VACCINE DELIVERY RESEARCH DIGEST

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

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1. A CLUSTER RANDOMISED TRIAL ON THE IMPACT OF INTEGRATING EARLY INFANT HIV DIAGNOSIS WITH THE EXPANDED PROGRAMME ON IMMUNIZATION ON IMMUNIZATION AND HIV TESTING RATES IN RURAL HEALTH FACILITIES IN SOUTHERN ZAMBIA.

Wang PC, Mwango A, Moberley S, Brockman BJ, Connor AL, Kalesha-Masumbu P et al.

PLoS One. 2015;10(10):e0141455.
PMID: 26513240

ABSTRACT

BACKGROUND: We assessed the integration of early infant HIV diagnosis with the expanded programme for immunization in a rural Zambian setting with the aim of determining whether infant and postpartum maternal HIV testing rates would increase without harming immunization uptake.

METHODS: In an unblinded, location stratified, cluster randomised controlled trial, 60 facilities in Zambia's Southern Province were equally allocated to a control group, Simple Intervention group that received a sensitization meeting and the resupply of HIV testing commodities in the event of a stock-out, and a Comprehensive Intervention group that received the Simple Intervention as well as on-site operational support to facilitate the integration of HIV testing services with EPI.

FINDINGS: The average change in number of first dose diphtheria, pertussis, and tetanus vaccine (DPT1) provided per month, per facility was approximately 0.86 doses higher [90% confidence interval (CI) -1.40, 3.12] in Comprehensive Intervention facilities compared to the combined average change in the Simple Intervention and control facilities. The interventions resulted in a 16.6% [90% CI: -7%, 46%, P-value = 0.26] and 10% [90% CI: -10%, 36%, P-value = 0.43] greater change in average monthly infant DBS testing compared to control for the Simple and Comprehensive facilities respectively. We also found 15.76 (90% CI: 7.12, 24.41, P-value < 0.01) and 10.93 (90% CI: 1.52, 20.33, P-value = 0.06) additional total maternal re-tests over baseline for the Simple and Comprehensive Facilities respectively.

CONCLUSIONS: This study provides strong evidence to support Zambia's policy of integration of HIV testing and EPI services. Actions in line with the interventions, including HIV testing material supply reinforcement, can increase HIV testing rates without harming immunization uptake. In response, Zambia's Ministry of Health issued a memo to remind health facilities to provide HIV testing at under-five clinics and to include under-five HIV testing as part of district performance assessments.

WEB: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0141455

IMPACT FACTOR: 3.23

CITED HALF-LIFE: 2.70

UW EDITORIAL COMMENT: Note that only the outcome of maternal HIV retesting had a statistically significant difference in change from baseline in frequency of testing, comparing control group to either intervention group. There was no statistically significant difference in change since baseline in frequency of infant dried blood spot (DBS) testing comparing control group to either intervention group. Figures 2 and 3 show point estimates in change from baseline in frequency of DBS and maternal retesting, respectively, by intervention arm, but note these are unadjusted point estimates without 95% confidence intervals. The differences in effect estimates for Simple and Comprehensive interventions were small, indicating that relatively simple interventions may be nearly as influential as more complex interventions, although neither Simple nor Comprehensive interventions were associated with a decline in coverage of DPT1, a proxy for EPI coverage.

2. COSTING RTS,S INTRODUCTION IN BURKINA FASO, GHANA, KENYA, SENEGAL, TANZANIA, AND UGANDA: A GENERALIZABLE APPROACH DRAWING ON PUBLICLY AVAILABLE DATA.

Galactionova K, Bertram M, Lauer J, Tediosi F.
Vaccine. 2015 Oct 28. [Epub ahead of print]
PMID: 26518406

ABSTRACT

Recent results from the phase 3 trial of RTS,S/AS01 malaria vaccine show that the vaccine induced partial protection against clinical malaria in infants and children; given the high burden of the disease it is currently considered for use in malaria endemic countries. To inform adoption decisions the paper proposes a generalizable methodology to estimate the cost of vaccine introduction using routinely collected and publicly available data from the cMYP, UNICEF, and WHO-CHOICE. Costing is carried out around a set of generic activities, assumptions, and inputs for delivery of immunization services adapted to a given country and deployment modality to capture among other factors the structure of the EPI program, distribution model, geography, and demographics particular to the setting. The methodology is applied to estimate the cost of RTS,S introduction in Burkina Faso, Ghana, Kenya, Senegal, Tanzania, and Uganda. At an assumed vaccine price of $5 per dose and given our assumptions on coverage and deployment strategy, we estimate total economic program costs for a 6-9 months cohort within $23.11-$28.28 per fully vaccinated child across the 6 countries. Net of procurement, costs at country level are substantial; for instance in Tanzania these could add as much as $4.2 million per year or an additional $2.4 per infant depending on the level of spare capacity in the system. Differences in cost of vaccine introduction across countries are primarily driven by differences in cost of labour. Overall estimates generated with the methodology result in costs within the ranges reported for other new vaccines introduced in SSA and capture multiple sources of heterogeneity in costs across countries. Further validation with data from field trials will support use of the methodology while also serving as a validation for cMYP and WHO-CHOICE as resources for costing health interventions in the region.

WEB: http://dx.doi.org/10.1016/j.vaccine.2015.10.079

IMPACT FACTOR: 3.62

CITED HALF-LIFE: 5.50

UW EDITORIAL COMMENT: Table 3 provides a summary of the average annual costs (economic costs, financial costs, and vaccine costs for introductory programs and ongoing implementation), of RTS,S immunization for a 6-9 month schedule, by country . Figure 3 provides a per-country overview of the proportion of average annual vaccine delivery costs corresponding to each component of the vaccine delivery program. Figure 4 is a sensitivity analysis providing estimates of economic cost per dose for service delivery using a 6-9 month schedule, under a range of different wastage, coverage, EPI allocation, RTS,S allocation, time per dose (inside and outside EPI), days outreach and discount rates for each country.

3. THE SCENARIO APPROACH FOR COUNTRIES CONSIDERING THE ADDITION OF ORAL CHOLERA VACCINATION IN CHOLERA PREPAREDNESS AND CONTROL PLANS.

Deen J, von Seidlein L, Luquero FJ, Troeger C, Reyburn R, Lopez AL, Debes A, Sack DA.

Lancet Infect Dis. 2015 Oct 19. [Epub ahead of print]
PMID: 26494426

ABSTRACT

Oral cholera vaccination could be deployed in a diverse range of situations from cholera-endemic areas and locations of humanitarian crises, but no clear consensus exists. The supply of licensed, WHO prequalified cholera vaccines is not sufficient to meet endemic and epidemic needs worldwide and so prioritisation is needed. We have developed a scenario approach to systematically classify situations in which oral cholera vaccination might be useful. Our scenario approach distinguishes between five types of cholera epidemiology based on experiences from around the world and provides evidence that we hope will spur the development of detailed guidelines on how and where oral cholera vaccines could, and should, be most rationally deployed.

WEB: http://dx.doi.org/10.1016/S1473-3099(15)00298-4

IMPACT FACTOR: 22.43

CITED HALF-LIFE: 4.70

UW EDITORIAL COMMENT: The five scenarios considered include ongoing outbreaks with declining sanitation/water due to disaster; deteriorating sanitation/water due to disaster; endemic cholera; poor sanitation/water without identified cholera; sufficient sanitation/water without identified cholera. Table 1 on the second page of the article provides an overview of the five different scenarios, the oral cholera vaccine recommendation and other considerations for each scenario. Authors recommended oral cholera vaccine for scenarios with ongoing outbreaks when water/sanitation is deteriorating due to disaster; in settings with deteriorating water/sanitation but no previous outbreaks if an outbreaks occurs,; and pre-emptively if cholera has been identified recently or near-by or the setting is such that spread is expected to be fast if an outbreak occurs. Oral cholera vaccine is also recommended in endemic settings where the incidence rate is high and in non-endemic settings with poor water/sanitation if an outbreak occurs near by. Oral cholera vaccine is not recommended in scenarios of high water/sanitation standards in which no cholera has been identified.

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4. PUBLIC HEALTH IMPACT AND COST-EFFECTIVENESS OF THE RTS,S/AS01 MALARIA VACCINE: A SYSTEMATIC COMPARISON OF PREDICTIONS FROM FOUR MATHEMATICAL MODELS.

Penny MA, Verity R, Bever CA, Sauboin C, Galactionova K, Flasche S, White MT, et al.
Lancet. 2015 Nov 5. [Epub ahead of print]
PMID: 26549466

ABSTRACT

BACKGROUND: The phase 3 trial of the RTS,S/AS01 malaria vaccine candidate showed modest efficacy of the vaccine against Plasmodium falciparum malaria, but was not powered to assess mortality endpoints. Impact projections and cost-effectiveness estimates for longer timeframes than the trial follow-up and across a range of settings are needed to inform policy recommendations. We aimed to assess the public health impact and cost-effectiveness of routine use of the RTS,S/AS01 vaccine in African settings.

METHODS: We compared four malaria transmission models and their predictions to assess vaccine cost-effectiveness and impact. We used trial data for follow-up of 32 months or longer to parameterise vaccine protection in the group aged 5-17 months. Estimates of cases, deaths, and disability-adjusted life-years (DALYs) averted were calculated over a 15 year time horizon for a range of levels of Plasmodium falciparum parasite prevalence in 2-10 year olds (PfPR2-10; range 3-65%). We considered two vaccine schedules: three doses at ages 6, 7·5, and 9 months (three-dose schedule, 90% coverage) and including a fourth dose at age 27 months (four-dose schedule, 72% coverage). We estimated cost-effectiveness in the presence of existing malaria interventions for vaccine prices of US$2-10 per dose.

FINDINGS: In regions with a PfPR2-10 of 10-65%, RTS,S/AS01 is predicted to avert a median of 93 940 (range 20 490-126 540) clinical cases and 394 (127-708) deaths for the three-dose schedule, or 116 480 (31 450-160 410) clinical cases and 484 (189-859) deaths for the four-dose schedule, per 100 000 fully vaccinated children. A positive impact is also predicted at a PfPR2-10 of 5-10%, but there is little impact at a prevalence of lower than 3%. At $5 per dose and a PfPR2-10 of 10-65%, we estimated a median incremental cost-effectiveness ratio compared with current interventions of $30 (range 18-211) per clinical case averted and $80 (44-279) per DALY averted for the three-dose schedule, and of $25 (16-222) and $87 (48-244), respectively, for the four-dose schedule. Higher ICERs were estimated at low PfPR2-10 levels.

INTERPRETATION: We predict a significant public health impact and high cost-effectiveness of the RTS,S/AS01 vaccine across a wide range of settings. Decisions about implementation will need to consider levels of malaria burden, the cost-effectiveness and coverage of other malaria interventions, health priorities, financing, and the capacity of the health system to deliver the vaccine.

WEB: http://dx.doi.org/10.1016/ S0140-6736(15)00807-7

IMPACT FACTOR: 45.22

CITED HALF-LIFE: 9.20

UW EDITORIAL COMMENT: Authors estimate that vaccination would result in one malaria death prevented for every 200 children fully vaccinated. Of note, although the 4-dose schedule provided additional public health benefit, this was offset by the incremental additional cost of implementation. Figure 1 is a plot of observed and model-predicted vaccine efficacy estimates.. Table 2 provides predictions of the proportion of clinical cases and deaths averted in <5s; clinical cases and deaths averted per 100,000 fully vaccinated in <5s; ICER per case and per DALY averted for 3- and 4-dose schedules; and incremental benefit of 4- vs. 3-dose schedules. Figure 4 provides estimates of cost per case and DALY averted as a function of parasite prevalence.

5. INDIVIDUAL LEVEL DETERMINANTS FOR NOT RECEIVING IMMUNIZATION, RECEIVING IMMUNIZATION WITH DELAY, AND BEING SEVERELY UNDERIMMUNIZED AMONG RURAL WESTERN KENYAN CHILDREN.

Gibson DG, Ochieng B, Kagucia EW, Obor D, Odhiambo F, O'Brien KL, Feikin DR.

Vaccine. 2015 Oct 16. [Epub ahead of print]
PMID: 26482146

ABSTRACT

BACKGROUND: Estimating vaccination coverage and delays are important because these measures can identify at risk sub-populations who can be targeted with interventions and public health policies. This paper sought to determine estimates and risk factors for children in rural western Kenya who did not receive immunization, received immunization with delay, or were severely underimmunized.

METHODS: Caregivers of children aged 12-23 months old were surveyed for immunization history using written records from the immunization booklet. Risk factors for not receiving immunization, delayed immunization, and severe underimmunization were calculated using log-binomial regression. Children were categorized as delayed if a given immunization was received greater than four weeks from the age-appropriate scheduled date. Severely underimmunized children were those who were fully unvaccinated for more than 90 days and had three or more vaccines delayed or not given.

RESULTS: Immunization coverage for pentavalent1, pentavalent3, measles, and fully immunized child (FIC; BCG, three doses of polio, three doses of pentavalent, and measles vaccines) were 99%, 94%, 83%, and 80%, respectively. Approximately, 10%, 24%, and 29%, of children were delayed for pentavalent1, pentavalent3, and measles, respectively. Each model produced a unique combination of risk factors with only advanced maternal age as a risk factor common to all models. Children with delayed receipt of pentavalent1 were at risk for not receiving pentavalent3 (RR: 5.20; 95%CI 3.48, 7.77), measles vaccine (RR: 1.48; 95%CI 1.12, 1.95), and not achieving FIC (RR: 1.88; 95%CI 1.51, 2.34) compared with children who received pentavalent1 on time.

CONCLUSIONS: Immunization coverage among 12-23 month old children was high, yet a substantial proportion of children were vaccinated with delay. Although vaccine coverage and timeliness are often conceptualized as separate measures, the finding that delayed pentavalent1 receipt was a strong risk factor for not receiving future immunizations indicates the two measures are intertwined.

WEB: http://dx.doi.org/10.1016/j.vaccine.2015.10.021

IMPACT FACTOR: 3.62

CITED HALF-LIFE: 5.50

UW Editorial Comment: Note that analyses don't include children without an MCH booklet or with self-reported vaccination history, a population among whom delay, underimmunization and not being fully vaccinated may be even more likely and for whom predictors may be different. Table 2 shows estimates for delay of each vaccine. Many predictors of underimmunization identified in bivariate analysis were no longer significant in multivariable models, but these factors may still be useful for identifying groups at high-risk for underimmunization. Most predictors differed by vaccine, and authors note that since schedules and mechanisms for delivery differ, factors that influence coverage logically differ. Thus effective strategies to address gaps may depend on the vaccine target and how the schedule converges with other health delivery system entry points.

6. MASS IMMUNIZATION WITH INACTIVATED POLIO VACCINE IN CONFLICT ZONES - EXPERIENCE FROM BORNO AND YOBE STATES, NORTH-EASTERN NIGERIA.

M Shuaibu F, Birukila G, Usman S, Mohammed A, Galway M, Corkum M et al.
J Public Health Policy. 2015 Nov 5. [Epub ahead of print]
PMID: 26538455

ABSTRACT

The use of Inactivated Polio Vaccine (IPV) in routine immunization to replace Oral Polio Vaccine (OPV) is crucial in eradicating polio. In June 2014,Nigeria launched an IPV campaign in the conflict-affected states of Borno and Yobe, the largest ever implemented in Africa. We present the initiatives and lessons learned. The 8-day event involved two parallel campaigns. OPV target age was 0-59 months, while IPV targeted all children aged 14 weeks to 59 months. The Borno state primary health care agency set up temporary health camps for the exercise and treated minor ailments for all. The target population for the OPV campaign was 685 674 children in Borno and 113 774 in Yobe. The IPV target population for Borno was 608 964 and for Yobe 111 570. OPV coverage was 105.1 per cent for Borno and 103.3 per cent for Yobe. IPV coverage was 102.9 per cent for Borno and 99.1 per cent for Yobe. (Where we describe coverage as greater than 100 per cent, this reflects original underestimates of the target populations.) A successful campaign and IPV immunization is viable in conflict areas.

WEB: http://dx.doi.org/10.1057/jphp.2015.34

IMPACT FACTOR: 1.91

CITED HALF-LIFE: 7.60

UW EDITORIAL COMMENT: Authors note that the development of an IPV committee made up of national, state, and NGO stake-holders was a key pre-implementation activity. The committee led the recruitment of health works, organization of supply and logistics, assessment of security risks, and preparation of mobile clinics, under the guidance of the national polio emergency operation center. Authors note the following as some of the key activities contributing to campaign success: substantial training of staff, frequent localized security risk assessments, advocacy and social mobilization activities, provision of free basic health services and medications at health camps along with vaccination activities, delivery of IPV at "fixed camps" versus house-to-house to ensure safety, and frequent review of targets and ongoing development of strategies to address identified gaps/challenges to increase coverage. Lot Quality Assurance (LQA) surveys were conducted by WHO to evaluate coverage, in addition to more traditional methods of estimating coverage by using tally sheets of numbers of vaccinations delivered relative to a "target population" denominator from estimates of the population size. Note that while traditional methods using estimated target population as denominator found more than 100% coverage (indicative of inaccurate population denominator estimates), LQA estimates for coverage were lower, between 80-90% for OPV and IPV in most states. Table 1 shows estimates of coverage by state using both methods.

7. MITIGATING MEASLES OUTBREAKS IN WEST AFRICA POST-EBOLA.

Truelove SA, Moss WJ, Lessler J.

Expert Rev Anti Infect Ther. 2015 Nov;13(11):1299-301. Epub 2015 Sep 7.
PMID: 26489536

ABSTRACT

The Ebola outbreak in 2014-2015 devastated the populations, economies and healthcare systems of Guinea, Liberia and Sierra Leone. With this devastation comes the impending threat of outbreaks of other infectious diseases like measles. Strategies for mitigating these risks must include both prevention, through vaccination, and case detection and management, focused on surveillance, diagnosis and appropriate clinical care and case management. With the high transmissibility of measles virus, small-scale reactive vaccinations will be essential to extinguish focal outbreaks, while national vaccination campaigns are needed to guarantee vaccination coverage targets are reached in the long term. Rapid and multifaceted strategies should carefully navigate challenges present in the wake of Ebola, while also taking advantage of current Ebola-related activities and international attention. Above all, resources and focus currently aimed at these countries must be utilized to build up the deficit in infrastructure and healthcare systems that contributed to the extent of the Ebola outbreak.

WEB: http://www.tandfonline.com/doi/full/10.1586/14787210.2015.1085305

IMPACT FACTOR: 2.25

CITED HALF-LIFE: 4.60

UW Editorial Comment: Authors recommended supplemental activities including attempting to conduct national mass vaccination campaigns, particularly in light of delays in previously-planned campaigns and disruption of routine vaccination activities. Authors also point out that weak health systems and lingering mistrust of the health care system may result in underperforming vaccination campaigns, and thus emphasize the importance of targeted reactive campaigns to address outbreaks. Authors also emphasize the importance of engaging in intense community mobilization activities to support effective campaign implementation, and note the importance of close monitoring and evaluation of campaigns to assess coverage, and they recommend repeat campaigns coverage targets aren't met. Authors also point out that to obtain adequate population immunity, a broader age range may be necessary in future campaigns. The importance of improving upon pre-Ebola levels of routine immunization coverage is also emphasized, given that even before the devastating effects of Ebola, many regions in these countries failed to reach recommended levels of coverage of routine vaccination.

8. A ROLE FOR VECTOR CONTROL IN DENGUE VACCINE PROGRAMS.

Christofferson RC, Mores CN.

Vaccine. 2015 Oct 20. [Epub ahead of print]
PMID: 26478199

ABSTRACT

Development and deployment of a successful dengue virus (DENV) vaccine has confounded research and pharmaceutical entities owing to the complex nature of DENV immunity and concerns over exacerbating the risk of DENV hemorrhagic fever (DHF) as a consequence of vaccination. Thus, consensus is growing that a combination of mitigation strategies will be needed for DENV to be successfully controlled, likely involving some form of vector control to enhance a vaccine program. We present here a deterministic compartmental model to illustrate that vector control may enhance vaccination campaigns with imperfect coverage and efficacy. Though we recognize the costs and challenges associated with continuous control programs, simultaneous application of vector control methods coincident with vaccine roll out can have a positive effect by further reducing the number of human cases. The success of such an integrative strategy is predicated on closing gaps in our understanding of the DENV transmission cycle in hyperedemic locations.

WEB: http://dx.doi.org/10.1016/j.vaccine.2015.09.114

IMPACT FACTOR: 3.62

CITED HALF-LIFE: 5.50

UW EDITORIAL COMMENT: Fig. 2. Shows the modeled predicted difference in the number of human cases with only vaccine at various coverage and efficacy rates and the difference in the number of infectious mosquitoes with only vaccine at various coverage and efficacy rates. Fig 3 shows predicted differences in the number of human cases with only mosquito control efforts, and infectious mosquitoes with only mosquito control at varying degrees of mosquito population suppression, compared with no vaccination and no mosquito control efforts.

Figure 4 shows expected differences in human cases for a range of scenarios at different vaccine coverage and efficacy levels and different levels of mosquito suppression (resulting from vector control). Authors state that this demonstrates how vector control can “enhance” vaccine strategies, resulting in similar reductions in human cases at lower vaccination coverage and efficacy when vector control activities are also provided in specific scenarios. “Optimal opportunity” scenarios for enhancing vaccination with vector control activities are outlined in red. Scenarios in which vector control provides negligible benefit in reduction of human cases, on top of vaccination, are grey.

9. MISSED OPPORTUNITIES FOR MEASLES, MUMPS, AND RUBELLA (MMR) IMMUNIZATION IN MESOAMERICA: POTENTIAL IMPACT ON COVERAGE AND DAYS AT RISK.

Mokdad AH, Gagnier MC, Colson KE, Dansereau E, Zuniga-Brenes P, Rios-Zertuche D et al.
PLoS One. 2015;10(10):e0139680.
PMID: 26506563

ABSTRACT

BACKGROUND: Recent outbreaks of measles in the Americas have received news and popular attention, noting the importance of vaccination to population health. To estimate the potential increase in immunization coverage and reduction in days at risk if every opportunity to vaccinate a child was used, we analyzed vaccination histories of children 11-59 months of age from large household surveys in Mesoamerica.

METHODS: Our study included 22,234 children aged less than 59 months in El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama. Child vaccination cards were used to calculate coverage of measles, mumps, and rubella (MMR) and to compute the number of days lived at risk. A child had a missed opportunity for vaccination if their card indicated a visit for vaccinations at which the child was not caught up to schedule for MMR. A Cox proportional hazards model was used to compute the hazard ratio associated with the reduction in days at risk, accounting for missed opportunities.

RESULTS: El Salvador had the highest proportion of children with a vaccine card (91.2%) while Nicaragua had the lowest (76.5%). Card MMR coverage ranged from 44.6% in Mexico to 79.6% in Honduras while potential coverage accounting for missed opportunities ranged from 70.8% in Nicaragua to 96.4% in El Salvador. Younger children were less likely to have a missed opportunity. In Panama, children from households with higher expenditure were more likely to have a missed opportunity for MMR vaccination compared to the poorest (OR 1.62, 95% CI: 1.06-2.47). In Nicaragua, compared to children of mothers with no education, children of mothers with primary education and secondary education were less likely to have a missed opportunity (OR 0.46, 95% CI: 0.24-0.88 and OR 0.25, 95% CI: 0.096-0.65, respectively). Mean days at risk for MMR ranged from 158 in Panama to 483 in Mexico while potential days at risk ranged from 92 in Panama to 239 in El Salvador.

CONCLUSIONS: Our study found high levels of missed opportunities for immunizing children in Mesoamerica. Our findings cause great concern, as they indicate that families are bringing their children to health facilities, but these children are not receiving all appropriate vaccinations during visits. This points to serious problems in current immunization practices and protocols in poor areas in Mesoamerica. Our study calls for programs to ensure that vaccines are available and that health professionals use every opportunity to vaccinate a child.

WEB: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0139680

IMPACT FACTOR: 3.23

CITED HALF-LIFE: 4.70

UW EDITORIAL COMMENT: Authors determined that "the greatest increase in vaccination over time occurred during the recommended vaccine interval….Differentiation between observed and potential days to MMR vaccination was largely gained before the child is 2 years." Table 5 summarizes the coverage cascade of MMR by country. Fig 1 shows the observed days to MMR vaccination compared to potential days to vaccination if children were caught up. Cox proportional hazards models for MMR vaccination and associated predictors are shown in Table 8. MMR coverage by stocks/availability of MMR and ORS at the health facility are presented in Table 9.

10. A PROTOTYPE OF A NOVEL CELL PHONE APPLICATION FOR TRACKING THE VACCINATION COVERAGE OF CHILDREN IN RURAL COMMUNITIES.

Katib A, Rao D, Rao P, Williams K, Grant J.
Comput Methods Programs Biomed. 2015 Nov;122(2):215-28.
PMID: 26363678

ABSTRACT

Immunization saves millions of lives against vaccine-preventable diseases. Yet, 24 million children born every year do not receive proper immunization during their first year. UNICEF and WHO have emphasized the need to strengthen the immunization surveillance and monitoring in developing countries to reduce childhood deaths. In this regard, we present a software application called Jeev to track the vaccination coverage of children in rural communities. Jeev synergistically combines the power of smartphones and the ubiquity of cellular infrastructure, QR codes, and national identification cards. We present the design of Jeev and highlight its unique features along with a detailed evaluation of its performance and power consumption using the National Immunization Survey datasets. We are in discussion with a non-profit organization in Haiti to pilot test Jeev in order to study its effectiveness and identify socio-cultural issues that may arise in a large-scale deployment.

WEB: http://dx.doi.org/10.1016/j.cmpb.2015.08.008

IMPACT FACTOR: 1.90

CITED HALF-LIFE: 6.20

UW Editorial Comment: Authors point out the following design requirements for a vaccination tracking device: unique personal identification regardless of location/setting; strategy for use in low-cellular coverage areas; low cost and easy to use; efficiency in performance and energy consumption. Fig. 2 illustrates how the Jeev application operates. A QR code is generated for each child, which contains encrypted personal identification information obtained from a national ID card, which is used to uniquely identify each child and their record and is stuck on the national identity card and paper vaccination record. Jeev uses a client-side software and a server-side software, which runs on a smartphone. The server, which can be based in a community clinic or health facility, stores and manages the vaccination records of individual children. Health workers (client) use smartphones running the client to access vaccination records and update records in the server (database) with new vaccinations, using the QR code to identify the child/record. SMS text messaging is used for communication between client and server to access and update records. Section 5 provides an overview of the results of Jeev's performance evaluation assessing different workload metrics, scalability and power consumption, server processing time for operations and client requests, using available datasets from well-resourced settings. Haiti-specific projected operations costs are provided in Table 8.

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 ("2015/10/15"[PDAT] : "2015/11/14"[PDAT]))

*On November 23, 2015, this search of English language articles published between October 15, 2015 and November 14, 2015 and indexed by the US National Library of Medicine resulted in 222 unique manuscripts.