

Determinants of health facilities to provide newborn care services in Ethiopia: finding from the 2018 service availability and readiness assessment

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Abstract

Introduction: Almost 50% of under-five mortality occurs during the neonatal period. Sub-Saharan Africa has the highest rates of neonatal mortality. In this study, we assessed the availability of emergency newborn care services and readiness of health facilities to provide the services, readiness variation by type of facility, managing authority, location and regions in Ethiopia.

Method: Using data from the 2018 Ethiopian Service Availability and Readiness Assessment (SARA), a newborn care services readiness score was calculated from ten tracer items. The mean availability score was created for measuring health facilities overall capacity to provide newborn care services. The factors that determine health facilities to provide newborn care services include the type of facility, managing authority, region, availability of power, water, emergency transport an infant weighing scale. A multiple linear regression model was used to determine factors associated with the readiness score. The analysis was done using SPSS version 20 and STATA version 14.

Results: A total of 632 health facilities were included in the analysis. On average facilities had 63% of tracer items. The overall newborn readiness score for health centres and clinics was lower than that of hospitals. The expected value of newborn care readiness to provide the service was lower in health facilities in Oromiya, Somali and Gambella than facilities in Tigray. In the adjusted model, the type of facility, managing authority and regions were significant. About 74% of the variability of factors associated with newborn care readiness score around its mean was explained.

Conclusion: The availability of four newborn signal functions including neonatal resuscitation, corticosteroids, antibiotics for preterm or prolonged premature rupture of membrane, injectable antibiotics for sepsis, and the readiness of health facilities in terms of the mean availability of ten tracer items to provide the signal functions were low in clinics compared with other facilities. There was a regional variation in the availability of the services. The focus should be given to clinics and regions whose readiness score was low to ensure equity in the distribution of newborn care service capacity.

Keywords: Readiness score, newborn, linear regression, multiple regression, Ethiopia

Introduction

Although there has been a global reduction in neonatal mortality over the past two decades (WHO et al. 2015), in 2018 about 2.5 million children died in the first month of life (Unicef 2019) and about 7700 new-borns still die every day due to complications related to childbirth and in the postpartum period (Wang et al. 2017). Almost 50% of under-five mortality occurs during the first 28 days of life and Sub-Saharan Africa has the highest rates of neonatal mortality (Mohammadi et al. 2014; WHO 2018). The immediate postnatal period – the first 24 hours of life – presents the greatest risk for newborns from birth asphyxia, trauma, pre-term birth-related breathing difficulty, and sepsis, and is the period when the need for high-quality newborn care services is critical. The early postnatal period (days 2 through 7) brings risks from sepsis, and other infectious diseases; and the late postnatal period (days 8 through 42) is when these risks begin to reduce (Mathai Matthews et al. 2015). Interventions joining resuscitation of newborn breastfeeding, prevention and management of hypothermia and kangaroo mother

care (KMC) can reduce the rate of newborn deaths by more than half (Darmstadt et al. 2014).

Causes of neonatal mortality include prematurity (2%), intrapartum-related complications including birth asphyxia (11%), neonatal sepsis (7%), congenital anomalies (5%), pneumonia (13%), neonatal tetanus (1%), and other causes (3%) (WHO 2018).

This article focuses on two measurable dimensions of quality: newborn service availability and readiness. The availability of emergency newborn care services in health facilities was assessed using the selected four signal functions: neonatal resuscitation, antenatal corticosteroids, antibiotics for preterm or prolonged premature rupture of membrane (PROM) and antibiotics for infections (sepsis). A summary, or composite, indicator, referred to as the overall score in this paper, is a useful means to summarize and communicate information about multiple indicators and domains of indicators (WHO 2015). Hence, the paper investigated factors associated with facility readiness to provide newborn care services and the availability of those services in the country.

Materials and Methods

Study Setting: Data were used from the Ethiopia Service Availability and Readiness Assessment (SARA) 2018 survey, which was a cross-sectional facility-based survey. Detailed methods of the survey were presented in the final SARA 2018 report (Ethiopian Public Health Institute 2018). The study was conducted in all 9 regions and two city administrations of Ethiopia including urban and rural settings. Data were collected from October to December 2017. All hospitals in the country and a random sample of health centres and clinics were included; however, health posts that were included in the SARA report were excluded from this analysis. A total of 632 facilities were included in this analysis.

Metrics: The newborn service readiness score was generated from a set of tracer items that are necessary to provide the four selected newborn signal functions. The readiness score is a composite score, and the overall readiness within a region or facility type is presented as the mean of the composite score of the following tracer items: neonatal bag & mask, suction apparatus (mucus extractor), injectable antibiotic, betamethasone injection, ampicillin powder for injection, gentamicin injection, guideline for childbirth care, checklist/job aid for childbirth care, at least one trained staff in childbirth care and trained staff in newborn resuscitation in the last two years before the survey. The independent variables are facility type, region, managing authority categorized into two as public or others, availability of any water source in the facility, and availability of power.

This article focuses on two measurable dimensions of quality: service availability and service readiness. Service availability refers to the reported availability of emergency newborn care or treatment of newborn complications at the facility which include neonatal resuscitation, antibiotics for neonatal infections, antenatal corticosteroids, and antibiotics for preterm or prolonged premature rupture of membrane, while service readiness refers to the facility's observed capacity to provide those services (WHO 2013).

Newborn services readiness, also called the overall readiness score, was measured using the WHO methods (WHO 2015) of assessing facility service availability and readiness. This was measured based on the availability and functioning of supportive items categorized into three domains as follows: 1) staff training which had four indicators—the presence of guidelines for childbirth care, checklist/job aid for childbirth care, received training in newborn resuscitation in the last two years and trained staff in childbirth care; 2) diagnostic equipment which had 2 indicators, that is, presence of neonatal bag and mask, suction apparatus (mucus extractor); and 3) basic medicine

and commodities which had 4 items contain essential medicines for newborn, these are 1) injectable antibiotic, 2) Betamethasone injection, 3) Ampicillin powder for injection, and 4) Gentamicin injection. As facilities were expected to have 100% of these items, each domain accounted for one third (33.3 percentage points) of the total score. The amount that each indicator could contribute to its domain was equal to 33.3 divided by the number of indicators in that domain. The newborn service readiness score for each facility was then calculated by adding the contributions of each indicator for a total facility-level readiness score with the maximum score possible equalling 100. As was done in Tanzania, (Bintabara et al. 2017; Bintabara and Mpondo 2018), facilities that scored 50% or more were considered to be ready to provide newborn services and those that scored less than 50% were considered not ready. A multiple linear regression model was used to determine factors associated with the readiness score. The dependent variable was the overall readiness score. The independent variables were the type of facility, managing authority, region, availability of power, availability of water, availability of emergency transport and availability of infant weighing scale. The value of beta (β) signifies how many predicted units change (either up or down) in the dependent variable there will be for anyone unit increase in the independent variable. The sign of β indicates the kind of correlation between the variables (Stellefson et al. 2008). All analyses were done using SPSS version 20 and STATA version 14.

Ethical clearance was obtained from the Ethiopian Public Health Institute (EPHI) scientific and ethical review board. Informed oral consent was taken from all selected health facilities. A letter of support was written and submitted to each health facility head or a person in charge before data collection. No personal identifier was used to maintain confidentiality and data were kept in a password protected EPHI's server.

Results

Background characteristics of facilities: This study covered 632 clinics, health centres, and hospitals. Among the total facilities, 48% were hospitals (primary, general or referral), 26% were health centers and 26% were clinics (lower, medium or higher). Regarding managing authority, 65% of facilities were public. Most of the facilities (78%) were located in urban areas (Table 1).

Availability of select newborn care signal functions: Among the total surveyed facilities, 74%, 48%, 68%, and 62% of facilities provided in the last 3 months neonatal resuscitation, antenatal corticosteroids, antibiotic for preterm or prolonged premature rupture of membrane, and antibiotic for

neonatal infections, respectively. The total mean availability of these newborn care services was 0.63 (on average 3 out of 4 services). Of the four newborn care signal functions, provision of corticosteroids was least (48%) available in facilities, while neonatal resuscitation (74%) was most available.

Table 1: Facility background characteristics (n=632)

Variable	Category	n	%
Type of facility	Hospital	303	48
	Health centre	164	26
	Clinic	165	26
Managing authority	Public	410	65
	Others ¹	222	35
Region	Tigray	65	10
	Afar	37	6
	Amhara	98	16
	Oromiya	109	17
	Somalia	44	7
	Ben-Gumuz	31	5
	SNNPR	89	14
	Gambella	30	5
	Harari	24	4
	Addis Ababa	77	12
	Dire Dawa	28	4
Location	Urban	494	78
	Rural	138	22
	Total	632	100

Others¹: Facilities managed or owned by private, Non government organization (NGO) or religious institution

Among assessed facilities, 99% of hospitals and 7% of clinics provided neonatal resuscitation. Just under one quarter and 1% of health centres and clinics provided corticosteroids, respectively. A higher proportion of public facilities provided all four signal functions compared to facilities managed by others entities.

Ninety-four percent of hospitals availed all the four signal functions, yet almost no clinics provided the four newborn signal functions. In public facilities, 3 out of 4 services were available (mean availability 0.82) but on average only 1 out of 4 services were provided in non-public facilities (mean availability 0.28). Seven percent, 1%, 3%, and 3% of clinics provided neonatal resuscitation,

antenatal corticosteroids, antibiotics for preterm or prolonged premature rupture of membranes and antibiotics for neonatal infection (sepsis), respectively. In general, the availability of the four newborn care services was higher in the Tigray region than among facilities in other regions. The mean availability of the selected newborn signal functions was highest in hospitals (0.94) and Tigray (0.77) compared with their counterparts. Similarly, the mean availability of the newborn services was higher in urban facilities (0.64) compared with rural facilities (0.57) (Table 2).

Facility readiness to provide newborn care services:

The facilities were assessed for their readiness to provide the four selected newborn signal functions in terms of the presence of neonatal bag and mask, suction apparatus, injectable antibiotic, ampicillin powder for injection, betamethasone injection, gentamicin injection, the guidelines for childbirth care, checklist/job aid for childbirth care, trained staff in childbirth care and trained staff in newborn resuscitation in the last two years prior to the survey. Eighty-seven percent, 72% and 2% of hospitals, health centres, and clinics had neonatal bags and masks, respectively. Fewer facilities had gentamicin injection, with 7%, 13% and 3% of hospital health centres, and clinics reporting its presence. Almost all hospitals (99%) and 94% of health centres had antibiotics for neonatal infection. In clinics, the availability of tracer items ranged from 1% with childcare guidelines to 28% with betamethasone injection. Guidelines for childbirth care were available in 60% and 63% of hospitals and health centres, respectively. Checklist/job aids for childbirth care were available in 78%, 67% and 2% of hospitals, health centres, and clinics, respectively. The availability of trained staff in newborn resuscitation in the last two years before the survey ranged from 72 % in hospitals to 2% in clinics. The mean readiness of tracer items to provide the selected newborn signal functions in hospitals and health centres were about 7 out of 10 (mean=0.65) and 6 out of 10 (mean=0.6) respectively. Clinics on average had fewer than 1 out of 10 tracer items (Table 3).

Table 2: Newborn care signal functions availability by health facility characteristics

		Neonatal Resuscitation (%)	Antinatal Corticosteroids (%)	Antibiotic for preterm PROM (%)	Antibiotics neonatal infections (%)	Mean availability of selected NB SFs (%)
Type of facility	Hospital	99	86	98	92	0.94
	Health centre	95	24	80	65	0.66
	Clinic	7	1	3	3	0.03
Managing authority	Public	96	61	89	80	0.82
	Others ¹	33	23	30	27	0.28
Location	Urban	73	53	69	62	0.64
	Rural	75	30	64	59	0.57
Region	Tigray	85	63	80	78	0.77
	Afar	54	32	49	51	0.47
	Amhara	85	61	80	74	0.75
	Oromiya	83	62	79	68	0.73
	Somalia	55	25	59	55	0.48
	Benishangul G.	58	26	55	29	0.42
	SNNPR	83	58	75	73	0.72
	Gambella	50	17	33	43	0.36
	Harari	54	33	38	42	0.42
	Addis Ababa	71	42	68	49	0.57
	Dire Dawa	61	21	61	46	0.47
	Total	74	48	68	62	0.63

NB = New born; Others¹: Facilities managed or owned by private, NGO or religious institution

Table 3: Readiness indicators for selected newborn care signal functions by type of health facilities

Tracer items	Hospital		Health centre		Clinic		Total	
	n	%	n	%	n	%	n	%
Neonatal bag and mask	263	87	118	72	4	2	385	61
Suction apparatus (mucus extractor)	289	95	138	84	7	4	434	69
Antibiotic for neonatal infection	301	99	154	94	46	28	501	79
Betamethasone injection	69	23	21	13	4	2	94	15
Ampicillin powder for injection	235	78	115	70	13	8	363	57
Gentamicin injection	21	7	22	13	5	3	48	8
Guideline for childbirth care	182	60	104	63	1	1	287	45
Checklist/job aid for childbirth care	236	78	110	67	3	2	349	55
Received training in newborn resuscitation in the last two years	217	72	108	66	3	2	328	52
Trained staff in childbirth care	185	61	81	49	3	2	269	43
Mean readiness of tracer items for selected newborn care	0.65		0.60		0.05		0.49	

Table 4: Determinants for newborn care services overall readiness score⁴

Health facility characteristics		Mean ²	SE	Beta ³	Crude Model 95% CI	Beta	Adjusted Model 95% CI
Type of health facility	Hospitals (Ref.)	0.665	0.009				
	Health centers	0.603	0.015	-0.052	(-0.083, -0.021)	-0.057	(-0.092, -0.023)
	Clinics	0.058	0.009	-0.599	(-0.631, -0.568)	-0.546	(-0.589, -0.503)
Managing authority	Public (Ref.)	0.638	0.009				
	Others ¹	0.217	0.019	-0.422	(-0.459, -0.385)	-0.068	(-0.108, -0.028)
Region	Tigray (Ref.)	0.600	0.034				
	Afar	0.381	0.050	-0.243	(-0.361, -0.124)	-0.074	(-0.136, -0.012)
	Amhara	0.565	0.029	-0.046	(-0.139, 0.046)	-0.049	(-0.096, -0.001)
	Oromiya	0.504	0.025	-0.119	(-0.209, -0.029)	-0.108	(-0.154, -0.061)
	Somali	0.371	0.035	-0.252	(-0.365, -0.139)	-0.083	(-0.142, -0.023)
	Bensh-Gumuz	0.373	0.056	-0.234	(-0.359, -0.108)	-0.040	(-0.106, 0.026)
	SNNP	0.564	0.030	-0.048	(-0.142, 0.046)	-0.043	(-0.092, 0.006)
	Gambella	0.293	0.055	-0.308	(-0.435, -0.181)	-0.103	(-0.170, -0.035)
	Harari	0.356	0.069	-0.238	(-0.376, -0.100)	-0.072	(-0.145, 0.000)
	Addis Ababa	0.498	0.038	-0.116	(-0.213, -0.019)	-0.018	(-0.070, 0.034)
Power	Dire Dawa	0.456	0.058	-0.147	(-0.278, -0.017)	-0.028	(-0.096, 0.040)
	No power (Ref)	0.458	0.019				
Water	Yes available	0.512	0.015	0.053	(0.006, 0.102)	0.012	(-0.015, 0.038)
	No water (ref)	0.371	0.030				
	Water available	0.511	0.013	0.142	(0.077, 0.207)	0.045	(0.007, 0.082)

Others¹: Facilities managed or owned by private, NGO or religion institute; Mean²: The overall readiness score mean;

Beta³: The value of beta signifies how many predicted units change in the dependent variable; Overall readiness⁴: It is an increase in the mean of tracer items included.

Factors associated with newborn care readiness score: At a 5% level of significance, the simple linear regression model result showed that facility type, managing authority, region, power, and water availability were associated with the newborn care readiness score. The adjusted coefficient from the multiple linear regression model revealed that the overall newborn readiness score for health centres and clinics were lower than that of hospitals ($\beta = -0.057$, C.I: (-0.092, -0.023)) and ($\beta = -0.546$, C.I: (-0.589, -0.503)) respectively.

The expected value of the newborn care readiness score was lower in health facilities found in Afar ($\beta = -0.074$, CI: (-0.136, -0.012)), Amhara ($\beta = -0.049$, CI: (-0.096, -0.001)), Oromiya ($\beta = -0.108$, C.I: (-0.154, -0.061)), Somali ($\beta = -0.083$, CI: (-0.142, -0.023)) and Gambella ($\beta = -0.103$, CI: (-0.170, -0.035)) than in health facilities found in the Tigray region. The expected value of the newborn care readiness score was lower in facilities managed by others ($\beta = -0.068$, CI: (-0.108, -0.028)) than facilities managed by the public (Table 4). In the multiple linear regression model, 79 % of the variability of factors associated with newborn care readiness score around its mean was explained by the model (Adjusted R Square(R^2)=0.79).

Discussion

This study used data from a cross-sectional national assessment of sampled facilities to examine the newborn care services in all regions and city administrations. This study examined the capacity of facilities to provide selected newborn care signal functions.

The selected signal functions and tracer items required to provide them were very small for clinics. Gentamicin injection was the least available item across all facilities. Neonatal bags and masks were available in more than two-thirds of health centers and this finding coincided with the finding in the India study which revealed that two-thirds of the facilities had. Suction apparatus was available in more than 9 out of 10 hospitals and 8 out of 10 health centres. A similar study conducted in India showed that suction devices were present and functional in all facilities.

In our study, less than 1 out of 10 hospitals and 1 out of 5 health centres respectively had gentamicin injection. A total of 69% of facilities had Suction apparatus (mucus extractor). In cross-sectional assessment in Afghanistan showed that a total of 71.7% of facilities had a functional suction device for mucus extraction (Atiqzai et al. 2019). In contrary to our findings, an assessment done in two districts of India revealed most drugs and intravenous (IV) fluids were available in all facilities during the assessment (Malhotra et al. 2014).

Among the regions, Tigray had the highest proportion for service availability followed by the Amhara region. Both service availability and readiness tend to be highest in hospitals, while clinics had much lower. These findings confirmed with the study done in 5 countries with the highest infant mortality (Winter et al. 2017). The availability of newborn services owned by public facilities was higher than governed by others, indicating considerable equity gaps in the availability of essential newborn care services for facilities owned by others and for people accessing clinics.

The finding of this study showed that, a total of 61% of facilities had neonatal bag and mask. On the contrary, in a study conducted in Madagascar, less than or equal 50% of facilities had this equipment (Andriantsimietry et al. 2016). Neonatal resuscitation was higher among hospitals than health centre and clinics. Similarly, a study conducted in Tanzania revealed that neonatal resuscitation was higher in hospitals than in health centres (Bintabara et al. 2019).

Antenatal corticosteroids were only available in 48% of facilities in the country. Almost all (98%) of hospitals in Ethiopia had antibiotics for PROM. A similar finding in Libya revealed that 82.7% of hospitals reported that provided antibiotics for PROM (WHO, MOH, ECHO, EMRO 2018). There are some limitations to the survey. All newborn signal functions were not assessed; kangaroo mother care, IV fluid, and oxygen supply were not included. To save newborn lives, facility capacity to deliver newborn care services must also be improved. The strength of this study is being a representative sample of facilities in Ethiopia using standard tools of WHO SARA questionnaires.

Conclusion

The availability of selected four newborn care signal functions and the readiness of health facilities to provide them in terms of the mean availability of nine tracer items were low in clinics compared with health centres and hospitals. In addition, only 2% of clinics had both neonatal bags and masks, and betamethasone injection. Readiness to offer newborn care service was low in Harari compared with the Tigray region. The newborn care interventions (the signal functions) have the potential to expand the options available to those working with newborns in resource-poor environments like Ethiopia and improve neonatal survival. Although they are all relatively inexpensive and should ideally be accessible to most health facilities, their implementation and coverage have so far been limited, in a rural setting. So, in the future for the improvement of newborn care service, the focus should be given to clinics, rural areas and the regions whose readiness score was low to ensure equity in distribution and its

newborn care service capacity. Though not assessed in this study, the current condition of the country (conflict war and COVID-19) could have a great impact on the provision of newborn care. The study was a representative sample of facilities in the country which addressed four of the essential newborn signal functions.

Availability of data and material: The datasets used during the current study are available from the corresponding author on reasonable request and based on EPHI's data sharing guideline.

Conflict of interests: The authors declare that they have no competing interests.

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