Title
Prevalence and determinants of readiness of health facilities for quality antenatal care services in Bangladesh

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Abstract

Background

The quality antenatal care (ANC) services can reduce the risk of the pregnancy complications, and hence reduce the maternal and child morbidity and mortality. To ensure the quality ANC services to the pregnant women, it is essential that healthcare providers should be fully prepared with six tracer indicators recommended by World Health Organization. In this study, the prevalence of readiness by selected covariates has been examined. Potential factors responsible for the readiness have also been identified.

Methods

Using data from nationally representative Bangladesh Health Facility Survey (BHFS), 2017, the readiness indices of health facilities providing ANC services have been measured based on the six tracer indicators of the service. The chi-square test has been applied to check the association of selected covariates with the readiness index, and to obtain the adjusted associations of covariates, we have carried out a multinomial logistic regression model.

Results

Only 4.26% of the facilities is found to provide quality ANC services to the pregnant women. Rural facilities have lower readiness to provide quality services compared to urban facilities [RRR: 0.13, 95% CI: 0.06-0.31; p<0.001]. Community clinics and private hospitals are less likely to have medium or high readiness compared to public hospitals or clinics. The health facilities having specialist or MBBS doctors are more likely to be considered as ready for quality ANC services compared to others facilities. Regional difference exists in readiness for providing the service.
Conclusion

A huge gap has been found in the facilities of Bangladesh to prove quality ANC services. This is a high time to reduce this gap in achieving sustainable development goals related with maternity and neonatal mortality. The present study recommends that the government of Bangladesh should take necessary initiatives to fully prepared healthcare providers so that quality ANC services can be equally provided to each pregnant woman.

Keywords: Readiness, Antenatal Care, Health Facility, Multinomial Regression, Bangladesh
Background

Antenatal care (ANC) is a widely accepted accessible and cost-efficient way to improve maternal and perinatal health outcomes [1]. ANC links women with health system and helps them to get proper information and advice regarding pregnancy complications, postnatal care including newborn care, promotion of early and exclusive breastfeeding, and planned birth spacing [2-4]. Therefore, negative pregnancy outcomes can be impeded by identifying and treating maternal health complications during pregnancy through ANC [2]. Better quality antenatal care can promote a woman to choose skilled care for herself and her child at and after birth of the child [5-8]. Furthermore, ANC could prevent maternal and neonatal deaths through prevention, treatment during pregnancy and also skilled care at and after childbirth [9]. Reducing maternal mortality ratio (MMR) as well as neonatal mortality rate (NMR) is considered as one of the global key priorities. In order to ensure this, the international community has adopted the third sustainable development goal (SDG 3) which aims to reduce MMR and NMR to 70 per 100000 live births and 12 per 1000 live births, respectively by 2030 [10]. Despite some achievements, around 295000 maternal deaths and 2.4 million neonatal deaths occur worldwide [10, 11]. Low resource countries account for majority of these deaths and most could be prevented if women had access to antenatal care [11-13]. As the reason for most maternal deaths is pregnancy or childbirth related complications, quality ANC could reduce such complications and hence results in lower maternal mortality [12]. Again, the risk of morbidity and mortality of their children can also be reduced by ensuring adequate maternity care during pregnancy [14].

Although four ANC visits during pregnancy are required to ensure the safety of mothers and their children, World Health Organization (WHO) recently revised ANC guidelines for most efficacious pregnancy outcomes [4, 15]. According to new guidelines, a minimum of eight ANC
visits in the absence of complications is recommended throughout pregnancy period, which will be challenging for developing countries to achieve this target due to many barriers [15]. Moreover, in order to meet this challenge, health facilities need to be well prepared with trained staffs, medicines, equipment, and infrastructure [8]. The availability and readiness to offer the services are important determinants of health care service utilization [8]. Increasing ANC utilization is essential to improve maternal and newborn health outcomes, but it fails to meet the targets of SDG 3 if quality ANC offered by health facilities is poor [16, 17]. Availability of services is deemed as a primary requirement for high-quality care delivery: and investigating readiness of healthcare providers is critical for understanding quality of care [16]. Therefore, examining readiness to offer ANC is required to improve quality of ANC.

Although some progress has been made over the last two decades, Bangladesh is far away from achieving SDG 3 by 2030 [18]. The Health, Population and Nutrition Sector Development Program (HPNSDP) has set a target that 50 percent of pregnant women should complete at least four ANC visits by 2022 in Bangladesh [2]. The Bangladesh Demographic and Health Survey (BDHS), 2017 showed that 82 percent of women received ANC from a skilled provider, while only 47 percent had completed four or more ANC visits during the last pregnancy [18]. Lack of access to health facilities and skilled health providers are responsible to refrain women from receiving four or more ANC visits during pregnancy in Bangladesh [9]. Previous studies showed that women receiving ANC late in the pregnancy reported poor experiences because of inadequate time for counselling and mistreatment from providers [19, 20]. Furthermore, maternal as well as neonatal mortality and morbidity can be reduced by assuring quality antenatal care services through high readiness of health care facilities [19, 21].
To provide information on health system functioning and readiness of health care facility services, Service Provision Assessment (SPA) or Health Facility Survey (HFS) has been conducted in developing countries. A number of HFSs has also been conducted in Bangladesh to assess availability and readiness of several facility-based health care services such as child health, antenatal care and newborn care, family planning (FP) as well as services for selected non-communicable diseases (diabetes, cardiovascular diseases) and tuberculosis. The Bangladesh HFS (BHFS), 2017 reported that almost all (99%) health facilities offer antenatal care services in Bangladesh, whereas only 4% are ready to provide quality ANC services according to World Health Organization (WHO) criteria [2]. To confirm better quality antenatal care services at health facilities, the huge difference between the availability and the readiness of these services needs to be reduced.

Although several studies have been conducted in Bangladesh to explore readiness of healthcare facilities to provide general health services [22], non-communicable diseases [23-27], child curative care [28] and child immunization services [29], readiness to provide quality ANC is still unexplored. So, this study has made first attempt to investigate on readiness of antenatal care services in Bangladesh. The purpose of the study is to find out the prevalence and influential factors of readiness for providing quality ANC services in Bangladesh. For this purpose, BHFS, 2017 data has been utilized.

Methods

Data

This study utilized data derived from nationally representative Bangladesh Health Facility Survey (BHFS), 2017. The BHFS, 2017 was based on service provision assessment (SPA) and conducted
in Bangladesh under the authority of National Institute of Population Research and Training (NIPORT) of Ministry of Health and Family Welfare (MOHFW) with financial assistance of Government of Bangladesh and U.S. Agency for International Development (USAID). The sample of 2017 BHFS was a stratified random sample of 1600 health facilities selected from all registered health facilities across all eight administrative divisions in Bangladesh. Finally, interviewers successfully collected information from 1524 health facilities.

In this study, in order to assess the readiness of antenatal care services, the facilities which offer antenatal care services were selected. Among the interviewed facilities, 1505 facilities were reported available to provide ANC services and those facilities were taken in this study. Again, data have been weighted i.e., complex survey design has been used in the study in order to avoid overestimation or underestimation problem.

**Outcome Variable**

We used service availability and readiness assessment (SARA) reference manual of WHO to identify the items or tracer indicators that a facility needs to offer quality ANC services [30]. To define the readiness of facilities providing antenatal care, less restrictive as well as Bangladesh context-oriented version of ANC service readiness measure has been applied in this study [2]. To serve this purpose, six tracer indicators under five domains given in Table 1 have been used.

(To be continued...)

In the study, outcome variable was readiness of health facilities to offer antenatal care services. The readiness index was created by WHO approach, where equal weights were given to each
domain of indicators/items and also to each item at each weighted domain for providing antenatal care services. The above six items are considered for each facility and summed up to generate weighted mean readiness score [8, 28, 30, 31]. Finally, mean score was multiplied by 100 to obtain the results of readiness score in percentage. Mathematically, the readiness score for the $i^{th}$ facility can be expressed as follows [28]

$$Y_i = \left( \frac{1}{m} \sum_{j=1}^{m} \frac{1}{p_j} \sum_{k=1}^{p_j} z_{ijk} \right) \times 100 ; i = 1,2, \ldots, n; j = 1,2, \ldots, m; k = 1,2, \ldots, p_j,$$

where $Y_i$ is the score of $i^{th}$ case (facility), $m$ is the number of domains, $p_j$ is the number of indicators/items in $j^{th}$ domain, $z_{ijk}$ is the value of $k^{th}$ indicator in $j^{th}$ domain for $i^{th}$ case (facility), and $n$ is the total number of facilities. This readiness index was a continuous variable giving value between 0 and 100. The higher value of readiness score indicates higher ANC service readiness of the health facilities whereas lower value implies lower readiness.

Based on the readiness scores, the health facilities were divided into three categories in this study. The facilities with readiness score 75 or below are considered as having low readiness; facilities with 75 to 99 score considered as having moderate readiness; and facilities with 100 score considered to be highly ready (complete readiness) to offer antenatal care services. Thus, the readiness score was categorized as low, medium and high readiness in this study.

**Covariates**

In the study, based on the previous studies on readiness of health facilities, the six covariates were selected to explore how these are associated with the readiness of facilities to provide antenatal care services [23, 28, 32, 33]. The covariates are: location of facility (Urban and Rural), type of facility (Public hospitals or clinics, Community Clinics, Non-Governmental Organization (NGO)
hospital or clinics and Private hospitals), health provider status (Assigned and Not assigned), qualification of health provider (Specialist or MBBS Doctors and Others), basic amenities in facility (Inadequate, Moderate and Adequate amenities) and division (Barisal, Chattogram, Dhaka, Khulna, Mymensingh, Rajshahi, Rangpur and Sylhet). The providers who are posted in a facility are defined as the assigned provider, and who are hired or seconded/deputed in the facility are defined as not assigned provider in the study. The variable “basic amenities” was created from observed information on nine amenities which are 1. national electricity grid availability, 2. regular electricity, 3. improved water source, 4. visual and auditory privacy, 5. client latrine, 6. communication equipment, 7. computer with internet 8. emergency transport, and 9. separate latrine or toilet for female clients. Based on the availability of the amenities, each of these amenities was created as indicator variables (Yes/No). In this study, the principal component (PC) analysis technique has been used to obtain a score index of basic amenities from nine indicator variables for reducing dimensionality. Higher score of a facility as compared with any other facilities indicates that the facility has more amenities than other facilities. The score index is continuous variable and also named as basic amenities in facility in this study. The distribution of scores was divided into three equal segments based on quantiles for study purpose. The lower part, middle part and upper part of score index were named as inadequate, moderate and adequate amenities, respectively.

**Statistical analysis**

To obtain the descriptive statistics for the selected variables, percentage frequency was computed. To check associations between several covariates and readiness of antenatal care services, the chi-square test was used in the study. Since readiness of antenatal care service is a polytomous outcome variable, multinominal logistic regression model was used to determine adjusted associations of
covariates with readiness of facilities [34]. STATA 14 package has been used in the study for analyzing the data.

Results

Results obtained from univariate and bivariate analyses have been reported in Table 2. Table 3 represents the results of regression model.

Univariate Results

Table 2 reveals among 1505 health facilities offering ANC, only 4% are completely ready to provide ANC services in Bangladesh, while about 73% facilities have lower readiness. More than half of health facilities giving ANC (55%) have at least one staff who have in-service training for ANC, while fewer than half of health facilities (46%) follow ANC guidelines. Majority of health facilities have reported the availability of blood pressure apparatus and necessary medicines (iron and/or folic acid tablets), whereas only fewer (14%) have confirmed the availability of functioning equipment and reagents required for diagnostic test (hemoglobin and urine protein test) at the facility. Most of facilities offering antenatal care services are from rural areas (about 93%). Among the facilities, approximately 67% of interviewed facilities are community clinics, whereas only 3% and 4% are private hospitals and NGO hospital or clinics, respectively. More than nine in ten of health facilities (98%) have assigned health providers. Again, only 8% of facilities offering antenatal care services have health professionals who are specialists or MBBS doctors. The distribution of facilities having inadequate, moderate and adequate basic amenities are almost similar. Approximately 20% and 19% of facilities offering antenatal care services situated in Dhaka and Chattogram respectively, as compared with only 6% and 7% of those were from Sylhet and Barisal respectively.
Bivariate Results

Overall Readiness

From Table 2, it is observed that all the selected covariates except health provider status have significant associations with readiness of facilities to offer antenatal care services. About 23% of urban facilities are completely ready to provide antenatal care services, as compared with 3% of rural facilities. Again, approximately 45% and 31% of facilities located in urban areas have low and medium readiness of antenatal care services, respectively, whereas 75% and 23% of rural facilities are observed to have low and moderate readiness respectively. Among public hospitals or clinics, about 9% facilities have full readiness, while about 64% facilities have poor readiness to provide such services. Approximately eight in ten of the community clinics have lower readiness, whereas only 1% of community clinics are completely ready to ensure antenatal care services to their clients. More than half of NGO hospitals or clinics (56%) are moderately ready to give the services, whereas fewer the one-fourth of those facilities have complete (23%) and lower (22%) readiness, respectively. Again, most of private hospitals (84%) have low readiness as compared with 14% and 2% of private hospitals with moderate and full readiness of providing the services, respectively. About 2% of facilities not having assigned health providers have complete readiness, whereas 4% of those having assigned health providers are fully ready to give the services on antenatal care. Table 2 demonstrates that facilities who have specialist or MBBS doctors as health providers (17%) are more likely to ensure highly ready service for antenatal care than those who have other health professionals (3%). As basic amenities index increases, the low readiness of antenatal care facility services also decreases from 82% of facilities with inadequate amenities to 66% of those with adequate amenities. By division, the percentage of facilities with high readiness to offer antenatal care varies from a low of 2% in Rangpur to a high of 7% in Sylhet.
Domains (Tracer indicators) of Readiness

Readiness to provide quality ANC services is measured based on five domains recommended by WHO, which are: trained staff for ANC at any time, guidelines on ANC, equipment (blood pressure apparatus), diagnostic capacity (hemoglobin and urine protein test) and medicines (iron and/or folic acid tablets). Table 2 shows that among five domains, availability of medicines (iron and/or folic acid tablets) to offer better ANC is highest (93%), whereas only 14% of health facilities have reported necessary functioning equipment and reagents for diagnostic test (hemoglobin and urine protein test) available at the facility.

(The Table 2 here)

Trained Staff for ANC at any time

Approximately 55% of health facilities offering ANC services have at least one staff who have in-service training on ANC. All covariates except type of facility and division exhibit no significant association with training on ANC for at least one staff member of the facility. Among four types of facilities, NGO hospitals or clinics are most likely to have at least one staff who received training for ANC (64%), whereas private hospitals are least likely to have trained staff for ANC (26%). Health facilities located in Rangpur are least likely to have trained staff for ANC compared to those located in other divisions.

Guidelines on ANC

About 46% of health facilities providing ANC have reported ANC guidelines available at the facility on the day of interview of the survey. Among all selected covariates, only type of facility
and division have significant association with availability of ANC guidelines. Only 7% of private hospitals follow ANC guidelines, while about three-fourth of NGO hospitals or clinics (75%) have reported to have ANC guidelines available. Approximately three in ten of facilities in Sylhet have ANC guidelines, whereas two-third of facilities located in Khulna follows ANC guidelines.

**Equipment (blood pressure apparatus)**

More than eight in ten of facilities offering ANC have confirmed the availability of functioning digital blood pressure machine or functioning manual sphygmomanometer with stethoscope at the facility. All the covariates except health provider status are significantly associated with the availability of blood pressure apparatus. About 97% of urban facilities have functioning blood pressure apparatus as compared with 86% of rural health facilities. Community clinics are least likely (83%) to avail functioning blood pressure apparatus compared to other facility types. More than nine in ten of facilities who have specialist or MBBS doctors as health providers have reported blood pressure apparatus available for antenatal care as compared with 85% of facilities who have other health professionals. With increasing basic amenities, the availability of blood pressure apparatus increases from 79% of facilities with inadequate amenities to 92% of those with adequate amenities. Health facilities of Barisal are least likely (80%) to have functioning blood pressure machine than those of other divisions.

**Diagnostic capacity (hemoglobin test and urine protein test)**

Only 14% of health facilities giving ANC services have reported functioning equipment and reagents needed to conduct diagnostic tests for ANC (hemoglobin test and urine protein test) available at the facility. All covariates but health provider status have significant association with the capacity to run tests for hemoglobin and urine protein. Only 9% of rural facilities have
available equipment and reagents for hemoglobin and urine protein tests as compared with around three-fourth of urban facilities. About 6% of Community clinics and 17% of public hospitals or clinics have the capacity for hemoglobin and urine protein tests, whereas more than 70% of NGO hospitals/clinics as well as private hospitals are capable to conduct these tests. Facilities with specialist or MBBS doctors (67%) are almost 7.5 times as likely as those with other health providers (9%) to conduct these tests. Again, facilities with adequate basic amenities are three times as likely as those with inadequate amenities to perform these tests. Facilities of Rangpur are least likely (5%) to conduct hemoglobin and urine protein tests compared to those of other divisions.

**Medicines (iron and/or folic acid tablets)**

Majority of health facilities that offer ANC have essential medicines (iron and/or folic acid tablets) for ANC. Each selected covariate has been observed to have significant association with availability of these medicines needed for ANC. About 88% of urban facilities have iron supplements and/or folic acid tablet as compared with 93% of rural facilities. Private hospitals are least likely (78%) to have these essential medicines than other facility types. About 80% of facilities not having assigned health providers have these two medicines, whereas 93% of those having assigned health providers reported to have these medicines available at the facility. Approximately nine in ten of facilities with specialist or MBBS doctors have these medicines, while 93% of facilities who have other health professionals have confirmed these medicines available for antenatal care. The availability of iron and/or folic acid tablets increases as basic amenities index increases. Facilities of Chattogram (83%) and Sylhet (85%) are less likely to have these medicines available than facilities of other divisions.
**Multinomial logistic results**

The covariates found to be significantly associated with readiness on antenatal care services in bivariate analysis are selected for multivariate analysis. In this study, multinomial logistic regression analysis has been performed considering low readiness as baseline outcome category for the comparison with medium readiness and high readiness. Table 3 shows the coefficients, relative risk ratios (RRR) with 95% confidence intervals, p-values obtained from analysis.

**Medium versus low readiness**

Table 3 reveals that the urban and rural facilities have the equal risk for being moderately ready relative to lower ready to provide the ANC services [RRR 1.05; 95% CI: 0.56-1.99; p-value 0.880].

The relative risk of NGO hospitals or clinics are 4.68 times compared to public hospitals or clinics to provide average quality of antenatal care services [RRR 4.68; 95% CI: 2.54-8.62; p<0.001]. By contrast, community clinics and private hospitals have 31% [RRR 0.69; 95% CI: 0.47-0.99, p-value 0.048] and 88% [RRR 0.12; 95% CI: 0.05-0.27; p<0.001] lower probability to be medium ready to offer ANC compared to public hospitals or clinics, respectively. The relative risk of being average ready relative to lower ready for ANC service would be expected to increase by a factor of 4.06 among the facilities with qualified physician i.e., specialist or MBBS doctors as health providers than those with other health providers [RRR 4.02; 95% CI: 2.24-7.21, p<0.001]. Again, the expected risks of having average readiness are increased by 2.54 [RRR 2.54; 95% CI: 1.52-4.26, p<0.001] and 1.70 [RRR 1.01; 95% CI: 1.01-2.88, p-value 0.047] for those facilities which have moderate and adequate basic amenities, respectively compared to the facilities with inadequate basic amenities. Facilities of Chattogram, Khulna and Mymensingh are significantly
associated with the increased probability of providing medium quality of ANC services compared to facilities located in Dhaka. Location of facility has no significant effect on medium readiness vs. low readiness to deliver ANC services.

**Complete versus low readiness**

Table 3 also demonstrates the results of the comparison between high and low readiness for delivering antenatal care services. The fact that a facility is located in rural area reduces the risk of being complete readiness relative to low readiness to provide the services by a factor of 0.13 compared to an urban facility [RRR 0.13; 95% CI: 0.06-0.31, p<0.001]. Community clinics and private hospitals also decrease the probabilities for getting the quality ANC services by the factor of 0.15 and 0.02, respectively compared to public hospital or clinics. On the other hand, the relative risk of NGO hospitals or clinics are 2.63 times compared to public hospitals or clinics to provide full quality of antenatal care services [RRR 2.63; 95% CI: 1.27-5.46; p-value 0.010]. The chance of giving quality ANC services increases by a factor of 2.22 when a facility has MBBS doctor or specialist health provider [RRR 2.22; 95% CI: 0.97-5.08, p-value 0.058] and it is noted that the evidence is justified at 10% level of significance. Compared to the facilities having inadequate basic amenities, the expected risk of giving quality ANC services are found to be equal among the facilities having average or adequate basic amenities. Facilities of all divisions except Rangpur are significantly associated with increased chance of getting higher readiness to offer ANC services compared to facilities of Dhaka.

**Discussion**

The aim of the present study is to evaluate the readiness of health facilities to provide proper antenatal care (ANC) services among pregnant women and also to determine its associated factors
using data from the National Survey of Bangladesh. To our knowledge, this is the first study to assess the readiness for offering ANC services in Bangladesh following WHO recommendation regarding service readiness indicators using a nationally representative health facility survey, where the health facilities were considered as sampling units. However, the survey found a huge quality gap for providing ANC services. Most facilities (72.11%) are poorly prepared, i.e., the indicators for ANC services are not adequately available to provide ANC services, where only 4.26% are fully prepared to provide. Again, compared with other indicators of ANC, diagnostic capacity (hemoglobin and urine tests) was not found in most facilities (13.66%), although diagnosis is required at this stage of pregnancy for better health of women as well as their preterm infants. The lack of WHO-recommended indicators for ANC in any facility may refrain women from visiting four or more ANCs as the previous studies have shown that optimal ANC coverage often depends on the availability, cost-effectiveness, and quality of ANC services [35-38]. It is noted that only 47% of women received healthcare four or more times from providers during their pregnancy in Bangladesh [18]. Nevertheless, the equipment (blood pressure apparatus) and drugs (iron or folic acid tablets) for ANC are now in a better position in terms of availability in Bangladesh than other proposed requirements. Findings related to the readiness of health facilities for quality ANC services are consistent with the studies in Nepal and Ethiopia that the health facilities did not meet the requirements set by WHO guidelines [8, 17]. Again, another study conducted in India also measured the low quality of ANC services, although the study defined the quality of ANC services based on clinical quality, interpersonal quality of care and utilization of ANC measures [39]. A study on quality ANC readiness in sub-Saharan Africa found out the readiness in specific tracer indicators of ANC services, where most of the countries selected in the study had better readiness than Bangladesh in availability of trained staff, ANC guidelines and
Iron supplementation [16]. In addition, compared to previous survey of 2014 BHFS, the present study did not find any considerable change in preparedness of the health facilities to provide ANC services [40].

(Table 3 is here)

This study also found some potential factors responsible for lower readiness of health facilities to offer ANC services. In the study, the outcome variable “readiness index” have three categories, and lower readiness was considered as the reference (or base) category for both medium and high readiness to run the multinomial logistic regression model. The urban and rural location of the facilities do not have significant difference in medium readiness but exist difference in high readiness, and rural facilities are less likely to be ready fully for providing ANC services compared to urban facilities. Several studies found the similar findings, where the studies explored the general services readiness, and explained the reasons behind the finding that ineffective coverage of health facilities in rural facilities and tertiary or highest-level care in urban facilities [22, 41-44]. Usually, the qualified health professionals are available to provide maternal health services in most urban facilities compared to rural facilities [18, 45], and according to their advice to their patients regarding the hemoglobin test, urine test, blood pressure apparatus and taking of iron or folic acids tablets, the authorities of urban facilities try to provide these necessary ANC services in the facilities. Again, the discrimination between urban and rural facilities was also observed in bivariate analysis for the above services (Table 2). There may have another reason behind this difference that comparatively the urban people are educated and more concerned about their health, and naturally, they will try to get the quality services from the health facilities which indirectly may influence the managing authorities in urban facilities to provide quality ANC services. Again, The finding of medium readiness versus low readiness was consistent with a
recent study in Ethiopia [8], where the study did not find any significant difference by location of facilities in providing ANC services. The reverse situation was observed in Burkina Faso, Ghana and Tanzania that the rural health facilities had a satisfactory level of quality ANC service [46].

The facility types significantly influence the preparedness of the facilities for providing ANC service, and the readiness is better in NGO hospitals or clinics but it is not good in private hospitals or community clinics compared to public hospitals or clinics. Similar studies were found in Ethiopia, Vietnam, and India, where the studies revealed that public health facilities were better in readiness than the private facilities to provide ANC service [8, 47, 48]. The finding was also consistent with a study of 46 low and middle-income countries, and the study revealed that public facilities are the primary source of getting ANC services in a country [8, 49]. This might be happened due to the reason that the government health monitoring team may routinely monitor the public health facilities for ensuring quality health services, and the Directorate General of Health Services (DGHS) has already taken the initiative of measuring performance, ranking, and rewarding the different tiers of health facilities in 2014 for improvement of health services in the public health sector. Again, the opposite scenario of providing the services was observed in NGO facilities. NGO hospitals or clinics in local areas are mainly functioned to help the poor local people and run by financial assistance from the Government of Bangladesh and foreign donors. Many NGOs have succeeded in providing child and maternal health services to their clients. In addition, USAID and other international organizations provide grants and funds to NGOs to provide quality health services, and also the organizations monitor the NGO facilities to strictly follow the guidelines [22, 50].

The preparation of health facilities for the delivery of quality ANC services also depends on the qualifications of the health provider. The facilities having qualified physicians, such as specialists
or MBBS doctors, are more likely to be considered as ready to provide ANC services than other facilities. Recently, the WHO has recommended eight or more health check-ups on women during pregnancy by qualified health professionals in healthcare to reduce pregnancy-related complications that result in death in the mother or their newborn [15]. Thus, the qualifications of a health provider play an important role in providing quality healthcare in any facility. Eligible physicians are always up to date on any guidelines related to health issues and they may be able to persuade managing authorities of the facilities to strictly follow WHO guidelines regarding the availability of ANC service indicators.

The basic amenities of health facilities significantly associated with medium readiness but it did not affect the high readiness to provide ANC services. Investigations prove that it is not always true that well-equipped healthcare provides quality ANC services, as there is no difference among inadequate, moderate and adequately equipped facilities in quality services. For example, private hospitals are generally equipped with more basic amenities than public hospitals [2, 22], but our research has shown that private hospitals are less prepared to provide quality ANC services. But this study suggests that health facilities should have adequate basic facilities in addition to maintaining the quality of service.

A significant association among division and readiness index was observed in the study, where the health facilities from Chattogram, Khulna and Mymensingh regions were more likely to have average or complete readiness to provide the ANC service compared to Dhaka region, but the facilities from Rangpur and Dhaka regions were equally likely to have medium or complete readiness for providing the service. Again, the facilities from Barisal, Rajshahi and Rangpur regions had the higher risk of being completely ready, but these facilities had no enough evidence to exist the difference related to medium readiness with the facilities in Dhaka region. This can
happen due to regional variation in providing health services or access to better health facilities [28]. Similar results were also found in several studies for quality ANC services [8, 49].

**Limitations**

This study focused only on the preparedness of health facilities to provide ANC services for intervention, but didn’t provide a guarantee for ensuring quality ANC services. Because, to ensure quality services, we also need to include the followings: health provider knowledge, provider effort, motivation, supervision or increased workloads [16, 51] which are not available in the SPA survey. Another limitation is the arbitrary use of cut-off points (below 75%, 75-99%, and 100%) to define the categories of outcome variable "readiness index" that may incorrectly classify the readiness for ANC service delivery. Again, the causal relationship of the factors with readiness of health facilities cannot be examined cause, as the BHFS or SPA data was in a cross-sectional setup. Moreover, the lack of previous studies related to the readiness of health facilities for the provision of ANC services using SPA or HFS data has made it difficult to compare the results of the current study with those of other studies.

**Conclusion**

The quality of ANC services is extremely poor in Bangladesh. So, in order to provide quality ANC services, it is necessary to accelerate the availability of several ANC service indicators. Reducing the gap in quality ANC services can be a positive aspect in reaching SDGs related to maternity and neonatal mortality [9, 17, 52, 53]. Again, to ensure the readiness among the facilities for improving quality, routine and robust monitoring in health facilities are required [17, 54]. The Ministry of Health and Family Welfare (MOHFW) is in charge of providing primary healthcare in rural areas through various channels. Among the channels, the community clinics and subdistrict
health complexes play a major role to provide quality healthcare services in rural areas. Therefore, the MOHFW should take the responsibility for ensuring quality ANC services in rural areas by improving and monitoring the community clinics and subdistrict health complexes. This study recommends that the government of Bangladesh should take the initiative of engaging qualified health professionals and arranging routine monitoring in rural health facilities for getting quality health services. In addition, the DGHS should offer incentives to private health facilities to follow the provision and integration of ANC services.

Abbreviations

ANC: Antenatal Care; WHO: World Health Organization; HFS: Health Facility Survey; BHFS: Bangladesh Health Facility Survey; MMR: Maternal Mortality Ratio; NMR: Neonatal Mortality Rate; SDG: Sustainable Development Goal; HPNSDP: Health, Population and Nutrition Sector Development Program; BDHS: Bangladesh Demographic and Health Survey; SPA: Service Provision Assessment; FP: Family Planning; NIPORT: National Institute of Population Research and Training; MOHFW: Ministry of Health and Family Welfare; USAID: United States Agency for International Development; SARA: Service Availability and Readiness Assessment; NGO: Non-Governmental Organization; MBBS: Bachelor of Medicine, Bachelor of Surgery; PC: Principal Component; RRR: Relative Risk Ratio; CI: Confidence Interval; DGHS: Directorate General of Health Services.

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Availability of data and materials

This study entails a secondary analysis of data from 2017 BHFS. The original survey dataset was available online at https://dhsprogram.com/data and the data set was freely downloadable after completing a registration at the website of DHS program.

Authors’ contributions

KKS and SN conceptualized and initiated the research question. FTZ and SN carried out the literature review. KKS and SN conducted the statistical analysis. All authors contributed equally in drafting the manuscript. WB supervised the entire study, reviewed the manuscript and incorporated changes as applicable. FTZ and WB finalized latest version. All authors read and approved the final manuscript.

Ethics approval and consent to participate

The survey used a freely available secondary survey data set (BHFS, 2017) which is available online (https://dhsprogram.com/data). The survey was approved by the Ethics Committee of ICF Macro in Calverton, USA, and by the National Institute of Population Research and Training (NIPORT) in Bangladesh, and the authority took permission from the participants i.e., facility in charge to participate in the survey (2017), and all participants signed in a consent form. Thus, ethical approval and consent to participate were automatically deemed unnecessary for the current study.

Consent for publication

Not applicable
Competing interests

The authors declare that they have no competing interests.

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