

Facility-Level Characteristics Associated with Family Planning and Child Immunization Services Integration in Urban Areas of Nigeria: A Longitudinal Analysis

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Abstract

Background: Unmet need for postpartum contraception is high. Integration of family planning with routine child immunization services may help to satisfy unmet need. However, evidence about the effects of integration has been inconsistent, and more evidence is required to determine whether and how to invest in integration. This study applies continuous facility-level family planning and child immunization integration index scores to: (1) determine whether integration changes over time, (2) assess the impact of the Nigerian Urban Reproductive Health Initiative (NURHI) on integration, and (3) identify facility-level characteristics associated with integration across facilities in urban areas of Nigeria.

Methods: Longitudinal data from health facilities in six urban areas of Nigeria are available from 400 facilities at baseline (2011) and 385 facilities at endline (2014). Difference-in-differences models estimate the impact of NURHI on Provider and Facility Integration Index scores and determine associations between facility-level characteristics and integration. The two outcome measures, Provider and Facility Integration Index scores, reflect attributes that support integrated service delivery. These indexes, which range from 0 (low) to 10 (high), were constructed using principal component analysis. Scores were calculated for each facility. Independent variables are (1) time period, (2) whether the facility received the NURHI intervention, and (3) facility-level characteristics.

Results: Within intervention facilities, mean Provider Integration Index scores were 6.46 at baseline and 6.79 at endline; mean Facility Integration Index scores were 7.16 (baseline) and 7.36 (endline). Within non-intervention facilities, mean Provider Integration Index scores were 5.01 at baseline and 6.25 at endline; mean Facility Integration Index scores were 5.83 (baseline) and 6.12 (endline). Provider Integration Index scores increased significantly ($p = 0.00$) among non-intervention facilities. Facility Integration Index scores did not increase significantly in either group. NURHI did not have a significant effect on integration index scores. Results identify facility-level characteristics associated with integration: location, family planning client load, years of provider experience, provider training, and public facility ownership.

Conclusion: Programs aiming to increase integration of family planning and immunization services should monitor and provide targeted support for the implementation of a well-defined integration strategy that considers the influence of facility characteristics and concurrent initiatives.

Background

Maternal and infant mortality has profoundly detrimental consequences (1). Despite national policies resolving to reduce these deaths, Nigeria continues to bear among the highest maternal mortality ratios (MMR) and infant mortality rates (IMR) worldwide (2, 3). Family planning has the potential to eliminate 25-40% of maternal deaths globally, in part by reducing the number of high-parity pregnancies (4). Pregnancies spaced fewer than 18 months apart are associated with increased risk of neonatal, perinatal and infant death, low birth weight, small size for gestational age, pre-term delivery, maternal anemia, premature membrane rupture, gestational diabetes, and maternal death (5, 6). To safeguard the health of women and their babies, the World Health Organization (WHO) promotes interpregnancy intervals of at least two years (7). Clinically, the postpartum period is often defined as the first six weeks following birth (8). However, because of the preponderance of evidence supporting spacing pregnancies two years apart, as well as the changing needs and preferences of women throughout this timeframe many policies and programs refer to the postpartum period as up to 12 months to two years after childbirth (9-11).

Many women in the postpartum period want to delay their next pregnancy but are not using an effective method of contraception; these women have an unmet need for family planning (12). In Nigeria, unmet need ranges from 78% in the first 0-5 months postpartum to 51% among women 12-23 months postpartum (13). In 2012, the Federal Government of Nigeria aimed to increase the modern contraceptive prevalence rate (mCPR) from 10% in that year to 27% by 2020 (14). By 2019, the mCPR among all women had increased to 14.2%, but still fell below the government's goal (15). Increasing contraceptive use, particularly among postpartum women, remains critical in Nigeria. Policies that focus on increasing access to contraception in the postpartum period encourage healthy birth spacing, and thus contribute to reduced MMR and IMR.

One approach to address high unmet need for family planning in the postpartum period is the integration of family planning services with routine child immunization services. The Nigerian government recommends immunization at birth, six weeks, ten weeks, fourteen weeks, nine months, twelve months, and fifteen months, which aligns with WHO recommendations (16). While immunization coverage in Nigeria is lower than in other sub-Saharan African countries, it has been improving in recent years (17). Integration provides an opportunity to provide immunization while simultaneously addressing the family planning needs of mothers. While numerous integration approaches exist, the two most common are: (1) combining service provision efforts such that family planning and immunization services are provided on the same day at the same facility and (2) providing one of the two services at a facility and referring the woman for the other service at another time or facility (18, 19). Although the Nigerian Ministry of Health promotes integration to increase access to family planning services, it does not advocate a specific model (20).

Despite its potential to improve service delivery and health outcomes, there is little research evaluating policies and programs that support integration (21, 22). Integration of family planning and immunization services in sub-Saharan Africa is feasible and may increase contraceptive prevalence without detriment to immunization rates (23-25); however, recent studies show no significant increase in family planning when family planning services are integrated with immunization visits (26-28). Systematic reviews highlight the need for more robust evidence about the effects of integration on service delivery and health outcomes (21, 22). Despite the lack of conclusive evidence, numerous international organizations, donors, and national governments promote policies supporting integration (29, 30).

Nigerian Urban Reproductive Health Initiative

The Nigerian Urban Reproductive Health Initiative (NURHI) is a Bill & Melinda Gates Foundation-funded project launched in 2009 that sought to increase modern contraceptive use in urban areas, especially among the urban poor (31). Phase I of NURHI (2009 to mid-2015) aimed to dismantle supply and

demand side barriers to contraceptive use by: (a) providing facility-level systems strengthening and quality improvement support; (b) generating demand for family planning services and sustained contraceptive use; (c) testing private sector approaches to increase access to and use of family planning among the urban poor; and (d) improving the policy environment for family planning initiatives in urban areas. Within health facilities, NURHI supported systems strengthening to improve the quality and accessibility of family planning services through: (a) improved contraceptive supply chains and logistics; (b) training health providers in family planning counseling and provision; and (c) improving facility level management systems (32). NURHI promoted integration of family planning into: (a) maternal, newborn, and child health services; (b) post-abortion services; and (c) HIV/AIDS services. The NURHI integration strategy specifically identified integrating family planning into child immunization as a top priority because of its potential to increase family planning uptake among postpartum women. At the facility level, NURHI incorporated the following family planning approaches into immunization services: (a) provision of information, education, and counseling materials on all methods; (b) group counseling; and (c) referral of prospective clients to the family planning clinic (33). NURHI Phase II (2015-2020) continued its focus on increasing contraceptive prevalence through advocacy, demand generation and service delivery support. NURHI Phase II incorporated evidence from Phase I into its approach and continued to support integration of family planning services into maternal, newborn and child health services, including immunization.

Measuring Integration

Only a few studies have attempted to develop categorical or continuous measures of integration (34, 35). Generally, studies classify a facility as 'integrated' if an intervention to improve integration has been implemented in the facility (25, 36, 37). More nuanced integration measures may be able to more accurately reflect dynamic service delivery environments and the effect of integration on service delivery and health outcomes. In a previous study, we developed Provider and Physical Integration Indexes and measured the degree of facility-level family planning and immunization services integration attained across approximately 400 facilities in Nigeria and found substantial heterogeneity in provider and facility capacity to offer integrated services (38). Using these integration indexes as outcomes, this study exploits a longitudinal dataset to identify associations between facility-level characteristics and integration and the impact of NURHI on integration index scores.

Facility-Level Characteristics Associated with Integration

It is critical to identify facility-level characteristics associated with integration in order to design interventions that effectively support family planning and immunization services integration (26). Some studies have used qualitative methods to document that contextual characteristics influence integrated care (39). To our knowledge, this is the first study that utilizes quantitative measures to identify facility-level characteristics associated with family planning and child immunization services integration. The objectives of this study are to: 1) determine whether facility-level integration changes over time, 2) assess the impact of NURHI on integration, and 3) identify facility-level characteristics associated with integration. The results of this study are relevant to policy makers, programmers, and donors seeking to better understand the evolution and facility-level characteristics associated with family planning and immunization services integration so as to develop health interventions that will have the greatest positive impact on critical health outcomes, such as MMR and IMR.

Methods

Setting

This study uses data from six cities in Nigeria: Abuja (Nigeria's capitol), Benin City, Ibadan, Ilorin, Kaduna and Zaria. These cities are located in both the northern and the southern regions of Nigeria, which differ culturally and socioeconomically. The country's more affluent Christian population is concentrated in the south, while the poorer Muslim population predominates in the north.

Data Source and Study Sample

This study leverages data collected for the NURHI impact evaluation, which was conducted by the Measurement, Learning & Evaluation (MLE) project, led by the Carolina Population Center. Baseline data were collected in 2011 (n = 400 facilities) and endline data were collected in 2014 (n = 385 facilities) (31).

The sample includes two categories of health facilities: high-volume facilities (HVF) and preferred-provider facilities (PPF). These facilities may be primary or secondary and publicly or privately owned. All public facilities in the study cities were included in the sample, most as high-volume facilities within the intervention group and the others as lower volume preferred-provider facilities. NURHI implemented the intervention in all of the high-volume facilities (HVF) in the sample. These facilities generally had the highest patient volumes of all facilities in the study cluster - they provided antenatal services to over 1,000 women annually and offered child immunization services. The non-intervention group consists of all preferred-provider facilities (PPF). These facilities were selected based on the results of a MLE survey, conducted in 2010/2011, of a representative sample of 16,144 women aged 15-49. In this survey, women specified the facility at which they received child health, maternal health, and family planning services. MLE then used that listing to identify the most commonly named facility in each study cluster. If a facility had already been included in the sample (e.g., as a HVF), then the second most frequently named facility was included as the PPF. If that facility was already included, then no additional facility was added. Inclusion of the PPF makes certain that the non-

intervention group contains facilities commonly utilized by women in the study cities. Overall, there were 112 HVF at baseline and 132 at endline. There were 228 PPF at baseline and 253 at endline. Table 1 shows facility characteristics at baseline and endline.

Survey Instruments

This study uses instruments developed by MLE for the NURHI impact evaluation; the instruments are informed by validated tools from the Quick Investigation of Quality (40). A health facility audit and provider surveys were conducted in each facility. One administrator or manager within each facility completed a facility audit, which gathered information about health facility characteristics, family planning service provision, and the extent of family planning integration into maternal, newborn and child health services. Within each facility up to four providers, selected through simple random sampling, completed the provider survey. In smaller facilities with fewer than four providers, all eligible providers were invited to complete the survey. Eligible providers offered family planning and/or maternal, newborn and child health services at the facility. Providers were asked about their training related to provision of family planning as well as their common practices related to integrated care.

Measures

The outcome measures are a) Provider Integration Index score and b) Facility Integration Index score (33). Both of these scores were calculated for each facility. Each index score ranges from zero (lowest level of integration) to ten (highest level of integration). The two integration indexes reflect facility-level attributes that support service integration. The Provider Integration Index measures provider skills and practices that support integrated service delivery while the Facility Integration Index measures facility operating norms that support integrated service delivery. The indexes align with guidance provided by Nigeria's Federal Ministry of Health (41), specifically, the inclusion of concurrent service provision and referral systems within the facility as well as provider behavior during a health visit. To create the indexes, we employed principal component analysis (PCA) on the baseline and endline data using eight input variables that contain variation sufficient to differentiate degrees of integration. Table 2 provides an overview of the constructs included in each index. Additional information about the construction of the indexes is detailed in another paper and can be found in the Appendix (38).

The independent variable of primary interest is whether the facility received the NURHI intervention. Additional independent variables reflect various facility-level characteristics that may be associated with the degree of family planning and immunization services integration within a health facility, including: a) facility family planning client load (defined as the number of clients who received family planning services in the past twelve months per health worker), b) average years of experience of health workers in facility, c) the proportion of health workers at the facility who have received any in-service training on modern family planning methods. We also include variables to reflect the type of facility (primary healthcare center or hospital), facility ownership (public or private), and the city (the reference city is Abuja).

Analytic Methods

We employed difference-in-differences analyses using multivariate regression models clustered at the facility level to investigate the impact of NURHI and facility-level characteristics associated with Provider and Facility Integration Index scores. The difference-in-differences approach is a quasi-experimental technique that measures the impact of NURHI on integration index scores by comparing the change in the integration index scores over time between the intervention facilities and the non-intervention facilities. Because the intervention was not randomized, significant differences exist between the intervention facilities (chosen specifically because they were the highest patient-volume facilities in the primary sampling unit and primarily public) and non-intervention facilities (Table 1). The difference-in-differences model measures the impact of the NURHI intervention while accommodating these differing characteristics by measuring the difference between the change in the outcome between the intervention and the non-intervention facilities over time. Use of this quasi-experimental method rests on the parallel trends assumption. To the best of our knowledge, no concurrent programs were implemented in these facilities that would have altered their respective trajectories. We also control for characteristics that differ significantly between the intervention and non-intervention facilities. We ran five models to analyze the effects of the independent variables on the Provider Integration Index and the Facility Integration Index; each model includes robust standard errors clustered at the facility level. Models 1 - 4 each include additional covariates that are analyzed as facility-level characteristics associated with integration. Model 5 is the fully specified estimation model to identify the impact of NURHI and other potential facility-level characteristics associated with Provider and Facility Integration Index scores:

$$Y_{it} = \alpha + \beta_1(\text{Year2014})_t + \beta_2(\text{NURHI})_g + \beta_3(\text{Year2014}_t * \text{NURHI}_g) + \beta_4 X_{gt} + \varepsilon_{it}. \quad (\text{Eqn. 1})$$

Y_{it} is the Provider or Integration Index score. Year2014 is an indicator variable that is equal to one if the observation pertains to the endline period (post-intervention) and equal to zero if the observation refers to the baseline period (pre-intervention). NURHI is an indicator variable equal to one if the facility was exposed to the NURHI intervention at any time. β_3 is the estimate of the impact of the NURHI intervention. X indicates a vector of variables, mentioned above, analyzed as potential facility-level characteristics associated with Provider and Facility Integration Index scores.

Results

The baseline and endline samples reflect the programmatic reality of shifting intervention groups. At baseline, the program identified the facilities where they would work; by endline, they had added some facilities to their sample. Some of the added facilities were part of the non-intervention sample at baseline. To examine whether the shifts within the sample influenced the outcomes, we conducted a sensitivity analysis that restricted the sample to facilities that were present at both baseline and endline. We found that, of the 432 facilities in the original analysis, 353 appeared in both baseline and endline. Because some facilities did not have complete exposure to the intervention, we anticipated that the estimate of program impact could be biased downward in the full sample. However, the results did not change with the analysis using the restricted sample. We thus present results from the full sample.

The mean Provider Integration Index score of the non-intervention (5.01, SD = 3.28) and intervention (6.46, SD=2.28) facilities at baseline differed significantly ($p < 0.001$). The mean Facility Integration Index score of the non-intervention (5.83, SD = 2.90) and intervention (7.16, SD=1.92) facilities at baseline also differed significantly ($p < 0.001$). We found an upward trend in Provider and Facility Integration Index scores among all facilities over time; however, this increase was statistically significant only for Provider Integration Index scores within the non-intervention facilities. Table 3 presents mean Provider and Facility Integration Index Scores while Figure 1 shows the trend in the average Provider Integration Index score among both intervention and non-intervention facilities over time.

Change in Provider and Facility Integration Index Scores Over Time

Provider Integration Index Scores

Among non-intervention facilities, the mean change in Provider Integration Index scores from baseline (5.01) to endline (6.25) was statistically significant ($p < 0.001$). The Provider Integration Index scores increased significantly among private facilities, primary care facilities, and hospitals ($p < 0.05$). Public facilities within the non-intervention group did not show a statistically significant increase in Provider Integration Index scores; however, the raw mean score in public non-intervention facilities remained higher at endline than the raw mean score among private non-intervention facilities at endline. Figure 2 shows that the proportion of non-intervention facilities with a Provider Integration Index score of zero decreased from baseline to endline – specifically, at baseline, 21% of non-intervention facilities had a score of zero while at endline only 2% did. The decrease in the number of zero scores can be attributed to improvements in provider capacity to offer integrated services. For example, among non-intervention facilities that score a zero at baseline, 18% of providers at baseline reported offering family planning information during child health visits while 41% of providers at endline reported the same. Among intervention facilities, the increase in Provider Integration Index scores was not statistically significant within any sub-group of facilities. Figure 3 shows the distribution of Provider Integration Index Scores in intervention facilities.

Facility Integration Index Scores

Among intervention facilities, the mean Facility Integration Index score was 7.16 at baseline and 7.36 at endline; among non-intervention facilities, the mean score was 5.83 at baseline and 6.12 at endline. Figures pertaining to Facility Integration Index scores may be obtained from the first author.

The Impact of NURHI on Provider and Facility Integration Index Scores

Tables 4 and 5 present associations between the facility characteristics and Provider and Facility Integration Index scores. Our fully specified models indicate that NURHI did not have a significant effect on Provider or Facility Integration Index scores.

Facility-Level Characteristics Associated with Provider and Facility Integration Index Scores

Provider Integration Index Scores

Time had a significant positive effect on Provider Integration Index scores ($b = 0.90, p < 0.001$). Facility family planning client load was negatively associated with Provider Integration Index scores ($b = -0.01, p < 0.05$), as was the average number of years of experience of health care providers in a facility ($b = -0.60, p < 0.001$). However, the proportion of providers who attended in-service training on the provision of modern family planning methods was positively associated with Provider Integration Index scores ($b = 1.15, p < 0.001$). Public ownership of a facility was associated with higher Provider Integration Index scores relative to privately owned facilities ($b = 2.04, p < 0.001$). Facilities located in Benin ($b = 1.41, p < 0.001$), Ibadan ($b = 1.60, p < 0.001$), Ilorin ($b = 1.77, p < 0.001$), and Zaria ($b = 0.98, p < 0.05$) scored higher than those in the reference city, Abuja.

Facility Integration Index Scores

Facility Integration Index scores did not change significantly over time. The average number of years of experience among health care providers in a facility was associated with a significant decrease in Facility Integration Index scores ($b = -0.37, p < 0.05$). Facilities located in Kaduna ($b = -0.80, p < 0.05$) and Zaria ($b = -1.23, p < 0.01$) scored lower than those in Abuja. Several other facility characteristics were associated with higher relative Facility Integration Index scores: (1) the proportion of providers at a facility who had attended in-service trainings on the provision of modern family planning methods ($b = 1.02, p < 0.001$); (2) hospitals scored higher than primary healthcare facilities ($b = 0.77, p < 0.01$); and (3) public ownership of a health facility relative to private ownership ($b = 1.58, p < 0.001$).

Discussion

Our results show that, aside from a significant increase in Provider Integration Index scores among non-intervention group facilities, integration index scores did not increase significantly over the NURHI project period. The significant increase in the average Provider Integration Index scores among non-intervention facilities was attributable to improvements in the proportion of providers who report offering family planning information during child health service visits. Additionally, while NURHI met its primary objective of increasing contraceptive prevalence in the intervention areas (31), the program did not have a significant effect on Provider or Facility Integration Index scores. Finally, our research identified several facility-level characteristics associated with integration index scores, including location, family planning client load, years of provider experience, provider training, and facility ownership (public or private).

Several plausible explanations exist for NURHI not affecting integration index scores. First, the family planning client load within NURHI facilities increased significantly over the project period. This may have been due to improved family planning service provision at the facilities and demand generation activities in the project cities leading to increased demand for family planning within the communities. Therefore, while NURHI articulated a strategy to integrate family planning into immunization services, health workers in these facilities may have had to prioritize non-integrated family planning provision in order to provide services to the additional clients. Another possibility is that providers and facilities found it challenging to incorporate family planning information and services into immunization services. This would reinforce research by Vance et al. (2014) that questions the feasibility of effectively providing family planning information during immunization appointments (28). Future studies could collect in-depth information from providers to understand their perspectives on facilitators and barriers to family planning and immunization services integration. This would provide valuable information for the development and support of integration strategies. It is important to consider that facilities may not need to attain very high levels of integration in order to have an impact on service delivery and health outcomes or that integration models that focus on ensuring effective referral mechanisms are more beneficial than those aiming to provide comprehensive family planning information and services during immunization visits. Understanding whether and how the degree of integration affects such outcomes is an important area for future research.

Our research identified several facility-level characteristics associated with integration index scores. First, facility location was associated with both Provider and Facility Integration Index scores. Facilities in Kaduna and Zaria had lower Facility Integration Index scores than facilities in Abuja; this implies that standard facility practices in these cities were less likely to link women attending for child health visits to family planning information or services on the same day. However, facilities located in Benin, Ibadan, Ilorin, and Zaria had higher Provider Integration Index scores than those in Abuja. Programs should consider demand-side preferences when developing integration strategies. It is crucial to ensure that specific integration approaches are acceptable to communities and providers so that immunization coverage and family planning prevalence does not fall, particularly in regions where immunization coverage and contraceptive prevalence is already low or has limited community acceptance. This is particularly relevant in northern Nigeria, where communities have boycotted immunizations because of widespread belief that immunizations were infused with anti-fertility drugs (42).

Second, the negative association between Provider Integration Index score and facility family planning client load suggests that providers may be less able to offer high-quality integrated care in busier settings. This finding reinforces studies highlighting that heavier workloads challenge integration efforts and result in poorer quality of care (43). One suggestion may be to increase staffing to manage workloads; however, chronic provider shortages make this an unlikely option in many contexts. Family planning service quality impacts family planning use (44). Poor quality integrated care could prove detrimental to family planning utilization and immunization coverage. It is therefore important to consider whether, in what contexts, and how integration should be promoted.

Third, provider experience is associated with lower Provider and Facility Integration Index scores. Though it is commonly assumed that more experienced providers offer higher quality care, some research suggests an inverse relationship between years of clinical practice and quality of care (45). One explanation for this is that provider "toolboxes" are developed during pre-service training and may not be regularly updated (46). Further, providers with more years of experience may be less likely to adopt new approaches or incorporate new information or services into their practice (47). Within the context of integration, individual providers with more years of experience may be less likely to expand their practice by providing family planning information and services during child health visits. This could also influence facility level norms, whereby facilities staffed by more experienced providers may be less likely to implement new systems that facilitate integration. Provision of in-service training may counterbalance the negative association between provider experience and integration index scores. Providers who receive in-service training on modern methods of family planning may be more apt to provide these services and discuss a wider range of family planning information during immunization visits (36). In turn, increased provider capacity to offer family planning information and services may facilitate facility-level practices that promote integration.

Lastly, publicly owned facilities score higher on integration than those that are privately owned. The private sector provides more than one-third of family planning services in low and middle-income countries globally and is an important source of contraception for women in Nigeria (48). Compared to the public sector, the private sector plays a limited role in the provision of immunization services in Nigeria (49). Public facilities may demonstrate a greater capacity to provide integrated services because they are more accountable to government standards and guidelines, which emphasize service integration. They may also have greater access to the vaccine delivery infrastructure, such as cold chain equipment. The Nigeria Strategy for Immunization and Primary Health Care System Strengthening calls for increased engagement of the private sector in the provision of immunizations (50). High-volume private facilities, such as the

ones in this study, could be prioritized for inclusion in government supply chains. To ensure equitable access to both immunization and family planning services, it is important to understand and support the service delivery environment in both public and private facilities.

This research has several limitations, including possible social desirability and recall bias during interviews. Because of NURHI's focus on high volume facilities within select urban areas, our sample is not representative of all facilities or all cities in Nigeria. Thus, our results are specific to our sample and are not generalizable to all facilities in Nigeria or other contexts. The intervention and non-intervention facilities differ significantly in some characteristics. We have controlled for significant differences, and the difference-in-differences model accommodates differences in intervention and non-intervention groups assuming the parallel trend assumption is met. In this case, we believe that the parallel trend holds as we could not identify any contextual factors that would alter the trajectories of the intervention and non-intervention groups during the intervention period. However, due to lack of pre-trend data, we cannot empirically test the parallel trend assumption. If the assumption is violated, it is possible that these differences bias the estimates of NURHI's impact on integration index scores. Additionally, a better understanding of the fidelity with which NURHI's integration strategy was implemented would enable a more accurate analysis of the impact of particular approaches on the extent of integration attained; unfortunately, we lack this information. Notwithstanding these limitations, this research offers valuable insight into the facility-level characteristics associated with family planning and child immunization services integration within a large sample of facilities in select urban areas of Nigeria. This is important information in light of the Nigerian government's goal to reduce MMR and IMR by increasing contraceptive prevalence, in part, by reaching more postpartum women through integration of family planning and child immunization services.

Conclusion

Understanding the facility-level characteristics associated with family planning and child immunization services integration is an important step in optimizing its potential to increase postpartum contraception use. Programs seeking to increase integration of immunization and family planning services should provide monitoring and support that focuses specifically on helping health workers to provide high-quality integrated services. Further, health services implementers and policy makers should consider the influence of facility characteristics and concurrent initiatives when designing and implementing integrated service delivery.

More evidence is needed to better understand whether and how varying degrees of integration affect service delivery and health outcomes. Future research should test different integration strategies, for example, how to optimize each of the recommended immunization appointments and should also monitor intervention fidelity. Such research should investigate the effects of integration on contraceptive uptake and continuation, client knowledge, immunization coverage, service delivery efficiency and quality, cost, and provider workload. The facilitators and barriers to integration should be explored from both provider and client perspectives so that implemented approaches are sustainable, quality of care is maintained, and contraceptive and immunization coverage improves.

Abbreviations

NURHI: Nigerian Urban Reproductive Health Initiative, MMR: maternal mortality rate, IMR: infant mortality rate, WHO: World Health Organization, mCPR: modern contraceptive prevalence rate, HIV: Human Immunodeficiency Virus, AIDS: Acquired Immune Deficiency Syndrome, MLE: Measurement, Learning & Evaluation Project, HVF: High Volume Facility, PPF: Preferred Provider Facility, PCA: principal component analysis

Declarations

Ethics approval and consent to participate:

The study protocol and all consent procedures and consent forms were approved by the Institutional Review Board at the University of North Carolina at Chapel Hill and by the National Health Research Ethics Committee of Nigeria (NHREC) in Nigeria. All facility respondents were asked to consent to participate in the study. Prior to being surveyed, health providers were asked to sign consent forms that included details on the purpose of the study, potential benefits and potential risk, and clarified that the information provided would not be identifiable. Facility administrators who were asked questions about the services offered at the facility through a facility audit were asked for verbal consent to participate.

Consent for publication

Not applicable

Availability of data and materials

Data from this study and all documentation are available upon request through the MLE Dataverse website at: <https://dataverse.unc.edu/dataverse/mle>

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

KS led the design and implementation of research, data analysis, interpretation of results and manuscript writing. ISS provided critical contextual, theoretical, and methodological guidance and expertise. JOM contributed to data analysis and interpretation of results. SC provided theoretical and methodological expertise. MW and JP contributed to conceptualization and presentation of the research. AVB contributed to conceptualization and presentation of the research and provided overall guidance and direction. All authors provided critical feedback and helped shape the research, interpretation of results and manuscript. All authors read and approved the final manuscript.

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Authors' information

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Tables

Facility Characteristics	Baseline (n= 400)			Endline (n= 385)		
	Intervention Facility (n= 112)	Non-intervention Facility (n= 288)	p- value	Intervention Facility (n= 132)	Non-intervention Facility (n= 253)	p- value
<i>Facility Ownership</i>						
Public Facility	0.79	0.26	0.00	0.79	0.28	0.00
Private Facility	0.21	0.74	0.00	0.21	0.72	0.00
Facility FP client load	73.48	40.71	0.00	143.97	56.31	0.00
Average years of provider experience	14.89	10.77	0.00	15.95	11.15	0.00
<i>Facility Level</i>						
Hospital	0.54	0.60	0.31	0.47	0.58	0.05
Primary Health Center	0.45	0.39	0.32	0.52	0.42	0.06
Primary Health Post	0.01	0.01	0.84	0.01	0.01	0.97
<i>Location</i>						
Abuja	0.10	0.13	0.40	0.10	0.10	0.71
Benin	0.15	0.19	0.40	0.20	0.19	0.80
Ibadan	0.27	0.11	0.00	0.23	0.11	0.00
Ilorin	0.19	0.18	0.81	0.17	0.19	0.52
Kaduna	0.18	0.25	0.13	0.17	0.24	0.09
Zaria	0.12	0.15	0.44	0.14	0.15	0.64
Providers at facility ever received in-service training on modern FP methods	0.63	0.31	0.00	0.58	0.40	0.00
Facility provides FP but not RI	0.04	0.24	0.00	0.07	0.25	0.00
Facility provides RI but not FP	0.00	0.02	0.10	0.01	0.01	0.69
Facility provides FP and RI services	0.96	0.72	0.00	0.92	0.74	0.00
Facility provides neither FP nor RI services	0.01	0.01	0.69	0.00	0.01	0.21
Notes: FP = family planning. RI= routine childhood immunization. Proportions are reported, except for facility FP client load and average years of provider experience. Facility FP client load is defined as the number of clients who received family planning services in the past twelve months per health worker. Provision of FP services includes those facilities that offer referral only. Some numbers may not add to 1.0 due to rounding.						

Table 1: Facility Characteristics by Intervention Status at Baseline and Endline

Table 2: Provider and Facility Integration Index Components

Provider Integration Index Components
Proportion of providers at facility that offer both RI and FP services
Proportion of providers at facility that routinely offers FP information during RI or CGM visits
Average count of FP items that providers at facility tell client during CHS visits
Proportion of providers at facility that do not request partner consent prior to woman's receipt of FP services during CHS visit
Facility provides both child immunization and family planning services
Facility Integration Index Components
Normal practice at this facility if client wants FP information during CHS visit
Normal practice at this facility if client wants hormonal method of FP during CHS visit
Score of operational days when both RI and FP services are offered
Notes: RI: Routine childhood Immunization FP: Family Planning CGM: Child Growth Monitoring CHS: Child Health Service CHS visits include either CI or CGM visits, but not sick child visits. Less than 2% of women report that CGM was the primary reason for their visit.

Table 3: Mean Provider and Facility Integration Index Scores by Intervention Status at Baseline and Endline

	<i>Intervention Facilities</i>			<i>Non-intervention Facilities</i>		
	<i>Baseline (n= 112)</i>	<i>Endline (n=132)</i>	<i>p-value</i>	<i>Baseline (n=288)</i>	<i>Endline (n=253)</i>	<i>p-value</i>
Mean Provider Integration Index Scores						
All facilities	6.46	6.79	0.26	5.01	6.25	0.00
Public facilities	6.48	6.90	0.19	6.80	7.46	0.06
Private facilities	6.40	6.38	0.98	4.36	5.72	0.00
Primary health facilities	7.14	7.48	0.36	5.02	6.51	0.00
Hospitals	5.89	5.98	0.84	5.02	6.04	0.00
Mean Facility Integration Index Scores						
All facilities	7.16	7.36	0.40	5.83	6.12	0.24
Public facilities	7.31	7.44	0.59	6.67	6.78	0.71
Private facilities	6.57	7.04	0.49	5.52	5.86	0.27
Primary health facilities	7.04	7.11	0.84	5.50	6.08	0.13
Hospitals	7.26	7.65	0.238	6.05	6.14	0.77

Table 4: Association Between NURHI Intervention and Other Facility Characteristics and Provider Integration Index Score

Characteristic	Model 1	Model 2	Model 3	Model 4	Model 5
Time	1.01 (0.20)	1.03 (0.21)	1.03 (0.21)	1.00 (0.21)	0.90 (0.21)
NURHI facility	1.41 (0.29)	1.44 (0.29)	1.32 (0.30)	0.35 (0.30)	0.14 (0.31)
NURHI intervention (time*NURHI facility)	-0.68 (0.32)	-0.62 (0.32)	-0.64 (0.32)	-0.51 (0.32)	-0.36 (0.32)
Facility FP client load		-0.0101 (0.0049)	-0.0120 (0.0049)	-0.0105 (0.0043)	-0.0100 (0.0044)
Average years experience of providers			0.24 (0.17)	-0.42 (0.18)	-0.60 (0.19)
Benin				1.58 (0.43)	1.41 (0.43)
Ibadan				1.97 (0.43)	1.60 (0.44)
Ilorin				1.88 (0.43)	1.77 (0.43)
Kaduna				0.71 (0.39)	0.74 (0.39)
Zaria				1.05 (0.43)	0.98 (0.43)
Public Facility				2.11 (0.31)	2.04 (0.31)
Hospital				0.15 (0.27)	0.09 (0.27)
Proportion providers received any in-service FP training					1.15 (0.31)
Constant	5.02 (0.19)	5.06 (0.19)	4.93 (0.28)	3.68 (0.43)	3.67 (0.43)
Observations	751	751	751	751	751

Notes: Beta coefficients in bold indicate $p < 0.05$. Robust standard errors in parentheses.

FP: Family Planning. 'Facility FP client load' unit is 10 additional FP patients per provider per year, i.e., an additional 10 FP patients per year per provider is associated with a 0.01 decrease in Provider Integration Index score.

Average years experience of providers' unit is 10 additional years, i.e., an additional 10 years of average experience among providers within a facility is associated with a 0.60 decrease in Provider Integration Index score.

Table 5: Association Between NURHI Intervention and Other Facility Characteristics and Facility Integration Index Score

Characteristic	Model 1	Model 2	Model 3	Model 4	Model 5
Time	0.30 (0.20)	0.31 (0.20)	0.28 (0.20)	0.31 (0.20)	0.21 (0.20)
NURHI Facility	1.31 (0.26)	1.33 (0.26)	1.24 (0.26)	0.57 (0.25)	0.38 (0.25)
NURHI intervention (time*NURHI facility)	-0.04 (0.31)	-0.01 (0.31)	0.02 (0.31)	0.06 (0.31)	0.21 (0.31)
Facility FP client load		-0.0056 (0.0058)	-0.0057 (0.0061)	-0.0063 (0.0057)	-0.0059 (0.0059)
Average years experience of providers			0.10 (0.15)	-0.21 (0.16)	-0.37 (0.16)
Benin			-0.53 (0.42)	-0.03 (0.42)	-0.18 (0.42)
Ibadan			-0.53 (0.42)	-0.36 (0.41)	-0.67 (0.41)
Ilorin			-0.20 (0.39)	-0.17 (0.37)	-0.26 (0.37)
Kaduna			-0.86 (0.41)	-0.82 (0.39)	-0.80 (0.39)
Zaria			-1.18 (0.46)	-1.19 (0.44)	-1.23 (0.44)
Public Facility				1.65 (0.29)	1.58 (0.28)
Hospital				0.82 (0.26)	0.77 (0.25)
Proportion providers received any in-service FP training					1.02 (0.28)
Constant	5.80 (0.18)	5.81 (0.18)	6.32 (0.39)	5.58 (0.45)	5.58 (0.45)
Observations	765	765	762	762	762

Notes: Beta coefficients in bold indicate $p < 0.05$. Robust standard errors in parentheses.

FP: Family Planning. Facility FP client load' unit is 10 additional FP patients per provider per year, i.e., an additional 10 FP patients per year per provider is associated with a 0.01 decrease in Provider Integration Index score.

Average years experience of providers' unit is 10 additional years, i.e., an additional 10 years of average experience among providers within a facility is associated with a 0.60 decrease in Provider Integration Index score.

Figures

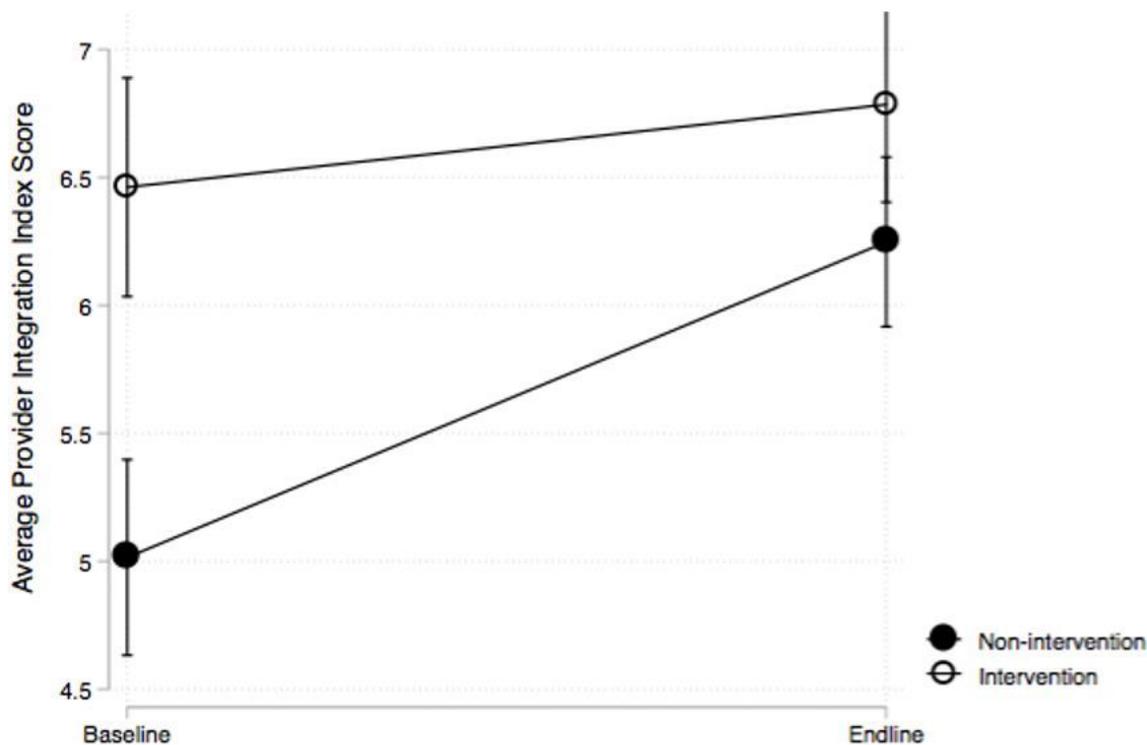


Figure 1

Average Provider Integration Index Scores from Baseline to Endline

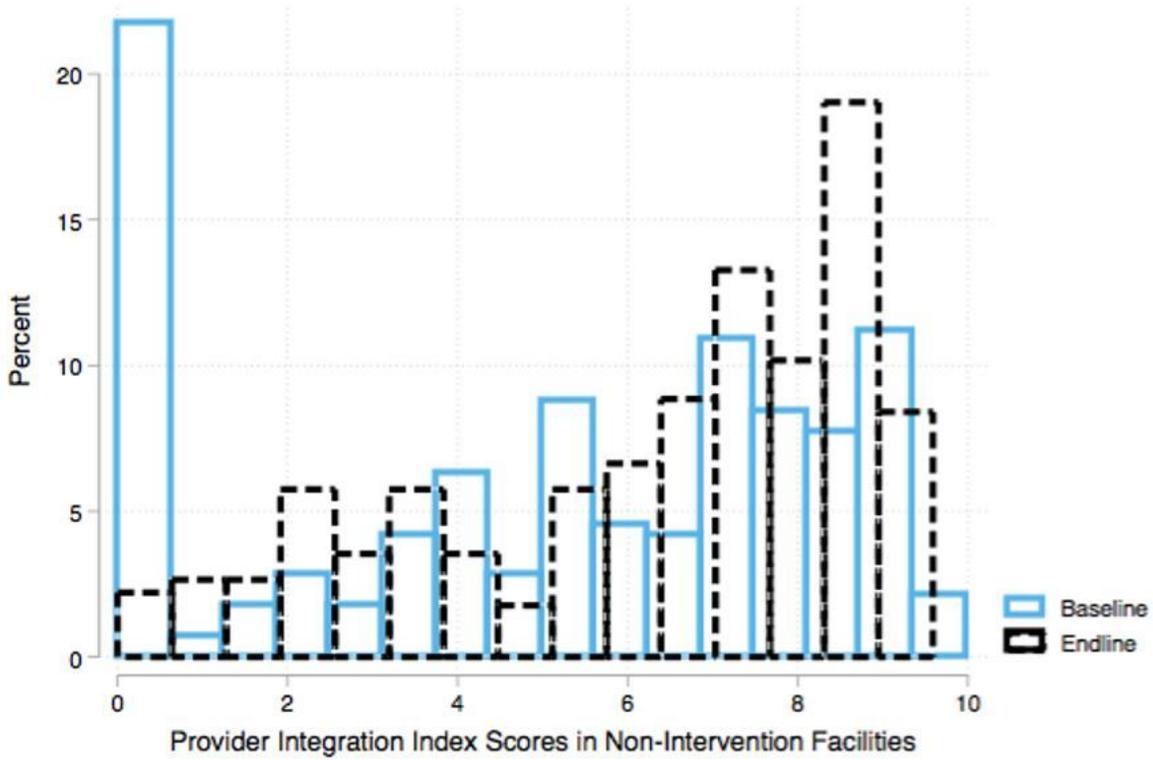


Figure 2

Distribution of Provider Integration Index Scores in Non-intervention Facilities at Baseline and Endline

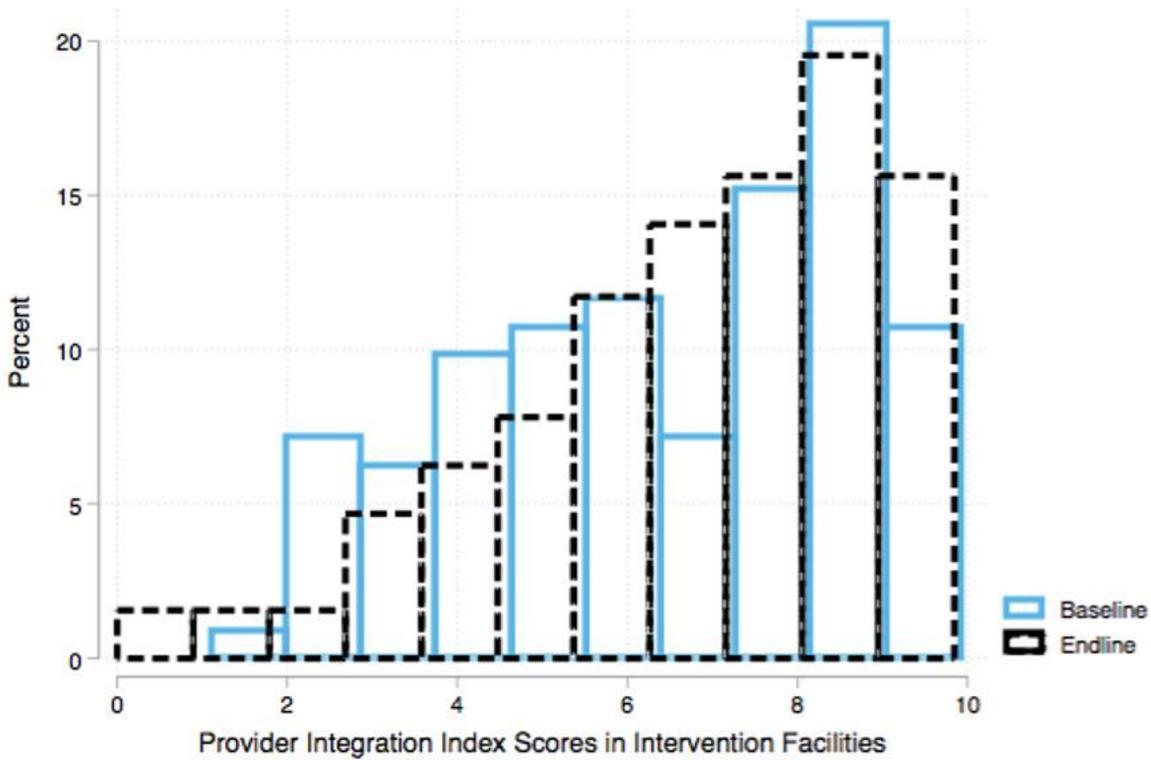


Figure 3

Distribution of Provider Integration Index Scores in Intervention Facilities at Baseline and Endline

Supplementary Files

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