Antenatal Care Services and Preparedness of Health Facilities in Bangladesh: Evidence From Two Nationally Representative Surveys

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Abstract

Objective

To assess whether health facilities in Bangladesh are prepared to provide ANC services and to investigate facility characteristics that are linked to preparedness.

Methods

This cross-sectional analysis used publicly available data from two waves of Bangladesh Health Facilities Survey (BHFS) that was conducted in 2014 and 2017 using stratified random sample of facilities. 1508 and 1506 health facilities were included as study samples from the 2014 and 2017 BHFS respectively. The outcome variable ‘ANC services preparedness’ was calculated as an index score using a group of tracer indicators. Multivariable logistic regression models were used to identify the important correlates of ANC service preparedness

Results

The percentage of facilities providing ANC services has increased slightly from 97.4% in 2014 to 98.8% in 2017. Union level public facilities were less likely to be prepared for providing ANC service than district level public facilities in 2014 (Odds ratio (OR): 0.20, Confidence interval (CI): 0.08-0.50, P-value=<0.001). Similar results were also found in 2017 (OR: 0.14, CI: 0.06-0.33, P-Value=<0.001). The facilities with high basic amenities score were more likely to be prepared for providing ANC than the facilities with low basic amenities score in 2014 (OR: 2.52, CI: 1.02-6.12, P-Value=0.04) and in 2017 (OR: 1.79, CI: 1.08-2.99, P-Value=0.02).

Conclusion

The overall preparedness score to offer ANC service was also poor. Our findings may be considered for not only health planning but also decision making in order to produce a healthy mother and a baby at the end of pregnancy.

Introduction

Pregnancy care, also known as antenatal care (ANC) is an umbrella term utilized to explain the medical care and methods that are performed to and for the childbearing women [1]. It is the care provided to childbearing women by experienced health professionals from the beginning of her pregnancy until the birth of her child. ANC aims to provide the treatment of the existing problems as well as the those that may occur during pregnancy affecting both the mother and her newborns [2]. Identifying high-risk pregnancies through ANC is considered as the cornerstone for eliminating child deaths and improving maternal health around the world[3]. The care comprises different tests, preventative treatments, diagnostic procedures, some of which are performed routinely, and others are offered to the women depend on identified difficulties and risk factors [4]. The standard of health care that a childbearing woman gets from a formal health system throughout ANC has a great effect on the mother health and on the pregnancy outcome [2]. According to World Health Organization (WHO) recommendation, a minimum of four ANC visits should be received by every pregnant woman during her pregnancy [5]. The above-mentioned services can be received either by going to a health facility or from domiciliary visits of health workers [6].

In Bangladesh, the number of women who received at least one ANC visit from a qualified health care professional increased from 64% in 2014 to 82% in 2017. During the same time period the percentage of women who had received ≥ 4 ANC visits also raised from 31–47%. This offers demonstrate that, Bangladesh is near to reaching the Health, Population and Nutrition Sector Program's target of 50% of women finishing minimum four ANC visits during her pregnancy by 2022 [7].

Significant improvement has been achieved in Bangladesh in eradicating maternal mortality over the last few decades, though the fifth target of Millennium Development Goals (MDG) to cut maternal mortality to 143 deaths per 100,000 live births by 2015 was not fulfilled [8]. (From 1990 to 2015, the maternal mortality ratio (MMR) reduced by 69 per cent – from 569 deaths to 176 deaths per 100,000 live births [9]. Bangladesh has ranked among nine countries that gain remarkable progress in minimizing maternal mortality by 2015 [10].

Despite an increase in ANC coverage and a decline in in MMR, pregnancy and childbirth related complications cause about 14 daily and 5200 annual deaths of reproductive aged women in Bangladesh [11, 12]. Moreover, maternal mortality account for 14% of all
reproductive aged women deaths [13]. The third sustainable development goal (SDG) established a global objective, implying that Bangladesh must reduce MMR to less than 70 per 100,000 live births [8]. It is estimated that 90% of maternal deaths and pregnancy associated diseases can be prevented by appropriate medical care at various steps of childbearing difficulty [14] and good ANC singly can lessen 20% of maternal mortality. [15]

An effective ANC program requires qualified health care providers in a functional health center with referral facilities as well as adequate supplies and diagnostic capabilities [4]. Therefore, health facilities should be well prepared with regard to trained health professionals, medications, supplies, equipment, amenities, and infrastructure to meet this demand. [16]

Several studies in Bangladesh have identified the factors responsible for frequency of ANC visit. [15, 17–19] For example, mothers level of education, place of residence, administrative division, media access, birth order were the common significant predictors of frequency of ANC visit in the published studies. Moreover, other studies have attempted to assess the utilization of ANC service in Bangladesh were limited to rural areas [6, 20, 21]. Furthermore, some studies identified the level and trends of frequency of ANC visits [22–24]. However, the preparedness to provide ANC services by health facilities has never been studied in Bangladesh.

Health facility preparedness is a vital aspect that indicates a facility's commitment to confirm cumulative availability of items needed to offer a specific service [25]. Assessing health facilities preparedness for ANC service is critical for not only health planning but also decision making in order to deliver a healthy mother and a baby at the end of pregnancy, which ultimately helps in reducing maternal mortality through improving maternal health. A sound understanding of the factors influencing facility readiness to provide ANC service is important to assist maternal and newborn health system progress. Therefore, the present study sought to evaluate the preparedness of health facilities to provide ANC services in Bangladesh. We also explored facility characteristics associated with the preparedness using two nationally representative surveys.

Methods

Study population and setting

This study used publicly available cross-sectional data from two waves of Bangladesh Health Facilities Survey (BHFS) that was conducted in 2014 and 2017 using standardized questionnaires from the service provision assessment (SPA) component of U.S. Agency for International Development (USAID)'s Demographic and Health Surveys (DHS) Program. The National Institute of Population Research and Training (NIPORT) and the Ministry of Health and Family Welfare (MOHFW) implemented the survey with financial assistance from the Government of Bangladesh and the USAID with technical assistance from ICF International and the Associates for Community and Population Research (ACPR) collected the data. The details of the survey instruments are published elsewhere. [26, 27]

The sample for the 2014 and 2017 BHFS was planned to involve facilities in all administrative divisions of the country. The sampling frames were a list of 19,184 and 19,811 registered health facilities, provided by NIPORT and MOHFW for the 2014 and 2017 BHFS, respectively. With stratified random sampling, 1,596 and 1,600 health facilities for were selected from the entire country in 2014 and 2017 BHFS, respectively. Interviewers were not capable of surveying some sampled facilities as some facilities were not open or not still operational during the survey. Finally, data are available in the 2014 and 2017 BHFS for 1,548 and 1,524 health facilities respectively. The sampling procedure and the study design is illustrated elsewhere. [26, 27]

Selection of study samples

Among all facilities that offer ANC services were included as final study samples. From 2014 BHFS, 1508 facilities were included as study sample and 1506 facilities were taken as final study sample from 2017 BHFS.

Outcome variable

The outcome variable 'ANC services preparedness' is defined as the readiness or willingness of the facility to provide ANC services. The WHO has determined a group of tracer indicators requires to be available for a health facility to be regarded as prepared to provide quality ANC services [25]. In this study, a somewhat smaller confined and Bangladesh specific-proper version of the WHO-suggested ANC service preparedness measure was constructed. The outcome variable was calculated as an index score using WHO definition of service preparedness index where the greater scores imply that the facilities have greater service preparedness (Table 1) [28]. For example, if a health facility has a score of 100, it means that the facility is completely prepared to offer ANC service, or if a facility has
a score of 50, the facility has 50% preparedness to offer the service. We created dichotomized variable by cutting off it in the middle. The facilities who scored 50% or higher were categorized as prepared and not prepared which scored less than 50%. This cut-off point was utilized similar in prior studies.[29–31]

Table 1

| Serial No. | ANC service domain | Tracer indicator | Variable name | Definition | Coding for analysis | ANC service domain score = mean availability of indicator |
|------------|--------------------|------------------|---------------|------------|--------------------|----------------------------------------------------------|
| A          | Staff & guidelines | Guideline on ANC | guideline     | Availability of national or other ANC related guidelines at the facility | 1 = Available 0 = Not available | (guideline + trained staff /2) ÷ 100 |
|            |                    |                  |               |            |                    |                                                          |
|            | Staff trained in ANC | trained staff |               | Availability of at least one staff member offering ANC service ever trained in some point of ANC | 1 = Available 0 = Not available |                                                          |
| B          | Equipment          | Blood pressure apparatus | bp | Availability of digital blood pressure machine or manual sphygmomanometer with stethoscope | 1 = Available 0 = Not available | Bp ÷ 100 |
| C          | Diagnostic capability | Hemoglobin test | hemoglobin | Availability of hemoglobin test for clients at the facility | 1 = Available 0 = Not available | (hemoglobin + urine_protein/2) ÷ 100 |
|            |                    | Urine protein test | urine protein | Availability of urine protein test for clients at the facility | 1 = Available 0 = Not available |                                                          |
| D          | Medicines          | Iron or folic acid tablets | iron folic | Availability of at least one valid dose of any of the following 3: 1) Iron tablet 2) Folic acid tablet 3) Combined iron and folic acid tablets | 1 = Available 0 = Not available | iron folic ÷ 100 |

ANC service preparedness index

Mean score of the four domains = (A + B + C + D)/4

Potential factors

Potential factors of interest include facility type (district and upazila public facilities, union-level public facilities, public community clinic (CC), non-government organization (NGO) clinic/hospital, private hospital), managing authority (public, private), location (urban, rural), administrative division (Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur, Sylhet, Mymensingh), quality assurance activities (performed, not performed), external supervision (received, not received), routine user fee (fixed for all service, separate fee for each service, no routine user fee), 24-hour duty schedule of medical specialists, medical officers, nurses and paramedics (maintained, not maintained), inpatient capability (yes, no), number of days per month ANC services provided (provides but not every day, provides every day), visual aids for client education related to pregnancy/ANC (available, not available), sufficient privacy for ANC exam (available, not available), infection safety precaution guideline (available, not available), individual client cards or records for ANC clients (maintained, not maintained), basic amenities score (low, high), infection prevention score (low, high).

The following tracer items such as a regular electricity, improved water source, visual and auditory privacy during consultations, client latrine, communication equipment (landline/mobile phone), and computer with internet access were included in the basic amenities...
score. Moreover, waste bin, sharps box, general disinfectant, syringes/needles, sterile disposable gloves, hand hygiene, running water, soap/hand disinfectant were included in the infection prevention score. For each facility, the score is equal to the sum of the availabilities (i.e. value = 1) of all the tracer items, divided by the total number of items. The score variables are continuous, and the distribution of scores was classified into two equal parts. The facility was regarded as "low" score if mentioned to have at least a half (score of ≤ 50%) and greater than a half (> 50%) considered as "high".

Data analysis

The proportion of ANC service preparedness between the categories of various potential factors was compared using chi-square test. Multivariable survey logistic regression model was used to identify the health facility characteristics associated with ANC service preparedness. The variable managing authority was not included in the final model due to very few frequencies in one category. Also, duty schedule and quality assurance activities were not included in the final model because of extensive amount of missing values. Multicollinearity was assessed and any high correlation between the potential factors was not found. All data management and analyses were conducted using Stata 13 (StataCorp, College Station, TX, USA). To account for the complex survey design, we weighted all our analyses using the weight option in Stata with the sampling weights provided in the dataset. For modeling exercise, we used ‘svy’ command of Stata to account the survey design, primary sampling unit and cluster.

Results

Univariate analysis

The percentage of facilities providing ANC service has slightly increased from 97.4% in 2014 to 98.8% in 2017. The availability of tracer indicators for ANC service preparedness is shown in Fig. 1. Since 2014, there have been increases in the percentages of facilities offering ANC services that had at least one staff trained in ANC (from 48.7–54.6%), capacity to conduct hemoglobin test (from 11.7–17.2%), urine protein test (from 18.5–24.8%) on the other hand, there have been reductions in the availability of guideline on ANC (from 49.6–46.4%), blood pressure apparatus (from 86.7–86.4%), and iron or folic acid tablets (from 95.7–92.9%). The availability of tracer indicators for ANC service preparedness by facility type is shown in Table 2. Between 2014 and 2017, availability of guideline on ANC is notably decreased in private facilities from 24.7–6.6%. The preparedness of all type facilities for conducting hemoglobin and urine protein tests raised since 2014. The availability of iron or folic acid tablets decreased in all type of facilities between 2014 and 2017. The overall ANC service preparedness score was low in both the survey years (4.4 and 4.3) and since 2014, no remarkable changes in overall ANC service preparedness have been observed (Appendix Table 1).

Table 2

| Facility type               | Guideline on ANC, n (%) | Staff trained for ANC, n (%) | Blood pressure apparatus, n (%) | Hemoglobin testing capacity, n (%) | Urine protein testing capacity, n (%) | Iron or folic acid tablets, n (%) |
|-----------------------------|-------------------------|-----------------------------|---------------------------------|-----------------------------------|--------------------------------------|-------------------------------|
| BHFS 2014                   | BHFS 2017               | BHFS 2014                   | BHFS 2017                       | BHFS 2014                         | BHFS 2017                            | BHFS 2014                     | BHFS 2017                     |
| District and upazila public facilities | 33 (70.3)              | 26 (60.3)                  | 39 (83.6)                       | 37 (85.5)                         | 46 (97.7)                            | 33 (70.2)                    | 32 (68.1)                     | 29 (66.1)                    | 47 (99.1)                         | 42 (96.1)                         |
| Union-level public facilities | 170 (47.8)             | 174 (50.4)                 | 178 (50.0)                      | 185 (53.5)                        | 304 (85.4)                           | 313 (90.6)                   | 28 (7.9)                      | 52 (15.0)                     | 43 (12.0)                         | 63 (18.1)                         | 346 (97.3)                        | 327 (94.5)                        |
| Public community clinic     | 480 (48.2)             | 447 (44.2)                 | 462 (46.3)                      | 549 (54.2)                        | 853 (85.5)                           | 842 (83.2)                   | 36 (3.6)                      | 93 (9.2)                      | 123 (12.3)                        | 196 (19.4)                        | 952 (95.4)                       | 940 (92.8)                       |
| NGO clinic/hospital         | 58 (72.9)              | 48 (75.1)                  | 48 (60.4)                       | 40 (63.8)                         | 78 (98.3)                            | 62 (98.0)                    | 55 (69.3)                     | 47 (74.8)                     | 60 (75.1)                         | 53 (83.7)                         | 75 (94.8)                        | 58 (91.5)                        |
| Private hospital            | 7 (24.7)               | 3 (6.6)                    | 8 (27.5)                        | 11 (26.4)                         | 26 (94.7)                            | 40 (97.7)                    | 24 (87.3)                     | 33 (81.6)                     | 22 (78.5)                         | 32 (79.3)                         | 23 (81.7)                        | 32 (78.0)                        |

Bivariate analysis
Table 3 depicts the proportion of ANC service preparedness between the categories of various potential factors. Among public facilities, the ANC service preparedness has increased from 63.5% in 2014 to 67.0% in 2017. There have been only minimal decreases since 2014 in the ANC service preparedness (from 88.9–80.4%) among facilities that performed quality assurance activities. Since 2014, the ANC service preparedness has raised among facilities that had low infection prevention score (from 52.2 to 63.1). The ANC service preparedness has also increased among facilities that don't provide ANC service in all working days per week (from 58.3–75.1%).
Table 3
Distribution of different factors and their associations with ANC service preparedness by survey years.

| Factors                      | BHFS 2014   | BHFS 2017   | P-value | BHFS 2014   | BHFS 2017   | P-value |
|------------------------------|-------------|-------------|---------|-------------|-------------|---------|
|                              | Facilities ANC service preparedness | Facilities ANC service preparedness |         |             |             |         |
|                              | Not prepared, n (%) | Prepared, n (%) | P-value | Not prepared, n (%) | Prepared, n (%) | P-value |
| Facility type                |             |             |         |             |             |         |
| District and Upazila public facilities | 1 (2.8)    | 46 (97.2)  | < 0.001 | 2 (4.0)     | 42 (96.0)   | < 0.001 |
| Union label public facilities | 130 (36.4) | 226 (63.6) |         | 105 (30.3)  | 241 (69.7)  |         |
| Public community clinic      | 381 (38.2) | 617 (61.8)  |         | 356 (35.1)  | 657 (64.9)  |         |
| NGO clinic                   | 5 (6.8)     | 74 (93.2)   |         | 2 (3.6)     | 61 (96.4)   |         |
| Private hospital             | 6 (21.0)    | 22 (79.0)   |         | 8 (20.6)    | 32 (79.4)   |         |
| Managing authority           |             |             | < 0.001 |             | < 0.001     |         |
| Public                       | 512 (36.5)  | 889 (63.5)  |         | 462 (33.0)  | 940 (67.0)  |         |
| Private                      | 11 (10.5)   | 96 (89.5)   |         | 11 (10.2)   | 93 (89.8)   |         |
| Location                     |             |             | < 0.001 |             | < 0.001     |         |
| Urban                        | 12 (9.7)    | 109 (90.3)  |         | 10 (9.9)    | 95 (90.1)   |         |
| Rural                        | 511 (36.9)  | 876 (63.1)  |         | 462 (33.0)  | 938 (67.0)  |         |
| Administrative division      |             |             | < 0.001 |             | < 0.001     |         |
| Barishal                     | 38 (33.3)   | 77 (66.7)   |         | 43 (37.9)   | 70 (62.1)   |         |
| Chattogram                   | 115 (41.1)  | 165 (58.9)  |         | 91 (32.2)   | 192 (67.8)  |         |
| Dhaka                        | 136 (33.1)  | 276 (66.9)  |         | 122 (40.5)  | 179 (59.5)  |         |
| Khulna                       | 58 (30.1)   | 133 (69.9)  |         | 35 (19.2)   | 149 (80.8)  |         |
| Rajshahi                     | 98 (46.1)   | 114 (53.9)  |         | 66 (30.7)   | 149 (69.3)  |         |
| Rangpur                      | 51 (25.2)   | 152 (74.8)  |         | 57 (29.7)   | 135 (70.3)  |         |
| Sylhet                       | 27 (28.2)   | 69 (71.8)   |         | 29 (30.1)   | 67 (69.9)   |         |
| Mymensingh                   | 30 (24.6)   | 92 (75.4)   |         |             |             |         |
| Qualities assurance activities|             |             | < 0.001 |             | < 0.001     |         |
| Performed                    | 17 (11.1)   | 136 (88.9)  |         | 44 (19.6)   | 179 (80.4)  |         |
| Not performed                | 36 (33.1)   | 73 (66.9)   |         | 134 (41.1)  | 192 (58.9)  |         |
| External supervision         |             |             | 0.01    |             | < 0.001     |         |
| Performed                    | 457 (33.7)  | 900 (66.3)  |         | 419 (30.0)  | 976 (70.0)  |         |
| Not performed                | 66 (43.6)   | 85 (56.4)   |         | 54 (48.8)   | 57 (51.2)   |         |
| Routine user fee             |             |             | < 0.001 |             | < 0.001     |         |
| Factors | BHFS 2014 | BHFS 2017 |
|---------|-----------|-----------|
|         | Facilities ANC service preparedness | Facilities ANC service preparedness |
|         | Not prepared, n (%) | Prepared, n (%) | P-value | Not prepared, n (%) | Prepared, n (%) | P-value |
| Fixed for all service | 9 (20.6) | 35 (79.4) | | 133 (32.6) | 275 (67.4) | |
| Separate for each service | 10 (8.7) | 101 (91.3) | | 45 (17.7) | 209 (82.3) | |
| No routine user fee | 504 (37.2) | 850 (62.8) | | 295 (34.9) | 549 (65.1) | |
| Duty schedule for 24-hours | 0.07 | | 0.21 | |
| Maintained | 8 (7.3) | 97 (92.7) | | 18 (15.5) | 97 (84.5) | |
| Not maintained | 12 (16.6) | 61 (83.4) | | 27 (22.5) | 95 (77.5) | |
| Inpatient capability | 0.51 | | 0.43 | |
| Available | 75 (36.9) | 129 (63.1) | | 12 (26.8) | 34 (73.2) | |
| Not available | 448 (34.3) | 856 (65.7) | | 460 (31.5) | 999 (68.5) | |
| Basic amenities score | < 0.001 | | < 0.001 | |
| Low | 494 (39.2) | 767 (60.8) | | 380 (35.3) | 696 (64.7) | |
| High | 28 (11.5) | 218 (88.5) | | 93 (21.6) | 337 (78.4) | |
| Infection prevention score | < 0.001 | | | |
| Low | 339 (47.8) | 370 (52.2) | | 265 (36.9) | 454 (63.1) | |
| High | 184 (23.0) | 615 (77.0) | | 208 (26.4) | 579 (73.6) | |
| Infection safety precaution guideline | < 0.001 | | 0.02 | |
| Available | 56 (14.6) | 329 (85.4) | | 114 (26.9) | 310 (73.1) | |
| Not available | 467 (41.6) | 656 (58.4) | | 359 (33.1) | 723 (66.9) | |
| Number of days per month ANC services provided | < 0.001 | | 0.08 | |
| Provides but not everyday | 100 (41.7) | 139 (58.3) | | 33 (24.9) | 101 (75.1) | |
| Provides every day | 423 (33.3) | 846 (66.7) | | 439 (32) | 932 (68) | |
| Visual aid for client education related to pregnancy/ANC | < 0.001 | | | |
| Available | 260 (25.8) | 749 (74.2) | | 362 (29.5) | 866 (70.5) | 0.001 |
| Not available | 263 (52.7) | 236 (47.3) | | 111 (39.8) | 167 (60.2) | |
| Sufficient privacy for ANC exam | < 0.001 | | < 0.001 | |
| Available | 176 (28.4) | 443 (71.6) | | 341 (31.8) | 731 (68.2) | |
| Not available | 347 (39.0) | 542 (61.0) | | 131 (30.3) | 302 (69.7) | |
| Individual client cards or records for ANC clients | < 0.001 | | < 0.001 | |
| Maintained | 196 (23.9) | 621 (76.1) | | 227 (24.7) | 691 (75.3) | |
| Not maintained | 327 (47.4) | 364 (52.6) | | 246 (41.8) | 342 (58.2) | |
Multivariable analysis

The results of the logistic regression model for ANC service preparedness are shown in Table 4. Union level public facilities were less likely to be prepared for providing ANC service than district level public facilities in 2014 (Odds ratio (OR): 0.20, Confidence interval (CI): 0.08–0.50, P-value = < 0.001). Similar results were also found in 2017 (OR: 0.14, CI: 0.06–0.33, P-Value = < 0.001). The facilities with high basic amenities score were more likely to be prepared for providing ANC than the facilities with low basic amenities score in 2014 (OR: 2.52, CI: 1.02–6.12, P-Value = 0.04) and in 2017 (OR: 1.79, CI: 1.08–2.99, P-Value = 0.02). The facilities that did not maintain Individual client cards or records for ANC clients were less likely to be prepared for providing ANC service than the counterparts in 2014 (OR: 0.57, CI: 0.37–0.88, P-Value = 0.01). In 2017, similar results were also found (OR: 0.53, CI: 0.35–0.78, P-Value = < 0.001).
Table 4
Correlates of ANC service preparedness: odds ratio (OR) and 95% confidence intervals (CI), P-values from multivariable logistic regression model.

| Facility type                        | BHFS 2014                  |          | BHFS 2017                  |          |
|--------------------------------------|----------------------------|----------|----------------------------|----------|
|                                      | OR (CI)                    | P-value  | OR (CI)                    | P-value  |
| District and Upazila public facilities | Reference                  | Reference| Reference                  | Reference|
| Union label public facilities        | 0.20 (0.08,0.50)           | < 0.001  | 0.14 (0.06,0.33)           | < 0.001  |
| Public community clinic              | 0.22 (0.09,0.53)           | < 0.001  | 0.11 (0.04,0.25)           | < 0.001  |
| NGO clinic                           | 0.23 (0.07,0.73)           | 0.01     | 0.90 (0.19,4.27)           | < 0.001  |
| Private hospital                     | 0.07 (0.02,0.24)           | < 0.001  | 0.46 (0.15,1.43)           | < 0.001  |
| **Administrative division**          |                            |          |                            |          |
| Barishal                             | 0.93 (0.47,1.86)           | 0.84     | 1.28 (0.63,2.63)           | 0.49     |
| Chattogram                           | 0.65 (0.35,1.22)           | 0.18     | 1.75 (0.92,3.33)           | 0.09     |
| Dhaka                                | Reference                  |          | Reference                  |          |
| Khulna                               | 1.18 (0.59,2.39)           | 0.64     | 2.68 (1.27,5.64)           | 0.01     |
| Rajshahi                             | 0.52 (0.26,1.05)           | 0.07     | 1.72 (0.82,3.6)            | 0.15     |
| Rangpur                              | 0.92 (0.42,2.03)           | 0.85     | 1.91 (0.98,3.74)           | 0.06     |
| Sylhet                               | 0.76 (0.36,1.61)           | 0.47     | 1.93 (0.85,4.39)           | 0.12     |
| Mymensingh                           |                            |          | 2.21 (1.02,4.78)           | 0.04     |
| **External supervision**             |                            |          |                            |          |
| Performed                            | Reference                  |          | Reference                  |          |
| Not performed                        | 0.67 (0.36,1.24)           | 0.20     | 0.43 (0.22,0.83)           | 0.01     |
| **Routine user fee**                 |                            |          |                            |          |
| Fixed for all service                | Reference                  |          | Reference                  |          |
| Separate for each service            | 3.33 (0.94,11.76)          | 0.06     | 1.32 (0.65,2.69)           | 0.44     |
| No routine user fee                  | 0.81 (0.25,2.66)           | 0.73     | 0.91 (0.54,1.53)           | 0.72     |
| **Inpatient capability**             |                            |          |                            |          |
| Available                            | Reference                  |          | Reference                  |          |
| Not available                        | 1.03 (0.53,1.98)           | 0.94     | 1.79 (0.59,5.39)           | 0.30     |
| **Basic amenities score**            |                            |          |                            |          |
| Low                                  | Reference                  |          | Reference                  |          |
| High                                 | 2.52 (1.03,6.12)           | 0.04     | 1.79 (1.08,2.99)           | 0.02     |
| **Infection prevention score**       |                            |          |                            |          |
| Low                                  | Reference                  |          | Reference                  |          |
| High                                 | 1.75 (1.12,2.73)           | 0.01     | 1.18 (0.78,1.79)           | 0.43     |
| **Injection safety precaution guideline** |                        |          |                            |          |
| Available                            | Reference                  |          | Reference                  |          |
### Discussion

In this study, we assessed the preparedness of health facilities including its characteristics associated with the preparedness to provide ANC services in Bangladesh. Since 2014, there have been only small changes in the number of facilities that offer ANC services. The preparedness of offering ANC was evaluated using five domains of the service. Among the domains, shortage of ANC guidelines, staff training, and laboratory diagnostic capacity were fields of weakness. In line with a prior study [17], the overall ANC service preparedness score was observed to be low. Moreover, we found that facility type, basic amenities score, and individual client cards or records for ANC clients were significantly associated with ANC service preparedness in both the 2014 and 2017 BHFS.

A step to evaluate the quality of ANC service is assuring that all facilities have availability of ANC service guidelines for the health workers which would assist to confirm that protocols are followed [32]. However, in this study, such guidelines were lacking in most of the private facilities. Moreover, this study demonstrated that extensive training on any of the ANC topics: ANC screening, counseling, complications of pregnancy and their management, nutritional assessment of pregnant woman, and prevention of mother-to-child transmission of HIV was rare across private facilities. These topics are usually contained in-service training given to government facility staffs who is employed in maternal and newborn care [33]. The safe motherhood program in Bangladesh should also set up a system to comprise private facility staff in same training in the future.

In Bangladesh, many mothers suffer from anemia, and it is estimated that about 20% maternal deaths are because of preeclampsia or eclampsia [27]. To diagnose these conditions, hemoglobin and urine protein testing are essential part of ANC which were missing in the most of union-level public facilities and community clinics, as well as some district and upazila-level public facilities (Table 2). Absence of diagnostic tests such as hemoglobin and urine protein test can result in tardy diagnosis or non-diagnosis of pregnancy complexity like pre-eclampsia/eclampsia [32]. Thus, it is necessary for all health facilities with preference given to the union-level facilities and CCs to have the capability to perform hemoglobin and urine protein test. Moreover, the ministry of health should give financial and technical support to the facilities in setting up laboratory diagnostic services.

Our analysis identified facility type as a significant factor for ANC service preparedness in both the survey years where district and upazila level public facilities are more likely to be prepared for offering the service compared with all other type of facilities. Because the availability of all the tracer indicators for ANC service preparedness was better in district and upazila public health (Table 2). The suboptimal preparedness found in other public facilities might be because of abstruse policy on how to assign funds in these facilities that may cause shortages and discriminations in the allocation of medical supplies [34]. The fortifying of the union level as well as community clinic facilities which are generally situated in the rural areas and private facilities is greatly required to address the shortage of tracer indicators of ANC service preparedness.
In this study, the basic amenities score was a significant factor for ANC service preparedness. This finding is important as the availability of basic amenities (regular electricity, improved water source, client latrine, communication equipment and computer with internet access etc.) is crucial to client contentment with health services provided at a facility [27]. Facilities having high basic amenities score were 2.52 times and 1.79 times more likely to be prepared in 2014 and 2017 respectively for offering ANC service compared to facilities having low basic amenities score. It may be because if a health facility has high basic amenities, the facility is well decorated and therefore are more likely to enhance the availability of services that may end in high preparedness of service.

The ANC card is an essential source of health information which gives every pregnant woman with an individual record of her medical as well as obstetric history over time. The woman is suggested to bring the card with her, whither she move, and to show the card every time she visits any health facility [35]. Our analyses showed that the facilities that did not maintain individual client cards or records for ANC clients were less likely to be prepared for providing ANC service than the counterparts. This may be since facilities did not maintain ANC card or records for clients are less likely to ameliorate the availability of ANC services that are essential aspect to evaluate the readiness of the facility to provide ANC services.

Consistent with the prior studies [16, 36], the present study found significant regional variation on ANC service preparedness in 2017. In 2014, almost all divisions were less likely but in 2017 all other divisions were to more likely to be prepared for providing ANC service than Dhaka division. The observed geographical variations in offering ANC services may be due to disparities in health seeking behavior, service availability and quality [15]. Further studies may be conducted to examine the underlying causes behind geographical variation of ANC service among the health facilities in Bangladesh. Nevertheless, we did not observe any significant difference by facilities location in accord with a prior study. [16]

Visual and auditory privacy is crucial during consultations with health professional since it permits clients to report their problems in detail without reluctance [27]. In this study, we found significant association between sufficient privacy for ANC exam with ANC service preparedness in 2017 but not in 2014. Now a days, women are more aware about their right of privacy and confidentiality and performs physical exams during their ANC visit in a facility where privacy could be protected. Moreover, we found that facilities having no sufficient privacy during ANC exam have 0.42 times lower chance of being prepared for offering ANC service than the facilities having the sufficient privacy in 2014. It is recommended that women's privacy and confidentiality in examination and counselling during every ANC visit should be protected to the reasonable extent at health facilities in Bangladesh.

External supervision not only fortifies a health system but also gives chance to health workers providing quality services and ameliorating performance [37]. The findings of this study indicate that facilities that received external supervision were more likely to be prepared to offer ANC service compared with facilities did not receive external supervision prior to 6 months of the survey in 2014. Therefore, supervision visits are necessary to entail observation of the ANC client examination/counseling at health facilities to confirm that standard guidelines are maintained. [32]

We found a significant association between visual aid for client education and ANC service preparedness in 2014 but not in 2017, where facilities having visual aid for client education were more likely to be prepared for providing ANC service. Visual aids at Bangladeshi health facilities require to be made available and it should also be checked regularly.

It is crucial that a health facility have infection control equipment and supplies suitable to the services delivered [7]. Our findings gave evidence that infection prevention score as well as injection safety precaution guideline are significant factors for ANC service preparedness in 2014 where facilities having high infection prevention score and having infection precaution guideline have higher odds of being prepared for offering the service than their counterparts.

Strengths and limitations

This study has several strengths. First, to our knowledge this study is the first of this nature in Bangladesh giving key insight into the preparedness of health facilities for offering ANC service. This study used nationally representative samples of health facilities in Bangladesh in which our findings reveals essential information about the factors responsible for ANC service preparedness. Second, SPA data are collected using a complex sampling strategy, hence the estimates of this study were corrected for using cluster effect and sample weights. Finally, we conducted a comparative study using the 2014 and 2017 BHFS, hence the changes that has been made in ANC service preparedness among health facilities of Bangladesh can be observed.
Results from this study should be taken into account in the context of some limitations. First, data were collected at a particular point in time and hence, this study is incapable of inferring causality. Longitudinal research is required to better understand the factors associated with ANC service preparedness. Second, this study did not catch provider-level data that would give more idea about the preparedness of care from the provider’s perspective [16]. Third, our analysis concentrated on health facility preparedness, which is an essential issue but not an assurance of offering quality ANC services [38]. Finally, although SPAs of other countries give information on other measures of quality based on observations of ANC consultations as well as client exit interviews, the BHFSs only give information on service availability and readiness. Future research is needed to assess quality of ANC service at health facilities in Bangladesh.

Conclusion

Although the percentage of facilities providing ANC services has increased slightly from 2014 to 2017, many Bangladeshi health facilities lack the ANC guidelines, staff training, and laboratory diagnostic capacity. The overall preparedness score to offer ANC service was also poor. There was a disparity in overall preparedness of ANC service provision by facility type. To improve the ANC service preparedness, there are range of policy options that government authorities might think about: the focus on union level facilities, community clinic, and private facilities, availability of basic amenities, availability of infection control items, administrative divisions, maintaining individual client cards or records for ANC clients, availability of sufficient privacy during ANC exam, receiving external supervision, and availability of visual aid for ANC clients.

List Of Abbreviations

Bangladesh Health Facilities Survey (BHFS)

Antenatal care (ANC)

World Health Organization (WHO)

Sustainable development goal (SDG)

Maternal mortality ratio (MMR)

Demographic and Health Surveys (DHS)

National Institute of Population Research and Training (NIPORT)

Odds Ratios (OR)

Declarations

Ethics approval and consent to participate: NA, as data used in this study is publicly available.

Consent for publication-NA/Not Applicable.

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Authors' contributions: S Hakim and M. A. B. Chowdhury conceptualized the study, designed the analytic approach, managed and analyzed the data, and interpreted the results. S Hakim, M. A. B. Chowdhury, drafted the article. Z. Ahmed reviewed, edited and updated the manuscript. MJ Uddin reviewed and supervised the study. All authors reviewed and approved the final version of the manuscript. The corresponding author accepts responsibility as guarantor.

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**Appendix**

**Appendix Table 1:** Frequency of the ANC service preparedness score by the survey years.
| ANC service preparedness score | Percentage |
|-------------------------------|------------|
|                               | BHFS 2014  | BHFS 2017  |
| 0.0                           | 0.4        | 0.3        |
| 12.5                          | 0.5        | 0.1        |
| 16.7                          | 0.4        | 0.4        |
| 25.0                          | 2.2        | 2.3        |
| 33.0                          | 1.5        | 1.9        |
| 37.5                          | 5.4        | 3.9        |
| 50.0                          | 24.2       | 22.4       |
| 62.5                          | 32.1       | 30.0       |
| 66.7                          | 0.8        | 2.4        |
| 75.0                          | 19.9       | 21.1       |
| 83.3                          | 0.3        | 1.1        |
| 87.5                          | 7.8        | 9.8        |
| 100.0                         | 4.4        | 4.3        |