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ABSTRACT

Early initiation of breastfeeding (within an hour of birth) has numerous benefits for newborn health and survival. Optimal breastfeeding supports child growth, health, and development. Health facilities provide essential pregnancy, maternal, and newborn care services and offer support for early breastfeeding. In this study, we examined the relationship between the breastfeeding-related health service environment during antenatal care (ANC) and early initiation of breastfeeding.

Using data from recent Service Provision Assessment (SPA) surveys in Haiti and Malawi, we defined three variables related to the health service environment: availability of facilities with ANC services that report routine counseling on breastfeeding; provider training on breastfeeding; and observation of breastfeeding counseling during ANC and client's report of it. We linked SPA data geographically to corresponding data from the Haiti and Malawi Demographic and Health Surveys (DHS). Multilevel, multivariable logistic regressions examined associations between the three service environment variables and women's early initiation of breastfeeding controlling for women's background characteristics, with separate analyses for urban and rural residence.

Over 95% of facilities in both urban and rural areas of Haiti and Malawi reported routinely providing breastfeeding counseling during ANC. The study found, however, that only 26%-40% of providers had received recent training in counseling on breastfeeding, and only 4%-10% of clients received counseling. Counseling was generally more common among clients who attended ANC with a provider who had received recent training. After linking SPA and DHS data, our analysis showed that having more providers recently trained on breastfeeding was significantly associated with increased odds of early breastfeeding among ANC clients in urban areas of Haiti and Malawi. Additionally, women in urban areas of Malawi who had more counseling during ANC were more likely to initiate breastfeeding within an hour of birth compared with women in areas with less counseling.

Our study identified gaps in the health system's capacity to implement the recommended global guidelines in support of optimal breastfeeding practices. While breastfeeding counseling during ANC can promote early breastfeeding, both the level and the quality of counseling are often inadequate. The study provides evidence that increased provider training could help to improve counseling and support for early initiation of breastfeeding.

Key words: Early initiation of breastfeeding, breastfeeding counseling, antenatal care, service readiness, Service Provision Assessment, Demographic and Health Survey

1 INTRODUCTION

1.1 Background

Breastfeeding supports children's health, growth, and development and could prevent over 800,000 deaths of children under age 5 annually (Rollins et al. 2016; Victora et al. 2016). The World Health Organization (WHO) recommends early initiation of breastfeeding (EIBF), defined as initiating breastfeeding within the first hour of birth (WHO 2017). EIBF protects infants from infection and death and promotes exclusive breastfeeding (Neovita Study Group 2016; Smith et al. 2017). Despite the benefits of EIBF, global progress has been slow. In 2018, only an estimated 42% of children began breastfeeding within an hour of birth (UNICEF 2018; WHO 2017, 2018).

Breastfeeding is influenced by individual, household, community, socioeconomic, health system, and policy factors, including birth size, maternal education, wealth, residence, antenatal care (ANC) attendance, skilled birth attendance, and mode of delivery (Adewuyi et al. 2017; Benedict et al. 2018; Berde and Yalcin 2016; Khan et al. 2017; Ogbo et al. 2017; Patel et al. 2015; Prior et al. 2012; Rollins et al. 2016), although these associations may vary by urban and rural residence (Adewuyi et al. 2017; Bhattacharjee et al. 2019). There are a number of interventions that are known to target many of these factors in order to improve EIBF (Rollins et al. 2016; Sinha et al. 2015). Among these, health systems interventions are the most effective, and have a stronger effect in low and middle income countries than high income countries, as well as in rural areas than urban, according to meta-analyses by Sinha et al. (2015).

One such intervention, the Baby-Friendly Hospital Initiative (BFHI), works to protect, promote, and support optimal breastfeeding practices in health facilities that provide maternal and newborn care services through implementation of the Ten Steps to Successful Breastfeeding, including ANC services (WHO 2017). Systematic reviews have examined the evidence for the impact of BFHI. One of these reviews on studies using data from low-, middle-, and high-income countries, identified improvements in EIBF from structured facility programs, such as the BFHI, compared with standard care (Beake et al. 2012). In another review, BFHI interventions, including skin-to-skin contact and rooming-in, were also found to have a positive impact on EIBF (Sinha et al. 2015). In a systematic review that included low income, middle income and high income countries, a dose-response relationship between each additional BFHI step and improved levels of EIBF was identified (Perez-Escamilla, Martinez, and Segura-Perez 2016). Despite the evidence, BFHI adoption, adherence, and implementation are suboptimal in many countries across most regions (Gupta et al. 2019).

Although the health service environment is an important factor for EIBF, there are few large-scale studies, especially in low and middle income countries, that have examined service environment factors related to quality of care. Khan et al. (2017) examined characteristics of country-level health systems, including government health expenditure and health-worker-to-population ratios, identifying bivariate associations with EIBF in a pooled analysis of 15 countries. Another study by Takahashi et al. (2017) used facility data collected from 24 low and middle income countries in the WHO Global Survey on Maternal and Perinatal Health to assess individual and facility factors related to EIBF, finding that facility characteristics such as location, capacity, ownership, and number of beds were not associated with early breastfeeding, whereas having guidelines for postnatal or neonatal care was associated. The authors postulate that guidelines may

represent quality of care or service delivery which may have a stronger relationship with EIBF than the facility characteristics, which may reflect service readiness but not necessarily service delivery (Takahashi et al. 2017). Neither study, however, included covariates related to quality of care, such as provider-client interactions, for example, as in a smaller scale study conducted in one province of the Democratic Republic of the Congo that found that women who received antenatal counseling on EIBF were significantly more likely to breastfeed in the first hour than those who weren't counseled (Kambale et al. 2018).

Service Provision Assessment (SPA) surveys conducted among the health facilities in a country are used to characterize the institutional environment for various health services. In the SPA, the health service environment is characterized by three parameters: availability of the service within the facility; capacity to provide the service (readiness), including trained providers; and for select services such as ANC, the observation and client report of the service delivery process. The observations and client report of visits can be used to describe the quality of care that clients receive at the facility. The aim of this study is to describe the breastfeeding-related service environment including facility readiness, provider training, and the delivery of services during ANC in Haiti and Malawi, and to link nationally representative SPA and Demographic and Health Surveys (DHS) data to assess the relationship between the breastfeeding-related service environment and EIBF.

1.2 Country Context

In Haiti, less than one percent of facilities have ever been BFHI certified, and information on recertification efforts is sparse (PAHO 2016). Rates of EIBF in the country have remained relatively unchanged, at 47%, between 2000 and 2017 (DHS). In the most recent survey, there were marginal differences in EIBF by place of delivery, skilled assistance at birth, but some variation by wealth and education, where EIBF was more common among lower wealth quintiles and lower maternal education compared with higher wealth and education (Republic of Haiti 2013). The 2013-18 Haiti National Nutrition Strategy Plan outlined six strategic areas to address malnutrition and coordination of multisectoral approaches, but regional monitoring and implementation of the plan have been fragmented (Republic of Haiti 2013; Scaling Up Nutrition 2017).

The rates of EIBF in Malawi are higher than the estimates of global EIBF rates, and have increased from 70% in 2000 to 94% in 2010 but declined to 76% by 2015-16 (DHS). The most recent survey showed there were minor differences in EIBF by place of delivery, where 77% of children born in a facility breastfed in the first hour versus 68% at home; however, 91% of babies were born in a facility; similar to Haiti, babies of lower wealth and education status more often breastfed in the first hour compared with highest socio-economic characteristics. Malawi was an early adopter of the BFHI in 1993 (Kavle et al. 2019). Through the 2007-12 Malawi National Nutrition Policy and Strategic Plan and subsequent 2018-2022 National Multi-Sector Nutrition Policy, the government outlined its multisectoral response to address malnutrition, including promotion of optimal breastfeeding at the facility, community, and household levels(Government of Malawi 2018, 2009). By 2008 almost five percent of facilities were ever certified, but a 2015 evaluation of facilities revealed there were no longer any BFHI certified facilities in the country (Kavle et al. 2019; Malawi Ministry of Health Nutrition Unit 2008). Although funding constraints hampered the implementation of the BFHI in the mid-2000's, recently the government has re-focused on strengthening the BFHI including certification of facilities (Kavle et al. 2019).

2 DATA AND METHODS

2.1 Data

This paper uses data from the 2013 Haiti SPA (IHE and ICF International 2014) and the 2013-14 Malawi SPA (MoH Malawi and ICF International 2014), together with data from DHS surveys conducted within 2-3 years of the SPA, in 2016-17 in Haiti and 2015-16 in Malawi (Cayemittes et al. 2013; NSO/Malawi and ICF 2017). We link data from the SPA with DHS data within the respective countries in order to explore the relationship between the local health service environment and women's practice of EIBF. We chose to analyze data from Haiti and Malawi because both countries have conducted recent, closely timed DHS and SPA surveys. Further, the SPA surveys conducted in Haiti and Malawi were censuses—that is, they included every formal health sector facility rather than just a sample. This census design enables geographic linkage of the health facility data to population data in DHS enumeration areas (clusters) (Burgert and Prosnitz 2014).

SPA surveys provide nationally representative health facility data on service provision for key health services. Facility data from formal sector public, private (for-profit, not-for-profit, nongovernmental, faith-based), and mixed private-public facilities are included, while data from informal outlets such as pharmacies and mobile clinics usually are excluded. The SPA uses four data collection instruments to capture the service environment of facilities: the Facility Inventory Questionnaire assesses the availability and readiness to provide services, e.g., basic infrastructure, equipment, medicines, guidelines, and human resources at the facility. The Health Worker Interview Questionnaire collects information on provider experience, qualifications, training, routine duties, and perceptions of the service environment. The Observation Checklist records the content and quality of selected health care visits, and the Client Exit Interview is conducted with clients whose visit was observed to learn their perceptions on the visit and their understanding of the consultation. The observations of service delivery are specific to the type of health visit and typically include ANC, family planning, and sick child services. The interviewer typically records a maximum of 15 consultations per service per facility, given the availability of clients on the day of the survey.

In this study, we used data from facilities that provide ANC services, including 310 urban and 522 rural facilities in Haiti and 116 urban and 516 rural facilities in Malawi. We examined data on providers at these ANC facilities who provide care that could encompass counseling on breastfeeding practices (antenatal, postnatal, newborn, or child health care). We also used client data from observations of women attending ANC visits, including the records of the observation and the exit interview. Table 1 presents the sample of facilities, providers, and clients in Haiti and Malawi included in the analysis.

Table 1 also shows the number of women studied from the DHS. The DHS Program conducts surveys among households in low and middle income countries approximately every 5 years. Data are representative nationally as well as subnationally by urban and rural residence and by region. Surveys are implemented with a two-stage cluster sampling design. The interviews include women age 15-49. Women with a live birth in the preceding 5 years are asked about the care they received during their pregnancy, birth, and in the postpartum period. We conducted the analysis among women who had a live birth in the 24 months preceding the survey in order to reduce the effects of recall bias and to better synchronize the timing of the

two surveys. For women with more than one birth in the time period, we examined only the most recent pregnancy and live birth. We excluded women who delivered via cesarean section (C-section) and women whose babies who died on the first day of life, as the mother-baby dyad faced complications that may have precluded the ability to breastfeed (Rowe - Murray and Fisher 2002; Takahashi et al. 2017), although this did not eliminate the chance entirely. As the SPA data describe the health care available and provided at facilities offering ANC near clusters of women interviewed in the DHS, we examined data only for mothers who attended ANC at least once during the index pregnancy, to ensure that the population studied was applicable to our linked service environment (Do et al. 2016). In sum, the analysis comprised 357 urban and 1,278 rural women in Haiti and 772 urban and 5,296 women in Malawi.

Table 1 Samples included in the analysis

	Haiti			Malawi		
	Urban[1] N (%)	Rural N (%)	Total N	Urban N (%)	Rural N (%)	Total N
SPA						
Year of survey		2013			2013-14	
Number of facilities with ANC	310 (37)	522 (63)	832	116 (18)	516 (82)	632
Number of health providers	707 (48)	758 (52)	1,465	326 (29)	783 (71)	1,109
Number of ANC clients observed	945 (58)	675 (42)	1,620	587 (28)	1,481 (72)	2,068
DHS						
Year of survey		2016-17			2015-16	
Number of women[2]	357 (22)	1,278 (78)	1,634	772 (13)	5,296 (87)	6,067

[1] Urban includes all urban facilities. However, analysis of women excludes urban women living in Port-au-Prince or rural women within 5 km of Port-au-Prince.
[2] Women analyzed included women with a live birth in the last 2 years, had at least one antenatal care (ANC) visit during their last pregnancy resulting in a live birth in last 2 years, delivered vaginally, and whose newborn survived the first day or longer.

2.2 Methods

2.2.1 Health service environment indicators

To assess the health service environment, we first identified three proxies of quality of care or readiness to provide care relative to breastfeeding at the facility, provider, and client levels. Among facilities that provide ANC, we examined the proportion that reported routine counseling on breastfeeding as part of ANC services. We constructed an indicator from the SPA health worker questionnaire to assess whether the provider had received any recent training related to breastfeeding. Specifically, we examined the proportion of health workers who provide ANC services who received training within the past 24 months on breastfeeding, infant and young child feeding (IYCF), or early and exclusive breastfeeding. We defined the client-level variable as the proportion of clients who were observed to receive counseling on breastfeeding (early initiation, prolonged breastfeeding, or exclusive breastfeeding) and who reported in the exit interview having received counseling on breastfeeding during the observed visit. To reduce the effects of courtesy bias and recall bias, we considered a client to have received counseling only if the observation of counseling and the client's account of it agreed. We presented the prevalence of each of the three indicators by urban and rural location of facilities in each country. We further presented the percentage of clients counseled according to recent provider training—for each type of training individually as well as the combined indicator for any training related to breastfeeding—and tested the differences in counseling using chi square tests of independence.

2.2.2 Linking SPA and DHS surveys

In order to test the association between the health service environment factors and early initiation of breastfeeding, we linked the facility-level data in the SPA surveys to the household-level data for women interviewed in DHS surveys in Haiti and Malawi. To enable linking, we summarized the provider- and client-level indicators within each facility. For providers, we aggregated data to the facility level to create an indicator for number of providers with recent training related to breastfeeding within each facility. For clients, we collapsed the client data to the mean of the facilities and categorized facilities as below average versus average to above average proportions of clients counseled.

After creating facility-level variables for provider and client data, we then summarized all of the facilities within geographic 'zones' around DHS clusters in order to facilitate linking. We created these zones of facilities within a 10 km radius for rural clusters and a 5 km radius for urban clusters, using GPS coordinates of facilities and clusters (Burgert and Prosnitz 2014). Creating zones of facilities using these distances are necessary as The DHS Program displaces GPS coordinates of sampled clusters. This linking process has been described in previous studies (Wang et al. 2015).

We used a slightly different summary calculation for each service environment indicator within each zone. For the service environment indicator for access to health facilities offering ANC that report conducting breastfeeding counseling, we calculated the number of facilities within each zone. For the indicator of access to trained providers, we calculated the average number of recently trained providers at ANC facilities within the zone. For counseling on breastfeeding, we averaged the proportions of clients reporting and observed receiving counseling among facilities within each zone.

We categorized clusters as having no data on facilities within the zone, or as having a low, medium, or high level of service environment for each indicator, using tercile cut points for each urban and rural cluster classification. Although using a continuous measure of the service environment would have been preferable, we categorized clusters in order to maintain the sample of clusters for which there were either no ANC facilities that report routine counseling services, no ANC providers interviewed at the ANC facilities, or no facilities with observations of ANC client visits. Left continuous, these clusters would have been scored as zero or excluded altogether, which would bias the results. For instance, some women with no health facility near their home might not be able to seek care because they lacked access, but others might seek care from a facility farther away. Further, although facilities without observations of any client visits tend to have less structural readiness (Mallick, Temsah, and Wang 2019), it is uncertain, had there been any clients observed in these facilities, whether providers would have counseled them on breastfeeding; service readiness is not necessarily associated with the quality of care provided (Leslie, Sun, and Kruk 2017).

Given the population density of Port-au-Prince (27,395/km^2 within 36 km^2 (IHSI 2015)), and the high concentration of facilities in the capital (Gage et al. 2017), where nearly one fifth of all facilities (174 of 905 facilities) are located (IHE and ICF International 2014), urban women in this city were excluded from the analysis; the 5 km radius might not be precise enough to define the service environment in this setting, where women have greater access to a larger number of facilities. We also excluded clusters of rural women within 5 km of Port-au-Prince, given their proximity to many urban facilities. Thus, 64 clusters of 398 women were excluded from the analysis in Haiti. We therefore describe the urban population in Haiti as "other urban".

2.2.3 Analysis

Our outcome of interest was early initiation of breastfeeding, which was based on responses to a question asked to mothers who ever breastfed, “How long after birth did you first put (NAME) to the breast?” If a woman responded immediately or within the first hour, we defined this as early initiation of breastfeeding. To understand the relationship between early initiation of breastfeeding and the health service environment, we analyzed their bivariate and multivariable relationships. We first presented the background characteristics of women with a birth in the preceding 2 years who attended ANC at least once, delivered vaginally, and whose child survived past the first day of birth, by urban (or other urban in Haiti) and rural residence. We then examined the coverage of EIBF among women by the service environment in their nearby health facility offering ANC—that is, we measured the proportion of women who began breastfeeding within an hour of birth by whether they resided in a cluster with a low, medium, high, or “no data” service environment, based on the three service environment variables: number of proximate facilities (within the respective radius) offering ANC that reported routine counseling on breastfeeding, average number of trained providers within the radius around the cluster, and average proportion of clients counseled. To further visualize the relationships, we apply a model-based geostatistics (MBG) methodology that uses a stacking and ensemble model approach to predict EIBF in order to produce high-resolution spatially interpolated maps for each country. The approach has been previously shown to improve the predictive accuracy of geostatistical models using DHS data (Bhatt et al. 2017; Gething and Burgert-Brucker 2017). These maps were then superimposed with the most relevant indicator of the service environment, as determined post-hoc according to the results of the analysis.

Finally, we conducted multilevel, multivariable logistic regression, by urban (or other urban) and rural residence. Multilevel logistic regression models account for the fact that women who live near on another are not necessarily independent of one another; the models simultaneously test for the effects of both group-level and individual-level effects on individual-level outcomes. In this study, the service environment variables represent group-level factors, while sociodemographic and care-seeking variables are individual-level factors.

Our regression analysis controlled for sociodemographic and care-seeking characteristics of the mother and baby. Maternal characteristics comprised region (Christian; other), wealth quintile regrouped into three categories (lowest and second; middle; fourth and highest), education (no school or primary; secondary or higher), employment (not employed; employed), religion (Christian; other), media exposure (exposed to TV, radio, or newspaper less than once a week; exposed to TV, radio, or newspaper at least once a week), marital status (not married; currently married), and parity (primiparous; multiparous). Characteristics of the child described sex at birth (male; female) and perceived or recorded size at birth (normal; smaller than average; larger than average), where mother’s perception of size was used in the absence of a reported or documented birth weight. Care-seeking variables included number of ANC visits (one to four; four or more), facility delivery by a skilled birth attendant (yes; no), and postnatal check, a proxy for postnatal care (PNC), for either the mother or baby within the first hour of birth (yes; no). A postnatal check includes whether or not a provider, community health worker, or traditional birth attendant checked on the health of either the mother or the baby within the first hour of birth. Although there exists a question specific on postnatal counseling and observation of breastfeeding in the DHS surveys, the time period noted refers to two days after delivery. As our outcome refers to the first hour after delivery, we could not include this as a variable without the risk of the predictor variable proceeding the outcome.

3 RESULTS

In this section we present study results for health facilities in Haiti and Malawi that provide ANC, including the percentage that report routinely counseling on breastfeeding, have providers with recent training in counseling on breastfeeding, and were observed to provide counseling on breastfeeding during ANC. After linking SPA and DHS data, we then examine the association between EIBF and the health service environment.

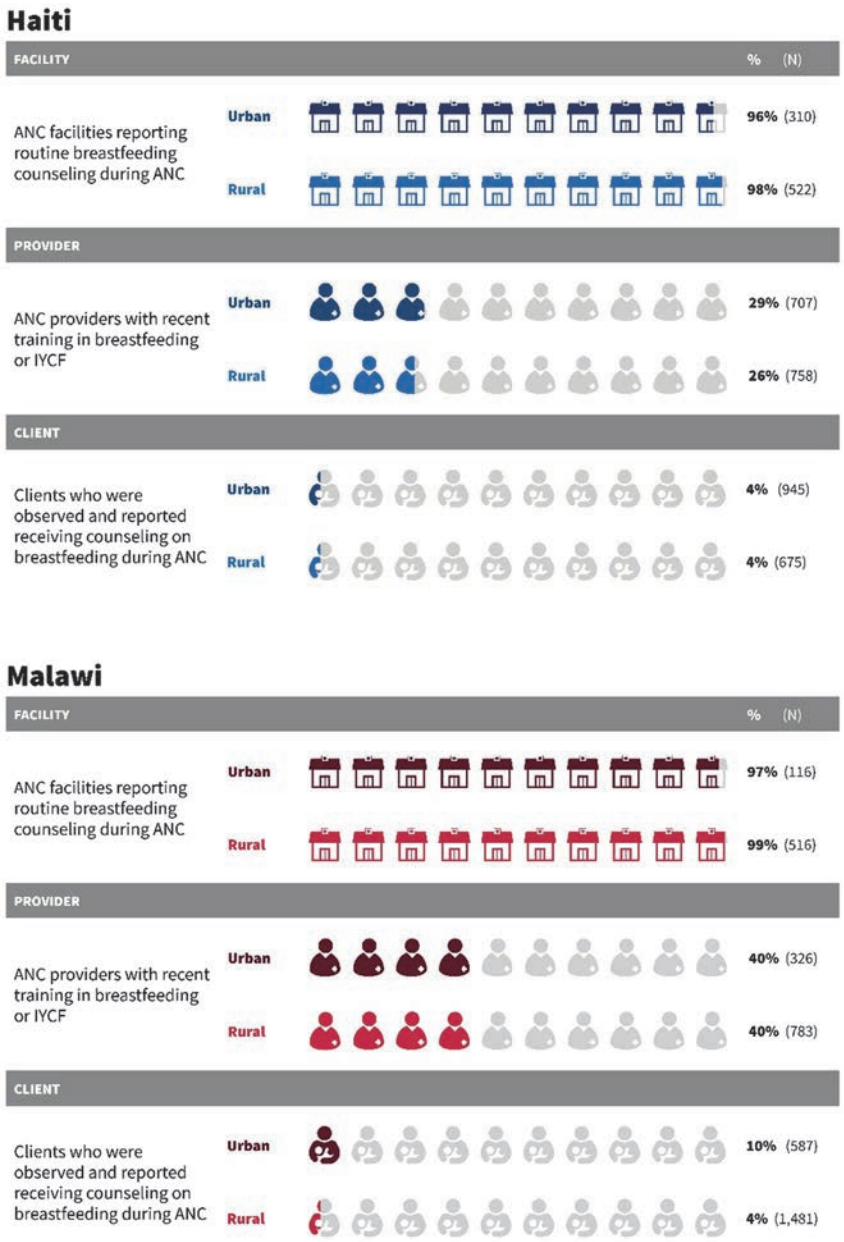
Appendix Table 1 presents the characteristics of the facilities in our analysis, by country and urban and rural location. The characteristics varied by the type of facility (hospital; health center; and dispensary, clinic or other), managing authority (public, private nonprofit, and private for profit or other), and department or region of the country. In Haiti, health centers constituted the majority of facilities in urban areas (65%) while in Malawi, facilities comprised mainly health centers in rural areas (80%) and were the least common in urban areas (24%). Facilities were fairly evenly distributed by managing authority in urban areas of both countries, although in rural areas of both countries, government facilities were the most prevalent (44% in Haiti and 67% in Malawi).

3.1 Readiness to Offer Counseling on Breastfeeding during ANC and Provision of Counseling

Figure 1 shows the percentage of facilities with readiness to offer counseling on breastfeeding, the level of training on breastfeeding among providers, and counseling about breastfeeding provided during ANC, by urban and rural location in Haiti and Malawi. In Haiti, among facilities that provide ANC, 96% of urban facilities and 98% of rural facilities reported in the SPA inventory that they routinely provide counseling about breastfeeding as part of ANC services. Twenty-nine percent of ANC providers at urban facilities and 26% of ANC providers at rural facilities reported having attended recent training related to breastfeeding or IYCF. While almost all facilities in Haiti reported that counseling on breastfeeding was a routine practice during ANC, only 4% of both urban and rural clients in fact were observed to have received counseling during ANC and reported receiving it. As counseling on breastfeeding increases in relevance to ANC visits attended later in pregnancy (WHO 2002), we calculated the proportion of women counseled among women attending ANC in their third trimester (N=557) and found that the proportion increased only to 5% (results not shown). Even among women 36-41 weeks pregnant, only 5% were counseled and reported having received the counseling (N=140).

Malawi shows similar findings for routine breastfeeding counseling, training on breastfeeding, and counseling on breastfeeding during ANC. Nearly all facilities reported that breastfeeding counseling is part of their routine care during ANC, at 97% and 99% in urban and rural facilities respectively. In rural and urban areas alike, 4 out of every 10 ANC providers reported recent training related to breastfeeding or IYCF. Also similar to Haiti, few clients were counseled about breastfeeding during ANC—10% of clients attending urban facilities and 4% of clients attending rural facilities. In Malawi as well, we examined the proportion of women counseled in the third trimester (N=1,208) and at 36-41 weeks pregnant (N=210) and, as in Haiti, found that only 5% and 4% of clients, respectively, were counseled (results not shown).

Figure 1 Readiness to provide breastfeeding counseling and provision of counseling among facilities, providers, and clients, Haiti and Malawi

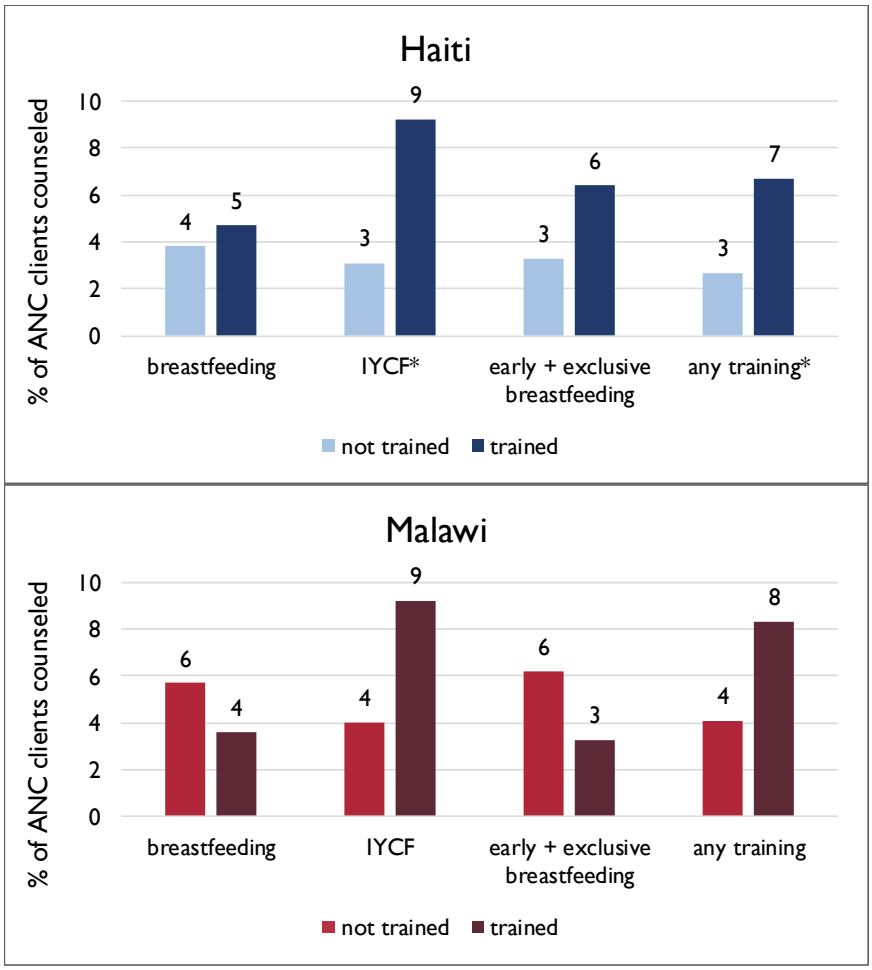


Note: ANC = antenatal care; IYCF = infant and young child feeding

Figure 2 shows the percentage of ANC clients counseled on breastfeeding by whether their provider had received recent training related to breastfeeding, including general breastfeeding, IYCF, early and exclusive breastfeeding, or any one of those trainings. In Haiti, for each type of training as well as the composite indicator, levels of counseling were higher among clients whose provider had recent training, with significant differences for training related to IYCF and for any relevant training (p-value < 0.01). The proportion of clients counseled was three times higher among clients who saw a provider with recent IYCF training than among clients who saw a provider without recent training (9% versus 3%), and counseling

was more than twice as common among clients whose provider had any one type of training compared with clients whose provider had no training (7% versus 3%). Similarly, in Malawi 9% of clients whose provider had received recent training in IYCF were counseled compared with 4% of clients whose provider had not, and 8% of clients whose provider had any training were counseled versus 4% of clients whose provider had no training. However, in Malawi the differences were not significant (p-value > 0.05), and for two of the trainings (breastfeeding and early or exclusive breastfeeding) the level of counseling was higher among clients who saw an untrained provider.

Figure 2 Percentage of ANC clients counseled by provider training according to SPA observations, Haiti and Malawi



Note: * p-value < 0.01; SPA = Service Provision Assessment; ANC = antenatal care; IYCF = Infant and young child feeding

3.2 Linked Analysis: The Relationship between the Health Service Environment and Early Breastfeeding

We linked SPA facility-level data to DHS clusters for each service environment indicator. Appendix Table 2 shows the number of facilities, average number of providers at facilities, and average proportion of clients counseled within each low, medium, and high tercile respective to place of residence among clusters with linked facilities. Table 2 shows the sociodemographic background characteristics, as well as care-seeking

and service environment characteristics by urban-rural residence and country. In both countries, the majority of women in urban areas were in the fourth and highest wealth quintile and had secondary or higher education. This contrasted with rural areas, where the majority of women were in the lowest and second-lowest wealth quintile and had no or primary education. In Haiti, only 26% of rural women delivered in a health facility and by a skilled attendant; however, in both urban and rural women, nearly all women received these services at delivery, 96% and 90%, respectively. In urban and rural settings of both countries, less than 40% of women reported PNC for either the mother or baby in the first hour. For the service environment characteristics, due to universally infrequent counseling, the lack of variation across clusters resulted in cluster classifications of “no data”, “low”, and “high” only. The category “no data” refers to areas with facilities offering ANC that either had no providers interviewed who provide ANC, or had no observations of women attending ANC on the day of the survey.

Table 2 Percent distribution of women who had a birth in the last 2 years by sociodemographic characteristics

	Haiti[1]		Malawi	
	Other urban	Rural	Urban	Rural
Region (Haiti)				
Ouest	7.4	20.4		
Sud-Est	3.8	8.1		
Nord	22.1	10.6		
Nord-Est	10.3	3.9		
Artibonite	26.6	19.7		
Centre	10.0	10.4		
Sud	5.5	8.7		
Grand-Anse	6.3	6.2		
Nord-Ouest	6.5	7.8		
Nippes	1.5	4.3		
Region (Malawi)				
Northern			9.6	11.4
Central			40.6	42.7
Southern			49.8	45.9
Wealth quintile				
Lowest and second	11.6	68.9	4.8	55.6
Middle	28.5	21.0	6.0	21.9
Fourth and highest	60.0	10.2	89.1	22.5
Education				
None or primary	36.5	67.6	46.3	85.1
Secondary or higher	63.5	32.4	53.7	14.9
Employment				
Not employed	44.8	42.0	44.7	29.5
Employed	55.2	58.0	55.3	70.5
Religion				
Christian	89.7	85.9	34.0	29.5
Other	10.3	14.1	66.0	70.5
Exposure to mass media				
Less than once per week	66.6	69.1	43.1	69.9
At least once per week	33.4	30.9	56.9	30.1

(Continued...)

Table 2—*Continued*

	Haiti[1]		Malawi	
	Other urban	Rural	Urban	Rural
Currently married				
No	17.4	13.0	16.5	16.2
Yes	82.6	87.0	83.5	83.8
Parity				
Primiparous	35.7	28.2	33.2	25.8
Multiparous	64.3	71.8	66.8	74.2
Size of baby at birth				
Normal	55.3	50.1	46.5	46.9
Small or very small	24.2	31.6	11.6	20.0
Large or very large	20.5	18.3	41.9	33.1
Sex of child				
Male	50.4	50.0	48.5	50.3
Female	49.6	50.0	51.5	49.7
Number of ANC[2] visits				
One to three	16.2	36.0	44.2	52.9
Four or more	83.8	64.0	55.8	47.1
Both SBA and facility delivery				
Neither or just one	48.4	73.9	4.5	10.1
Both	51.6	26.1	95.5	89.9
Mother or baby postnatal check in the first hour				
No	64.7	79.5	61.1	62.3
Yes	35.3	20.5	38.9	37.7
ANC facilities reporting breastfeeding counseling				
No data	0.0	0.0	0.0	2.2
Low	40.4	35.7	31.9	54.6
Medium	33.1	33.0	32.0	19.8
High	26.5	31.3	36.0	23.3
Access to trained providers				
No data	0.0	0.0	0.0	2.8
Low	37.3	32.4	34.9	35.1
Medium	33.3	32.1	34.0	29.8
High	29.4	35.4	31.1	32.2
Average facility breastfeeding counseling				
No data	12.4	4.6	1.5	14.9
Low	63.6	67.6	66.9	67.7
High	24.0	27.8	31.7	17.4
Number of clusters	**92**	**284**	**171**	**675**
Number of women[3]	**357**	**1,278**	**772**	**5,296**

Note: ANC = antenatal care; SBA = skilled birth attendant; PNC = postnatal care
[1] Excludes urban women living in Port-au-Prince or rural women within 5 km of Port-au-Prince.
[2] Includes women who had at least one ANC visit, who delivered vaginally, and whose baby survived past the day of birth.

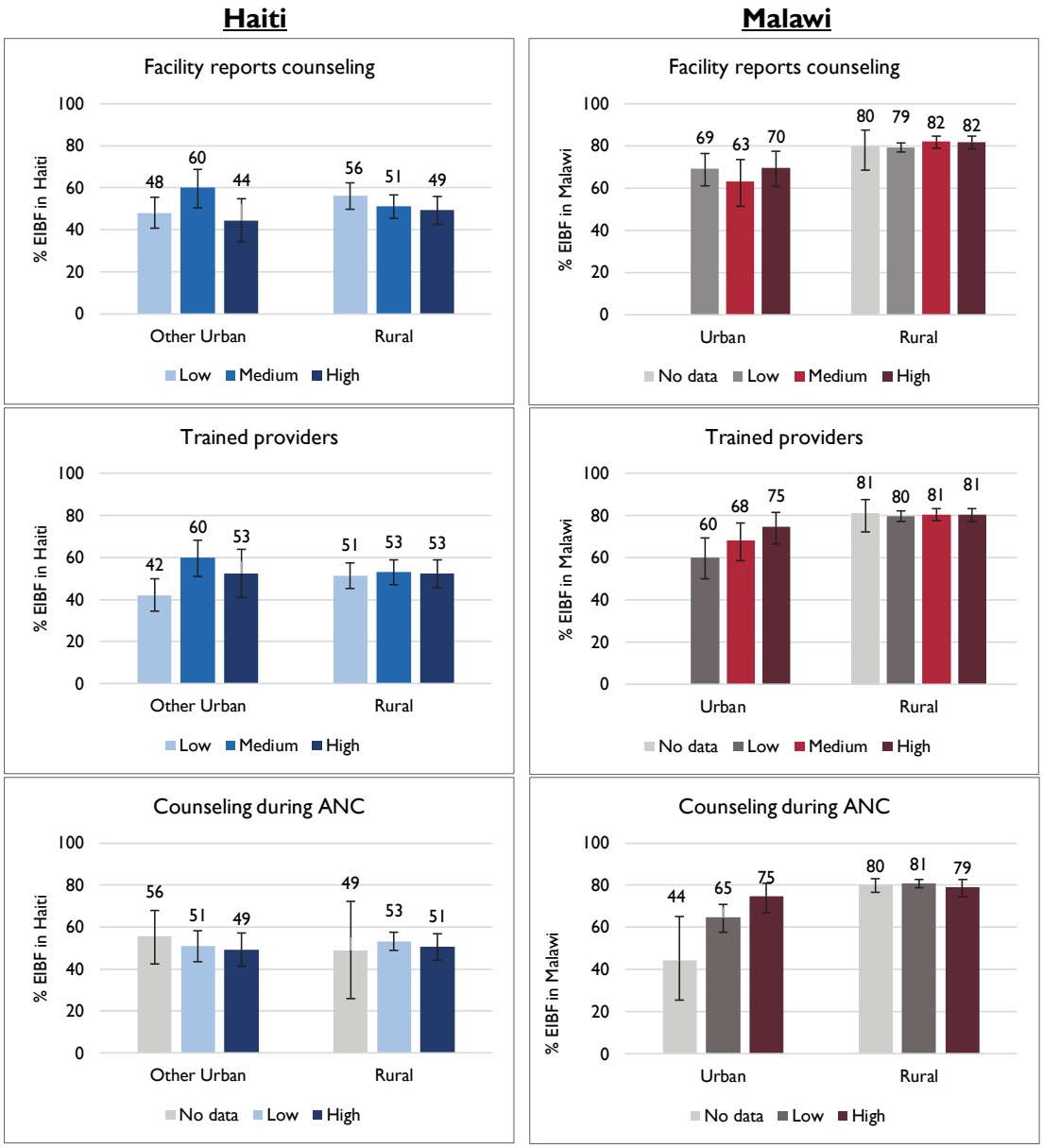
Figure 3 presents the proportion of women in Haiti and Malawi who practiced EIBF for their most recent birth, by each service environment factor. In Haiti, no obvious relationships appear between service environment factors and EIBF, except for an association with trained providers, whereas for the other urban areas category there is a difference of 18 percentage points in EIBF between women with low access to trained providers (42%) and women with medium access (60%), and a difference of 11 percentage points between having low access and high access (53%). Similarly, in urban areas of Malawi, 60% of women with low access to trained providers practiced EIBF compared with 68% of women with medium access and 75% of women with high access. Regarding EIBF by receipt of counseling on breastfeeding during ANC, Figure 3 shows that in Malawi a lower percentage of urban women in DHS clusters with no facilities offering ANC or with no ANC clients observed at nearby health facilities practiced EIBF (44%), compared with 65% of women in clusters with a low level of counseling and 75% of women in clusters with a high level of counseling on breastfeeding.

Figure 4 reflects the spatially interpolated surfaces of early initiation of breastfeeding in Haiti and Malawi superimposed with the facility categorization of trained providers respective to urban and rural areas. The maps show that the geographic variation in EIBF is greater in Malawi than in Haiti. Neither map revealed distinct differences in variation of EIBF by provider training within facilities; however, the maps did not distinguish between urban and rural residence or facilities.

Table 3 shows the results of the adjusted multilevel logistic regression assessing the associations between early breastfeeding and the health service environment, as well as other sociodemographic and care-seeking covariates. Appendix Table 3 includes the unadjusted results. In both Haiti and Malawi, we found no evidence of an association between the service environment factors and EIBF in rural areas. In Haiti, we found limited evidence of any relationships between service environment and EIBF. The only significant association identified between service environment and EIBF was for access to ANC providers with recent training on breastfeeding. In other urban areas of Haiti, women with medium and high access to trained providers had over twice the odds of EIBF compared with women with low access. This relationship was statistically significant (p-value < 0.01) for women with medium access (AOR = 2.2, CI: 1.3-3.5) but not for women with high access (AOR = 2.1, CI: 1.0-4.5).

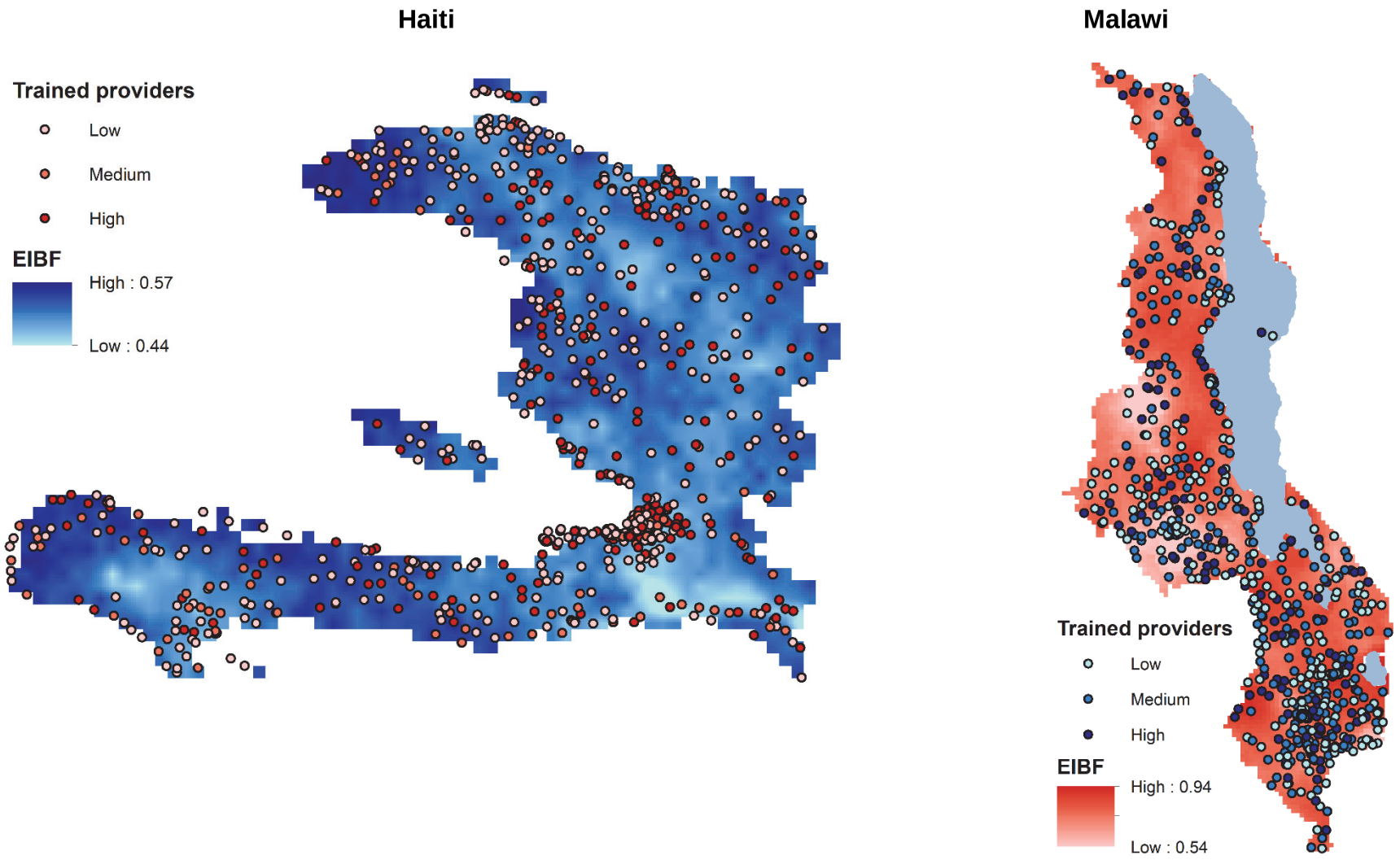
In Malawi, we also identified a significant, positive relationship between EIBF and access to trained providers in urban areas. Women in urban clusters with high access to trained providers had over twice the odds of breastfeeding within the first hour compared with women with low access (AOR = 2.1, CI: 1.1-4.0). Additionally, urban women in clusters where clients were most often counseled on breastfeeding during ANC had nearly twice the odds of EIBF compared with women in clusters with the lowest level of counseling (AOR = 1.9, CI: 1.0-3.5), and urban women in clusters with “no data” (no facilities or facilities with observation of women attending ANC) were significantly less likely than women in clusters with low counseling on breastfeeding during ANC (AOR = 0.3, CI: 0.2-0.7).

Figure 3 Breastfeeding in the first hour by health service environment factors, Haiti and Malawi



Note: ANC= antenatal care; EIBF = early initiation of breastfeeding

Figure 4 **Geographic variation in early initiation of breastfeeding and level of provider training at health facilities, Haiti and Malawi**



We found mixed significant relationships across the two countries and by urban and rural residence between EIBF and care-seeking and other demographics. In other urban areas of Haiti, women with four or more ANC visits (compared with one to three visits) had a 50% reduction in the odds of EIBF (AOR = 0.5, CI: 0.3-0.9), although PNC for the mother and baby was positively associated with EIBF (AOR = 1.9, CI: 1.0-3.7). In rural Haiti, however, ANC or PNC were not significantly associated with early breastfeeding. Also, in rural areas of Haiti we found a reduced likelihood of EIBF among women in the wealthiest (fourth and fifth) household income quintiles (AOR = 0.5, CI: 0.3-0.9) compared with the lowest and second-lowest quintiles. Employed women in rural Haiti had increased odds of EIBF (AOR = 1.4, CI: 1.1-1.8) compared with unemployed women.

In Malawi, we found significant but different associations between EIBF and care seeking as well as other demographic characteristics. Women in urban and rural areas who did not deliver with assistance by a skilled birth attendant (SBA) at a health facility were less likely to practice EIBF compared with women delivering in a facility with an SBA (urban AOR = 0.3, CI: 0.1-0.9; rural AOR = 0.7, CI: 0.5-0.9). However, women or babies who had a postnatal check in the first hour compared with those who did not were less likely to initiate breastfeeding within the first hour (AOR = 0.5, CI: 0.3-0.8). In urban Malawi, women who were exposed to the media at least once a week had a twofold increase in the odds of EIBF compared with women with media exposure less than once a week (AOR = 2.0, CI: 1.1-3.7). Women with large or very large babies at birth were less likely to practice EIBF compared with women with normal-sized babies (AOR = 0.5, CI: 0.3-0.9). In rural areas, women giving birth to their first child were less likely to breastfeed immediately compared with those who had also given birth previously (AOR = 0.8, CI: 0.6-1.0).

Table 3 Results of multivariable logistic regressions of early initiation of breastfeeding for the most recent birth in the 2 years preceding the survey, Haiti and Malawi

	Haiti				Malawi			
	Other urban		Rural		Urban		Rural	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Department: Haiti (ref=Artibonite)								
Ouest	0.7	0.2 - 2.8	0.8	0.5 - 1.5				
Sud-Est	0.6	0.2 - 2.4	0.6	0.3 - 1.1				
Nord	0.9	0.5 - 2.0	1.4	0.8 - 2.4				
Nord-Est	0.9	0.4 - 2.1	0.7	0.4 - 1.2				
Centre	0.8	0.4 - 1.9	**0.4****	0.2 - 0.8				
Sud	**0.3***	0.1 - 0.9	1.0	0.5 - 1.9				
Grand-Anse	2.7*	1.2 - 6.0	0.8	0.4 - 1.7				
Nord-Ouest	1.2	0.5 - 2.9	1.1	0.6 - 2.1				
Nippes	0.6	0.2 - 1.8	0.9	0.4 - 1.9				
Region: Malawi (ref=Northern)								
Central					**0.2*****	0.1 - 0.3	**0.7****	0.5 - 0.9
Southern					**0.4***	0.2 - 0.9	1.1	0.8 - 1.5
Wealth quintile								
Lowest and second	**0.3***	0.1 - 0.8	ref		0.79	0.35 - 1.75	ref	
Middle	0.7	0.4 - 1.3	0.7	0.5 - 1.1	1.7	0.6 - 4.8	1.0	0.8 - 1.3
Fourth and highest	ref		**0.5***	0.3 - 0.9	ref		0.9	0.7 - 1.2
Education (ref=none or primary)								
Secondary or higher	0.8	0.5 - 1.3	1.1	0.8 - 1.5	1.0	0.6 - 1.8	1.0	0.8 - 1.4
Employment (ref=not employed)								
Employed	1.1	0.7 - 2.0	**1.4****	1.1 - 1.8	1.0	0.5 - 1.7	0.9	0.7 - 1.1
Religion (ref=Christian)								
Other	1.4	0.7 - 2.9	0.8	0.5 - 1.3	1.3	0.9 - 2.0	0.9	0.8 - 1.1
Exposure to mass media (ref=less than once per week)								
At least once per week	1.1	0.6 - 1.8	1.0	0.7 - 1.4	**2.0***	1.1 - 3.7	1.0	0.8 - 1.2
Currently Married (ref=yes)								
No	1.4	0.7 - 2.8	0.7	0.5 - 1.1	0.7	0.4 - 1.3	1.2	1.0 - 1.6
Parity (ref=multiparous)								
Primiparous	0.7	0.4 - 1.2	0.8	0.6 - 1.1	0.6	0.3 - 1.0	**0.8***	0.6 - 1.0
Size of baby at birth (ref=normal)								
Small or very small	0.7	0.4 - 1.2	1.0	0.8 - 1.4	0.9	0.4 - 2.0	0.8	0.6 - 1.1
Large or very large	0.7	0.4 - 1.4	1.3	0.9 - 2.0	**0.5***	0.3 - 0.9	0.9	0.7 - 1.0
Sex of child (ref=female)								
Male	0.9	0.5 - 1.4	1.0	0.8 - 1.2	**1.7***	1.0 - 2.9	1.0	0.9 - 1.3
Number of ANC visits (ref=one to three)								
Four or more	**0.5***	0.3 - 0.9	0.9	0.7 - 1.2	0.9	0.5 - 1.6	1.1	0.9 - 1.4
Both SBA and facility delivery (ref=yes)								
Neither or one or the other	0.8	0.4 - 1.7	1.0	0.6 - 1.5	**0.3***	0.1 - 0.9	**0.7****	0.5 - 0.9
PNC in the first hour (ref=no)								
Yes	**1.9***	1.0 - 3.7	1.4	0.9 - 2.3	**0.5****	0.3 - 0.8	1.2	1.0 - 1.5
Access to breastfeeding counseling in ANC (ref=low)								
No data	n/a		n/a		n/a		0.8	0.3 - 1.7
Medium	1.3	0.8 - 2.2	0.7	0.4 - 1.0	0.7	0.4 - 1.2	1.1	0.8 - 1.4
High	0.8	0.4 - 2.0	0.6	0.4 - 1.0	0.9	0.5 - 1.6	1.0	0.7 - 1.3
Access to trained providers (ref=low)								
No data	n/a		n/a		n/a		1.3	0.7 - 2.4
Medium	**2.2****	1.3 - 3.5	1.1	0.8 - 1.5	1.0	0.5 - 1.8	1.0	0.8 - 1.3
High	2.1	1.0 - 4.5	1.4	0.9 - 2.0	**2.1***	1.1 - 4.0	1.0	0.8 - 1.3
Average facility breastfeeding counseling in ANC (ref=low)								
No data	1.7	0.9 - 3.3	0.6	0.2 - 2.0	**0.3****	0.2 - 0.7	0.9	0.7 - 1.2
High	0.7	0.4 - 1.3	0.9	0.7 - 1.3	**1.9***	1.0 - 3.5	0.9	0.7 - 1.2

*p<0.05; **p<0.01; ***p<0.001
n/a = not applicable; ANC = antenatal care; SBA = skilled birth attendant; PNC = postnatal care

4 DISCUSSION

4.1 Overview of Findings

EIBF is a recommended practice that is important for newborn health and survival. Using data from SPA surveys, this study explored health facility readiness to offer counseling on breastfeeding and levels of breastfeeding counseling in Haiti and Malawi. Linking SPA data with data from the DHS surveys, the results showed that in urban Malawi breastfeeding counseling was an important factor associated with EIBF, and in both urban Haiti and Malawi having trained providers was also an important factor. However, these associations did not manifest in rural residence. Our findings illuminate key supply-side factors affecting EIBF in Malawi and Haiti, and provide insight on critical steps that could be taken to improve breastfeeding interventions.

Breastfeeding counseling is recommended for all pregnant women and is a key component of ANC services (WHO 2016, 2018). In urban Malawi, we identified a significant association between EIBF and higher levels of counseling on breastfeeding during ANC. Nevertheless, our results showed that although almost all facilities with ANC in Haiti and Malawi reported that they provided breastfeeding counseling as part of routine ANC services, less than 10% of clients received counseling on breastfeeding, regardless of trimester. Possible reasons for selective counseling during ANC include low levels of counseling knowledge and skills among providers as well as heavy workloads (Magoma et al. 2011; Ngabo et al. 2012; Phillips et al. 2017; Rurangirwa et al. 2018; Solnes Miltenburg et al. 2017). Where health personnel resources are already overburdened, providers often have little time to spend with clients (Phillips et al. 2017; Solnes Miltenburg et al. 2017), and so counseling on breastfeeding or other topics that are part of recommended ANC practices is often neglected (Magoma et al. 2011; von Both et al. 2006). Studies examining quality of care during ANC in Rwanda and Mozambique have reported that health workers prioritize counseling on some topics, such as HIV, over others (Biza et al. 2015; Magoma et al. 2011; Rurangirwa et al. 2018; von Both et al. 2006).

However, providers who have undergone training for ANC spend more time on counseling (Magoma et al. 2011). As training can lead to improvements in counseling and, consequently, improved practices (Magoma et al. 2011), prenatal counseling has been identified as an effective means to improve early breastfeeding outcomes (Imdad, Yakoob, and Bhutta 2011) (Wouk, Tully, and Labbok 2017), yet training across a number of reproductive and maternal health topics including breastfeeding is not common (Mallick, Temsah, and Benedict 2018; Mallick, Temsah, and Wang 2019; Wang et al. 2019). Our study adds support to this. We observed that clients attending ANC with a provider with recent training in breastfeeding tended to be counseled more than clients with a provider without recent training—significantly more so in Haiti, but not Malawi. Additionally, we found that in both countries, women in urban areas with more trained providers available at nearby facilities were more likely to practice EIBF than women in areas with fewer trained providers. Yet in Haiti, fewer than 3 providers in every 10 had attended training on breastfeeding or IYCF in the preceding 24 months, and in Malawi, fewer than 4 in every 10 providers.

Our results showed that women's reporting of receipt of maternal health services did not consistently predict EIBF. In urban Haiti, PNC was positively associated with EIBF, but attending four or more ANC visits was inversely associated with EIBF. In rural Haiti, no healthcare-seeking or health service environment factors

predicted EIBF. In Malawi, ANC attendance was not associated with EIBF, but skilled attendance at birth was associated in both rural and urban areas. PNC was inversely associated with EIBF, but only among urban women. Several studies from different settings have shown that having skilled health workers is associated with higher prevalence of EIBF (Bergamaschi, Oakley, and Benova 2019; Khan et al. 2017; Ogbo et al. 2017; Sharma et al. 2016). In our study, however, these self-reported measures of healthcare contact (crude coverage of services) do not reflect the content or the circumstances of the care received. These factors are possibly influenced by confounding of unmeasured factors, such as pregnancy or birth complications that may have influenced care seeking, contact with the health system, and adoption of early breastfeeding. Further, effective coverage measures—that is, crude coverage (number of ANC visits) adjusted for the quality of care—are proving to be robust determinants of nutrition-related outcomes (e.g., immediate breastfeeding) (Joseph et al. in press).

4.2 Implications and Recommendations

Altogether, our findings suggest that provider training in breastfeeding counseling, which results in more counseling, can promote EIBF and likely other breastfeeding outcomes. Our study further identified deficits in provider training and counseling during ANC, pointing to a need for additional trainings for health workers. Additionally, emphasizing counseling during provider training is important, and training curricula should include specific guidance on breastfeeding counseling. Further, the findings suggest that in both countries, in addition to addressing the trained-provider gap, refresher training is also important.

Based on our results, dedicated resources for scale-up of the Baby Friendly Hospital Initiative are also warranted in both Haiti and Malawi, especially to increase the availability of providers trained in breastfeeding counseling, although this recommendation should not be made without noting the additional burden that more time spent on counseling could mean for already overworked health providers. As a complement to facility heath workers, peer breastfeeding counseling through women's groups and community-based health workers should continue to be used to improve EIBF; similarly, lay workers should receive appropriate training in breastfeeding counseling (Chapman et al. 2010; Perry and Zulliger 2012; Sinha et al. 2015; WHO 2018).

4.3 Strengths and Limitations

This study took information from SPA health facility data on breastfeeding, which has been descriptively studied in recent research (Mallick, Temsah, and Benedict 2018), and linked this information to data from the DHS surveys, providing a novel approach to study the association between ANC, the health service environment, and breastfeeding within an hour of birth. This methodology adds a health-systems perspective to research on breastfeeding that few studies have done before (Khan et al. 2017; Takahashi et al. 2017), while taking into account differences between urban and rural areas in how the health service environment can relate to breastfeeding. Overall our results underscore the importance of women's health-care-seeking behavior and the health facility service environment to breastfeeding outcomes, and add to extant research that the relationships between the two vary by urban and rural residence (Adewuyi et al. 2017; Wang et al. 2015). Our analysis identifies missed opportunities for the health system to ensure adoption of recommended breastfeeding practices, and the findings point to clear recommendations for ongoing and future policies and programs related to provider training.

A limitation of the study is the use of the aggregate measures of the service environment. In this facility-to-population linkage method, we cannot examine the direct relationship between a woman's actual care received and her health outcomes, but rather the average care available at facilities and received among women in her area. These aggregate measures may be problematic when using provider and client variables, which we had already summarized within the facilities and then again within each zone around clusters. For counseling, the very low levels overall contributed to little variation within facilities and within zones, to the extent that, due to skewness, it was only possible to dichotomize rather than use terciles for analysis.

There are some limitations to the service environment variables as well. The mismatch between a facility's report and observed practice of counseling was large. Nearly all facilities reported that they counsel on breastfeeding as part of ANC, but very few clients were observed and reported receiving counseling during their ANC visits. It is possible that counseling on breastfeeding could have been provided during group sessions (Conrad et al. 2012) and therefore was not observed during ANC visits. Although the SPA questionnaires assess whether group health education sessions are routinely conducted, we did not include this information as part of our service environment assessment, as it was not specific to breastfeeding. This could in part explain the finding of a relationship between provider training and EIBF despite the low levels of counseling documented.

Although our multilevel, multivariable analysis accounted for the nesting of individuals within clusters, we were not able to control for all individual, community, subnational, or national factors that might influence early breastfeeding. For example, while we controlled for birth weight, where low birth weight could serve as a proxy for preterm birth, we were unable to control for other complications that could impede early breastfeeding. We excluded neonatal deaths on the first day of life; however, near-miss cases and cases of maternal or newborn complications are unaccounted for in our analysis. We could not control for breastfeeding support and counseling from community health workers or cultural norms around breastfeeding within the community with any direct measure, nor did we incorporate higher-level factors such as large-scale or national programs or policies. Because of the cross-sectional nature of the data used in this study, we are unable to draw any causal inferences from our findings. Our analysis is limited to only Haiti and Malawi and may not be generalizable beyond these countries.

5 CONCLUSIONS

Initiation of breastfeeding within the first hour of birth has prodigious benefits for newborn health and survival, and counseling on breastfeeding during ANC can promote this behavior. This study found that although facilities reported that they routinely counseled on breastfeeding, in fact providers often lacked recent training on the topic, and counseling was rare during ANC, although the level was slightly higher among women attended by a health provider who had recent training on breastfeeding. Among women in urban areas of Haiti and Malawi, having more providers with recent training on breastfeeding counseling at nearby facilities was associated with early initiation of breastfeeding. In urban Malawi, client receipt of breastfeeding counseling at nearby facilities also was associated with early breastfeeding. These findings highlight and reinforce the importance of the Ten Steps to Successful Breastfeeding and the role of provider training on breastfeeding counseling.

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APPENDICES

Appendix Table 1 Characteristics of health facilities that provide antenatal care services

	Haiti		Malawi	
	Urban	Rural	Urban	Rural
Type of facility[1]				
Hospital	25.8	4.2	44.4	9.9
Health center	64.5	37.2	24.4	80.8
Dispensary, clinic, other	9.7	58.6	31.3	9.2
Managing authority				
Government	33.0	43.7	48.3	66.5
Private not-for-profit	37.1	38.5	22.1	25.9
Private for profit, other	30.0	17.8	29.6	7.6
Region (Haiti)				
Aire Métropolitain / Reste-Ouest	54.8	24.3		
Sud-Est	4.2	9.6		
Nord	9.3	8.8		
Nord-Est	1.6	5.5		
Artibonite	4.5	18.0		
Centre	3.5	6.3		
Sud	9.7	6.1		
Grand-Anse	4.8	4.8		
Nord-Ouest	4.0	13.3		
Nippes	3.5	3.4		
Region (Malawi)				
North			16.0	19.2
Central			40.8	36.3
South			43.2	44.5
Total	**310**	**522**	**116**	**516**

[1] In Haiti, hospitals are university, regional, community, and other hospitals; and health centers include those with and without beds. In Malawi, hospitals are central, district, community, and other hospitals; health centers include maternity health centers; and other refers to health posts.

Appendix Table 2 Urban and rural cluster ranges of facility breastfeeding readiness and counseling, Haiti and Malawi

	Haiti[1]						Malawi					
	Other Urban			Rural			Urban			Rural		
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Number of ANC facilities with reporting routine counseling on breastfeeding[2]	1 - 2	3 - 5	6 - 22	1 - 5	6 - 9	10 - 23	0 - 3	4 - 7	8 - 17	0 - 2	3	4 - 18
Average number of providers trained on breastfeeding[2]	0 - 0.4	0.4 - 0.6	0.6 - 2.6	0 - 0.3	0.3 - 0.5	0.5 - 2.9	0 - 0.2	0.2 - 0.5	0.5 - 4.3	0 - 0.3	0.3 - 0.6	0.6 - 3.4
Percent of clients counseled on breastfeeding[3]	0%	n/a	1% - 60%		n/a	1% - 100%	0%	n/a	1% - 33%	0%	n/a	3% - 100%

[1] Excludes urban clusters in Port-au-Prince or rural clusters with 5 km of Port-au-Prince
[2] Includes only clusters with women who had at least one ANC visit, who delivered vaginally, and whose baby survived past the day of birth
[3] Includes only clusters with at least one linked facility with antenatal care client data in addition to inclusion criteria above

Appendix Table 3 Results of unadjusted logistic regressions of early initiation of breastfeeding for the last birth in the 2 years preceding the survey

	Haiti				Malawi			
	Other urban		Rural		Urban		Rural	
Variables	UOR	95% CI	UOR	95% CI	UOR	95% CI	UOR	95% CI
Department: Haiti (ref=Artibonite)								
Ouest	0.8	0.2 - 3.3	0.8	0.4 - 1.7				
Sud-Est	1.4	0.4 - 5.0	1.5	0.8 - 2.7				
Nord	1.5	0.4 - 6.1	1.0	0.5 - 2.1				
Nord-Est	2.3	0.6 - 8.2	1.2	0.7 - 2.2				
Centre	1.6	0.4 - 6.2	0.9	0.5 - 1.6				
Sud	0.6	0.2 - 2.4	1.2	0.7 - 2.1				
Grand-Anse	2.4	0.6 - 8.8	1.3	0.6 - 2.5				
Nord-Ouest	1.2	0.3 - 5.1	1.3	0.7 - 2.4				
Nippes	1.6	0.3 - 8.3	1.2	0.6 - 2.5				
Region: Malawi (ref=Northern)								
Central					0.3***	0.1 - 0.5	0.6***	0.5 - 0.8
Southern					0.4**	0.2 - 0.8	1.1	0.8 - 1.4
Wealth quintile								
Lowest and second	**0.5***	0.2 - 1.0	ref		0.5	0.2 - 1.3	ref	
Middle	0.9	0.5 - 1.6	0.8	0.6 - 1.1	1.0	0.4 - 2.6	1.0	0.8 - 1.3
Fourth and highest	ref		0.6*	0.3 - 0.9	ref		1.0	0.8 - 1.3
Education (ref=none or primary)								
Secondary or higher	0.9	0.6 - 1.3	0.9	0.7 - 1.2	1.1	0.6 - 1.8	1.0	0.8 - 1.3
Employment (ref=not employed)								
Employed	1.3	0.8 - 2.1	1.5**	1.2 - 1.9	0.9	0.5 - 1.5	0.9	0.7 - 1.1
Religion (ref=Christian)								
Other	1.5	0.7 - 3.0	0.8	0.5 - 1.2	1.3	0.8 - 2.1	1.0	0.9 - 1.2
Exposure to mass media (ref=less than once per week)								
At least once per week	1.0	0.6 - 1.7	1.0	0.7 - 1.4	2.0**	1.2 - 3.4	1.0	0.8 - 1.2
Currently Married (ref=yes)								
No	1.1	0.5 - 2.3	0.7*	0.5 - 1.0	0.7	0.4 - 1.3	1.2	0.9 - 1.5
Parity (ref=multiparous)								
Primiparous	0.7	0.5 - 1.1	0.8	0.6 - 1.0	0.6	0.4 - 1.0	0.8	0.7 - 1.0
Size of baby at birth (ref=normal)								
Small or very small	0.7	0.4 - 1.1	1.0	0.8 - 1.4	0.7	0.3 - 1.7	0.8	0.6 - 1.0
Large or very large	0.8	0.4 - 1.4	1.3	0.9 - 1.9	0.6*	0.3 - 0.9	0.9	0.7 - 1.1
Sex of child (ref=female)								
Male	0.9	0.6 - 1.5	0.9	0.8 - 1.2	1.5	0.9 - 2.6	1.0	0.9 - 1.3
Number of ANC visits (ref=one to three)								
Four or more	0.7	0.4 - 1.3	0.9	0.7 - 1.1	0.9	0.6 - 1.5	1.2	0.9 - 1.4
Both SBA and facility delivery (ref=yes)								
Neither or one or the other	0.7	0.4 - 1.1	1.0	0.7 - 1.3	0.4	0.1 - 1.4	0.6**	0.5 - 0.9
PNC in the first hour (ref=no)								
Yes	**1.8****	1.2 - 2.7	1.3	0.9 - 1.9	0.6*	0.3 - 0.9	1.2*	1.0 - 1.5
Service environment variables								
Access to breastfeeding counseling in ANC (ref=low)								
No data	n/a		n/a		n/a		1.0	0.5 - 2.1
Medium	1.6	1.0 - 2.6	0.8	0.6 - 1.1	0.8	0.4 - 1.6	1.2	0.9 - 1.5
High	0.9	0.5 - 1.4	0.8	0.5 - 1.1	1.0	0.5 - 1.9	1.1	0.9 - 1.5
Access to trained providers (ref=low)								
No data	n/a		n/a		n/a		1.1	0.6 - 2.0
Medium	2.1**	1.3 - 3.3	1.1	0.7 - 1.5	1.5	0.8 - 2.9	1.0	0.8 - 1.3
High	1.5	0.8 - 2.7	1.1	0.7 - 1.5	2.1*	1.1 - 4.0	1.1	0.8 - 1.4
Average facility breastfeeding counseling in ANC (ref=low)								
No data	1.2	0.6 - 2.3	0.8	0.3 - 2.6	0.4*	0.2 - 0.9	0.9	0.7 - 1.2
High	0.9	0.6 - 1.5	0.9	0.7 - 1.3	1.6	1.0 - 2.8	0.9	0.6 - 1.2

*p<0.05; **p<0.01; ***p<0.001; ANC = antenatal Care; SBA = skilled birth attendance; PNC = postnatal care