HHS Public Access

Author manuscript

Vaccine. Author manuscript; available in PMC 2023 July 15.

Published in final edited form as:

Vaccine. 2016 September 22; 34(41): 5034–5039. doi:10.1016/j.vaccine.2016.07.021.

Acceptance of Multiple Injectable Vaccines in a Single Immunization Visit in The Gambia Pre and Post Introduction of Inactivated Polio Vaccine

Olubukola T. Idoko[1,*], **Lee M. Hampton**[2], **Robert B. Mboizi**[1], **Schadrac C. Agbla**[1], **Aaron S. Wallace**[2], **Jennifer B. Harris**[2], **Dawda Sowe**[3], **Daniel C. Ehlman**[2], **Beate Kampmann**[1,4], **Martin O. Ota**[5], **Terri B. Hyde**[2]

[1]Vaccines and Immunity Theme, Medical Research Council Unit, The Gambia.

[2]Global Immunization Division, Centres for Disease Control and Prevention, Atlanta, USA.

[3]Ministry of Health and Social Welfare, Banjul, The Gambia.

[4]Academic Department of Paediatrics, Imperial College London, UK.

[5]WHO Regional Office for Africa, Brazaville, Congo.

Abstract

Background: As the World Health Organization (WHO) currently recommends that children be protected against 11 different pathogens, it is becoming increasingly necessary to administer multiple injectable vaccines during a single immunization visit. In this study we assess Gambian healthcare providers' and infant caregivers' attitudes and practices related to the administration of multiple injectable vaccines to a child at a single immunization visit before and after the 2015 introduction of inactivated polio vaccine (IPV). IPV introduction increased the number of injectable vaccines recommended for the 4-month immunization visit from two to three in The Gambia.

Methods: We conducted a cross-sectional questionnaire-based survey before and after the introduction of IPV at 4 months of age in a representative sample of all health facilities providing immunizations in The Gambia. Healthcare providers who administer vaccines at the selected health facilities and caregivers who brought infants for their 4 month immunization visit were surveyed.

Findings: Prior to IPV introduction, 9.9% of healthcare providers and 35.7% of infant caregivers expressed concern about a child receiving more than 2 injections in a single visit. Nevertheless, 98.8% and 90.9% of infants received all required vaccinations for the visit before and after IPV introduction, respectively. The only reason why vaccines were not received was vaccine stock-outs. Infant caregivers generally agreed that vaccinators could be trusted to provide accurate information regarding the number of vaccines that a child needed.

[*]Corresponding author: Vaccines and Immunity Theme, Medical Research Council Unit, The Gambia.

Conflict of interest: Funds for the conduct of the study were received from the Centres for Disease Control by The medical Research Council Unit, The Gambia. The authors have no other conflicts of interest to declare.

Conclusion—Healthcare providers and infant caregivers in this resource limited setting accepted an increase in the number of injectable vaccines administered at a single visit even though some expressed concerns about the increase.

Introduction

The World Health Organization (WHO) currently recommends that all children receive vaccines against 11 different pathogens between birth and 12 months of age. Injectable vaccines are used to protect against 10 of these pathogens.[1] As more countries introduce all WHO-recommended vaccines, it is increasingly important to administer multiple injectable vaccines in a single visit or to use combination vaccines that contain multiple antigens. These strategies are safe [2]and accommodate additional vaccines without adding immunization visits that would be costly to both health systems and families and could increase the proportion of children that are not fully vaccinated. [3–5] However, some antigens are not available or are prohibitively expensive in combination formulations, leaving administering more injectable vaccines in a single visit as the best option for accommodating new injectable vaccines in immunization schedules. The recent introductions of pneumococcal conjugate vaccine (PCV) and inactivated polio vaccine (IPV) have presented many low- and middle-income countries for the first time with the decision of whether to increase the number of injectable vaccines administered in a single visit from one or two to three. [3–6]

Concerns about whether healthcare providers and infant caregivers will accept the administration of increasing numbers of vaccines, especially injectable vaccines, in a single visit have previously influenced decisions about the introduction of new vaccines. [7] In the US in 1997, caregivers were given an option to use either IPV or OPV at the first two immunization visits because of the fear that multiple injections would limit vaccine acceptance. [8–10]With the introduction of IPV and PCV, both Nepal and Bangladesh opted to introduce these vaccines on schedules that avoided the administration of more than two injectable vaccines at a single visit. In Nepal, PCV was scheduled to be given to children at six at weeks, 10 weeks, and nine months of age so that the IPV and pentavalent vaccines (containing diphtheria, pertussis, tetanus, *Haemophilus influenzae* type b, and hepatitis B antigens) would be the only injectable vaccines given to children at 14 weeks of age. This schedule potentially reduces the protection provided because the two doses of PCV administered at less than six months of age are scheduled only four weeks apart instead of the recommended eight.[1, 9, 11] In Bangladesh, an additional visit was added to the recommended vaccination schedule so that children would be given the third dose of PCV at 18 weeks of age, again allowing IPV and pentavalent vaccines to be the only injectable vaccines given at 14 weeks of age.[12] Previous studies in upper and middle income countries have indicated that healthcare providers and infant caregivers usually comply with the administration of three or more injectable vaccines at a single immunization visit, despite having initially voiced concerns.[7, 13, 14] However, few studies have assessed the attitudes and practices of both healthcare providers and infant caregivers during vaccine introduction, especially outside of upper and middle income countries. We sought to obtain insights and observe practices in a lower income country to determine if administering multiple injectable vaccines during a single visit had a negative impact on vaccine uptake. The study

was meant to provide evidence for health care workers and immunization program managers who are trying to decide how best to accommodate new injectable vaccines, particularly since some health care workers and managers have voiced or acted on concerns about increasing the number of injectable vaccines administered in a single visit.

In April 2015, The Gambia introduced IPV into its vaccination schedule at the immunization visit for children four months of age alongside two other injectable vaccinations already in use: the third dose of pentavalent vaccine and the third dose of PCV. We conducted two surveys of healthcare providers and infant caregivers from a representative sample of healthcare facilities in The Gambia before and after the introduction of IPV. Our primary objective was to estimate the proportion of children who received all of the recommended vaccines at the immunization visit for children four months of age before and after the introduction of IPV. We also assessed the attitudes and practices of healthcare providers and infant caregivers with regards to vaccinations and the administration of multiple injectable vaccines in a single visit. To our knowledge, this is the first time that such data have been collected and analysed from a low income country.

Methods

Site Selection

Health facilities were selected using a two-stage stratified cluster sampling procedure. The Gambia has a total of 67 health facilities providing vaccines from the Ministry of Health's Expanded Programme on Immunizations (EPI). We stratified all facilities by urban/rural status and randomly sampled 30% (21 facilities) of the facilities within each strata (9/28 urban and 12/39 rural facilities), using probability proportional to size selection based on the average number of vaccination visits per month at each facility. Information regarding the average number of vaccination visits per month was provided by the Ministry of Health of The Gambia. The same facilities were used pre- and post-IPV introduction.

Healthcare Provider Selection

All eligible healthcare providers in each of the 21 selected health facilities were approached for interviews both pre- and post-IPV introduction. Eligible healthcare providers were those who had administered vaccinations during at least one routine immunization session in the previous two months. Healthcare providers who had administered vaccinations only during campaigns were not eligible. Thus the same healthcare providers were targeted pre- and post-IPV introduction.

Infant Caregiver Selection

An infant caregiver was defined as any adult who brought an infant to the health facility for the infant's four months of age vaccination visit. In order to self-weight the sample, the target enrolment for infant caregivers was 20% of the average monthly number of infants that receive their four months of age vaccination at each facility, for a total of 393 infant caregivers. Consecutive infant caregivers presenting with their infant for the 4-month visit were enrolled until this target was reached or the surveyors had to stop conducting interviews due to time constraints, specifically the introduction of IPV at the end of the

pre-introduction phase of the study. Exit interviews were conducted immediately following the infants' four months of age vaccination visit. Different infant caregivers were surveyed pre- and post-introduction since each infant completes only one immunization visit at four months of age.

Data collection and handling

Trained field staff collected data at the health facilities using an electronic data entry system on smart phones. There were a variety of closed-ended questions including multiple choice, yes/no questions, and a series using a Likert scale ranging from "Strongly Agree" to "Strongly Disagree". Other sections posed open-ended questions to the interviewee for which the interviewers had a list of possible responses. For such questions, the interviewers were trained to check all answers that were mentioned by the interviewee. All questions were administered orally by the interviewer. Data were uploaded directly to a secure server using a mobile data connection to the Task Force for Global Health (TFGH's) LINKS system. A dedicated study assistant and clinician conducted quality control checks and cleaning on all data uploaded to the server.

Data Analysis

Proportions and 95% confidence intervals (95% CI) were estimated from the pre- and post-IPV introduction data. Standard errors were calculated using jackknife estimation[15] method to account for non-response. Pre- and post-IPV introduction proportions were compared using adjusted Wald tests[16] for both groups. Paired analyses were used for healthcare provider data since the same providers were interviewed pre- and post-IPV introduction. Where questions required the respondent to state whether they "agreed strongly", "agreed", "disagreed" or "disagreed strongly" with a statement, a binary variable created such that "strongly agreed" and "agreed" were combined and "strongly disagreed" and "disagreed" were combined. For open ended questions responses are presented giving the proportion of respondents who gave this response from the list of possible responses at the 2 time points. All analyses were performed in STATA version 13.1.

The study was approved by the Gambian Government/MRC Joint Ethics Committee, and the ethics review committee of the WHO African region.

Results

The pre-introduction survey was conducted between 23rd March and 2nd April 2015 and included 40 healthcare providers and 194 infant caregivers. Due to the limited time period available to conduct the pre-introduction survey, the number of infant caregivers surveyed was lower than the initial target. This was accounted for during the analyses. The post-introduction survey was conducted from 1st to 30th June 2015 and included 38 healthcare providers and 391 infant caregivers. One private clinic surveyed in the pre-introduction phase had not yet introduced IPV at the time of the post-introduction survey and thus was excluded from this phase, accounting for two fewer healthcare providers and two fewer infant caregivers than targeted in the post-introduction phase.

Healthcare providers

Most healthcare providers interviewed were public health officers (94.7%), and most had been practicing for five or fewer years (88.9%). Almost all (97.6%) had received training in IPV administration prior to IPV introduction (Table 1).

Prior to IPV introduction, 9.9% of healthcare providers stated that they would be unwilling to give more than two injectable vaccines at a single visit, and 29.7% (15.4 −31.5%) had never administered more than two injectable vaccines at a single visit (Table 2). The latter proportion decreased significantly to 0.7% (0.1 – 6.5%) after IPV introduction ($p = 0.03$). Only 5% of healthcare providers were uncomfortable with the highest number of injections they had been required to give post-IPV introduction even though 16.1% of healthcare providers stated in post-introduction interviews that two injectable vaccines per visit was the highest number they would be willing to administer. The most frequently cited reasons why healthcare providers would be willing to give several injections in one visit were the need to provide maximum protection to the child (cited by over 70% at both time points) and the need for children to be vaccinated in a timely manner (cited by over 60% at both time points) (Table 2). The most frequently cited reasons why healthcare providers would not be willing to give several injections in one visit were concerns about causing too much pain and discomfort for the child (over 20% at both time points) and concerns about adverse events (over 20%) and possible complaints from caregivers (approximately 10% at both time points) (Table 2).

Infant Caregivers

Almost all caregivers interviewed pre- (99.3%) and post-introduction (98.2%) were the mothers of the vaccinated infants. Demographic characteristics of pre- and post-introduction caregivers were very similar (Table 3). Among children whose caregivers were interviewed, 98.8% (87.5 – 99.9%) pre-IPV introduction and 90.9% (65.5 – 98.1%) post-IPV introduction received all required vaccinations for that visit, including two injectable vaccines pre-introduction and three injectable vaccines post-introduction (Table 4). For the 1.2% of children pre-IPV introduction and 9.1% of children post-introduction who were incompletely vaccinated, the reason given was vaccine stock outs (data not shown), rather than any objections.

Prior to IPV introduction, 12.0% of infant caregivers stated that they were not comfortable with their child receiving more than one injectable vaccine at a single visit, with an additional 23.7% objecting to more than two injectable vaccines. Post-introduction, 8.9% and 17.9% reported not being comfortable with more than one or two injections respectively. The most common reasons cited for hesitation were concern about pain (38.3% pre- and 47.0% post-introduction) and fever (31.7% pre- and 38.5% post-introduction) from several injections (Table 4).

There was high agreement (>95%) among infant caregivers pre- and post-IPV introduction with questionnaire statements relating to vaccines protecting children from serious disease and doing more good than harm. Over 90% of caregivers at both time points also agreed with statements regarding the receipt of several injectable vaccines at a single visit if it

resulted in better protection from disease, while approximately 70% were concerned about pain and discomfort from injectable vaccines spread over several visits. However, 53.3% of infant caregivers pre-IPV introduction and 70.6% of infant caregivers post-IPV introduction agreed with the statement that infants are receiving more vaccines than necessary (Table 4).

More than 90% of infant caregivers pre- and post-introduction agreed that vaccinators could be trusted to know how many vaccines a child should receive in order to be protected. Finally, infant caregivers most frequently identified healthcare providers as their source of information about vaccination, followed by family members (Table 5).

Discussion

Our results show that statements of concern from infant caregivers and healthcare providers about the administration of multiple injectable vaccines at single visit did not prevent children from receiving all recommended injections. Nearly all surveyed children received three injectable vaccines four month of age immunization visit as recommended after IPV introduction. For those children who did not receive all vaccines as recommended, vaccine stock out, rather than concerns about the administration of multiple injectable vaccines, was the reason cited. Similar to our own findings, high uptake of additional injectable vaccines has been documented in high-income countries despite initial concerns from healthcare providers and/or infant caregivers about the increased number of injections, the pain infants may feel as a result, and possible unwillingness of infant caregivers to accept the administration of multiple injectable vaccines at a single visit. [7, 14, 17] While concerns about the administration of multiple injectable vaccines at a single visit need to be recognized, our results and those of others indicate that such concerns do not lead to reduced uptake of vaccines, suggesting that such concerns should not dominate policy-making.

The high rate of acceptance by healthcare providers of the administration of three injectable vaccines may have been aided by previous experience as approximately 70% of the surveyed providers reported that they had already administered >2 injections in a single visit before the introduction of IPV. These extra injections were probably due to provision of catch up vaccinations to infants who were behind in their immunizations, either because they had presented late for one or more vaccination visits or because some recommended vaccines had been out of stock, as frequently occurs in lower resourced settings such as The Gambia. However, previous experience with administering three injectable vaccines was not the only factor determining individuals' acceptance of the post-IPV introduction vaccine recommendations since the approximately 30% of healthcare providers who reported having never administered more than 2 injectable vaccines at a single visit prior to IPV introduction also seemed able to accommodate administering three injectable vaccines at a single visit. This suggests that the desire to ensure that children received vaccines in a timely manner and obtained maximum protection from vaccines outweighed any misgivings healthcare providers might have had initially.

The infant caregivers in our study appear to have balanced their concerns about pain from the administration of multiple injectable vaccines against concern about risk of severe disease, convenience of minimizing the number of recommended visits to the facility, and

trust in the vaccinator's guidance on which vaccines their child should receive. Ensuring that messages to infant caregivers include these topics may be useful for addressing infant caregivers' concerns regarding the administration of multiple injectable vaccines. Other studies have identified similar decision-making factors for infant caregivers in the process of determining whether their children should receive all injections as recommended. [14, 18–20]

Our study was also consistent with a previous study [14] in identifying healthcare providers as a principal, trusted source of information for infant caregivers' decisions, emphasising that healthcare providers should continue to play a central role in educating and building acceptance among caregivers about new vaccines.

Our study has a number of limitations. Our survey of infant caregivers, including our review of infant immunization cards, included only those caregivers who brought their children to a health facility for immunization. Therefore, our results may not be applicable to infants and infant caregivers who do not come to immunization sessions at all, although such individuals are relatively uncommon in The Gambia which has coverage with three doses of DTP-containing vaccine estimated to be at least 88% in 2013. [21] We also note that, the time between the pre- and post-introduction surveys was only two months. Healthcare providers and infant caregivers may have different attitudes or responses after longer experience with administering three vaccines in a single visit. It is also possible that healthcare providers and infant caregivers would react differently to the administration of four or five injectable vaccines at a single session. However, previous studies suggest the results from all such scenarios would be similar to the findings of this study. [7, 22]

In addition, the period of time available for the pre-IPV introduction survey was limited due to the pending roll-out of IPV, resulting in recruitment of fewer infant caregivers than planned into the pre-introduction survey. However, this was taken into consideration during the data analysis. Finally, our study specifically examined healthcare providers' and infant caregivers' attitudes and practices in relation to increasing the number of injectable vaccines administered from two to three per visit.

Conclusions

Despite expressions of concern from some healthcare providers and infant caregivers about the administration of multiple injectable vaccines to children both before and after the introduction of IPV, all children presenting to vaccination clinics in The Gambia for three injectable vaccines received all required vaccines for the visit as long as the vaccines were available. This acceptance of an increase in the number of injectable vaccines administered at a single visit likely reflected recognition of the benefits provided by timely vaccinations and infant caregivers' high level of trust in healthcare providers. While concerns about an increase in the number of injectable vaccines administered at a single visit should be addressed through educational efforts, this should not preclude immunization programs from introducing new injectable vaccines to achieve an efficient, effective schedule.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgement:

The authors acknowledge the study communities, community participants and health staff who were interviewed. We also acknowledge the dedicated team of field staff led by Abdou Gibba, Basiru Sanyang, Philip Mendy and Assan Sanyang.

References

1. WHO, WHO recommendations for routine immunization - summary tables 2015.
2. Meeting of the Strategic Advisory Group of Experts on immunization, April 2015: conclusions and recommendations. Wkly Epidemiol Rec, 2015. 90(22): p. 261–78. [PubMed: 26027016]
3. Introduction to inactivated polio vaccine and switch from trivalent to bivalent oral poliovirus vaccine worldwide, 2013–2016. Wkly Epidemiol Rec, 2015. 90(27): p. 337–43. [PubMed: 26151981]
4. Okeibunor JC, et al. , Polio eradication in the African Region on course despite public health emergencies. Vaccine, 2015.
5. Duintjer Tebbens RJ and Thompson KM, Managing the risk of circulating vaccine-derived poliovirus during the endgame: oral poliovirus vaccine needs. BMC Infect Dis, 2015. 15(1): p. 390. [PubMed: 26404780]
6. Centers for Disease, C. and Prevention, Progress in introduction of pneumococcal conjugate vaccine - worldwide, 2000–2012. MMWR Morb Mortal Wkly Rep, 2013. 62(16): p. 308–11. [PubMed: 23615674]
7. Wallace AS, et al. , Experiences with provider and parental attitudes and practices regarding the administration of multiple injections during infant vaccination visits: lessons for vaccine introduction. Vaccine, 2014. 32(41): p. 5301–10. [PubMed: 25092632]
8. Poliomyelitis prevention in the United States: introduction of a sequential vaccination schedule of inactivated poliovirus vaccine followed by oral poliovirus vaccine. Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recomm Rep, 1997. 46(RR-3): p. 1–25.
9. Hasman A, Raaijmakers HC, and Noble DJ, Inactivated polio vaccine launch in Nepal: a public health milestone. Lancet Glob Health, 2014. 2(11): p. e627–8. [PubMed: 25442682]
10. Prevots DR, et al. , Poliomyelitis prevention in the United States. Updated recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recomm Rep, 2000. 49(RR-5): p. 1–22; quiz CE1–7.
11. Goldblatt D, et al. , Immunogenicity of a reduced schedule of pneumococcal conjugate vaccine in healthy infants and correlates of protection for serotype 6B in the United Kingdom. Pediatr Infect Dis J, 2010. 29(5): p. 401–5. [PubMed: 20010312]
12. WHO vaccine-preventable diseases: monitoring system. 2016 global summary 2016.
13. Dudley LD, T.H., Mahomed H, Cameron N, Knight S, Abdullahi L, Goliath C, Wiysonge C, The acceptability of three vaccine injections given to infants during clinic visits in South Africa 2015.
14. Kolasa MS, et al. , Parental attitudes toward multiple poliovirus injections following a provider recommendation. Public Health Rep, 2001. 116(4): p. 282–8. [PubMed: 12037256]
15. Efron B SC, The jackknife estimate of variance. Ann Statist, 1981. 3: p. 586–596.
16. Koch GG, F.D.J., Freeman JL, Strategies in the multivariate analysis of data from complex surveys. international Statistical Review, 1975. 43: p. 59–78.
17. Kolasa MS, et al. , Impact of multiple injections on immunization rates among vulnerable children. Am J Prev Med, 2001. 21(4): p. 261–6. [PubMed: 11701295]
18. Bakhache P, et al. , Health care providers' and parents' attitudes toward administration of new infant vaccines--a multinational survey. Eur J Pediatr, 2013. 172(4): p. 485–92. [PubMed: 23271490]

19. Healy CM, Montesinos DP, and Middleman AB, Parent and provider perspectives on immunization: are providers overestimating parental concerns? Vaccine, 2014. 32(5): p. 579–84. [PubMed: 24315883]

20. Dawar M, et al. , Measuring hepatitis B uptake in a new universal infant program. Can J Public Health, 2002. 93(4): p. 281–4. [PubMed: 12154531]

21. WHO, Data, Statistics, and Graphs . 2015.

22. Wallace AS, Ryman TK, and Dietz V, Overview of global, regional, and national routine vaccination coverage trends and growth patterns from 1980 to 2009: implications for vaccine-preventable disease eradication and elimination initiatives. J Infect Dis, 2014. 210 Suppl 1: p. S514–22. [PubMed: 25316875]

Table 1:

Demographic characteristics of healthcare providers

Healthcare Provider (n=40)	Percentage [a]
Age (years)	
18–24	18.1
25–34	75.1
>35	6.8
Years of professional experience	
≤5	88.9
>5	11.1
Position	
State Registered Nurse	1.3
Public Health Officer	94.7
Community Health Nurse	2.5
Other	1.5
Had heard of the IPV vaccine before introduction	99.3

[#]Proportions were estimated accounting for sampling.

NB: the same healthcare providers were assessed pre- and post-IPV introduction.

Table 2:

Attitudes, perceptions and practices of healthcare providers pre- and post-IPV introduction

	Pre-IPV Introduction Percentage (95% CI)[a]	Post-IPV Introduction Percentage (95% CI)[a]
Highest number of injections administered to a child in a single visit		
2 injections	29.7 (14.6–51.1)	0.7 (0.1–6.7)
3 injections	15.5 (6.3–33.3)	42.9 (17.9–72.2)
4 injections	54.0 (35.2–71.6)	27.6 (9.8–57.2)
≥5 injections	0.9 (0.1–7.6)	28.8 (12.0–54.5)
Comfort towards highest number of injections administered to a child in a single visit		
Very comfortable	72.5 (50.6–87.2)	65.2 (39.4–84.3)
Comfortable	19.4 (6.8–44.4)	29.9 (16.0–48.9)
Not comfortable	8.1 (1.1–42.0)	5.0 (0.5–34.7)
Highest number of injections per child willing to administer in a single visit		
2 injections	9.9 (3.8–23.4)	16.1 (5.6–38.3)
3 injections	23.1 (10.2–44.2)	16.2 (6.3–35.7)
4 injections	23.2 (6.9–55.1)	10.5 (4.2–23.0)
≥5 injections	3.2 (0.5–17.7)	25.2 (6.1–63.9)
Comfortable with any number	40.6 (22.9–61.2)	32.0 (13.5–58.6)
Reasons for willingness to administer given number of vaccines (top 3 reasons were recorded)		
Provide maximum protection against disease	74.3 (41.6–92.1)	79.8 (63.1–90.1)
Limit number of visits and avoid missed opportunities	44.7 (24.9–66.4)	42.8 (22.4–66.0)
Child gets vaccines needed in a timely manner	65.4 (46.9–80.2)	68.0 (48.1–83.0)
Vaccines work better if several are given together	1.1 (0.1–9.5)	2.4 (0.4–13.2)
Avoid too much pain and discomfort to child	26.8 (11.3–51.3)	27.1 (13.8–46.2)
Limit risk of fever caused by many vaccines	6.5 (1.9–20.1)	3.7 (0.6–20.0)
Limit risk of adverse effects besides fever	17.4 (6.1–40.7)	26.7 (16.0–41.0)
Caregiver may complain if too many vaccine	12.5 (4.5–30.5)	8.3 (1.8–31.4)
Proportion of infant caregivers that “agree” or “strongly agree” with the following pre-formulated statements:		
“Children get more vaccinations than necessary”	11.1 (3.7–28.9)	13.0 (4.4–32.4)
“Immunizations do more good than harm”	93.5 (77.1–98.4)	100
“Many of the illnesses which vaccinations prevent are severe”	92.7 (55.3–99.3)	100
“Better for a child to receive more vaccines at a single visit”	87.7 (66.9–96.1)	96.7 (82.1–99.5)
“Better for a child to receive 3 vaccines at a single visit rather than 1 vaccine in 3 visits”	81.7 (65.2–91.4)	88.7 (63.3–97.3)
“Fewer side effects if a child receives 1 vaccine per visit”	19.8 (8.4–40.2)	12.8 (4.8–29.8)
“Most or all parents will accept 3 injections in a single visit”	94.4 (70.2–99.2)	87.2 (48.4–98.0)

[a]Proportions and 95% CI were estimated accounting for the sampling.

Table 3:

Demographic characteristics of infant caregivers pre- and post-IPV introduction

	Pre-IPV Introduction Percentage (95% CI)[a]	Post-IPV Introduction Percentage (95% CI)
Infant brought by mother	99.3 (94.0–99.9)	98.2 (96.0–99.2)
Caregiver's age (years)		
14–24	46.3 (34.1–59.1)	36.8 (27.5–47.2)
25–34	44.7 (30.8–59.5)	49.4 (44.1–54.7)
35–50	9.0 (5.3–14.9)	13.8 (9.2–20.1)
Caregiver's number of children		
1–2	44.0 (35.8–52.4)	39.6 (29.8–50.4)
3–4	32.3 (26.7–38.5)	36.6 (30.0–43.8)
5 or more	23.8 (17.9–30.8)	23.8 (18.6–30.0)
Caregiver's ethnicity		
Mandinka	27.6 (14.8–45.6)	30.8 (22.9–40.0)
Wollof	22.8 (14.1–34.6)	23.7 (8.6–50.5)
Serehule	2.1 (0.2–23.7)	8.7 (3.1–22.2)
Jola	13.8 (2.0–55.6)	6.9 (2.3–19.1)
Fula	25.6 (12.3–45.9)	25.5 (13.0–43.8)
Other	8.1 (4.1–15.5)	4.6 (2.1–9.6)
Caregiver's Education		
None	31.5 (24.7–39.1)	31.5 (21.2–44.2)
Arabic school only	21.0 (17.4–25.1)	28.1 (18.8–39.8)
Primary	16.6 (13.4–20.4)	13.3 (9.5–18.2)
Part secondary	18.4 (12.2–26.9)	15.2 (10.8–20.8)
Completed secondary and above	12.5 (5.2–27.0)	11.9 (6.1–21.9)

[a]Proportions were estimated accounting for sampling.

Table 4:

Attitudes, perceptions and practices of infant caregivers pre- and post-IPV introduction

	Pre-IPV Introduction Percentage (95% CI)[a]	Post-IPV Introduction Percentage (95% CI)[a]
Caregiver brought immunization card to visit	98.9 (85.9–99.9)	99.5 (95.3–99.9)
Infant received all required vaccinations for the day	98.8 (81.6–99.9)	90.9 (59.8–98.5)
Highest number of injections comfortable with infant receiving in a single visit		
1 injection	12.0 (7.1–19.7)	8.9 (4.7–16.3)
2 injections	23.7 (15.2–35.1)	17.9 (8.3–34.3)
3 injections	9.8 (2.7–29.7)	11.5 (5.8–21.5)
4 injections	0.5 (0.04–7.5)	2.1 (0.6–7.3)
≥5 injections	1.3 (0.1–11.5)	0.5 (0.1–47)
Comfortable with any number	10.0 (3.8–23.9)	23.5 (12.3–40.1)
Whatever is recommended	42.6 (24.6–62.8)	35.7 (23.3–50.4)
Proportion of infant caregivers that "agree" or "strongly agree" with the following pre-formulated statements:		
"Children get more vaccinations than necessary"	53.3 (29.3–75.8)	70.6 (59.2–79.9)
"Immunizations do more good than harm"	95.6 (88.9–98.3)	99.3 (96.0–99.9)
"Concerned about side effects from vaccination"	63.3 (44.8–78.6)	42.2 (29.5–56.2)
"Vaccinator can be trusted concerning how many vaccines your child needs to receive in a single visit"	94.6 (88.5–97.6)	97.0 (89.3–99.2)
"The vaccination schedule is good for your children"	99.3 (97.4–99.8)	99.6 (96.5–99.9)
"The vaccinations provided protect children from severe disease"	99.3 (94.0–99.9)	100
"Better for a child to receive more injectable vaccines at a single visit if it means that they will be better protected against diseases"	92.4 (84.6–96.4)	92.7 (88.6–95.4)
"Prefer to visit the clinic only once so that your child receives all 3 vaccine injections at one visit"	54.8 (17.7–87.3)	83.0 (73.2–89.6)
"More concerned about your child having pain and discomfort from vaccinations spread out over multiple visits than about pain and discomfort from vaccinations administered all at once during a single visit"	70.3 (47.9–85.9)	68.2 (55.3–78.9)
"Vaccines will not work as well if many are injected at a single visit"	30.1 (23.1–38.3)	18.1 (9.9–30.7)

[a]Proportions and 95% CI were estimated accounting for the study design.

Table 5:

Caregivers source of information regarding vaccination

	Percentage (95% CI)[a] Pre-IPV Introduction	Percentage (95% CI)[a] Post-IPV Introduction
Source of information about childhood vaccination		
Family members	42.8 (28.8–58.0)	44.9 (26.0–65.4)
Radio	29.1 (19.1–41.6)	26.1 (18.9–35.0)
Healthcare provider	80.7 (62.4–91.3)	90.5 (83.4–94.8)
Television	19.0 (7.9–39.0)	11.8 (5.6–23.4)
Friends or neighbours	37.2 (13.3–69.6)	48.9 (37.2–71.0)
Religious leaders or organizations	2.3 (0.3–17.3)	5.8 (2.4–13.1)
Internet	0.2 (0.01–3.1)	0.4 (0.04–4.3)
Newspapers	1.3 (0.1–19.6)	0
Source about whether or not children should get two or three vaccines		
Family members	39.3 (23.1–58.2)	47.6 (27.5–68.5)
Radio	15.7 (6.4–33.6)	18.2 (11.1–28.5)
Healthcare provider	89.6 (85.8–92.5)	93.2 (91.3–94.7)
Television	10.9 (4.0 −26.6)	4.8 (1.2–16.8)
Friends or neighbours	24.8 (10.9–47.1)	44.5 (21.5–70.2)
Religious leaders or organizations	0.4 (0.01–4.6)	3.5 (1.5–8.3)
Newspapers	0.7 (0.1–8.9)	0

[a]Proportions and 95% CI were estimated accounting for the study design.