Determinants of health facilities to provide newborn care services in Ethiopia: Finding from service Availability and Readiness Assessment 2018

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SUBJECT AREAS
Health Economics & Outcomes Research Health Policy
Abstract

Background: Almost 50% of under-five mortality happens during the neonatal period. Sub-Saharan Africa has the highest rates of neonatal mortality. In this study we assessed the availability and readiness of health facility for newborn care service, its variations by health facility type, managing authority, location and regions in Ethiopia.

Method: Data were used from the 2018 Ethiopian Service Availability and Readiness Assessment (SARA) from 9 regions and two city administration of the country. The overall newborn care services readiness score was calculated using ten tracer items and its mean availability was created for measuring health facilities overall capacity to provide newborn care services. A multiple linear regression model was used to determine factors associated with the newborn health readiness score. The analysis was done using SPSS version 20 and STATA version 14.

Result: A total of 632 health facilities were included in the analysis. The mean availability of newborn care services at a national level was 63%. Only 7% of clinics provided neonatal resuscitation. A higher proportion of public facilities provided all signal functions compared with others facility types. Availability of newborn care services in overall facilities found in Tigray region were higher than facilities found in other regions. The overall newborn readiness score for health centres and clinics were lower than hospitals respectively. The expected value of newborn care readiness to provide the service was lower in health facilities found in Oromiya, Somali and Gambella than health facilities in Tigray.

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

**Background/rationale**

Almost 50% of under-five mortality happens during the neonatal period, the first 28 days of life and Sub-Saharan Africa has the highest rates of neonatal mortality (1,2). The immediate postnatal period, the first 24 hours, accounts the greatest risk for neonatal mortality, from birth asphyxia, trauma, pre-term birth-related breathing difficulty, and sepsis, and is the period when the need for high-quality newborn care service is important; 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 will reduce in the long run (3,4). Even if advocacy and policy efforts have advanced the agenda for newborn health, they have not been followed by sufficient investment and large-scale implementation of evidence-based interventions (5).

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%)(1).

Interventions joining resuscitation of newborn, breastfeeding, prevention and management of hypothermia and kangaroo mother care (KMC) can reduce Neonatal Mortality Rate (NMR) by more than half (6).

This article focuses on two measurable dimensions of quality: service availability and service readiness. Hence, the paper tried to investigate associated factors for the readiness of newborn care services and the availability of those services in the country.
Methods

Data were used from the Ethiopia service availability and readiness assessment (SARA) 2018 survey, which was a cross-sectional facility-based survey. Detail methods of the survey were presented in SARA 2018 report (7).

The study was conducted in all 9 regions and two city administrations of Ethiopia both in urban and rural settings. Data were collected from October to December 2017. All hospitals in the country and sampled health centres, and clinics were included. While health posts were excluded from this analysis. A total of 632 facilities were included in this analysis.

The outcome variable, overall readiness score, was a composite score of neonatal bag & mask, suction apparatus (mucus abstractor), injectable antibiotic, betamethasone injection, ampicillin powder for injection, gentamicin injection, guideline 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. The independent variables are facility type, region, managing authority, availability of water, availability of power, emergency transport, and infant weight scale.

This article focuses on two measurable dimensions of quality: service availability and service readiness. Service availability refers to the reported availability of essential newborn care services at the facility which is neonatal resuscitation, antibiotic for neonatal infections, antenatal corticosteroids, and antibiotic for preterm or prolonged premature rupture of membrane, while service readiness refers to the facility’s observed capacity to provide those services (8).

The newborn readiness score was generated based on the set of tracer items that were necessary to provide the selected newborn signal functions. 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.

Ethical clearance was obtained from the Ethiopian Public Health Institute (EPHI) scientific and ethical review board. Informed 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.

Result

Background characteristics of facilities

This study covered clinics, health centres, and hospitals which sum up to 632 facilities. 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%) found in urban areas (Table 1).

| Table 1. Facility background characteristics (n=632) |
|----------------------------------|---------|------|
| **Type of facility**                  |        |      |
| Hospital                          | 303    | 48%  |
| Health centre                     | 164    | 26%  |
| Clinic                            | 165    | 26%  |
| **Managing authority**              |        |      |
| Public                            | 410    | 65%  |
| Others¹                           | 222    | 35%  |
| **Region**                        |        |      |
| Tigray                            | 65     | 10%  |
| Afar                              | 37     | 6%   |
| Amhara                            | 98     | 16%  |
| Oromiya                           | 109    | 17%  |
| Somalia                           | 44     | 7%   |
| Benshangul 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, NGO or religion institute
Essential newborn Signal Functions

The availability of essential newborn service in health facilities was assessed using the four signal functions: neonatal resuscitation, corticosteroids, antibiotics for preterm or prolonged premature rupture of membrane and injectable antibiotics for sepsis. Among the total surveyed facilities, 74%, 48%, 68%, and 62% of facilities provided neonatal resuscitation, parenteral corticosteroid, antibiotic for preterm or prolonged premature rupture of membrane, and injectable antibiotics respectively. The total mean availability of newborn care services was 0.63 (on average 3 out of 4 services). Of the four newborn signal functions, corticosteroid was least (48%) available in facilities, while neonatal resuscitation (74%) was most available. Among assessed facilities, 99% of hospitals and only 7% of clinics provided neonatal resuscitation. Only 24% and 1% of health centres and clinics provided corticosteroids respectively. A higher proportion of facilities managed by the public provided all signal functions compared with facilities managed by others. Ninety-four percent of hospitals availed all the four signal functions. But on the contrary, almost none of the clinics provided the essential newborn care services. In public facilities, 3 out of 4 services were available (mean availability 0.82) but only 1 out of 4 services were provided in other facilities (mean availability 0.28). Seven percent, 1%, 3%, and 3% of clinics provided neonatal resuscitation, corticosteroids, antibiotics for preterm or prolonged premature rupture of membrane and injectable antibiotics for sepsis respectively. In general, the availability of newborn care services at facilities found in the Tigray region was higher than the facilities found in other regions. The mean availability of selected newborn signal functions was highest in hospitals (0.94) and Tigray (0.77) compared with their counterparts. Similarly, the mean availability of newborn services was higher in urban facilities (0.64) compared with rural facilities (0.57) (Table 2).
Table 2. Essential newborn care services availability by health facility characteristics

|                      | Neonatal Resuscitation | Corticosteroids | Antibiotic for preterm PROM | Injectable antibiotics | Mean availability of selected NB SFs |
|----------------------|-------------------------|-----------------|-----------------------------|------------------------|--------------------------------------|
|                      | %                       | %               | %                           | %                      | Mean                                 |
| 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                                 |
| Others¹              | 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                                 |
| Benshangul Gumuz     | 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                                 |

Others¹: Facilities managed or owned by private, NGO or religion institute

Tracer Items for selected newborn care services

The facilities were assessed for the readiness of newborn care in terms of neonatal bag & mask, suction apparatus, injectable antibiotic, ampicillin powder for injection, betamethasone injection, gentamicin injection, guideline 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 & mask respectively. Only 7%, 13% and 3% of hospital health centres, and clinics had gentamicin injection respectively. Almost all hospitals (99%) and 94% of health centres had injectable antibiotics. In clinics, the availability of tracer items ranged from 1% for a guideline for childcare to 28% betamethasone injection. Guideline for childbirth care was available in 60% and 63% of hospitals and health centres respectively. Checklist/job aid for childbirth care was
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 the highest 72% in hospitals to the lowest 2% in clinics. The mean readiness of tracer items to provide the selected newborn care 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 less than 1 out of 10 tracer items (Table 3).

Table 3. Readiness indicators for selected Newborn care services by type of health facilities

| Tracer items                                    | Hospital | Health centre | Clinic | Total |
|-------------------------------------------------|----------|---------------|--------|-------|
|                                                 | n        | n             | n      | n     |
| Neonatal bag and mask                           | 263      | 118           | 4      | 2     | 385   |
| Suction apparatus (mucus extractor)             | 289      | 138           | 4      | 4     | 434   |
| Injectable antibiotic                            | 301      | 154           | 46     | 28    | 501   |
| Betamethasone injection                         | 69       | 21            | 4      | 2     | 94    |
| Ampicillin powder for injection                 | 235      | 115           | 13     | 8     | 363   |
| Gentamicin injection                             | 21       | 22            | 5      | 3     | 48    |
| Guideline for childbirth care                   | 182      | 104           | 1      | 1     | 287   |
| Checklist/job aid for childbirth care           | 236      | 110           | 3      | 2     | 349   |
| Received training in newborn resuscitation in the last two years | 217      | 108           | 3      | 2     | 328   |
| Trained staff in childbirth care                 | 185      | 81            | 49     | 2     | 269   |
| Mean readiness of tracer items for selected newborn care | 0.65     | 0.60          | 0.05   | 0.49  |

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, water availability, emergency transport, and availability of infant weight scale was associated with newborn care readiness score to provide the services. The adjusted coefficient from multiple linear regression model revealed that, overall newborn readiness score for health centres and clinics were lower.
than that of hospitals ($\beta = -0.049$, C.I: (-0.085, -0.013)) and ($\beta = -0.361$, C.I: (-0.434, -0.288)) respectively.

The expected value of newborn care readiness to provide the services was lower in health facilities found in Afar ($\beta = -0.073$, CI: (-0.137, -0.008)), Amhara ($\beta = -0.053$, CI: (-0.101, -0.004)), Oromiya ($\beta = -0.122$, C.I: (-0.169, -0.074)), Somali ($\beta = -0.095$, CI: (-0.156, -0.034)) and Gambella ($\beta = -0.096$, CI: (-0.166, -0.026)) than health facilities found in Tigray region. The expected value of newborn care readiness was lower in facilities managed by others ($\beta = -0.072$, CI: (-0.113, -0.031)) than facilities managed by the public. The expected value of newborn care readiness to provide the service with the availability of infant weight scale was higher than that of without it ($\beta = 0.195$, CI: (0.133, 0.257)) (Table 4).

In the multiple linear regression model, 74% of the variability of factors associated with newborn care readiness score around its mean was explained by the model (Adjusted R Square=0.74).

Table 4. Determinants for newborn care services overall readiness score
| Health facility characteristics | Type of health facility | SE  | Mean | Crude Model Beta | 95% Confidence Interval | Adjusted Model Beta | 95% Confidence Interval |
|--------------------------------|-------------------------|-----|------|------------------|-------------------------|---------------------|-------------------------|
|                                | Hospitals (Ref.)        |     | 0.652| 0.010            |                         |                     |                         |
|                                | Health centers          |     | 0.601| 0.016            | -0.052 (-0.083, -0.021) | -0.049 (-0.085, -0.013) |
|                                | Clinics                 |     | 0.053| 0.008            | -0.599 (-0.631, -0.568) | -0.361 (-0.434, -0.288) |
| Managing authority             | Public (Ref.)           |     | 0.631| 0.010            |                         |                     |                         |
|                                | Others¹                 |     | 0.209| 0.019            | -0.422 (-0.459, -0.385) | -0.072 (-0.113, -0.031) |
| Region                         | Tigray (Ref.)           |     | 0.605| 0.035            |                         |                     |                         |
|                                | Afar                    |     | 0.362| 0.049            | -0.243 (-0.361, -0.124) | -0.073 (-0.137, -0.008) |
|                                | Amhara                  |     | 0.558| 0.030            | -0.046 (-0.139, 0.046)  | -0.053 (-0.101, 0.004) |
|                                | Oromiya                 |     | 0.485| 0.025            | -0.119 (-0.209, -0.029) | -0.122 (-0.169, -0.074) |
|                                | Somali                  |     | 0.352| 0.035            | -0.252 (-0.365, -0.139) | -0.095 (-0.156, -0.034) |
|                                | Benshangul              |     | 0.371| 0.058            | -0.234 (-0.359, -0.108) | -0.039 (-0.107, 0.029) |
|                                | Gumuz                   |     | 0.556| 0.031            | -0.048 (-0.142, 0.046)  | -0.049 (-0.099, 0.002) |
|                                | SNNP                    |     | 0.297| 0.056            | -0.308 (-0.435, -0.181) | -0.096 (-0.166, -0.026) |
|                                | Gambella                |     | 0.367| 0.072            | -0.238 (-0.376, -0.100) | -0.059 (-0.134, 0.015) |
|                                | Harari                  |     | 0.488| 0.038            | -0.116 (-0.213, -0.019) | -0.028 (-0.081, 0.026) |
|                                | Addis Ababa             |     | 0.457| 0.061            | -0.147 (-0.278, -0.017) | -0.018 (-0.088, 0.052) |
|                                | Dire Dawa               |     | 0.256| 0.026            |                         |                     |                         |
|                                | Power                   |     | 0.504| 0.016            | 0.053 (0.005, 0.102)    | 0.008 (-0.019, 0.035) |
|                                | No power (Ref.)         |     | 0.364| 0.031            |                         |                     |                         |
|                                | Yes available           |     | 0.503| 0.013            | 0.139 (0.073, 0.205)    | 0.038 (0.001, 0.077)  |
|                                | Water                   |     | 0.256| 0.012            | 0.290 (0.237, 0.343)    | -0.008 (-0.042, 0.026) |
|                                | No water (Ref.)         |     | 0.546| 0.012            |                         |                     |                         |
|                                | Yes available           |     | 0.087| 0.013            |                         |                     |                         |
|                                | Availability of infant weight scale | | 0.639| 0.008            | 0.551 (0.521, 0.582)    | 0.195 (0.133, 0.257)  |

Others¹: Facilities managed or owned by private, NGO or religion institute

**Discussion**

This study was a cross-sectional national assessment of sampled facilities that examined the essential newborn care services in all regions and city administrations. This study examined the capacity of facilities to provide selected newborn care.
The selected newborn services and tracer items required for newborn care were very small for clinics. Gentamicin injection was the least available item across all facilities. Neonatal bag and mask were available in more than two-third of health centers and this finding coincided with the finding in 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. In contrary to our findings, the study in India revealed most drugs and IV fluids were available in all facilities during the assessment (9).

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 (10). 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. In order to save newborn lives, facility capacity to deliver newborn care services must also be improved.

Conclusion

The availability of selected four newborn signal functions and the capacity of health facilities in terms of the mean availability of nine tracer items to provide newborn care services were low in clinics compared with health centres and hospitals. In addition, only 2% of clinics had both neonatal bag & mask, and betamethasone injection. Readiness to offer new-born care service was low in Harari compared with the Tigray region. So, in the future for the improvement of newborn care service, the focus should be given on clinics
and the regions whose readiness score was low to ensure equity in distribution and its newborn care service capacity.

The study was a representative sample of facilities in the country which addressed most of the essential newborn signal functions. 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.

Abbreviations

EPHI
Ethiopian Public Health Institute
IV
Intravenous
KMC
kangaroo mother care
NB
Newborn
NGO
Non government organization
NMR
Neonatal Mortality Rate
PRoM
Prolonged rupture of Membrane
SARA
Service Availability and Readiness Assessment
SE
Standard Error

Declarations

Ethics approval and consent to participate

Ethical approval letter was obtained from EPHI’s IRB. Informed consent was taken from all selected health facilities. Letter of support was written and submitted to each health
facility head or a person in charge before data collection. Only who gave consent were included in the study.

Consent for publication

Not applicable

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.

Competing interests

The authors declare that they have no competing interests.

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Not applicable

Authors' contributions

TT initiated the write-up of the manuscript, wrote the result section, analysed the data and critically reviewed the article. GT analysed the data and critically reviewed it. TG analysed the data, wrote method, and critically reviewed the final article. MG critically reviewed the final article. AB critically reviewed the final article. AD reviewed the final article. TS reviewed the final article. GM reviewed literature and revised the manuscript.

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