authors point out that for a given interruption time point, a rapid epidemic may already have “run its course”, whereas a slower epidemic might be interrupted during a period of substantial growth. Panel B shows that the speed of an epidemic can affect the relationship between transmissibility and the attack rate. Panel C shows the impact of vaccine coverage on attack rate under different serial interval scenarios, and Panel D shows the infectious averted per vaccination, given a range of vaccination coverage levels, for different serial intervals and uninterrupted or interrupted epidemic, indicating that the efficiency of mass vaccination as coverage increases depends on the speed of transmission relative to the length of the epidemic season. Authors explain that coverage at exactly the critical vaccination fraction is the most efficient, and that the efficiency is lower at higher coverage levels, because additional infections are not prevented above the critical fraction.

Figure 2 is a heat map of the relationship between transmissibility, serial interval, and season length on the magnitude of the effect of a limited transmission season.

9. **Use of rapid needs assessment as a tool to identify vaccination delays in Guatemala and Peru.**

D'Ardenne KK, Darrow J, Furniss A, Chavez C, Hernandez H, et al.

Vaccine. 2016 Mar 29;34(14):1719-25.
PMID: 26902545

ABSTRACT

OBJECTIVE: To explore the use of rapid needs assessment (RNA) surveys to determine the prevalence and factors contributing to delays in vaccination of children in two low middle-income countries (LMIC).
METHODS: Data from two RNA surveys performed as part of program improvement evaluations in Guatemala and Peru were used for this analysis. The primary endpoint was the timeliness of immunization with delay defined as administration of vaccines beyond 28 days from recommended age for DTwP-HepB-Hib (Penta) and measles-mumps-rubella (MMR) vaccines, as well as past age-restrictions for rotavirus vaccine. Independent risk factors analyzed included child's gender, birth year, number of children in household, maternal age, maternal education, and food insecurity.
RESULTS: Vaccine information was available from 811 children from 838 households surveyed. High rate of immunization delays was observed, with 75.6% of children in Guatemala and 57.8% of children in Peru being delayed for the third dose of Penta primary series. Factors associated with delayed vaccination in Guatemala included advanced maternal age and increased number of children in household. In Peru, significant associations were birth year before 2009, lower maternal education level, and increased number of children in household.
CONCLUSIONS: RNA is a fast and effective method to identify timely vaccine coverage and derive a hypothesis of factors possibly associated with vaccination delay.

WEB: http://dx.doi.org/10.1016/j.vaccine.2016.01.060
IMPACT FACTOR: 3.62
CITED HALF-LIFE: 5.50
UW EDITORIAL COMMENT: The RNA consisted of a questionnaire that was administered to mothers/caregivers of children greater than 6 week of age, identified using WHO Lot Quality Assurance sampling methods to identify a random sample of households within regional sampling clusters. Vaccination status was based on vaccination cards, and it should be noted that household for which children didn't have a vaccination card were excluded from the study, but such households may be more likely to have an unvaccinated/ under-vaccinated/ vaccination-delayed child than household in which vaccination cards were available, and thus estimates for proportion delayed may be under-estimates. Furthermore, it may be possible that factors associated with delayed vaccination in the overall population may not be identified in the subset of households in which vaccination cards are available, or may differ in these subgroups. Table 2 indicates that few of the factors associated with delayed-vaccination were consistently associated with delay across all three penta doses and MMR. This may be indicative of true differences in the factors predictive of risk during different time periods across the vaccination schedule on an individual level, or may be indicative of substantial between-individual variation in barriers, and the statistical instability of estimates.

10. **How a New Health Intervention Affects the Health Systems? Learnings from Pentavalent Vaccine Introduction in India.**

Lahariya C, Paruthi R, Bhattacharya M.

Indian J Pediatr. 2016 Apr;83(4):294-9.
PMID: 26264631

ABSTRACT

OBJECTIVES: To summarize the findings from a Post Introduction Evaluation (PIE) of pentavalent vaccine in Tamil Nadu and Kerala state of India and to understand how the health systems could be prepared for (prior to) introducing a new intervention and how such introduction could affect the health systems (afterwards).
METHODS: A post introduction evaluation (PIE) of Haemophilus influenzae type b (Hib) as pentavalent (DPT + HepB + Hib) vaccine was conducted in Tamil Nadu and Kerala states of India in July-Aug 2012. The PIE was conducted as per World Health Organization PIE methods and tools specifically adapted for India. This PIE adopted a 'mixed method approach' with qualitative data focus.
RESULTS: The planning for the introduction of pentavalent vaccine provided opportunities to strengthen various functions of the health system i.e., piloting of Open Vial Policy, strengthening surveillance system, improving Adverse Events Following Immunization (AEFI) reporting system and formation of the technical expert groups. It provided opportunity for bringing attention on the immunization programme in general as well. After the vaccine introduction, the beneficial effects were noted on stewardship (increased oversight by top level policy makers and programme managers), creating resources (investment and trainings of staff in immunization), service delivery (increased coverage with the vaccines and improved quality of services) and financing (increased financial allocation and reduced out of pocket expenditures as more people started attending public health facilities). The vaccine introduction was found to be associated with improvement in the health equity, efficiency and service utilization (effective coverage).
CONCLUSIONS: New vaccine introduction provides opportunities (both before and after) for strengthening the health systems in setting such as India. Preparing the health system for new challenges has potential to strengthen the health systems, if done in well-coordinated and planned manner. Considering that essential steps are largely similar, these lessons could be applicable for the introduction of other new health interventions in the similar settings.

WEB: http://dx.doi.org/10.1007/s12098-015-1844-x
IMPACT FACTOR: 0.87
CITED HALF-LIFE: 6.90
UW EDITORIAL COMMENT: "Preparedness" of the health system for introducing pentavalent vaccine and "Effect" of vaccine introduction was evaluated based on health system functional areas of 1) service delivery, 2) resource creation, 3) health financing, 4) stewardship/governance. Authors report the following benefits: improved oversight, greater investments and additional trainings, successful implementation of a new policy, and cost saving by reduction in vaccine wastage. Authors also report that vaccine introduction was associated with improvements in coverage and increased utilization of public sector immunization and other health services, as well as a shift towards public-sector service use over use of private services. Authors note that though the health system capacity was often weak pre-introduction, with planning and preparation, successful introduction was feasible, even in the absence of more broad health system infrastructure support or development.

APPENDIX: PUBMED 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]) AND ("2016/3/15"[PDAT] : "2016/04/14"[PDAT]))

* On May 4, 2016, this search of English language articles published between March 15, 2016 and April 14, 2016 and indexed by the US National Library of Medicine resulted in 209 unique manuscripts.