Effective Coverage of Facility Delivery in Bangladesh, Haiti, Malawi, Nepal, Senegal, and Tanzania

Introduction

Despite global increases in coverage of facility delivery and skilled attendance at birth, the reduction in maternal and neonatal deaths remains limited (Marchant et al. 2016; Winter et al. 2017). Crude coverage describes the use of care services, and may be informative, but does not provide information about the actual quality of care received. Examining quality of maternal and newborn healthcare services centers upon the idea that skilled care provided at delivery, supported by well-equipped facilities, is critical to identifying and addressing complications in time for women to receive treatment and to save lives (Tura, Fantahun, and Worku 2013). Moving beyond the conventional measurement of crude coverage, effective coverage combines both use and quality into one measurement, which can be understood as the fraction of the maximum health gain actually delivered through the health system to the population in need (Ng et al. 2014; Shengelia et al. 2005).

Effective coverage can be assessed by linking data from assessments of health facilities with data from household-based surveys that measure the use of services. Though it would be desirable to link a respondent to the facility where the service was actually received, this is often not feasible due to data unavailability. Instead, a geographic linkage approach that summarizes facilities within administrative or geographic boundaries near clusters of households using GPS data collected in both types of surveys is commonly practiced. Willey et al. (2018) assessed the geographical-linking method to the gold-standard but resource-intensive method of linking individuals to the facility they attended. This study found little difference between the two methods, suggesting that the ecological-linking method is a suitable proxy. More precise agreement was found with geographically linking when accounting for the variable levels of quality by facility type (Willey et al. 2018).

Despite straightforward methods of measuring crude coverage, measuring quality of care can be challenging (Nguhiu, Barasa, and Chuma 2017). Of concern for quality of delivery care is that there is no single set of standard measures used to assess quality (Marchant et al. 2016; Nesbitt et al. 2013; Tripathi et al. 2015; Van den Broek and Graham 2009; Willey et al. 2018). The frequently used Donabedian quality measures are structure, process, and outcome (Donabedian 1988), which provide a comprehensive picture of the health facility setting, care delivered to the client, and the client outcome. Across studies of quality of care in facility delivery, structural indicators have several common domains, including infrastructure, infection prevention, monitoring labor, essential medications, equipment, neonatal resuscitation, routine and emergency obstetric care, and clean cord care (Gabrysch et al. 2012; Larson et al. 2017; Nesbitt et al. 2013; Tripathi et al. 2015; Willey et al. 2018; Winter et al. 2017). Ideally, assessments of quality of facility-based delivery care should examine structure as well as process – the facility's readiness to provide delivery care and the care practices provided during delivery care. There is an index for quality of the process of intrapartum and immediate postpartum care (QOPIIPC) (Tripathi et al 2015), though assessments of the observation of delivery services in a facility are time-consuming, prone to measurement error, and subject to their own quality limitations – particularly in resource-constrained and high-mortality settings (Lain et al. 2012; Tripathi et al. 2015). Thus, service readiness assessments such as the World Health Organization (WHO) Service Availability Readiness Assessment (SARA), the Demographic and Health Survey

Program's Service Provision Assessment (SPA) have been used as substitutes (Willey et al. 2018). These tools provide an overview of structural capacity to provide services in terms of infrastructure, equipment, commodities, staffing, and management, but do not capture observation of actual service delivery. Using these data sources, quality measurements are limited to the structural readiness of facilities to provide quality services.

Among few studies on effective coverage of maternal and child health services, it was found that effective coverage estimates result in striking reductions of crude coverage. In Ghana, linking facility data to population data by districts, two-thirds of all births occurred in a health facility, though only one in every four births occurred in a high-quality facility (Nesbitt et al. 2013). Similarly in Tanzania, using a high quality standard – facilities must have 90% of required items – the estimate of effective coverage reduced crude coverage from 80% to zero percent (Leslie et al. 2017). In a larger study of 17 countries, using a stringent quality measurement cut-off of 20 or more out of 23 essential items median coverage of facility delivery fell from 42% to 28% (Kanyangarara et al. 2018).

This study contributes to the limited research on effective coverage of obstetric and newborn care in health facilities by linking data from nationally representative household surveys with data from surveys of health facilities in six countries with high prevalence of maternal and newborn mortality. We use a wide range of input-based quality-of-care indicators to provide a comprehensive assessment of the readiness of facilities to deliver obstetric and newborn care. In linking coverage and quality measurements, we use a refined ecological linkage approach stratifying the calculation by facility category, which has proven effective in producing similar estimates when the exact source of care is unknown.

Data and methods

Data

This analysis is based on data from the Demographic and Health Surveys (DHS) and Service Provision Assessment (SPA) surveys in six countries—Bangladesh, Haiti, Malawi, Nepal, Senegal, and Tanzania. These countries were selected because they all have had a recent DHS survey and a recent SPA survey completed within two years of each other.

The DHS is a population-based household survey that provides representative data on population and health indicators at the national and regional levels for a specific country. All women age 15-49 in selected households with a birth in the five years before the survey are interviewed about delivery care, including place of delivery for all of her live births during this period. This study focuses on delivery care received for live births in the two years preceding the survey, to better synchronize the timing of the DHS data and the SPA data. The SPA is a health facility-based survey designed to provide information on the availability and quality of preventive and curative health services in a country. In each country except Haiti and Malawi, where the SPA was a facility census, a sample of formal health facilities was selected to represent the country and the administrative regions, as well as by type of facility and by managing authority. SPA surveys collect data on facilities, providers, and clients. This study focused on facilities that reported to provide delivery services and primarily analyzed data from the facility inventory and provider interviews. The Facility Inventory Questionnaire collects information on the availability of specific services and related infrastructure, supplies, medicines, staffing, procedures, and management practices. The Provider Interview

Questionnaire collects information on provider qualifications, training, and supervision experiences. Table 1 provides the number of births and health facilities included in the analysis for each country.

Defining components of effective Coverage

Effective coverage is calculated among individuals in need of care as the mathematical product of the use of the service and the quality of care provided. To estimate effective coverage of facility delivery, we first calculated its two components—coverage of facility delivery, and the quality of facility delivery services—as described below.

Coverage of facility delivery

We estimated the coverage of facility delivery based on DHS data as the percentage of births in the two years preceding the survey delivered in a health facility. We disaggregated the coverage by type of facility where the delivery occurred. This is because women are expected to seek delivery care in a range of facilities with varied preparedness to provide delivery services. For each of the six countries studied, facility types were harmonized between the DHS and SPA. Facilities are generally categorized by managing authority (public or private) and level of facility (hospital, health center, and dispensary or health post). Appendix Table 1 provides a summary of reported facility categories in both DHS and SPA by the harmonized classifications unique to each country.

Facility readiness to provide delivery care

Quality of care is often measured in three dimensions: *structure*, *process*, and *outcome* (Donabedian 1988). This study focused on structure, which refers to the physical attributes of a health facility including infrastructure, equipment, supplies, commodities, and the availability of trained personnel. In other words, it assesses whether a facility is ready to provide quality services. We measured facility readiness to provide delivery care with a service readiness score based on a set of indicators for the *structure* component of quality of obstetric and newborn care. The indicator selection was guided by three references: the World Health Organization (WHO) SARA Manual (WHO 2015), the indicators suggested by the Newborn Indicator Technical Working Group (Save the Children Federation, Inc. 2017), and a comprehensive systematic review by Gabrysch et al. (2012) that suggested important indicators for measuring obstetric and newborn care at health facilities. An indicator suggested by at least one of these three references was included in the analysis if data are available in the SPA. In general, the selected indicators fall in six domains: 1) comprehensive emergency obstetric care; 2) newborn signal functions and immediate care; 3) general requirements; 4) equipment; 5) medicine and commodities; and 6) guidelines, staff training, and supervision. Appendix Table 2 provides definitions of these indicators. All indicators were made dichotomous according to whether the facility meets the criterion of availability. In rare cases, when data are missing for some facilities, the indicator was coded as No.

We calculated the readiness score using an equal-weight approach, the most intuitive approach to create a composite measurement compared with other commonly used weighting schemes (Shwartz, Restuccia, and Rosen 2015). When computing the readiness score, equal weight was given to each domain and to each indicator within the same domain; the sum of all domains was standardized to have a maximum of 100. This approach assumes that all domains and all indicators within the same domain are equally important in

preventing maternal and newborn deaths. Since non-CEmOC facilities are not expected to provide C-sections and safe blood transfusion, these two indicators were included in the calculation of readiness scores only for CEmOC facilities. Given this standardization, a facility's score should be interpreted as the percentage of highest possible readiness that the facility could have.

Estimating effective Coverage

Effective coverage was estimated at both the regional and the national level, with the mathematical product of the coverage and readiness score by accounting for types of facilities where delivery care was sought. In most countries, the regions are administrative regions or provinces for which both DHS data and SPA data are representative. In Tanzania, regions were further grouped into nine geographic zones to allow for a large sample size in each zone, therefore reduced sampling errors.

At the regional level, the effective coverage is the summation of effective coverage of each type of facility that is constructed as the product of the coverage and readiness estimates:

$$EC_r = \sum_j (C_{rj} * Q_{rj})$$

where EC_r represents effective coverage in region r,

C_{rj} is the proportion of births delivered in facility type j in region r,

and

Q_{rj} is the average readiness score of facility type j in region r.

We accounted for the DHS sampling weight when estimating facility delivery coverage and SPA sampling weight when calculating readiness scores. The calculated readiness score for a specific facility category is an average score of all facilities in the same category.

The national effective coverage is the summation of regional effective coverage weighted by the proportion of births in each region:

$$EC_T = \sum_r (EC_r * w_r)$$

where w_r represents the proportion of births in region r.

Effective coverage of facility delivery can be considered as facility delivery coverage after adjusting for facilities' readiness to provide the service. Since the readiness score lies between 0 and 100%, the effective coverage should be equal to or below the crude coverage. In cases when all facilities reach 100% of the maximum readiness, the effective coverage would be equivalent to the crude coverage. The national estimates are improved by taking regional variations into account because regions differ in the use of each type of facility and in readiness among facilities in the same category.

The uncertainty of the estimates of effective coverage was assessed with an approximation procedure sometimes referred to as the "delta" method (Hogg and Craig 1965). We refer to the SPA and DHS estimates

with the subscripts i=1 and i=2 respectively. The mean readiness score, noted as p_1 for the facilities of a specified type and in a specified region, can be calculated with the coefficient of an OLS regression of readiness scores with no covariates. We call this coefficient b_1 and the standard error of its mean is s_1. The lower and upper ends of the 95% confidence interval for the readiness are $L = b_1$ -1.96* s_1 and $U = b_1$+1.96* s_1. We took into account the effect of survey design in the estimation of standard errors when the SPA was a sample survey. A finite population correction factor was adjusted for in the estimation, given the fact that the SPA sample was drawn from more than 5% of a finite population.

The coverage of facility delivery, noted as p_2, can be estimated using the coefficient b_2 of a logit regression of facility delivery with no covariates. That is, logit(p_2)=log[p_2/(1- p_2)]= b_2. The sampling distribution of b_2 is asymptotically normal with standard deviation s_2. The lower and upper ends of the 95% confidence interval for logit(p_2) are $L = b_2$-1.96* s_2 and $U = b_2$+1.96* s_2. We can calculate the facility delivery coverage as p_2=[exp(b_2)]/[1+exp(b_2)]. If the same anti-logit transformation is applied to L and U, we obtain the lower and upper ends of the confidence interval for coverage. All estimates are adjusted for the survey design.

Effective coverage, p, is defined by $p = p_1 * p_2$. A confidence interval for p is calculated by converting p to the logit scale with

$$F = logit(p) = \log(\frac{p}{1-p}) = \log(\frac{p_1 * p_2}{1 - p_1 p_2})$$

p_1 and p_2 are functions of the coefficients b_1 and b_2 respectively; the standard errors of b_1 and b_2 are s_1 and s_2 respectively; and the covariance of b_1 and b_2 is 0 because of the independence of the SPA and DHS. Therefore, the sampling variance of F is estimated with the delta method to be

$$s^2 = \left(\frac{\partial F}{\partial b_1}\right)^2 s_1^2 + \left(\frac{\partial F}{\partial b_2}\right)^2 s_2^2$$

and the standard error of F is the square root, s. The partial derivatives in this formula are calculated from the formula for F to be

$$\frac{\partial F}{\partial b_1} = \frac{1}{p_1(1-p_1 p_2)} \text{ and } \frac{\partial F}{\partial b_2} = \frac{1-p_1}{1-p_1 p_2}$$

We calculate the lower and upper ends of a 95% confidence interval as $L = F$ -1.96* s and $U = F$ +1.96* s, and then apply the anti-logit transformation to L and U to get the lower and upper ends of the confidence interval for $p = p_1 * p_2$ (effective coverage). Similar steps are used to obtain confidence intervals for the aggregated regional and national estimates.

Results

Analyzing the distribution of facilities by type, we found that government health facilities are the major providers of delivery care in all six countries (Appendix Figure 1). About 80% or more of facilities offering delivery care in Bangladesh, Tanzania, Nepal, and Senegal are government health facilities. Private facilities, especially private not-for-profit facilities, represent a larger share in Haiti and Malawi than in

other countries. Most of the countries rely on lower-level facilities such as health posts or sub-health posts and dispensaries for delivery care. Government hospitals have a small share ranging from 1% in Senegal to 11% in Haiti.

We examined the availability of tracer items that are important for providing delivery care in each country at the regional level (only for non-CEmOC facilities) and at the national level (Appendix Tables 3-8). We found that facilities, especially non-CEmOC facilities, were often poorly equipped or had a shortage of essential supplies or medicines for care of mothers and newborns. Expectedly, the availability of items was higher among CEmOC facilities for all domains except in the area of guidelines and staff training. Among non-CEmOC facilities, with some variability, the regions often had similar items availability at their facilities. For example, while health facilities performed well in providing immediate newborn care services such as skin-to-skin care, wrapping newborns and earlier initiation of breastfeeding, provision of basic emergency obstetric care and newborn resuscitation was limited, a finding that was consistent across regions. Many non-CEmOC facilities lacked an emergency transportation system, only 30% of non-CEmOC facilities in Bangladesh and Haiti. In all the countries, the domain with the most limited availability was guidelines, training, and supervision. More than two-thirds of CEmOC facilities did not have a provider who received in-service training in CEmOC.

Readiness scores were calculated by facility type and region. We present the results with the corresponding coverage of facility delivery to facilitate the comparisons between readiness and use (Appendix Figures 2-13). In all countries, hospitals, private or public, were typically the type of facility most ready to provide delivery care, whereas lower-level facilities are much less prepared. For example, in Bangladesh, public hospitals had the highest readiness score, with 77% of the maximum capacity to provide delivery care services, but public union facilities had a readiness score of only 37%. Despite the poor readiness of these lower-level facilities, many were reported by women to be one of the major sources of delivery care. In fact, in several countries the type of facility least ready to provide delivery care was the most commonly reported source of delivery care. In Nepal, for example, despite having the lowest readiness score, government health posts were widely used in Provinces 6 and 7. In Tanzania, delivery care was commonly sought in public dispensaries, the facility type with the lowest readiness score. A similar pattern was found in Senegal—the most commonly used type of facility, the government health post, had low service readiness scores compared with government hospitals and health centers.

Figure 1 depicts the countries' national average of facility delivery against their facilities' readiness score as well as the range among their regions. For each country, the width of the horizontal whisker indicates the range of the readiness score among the country's regions, and the length of the vertical whisker represents the range of the facility delivery coverage among the regions. The longer the whisker, the greater the variability among the regions. Four countries—Malawi, Senegal, Tanzania, and Nepal—national averages of coverage and readiness fell in quadrant I, indicating a national coverage and readiness score both higher than 50%. Malawi had both the highest coverage of facility delivery and the greatest readiness to provide delivery services. Bangladesh had the lowest coverage and readiness, both lower than 50%. Haiti is in quadrant IV, with a readiness score above 50% but coverage below 50%. All countries demonstrated a larger regional variability in coverage than in readiness except Malawi, where the regions had similar levels of coverage and readiness. Senegal had the greatest range of crude coverage of both facility delivery and facility readiness by region.

Appendix Figure 14 presents regional levels of readiness against coverage for each country.

Taking into account the readiness of facilities to provide the service, we estimated the effective coverage at the national and regional level (Figures 2 and Table 2). Malawi had the highest effective coverage, at 66%, 27 percentage points lower than its crude coverage. In all three regions, the effective coverage was also 66% because of their similar levels of coverage and readiness. Senegal was the only other country with a national effective coverage higher than 50%, but with considerable variations among regions, from 30% in the East to 64% in Dakar. Dakar's surrounding area, the Thiès region, had the second highest effective coverage, at 62%. The level of effective coverage appeared lowest in the East (30%) and North (38%) compared with other regions. Across countries, the lowest effective coverage estimate was found in Haiti, at 24%, with effective coverage below 25% in most regions. Effective coverage was also low in Bangladesh, at 27%. Khulna had much higher effective coverage (41%) compared with all other divisions, while Sylhet had the lowest effective coverage (16%); in fact, the score was significantly lower than in all other divisions except Barisal.

While over half of births in Nepal were delivered in a health facility, the country's effective coverage was 42%. While Provinces 3, 4, and 7 had higher effective coverage than other provinces, about 50%, Provinces 6 and 2 had the lowest effective coverage, at 27% and 34% respectively. Nationally, effective coverage in Tanzania was 44%, which was substantially lower than the crude facility delivery coverage of 65%. There was a large variation in effective coverage by zones. The zone with the highest effective coverage (Southern Highlands) was twice the level of the zone with the lowest effective coverage (Lake zone). Every zone's effective coverage estimate was 16-27 percentage points lower than the level of crude coverage.

Discussion and conclusions

Effective coverage—a measurement that adjusts the conventional measurement of facility use for the quality of care clients receive—is a useful tool for evaluating the impact of maternal and newborn health interventions, and monitoring a country's progress toward achieving universal coverage of health care with sufficient quality (Colston 2011). This study estimated effective coverage of facility delivery in Bangladesh, Haiti, Malawi, Nepal, Senegal, and Tanzania by linking data from household surveys with data from health facility surveys. We focused on the structural dimension of quality of care. Other studies have used different methods to measure service readiness, such as requiring a minimum number of items to deem a facility "ready" or not (Kanyangarara et al. 2018; Larson et al. 2017). The different measures of quality should be kept in mind in the interpretation and comparisons of effective coverage across studies.

Given the global efforts to improve maternal health, many developing countries including the six in this study have witnessed a remarkable increase in coverage of facility delivery in the last two decades. Nevertheless, after taking into account facilities' preparedness to provide delivery care services, the level of effective coverage in all countries studied becomes much lower. The reduction ranges from 20% in Nepal to 39% in Haiti, whose resulting national effective coverage is only 24%. Even though Malawi has achieved almost universal facility delivery, the effective coverage is much lower, at 66%. These findings suggest that many women who delivered in a health facility did not necessarily receive the quality of care needed to avoiding preventable maternal and newborn mortality (Bhutta et al. 2014).

The substantial drop of coverage shown in this study when incorporating the quality of care component is also found in other health areas and other settings. Leslie et al. (2017) found that in eight high-mortality countries, after adjusting for the process aspect of quality of care, coverage was reduced by half or more when examining prevalence of four or more antenatal care visits, treatment for child illnesses, and demand satisfied for modern contraception. In rural Burkina Faso, compared with the level of crude coverage of curative child care, at around 70%, the effective coverage was only an estimated 5% based on a high-quality standard and 45% based on a high or intermediate standard of quality (Koulidiati et al. 2018). A study in a rural region of Tanzania found that, while over 80% of women delivered their most recent birth in a health facility, few delivered at a facility that offered high-quality routine or emergency obstetric care, and none delivered in a facility staffed by providers with a high level of clinical knowledge and skills (Larson et al. 2017). The authors estimated that effective coverage of obstetric care was only 25%, even using a minimum threshold of quality. These studies, along with our own analysis, highlight the need for improving quality of care to achieve the health-related Sustainable Development Goals.

Among the six countries studied, CEmOC facilities were exceedingly rare. Entire regions of a country undoubtedly lack a CEmOC facility, as in Senegal, where only two CEmOC facilities were available among the six regions, indicating that lack of proximity may be a physical barrier for many women. It is expected that primary facilities will continue to play an important role in providing delivery services to women. Countries need to increasingly invest in these facilities, and ensure that they are properly equipped to deliver services and have a referral system in place. While investment in all domains of service readiness seems needed, most urgent are expanding emergency obstetric care and newborn resuscitation, which are critical for saving mothers' and newborns' lives. More investment in human resources is also warranted, as demonstrated in our analysis and in other studies (Lanata 2007; Manzi et al. 2012).

While it is important to strengthen the ability of health facilities to provide quality delivery services, additional efforts should continue to improve the use of these services in countries or regions where a large proportion of women still deliver at home. Looking across countries and within countries, the wide variation in effective coverage appears to be a result of the differences in both facility delivery coverage and facility readiness to provide good care. Malawi possesses the highest level of effective coverage because it has the highest coverage and highest facility readiness, while Haiti, the country with the lowest use of facility delivery and a low facility readiness score, has the lowest level of effective coverage. However, national levels of effective coverage align more with the level of coverage for facility births than with facility readiness. In fact, all countries except Malawi demonstrate a greater regional variability in the percentage of facility births than in facility readiness; hence, differences in effective coverage appear to be primarily driven by a country's various levels of facility delivery coverage. Haiti, Nepal, and Bangladesh, the regions with the highest percentages of facility deliveries had double the level of effective coverage compared with countries with the lowest percentages of facility deliveries. In regions with very low readiness scores, levels of facility delivery are correspondingly low. The patterns observed between use of health facilities and their readiness to provide adequate services supports that quality of care is an important factor that drives or deters facility use (Acharya and Cleland 2000; Karim et al. 2015).

Haiti presents the lowest effective coverage among the six countries—just 24% at the national level. In five of its ten regions, effective coverage is below 20%. Though Haiti has readiness scores similar to Tanzania's, its low effective coverage seems primarily a result of low levels of use of facility delivery. Due to the

mountainous terrain in Haiti, women face a particular challenge in reaching health facilities (Alexandre et al. 2005). Further, half of all of the health facilities were destroyed in the earthquake in 2010 (Behrman and Weitzman 2016)—only three years before the Haiti SPA was conducted. Access to facilities with a better quality of services could be even more limited, and women in rural areas particularly likely to suffer, as those facilities are usually located in the metropolitan or urban areas (Gage and Guirlène Calixte 2006; Gage et al. 2017). Studies have found that physical proximity to a health facility is significantly associated with women's use of maternal health services (Gage and Guirlène Calixte 2006; Wang, Winner, and Burgert-Brucker 2017). In addition to other factors that affect women's access to facilities, quality of care provided by health facilities still plays an important role in the use of services, especially where access to services is less of an issue. The odds of facility delivery in a nonmetropolitan urban area was found to be doubled if they lived in an area with a high level of facility service readiness compared with women in an area with low readiness (Wang, Winner, and Burgert-Brucker 2017).

Second to Haiti, Bangladesh has the lowest effective coverage among the six countries, which is the result of both limited use of health facilities for delivery and poor readiness among the facilities. About 60% of births in the country, and up to 70-80% in some regions, were delivered at home. Among the many factors that could hinder women from using a health facility for delivery, the poor quality of services undoubtedly contributes to the low rate of use (Acharya and Cleland 2000; Karim et al. 2015). This is supported by our findings that the most commonly used sources, private hospital and clinics, have relatively better service readiness than other types of facilities. Union facilities, the most common type of facility, have the lowest readiness and are the least used. It is believed that the poor quality of care in health facilities contributes to the stall of maternal mortality decline identified in the 2016 Bangladesh Maternal Mortality and Health Care Survey compared with the 2011 survey, despite an increase in facility delivery coverage between the two surveys (National Institute of Population Research and Training (NIPORT), International Centre for Diarrhoeal Disease Research Bangladesh (ICDDRB), and MEASURE Evaluation 2017). The poor quality of obstetric care has also been reported in other studies (Anwar, Kalim, and Koblinsky 2009). While private facilities play a major role in providing facility delivery in Bangladesh, and they generally provide better quality of care, as indicated in this study and others (Alam et al. 2015; Siddiqui and Khandaker 2007; Sikder et al. 2015), they are usually less financially and geographically accessible compared with public facilities (Sikder et al. 2015). The Bangladesh SPA survey excluded private facilities with fewer than 20 beds. The exclusion of small private facilities could bias the effective coverage estimates if women also use these facilities for delivery care since these facilities possess different levels of readiness from the facilities included in the survey.

Malawi has the highest effective coverage among the six countries. Further, no other country in the study shows as much consistency among regions, nor such universally high delivery coverage. Malawi's high prevalence of facility delivery is due in part to a ban on informal birth attendants enacted in 2007—a policy aimed at transitioning births to the formal sector, where quality of care is higher (Godlonton and Okeke 2016). Additionally, adoption of the Newborn Action Plan prioritized quality of care during labor, delivery, and the newborn period. This plan directed efforts to strengthening facility capacity including provision of medicines, commodities, equipment, staff training, and care guidelines (The Ministry of Health of Malawi 2015).

Our study is subject to several limitations. First, the effective coverage estimated in this study is the facility delivery coverage adjusted for structural inputs. Structure is only one aspect of the quality of care. We did not assess the process of the service delivery, that is, to what extent the providers adhere to acceptable standards of care. Possessing infrastructure, supplies, and equipment enables a facility to provide good quality of care, but does not guarantee that it will do so. The positive association between structure and process was found to be weak in 11 countries studied based on SPA data (Leslie, Sun, and Kruk 2017). This limitation suggests that our results might overestimate effective coverage in the absence of data on the process of service delivery.

Indicators used to assess quality of care have an impact on effective coverage estimates. The readiness indicators in this study were chosen based on international guidance and empirical evidence. Although not all facilities are expected to provide all tracer items examined, a scoring approach as used in this study is necessary to provide a comprehensive picture of a facility's preparedness to provide delivery services and provide effective coverage estimates at the population level. That is, effective coverage aims to capture the expected level of coverage of services provided in a service delivery environment with the optimal readiness. However, the readiness score itself cannot identify where a service delivery problem lies. Facilities with a similar score could possess quite different specific tracer items. Information on the availability or lack of specific items should be assessed to identify specific areas that need improvement. Effective coverage must be interpreted with pragmatism, and the tracer items used to compute the measure should always be referenced.

Another limitation is associated with harmonizing facility categories between the SPA and DHS surveys. In the DHS recode data, some sources of care, especially those infrequently reported as place of delivery, were combined into one category. For example, private facilities, including hospital, health center, and others, could be recoded in one category. To adjust coverage by type of facility, we needed to match such categorization between the SPA and DHS surveys conducted in the same country. Therefore, an assumption was made such that any facilities grouped into one category had a similar level of readiness, which might not be true. These facilities are usually not widely used for delivery, hence they have only a limited contribution to coverage. Invalidity of this assumption should not substantially affect the estimates of effective coverage.

Finally, we linked the DHS and SPA surveys at the regional level stratified by facility type. We used an average readiness score for all deliveries that occurred in the same type of facility. Variation in readiness may exist among the same types of facilities in the same region. However, matching deliveries with exact facilities is not possible with the data available. In fact, a study that compared exact-match and ecological-linking methods in Côte d'Ivoire found that both methods produced similar estimates of effective coverage for maternal and sick child health services, when a census of providers was available and provider category was taken into account (Munos et al 2018).

We found that adjusting for facility readiness reduces crude coverage of facility delivery everywhere, resulting in estimates of effective coverage that give a richer understanding of how need, use, and quality create a landscape of delivery care. Our findings reinforce the importance of prioritizing quality of obstetric and newborn care to achieve further reduction of maternal and neonatal mortality. Health care can only achieve its full potential when it offers sufficient quality. Meanwhile continued efforts are needed to

increase the use of facility delivery services in countries where coverage remains low or varies substantially among different regions. Also highlighted in our results is the lack of specific items for service delivery, which should be kept in mind when interpreting estimates of effective coverage. Disaggregating by facility type added value to our analysis, since facility types have a wide range of readiness and use for delivery.

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Table 1 Description of SPA and DHS samples included in the study

Country	DHS survey year	Number of births in the two years preceding the survey	SPA survey year	Number of facilities with delivery services					
				Non-CEmOC facilities		CEmOC facilities		All facilities	
				Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted
Bangladesh	2014	3,147	2014	520	267	66	13	586	280
Haiti	2012	2,747	2013	379	379	10	10	389	389
Malawi	2015-16	6,596	2013-14	529	517	11	11	540	528
Nepal	2016	1,978	2015	585	448	36	9	621	457
Senegal	2016	2,311	2015	358	361	4	2	364	363
Tanzania	2015-16	4,327	2014-15	905	896	46	8	951	905

Figure 1 National readiness score versus coverage and regional variations

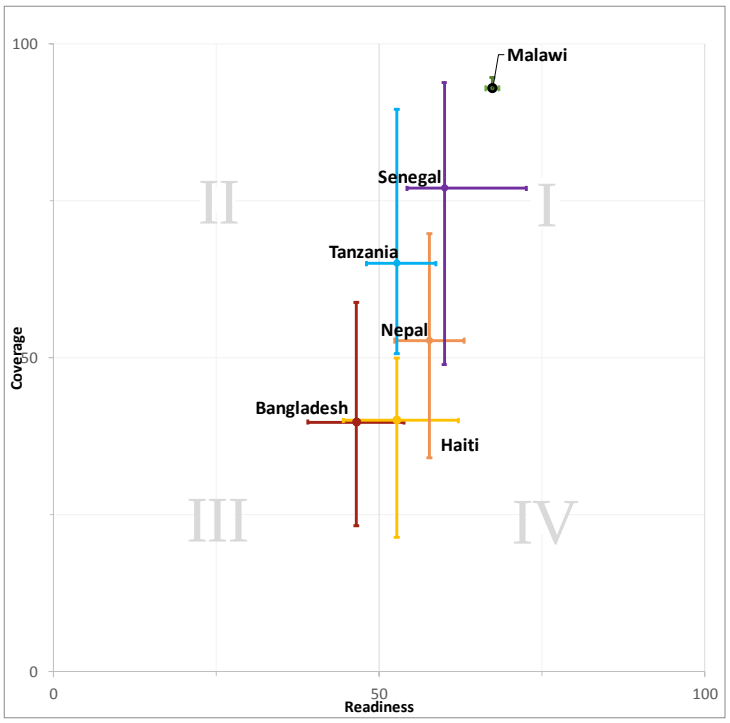


Figure 2: Effective coverage of facility delivery by region

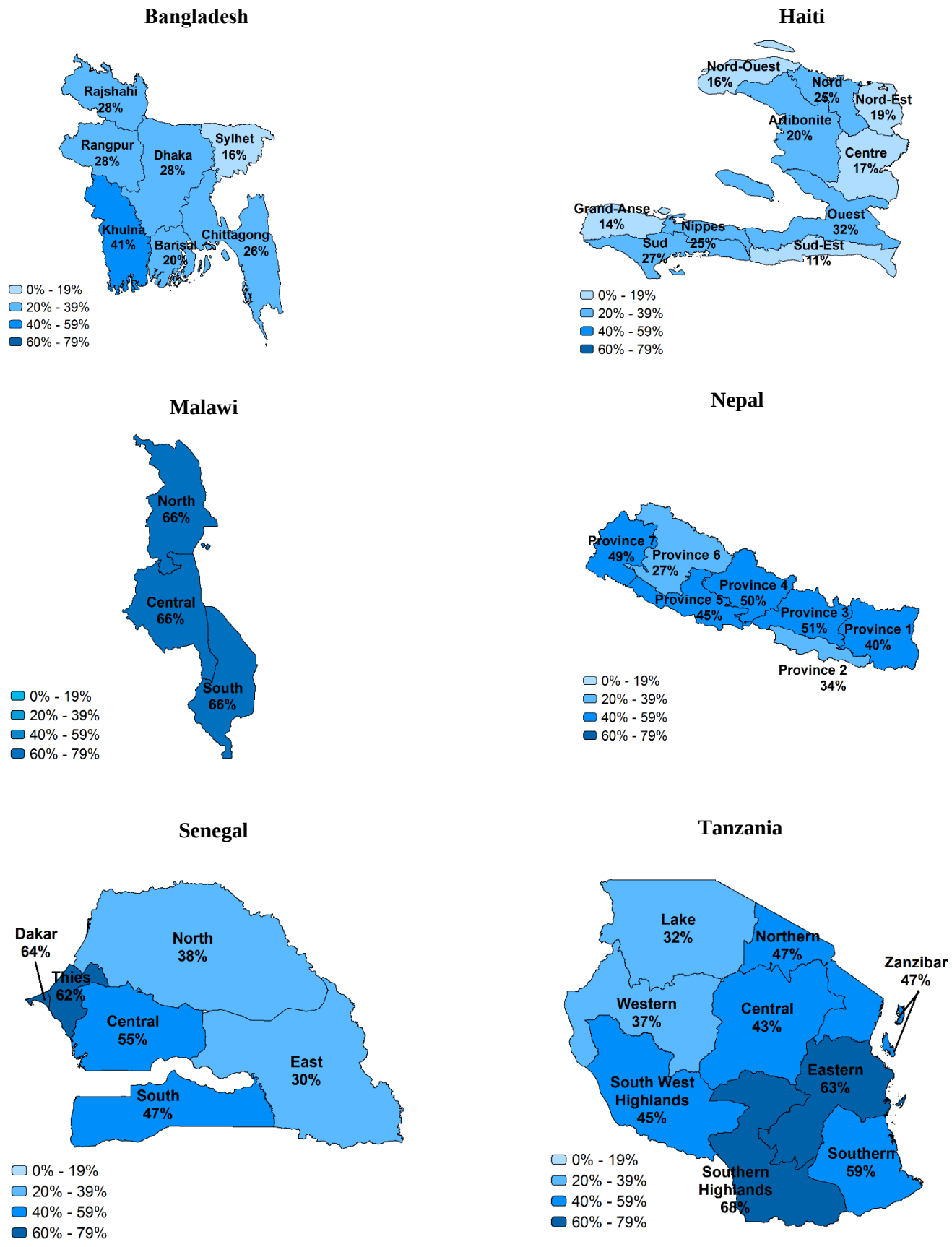
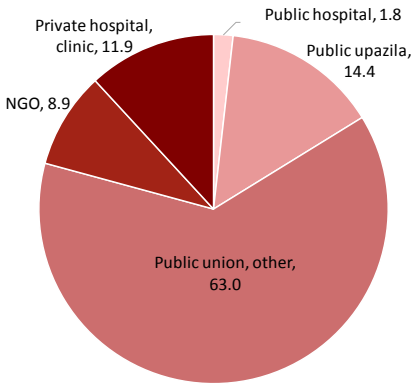


Table 2 Estimated effective coverage of facility delivery in all six countries

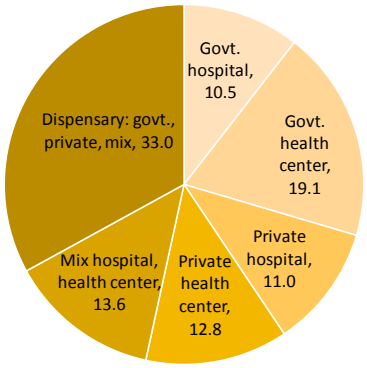
			Effective coverage		
	Coverage	Readiness score	Estimate	LB	UB
Bangladesh					
Barisal	30.5	42.5	20.5	15.9	25.8
Chittagong	36.8	46.3	25.8	21.0	31.2
Dhaka	43.7	46.8	27.6	23.1	32.7
Khulna	58.8	49.3	40.9	35.0	47.0
Rajshahi	40.9	39.0	27.6	23.1	32.7
Rangpur	35.4	53.8	27.6	22.6	33.2
Sylhet	23.2	46.9	15.6	11.6	20.8
Total	39.7	46.5	26.8	24.5	29.1
Haiti					
Ouest	50.0	57.4	31.5	26.7	36.7
Sud-Est	23.0	47.0	10.5	6.3	17.0
Nord	39.9	54.0	25.3	18.6	33.3
Nord-Est	38.0	48.0	19.2	12.6	28.1
Artibonite	30.2	49.3	20.0	14.2	27.4
Centre	31.2	59.8	17.5	11.3	26.1
Sud	40.7	60.9	27.4	19.2	37.4
Grand-Anse	21.4	55.0	14.4	9.1	22.1
Nord-Ouest	31.5	43.2	16.1	11.2	22.5
Nippes	38.7	57.0	24.8	16.3	35.8
Total	40.0	52.7	24.4	22.0	27.0
Malawi					
North	94.7	67.5	66.2	58.2	73.4
Central	92.8	67.6	66.3	61.6	70.7
South	92.7	67.2	66.4	62.1	70.5
Total	92.9	67.4	66.4	63.4	69.2
Nepal					
Province 1	55.9	57.9	40.1	33.4	47.3
Province 2	37.4	63.0	33.7	28.4	39.5
Province 3	69.8	57.4	50.7	41.7	59.7
Province 4	67.1	54.6	50.3	41.7	58.8
Province 5	54.1	62.5	45.4	36.9	54.3
Province 6	34.1	52.4	27.1	21.4	33.6
Province 7	61.9	58.4	49.5	39.9	59.1
Total	52.7	57.7	41.9	38.9	45.1
Senegal					
North	62.9	54.3	37.8	31.7	44.4
Dakar	93.9	72.6	63.9	46.9	78.0
Thiès	91.9	56.9	61.6	48.8	73.0
Central	80.1	59.8	54.6	48.4	60.6
East	48.9	63.8	29.7	23.3	36.9
South	67.0	61.7	46.7	38.5	55.1
Total	77.0	60.0	51.3	47.2	55.3
Tanzania					
Western	53.0	56.0	37.0	28.9	46.0
Northern	68.2	58.7	46.8	37.9	55.8
Central	61.7	52.8	42.9	35.1	51.0
Southern Highlands	89.5	53.4	67.7	55.7	77.8
Southern	85.8	51.2	58.5	48.0	68.3
South West Highlands	69.3	52.7	45.2	36.2	54.5
Lake	50.6	48.0	32.4	28.5	36.6
Eastern	89.0	52.3	63.1	55.6	70.0
Zanzibar	70.2	55.3	47.1	42.5	51.8
Total	65.0	52.7	44.2	41.6	46.8

Appendix Figure 1 Distribution of facilities with delivery care by facility type

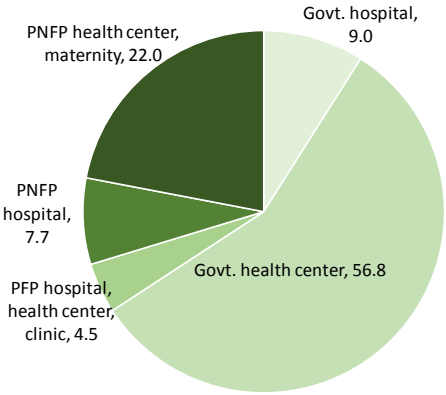
Bangladesh, SPA 2014



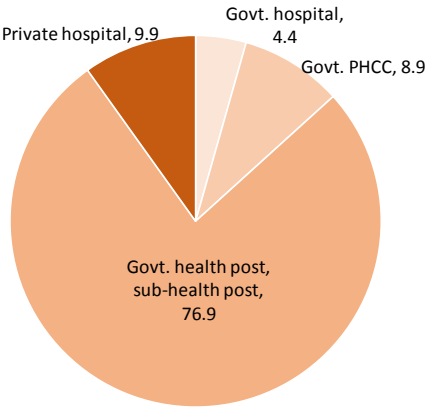
Haiti, SPA 2013



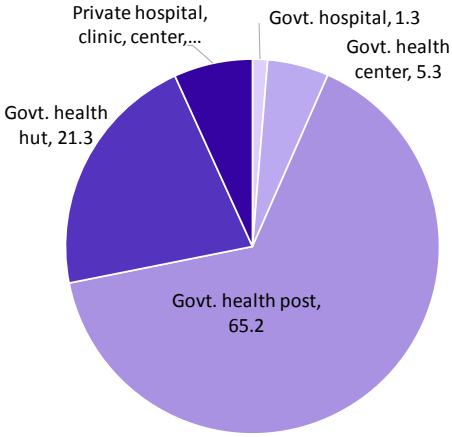
Malawi, SPA 2013-14



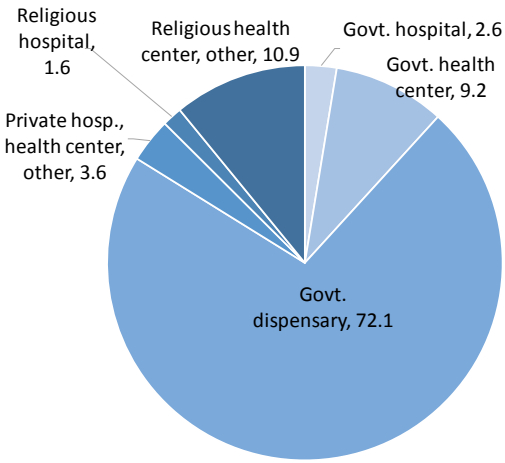
Nepal, SPA 2015-16



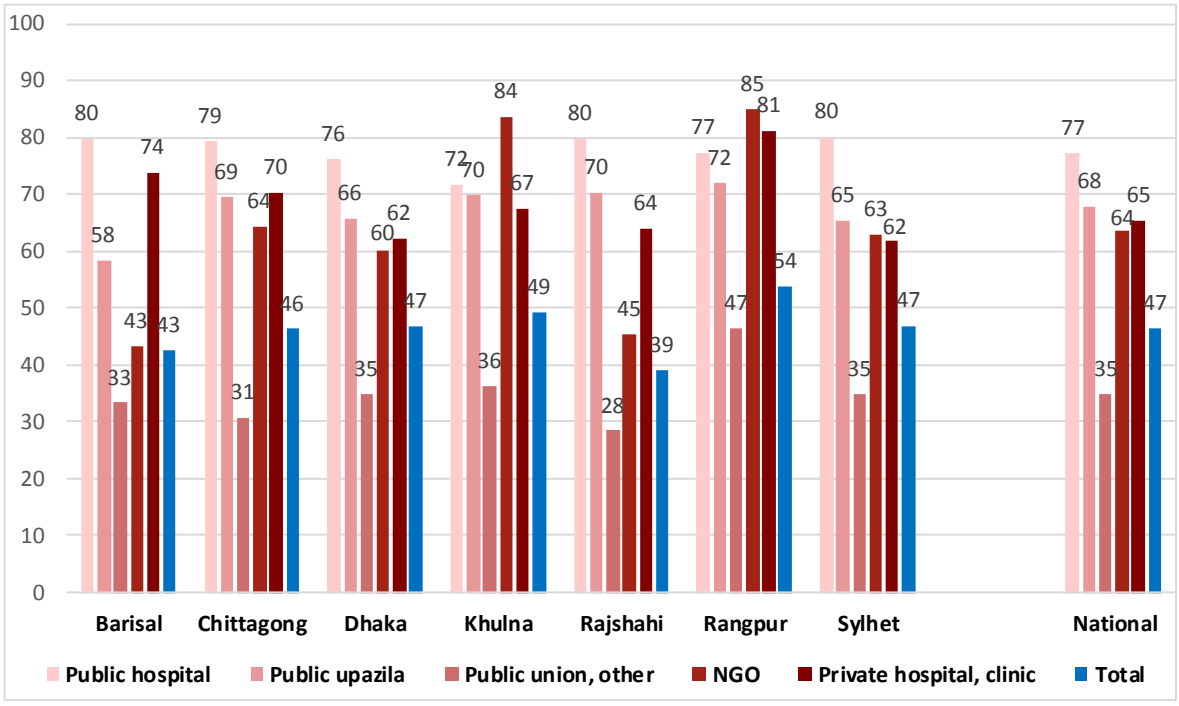
Senegal, SPA 2015



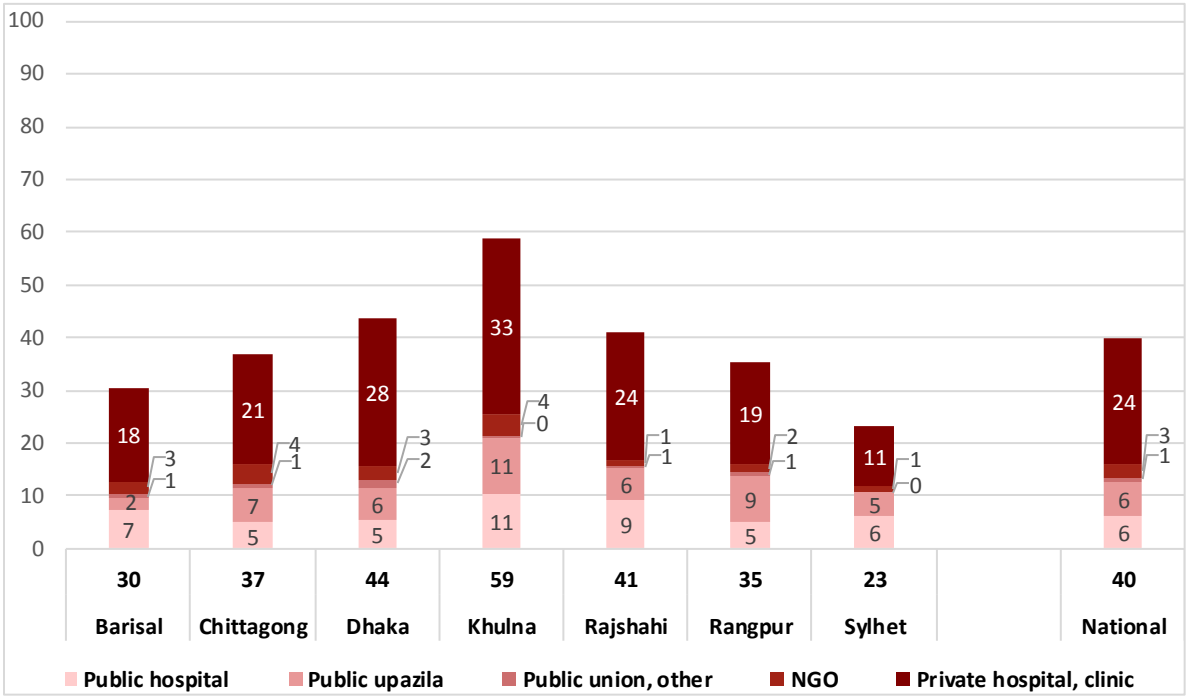
Tanzania, SPA 2014-15



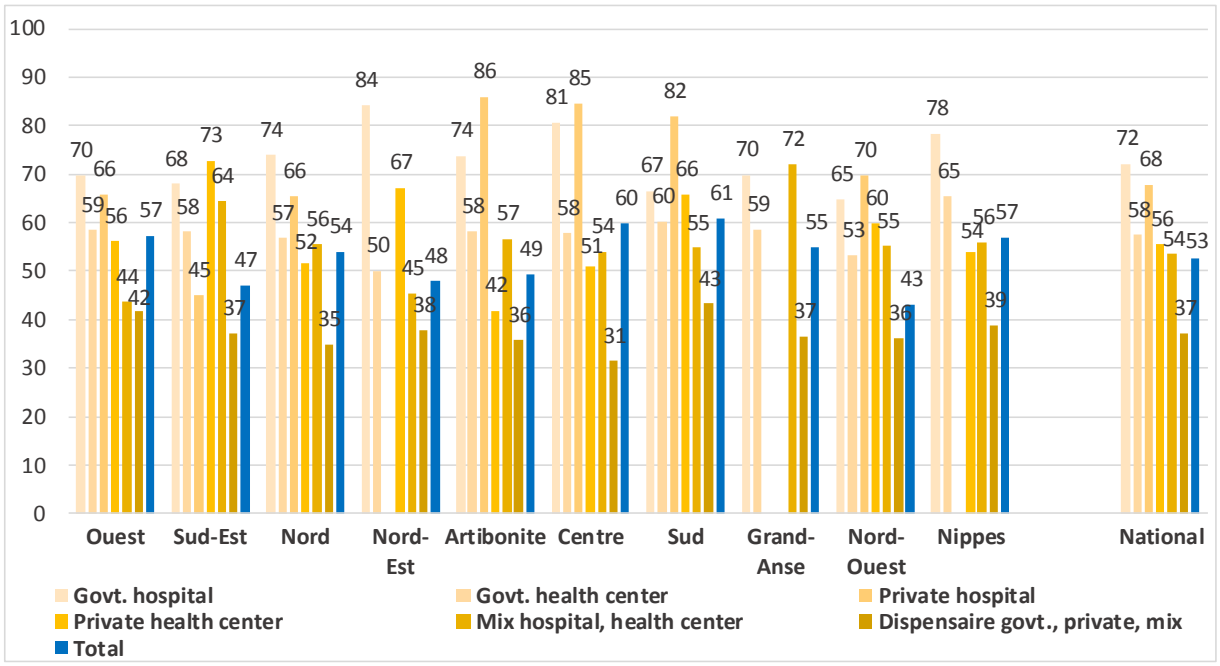
Appendix Figure2Readiness score of delivery services by facility type and division, Bangladesh SPA 2014



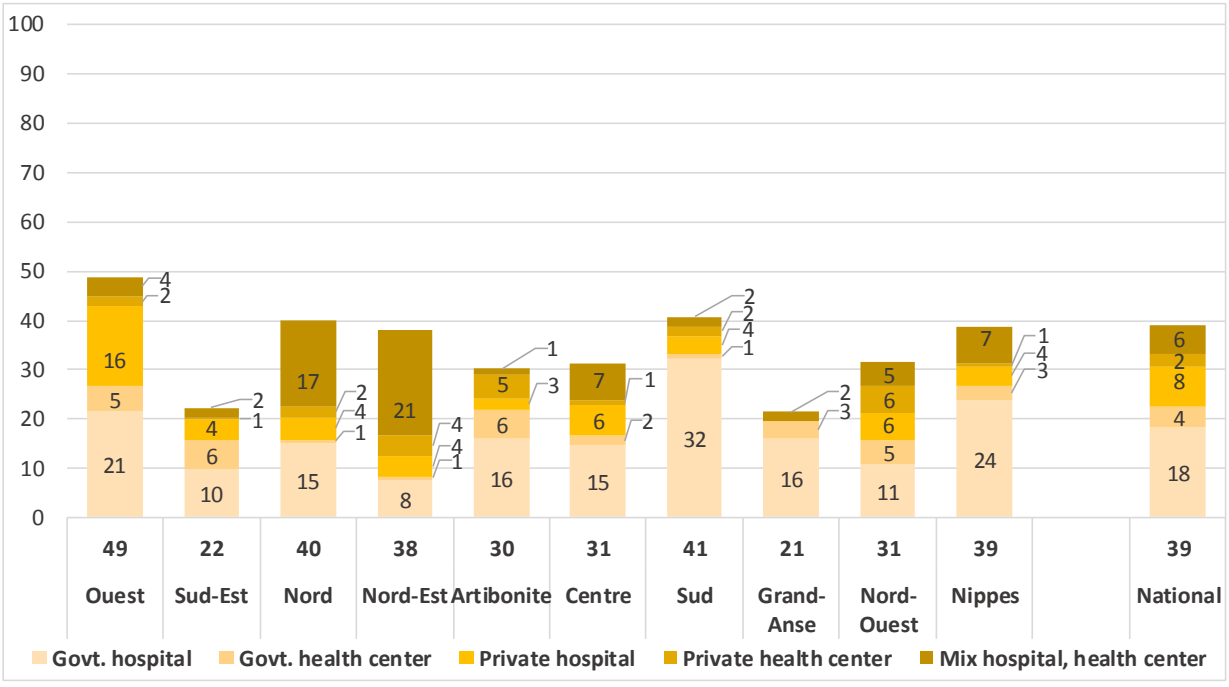
Appendix Figure 3 Percentage delivered in a health facility by facility type and division, among births in the two years preceding the survey, Bangladesh DHS 2014



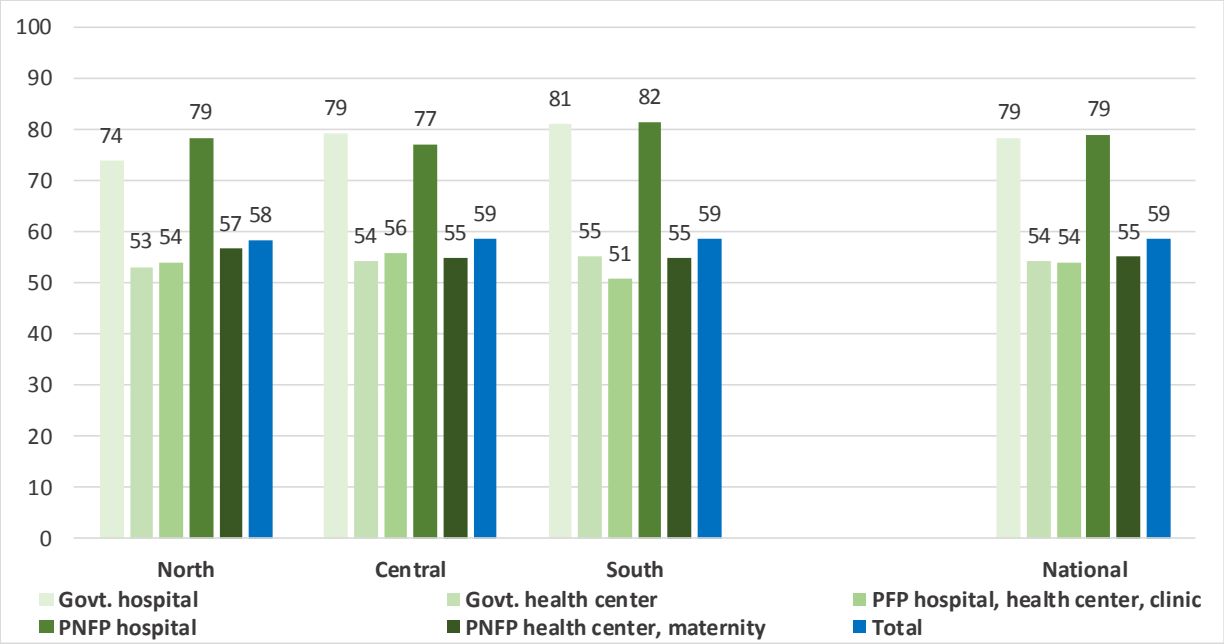
Appendix Figure 4 Readiness score of delivery services by facility type and region, Haiti SPA 2013



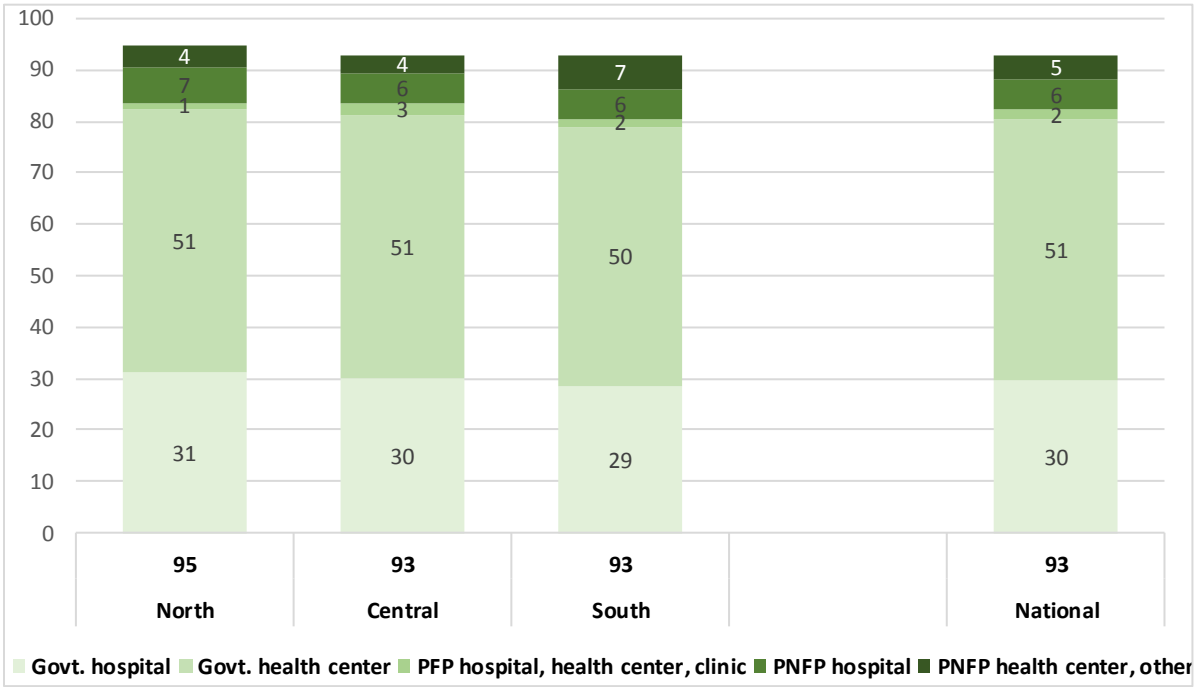
Appendix Figure 5 Percentage delivered in a health facility by facility type and region, among births in the two years preceding the survey, Haiti DHS 2012



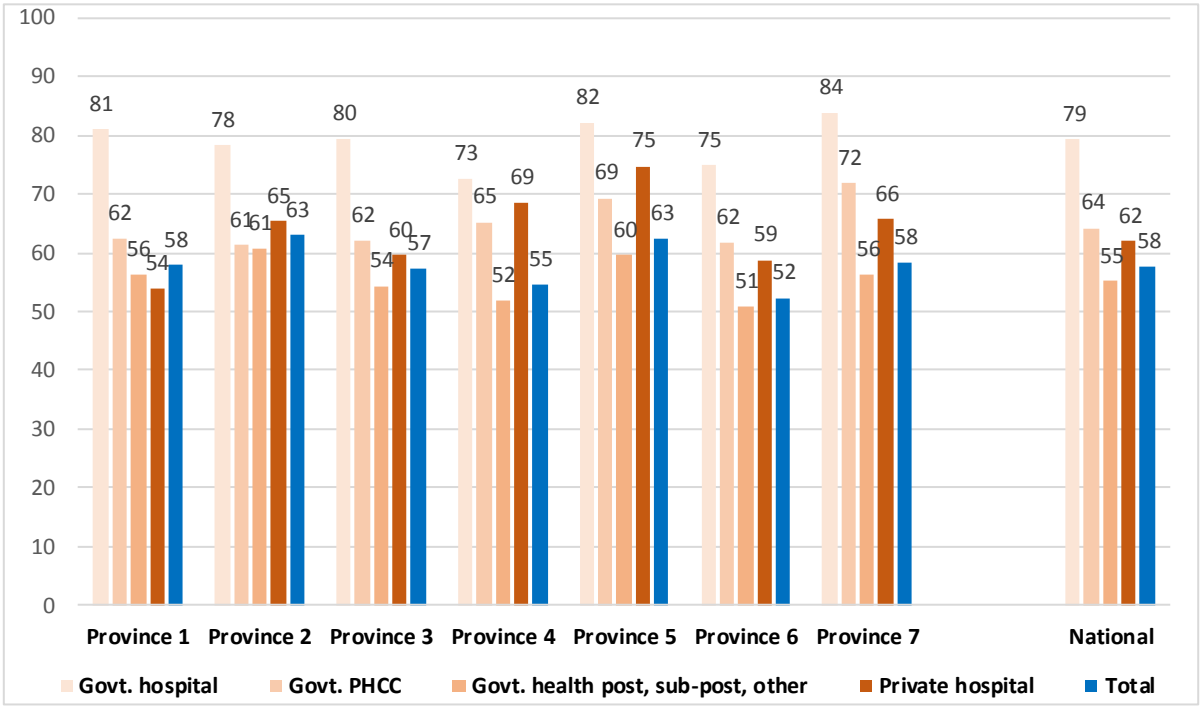
Appendix Figure 6 Readiness score of delivery services by facility type and region, Malawi SPA 2013-14



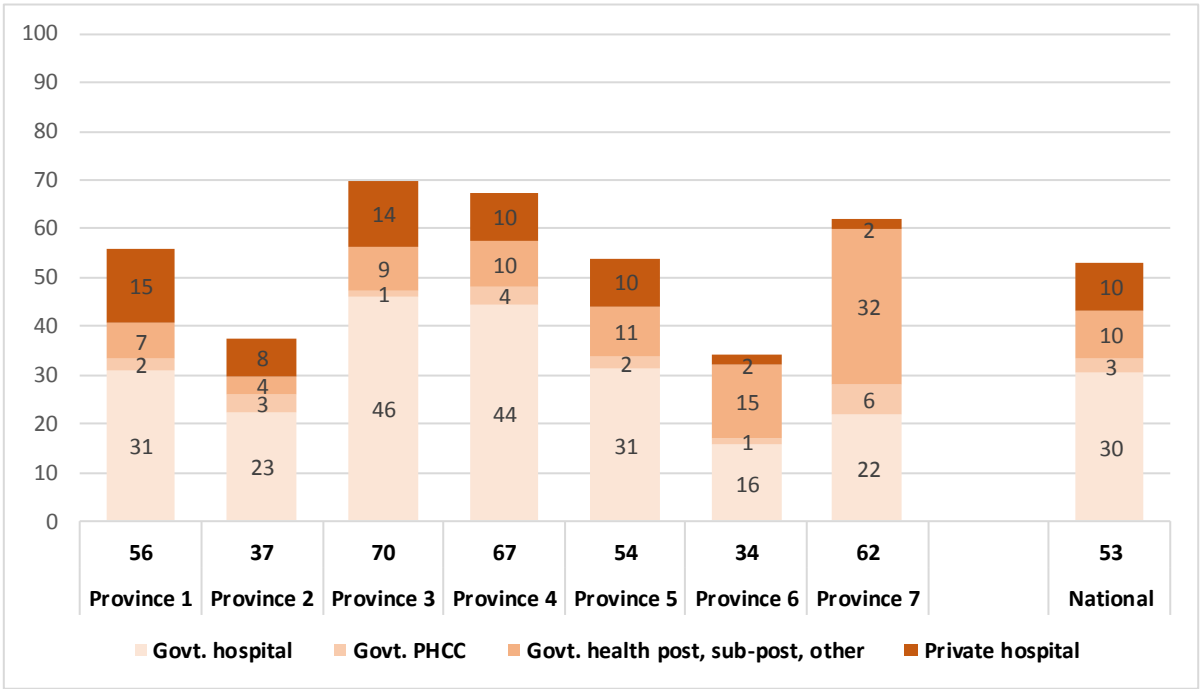
Appendix Figure 7 Percentage delivered in a health facility by facility type and region, among births in the two years preceding the survey, Malawi DHS 2012



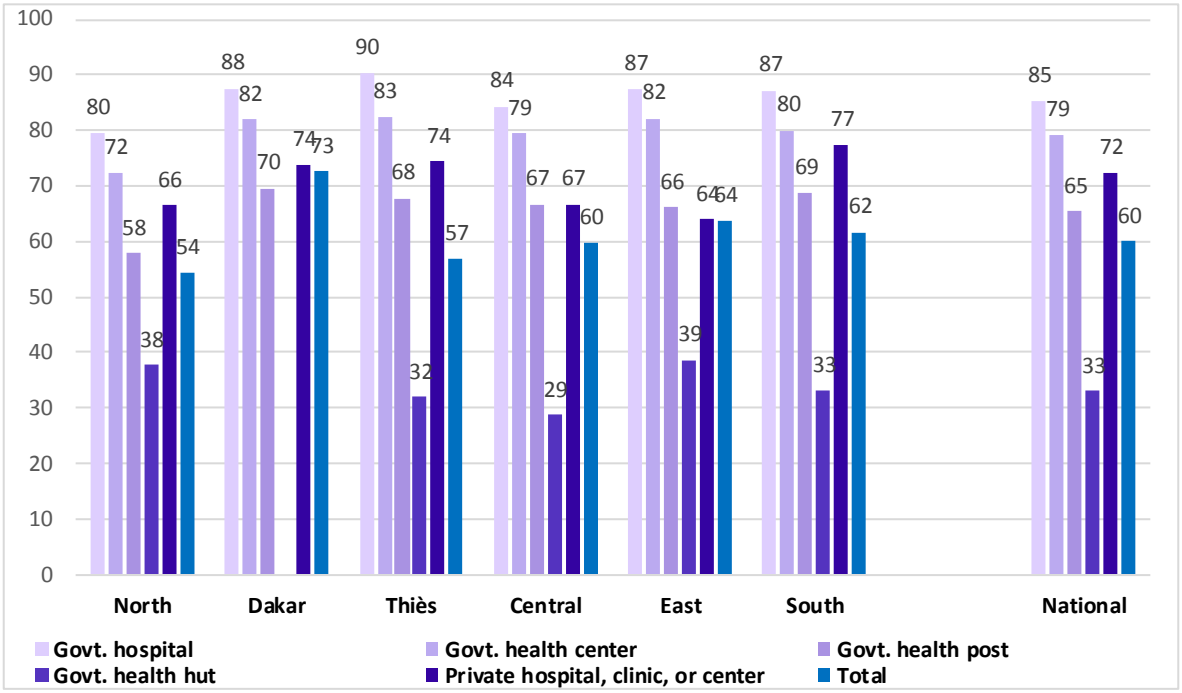
Appendix Figure 8 Readiness score of delivery services by facility type and province, Nepal SPA 2015-16



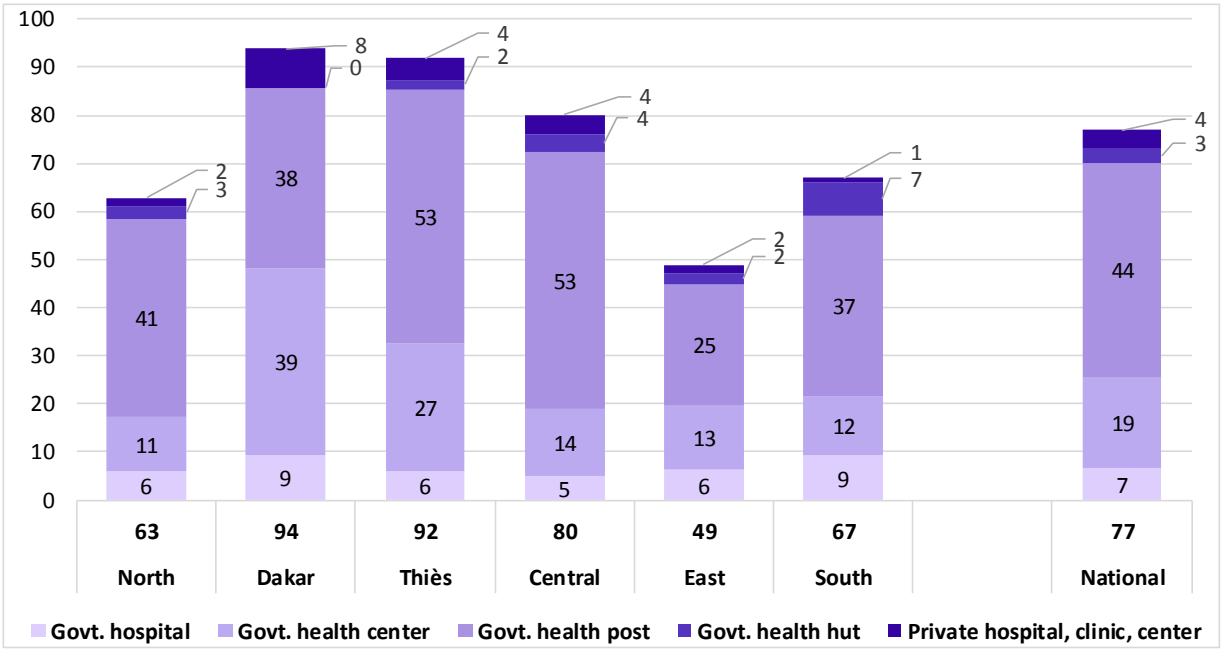
Appendix Figure 9 Percentage delivered in a health facility by facility type and province, among births in the two years preceding the survey, Nepal DHS 2015



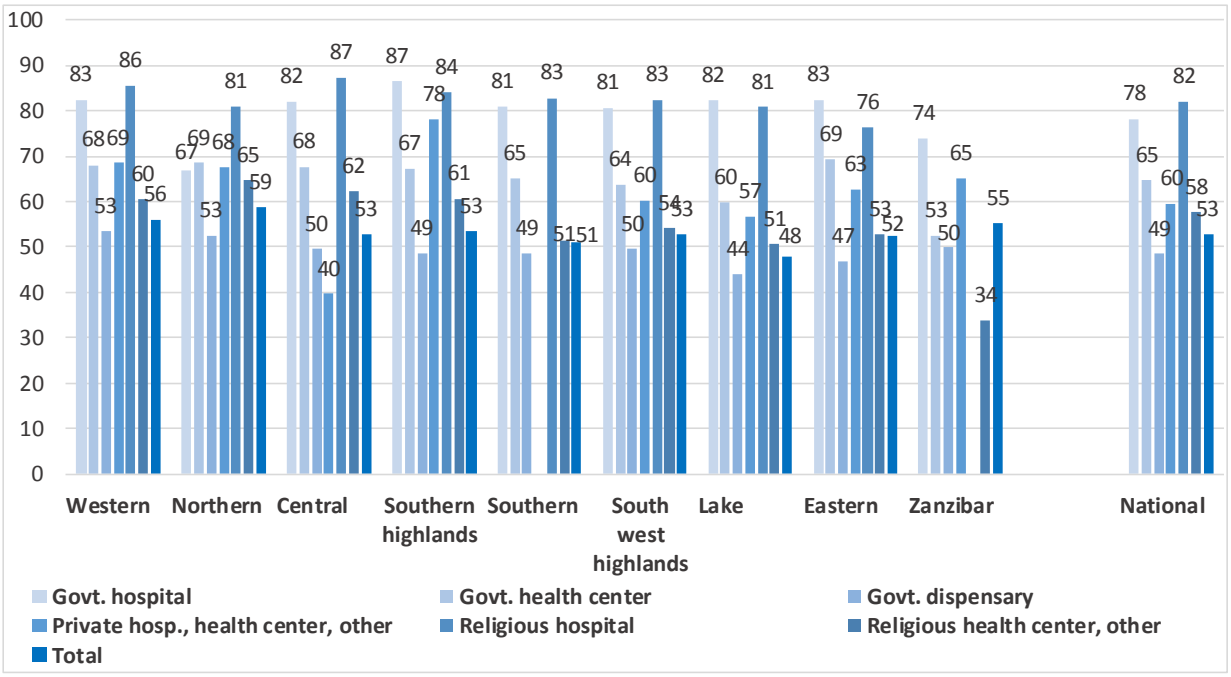
Appendix Figure 10 Readiness score of delivery services by facility type and region, Senegal SPA 2015



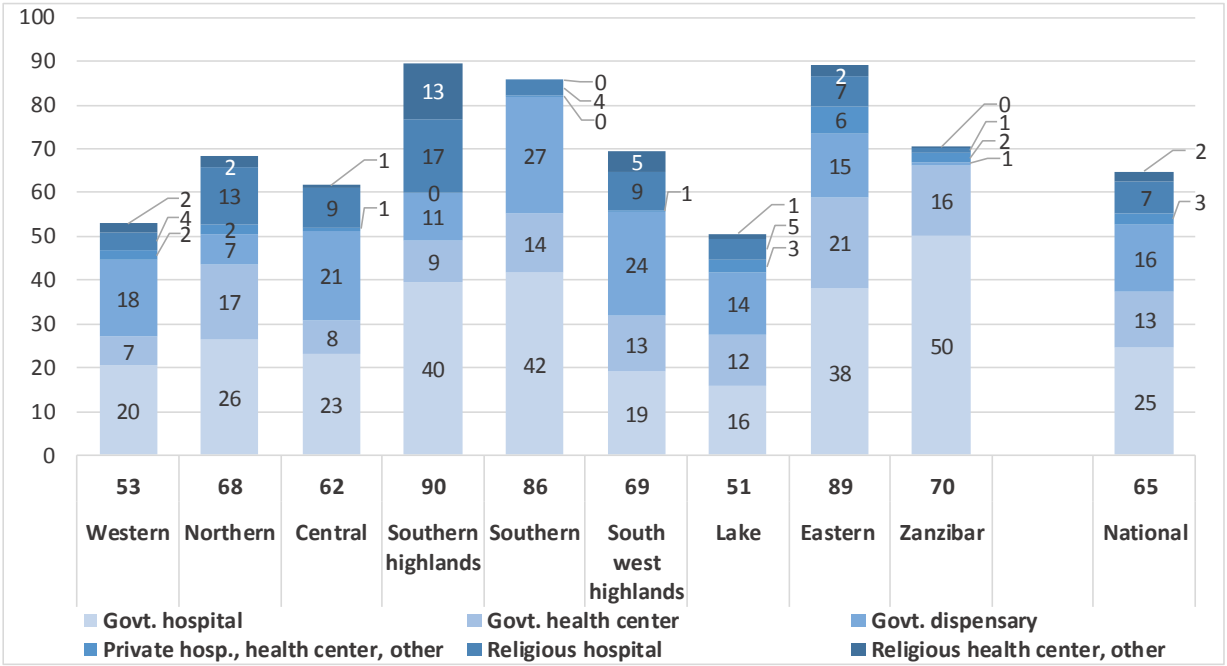
Appendix Figure 11 Percentage delivered in a health facility by facility type and region, among births in the two years preceding the survey, Senegal DHS 2016



Appendix Figure 12 Readiness score of delivery services by facility type and zone, Tanzania SPA 2014-15

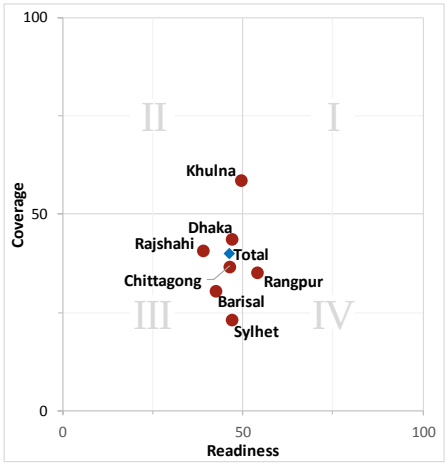


Appendix Figure 13 Percentage delivered in a health facility by facility type and zone, among births in the two years preceding the survey, Tanzania DHS 2015-16

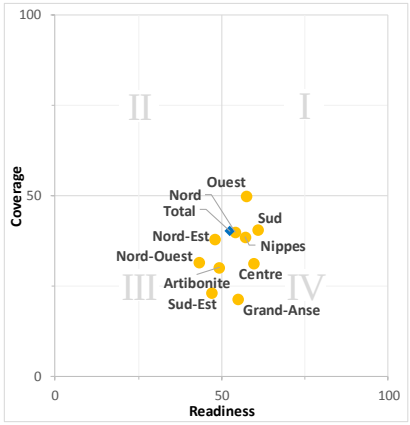


Appendix Figure 14 Readiness versus coverage by region

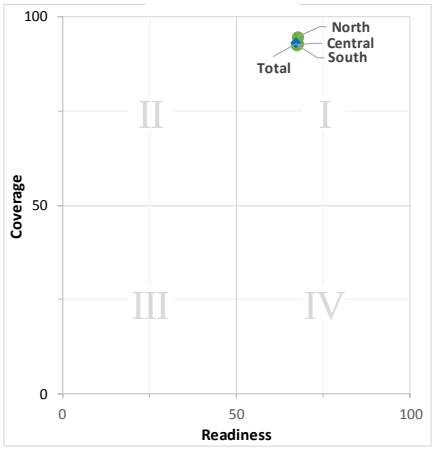
Bangladesh



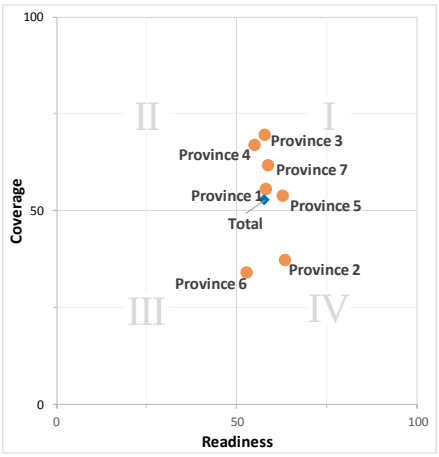
Haiti



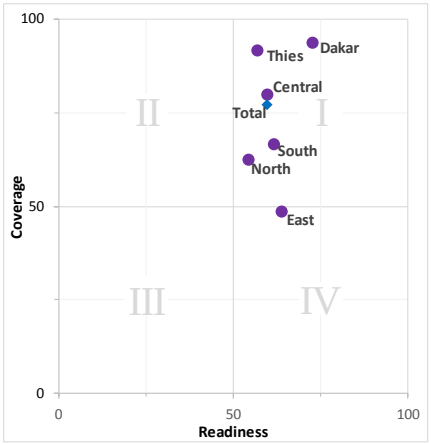
Malawi



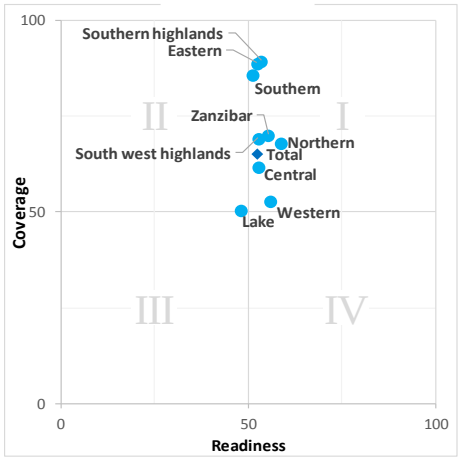
Nepal



Senegal



Tanzania



Appendix Table 1 Harmonized facility categories and reported categories in SPA and DHS

Harmonized facility category	SPA facility category	DHS facility category
Bangladesh		
Government hospital	Government district hospital	Government hospital Government district hospital
Government upazila facilities	Upazila health complex Maternal and child welfare center	Upazila health complex Upazila health & family welfare center Maternal and child welfare center
Government union, other Government	Union health and family welfare center Union health and family welfare center Union subcenter (UNSC) / rural dispensary Community clinic	Other Government sector Community clinic
NGO	NGO clinic NGO hospital	NGO clinic Other NGO sector
Private hospital, clinic	Private hospital	Private hospital/clinic
Haiti		
Government hospital	Government university hospital Government departmental hospital Government community hospital Other government hospital	Government hospital Government maternity
Government health center	Government health center with bed Government health center without bed	Government health center
Private hospital	Private university hospital Private departmental hospital private community hospital Private hospital	Private hospital/clinic
Private health center	Private health center with bed Private health center without bed	Private health center
Mix hospital, health center	Mix hospital Mix health center	Mix hospital Mix health center Mix maternity center
Dispensary	Dispensary	
Malawi		
Government hospital	Central hospital District hospital Rural/community hospital Other hospital	Government hospital
Government health center	Government health center Government maternity health	Government health center Government health post other Government sector
Private for-profit hospital, health center, clinic	Private hospital Private health center Private clinic Private maternity center	Private for-profit hospital/clinic
Private not-for-profit hospital	private not-for-profit hospital	CHAM/mission hospital
Private not-for-profit health center, maternity	Private not-for-profit health center Private not-for-profit maternity Private not-for-profit clinic	CHAM/mission health center BLM
Nepal		
Government Hospital	Central government hospital Regional government hos Sub-regional government hospital Zonal government hospital District government hospital	Government hospital
Government primary health care center (PHCC)	Government primary health care center (PHCC)	Government primary health care center (PHCC)
Government health post, sub-post, other	Government health post Government sub-health post	Government health center Other government sector
Private hospital	Private hospital	Private hospital
Senegal		
Government hospital	Government hospital	Government hospital
Government health center	Government health center	Government health center/maternity
Government health post	Government health center	Government health center

Government health hut	Government health hut	Government health hut
Private hospital, clinic, or center	Private hospital Private health center Private health poster	Private hospital/clinic
	Tanzania	
Government hospital	Government national referral hospital Government regional hospital Government district hospital Government district-designated hospital Other government hospital	Government national referral hospital Government regional referral hospital Government regional hospital Government district hospital
Government health center	Government health center	Government health center
Government dispensary	Government dispensary	Government dispensary
Private hospital, health center, other	Private hospital Private health center private dispensary private clinic	Private hospital Private health center private dispensary private clinic
Religious hospital	Religious national referral hospital Religious regional hospital Religious district hospital Religious district-designated hospital Other religious hospital	Religious national referral hospital Religious district hospital Other religious hospital
Religious health center, other	Religious health center Religious other	Religious health center Religious other

Appendix Table 2 Obstetric and newborn care readiness indicators and definitions

Domain/ Indicator Name	Definition
Domain A: Comprehensive emergency obstetric care	
Parenteral administration of antibiotics	Facility performed this signal function for emergency obstetric care at least once during the three months before the assessment
Parenteral administration of uterotonic drugs/oxytocin	See above
Parenteral administration of anticonvulsants for hypertensive disorders of pregnancy	See above
Manual removal of placenta	See above
Assisted vaginal delivery	See above
Removal of retained products	See above
Caesarean section	See above (incorporate the availability of equipment and materials for performing the service)
Blood transfusion	See above (incorporate the availability of equipment and materials for performing the service)
Domain B: Newborn signal functions and immediate care	
Neonatal resuscitation	Facility performed neonatal resuscitation at least once during the three months before the assessment
Skin-to-skin	Facility reported this intervention is routinely practiced
Breast feeding in 1st hour	See above
Drying and wrapping newborns	See above
Domain C: General requirements	
Electricity	Facility is connected to a central power grid and there has not been an interruption in power supply lasting for more than two hours at a time during normal working hours in the seven days before the assessment, or the facility had a functioning generator with fuel available on the day of the assessment, or else facility has a backup solar power.
Improved water source	Facility has an improved water source available. For most countries, this means that water is piped into the facility or onto facility grounds, or else water comes from a public tap or standpipe, a tube well or borehole, a protected dug well, protected spring, rain water, or bottled water, and the outlet from this source is within 500 meters of the facility.
Improved sanitation	Facility has a functioning flush or pour-flush toilet, a ventilated improved pit latrine, or composting toilet.
24/7 Skilled birth attendance	Provider of delivery care available on-site or on-call 24 hours/day, with observed duty schedule.
Emergency transport	The facility had a functioning ambulance or other vehicle for emergency transport that was stationed at the facility and had fuel available on the day of the assessment, or the facility has access to an ambulance or other vehicle for emergency transport that is stationed at another facility or that operates from another facility.
Domain D: Equipment	
Sterilization equipment	Facility reports that some instruments are processed in the facility and the facility has a functioning electric dry heat sterilizer, a functioning electric autoclave, or a non-electric autoclave with a functioning heat source available somewhere in the facility.
Delivery bed	At least one delivery bed available and observed in delivery area.
Examination light	Examination light (flashlight okay) available, observed, and functioning in delivery area.
Delivery pack	Delivery pack OR cord clamp, episiotomy scissors, scissors/lade to cut cord, suture material with need, AND needle holder all available in delivery area.
Suction apparatus (mucus abstractor)	Suction apparatus (mucus abstractor) available, observed, and functioning in the delivery area.
Manual vacuum extractor	Manual vacuum extractor available, observed, and functioning in the delivery area.
Vacuum aspirator or D&C kit	Vacuum aspirator or D&C kit available, observed, and functioning, in the delivery area.
Partograph	Partograph available, observed, and functioning in delivery area.
Disposable latex gloves	Disposable latex gloves observed in delivery area.
Newborn bag and mask	Newborn bag and mask (AMBU bag and mask) available, observed, and functioning in the delivery area.
Infant scale	Infant scale observed and functioning in delivery area.
Blood pressure apparatus (digital or manual)	Manual or digital blood pressure apparatus observed and functioning in delivery area.
Hand-washing soap and running water or hand disinfectant	Hand-washing soap and running water or hand disinfectant available and observed in delivery area.
Domain E: Medicines and commodities	
Injectable antibiotic	Injectable antibiotics observed in delivery area (i.e., at “service site”) and at least one dose valid.
Hydrocortisone available at the facility	Hydrocortisone observed at the facility and at least one dose valid.
Injectable uterotonic	Oxytocin observed in delivery area with at least one dose valid.
Skin disinfectant	Skin disinfectant available for newborns in delivery area.
Magnesium sulfate	Magnesium sulphate available in delivery area with at least one dose valid.
IV solution with infusion set	IV solution with infusion set available in delivery area with at least one set valid.
Chlorhexidine for cord cleaning	Chlorhexidine solution (4%) for umbilical cord cleaning available in delivery area, with at least one dose valid.
Antibiotic eye ointment for newborn	Tetracycline eye ointment for newborn available in delivery area and at least one dose valid.

Domain F: Guidelines, staff training and supervision	
Guidelines: Integrated Management of Pregnancy and Childbirth (IMPAC) Guidelines	Guidelines available in delivery area
Guidelines: CEmOC Guidelines	Guidelines available in delivery area
Guidelines: Guidelines for management of pre-term labor	Guidelines available in delivery area
Guidelines for standard precautions	Guidelines available in delivery area
Training in neonatal resuscitation	At least one provider of delivery/newborn care in facility received training in neonatal resuscitation in the past 24 months
Training in early and exclusive breastfeeding	At least one provider of delivery/newborn care in facility received training in early and exclusive breastfeeding in the past 24 months
Training in newborn infection management (including injectable antibiotics)	At least one provider of delivery/newborn care in facility received training in newborn infection management (including injectable antibiotics) in the past 24 months
Training in thermal care	At least one provider of delivery/newborn care in facility received training in thermal care in the past 24 months
Training in cord care	At least one provider of delivery/newborn care in facility received training in cord care in the past 24 months
Training in IMPAC	At least one provider of delivery/newborn care in facility received training in IMPAC in the past 24 months
Training in routine care during labor and delivery	At least one provider of delivery/newborn care in facility received training in routine care during labor and normal vaginal delivery in the past 24 months
Training in CEmOC	At least one provider of delivery/newborn care in facility received training in IMPAC in the past 24 months
Training in Active Management of Third Stage of Labor (AMTSL)	At least one provider of delivery/newborn care in facility received training in AMTSL in the past 24 months
Training in Kangaroo Mother Care (KMC)	At least one provider of delivery/newborn care in facility received training in KMC in the past 24 months
Supervision	At least half of interviewed providers reported being personally supervised at least once during the 6 months preceding the survey

Appendix Table 3 Percentage of health facilities with structural tracer items, Bangladesh SPA 2014

	Non-CEmOC facilities								CEmOC facilities
Domain/Indicator Name	Barisal	Chittagong	Dhaka	Khulna	Rajshahi	Rangpur	Sylhet	National Average	National average
Domain A: Comprehensive emergency obstetric care									
Parenteral administration of antibiotics	46.1	49.1	46.5	38.6	28.2	37.1	36.1	42.2	100.0
Parenteral administration of uterotonic drugs/oxytocin	44.9	48.0	48.3	55.5	27.5	68.7	41.3	48.1	100.0
Parenteral administration of anticonvulsants for hypertensive disorders of pregnancy	17.2	21.0	23.6	31.1	17.6	53.1	28.4	26.5	100.0
Manual removal of placenta	43.8	41.9	35.7	34.4	39.7	45.4	43.3	39.4	100.0
Assisted vaginal delivery	40.1	43.0	46.1	39.8	46.1	43.9	63.0	45.4	100.0
Removal of retained products	27.8	27.3	25.8	25.5	29.7	43.5	28.3	29.0	100.0
Caesarean section	na	na	na	na	na	na	na	na	100.0
Blood transfusion	na	na	na	na	na	na	na	na	100.0
Domain B: Newborn signal functions and immediate care									
Neonatal resuscitation	29.8	34.2	45.0	55.9	26.9	48.9	31.1	40.2	94.3
Skin-to-skin care	51.6	57.3	70.5	84.4	62.4	90.9	62.5	69.0	93.1
Wrap baby	90.1	90.8	98.7	98.4	96.4	87.8	89.5	94.4	99.4
Initiate breastfeeding within the first hour	91.8	97.5	100.0	98.8	100.0	91.2	87.9	97.1	99.4
Domain C: General requirements									
Electricity	39.0	48.0	42.6	62.1	24.4	59.3	49.7	45.4	94.5
Improved water source	88.5	95.6	90.0	97.5	88.6	96.9	93.2	92.6	98.7
Improved sanitation	77.6	85.9	67.1	53.1	77.3	76.8	86.0	73.9	93.1
24/7 skilled birth attendance	37.8	25.7	27.6	30.7	17.4	44.0	30.1	28.9	64.7
Emergency transport	31.0	27.5	34.7	43.9	14.4	20.9	40.0	29.9	88.5
Domain D: Equipment									
Sterilization equipment	61.4	58.5	65.5	57.3	30.5	94.7	59.6	61.9	90.6
Delivery bed	80.2	67.9	76.7	64.9	70.9	68.8	73.4	72.2	92.4
Examination light	42.1	51.4	66.2	72.7	44.7	93.3	72.4	63.5	98.7
Delivery pack	54.1	47.9	59.5	44.4	56.9	89.7	52.1	58.4	82.0
Suction apparatus (mucus abstractor)	40.5	45.1	53.3	54.0	25.6	49.0	31.8	45.6	93.7
Manual vacuum extractor	22.6	28.1	18.1	18.6	14.8	40.1	25.9	23.2	52.7
Vacuum aspirator or D&C kit	27.9	33.9	20.1	32.0	10.5	45.5	29.2	26.8	66.3
Partograph	25.7	16.2	28.5	27.3	12.7	35.2	21.9	24.2	45.9
Disposable latex gloves	82.7	63.7	57.7	81.2	62.8	98.2	96.1	70.4	91.0
Newborn bag and mask	48.6	39.8	45.6	48.9	26.9	62.3	43.7	44.4	84.3
Infant scale	50.1	53.7	48.7	57.2	76.5	89.5	51.1	59.2	64.6
Blood pressure apparatus (digital or manual)	87.0	82.3	88.9	82.0	99.8	100.0	92.8	89.8	98.7
Hand-washing soap and running water or hand disinfectant	69.6	69.0	75.3	73.4	68.9	94.7	83.1	75.6	95.0
Domain E: Medicines and commodities									
Injectable antibiotic	20.1	30.4	39.8	18.8	27.6	23.2	30.0	30.8	68.4
Hydrocortisone available at the facility	11.2	20.7	21.7	13.5	8.8	11.7	20.5	17.3	71.6
Injectable uterotonic	19.9	26.9	33.6	30.2	28.1	46.2	33.4	32.0	79.1
Skin disinfectant	18.9	27.8	23.0	36.6	14.9	27.5	27.3	24.8	66.5
Magnesium sulfate	3.5	15.2	24.8	14.9	24.2	20.4	25.7	20.3	56.6
IV solution with infusion set	22.5	28.7	37.6	30.2	31.5	36.0	36.3	33.3	83.3
Chlorhexidine for cord cleaning	14.5	33.7	31.0	21.3	15.4	50.5	26.8	29.9	71.3
Antibiotic eye ointment for newborn	10.1	20.2	26.5	7.7	22.6	33.4	29.3	23.2	37.9

Domain F: Guidelines, staff training and supervision									
Guidelines: Integrated Management of Pregnancy and Childbirth (IMPAC) Guidelines	30.8	17.3	23.8	18.8	4.1	56.4	20.2	23.7	25.4
Guidelines: CEmOC Guidelines	16.4	22.5	15.1	20.9	9.8	56.7	20.7	21.9	28.9
Guidelines: Guidelines for management of pre-term labor	19.1	15.8	18.8	12.6	11.4	41.4	34.1	20.5	36.9
Guidelines on standard precaution	29.6	19.1	31.7	19.9	9.9	59.1	19.8	27.8	32.7
Training in neonatal resuscitation	19.3	24.7	11.8	48.4	6.7	17.4	43.4	20.1	29.9
Training in early and exclusive breastfeeding	18.8	28.3	16.7	35.3	2.2	19.7	39.4	20.8	21.7
Training in newborn infection management (including injectable antibiotics)	11.4	13.0	6.9	18.2	1.2	9.5	17.0	9.6	25.3
Training in thermal care	21.8	15.7	7.9	33.7	1.2	7.4	33.0	13.2	21.8
Training in cord care	21.8	19.4	13.5	43.8	2.2	10.5	28.7	17.0	29.2
Training in IMPAC	11.4	12.5	6.2	11.0	1.9	7.4	10.6	8.1	30.1
Training in normal labor and delivery care	17.8	13.4	7.6	18.9	3.1	7.7	17.8	10.4	33.3
Training in CEmOC	12.2	6.9	5.4	14.7	1.0	4.3	3.9	6.1	28.9
Training in AMTSL	16.9	15.8	5.4	23.6	1.2	8.4	15.1	10.2	32.0
Training in KMC	11.8	17.2	14.3	33.7	2.2	9.6	19.1	14.7	30.2
Supervision	82.4	89.2	87.9	89.3	90.3	95.2	84.0	88.9	92.0
Number of facilities	15	53	92	24	34	32	17	267	13

Appendix Table 4 Percentage of health facilities with structural tracer items, Haiti SPA 2013

	Non-CEmOC facilities											CEmOC facilities
Domain/Indicator Name	Ouest	Sud-Est	Nord	Nord-Est	Artibonite	Centre	Sud	Grand-Anse	Nord-Ouest	Nippes	National Average	National average
Domain A: Comprehensive emergency obstetric care												
Parenteral administration of antibiotics	70.3	40.0	61.1	42.3	45.1	47.6	73.9	40.0	46.1	50.0	54.6	100.0
Parenteral administration of uterotonic drugs/oxytocin	72.3	45.7	66.7	65.4	60.8	76.2	100.0	75.0	58.1	75.0	67.5	100.0
Parenteral administration of anticonvulsants for hypertensive disorders of pregnancy	34.7	17.1	36.1	23.1	29.4	28.6	34.8	35.0	21.8	18.8	29.0	100.0
Manual removal of placenta	55.4	34.3	47.2	42.3	52.9	42.9	56.5	65.0	42.2	50.0	49.3	100.0
Assisted vaginal delivery	79.2	65.7	80.6	73.1	62.7	76.2	87.0	70.0	63.9	81.3	73.3	100.0
Removal of retained products	53.5	48.6	50.0	42.3	41.2	52.4	47.8	65.0	32.0	37.5	46.9	100.0
Caesarean section	na	na	na	na	na	na	na	na	na	na	na	100.0
Blood transfusion	na	na	na	na	na	na	na	na	na	na	na	100.0
Domain B: Newborn signal functions and immediate newborn care												
Neonatal resuscitation	47.5	25.7	38.9	23.1	37.3	42.9	47.8	40.0	39.7	56.3	40.3	100.0
Skin-to-skin care	78.2	97.1	86.1	69.2	76.5	85.7	91.3	95.0	84.0	93.8	83.4	80.0
Wrap baby	97.0	97.1	94.4	84.6	88.2	95.2	100.0	95.0	96.0	100.0	94.7	100.0
Initiate breastfeeding within the first hour	86.1	85.7	97.2	84.6	88.2	95.2	100.0	90.0	96.0	93.8	90.5	90.0
Domain C: General requirements												
Electricity	83.2	68.6	88.9	69.2	62.7	85.7	95.7	95.0	74.0	68.8	78.4	90.0
Improved water source	72.3	85.7	77.8	69.2	68.6	71.4	87.0	85.0	70.1	93.8	75.5	80.0
Improved sanitation	78.2	28.6	36.1	38.5	41.2	52.4	47.8	35.0	15.9	56.3	47.1	50.0
24/7 skilled birth attendance	38.6	22.9	41.7	30.8	33.3	42.9	30.4	50.0	15.7	25.0	32.9	90.0
Emergency transport	40.6	25.7	30.6	11.5	41.2	42.9	34.8	15.0	7.9	31.3	30.0	80.0
Domain D: Equipment												
Sterilization equipment	55.4	40.0	50.0	53.8	35.3	76.2	56.5	25.0	35.9	50.0	47.5	100.0
Delivery bed	93.1	88.6	91.7	92.3	92.2	100.0	100.0	90.0	94.0	100.0	93.4	100.0
Examination light	46.5	28.6	27.8	38.5	27.5	42.9	47.8	45.0	23.9	43.8	36.6	30.0
Delivery pack	80.2	82.9	86.1	76.9	62.7	95.2	91.3	85.0	70.1	81.3	78.9	100.0
Suction apparatus (mucus abstractor)	45.5	11.4	25.0	15.4	25.5	14.3	43.5	35.0	11.9	18.8	27.7	10.0
Manual vacuum extractor	16.8	2.9	13.9	7.7	3.9	9.5	4.3	10.0	5.9	0.0	9.2	40.0
Vacuum aspirator or D&C kit	28.7	20.0	25.0	15.4	11.8	4.8	26.1	15.0	9.9	18.8	19.2	30.0
Partograph	22.8	25.7	19.4	23.1	23.5	28.6	26.1	40.0	7.9	31.3	22.7	90.0
Disposable latex gloves	93.1	94.3	88.9	96.2	92.2	90.5	87.0	100.0	81.9	93.8	91.3	100.0
Newborn bag and mask	49.5	25.7	38.9	15.4	27.5	47.6	56.5	25.0	11.8	43.8	34.8	80.0
Infant scale	73.3	74.3	91.7	65.4	60.8	90.5	78.3	75.0	65.9	62.5	72.8	90.0
Blood pressure apparatus (digital or manual)	87.1	88.6	91.7	73.1	84.3	100.0	82.6	75.0	92.1	93.8	87.1	70.0
Hand-washing soap and running water or hand disinfectant	80.2	71.4	63.9	65.4	64.7	81.0	69.6	50.0	65.9	75.0	70.4	60.0
Domain E: Medicines and commodities												
Injectable antibiotic	40.6	20.0	33.3	30.8	19.6	47.6	34.8	25.0	17.8	37.5	30.6	50.0
Hydrocortisone available at the facility	33.7	20.0	36.1	23.1	25.5	52.4	52.2	20.0	9.9	31.3	29.0	70.0
Injectable uterotonic	52.5	51.4	55.6	50.0	41.2	52.4	60.9	60.0	45.8	50.0	50.9	90.0
Skin disinfectant	66.3	51.4	61.1	65.4	64.7	76.2	73.9	65.0	53.7	68.8	63.5	90.0
Magnesium sulfate	44.6	28.6	36.1	34.6	33.3	61.9	52.2	45.0	25.8	25.0	38.2	100.0
IV solution with infusion set	40.6	40.0	50.0	50.0	41.2	52.4	34.8	40.0	31.8	43.8	41.4	60.0
Chlorhexidine for cord cleaning	43.6	51.4	47.2	46.2	39.2	42.9	65.2	45.0	26.0	62.5	44.0	40.0
Antibiotic eye ointment for newborn	45.5	40.0	63.9	42.3	58.8	57.1	52.2	40.0	41.9	37.5	48.3	80.0

Domain F: Guidelines, staff training and supervision												
Guidelines: Integrated Management of Pregnancy and Childbirth (IMPAC) Guidelines	15.8	31.4	19.4	26.9	23.5	19.0	21.7	15.0	26.0	25.0	21.7	60.0
Guidelines: CEmOC Guidelines	15.8	14.3	19.4	15.4	15.7	19.0	21.7	30.0	14.0	18.8	17.1	50.0
Guidelines: Guidelines for management of pre-term labor	12.9	5.7	16.7	3.8	11.8	23.8	13.0	20.0	9.9	18.8	12.6	20.0
Guidelines on standard precaution	8.9	5.7	25.0	7.7	11.8	4.8	4.3	10.0	9.9	37.5	11.3	60.0
Training in neonatal resuscitation	44.6	20.0	33.3	23.1	27.5	42.9	43.5	35.0	22.0	50.0	34.0	60.0
Training in early and exclusive breastfeeding	51.5	28.6	30.6	34.6	31.4	42.9	34.8	30.0	19.8	50.0	36.6	60.0
Training in newborn infection management (including injectable antibiotics)	39.6	22.9	25.0	23.1	31.4	42.9	26.1	25.0	18.0	37.5	30.1	30.0
Training in thermal care	43.6	31.4	27.8	26.9	25.5	42.9	34.8	35.0	17.8	50.0	33.2	70.0
Training in cord care	46.5	31.4	27.8	30.8	29.4	42.9	34.8	45.0	13.8	50.0	34.8	70.0
Training in IMPAC	43.6	31.4	30.6	42.3	35.3	52.4	47.8	20.0	26.0	43.8	37.2	70.0
Training in normal labor and delivery care	41.6	34.3	30.6	46.2	33.3	47.6	47.8	30.0	24.0	50.0	37.2	60.0
Training in CEmOC	37.6	25.7	27.8	34.6	27.5	42.9	34.8	20.0	20.0	43.8	31.1	60.0
Training in AMTSL	38.6	31.4	33.3	46.2	35.3	47.6	43.5	25.0	24.0	43.8	35.9	70.0
Training in KMC	33.7	20.0	25.0	23.1	25.5	42.9	30.4	20.0	5.9	37.5	25.8	50.0
Supervision	73.3	88.6	77.8	88.5	80.4	95.2	87.0	70.0	76.0	93.8	80.2	80.0
Number of facilities	100	35	36	26	51	21	23	20	51	16	379	10

Appendix Table 5 Percentage of health facilities with structural tracer items, Malawi SPA 2013-14

	Non-CEmOC facilities				CEmOC facilities
Domain/Indicator Name	**North**	**Central**	**South**	National Average	National average
Domain A: Comprehensive emergency obstetric care					
Parenteral administration of antibiotics	75.6	84.9	80.7	81.3	100.0
Parenteral administration of uterotonic drugs/oxytocin	98.1	97.0	98.7	97.9	100.0
Parenteral administration of anticonvulsants for hypertensive disorders of pregnancy	46.4	49.2	48.6	48.4	100.0
Manual removal of placenta	35.8	44.7	42.4	42.0	100.0
Assisted vaginal delivery	57.1	52.7	45.2	50.3	100.0
Removal of retained products	42.4	38.1	35.0	37.6	100.0
Caesarean section	na	na	na	na	100.0
Blood transfusion	na	na	na	na	100.0
Domain B: Newborn signal functions and immediate newborn care					
Neonatal resuscitation	93.2	90.5	82.8	87.7	100.0
Skin-to-skin care	100.0	96.5	98.7	98.1	100.0
Wrap baby	100.0	99.5	100.0	99.8	100.0
Initiate breastfeeding within the first hour	100.0	98.5	98.7	98.9	100.0
Domain C: General requirements					
Electricity	69.9	75.8	58.8	67.4	91.0
Improved water source	88.3	95.5	97.4	94.9	100.0
Improved sanitation	24.1	28.1	21.2	24.3	54.6
24/7 skilled birth attendance	36.6	52.2	60.9	52.8	100.0
Emergency transport	89.3	88.4	90.0	89.3	100.0
Domain D: Equipment					
Sterilization equipment	20.1	32.6	31.6	29.7	81.7
Delivery bed	98.0	99.0	98.3	98.5	100.0
Examination light	42.5	24.6	30.3	30.6	82.0
Delivery pack	86.4	90.4	96.0	92.0	100.0
Suction apparatus (mucus abstractor)	64.9	64.8	59.2	62.4	91.0
Manual vacuum extractor	34.7	43.1	38.5	39.5	100.0
Vacuum aspirator or D&C kit	18.2	23.1	24.5	22.7	91.0
Partograph	86.3	86.9	89.4	87.9	100.0
Disposable latex gloves	100.0	96.5	96.9	97.4	100.0
Newborn bag and mask	93.2	91.4	85.4	89.2	100.0
Infant scale	95.1	94.5	95.6	95.1	100.0
Blood pressure apparatus (digital or manual)	76.6	72.8	76.4	75.1	100.0
Hand-washing soap and running water or hand disinfectant	76.6	75.9	73.7	75.1	82.0
Domain E: Medicines and commodities					
Injectable antibiotic	57.2	52.2	55.3	54.5	100.0
Hydrocortisone available at the facility	13.4	9.5	13.3	11.9	73.0
Injectable uterotonic	90.3	97.0	95.6	95.1	100.0
Skin disinfectant	63.0	46.7	57.4	54.5	91.0
Magnesium sulfate	83.5	82.9	85.7	84.2	100.0
IV solution with infusion set	69.0	65.4	67.6	67.1	64.0
Chlorhexidine for cord cleaning	34.8	30.7	39.4	35.2	64.0
Antibiotic eye ointment for newborn	98.1	90.5	93.9	93.4	91.0
Domain F: Guidelines, staff training and supervision					
Guidelines: Integrated Management of Pregnancy and Childbirth (IMPAC) Guidelines	48.6	41.2	45.6	44.5	54.4
Guidelines: CEmOC Guidelines	40.8	21.6	25.0	26.8	54.7
Guidelines: Guidelines for management of pre-term labor	40.8	41.2	40.7	40.9	82.0
Guidelines on standard precaution	47.4	40.7	40.8	42.1	73.0
Training in neonatal resuscitation	70.7	58.2	60.4	61.6	91.0
Training in early and exclusive breastfeeding	56.2	45.2	45.6	47.5	72.9
Training in newborn infection management (including injectable antibiotics)	46.5	41.2	35.9	39.9	54.6
Training in thermal care	54.2	53.2	53.4	53.5	81.9
Training in cord care	55.2	55.7	53.4	54.6	72.9
Training in IMPAC	21.2	31.6	17.9	23.7	35.9
Training in normal labor and delivery care	37.7	44.7	32.8	38.2	54.3
Training in CEmOC	21.2	29.1	18.8	23.1	35.9
Training in AMTSL	35.7	47.7	34.5	39.7	54.3
Training in KMC	42.6	43.2	35.9	40.0	54.3
Supervision	76.7	86.4	82.9	83.0	91.0
Number of facilities	102	194	221	517	11

Appendix Table 6 Percentage of health facilities with structural tracer items, Nepal SPA 2015

	Non-CEmOC facilities								CEmOC facilities
Domain/Indicator Name	Province 1	Province 2	Province 3	Province 4	Province 5	Province 6	Province 7	National Average	National average
Domain A: Comprehensive emergency obstetric care									
Parenteral administration of antibiotics	35.6	64.6	40.2	35.5	57.8	28.6	33.5	39.5	100.0
Parenteral administration of uterotonic drugs/oxytocin	83.1	95.7	77.3	76.0	93.8	85.3	96.2	85.5	100.0
Parenteral administration of anticonvulsants for hypertensive disorders of pregnancy	7.9	27.0	9.9	4.1	15.8	5.5	6.8	8.1	100.0
Manual removal of placenta	51.3	54.3	31.6	32.4	57.1	34.4	44.7	41.6	100.0
Assisted vaginal delivery	11.4	35.0	12.9	8.7	22.4	16.5	15.3	14.3	100.0
Removal of retained products	40.5	44.3	25.6	15.5	46.0	23.9	39.8	31.6	100.0
Caesarean section	na	na	na	na	na	na	na	na	100.0
Blood transfusion	na	na	na	na	na	na	na	na	100.0
Domain B: Newborn signal functions and immediate newborn care									
Neonatal resuscitation	42.3	54.0	27.9	19.1	46.1	43.5	33.5	35.5	97.8
Skin-to-skin care	96.4	84.9	89.0	98.1	93.3	75.5	93.5	90.8	85.4
Wrap baby	97.2	100.0	100.0	97.9	100.0	86.1	100.0	97.3	100.0
Initiate breastfeeding within the first hour	98.5	100.0	99.7	99.7	100.0	94.1	100.0	98.8	100.0
Domain C: General requirements									
Electricity	80.5	69.0	72.4	54.0	77.1	94.2	76.3	74.5	100.0
Improved water source	91.8	100.0	91.9	87.6	85.2	61.9	77.7	84.7	95.6
Improved sanitation	97.1	90.6	95.3	92.0	89.8	79.4	83.3	89.9	97.8
24/7 skilled birth attendance	21.5	39.3	30.4	27.3	21.3	5.3	22.1	22.4	70.6
Emergency transport	55.1	81.7	81.1	67.4	64.1	37.7	51.7	61.5	97.8
Domain D: Equipment									
Sterilization equipment	95.0	91.9	96.6	91.4	88.6	81.7	95.3	91.8	97.6
Delivery bed	94.9	96.2	95.0	95.8	99.7	93.3	100.0	96.3	97.6
Examination light	60.8	65.3	68.2	73.7	63.5	38.1	54.2	59.9	97.6
Delivery pack	91.4	95.2	91.1	87.5	100.0	91.5	95.1	92.8	97.6
Suction apparatus (mucus abstractor)	63.0	87.8	76.9	77.0	52.0	31.5	50.0	61.2	97.6
Manual vacuum extractor	28.2	28.8	22.0	13.4	16.9	14.1	22.6	19.3	87.4
Vacuum aspirator or D&C kit	18.4	35.0	25.1	10.4	17.7	10.8	21.3	17.9	80.8
Partograph	68.3	72.4	80.2	93.8	91.1	82.7	71.6	79.9	85.1
Disposable latex gloves	96.0	96.5	91.1	95.7	95.4	85.9	88.3	92.6	91.8
Newborn bag and mask	80.9	93.6	89.6	72.7	88.2	71.5	85.7	82.5	97.6
Infant scale	80.5	93.8	87.3	87.0	99.7	88.2	96.7	89.7	95.4
Blood pressure apparatus (digital or manual)	78.4	76.9	81.5	87.4	90.7	80.3	84.2	82.6	97.6
Hand-washing soap and running water or hand disinfectant	69.8	78.2	84.2	84.3	81.1	61.0	61.3	74.0	87.4
Domain E: Medicines and commodities									
Injectable antibiotic	41.6	62.3	42.6	30.4	48.6	39.0	30.2	39.8	90.9
Hydrocortisone available at the facility	10.9	22.4	25.3	17.5	13.8	9.1	14.0	14.9	70.3
Injectable uterotonic	83.8	92.2	82.5	89.7	95.5	78.7	98.0	88.0	97.6
Skin disinfectant	87.5	96.2	94.7	91.4	93.9	83.7	93.4	91.2	97.6
Magnesium sulfate	62.9	59.8	63.1	84.0	81.9	65.3	86.7	71.6	97.6
IV solution with infusion set	88.0	89.8	86.8	93.6	92.9	83.2	98.6	90.4	87.4
Chlorhexidine for cord cleaning	61.9	52.6	60.4	41.0	75.7	37.6	72.3	58.3	41.8
Antibiotic eye ointment for newborn	25.1	24.5	40.0	53.4	48.2	45.2	37.0	40.0	13.3

Domain F: Guidelines, staff training and supervision									
Guidelines: Integrated Management of Pregnancy and Childbirth (IMPAC) Guidelines	na	na	na	na	na	na	na	na	na
Guidelines: CEmOC Guidelines	na	na	na	na	na	na	na	na	na
Guidelines: Guidelines for management of pre-term labor	na	na	na	na	na	na	na	na	na
Medical Standards Volume III or reproductive health Guidelines	19.5	20.4	9.5	25.9	41.6	20.4	19.2	22.0	13.1
Guidelines on standard precaution	1.6	4.3	3.9	14.8	11.8	5.2	8.7	6.9	14.6
Training in neonatal resuscitation	30.7	25.5	25.6	12.0	30.6	44.6	34.9	29.2	26.9
Training in early and exclusive breastfeeding	32.6	24.5	23.3	13.5	30.6	52.4	32.9	30.1	22.1
Training in newborn infection management (including injectable antibiotics)	23.5	8.5	11.6	6.5	23.3	38.9	19.0	19.2	11.0
Training in thermal care	30.7	21.4	21.4	11.4	26.2	42.4	27.7	26.2	15.3
Training in cord care	30.7	25.5	21.2	10.8	31.2	38.5	34.4	27.5	17.5
Training in IMPAC	2.0	3.8	0.0	0.3	0.0	0.7	0.6	0.9	2.2
Training in normal labor and delivery care	30.6	24.6	28.6	13.5	25.3	23.9	30.2	25.5	29.9
Training in CEmOC	13.1	8.5	7.0	6.5	13.3	15.2	20.4	12.1	11.0
Training in AMTSL	31.9	33.7	29.1	12.9	24.1	26.2	32.4	27.0	29.9
Training in KMC	30.9	19.2	21.7	13.8	32.5	40.8	31.7	27.6	19.7
Supervision	76.0	81.6	59.3	84.2	91.7	72.5	88.6	78.2	76.5
Number of facilities	77	37	79	65	61	61	67	448	9

Appendix Table 7 Percentage of health facilities with structural tracer items, Senegal SPA 2015

	Non-CEmOC facilities							CEmOC facilities
Domain/Indicator Name	North	Dakar	Thiès	Central	East	South	National Average	National average
Domain A: Comprehensive emergency obstetric care								
Parenteral administration of antibiotics	47.5	85.3	55.5	68.3	41.2	57.5	58.9	100.0
Parenteral administration of uterotonic drugs/oxytocin	83.3	98.4	64.3	80.5	87.3	74.3	79.6	100.0
Parenteral administration of anticonvulsants for hypertensive disorders of pregnancy	21.2	44.3	15.1	25.8	34.4	17.1	23.9	100.0
Manual removal of placenta	40.0	41.1	34.0	43.9	39.5	26.4	37.8	100.0
Assisted vaginal delivery	98.3	100.0	93.6	94.3	94.4	99.3	96.4	100.0
Removal of retained products	69.2	78.6	51.9	59.3	66.6	41.0	59.3	100.0
Caesarean section	na	na	na	na	na	na	na	100.0
Blood transfusion	na	na	na	na	na	na	na	100.0
Domain B: Newborn signal functions and immediate newborn care								
Neonatal resuscitation	41.3	85.2	55.5	53.9	43.2	43.0	51.2	100.0
Skin-to-skin care	92.0	100.0	100.0	97.9	100.0	100.0	97.7	100.0
Wrap baby	100.0	100.0	100.0	99.2	100.0	100.0	99.8	100.0
Initiate breastfeeding within the first hour	99.3	100.0	100.0	99.2	100.0	99.2	99.5	100.0
Domain C: General requirements								
Electricity	42.4	67.1	34.5	41.9	68.7	52.1	47.2	52.9
Improved water source	97.2	100.0	95.4	92.3	86.1	64.0	88.8	100.0
Improved sanitation	93.6	100.0	86.0	84.9	89.6	84.7	88.6	100.0
24/7 skilled birth attendance	2.5	40.0	8.5	10.5	8.4	6.4	10.0	100.0
Emergency transport	45.2	57.1	31.3	49.9	75.1	65.4	51.6	100.0
Domain D: Equipment								
Sterilization equipment	35.1	100.0	41.7	37.3	28.3	40.7	42.6	100.0
Delivery bed	98.3	100.0	100.0	96.8	97.9	99.2	98.4	100.0
Examination light	57.1	95.3	60.9	53.2	54.0	66.8	61.3	100.0
Delivery pack	98.4	100.0	100.0	97.2	96.9	100.0	98.6	100.0
Suction apparatus (mucus abstractor)	29.7	73.5	35.3	22.9	9.0	20.4	28.9	100.0
Manual vacuum extractor	3.5	7.9	2.1	2.3	2.3	2.6	3.1	58.8
Vacuum aspirator or D&C kit	35.0	27.9	16.8	33.9	48.6	51.1	35.4	70.6
Partograph	56.8	91.9	62.2	71.5	75.0	57.4	66.4	100.0
Disposable latex gloves	86.9	100.0	84.3	82.0	95.7	91.9	87.9	100.0
Newborn bag and mask	39.1	68.6	42.8	41.8	34.8	53.4	45.1	100.0
Infant scale	87.0	100.0	97.4	88.9	83.8	90.1	90.5	100.0
Blood pressure apparatus (digital or manual)	24.5	93.5	46.9	63.7	86.6	76.4	59.4	100.0
Hand-washing soap and running water or hand disinfectant	88.9	100.0	84.3	87.8	92.7	87.0	88.8	100.0
Domain E: Medicines and commodities								
Injectable antibiotic	2.7	64.5	45.9	37.9	34.5	51.5	35.9	88.2
Hydrocortisone available at the facility	41.2	41.8	37.2	44.5	45.5	50.1	43.5	52.9
Injectable uterotonic	30.8	96.9	60.6	57.4	73.9	70.2	59.2	88.2
Skin disinfectant	88.1	93.5	83.2	84.5	97.6	85.3	87.1	100.0
Magnesium sulfate	19.6	54.4	39.1	30.6	35.0	46.4	34.8	100.0
IV solution with infusion set	28.3	56.0	53.0	44.6	41.1	44.8	43.0	100.0
Chlorhexidine for cord cleaning	25.9	59.3	41.8	43.8	85.6	78.7	50.9	58.8
Antibiotic eye ointment for newborn	0.4	62.8	47.4	51.0	69.0	63.4	44.3	41.2

Domain F: Guidelines, staff training and supervision								
Guidelines: Integrated Management of Pregnancy and Childbirth (IMPAC) Guidelines	65.8	56.5	70.4	53.9	59.1	74.5	63.4	47.1
Guidelines: CEmOC Guidelines	52.0	45.0	47.3	25.3	43.0	42.4	40.8	76.5
Guidelines: Guidelines for management of pre-term labor	19.2	14.9	18.8	9.6	9.2	10.2	13.6	47.1
Guidelines on standard precaution	23.5	52.2	38.3	30.4	65.3	54.8	39.4	47.1
Training in neonatal resuscitation	44.6	34.9	35.5	58.3	75.5	65.0	52.5	100.0
Training in early and exclusive breastfeeding	50.7	49.8	35.7	56.3	72.2	63.5	54.0	100.0
Training in newborn infection management (including injectable antibiotics)	28.6	33.3	23.9	50.8	50.9	54.8	41.1	100.0
Training in thermal care	47.8	49.8	33.7	56.8	74.0	66.8	54.0	100.0
Training in cord care	47.8	49.8	33.7	57.0	74.0	65.0	53.7	100.0
Training in IMPAC	18.4	52.9	25.6	34.5	27.0	45.1	32.4	58.8
Training in normal labor and delivery care	42.6	52.9	35.4	48.0	42.4	50.0	45.2	11.8
Training in CEmOC	17.9	26.5	18.6	24.5	17.0	37.0	23.9	11.8
Training in AMTSL	30.9	42.9	26.5	40.8	31.3	45.1	36.6	58.8
Training in KMC	49.0	39.8	30.0	54.8	56.0	61.2	49.7	100.0
Supervision	56.1	37.6	49.1	51.8	35.9	45.7	48.6	88.2
Number of facilities	78	31	56	100	31	65	361	2

Appendix Table 8 Percentage of health facilities with structural tracer items, Tanzania SPA 2014-15

	Non-CEmOC facilities										CEmOC facilities
Domain/Indicator Name	Western	Northern	Central	Southern Highlands	Southern	South West Highlands	Lake	Eastern	Zanzibar	National Average	National average
Domain A: Comprehensive emergency obstetric care											
Parenteral administration of antibiotics	43.0	31.9	50.5	20.9	25.2	43.6	28.1	30.4	22.5	33.4	100.0
Parenteral administration of uterotonic drugs/oxytocin	81.9	89.5	90.3	72.1	91.6	95	73.8	85.1	92.3	83.5	100.0
Parenteral administration of anticonvulsants for hypertensive disorders of pregnancy	24.6	18.1	13.0	7.2	3.8	6.8	7.2	22.8	17.5	12.6	100.0
Manual removal of placenta	37.8	31.3	36.5	30.5	59.1	27.4	31.3	27.0	21.0	33.4	100.0
Assisted vaginal delivery	81.6	78.1	78.5	57.2	75.5	55.9	74.0	58.6	29.1	69.3	100.0
Removal of retained products	38.7	21.7	63.8	32.0	33.7	26.3	37.3	25.1	29.3	34.8	100.0
Caesarean section	na	na	na	na	na	na	na	na	na	na	100.0
Blood transfusion	na	na	na	na	na	na	na	na	na	na	100.0
Domain B: Newborn signal functions and immediate newborn care											
Neonatal resuscitation	50.1	56.2	59.0	74.4	57.9	61.3	35.4	36.4	35.5	51.7	100.0
Skin-to-skin care	89.7	99.8	91.3	99.4	100.0	95.4	92.4	84.3	81.3	93.6	97.9
Wrap baby	97.5	99.6	99.7	95.7	100.0	96.3	99.7	93.9	96.5	97.9	100.0
Initiate breastfeeding within the first hour	99.7	99.6	92.8	100.0	100.0	100.0	99.3	96.4	88.0	98.4	97.9
Domain C: General requirements											
Electricity	87.9	54.2	66.7	63.9	68.4	56.1	72.8	56.6	86.8	66.0	100.0
Improved water source	74.2	69.7	66.2	65.6	61.2	41.8	56.0	65.6	90.3	62.0	88.0
Improved sanitation	25.6	28.1	18.7	25.7	31.7	19.5	45.3	45.7	92.6	32.3	72.1
24/7 skilled birth attendance	18.9	32.7	23.7	18.0	16.9	28.2	39.9	27.0	21.0	27.6	100.0
Emergency transport	57.7	67.5	78.2	42.5	35.8	68.4	74.5	48.4	43.6	61.4	87.5
Domain D: Equipment											
Sterilization equipment	28.9	36.7	6.2	12.7	10.1	10.5	15.9	37.0	59.6	20.1	91.3
Delivery bed	100.0	100.0	100.0	98.0	89.0	96.0	99.4	100.0	100.0	98.3	100.0
Examination light	6.5	21.0	6.3	5.6	10.1	26.1	9.0	26.2	35.1	13.9	60.8
Delivery pack	87.9	86.3	89.5	92.2	85.0	95.2	78.8	88.2	52.5	86.8	100.0
Suction apparatus (mucus abstractor)	24.8	25.7	17.7	22.0	22.9	24.3	21.0	21.9	37.4	22.4	73.4
Manual vacuum extractor	2.5	7.0	3.5	1.2	1.0	1.4	7.3	8.3	11.6	4.6	78.8
Vacuum aspirator or D&C kit	11.3	9.5	3.6	4.7	1.3	0.7	10.5	8.4	25.4	7.0	62.0
Partograph	60.1	74.0	43.9	62.0	76.6	51.4	45.9	59.4	59.9	57.1	100.0
Disposable latex gloves	73.4	87.8	95.0	92.7	79.8	83.1	85.3	86.4	96.5	86.1	100.0
Newborn bag and mask	76.4	96.0	85.3	94.1	83.1	76.4	40.5	89.0	45.8	75.9	100.0
Infant scale	82.0	79.5	71.5	74.0	83.9	80.7	76.9	90.2	82.8	79.4	100.0
Blood pressure apparatus (digital or manual)	46.9	77.5	66.9	76.4	57.5	91.4	53.7	65.2	68.6	66.5	95.8
Hand-washing soap and running water or hand disinfectant	46.3	78.4	50.6	87.6	56.8	76.2	56.2	81.2	86.0	67.1	95.8
Domain E: Medicines and commodities											
Injectable antibiotic	41.5	35.3	34.8	21.6	35.3	49.9	22.8	26.4	21.0	31.8	70.4
Hydrocortisone available at the facility	25.1	44.6	37.8	26.5	14.8	24.3	21.8	52.4	26.3	31.0	91.7
Injectable uterotonic	71.0	87.6	81.7	84.8	74.0	87.5	71.5	72.7	92.3	78.6	100.0
Skin disinfectant	63.3	70.2	55.6	42.3	71.9	64.9	62.7	60.1	64.0	60.9	85.9
Magnesium sulfate	40.3	41.8	21.1	35.7	50.4	57.0	34.0	48.8	71.2	40.3	97.7

IV solution with infusion set	40.6	55.3	47.4	49.5	28.5	62.5	44.1	45.7	85.5	47.7	95.8
Chlorhexidine for cord cleaning	6.3	19.6	5.0	11.0	9.0	25.4	9.3	9.9	8.2	11.9	20.3
Antibiotic eye ointment for newborn	8.8	34.2	29.3	46.9	9.9	46.3	16.5	30.1	7.0	27.8	51.6
Domain F: Guidelines, staff training and supervision											
Guidelines: Integrated Management of Pregnancy and Childbirth (IMPAC) Guidelines	41.2	36.2	16.2	26.7	31.9	21.7	19.7	40.0	32.0	28.0	56.1
Guidelines: CEmOC Guidelines	14.4	5.6	7.5	9.1	3.8	1.5	5.9	22.7	8.2	8.7	26.6
Guidelines: Guidelines for management of pre-term labor	7.7	7.7	8.1	30.4	12.9	4.8	4.4	18.0	7.0	11.2	47.9
Guidelines on standard precaution	12.1	47.2	16.0	38.9	21.9	31.6	19.6	31.0	33.9	27.4	55.0
Training in neonatal resuscitation	79.1	92.1	43.8	76.5	46.2	43.4	21.7	64.5	67.3	55.1	72.9
Training in early and exclusive breastfeeding	74.4	72.6	43.4	69.4	34.6	43.5	23.5	50.1	58.0	49.1	66.5
Training in newborn infection management (including injectable antibiotics)	66.3	54.3	34.8	45.3	30.7	34.6	20.7	34.7	46.3	38.1	54.5
Training in thermal care	76.7	87.4	41.3	61.5	43.0	38.4	22.6	41.3	53.3	48.5	66.5
Training in cord care	76.7	90.5	43.6	65.6	43.0	36.9	21.3	41.6	55.7	49.3	62.3
Training in IMPAC	26.0	24.7	13.2	21.0	10.9	20.0	11.6	13.9	4.7	17.0	24.7
Training in normal labor and delivery care	33.8	28.3	16.1	17.6	24.1	26.5	15.7	16.5	4.7	21.1	37.5
Training in CEmOC	28.6	20.6	9.1	13.7	12.6	15.8	14.1	13.7	2.3	15.6	30.9
Training in AMTSL	33.8	25.0	18.8	17.8	21.3	27.3	16.1	21.3	7.0	21.6	37.4
Training in KMC	59.3	57.8	38.8	55.5	33.8	36.7	19.6	39.8	52.2	40.5	62.2
Supervision	83.0	73.8	81.3	69.2	82.2	86.2	82.7	62.3	89.5	77.6	69.3
Number of facilities	84	109	103	114	65	103	198	113	7	896	8