

# Development of Integration Indexes to Determine the Extent of Family Planning and Child Immunization Services Integration in Health Facilities in Urban Areas of Nigeria

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## Research

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## Abstract

*Background:* Integrating family planning into child immunization services may address unmet need for contraception by offering family planning information and services to postpartum women during routine child immunization visits. However, policies and programs promoting integration are often based on insubstantial or conflicting evidence about its effects on service delivery and health outcomes. Since most studies measure integration as binary (a facility is integrated or not) rather than a multidimensional and varying continuum, it is difficult to understand the determinants and effects of integration. This study creates Facility and Provider Integration Indexes, which measure capacity to support integrated family planning and child immunization services, and applies them to analyze the extent of integration across 400 health facilities.

*Methods:* This study utilizes cross-sectional health facility (N= 400; 49% hospitals, 51% primary healthcare centers) and healthcare provider (N= 1,479) survey data that were collected in six urban areas of Nigeria for the impact evaluation of the Nigerian Urban Reproductive Health Initiative. Principal Components Analysis was used to develop Provider and Facility Integration Indexes that estimate the extent of integration in these health facilities. The Provider Integration Index measures provider skills and practices that support integrated service delivery while the Facility Integration Index measures facility norms that support integrated service delivery. Index scores range from zero (low) to ten (high).

*Results:* Mean Provider Integration Index score is 5.42 (SD 3.10), and mean Facility Integration Index score is 6.22 (SD 2.72). Twenty-three percent of facilities were classified as having low Provider Integration scores, 32% as medium, and 45% as high. Fourteen percent of facilities were classified as having low Facility Integration scores, 38% as medium, and 48% as high.

*Conclusion:* Many facilities in our sample have achieved high levels of integration, while many others have not. Results suggest that measuring integration as a binary variable does not (a) reflect the true variation in integration within and across health facilities, (b) enable nuanced measurement of the determinants or effects of integration, or (c) provide tailored, actionable information about how best to improve integration. Overall, results reinforce the importance of utilizing more nuanced measures of facility-level integration.

## Plain English Summary

Inadequate spacing between pregnancies can lead to adverse health outcomes among women and babies. The WHO recommends 24-months between pregnancies. Access to postpartum contraception is critical, yet many women wishing to space their pregnancies do not use it. Integrating family planning (FP) services into child immunization (CI) services may increase access to postpartum contraception. While previous research shows that integration is acceptable to women, evidence about its effects on service delivery and health outcomes is scarce and inconsistent. This is due, in part, to challenges surrounding the measurement of integration. One such challenge is that integration within health facilities is often measured as binary (i.e., a facility is designated as integrated or not), though numerous factors influence the extent of integration within facilities over time. Without capturing variation in integration, analyzing the effects of integration is difficult. This study addresses that challenge by developing Provider (i.e., nurse/midwife) and Facility Integration Indexes, which measure capacity to support integrated FP and CI services. Utilizing cross-sectional data collected for the Nigerian Urban Reproductive Health Initiative, we apply the indexes to describe the extent of

integration across 400 facilities: 23% of facilities have low Provider Integration scores, 32% have medium, and 45% have high. Fourteen percent of facilities have low Facility Integration scores, 38% have medium, and 48% have high. These results suggest that nuanced measures of integration, like those described in this paper, may enable more accurate evaluation of integration's effects, and provide more specific information about whether and how to support integration.

## Introduction

Nigeria has among the highest maternal and infant mortality rates in the world. In 2015, Nigeria had a maternal mortality ratio (MMR) of 814/100,000 live births, which was the fourth highest in the world(1). At the same time, Nigeria's infant mortality rate (IMR) was 72.7/1,000 live births, which was the tenth highest in the world.(2) Nigeria signed on to achieve Sustainable Development Goal 3 to reduce MMR to below 70/100,00 live births and to end preventable deaths of newborns and children under age 5 years by 2030.

Family planning use has the potential to drastically reduce newborn and maternal deaths globally (3). Yet, unmet need for contraception remains high among Nigerian women; 24.8% of women of reproductive age (15–49 years) want to stop or delay childbearing but are not using contraception (4). The Federal Government of Nigeria set a target to increase the modern contraceptive prevalence rate from 10% in 2012 to 27% by 2020 (5). By 2018, the modern contraceptive prevalence rate among all women had increased to 13.8%, though this remains well below the target (4). Thus, increasing access to, and utilization of, family planning methods remains an urgent priority in Nigeria.

## Contraception Among Postpartum Women: Critical to Maternal and Infant Health

Postpartum contraceptive use is particularly critical to the health of women and babies. Interpregnancy intervals of less than 18 months are associated with increased risk of morbidity and mortality (6). The World Health Organization (WHO) recommends an interval of at least 24 months after a live birth prior to attempting the next pregnancy (7). In Nigeria, 59% of women who have given birth within the last year have an unmet need for contraception (8). Meeting this postpartum need for contraception would contribute substantially to contraceptive prevalence, which would in turn decrease MMR and IMR.

## Integration of Family Planning and Child Immunization Services

Integrating family planning into routine child immunization services has the potential to address unmet need for contraception among postpartum women by leveraging repeated immunization consultations to offer family planning information and services. While integration models vary in purpose and design, two primary models are commonly implemented (9, 10). The first, combined service provision, entails offering both family planning and immunization services on the same day at the same location. The second, single service provision plus referral, entails offering either family planning or immunization services along with education, screening, and/or referral for the other service at a different place or time. Previous research has shown that integration can be feasible and acceptable to providers and clients (11–14). However, numerous factors and

challenges influence the extent of integration attained within a facility, including health system characteristics, provider and client characteristics, staffing and space constraints, and the cultural context (15–17).

Within health facilities, family planning services may be integrated into child immunization services at the primary and secondary levels. The Nigerian Ministry of Health promotes the integration of family planning into immunization services as an important approach to increasing family planning availability and accessibility (18). The Minimum Standards for Primary Healthcare (MSPH) in Nigeria identify both family planning and immunization services as minimum components of primary healthcare and require provision of these services at all public primary healthcare facilities while advocating that privately owned facilities align with these standards (19). Both immunization and family planning services form part of a standard package of primary healthcare services commonly provided within hospitals.

## **Evidence and Measurement Gaps**

Policy and programming recommendations that promote integrating family planning and child immunization services are often based on insubstantial or conflicting evidence about its impact on health services delivery and patient outcomes (20–23). Given the scarcity of evidence and the resource and planning implications of integration, it is critical to develop context specific evidence that captures the nature, extent, and effects of integration in order to inform policy and program design (9).

The complexity of implementing integrated service delivery and the varied integration models and definitions prompt questions related to how integration and its effects should be measured (24–26). Many studies measure integration as a binary variable (a facility is integrated or not) rather than a multidimensional continuum that varies across time and place (13, 14, 24). Only a few identified studies attempt to measure or rank reproductive health services integration and none, to our knowledge, measure the extent of family planning and child immunization services integration (27, 28). Multi-dimensional, continuous measures of integration are valuable because they enable analyses related to the extent of integration within and across facilities and the effects of varying degrees of integration on service delivery and health outcomes.

This study aims to address the evidence and measurement gap by developing integration indexes that quantify the extent of facility-level family planning and child immunization services integration as a varying and multifaceted outcome. Such indexes may be used to analyze associations between the extent of integration and outcomes such as receipt of services, client satisfaction, and quality of care. The methodological process demonstrated in this study may be adapted by those aiming to better understand the extent of integration within facilities and over time.

## **Methods**

### **Setting and Data Source**

The data for this study were collected by the Measurement, Learning & Evaluation (MLE) project for the impact evaluation of the Nigerian Urban Reproductive Health Initiative (NURHI), a project funded by the Bill & Melinda Gates Foundation that aimed to increase modern family planning use among the urban poor. This study utilizes health facility (N = 400, 49% hospitals, 51% primary healthcare centers) and healthcare provider (N = 1,479) baseline survey data that were collected in Abuja (Nigeria's capitol), Benin City, Ibadan, Ilorin, Kaduna

and Zaria (29). NURHI selected these cities because they include both northern and southern regions of the country and each has a population of approximately, or more than, one million. The northern and southern regions of Nigeria differ in their cultural, economic, and religious characteristics; the north is poorer and predominantly Muslim while the south is more affluent and predominantly Christian.

## **Study Sample**

Two categories of healthcare facilities are included in the sample: high-volume facilities (HVF) and preferred-provider facilities (PPF). HVF and PPF can be either public or private, and they can be either primary or secondary facilities. The sample includes all public facilities in the study cities. HVF, generally the top service delivery sites by client load, offered both antenatal care and immunization services; these facilities served more than 1,000 antenatal clients per year. The NURHI program provided an intervention to all HVF, and all of these facilities are included in the sample (29). PPF were identified from a baseline household survey conducted by MLE that contained a representative sample of 16,144 women aged 15–49. Women were asked the name of each facility where they went for family planning, maternal health, and child health services. Using this information, MLE created a list of facilities that women reported by study cluster (primary sampling unit). The most commonly mentioned facility in each primary sampling unit was categorized as a PPF. If the PPF was already included in the sample as a public facility or an HVF, then the second most-commonly mentioned facility was included. If the second most-commonly stated facility was already in the sample, no additional facility was included. Including the PPFs along with the public facilities and HVFs ensures that the sample includes facilities that women in these urban areas actually visit.

## **Survey Instruments**

This study utilizes instruments developed for the NURHI impact evaluation, which draws upon validated tools selected from the Quick Investigation of Quality (30). Facility and provider surveys were conducted in each facility by trained interviewers hired by Data Research and Mapping Corporation; the MLE project provided technical assistance for training of interviewers. The surveys collected information on the readiness of facilities and providers to offer integrated services, normal family planning service provision practices, gaps in commodities, equipment, training and resources, the extent of family planning integration into maternal, newborn and child health services, and other health facility characteristics. One facility audit was conducted per facility by asking questions of a manager or another administrator. In larger facilities, four providers were selected through simple random sampling to complete the provider survey; in facilities with four or fewer providers, all were approached for interview. Providers eligible for inclusion were medically qualified to provide clinical services and assigned to provide direct family planning and/or maternal, newborn and child health services to clients at that facility.

## **Statistical Method**

This study employs Principal Components Analysis (PCA) to create two family planning and child immunization services integration indexes: a Provider Integration Index and a Facility Integration Index. All analyses were conducted using Stata version 13.1 (Stata Corp, LP, College Station, Texas).

## **Constructing and Interpreting the Indexes**

### *Selection of Variables for Inclusion in the PCA*

Drawing on Mayhew et al (2016), we posit that numerous characteristics and processes interact within a health facility to result in varying degrees of integrated service delivery (26). While the Nigerian Ministry of Health does not provide a specific definition of integrated family planning and immunization services, their 2008 National Guidelines for the Integration of Reproductive Health and HIV Programmes offers this explanation:

Integration in the health sector has been defined by offering two or more services at the same facility during the same operating hour, with the provider of one service actively encouraging clients to consider using the other services during the same visit, in order to make those services more convenient and efficient. Integrated services should be offered at the same point but where that is not possible, strong referral systems are required to ensure that clients receive high quality service (31).

NURHI's Strategy for Integrating Family Planning into Maternal, Newborn, Child Health and HIV/AIDS Services references this guidance (32). This study also refers to this guidance to inform the attributes measured in the indexes. Additionally, we reviewed the integration literature to identify facility-level attributes that support service integration. Several critical attributes emerged, including a) facility norms that support concurrent service provision (e.g., operational management standards and procedures that support the availability of both child immunization and family planning services at the same consultation or on the same day), and b) provider capacity to offer multiple services (e.g., provider(s) has the skills and willingness to offer family planning information or services during a child immunization visit) (22, 26, 33–36).

Because this study was conceptualized after data collection, we leveraged the available data and selected eight indicators for inclusion in the indexes (Table 1). Table 2 describes these and other facility characteristics. A few of these indicators warrant additional explanation. Improving outcomes through integration relies upon both high coverage and quality of integrated services. A substantial body of research links higher quality family planning services with increased contraceptive adoption, prevalence, and continuation; poor family planning service quality can hinder use (37). Therefore, the level of quality provided and the absence of barriers that limit coverage and quality are essential indicators of effective integration (35, 38). We analyzed quality of integrated family planning services by measuring the range and breadth of family planning topics that providers discuss with a client during child health service visits. Because the extent of integration can be influenced by provider bias (39, 40), we include social norm-based service barriers by measuring the extent to which providers at a facility require spousal consent prior to provision of a family planning method during an integrated visit. While numerous such barriers exist and could have been employed in the indexes this is the only variable in our dataset that captures such barriers to family planning specifically during immunization visits.

Table 1  
Description of PCA Input Variables

<b><i>Input Variable Description</i></b>	<b><i>Type</i></b>	<b><i>Survey Source</i></b>
<i>What proportion of providers at facility offer both CI and FP services?*</i>	Continuous between 0 and 1	Provider
<i>What proportion of providers at facility routinely offers FP information during CI or CGM visits*?</i>	Continuous between 0 and 1	Provider
<i>What is the average count of FP items that providers at facility tell client during CHS visits?*</i>	Ordinal between 0 and 7 FP items include: 1) Identify reproductive goals 2) Provide information about different FP methods 3) Discuss the client's FP preferences 4) Help women select a suitable method 5) Educate women to use the selected method 6) Explain side effects 7) Explain specific medical reasons to return 8) Request for partner's consent prior to receipt of FP method	Provider
<i>What proportion of providers at facility do not request partner consent prior to woman's receipt of FP services during CHS visit?*</i>	Continuous between 0 and 1	Provider
<i>Does the facility provide both child immunization and family planning services?</i>	Binary (0 = no, 1 = yes)	Facility
<i>What is the normal practice at this facility if client wants FP information during CHS visit?***</i>	Ordinal between 0 and 7. Responses include: 0) Facility does not provide child health services 1) Facility does provide child health services but does not provide family planning services 2) Client is given no information or referral 3) Client is given referral to another facility 4) No appointment made, client told to return on a different day 5) Appointment made for different day 6) Client sometimes receives information on same day 7) Client always receives information on same day	Facility
<i>What is the normal practice at this facility if client wants hormonal method of FP during CHS visit?***</i>	Ordinal between 0 and 7. Responses include: 0) Facility does not provide child health services 1) Facility does provide child health services but does not provide family planning services 2) Client is given no information or referral 3) Client is given referral to another facility 4) No appointment made, client told to return on a different day 5) Appointment made for different day 6) Client sometimes receives method on same day 7) Client always receives method on same day	Facility

<b><i>Input Variable Description</i></b>	<b><i>Type</i></b>	<b><i>Survey Source</i></b>
<i>What is the score of operational days when both CI and FP services are offered?</i>	Continuous between 0 and 1. Defined as: (Proportion of operational days that child immunization services are provided) multiplied by (Proportion of operational days that family planning services are provided)	Facility
<p><i>Notes:</i> CI: Child 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. In variables referring to CHS visits, it was not possible to differentiate data pertaining only to CI from data pertaining only to CGM. CI visits comprise the vast majority of all CHS visits. Of the 5,440 women who participated in the concurrent health facility client exit interview, only 1.65% report that CGM was the primary purpose of their visit. * Proportion of providers was obtained from the provider survey by taking an average of provider responses to dichotomous survey questions (0 = no, 1 = yes). For example, if two providers responded that they did not routinely offer FP information during a CI or CGM visit and two responded that they did then the facility would score a 0.5 on this item. ** Facility score calculated by adding one point for affirmative responses to items 1–7. ***Facility scores reflect the response, ranked from 0 (low) to 7 (high).</p>		

Table 2  
Facility Characteristics

Characteristic	Percent or Mean Value (SD) <i>N = 400</i>
<i>Ownership</i>	
Publicly Owned	41%
Privately Owned	59%
<i>Level</i>	
Primary	51%
Secondary	49%
<i>Location</i>	
Abuja	12%
Benin	18%
Ibadan	15%
Ilorin	18%
Kaduna	23%
Zaria	14%
Proportion of facilities that offer CI and/or CGM	<i>0.85 (0.36)</i>
Facility provides CI and FP services	0.77 (0.42)
Normal practice if FP info wanted during CH visit	5.82 (2.23)
Normal practice if hormonal FP wanted during CH visit	4.63 (1.97)
Score of days where both CI and FP are offered	0.29 (0.35)
Proportion providers at facility who offer CI and at least 1 modern FP method	0.56 (0.40)
Proportion providers at facility who routinely offer FP info during CI/CGM	0.58 (0.39)

Characteristic	Percent or Mean Value (SD) <i>N = 400</i>
Average FP items that a provider at a facility tells client during CHS	1.67 (1.52)
Proportion providers at facility that do not request partner consent for FP during CHS	0.50 (0.37)
<i>Notes:</i> See Table 1 for complete variable definitions. CI: Child Immunization FP: Family Planning CGM: Child Growth Monitoring CHS: Child Health Service	

Several variables refer to child immunization, child growth monitoring, or child health service visits. Child health services visits include either immunization or growth monitoring visits, but not sick child visits. In variables referring to child health services, it was not possible to differentiate data pertaining only to child immunizations from data pertaining only to child growth monitoring. However, child immunization visits comprise the vast majority of all child health services visits. Of the 5,440 women who participated in the concurrent health facility client exit interview, only 90 (1.65%) report that child growth monitoring was the primary purpose of their visit. Facility-level variables are based on a summary of provider responses. Means were imputed for missing data.

*PCA Application*

PCA was applied following the selection and transformation of variables. Input variables were standardized to a mean of zero and a standard deviation of one prior to the analysis to prevent variables with greater variance from dominating each component. The Kaiser-Meyer-Olkin (KMO) test of sampling adequacy was used to ascertain the suitability of the data for use in a PCA. Our KMO test yielded a score of 0.8, indicating sampling adequacy for each variable and the complete model. Based on evaluation of the eigenvalues (Table 3) and the scree plot (Fig. 1) we retained two components. The factor loading scores (see factor loadings column in Table 4) were examined to determine which dimensions of integration are represented by the components. The scores confirmed the anticipated dimensions: provider integration and facility integration.

Table 3  
Main PCA Results from Analysis of Health Facility Data from Six Cities in Nigeria

<b>Component</b>	<b>Eigenvalue</b>	<b>Proportion of Explained Variance</b>	<b>Proportion of Cumulative Explained Variance</b>
Comp1	4.456	0.557	0.557
Comp2	1.532	0.191	0.748
Comp3	0.795	0.099	0.848
Comp4	0.450	0.056	0.904
Comp5	0.315	0.039	0.943
Comp6	0.256	0.032	0.975
Comp7	0.107	0.013	0.989
Comp8	0.089	0.011	0.999

Table 4  
 Provider and Facility Integration Index Scores and Variable Means by Group

Provider Integration Variable Description	Factor Loading	Sum	Weight	Overall Mean (SD)	Integration Index Score Classification Group Means			p-values	
					Low Score	Medium Score	High Score	Low-Med.	Med. - High
Proportion providers at facility who offer CI and at least 1 modern FP method	0.39	1.87	0.21	0.56 (0.4)	0.05	0.47	0.90	0.00	0.00
Proportion of providers at facility who routinely offer FP info during CI/CGM	0.41	1.87	0.22	0.58 (0.39)	0.04	0.49	0.93	0.00	0.00
Average FP items that a provider at a facility tells client during CHS	0.33	1.87	0.18	1.67 (1.52)	0.14	1.76	3.38	0.00	0.00
Proportion of providers at facility that do not request consent during CHS	0.37	1.87	0.20	0.5 (0.37)	0.04	0.41	0.81	0.00	0.00
Facility provides CI and FP services	0.38	1.87	0.20	0.77 (0.42)	0.23	0.88	0.97	0.00	0.00
Provider Integration Index Score				5.42 (3.10)	0.75 <i>(23% of facilities)</i>	4.99 <i>(32% of facilities)</i>	8.23 <i>(45% of facilities)</i>	0.00	0.00
<b>Physical Integration Variable Description</b>									

	Factor Loading	Sum	Weight	Overall Mean (SD)	Integration Index Score Classification Group Means			p-values	
Normal practice if FP info wanted during CH visit	0.38	1.21	0.32	5.82 (2.23)	0.09	0.91	0.98	0.00	0.00
Normal practice if hormonal FP wanted during CH visit	0.41	1.21	0.34	4.63 (1.97)	0.05	0.80	0.96	0.00	0.00
Score of days where both CI and FP are offered	0.42	1.21	0.34	0.29 (0.35)	0.01	0.11	0.49	0.00	0.00
Physical Integration Index Score				6.22 (2.72)	0.50 <i>(14% of facilities)</i>	6.00 <i>(38% of facilities)</i>	8.10 <i>(48% of facilities)</i>	0.00	0.00

### *Creating the Indexes*

We constructed the Provider Integration Index and Facility Integration Index using weights calculated for each of the variables by dividing its factor loading by the sum of the factor loadings of all variables in that component (see weights column in Table 4). Next, we multiplied the variables included in each component by their associated weights and summed the values. Finally, we calculated the Provider Integration Index score and the Facility Integration Index score for each facility by multiplying these values by ten. The indexes thus range in value from zero to ten, with a higher score indicating a higher level of integration. A sensitivity analysis was conducted to identify the effects of excluding from the sample those facilities that do not offer child immunization (n = 61); there were no statistically significant differences between the indexes that include all facilities versus those with the restricted set of facilities. We retained these facilities in the sample because one goal of the paper is to assess integration across the range of facilities and circumstances represented by our sample. Excluding these facilities would prevent us from knowing the full extent of integration across our sample. Additionally, one key benefit of developing these indexes is the ability to apply them to understand the effects of integration on health and service delivery outcomes. Having a score for facilities that do not offer child immunization allows future research to better identify correlations between level of integration (even very low level) and other outcomes.

As a robustness check, we also created the indexes using Exploratory Factor Analysis. The indexes created using EFA correlate strongly with the indexes created using PCA (Spearman rank correlation 0.99 for the Provider Indexes and 0.89 for the Facility Indexes), indicating that the results are robust to the use of either method.

## Results

Eighty-five percent of facilities offer either child immunization or child growth monitoring services while 77% of facilities provide both family planning and child immunization services (Table 2). On average, 58% of providers in each facility report offering family planning information during child health visits while 56% of providers in each facility have been trained to provide both child immunization and family planning services. Providers addressed fewer than two of the seven elements of family planning service provision during child health visits. Half of providers report requesting partner consent prior to providing family planning at a child health visit.

Index scores vary across facilities (Figs. 2 and 3). Table 4 provides Provider and Facility Integration Index scores and their classifications. The mean Provider Integration Index score is 5.4 (standard deviation: 3.1, range: 0–10) and the mean Facility Integration Index score is 6.2 (standard deviation: 2.7, range: 0–9.9) (Table 4). Each facility was classified as having “low integration” (index score 0–3.29), “medium integration” (3.30–6.59) or “high integration” (6.60–10.00). Twenty-three percent of facilities are classified as having low Provider Integration Index scores, 32% are classified as having medium scores and 45% are classified as having high scores. Mean Provider Integration Index scores are 0.75, 4.99, and 8.23 for the low, medium, and high groups respectively. Fourteen percent of facilities are classified as having low Facility Integration Index scores, 38% have medium scores and 48% have high scores. The mean Facility Integration Index scores are 0.50, 6.00, and 8.10 for the low, medium, and high groups respectively.

### *Index Coherence and Robustness*

We examined the internal coherence of the indexes by comparing facility characteristics and index scores across low, medium, and high integration groups (41). We note significant differences in facility characteristics and overall index scores across all groups for both indexes, indicating that both indexes have strong internal coherence (see p-values in Table 4).

We assessed the robustness of the indexes by examining how the classifications of facilities having high Integration Index scores changed when different sub-sets of variables were entered into the PCA (41). To assess the robustness of the Provider Integration Index, we ran 6 variations of the PCA. The first variation (“base case”) included all variables. Each subsequent model omitted one of the provider integration variables. Similarly, to assess the robustness of the Facility Integration Index, we ran 4 variations of the PCA. The first variation (the “base case”) included all variables. Each subsequent model omitted one of the facility integration variables. Looking only at the sites classified as “high integration” in the base case, we examine the impact on classification when we omit one variable at a time from the PCA. Table 5 shows the percentage of facilities classified as “high integration” in the base case compared with the percentage of facilities classified as “high integration” in the subsequent models. The Provider Integration Index is highly robust to the inclusion of different sub-sets of variables in the model. This is evidenced by the very similar classification results across models.

Table 6 presents the same results for the Facility Integration Index. Unlike the Provider Integration Index, the Facility Integration Index shows considerable sensitivity to the different sub-sets of variables included in the PCA models. When the variables indicating normal practices at the facility are omitted, the Facility Integration Index score shifts towards the mean value of the score of operational days when both child immunization and family planning services are offered. Based on these assessments, we retained all base case variables in the model in order to reflect more characteristics of provider and facility integration (42).

Table 5

Provider Integration Index Score Classification Differences in Facilities with High Provider Integration Index Scores Following Use of Variable Sub-Sets in the PCA

Provider Integration Index Score Classification	Index Score	Base case: all variables	Omitted Variable				
			Proportion providers who offer CI and at least 1 modern FP method	Proportion providers who routinely offer FP info during CI/CGM	Average FP items that a provider tells client during CHS	Proportion providers who do not request partner consent during CHS	Facility provides both CI and FP
Low	0.00–3.29	0%	0%	0%	0%	0%	0%
Medium	3.30–6.59	0%	7%	5%	0%	5%	24%
High	6.60–10.00	100%	93%	95%	100%	95%	76%

Table 6

Facility Integration Index Score Classification Differences in Facilities with High Facility Integration Index Scores Following Use of Variable Sub-Sets in the PCA

Facility Integration Index Score Classification	Index Score	Base case: all variables	Omitted Variable		
			Normal practice if FP information is wanted during CH visit	Normal practice if hormonal method of FP is wanted during CH visit	Score of days when both CI and FP are offered
Low	0.00–3.29	0%	0%	0%	0%
Medium	3.30–6.59	0%	55%	55%	1%
High	6.60–10.00	100%	45%	45%	99%

Integration Index Scores Following Use of Variable Sub-Sets in the PCA

## Discussion

Integration of family planning and immunization services is complex and challenging, and evidence about its effects on service delivery and health outcomes has been inconsistent. Previous research on the integration of

family planning and child immunization has designated health facilities as integrated or not based on whether the facility received an intervention intended to increase integration. This study takes a novel approach by developing indexes that offer continuous measures of facility-level family planning and child immunization services integration and using the indexes to identify the extent of integration within a sample of 400 health facilities. Measuring the degree of integration is valuable as a means of monitoring health facility and system performance. Over time, such measurement will enable clearer understanding of the extent, patterns and adoption of integration as well the effect of integration on service delivery and health outcomes.

The index scores and classifications suggest that facility norms and provider capacity to support integrated family planning and child immunization service delivery varies considerably across our sample. The identification of two distinct dimensions of integration, the heterogeneity of the scores and the substantial percentage of facilities within each integration index classification level, suggests that measuring integration as a binary variable, as is the status quo, does not reflect the true variation in integration within and across health facilities in urban areas of Nigeria.

The development of the integration indexes required us to take a detailed look at provider and facility characteristics in each index. Several characteristics warrant particular attention. First, the majority of facilities with low Provider Integration Index scores ( $n = 94$ ) do not provide both child immunization and family planning services, which is essential to integration. While we considered excluding these facilities from the sample, we opted to retain them because doing so enables description of the full spectrum of integration across our sample. Additionally, one benefit of these indexes is the ability to apply them to analyze the evolution of integration and its effects on a variety of outcomes. Having the complete range of scores allows future research to track integration in all of the facilities and identify correlations between level of integration (even very low level) and other outcomes. Lastly, we retained these facilities in the sample because the Minimum Standards for Primary Healthcare in Nigeria stipulate that primary healthcare centers should provide both services, and both services form part of a standard package of primary health services provided by hospitals. Our results show that it is primarily private facilities that do not provide both family planning and immunization services. The private sector provides a substantial amount of health services in developing countries, including in urban areas of Nigeria (43). Thus, it is important to understand its capacity to provide integrated services and consider how private sector facilities might implement integration. Secondly, the relatively low mean score of the operational days when both child immunization and family planning services are offered (mean = 0.29, range = 0–1) indicates that even facilities that offer both of these services do not do so at the same time. Policies and programs supporting the integration of family planning and child immunization services could improve integration levels by initially focusing on this essential aspect. For example, such policies and programs could ensure that facilities reliant on cold-boxes delivered on specific days provide a full range of family planning services on immunization days.

Another factor we observed is the high percentage of providers requiring partner consent prior to providing a method of contraception. Our results show that 50% of providers report requiring partner consent during integrated visits; the percentage varies by method. This substantial barrier to family planning service during integrated visits warrants additional investigation. Finally, it is important to consider the quality of family planning services when they are integrated into immunization services. Our results indicate a low quality of family planning information provided to women during integrated visits. While integration may offer benefits,

such as decreased need for repeat visits, it also presents challenges, such as potentially insufficient staffing, consultation time, or clinic space that could compromise service quality. Policies and programs promoting integration should ensure sufficient support to individual providers and facility systems to ensure that high quality family planning services are delivered during integrated appointments.

This study has several limitations. First, while the Nigerian Ministry of Health promotes the integration of family planning and child immunization services, it does not provide a precise definition of it. We therefore relied upon Nigeria's 2008 National Guidelines for the Integration of Reproductive Health and HIV Programmes, the NURHI integration strategy, and the broader integration literature to shape the attributes included in the indexes. This issue has challenged previous research; the lack of precise definitions of integration has long complicated its measurement (44). Also, because this was a secondary analysis, we could not examine potentially-important variables such as commodity availability, other logistic factors (e.g., constraints related to cold-box delivery schedules) and various service barriers during integrated visits (e.g., influence of vaccinator characteristics, such as sex, on integrated service delivery). Additionally, the provider and facility survey responses may be subject to social desirability bias. This may lead to integration index scores that overestimate the actual level of provider and facility integration of family planning and child immunization services. Last, our results are specific to our sample and are not generalizable to all facilities in Nigeria or other contexts. For example, because of NURHI's focus on high volume facilities, the sample includes 49% hospitals and thus over represents secondary facilities, which comprise 12% of total health facilities in Nigeria (45).

Notwithstanding these limitations, this research advances the conversation about how to measure integration by describing the development of more nuanced measures of integration that identify facility and provider attributes that support integrated service delivery. Such indexes are valuable because they allow for more detailed measurement of the determinants and effects of integration over time. This research also describes the nature and extent of family planning and child immunization services integration in six cities 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

The purpose of this paper is to demonstrate the development of novel indexes that may be adapted and applied to measure integration along a continuum, and to apply these indexes to describe the extent of family planning and child immunization integration across a large sample of primary and secondary health facilities. Results show that integration varies across facilities; thus, measuring integration as a binary variable (either a facility is integrated or it is not) does not capture this variation. The index scores provide more accurate measures of integration that allow for individual facility scoring and ranking; the components within the indexes enable even more nuanced analyses to inform policy and program strengthening. These integration indexes may be adapted and employed to enrich understanding of integration levels within and across health facilities and also to investigate the effect of integration on a range of service delivery and health outcomes. Those wishing to use the methodology outlined in this paper will have to use, adapt, or conduct a survey suited to their purposes. Some widely used surveys offer opportunity to adapt this methodology to analyze integration of family planning into other services. For example, the DHS Program's Service Provision

Assessment (SPA) and the PMA surveys include indicators that assess service availability, provider training and/or scope of practice, and client receipt of family planning information and services during other consultations, though not immunization services. With these other survey tools, a similar non-binary index of integration can be created to assess family planning integration into other reproductive health services.

This research underscores the need for policies and programs seeking to promote or improve integration to start with a clear, context-specific definition and approach that recognizes the dual provider and facility dimensions. The definition should align with specific Ministry of Health and program objectives and strategies and should be captured in data collection initiatives from the outset. While the method outlined in this paper is most appropriate for programs that include a large number of facilities and have the necessary data collection and analytic expertise, smaller programs may incorporate some of the approaches highlighted in this paper. Such programs can articulate a precise and context-specific definition of integration and ensure that project implementation and routine monitoring and evaluation activities capture this definition. Future research should analyze the determinants of integration and the effects of varying degrees of integration on service delivery and health outcomes. While this research focuses specifically on service delivery within health facilities, further research should examine how health systems pillars such as governance, human resources, logistics, financing, and information management systems influence integrated service delivery. A more robust evidence base is essential to the development of integration policies and programs that will increase contraceptive prevalence among postpartum women to promote healthy birth spacing and, ultimately, reduce maternal and infant morbidity and mortality globally.

## Abbreviations

### AIDS

Acquired Immune Deficiency Syndrome; CI:Child Immunization; EFA:Exploratory Factor Analysis; FP:Family Planning; HIV:Human Immunodeficiency Syndrome; HVF:High Volume Facility; IMR:Infant Mortality Rate; KMO:Kaiser-Meyer-Olkin; MLE:Measurement, Learning & Evaluation; MMR:Maternal Mortality Rate; MSPH:Minimum Standards for Primary Healthcare; NURHI:Nigerian Urban Reproductive Health Initiative; PCA:Principal Components Analysis; PPF:Preferred Provider Facility; SD:Standard Deviation; WHO:World Health Organization

## 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 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

### **Data availability:**

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.

### **Funding:**

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### **Authors' contributions:**

KS led the design and implementation of research, data analysis, interpretation of results and manuscript writing. JOM contributed to data analysis and interpretation of results. IS provided critical contextual, theoretical, and methodological guidance and expertise. 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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Not applicable

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## Figures

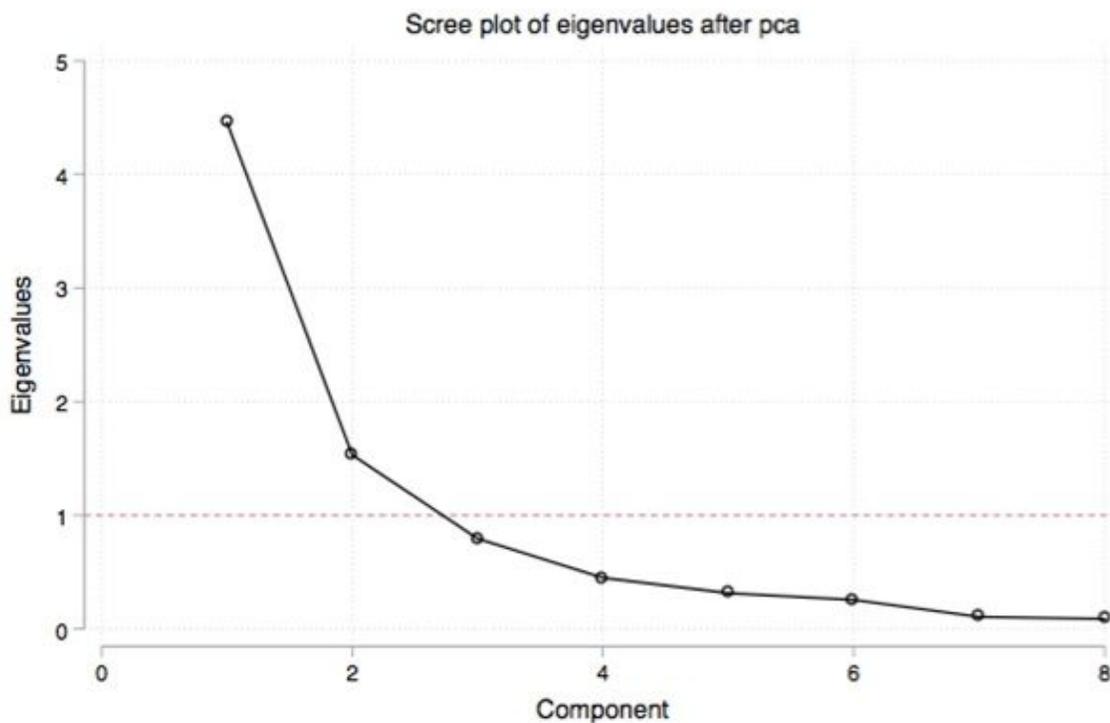


Figure 1

Scree Plot of Eigenvalues after PCA

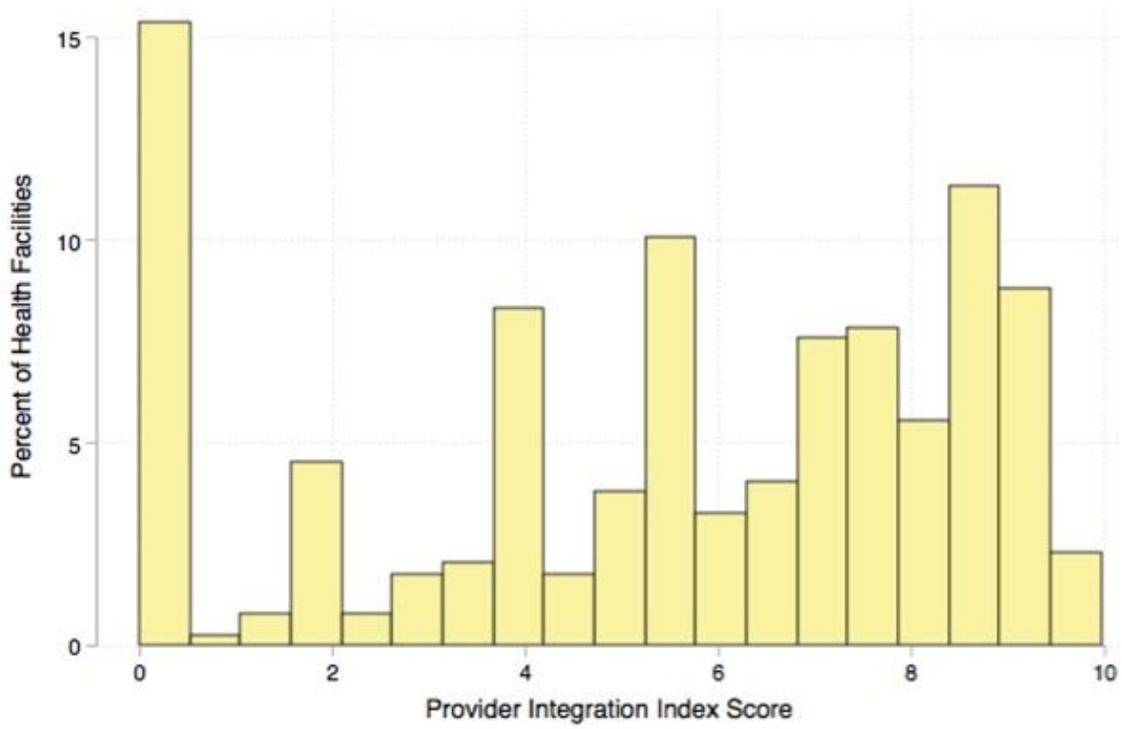
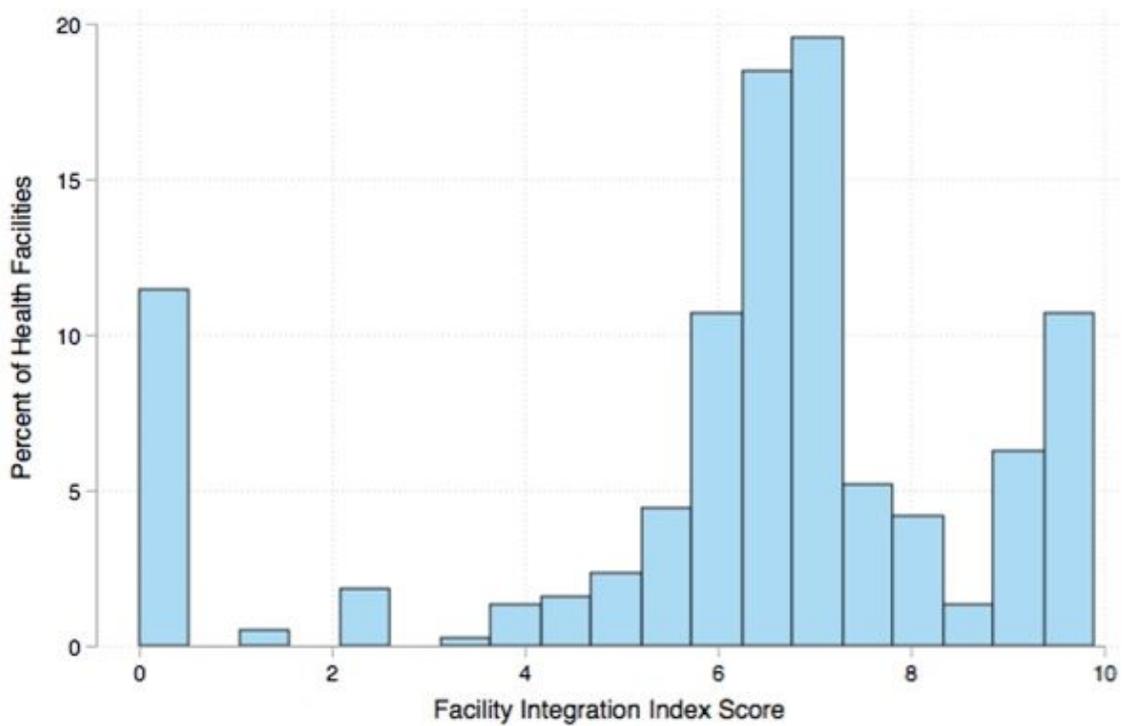


Figure 2

Provider Integration Index Scores



## Figure 3

Facility Integration Index Scores

## Supplementary Files

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