BMJ Open

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Journal:	*BMJ Open*
Manuscript ID	bmjopen-2018-022817
Article Type:	Research
Date Submitted by the Author:	10-Mar-2018
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Keywords:	HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Quality in health care < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Human resource management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Organisational development < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

Title: Assessment of the Readiness of Health Facilities for Diabetes and Cardiovascular Services in Bangladesh: Analysis of Data from Nationwide Survey

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ABSTRACT

Objectives: The objective of this study was to assess the readiness of health facilities for diabetes and cardiovascular services in Bangladesh.

Design: This study was a cross sectional survey.

Setting: This study used data from a nationwide bangladesh health facility survey (bhfs) 2014

Participants: One thousand five hundred and ninety six (1,596) health facilities were included primary and secondary-care facilities of the public sector and from private/NGO facilities, offering services only for diabetes and cardiovascular diseases (CVD).

Primary and secondary outcome measures: The primary outcome was readiness of health facilities for diabetes and cardiovascular services. We analyzed those data following service availability and readiness assessment (SARA), manual of the world health organization (WHO) to assess the readiness of selected health facilities towards services for diabetes and CVD.

Results: Fifty-eight and 24.1% of the facilities had diagnosis and treatment services for diabetes and CVD respectively. Shortage of trained staff (18.8% and 14.7%) and meager medicine supply (23.5% and 43.9%) were identified to be factors responsible for inadequate services for diabetes and CVD. Among the facilities that offer services for diabetes and CVD, only 0.4% and 0.9% had all the four service-readiness items (guideline, trained staff, equipment, and medicine).

Conclusions: our study suggested that health facilities suffered from the lack of readiness in various aspects, such as shortage of trained staff and required medicine, unavailability of guidelines on diagnosis and treatment for diabetes and CVD. It is, therefore, essential now to ensure trained staff, required medicine, and guidelines on diagnosis and treatment for diabetes and CVD in Bangladesh.

Key words: CVD, Diabetes, Health facilities, Health services, NCDs. Readiness

STRENGTHS AND LIMITATIONS OF THE STUDY

- The study used 1,596 health facilities as sample which included all the administrative regions of Bangladesh which is nationally representative in nature.
- The study collected information from primary and secondary-care facilities of the public sector and from private/NGO facilities, offering services only for diabetes and cardiovascular diseases (CVD).
- Information from tertiary care facilities and information on other NCDs were not collected.

INTRODUCTION

Historically, health facilities in Bangladesh have focused on maternal, child and reproductive health, immunization and communicable diseases.[1] Overall health status of Bangladeshi population has been continually improving over the past few decades.[2] In some cases, the country has shown more impressive progress than most of its neighbors. The success in expanding immunization, improving maternal and child health, and in reducing malnutrition must be commended.[3] However, due to simultaneous demographic and epidemiological transitions, coupled with rapid urbanization, Bangladesh has been suffering from double burden of disease.[4 5]

The rising burden of non-communicable diseases (NCDs) is becoming a major challenge of health systems in Bangladesh.[6] The prevailing health system of Bangladesh is still poorly organized with inadequate fiscal and human resources, lack of good governance, highly-centralized service delivery models and weak information systems.[3] At the same time, Bangladesh is now moving towards universal health coverage (UHC) but rising burden of NCDs which are further imposing challenges to the three dimensions (coverage, service and financing) of UHC.[1] To combat the burden of NCDs, a dedicated unit has been established within the Ministry of Health and Family Welfare (MOHFW) but access to and availability of essential services for NCDs remain fragmented.[6]

Readiness of the health system is important for coping with the growing epidemic of NCDs and supporting policy-makers to plan appropriate responses and make this sustainable.[7-9] In Bangladesh, preparedness of the health facilities for coping with the rising burden of NCDs is insufficient.[6] To identify gaps and opportunities for further strengthening of health services for

NCDs, assessment of health facilities is crucial. Information from research is needed to guide policy-makers on how to strengthen health systems and reduce the overall burden of NCDs in resource- poor countries, like Bangladesh. In response to this issue, we assessed the readiness of health facilities in a representative sample of public, private and non-profit health facilities in Bangladesh.

METHODS

study design

This study was based on the secondary analysis of data from the Bangladesh Health Facility Survey (BHFS) 2014. The BHFS 2014 was conducted during March-October 2014, in collaboration among the National Institute of Population Research and Training (NIPORT); ICF International (USA); and Associate for Community and Population Research (ACPR), Dhaka, Bangladesh.[10]

sample-size

A total of 1,596 health facilities from all formal-sector health facilities were selected from 19,184, using stratified random sample procedure. The sample for the 2014 BHFS was designed to include facilities from seven administrative divisions (Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur, and Sylhet) of the country. All seven types of public facilities—district hospitals (DHs), maternal and child welfare centers (MCWCs), upazila health complexes (UHCs), upgraded union health and family welfare centers (upgraded UHFWCs), union health and family welfare centers (UHFWCs), union sub-centers/rural dispensaries (USCs/RDs), and community clinics (CCs)—as well as private hospitals with at least 20 beds and NGO static

clinics/hospitals were included.[10] It may be mentioned that, in Bangladesh, health facilities up to the subdistrict level (upazila health complex) provide services for NCDs. Considering this; we excluded the facilities below subdistrict level and also excluded those with missing values.

data collection

Data were collected through an electronic structured questionnaire. After training (15 days), 40 data-collection teams, with two interviewers in each team, were formed. Data collection was done from 22 May to 20 July 2014. Supervision of data collection was coordinated by ACPR and NIPORT. Seven field supervision teams, with seven medical doctors (who were master trainers) and seven trained data-processing specialists, were formed. The field supervision teams made periodic visits to their assigned data-collection teams to review their work and monitor quality of data. Ethics approval for the BHFS was obtained from the Institutional Review Board of the Medical Research Council of Bangladesh. Informed consent was given by the participants.[10]

data analysis

We divided health facilities into two broad categories--public and private/NGO facilities and analyzed data following Service Availability and Readiness Assessment (SARA) Manual of the World Health Organization (WHO)[11] to assess general service readiness in four domains (e.g. basic amenities, basic equipment, standard precautions for prevention of infection, and diagnostic capacity) in 319 facilities. We assessed diabetes and CVD-specific readiness following the said WHO manual. Moreover, we did assessment of readiness index for diabetes and CVD-related services, stratified by seven administrative divisions. Overall readiness was

calculated by the mean of proportion of each domain. Data were weighted during the analysis, and all the results were summarized and presented as frequencies and percentages by facility types. All analyses were adjusted for sample weight and conducted using SPSS version 21.

patient involvement

Patient's were not involved in the study.

RESULTS

Of the selected 319 facilities, 179 (56.1%) were public, and 140 (43.9%) were from the private and NGO sectors. Table 1 presents the results for all four domains under two broad categories (public and private, including NGO facilities) of general service readiness. In general, district hospitals exhibited higher availability of items in all four domains of readiness than other facilities. For basic amenities, the availability individual items ranged between 62.8% and 100% for all facilities, and, overall, private facilities had the lowest emergency transport facility (ambulance) compared to public facilities. In the basic equipment domain, all items were available in most of the facilities, except child scale at upazila health complexes (58.5%) in the public sector and at NGO clinics/hospitals (63.8%) in the private sector. Although proper disposal of sharp and infectious wastes were done in most of the facilities, 36.9% facilities had no guidelines on standard precautions. In terms of diagnosis capacity, availability of items was observed in all facilities but facilities for diagnosis of tuberculosis (TB) were comparatively low in district hospitals (72.9%) and in NGO clinics/hospitals (21.1%).

144 **Table 1. Status of general service-readiness indicators of the facilities**

General readiness	Public facilities (%)		Private/NGO facilities (%)		Total (%) (n=319)
	UHC (n=120)	District hospital (n=59)	Private clinic/hospital (n=71)	NGO clinic/hospital (n=69)	
Basic amenities					
Power	97.7	100.0	86.9	96.8	94.3
Generator	68.9	88.1	98.0	62.8	76.2
Water source	100.0	100.0	100.0	100.0	100.0
Room with privacy	100.0	100.0	100.0	100.0	100.0
Adequate sanitation facilities	98.0	98.3	100.0	100.0	99.3
Communication equipment	100.0	100.0	100.0	100.0	100.0
Access to computer with Internet	99.7	100.0	95.7	67.4	86.7
Emergency transportation (ambulance)	97.0	93.2	66.0	29.0	62.8
Mean domain score	95.2	97.5	93.3	82.0	89.9
Basic equipment					
Blood pressure apparatus	93.0	93.2	98.0	100.0	97.0
Stethoscope	98.0	98.3	98.0	100.0	98.7
Adult scale	82.8	84.7	74.0	85.0	81.1
Infant scale	64.8	86.4	71.1	79.8	73.2
Child scale	58.5	71.2	69.3	63.8	64.2
Thermometer	94.6	94.9	98.0	98.1	96.9
Light source	74.7	86.4	87.6	78.6	80.5
Mean domain score	80.9	87.9	85.1	86.5	84.5
Standard precautions					
Safe final disposal of sharps	99.7	100.0	100.0	98.4	99.3
Safe final disposal of infectious wastes	100.0	100.0	100.0	100.0	100.0
Running water	89.4	84.7	88.8	91.7	89.8
Handwashing soap	88.8	83.1	88.7	84.9	87.1
Disposable latex gloves	72.4	72.9	63.4	79.5	72.4

Medical masks	62.6	64.4	69.8	76.1	69.8
Gowns	41.4	52.5	57.0	65.6	55.4
Eye protection	21.7	35.6	32.4	45.1	34.1
Guidelines on standard precautions	27.3	52.5	28.5	49.0	36.9
Mean domain score	67.0	71.8	69.8	76.7	71.6
Laboratory capacity					
Hemoglobin tests	96.0	100.0	98.7	97.7	97.6
Blood glucose tests	83.0	98.3	100.0	98.0	94.1
Renal function tests	30.9	69.5	91.4	50.3	58.2
Urine chemistry testing/urine pregnancy tests	75.2	81.4	88.0	82.2	81.8
Syphilis	43.1	91.5	88.4	60.8	65.7
TB	90.9	72.9	64.2	21.1	58.4
Mean domain score	69.9	85.6	88.4	68.4	76.0

readiness index specific to services for diabetes

In total, 179 public and 140 private facilitates were involved in diabetes-specific services, such as diagnosis and treatment of diabetes. Readiness index scores specific to services for diabetes according to facilities are presented in Table 2. Among the selected 319 facilities, 58.1% offered diagnosis and treatment for diabetes. Status of diagnosis and treatment for diabetes was low in upazila health complexes (53.1%) compared to district hospitals (72.9%). On the other hand, the status of diagnosis and treatment was low in NGO clinics/hospitals (43.8%) compared to private clinics/hospitals (78.3%). As a whole, readiness index (18.8%) of the trained staff (those who received training during the 24 months before the survey) was low in all facilities. On the other hand, mean domain score for equipment and diagnosis was 77.2% and 84.1% respectively. In terms of readiness for medicine, all facilities had low availability of medicines. In public facilities, such as upazila health complexes, only 10.9% medicines were available, and district hospitals had 29.7% of medicines available. It was reported that all items under medicine domain were less available. On the other hand, scenario at the private facilities was comparatively better than at the public facilities. Private hospitals/clinics (58.4%) had higher availability of medicines compare to other facilities. The overall readiness index specific to services for diabetes was 49.8% in the consideration of five domains (guideline, trained staff, equipment, diagnosis capacity, and medicine).

163 **Table 2. Readiness index and domain scores specific to services for diabetes by facility**

Services for diabetes	Public facilities (%)		Private facilities (%)		Total (%) (n=319)
	UHC (n=120)	District hospital (n=59)	Private clinic/hospital (n=71)	NGO clinic/ hospital (n=69)	
Both diagnose and treatment facilities					
	53.1	72.9	78.3	43.8	58.1
Guidelines on the diagnosis and treatment					
Yes	60.5	72.9	31.0	40.8	45.3
Mean domain score	60.5	72.9	31.0	40.8	45.3
Trained staff					
Yes	37.0	30.5	11.6	8.7	18.8
Mean domain score	37.0	30.5	11.6	8.7	18.8
Equipment					
Blood pressure	94.2	94.9	98.0	100.0	97.5
Adult weighing scale	76.9	76.3	74.0	85.0	79.0
Height board/stadiometer	60.3	61.0	42.0	60.8	55.1
Mean domain score	77.2	77.4	71.3	81.9	77.2
Diagnostic capacity					
Blood glucose	83.0	98.3	100.0	98.0	94.1
Urine protein	56.2	64.6	96.1	87.5	80.4
Urine glucose	53.2	64.6	96.1	82.7	77.9
Mean domain score	64.2	75.8	97.4	89.4	84.1
Medicines					
Metformin	10.5	39.0	71.3	12.8	29.1
Gliben-clamide	19.8	25.4	42.4	2.4	19.7
Injectable insulin	1.6	20.3	64.1	4.6	20.5
Injectable glucose solution	11.8	33.9	55.6	11.6	24.6
Mean domain score	10.9	29.7	58.4	7.8	23.5
Readiness index for services specific to diabetes	50.0	57.3	53.9	45.7	49.8

readiness index specific to services for CVD

Readiness index scores specific to services for CVD according to facilities are presented in Table 3. Among the 319 facilities under study, only 24.1% facilities had both diagnosis and treatment facilities and 44.5% had national guidelines on CVD. As in the case of diabetes, only 14.7% facilities had trained staff, and the rate was higher (47.5%) in public facilities compared to private facilities (18.8%). In terms of equipment, more than 70% facilities had appropriate equipment available. On the other hand, overall mean domain score for medicine was 43.9%, and the score was higher in district hospitals (51.5%) compared to upazila health complexes (41.4%); and the score was higher in private hospitals/clinics (62.9%) compared to NGO clinics/hospitals (31.2%). The overall readiness index specific to services for CVD, in the consideration of five domains (guideline, trained staff, equipment, diagnosis capacity, and medicine) was 45.1%.

division-wise readiness index scores specific to services for diabetes and CVD

Figure 1 and 2 show the readiness index scores specific to services for diabetes and CVD. Readiness index specific to services for diabetes was high in Rangpur division (54.1%) and low in Rajshahi division (46.5%). On the other hand, readiness index specific to services for CVD was high in Rangpur division (46.0%) and low in Sylhet division (38.2%). Figure 1 and 2 also project that, if we would ensure guidelines on diagnosis and treatment for diabetes in all facilities (n=319), the readiness index could be 49.8% to 60.7%. Like availability of guidelines, if we

Table 3. Readiness index scores specific to services for CVD and domain scores by facility

Services for CVD	Public facilities (%)		Private facilities (%)		Total (%) (n=319)
	UHC (n=120)	District hospital (n=59)	Private clinic/hospital (n=71)	NGO clinic/ hospital (n=69)	
Both diagnosis and treatment facility					
	26.1	23.7	14.7	30.1	24.1
Guidelines on diagnosis and treatment					
Yes	47.1	61.0	41.2	42.3	44.5
Mean domain score	47.1	61.0	41.2	42.3	44.5
Trained staff					
Yes	25.5	22.0	8.6	10.2	14.7
Mean domain score	25.5	22.0	8.6	10.2	14.7
Equipment					
Blood pressure	94.2	94.9	98.0	100.0	97.5
Adult weighing scale	76.9	76.3	74.0	85.0	79.0
Height board/stadiometer	60.3	61.0	42.0	60.8	55.1
Mean domain score	77.2	77.4	71.3	81.9	77.2
Medicines					
Amlodipine/nifedipine	29.7	54.2	88.1	27.1	45.7
Beta-blockers (atenolol)	59.8	71.2	76.8	24.5	51.8
Aspirin	18.9	25.4	42.1	15.8	24.3
Nifedipine tablet	24.4	32.2	34.9	17.7	25.2
Thiazide	74.1	74.6	72.4	70.7	72.4
Mean domain score	41.4	51.5	62.9	31.2	43.9
Readiness index specific to services for CVD	47.8	53.0	46.0	41.4	45.1

would ensure training for at least one care provider in each facility, the readiness index could be increased more than 15% (i.e.16.2%). For CVD, only ensuring guideline will increase the readiness index by14.0%, and ensuring trained staff will increase the readiness index by 7.4%.

readiness of health facilities to provide services for diabetes and CVD

Among the facilities that offer services for diabetes and CVD, only 0.4% had all the five items for service readiness (guideline, trained staff, equipment, diagnosis capacity, and medicine) for services specific to diabetes. On the other hand, only 0.9% facilities had four items of service readiness (guideline, trained staff, equipment, and medicine) for services specific to CVD.

DISCUSSION

The major findings from this study are as follows: (i) The healthcare facilities, in general, had adequate readiness for provision of general services, with the exceptions for items in standard precautions (eye protection and guideline for standard precautions); (ii) Critical gaps exist in key domain, such as guidelines on the diagnosis and treatment for diabetes; (iii) There is shortage of trained staff for services specific to diabetes and CVD; (iv) Supply of medicines for diabetes and CVD is inadequate; (v) Of the facilities that offer services for diabetes and CVD, only 0.4% have readiness for such services, and 0.8% had readiness items/indicators for all services.

The Bangladesh Government provides primary healthcare services to all citizens through a three-tiered health service delivery system in rural areas: the community clinics, each for 6,000 people; the union health and family welfare centers (UH&FWCs), each for 25,000 people; and the upazila (subdistrict) health complexes (UHCs), with an outpatient and an emergency department, 10-50 inpatient beds and an operating room, each for 250,000 people.[12] In the context of Bangladesh, the UHC is the main point for seeking services for NCDs but, according to our findings, it was reported that overall readiness index of facilities offering services for diabetes was comparatively low in the UHCs compared to district hospitals. Availability of required medicines for diabetes was also low in the UHCs, which indicates that our primary healthcare system is still not ready to combat diabetes and other NCDs. A recent study in Bangladesh also reported that relevant medicines for NCDs were either supplied inadequately or not supplied at all.[13]

Various studies in Bangladesh reported that the health system is still not integrated to combat NCDs[6]; availability of medicines in the facilities is still a major challenge in the public healthcare delivery system.[14] Cockroft and colleagues, in a study based on three national community-based surveys, identified lack of/poor quality of medicines as one of the major causes of patients' dissatisfaction with the government health facilities.[15] A study in our neighboring country India also reported discordance in the availability of recommended class of drugs for CVD.[16]

Our study reports that trained staff for providing services for diabetes and cardiovascular diseases was only 18.8% and 14.7% respectively. This is not surprising because the health system of Bangladesh still faces shortage of trained human resources.[17] The current ratio of doctors-to-nurses-to-health technologists in Bangladesh is 1: 0.4: 0.24–being stark opposite to the WHO-recommended standards, i.e. doctors: nurses: technologists=1: 3: 5).[12] Trained staff plays a crucial role in services for NCDs. Different studies in the sub-Saharan Africa already reported that poor knowledge and experience of frontline healthcare workers have been recognized as a major barrier to care for NCDs.[18-20] It is also established that proper training to and supervision of non-medical-doctors, clinicians, or personnel in nurse-led clinics could provide effective primary care for NCDs.[21-23] In the context of Bangladesh, there is no provision of training for non-medical health workforce for services specific to NCDs.

In our study, we also project how only a single guideline and trained staff could increase the overall readiness index, which can give some direction to policy-makers as well as related stakeholders to take necessary actions for strengthening the health facilities in Bangladesh.

Other studies also reported that the health system in Bangladesh is still not ready to combat NCDs. A recent study in Bangladesh titled "A scorecard for tracking actions to reduce the burden of non-communicable diseases" reported that, among the four domains i.e. governance, risk factor surveillance, research, and health system response, the country's performance score was low in three domains, except for the governance (moderate performance).[24]

strengths and limitations of the study

The strength of this study is that it involved analysis of a large national sample of facilities located in all seven administrative divisions of Bangladesh. However, there are a number of limitations of the study. Bangladesh Health Facility Survey 2014 collected information from primary and secondary-care facilities of the public sector and from private/NGO facilities, offering services only for diabetes and CVD. Further research is recommended for collecting information on other NCDs and from higher-level facilities, including tertiary-level health facilities so that findings can give a clear direction to policy-makers and other stakeholders to take necessary actions.

CONCLUSIONS

Our findings suggest that both public and private health facilities in Bangladesh suffer from lack of readiness in various aspects, especially in guidelines on the diagnosis and treatment, trained staff, and shortage of medicine. Now, it is time to ensure guidelines on the diagnosis and treatment for NCDs, trained staff, and adequate medicine to make the facilities ready for strengthening the health system to combat NCDs and to achieve universal health coverage. Information provided in the study would help in generating evidence-based information for the policy-makers and related stakeholders in order to ensure equitable access and improve overall population health outcomes.

LIST OF ABBREVIATION

NCDs- Non-Communicable Diseases

USCs/RDs- Sub-Centers/Rural Dispensaries

ACPR- Community and Population Research

BHFS- Bangladesh Health Facility Survey

CVD- Cardiovascular Disease

DHs- District Hospitals

MOHFW- Ministry of Health and Family Welfare

SARA- Service Availability and Readiness Assessment

TB -Tuberculosis

UHCs- Upazila Health Complexes

UH&FWCs- Union Health and Family Welfare Centers

WHO- World Health Organization

Contributors

TB, MMH and MJU conceptualized the study. TB, MMH and RDG designed the study and acquired the data. TB and MMH conducted the data analysis. TB, RDG and MJU interpreted the data. TB, MMH, RDG prepared the first draft. TB, MMH, RDG and MJU participated in critical revision of the manuscript and contributed to its intellectual improvement. All authors went through the final draft and approved it for submission.

Funding

None.

Acknowledgments

The survey was funded by Government of the People's Republic of Bangladesh and US Agency for International Development (USAID), Bangladesh. The authors acknowledge the contributions of the BHFS 2014 team for their efforts in providing open access to the dataset; icddr,b is thankful to the Government of Bangladesh, Canada, Sweden, and the UK for providing core support.

Competing Interests

None declared.

Patient consent

None Declared

Disclaimer

The authors are alone responsible for the integrity and accuracy of data analysis and the writing the manuscript.

Ethics approval

The datasets were obtained from DHS Programme with proper procedure. The study exempt from collecting ethical approval because the survey protocols were reviewed and approved by Nepal Health Research Council)NHRC (and the ICF Institutional Review Board in Calverton, Maryland, USA.

Data sharing statement

The dataset of BHFS 2014 is available at the Demographic and Health Surveys Program. Extra data is available which is available on request at http://dhsprogram-com/what-we-do/survey/survey-display-349.cfm.

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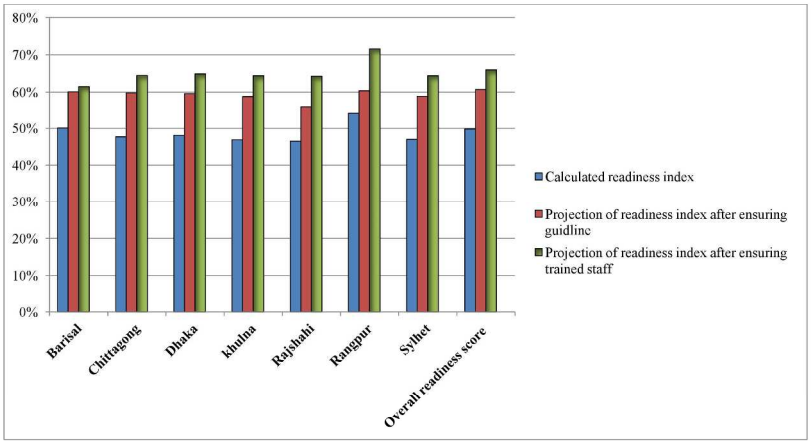
Figures

Figure 1. Readiness index specific to services for diabetes by administrative division and projected direction

Figure 2. Readiness index specific to services for CVD by administrative division and projected direction



Readiness index specific to services for diabetes by administrative division and projected direction

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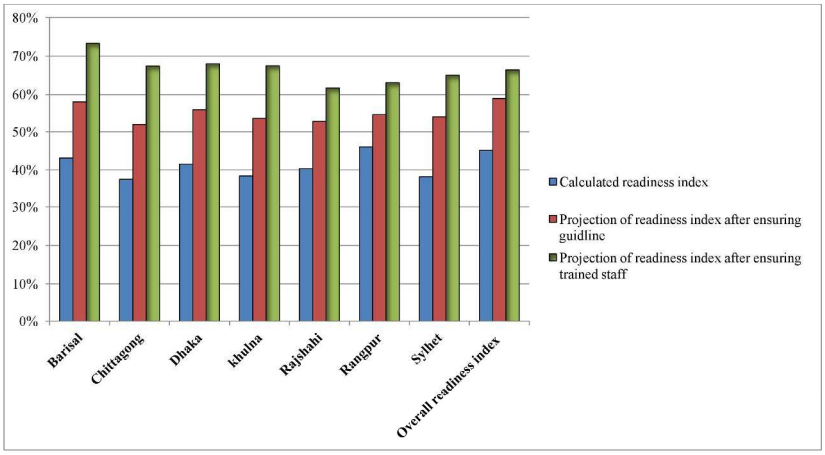

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BMJ Open

Assessment of the Readiness of Health Facilities for Diabetes and Cardiovascular Services in Bangladesh: Analysis of Data from Nationwide Survey

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2018-022817.R1
Article Type:	Research
Date Submitted by the Author:	26-Jun-2018
Complete List of Authors:	Biswas, Tuhin; International Centre for Diarrhoeal Disease Research Bangladesh, Universal Health Coverage Haider , M Moinuddin ; International Centre for Diarrhoeal Disease Research Bangladesh Das Gupta, Rajat; BRAC University James P Grant School of Public Health, Centre for Science of Implementation and Scale-Up (SISU) Uddin, Jasim ; International Centre for Diarrhoeal Disease Research Bangladesh, Universal Health Coverage
Primary Subject Heading:	Health services research
Secondary Subject Heading:	Health services research, Health policy, Health economics, Health informatics, Global health
Keywords:	HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Quality in health care < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Human resource management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Organisational development < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

Title: Assessment of the Readiness of Health Facilities for Diabetes and Cardiovascular Services in Bangladesh: Analysis of Data from Nationwide Survey

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ABSTRACT

Objectives: The objective of this study was to assess the readiness of health facilities for diabetes and cardiovascular services in Bangladesh.

Design: This study was a cross sectional survey.

Setting: This study used data from a nationwide Bangladesh Health Facility Survey (BHFS) 2014

Participants: Three hundred nineteen (319) health facilities were included primary and secondary-care facilities of the public sector and from private/NGO facilities, offering services only for diabetes and cardiovascular diseases (CVD).

Primary and secondary outcome measures: The primary outcome was readiness of health facilities for diabetes and cardiovascular services. We analyzed those data following service availability and readiness assessment (SARA) manual of the world health organization (WHO) to assess the readiness of selected health facilities towards services for diabetes and CVD.

Results: 58% and 24.1% of the facilities had diagnosis and treatment services for diabetes and CVD respectively. Shortage of trained staff (18.8% and 14.7%) and meager medicine supply (23.5% and 43.9%) were identified to be factors responsible for inadequate services for diabetes

and CVD. Among the facilities that offer services for diabetes and CVD, only 0.4% and 0.9% had all the four service-readiness items (guideline, trained staff, equipment, and medicine).

Conclusions: Our study suggested that health facilities suffered from the lack of readiness in various aspects, such as shortage of trained staff and required medicine, unavailability of guidelines on diagnosis and treatment for diabetes and CVD. It is, therefore, essential now to ensure trained staff, required medicine, and guidelines on diagnosis and treatment for diabetes and CVD in Bangladesh.

Key words: CVD, Diabetes, Health facilities, Health services, NCDs. Readiness

STRENGTHS AND LIMITATIONS OF THE STUDY

- The study used 1,596 health facilities as sample which included all the administrative regions of Bangladesh which is representative with respect to administrative and geographic characteristics. .
- The study sample contains a mix of public and private facilities, leading to greater generalizability to an array of facility types.
- Information from tertiary care facilities and information on other NCDs were not collected.

INTRODUCTION

Historically, health facilities in Bangladesh have focused on maternal, child and reproductive health, immunization and communicable diseases.[1] Overall, the health status of Bangladeshis has been continually improving over the past few decades.[2] In some cases, the country has shown more impressive progress than its neighbors. Bangladesh's success in expanding immunization, improving maternal and child health, and in reducing malnutrition must be commended.[3] However, due to simultaneous demographic and epidemiological transitions, coupled with rapid urbanization, have led Bangladesh to experience double burden of disease.[4 5]

The rising burden of non-communicable diseases (NCDs) is becoming a major challenge of health systems in Bangladesh.[6] The prevailing health system of Bangladesh is still poorly organized with inadequate fiscal and human resources, lack of good governance, highly-centralized service delivery models and weak information systems.[3] At the same time, Bangladesh is considering universal health coverage (UHC) but rising burden of NCDs impose challenges to the three dimensions (coverage, service, and financing) of UHC.[1] To combat the burden of NCDs, a dedicated unit has been established within the Ministry of Health and Family Welfare (MOHFW) but access to and availability of essential services for NCDs remain fragmented.[6]

Readiness of the health system to NCDs is important for coping with the growing epidemic of NCDs and supporting policy-makers to plan appropriate sustainable responses.[7-9] In Bangladesh, preparedness of the health facilities for coping with the rising burden of NCDs is

insufficient.[6] To identify gaps and opportunities for further strengthening of health services for NCDs, assessment of health facilities is crucial. Such information is needed to guide policy-makers on how to strengthen health systems and reduce the overall burden of NCDs in resource-poor countries, like Bangladesh. In response to this issue, we assessed the readiness of health facilities in a representative sample of public, private and non-profit health facilities in Bangladesh.

METHODS

study design

This study was based on the secondary analysis of data from the Bangladesh Health Facility Survey (BHFS) 2014. The BHFS 2014 was conducted during March-October 2014, in collaboration among the National Institute of Population Research and Training (NIPORT); ICF International (USA); and Associate for Community and Population Research (ACPR), Dhaka, Bangladesh.[10] The 2014 BHFS is a cross-sectional study with a stratified random sample of 1,596 health facilities selected from all formal-sector health facilities in Bangladesh. The BHFS 2014 was a cross sectional-study. The aim of the survey was to ascertain the service availability and readiness of maternal and child health, family planning, selected NCDs (diabetes and cardiovascular diseases) and tuberculosis in the health facilities of Bangladesh. The survey also assessed the availability of human resources, basic services, and logistics including equipment, essential drugs, laboratory services, infection control mechanisms following standard procedures, at the health facilities of Bangladesh.[10] **sample-size**

A total of 1,596 health facilities from all formal-sector health facilities were selected from 19,184, using stratified random sampling (stratified according to administrative unit and

type of facilities) procedure. The sample for the 2014 BHFS was designed to include facilities from seven administrative divisions (Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur, and Sylhet) of the country. All seven types of public facilities—district hospitals (DHs), maternal and child welfare centers (MCWCs), upazila health complexes (UHCs), upgraded union health and family welfare centers (upgraded UHFWCs), union health and family welfare centers (UHFWCs), union sub-centers/rural dispensaries (USCs/RDs), and community clinics (CCs)—as well as private hospitals with at least 20 beds and NGO static clinics/hospitals were included.[10] It may be mentioned that, in Bangladesh, health facilities up to the subdistrict level (upazila health complex) provide services for NCDs. Considering this; we excluded the facilities below subdistrict level and also excluded those with missing values.

data collection

Data were collected through an electronic structured questionnaire. After training (15 days), 40 data-collection teams, with two interviewers in each team, were formed. Data collection was done from 22 May to 20 July 2014. Supervision of data collection was coordinated by ACPR and NIPORT. Seven field supervision teams, with seven medical doctors (who were master trainers) and seven trained data-processing specialists, were formed. The field supervision teams made periodic visits to their assigned data-collection teams to review their work and monitor the quality of data. Ethics approval for the BHFS was obtained from the Institutional Review Board of the Medical Research Council of Bangladesh. Informed consent was given by the participants.[10]

data analysis

We divided health facilities into two broad categories--public and private/NGO facilities and analyzed data following Service Availability and Readiness Assessment (SARA) Manual of the World Health Organization (WHO)[11] to assess general service readiness in four domains (e.g. basic amenities, basic equipment, standard precautions for prevention of infection, and diagnostic capacity) in 319 facilities. We assessed diabetes and CVD-specific readiness following the said WHO manual. Moreover, we did an assessment of readiness index for diabetes and CVD-related services, stratified by seven administrative divisions. A detailed description of each domain described in Table-1. Score for each domain was calculated based on the mean availability of tracer items as percentage within that domain. Finally, mean (SD) of all domain scores were calculated and expressed as general service, diabetes and CVD service readiness index. In addition, we also projected the facility overall readiness, if we would ensure guidelines on diagnosis and treatment for diabetes in all facilities. Data were weighted by administrative cluster and type of facilities during the analysis, and all the results were summarized and presented as frequencies and percentages by facility types. All analyses were adjusted for sample weight and conducted using SPSS version 21.

Table-1: Detail description of each domain (General readiness, Diabetes service readiness and CVD service readiness)

General readiness	Diabetes service readiness	CVD service readiness
Please tell me if the following amenities are available at this site today and is functioning. a) Power b) Generator c) Water source d) Room with privacy e) Adequate sanitation facilities f) Communication equipment g) Access to computer with Internet h) Emergency transportation (ambulance) **Please tell me if the following equipment are available at this site today and is functioning**. a) Blood pressure apparatus b) Stethoscope c) Adult scale d) Infant scale e) Child scale f) Thermometer g) Light source **Following standard precautions are available at this site today?** **a)** Safe final disposal of sharps b) Safe final disposal of infectious wastes c) Running water d) Handwashing soap e) Disposable latex gloves	**Do providers in this facility diagnose and/or manage diabetes?** a) Yes b) No **Do you have the national guidelines for the diagnosis and management of diabetes?** a) Yes b) No **Had at least one staff member who had received in service training in diabetes services during the 24 months before the survey** a) Yes b) No **Does this facility have bellow-listed equipment?** **a)** Blood pressure **b)** Adult weighing scale **c)** Height board/stadiometer **Does this facility do below listed testing in the facility?** **a)** Blood glucose **b)** Urine protein **c)** Urine glucose **Are any of the following medicines for the management of diabetes available in the facility/location today?** **a)** Metformin **b)** Gliben-clamide **c)** Injectable insulin **d)** Injectable glucose solution	**Do providers in this facility diagnose and/or manage CVD?** a) Yes b) No **Do you have the national guidelines for the diagnosis and management of CVD?** a) Yes b) No **Had at least one staff member who had received in service training in CVD services during the 24 months before the survey** a) Yes b) No **Does this facility have bellow-listed equipment?** **a)** Blood pressure **b)** Adult weighing scale **c)** Height board/stadiometer **Does this facility do below listed testing in the facility?** **a)** Blood pressure **b)** Adult weighing scale **c)** Height board/stadiometer **Are any of the following medicines for the management of CVD available in the facility/location today?** **d)** Amlodipine/nifedipine **e)** Beta-blockers (atenolol) **f)** Aspirin **g)** Nifedipine tablet **h)** Thiazide

f) Medical masks g) Gowns h) Eye protection i) Guidelines on standard precautions **Following laboratory capacity, are available at this site?** a) Hemoglobin tests b) Blood glucose tests c) Renal function tests d) Urine chemistry testing/urine pregnancy tests e) Syphilis f) TB		

patient involvement

Patients were not involved in the study.

RESULTS

Of the selected 319 facilities, 179 (56.1%) were public, and 140 (43.9%) were from the private and NGO sectors. Table 2 presents the results for all four domains under two broad categories (public and private, including NGO facilities) of general service readiness. In general, district hospitals exhibited higher availability of items in all four domains of readiness than other facilities. For basic amenities, the availability of individual items ranged between 62.8% and 100% for all facilities, and, overall, private facilities had the lowest emergency transport facility (ambulance) compared to public facilities. In the basic equipment domain, all items were available in most of the facilities, except child scale at upazila health complexes (58.5%) in the public sector and at NGO clinics/hospitals (63.8%) in the private sector. Although proper

disposal of sharp and infectious wastes were done in most of the facilities, 36.9% facilities had no guidelines on standard precautions. In terms of diagnosis capacity, availability of items was observed in all facilities but facilities for diagnosis of tuberculosis (TB) were comparatively low in district hospitals (72.9%) and in NGO clinics/hospitals (21.1%).

Table 2. Status of general service-readiness indicators of the facilities

General readiness	Public facilities (%)		Private/NGO facilities (%)		Total (%) (n=319)
	UHC (n=120)	District hospital (n=59)	Private clinic/hospital (n=71)	NGO clinic/hospital (n=69)	
Basic amenities					
Power	97.7	100.0	86.9	96.8	94.3
Generator	68.9	88.1	98.0	62.8	76.2
Water source	100.0	100.0	100.0	100.0	100.0
Room with privacy	100.0	100.0	100.0	100.0	100.0
Adequate sanitation facilities	98.0	98.3	100.0	100.0	99.3
Communication equipment	100.0	100.0	100.0	100.0	100.0
Access to computer with Internet	99.7	100.0	95.7	67.4	86.7
Emergency transportation (ambulance)	97.0	93.2	66.0	29.0	62.8
Mean domain score (SD)	95.2 (9.9)	97.5 (4.1)	93.3 (11.14)	82.0 (24.7)	89.9 (12.9)
Basic equipment					
Blood pressure apparatus	93.0	93.2	98.0	100.0	97.0
Stethoscope	98.0	98.3	98.0	100.0	98.7
Adult scale	82.8	84.7	74.0	85.0	81.1
Infant scale	64.8	86.4	71.1	79.8	73.2
Child scale	58.5	71.2	69.3	63.8	64.2
Thermometer	94.6	94.9	98.0	98.1	96.9
Light source	74.7	86.4	87.6	78.6	80.5
Mean domain score	80.9 (14.2)	87.9 (8.2)	85.1(12.3)	86.5 (12.6)	84.5 (12.4)
Standard precautions					
Safe final disposal of sharps	99.7	100.0	100.0	98.4	99.3
Safe final disposal of infectious wastes	100.0	100.0	100.0	100.0	100.0
Running water	89.4	84.7	88.8	91.7	89.8
Handwashing soap	88.8	83.1	88.7	84.9	87.1

Disposable latex gloves	72.4	72.9	63.4	79.5	72.4
Medical masks	62.6	64.4	69.8	76.1	69.8
Gowns	41.4	52.5	57.0	65.6	55.4
Eye protection	21.7	35.6	32.4	45.1	34.1
Guidelines on standard precautions	27.3	52.5	28.5	49.0	36.9
Mean domain score (SD)	67.0 (28.8)	71.8 (21.0)	69.8 (25.4)	76.7 (18.8)	71.6 (23.6)
Laboratory capacity					
Hemoglobin tests	96.0	100.0	98.7	97.7	97.6
Blood glucose tests	83.0	98.3	100.0	98.0	94.1
Renal function tests	30.9	69.5	91.4	50.3	58.2
Urine chemistry testing/urine pregnancy tests	75.2	81.4	88.0	82.2	81.8
Syphilis	43.1	91.5	88.4	60.8	65.7
TB	90.9	72.9	64.2	21.1	58.4
Mean domain score (SD)	69.9 (24.3)	85.6 (11.8)	88.4 (11.7)	68.4 (27.5)	76.0 (16.1)

readiness index specific to services for diabetes

In total, 179 public and 140 private facilitates were involved in diabetes-specific services, such as diagnosis and treatment of diabetes. Readiness index scores specific to services for diabetes according to facilities are presented in Table 3. Among the selected 319 facilities, 58.1% offered diagnosis and treatment for diabetes. Status of diagnosis and treatment for diabetes was low in upazila health complexes (53.1%) compared to district hospitals (72.9%). On the other hand, the status of diagnosis and treatment was low in NGO clinics/hospitals (43.8%) compared to private clinics/hospitals (78.3%). As a whole, readiness index (18.8%) of the trained staff (those who received training during the 24 months before the survey) was low in all facilities. On the other hand, mean domain score for equipment and diagnosis was 77.2% and 84.1% respectively. In terms of readiness for medicine, all facilities had low availability of medicines. In public facilities, such as upazila health complexes, only 10.9% medicines were available, and district hospitals had 29.7% of medicines available. It was reported that all items under medicine domain were less available. On the other hand, scenario at the private facilities was comparatively better than at the public facilities. Private hospitals/clinics (58.4%) had higher availability of medicines compare to other facilities. The overall readiness index specific to services for diabetes was 49.8% (SD=26.8) in the consideration of five domains (guideline, trained staff, equipment, diagnosis capacity, and medicine).

181 **Table 3. Readiness index and domain scores specific to services for diabetes by facility**

Services for diabetes	Public facilities (%)		Private facilities (%)		Total (%) (n=319)
	UHC (n=120)	District hospital (n=59)	Private clinic/hospital (n=71)	NGO clinic/ hospital (n=69)	
Both diagnose and treatment facilities					
	53.1	72.9	78.3	43.8	58.1
Guidelines on the diagnosis and treatment					
Yes	60.5	72.9	31.0	40.8	45.3
Mean domain score	60.5	72.9	31.0	40.8	45.3
Trained staff					
Yes	37.0	30.5	11.6	8.7	18.8
Mean domain score	37.0	30.5	11.6	8.7	18.8
Equipment					
Blood pressure	94.2	94.9	98.0	100.0	97.5
Adult weighing scale	76.9	76.3	74.0	85.0	79.0
Height board/stadiometer	60.3	61.0	42.0	60.8	55.1
Mean domain score (SD)	77.2 (13.8)	77.4(13.8)	71.3 (22.9)	81.9 (16.14)	77.2 (17.3)
Diagnostic capacity					
Blood glucose	83.0	98.3	100.0	98.0	94.1
Urine protein	56.2	64.6	96.1	87.5	80.4
Urine glucose	53.2	64.6	96.1	82.7	77.9
Mean domain score (SD)	64.2 (13.4)	75.8 (15.8)	97.4 (1.8)	89.4 (6.3)	84.1(7.1)
Medicines					
Metformin	10.5	39.0	71.3	12.8	29.1
Gliben-clamide	19.8	25.4	42.4	2.4	19.7
Injectable insulin	1.6	20.3	64.1	4.6	20.5
Injectable glucose solution	11.8	33.9	55.6	11.6	24.6
Mean domain score (SD)	10.9 (6.4)	29.7 (7.2)	58.4 (10.7)	7.8 (4.4)	23.5 93.5)

Readiness index for services specific to diabetes	50.0 (23.4)	57.3 (22.2)	53.9 (30.0)	45.7 (34.7)	49.8 (26.8)

readiness index specific to services for CVD

Readiness index scores specific to services for CVD according to facilities are presented in Table 4. Among the 319 facilities under study, only 24.1% facilities had both diagnosis and treatment facilities and 44.5% had national guidelines on CVD. As in the case of diabetes, only 14.7% facilities had trained staff, and the rate was higher (47.5%) in public facilities compared to private facilities (18.8%). In terms of equipment, more than 70% facilities had appropriate equipment available. On the other hand, overall mean domain score for medicine was 43.9%, and the score was higher in district hospitals (51.5%) compared to upazila health complexes (41.4%); and the score was higher in private hospitals/clinics (62.9%) compared to NGO clinics/hospitals (31.2%). The overall readiness index specific to services for CVD, in the consideration of five domains (guideline, trained staff, equipment, diagnosis capacity, and medicine) was 45.1% (SD=22.1).

division-wise readiness index scores specific to services for diabetes and CVD

Figure 1 and 2 show the readiness index scores specific to services for diabetes and CVD. Readiness index specific to services for diabetes was high in Rangpur division (54.1%) and low in Rajshahi division (46.5%). On the other hand, readiness index specific to services for CVD was high in Rangpur division (46.0%) and low in Sylhet division (38.2%). Figure 1 and 2 also project that, if we would ensure guidelines on diagnosis and treatment for diabetes in all facilities (n=319), the readiness index could be 49.8% to 60.7%. Like availability of guidelines, if we

202 **Table 4. Readiness index scores specific to services for CVD and domain scores by facility**

Services for CVD	Public facilities (%)		Private facilities (%)		Total (%) (n=319)
	UHC (n=120)	District hospital (n=59)	Private clinic/hospital (n=71)	NGO clinic/ hospital (n=69)	
Both diagnosis and treatment facility					
	26.1	23.7	14.7	30.1	24.1
Guidelines on diagnosis and treatment					
Yes	47.1	61.0	41.2	42.3	44.5
Mean domain score	47.1	61.0	41.2	42.3	44.5
Trained staff					
Yes	25.5	22.0	8.6	10.2	14.7
Mean domain score	25.5	22.0	8.6	10.2	14.7
Equipment					
Blood pressure	94.2	94.9	98.0	100.0	97.5
Adult weighing scale	76.9	76.3	74.0	85.0	79.0
Height board/stadiometer	60.3	61.0	42.0	60.8	55.1
Mean domain score (SD)	77.2 (13.8)	77.4 (13.8)	71.3 (22.9)	81.9 (16.1)	77.2 (17.3)
Medicines					
Amlodipine/nifedipine	29.7	54.2	88.1	27.1	45.7
Beta-blockers (atenolol)	59.8	71.2	76.8	24.5	51.8
Aspirin	18.9	25.4	42.1	15.8	24.3
Nifedipine tablet	24.4	32.2	34.9	17.7	25.2
Thiazide	74.1	74.6	72.4	70.7	72.4
Mean domain score (SD)	41.4 (21.6)	51.5 (19.9)	62.9 (20.6)	31.2 (20.2)	43.9 (17.9)
Readiness index specific to services for CVD	47.8 (18.7)	53.0 (20.1)	46.0 (24.2)	41.4 (26.0)	45.1(22.1)

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would ensure training for at least one care provider in each facility, the readiness index could be increased more than 15% (i.e.16.2%). For CVD, only ensuring guideline will increase the readiness index by14.0%, and ensuring trained staff will increase the readiness index by 7.4%.

readiness of health facilities to provide services for diabetes and CVD

Among the facilities that offer services for diabetes and CVD, only 0.4% (n=2) had all the five items for service readiness (guideline, trained staff, equipment, diagnosis capacity, and medicine) for services specific to diabetes. On the other hand, only 0.9% (n=4) facilities had four items of service readiness (guideline, trained staff, equipment, and medicine) for services specific to CVD.

DISCUSSION

The major findings from this study are as follows: (i) The healthcare facilities, in general readiness was quiet high, with the exceptions for items in standard precautions (eye protection and guideline for standard precautions); (ii) Critical gaps exist in key domains, such as guidelines on the diagnosis and treatment for diabetes; (iii) There is shortage of trained staff for services specific to diabetes and CVD; (iv) Supply of medicines for diabetes and CVD is inadequate; (v) Of the facilities that offer services for diabetes and CVD, only 0.4% have readiness for such services, and 0.8% had readiness items/indicators for all services.

In the context of Bangladesh healthcare system of Bangladesh, typically designed to address maternal health, child health and infectious diseases. The Bangladesh Government provides primary healthcare services to all citizens through a three-tiered health service delivery system in rural areas: the community clinics, each for 6,000 people; the union health and family welfare centers (UH&FWCs), each for 25,000 people; and the upazila (subdistrict) health complexes (UHCs), with an outpatient and an emergency department, 10-50 inpatient beds and an operating room, each for 250,000 people.[12] In the context of Bangladesh, the UHC is the main point for seeking services for NCDs but, according to our findings, it was reported that overall readiness index of facilities offering services for diabetes was comparatively low in the UHCs compared to district hospitals. Availability of required medicines for diabetes was also low in the UHCs, which indicates that our primary healthcare system is still not ready to combat diabetes and other NCDs. A recent study in Bangladesh also reported that relevant medicines for NCDs were either supplied inadequately or not supplied at all.[13]

Various studies in Bangladesh reported that the health system is still not integrated to combat NCDs[6]; availability of medicines in the facilities is still a major challenge in the public healthcare delivery system.[14] Cockroft and colleagues, in a study based on three national community-based surveys, identified lack of/poor quality of medicines as one of the major causes of patients' dissatisfaction with the government health facilities.[15] A study in our neighboring country India also reported discordance in the availability of recommended class of drugs for CVD.[16]

Our study reports that trained staff for providing services for diabetes and cardiovascular diseases was only 18.8% and 14.7% respectively. This is not surprising because the health system of Bangladesh still faces shortage of trained human resources.[17] The current ratio of doctors-to-nurses-to-health technologists in Bangladesh is 1: 0.4: 0.24–being stark opposite to the WHO-recommended standards, i.e. doctors: nurses: technologists=1: 3: 5).[12] Trained staff plays a crucial role in services for NCDs. Different studies in the sub-Saharan Africa already reported that poor knowledge and experience of frontline healthcare workers have been recognized as a major barrier to care for NCDs.[18-20] It is also established that proper training to and supervision of non-medical-doctors, clinicians, or personnel in nurse-led clinics could provide effective primary care for NCDs.[21-23] In the context of Bangladesh, there is no provision of training for non-medical health workforce for services specific to NCDs.

In our study, we also project how only a single guideline and trained staff could increase the overall readiness index, which can give some direction to policy-makers as well as related stakeholders to take necessary actions for strengthening the health facilities in Bangladesh.

Other studies also reported that the health system in Bangladesh is still not ready to combat NCDs. A recent study in Bangladesh titled "A scorecard for tracking actions to reduce the burden of non-communicable diseases" reported that, among the four domains i.e. governance, risk factor surveillance, research, and health system response, the country's performance score was low in three domains, except for the governance (moderate performance).[24]

strengths and limitations of the study

The strength of this study is that it involved analysis of a large national sample of facilities located in all seven administrative divisions of Bangladesh. However, there are a number of limitations of the study. Bangladesh Health Facility Survey 2014 collected information from primary and secondary-care facilities of the public sector and from private/NGO facilities, offering services only for diabetes and CVD. In addition another limitation of all facility readiness analyses is that important aspects of care, such as adherence to guidelines, level of skilled workforce, medicine availability, infrastructure readiness, are all assessed using many survey questions that inevitably get lumped together to reduce dimensionality. This makes it more challenging to identify the specific drivers within each broader health system area that requires intervention. Further research is recommended for collecting information on other NCDs and from higher-level facilities, including tertiary-level health facilities so that findings can give a clear direction to policy-makers and other stakeholders to take necessary actions.

CONCLUSIONS

Our findings suggest that both public and private health facilities in Bangladesh suffer from lack of readiness in various aspects, especially in guidelines on the diagnosis and treatment, trained staff, and shortage of medicine. Now, it is time to ensure guidelines on the diagnosis and treatment for NCDs, trained staff, and adequate medicine to make the facilities ready for strengthening the health system to combat NCDs and to achieve universal health coverage. Information provided in the study would help in generating evidence-based information for the

policy-makers and related stakeholders in order to ensure equitable access and improve overall population health outcomes.

LIST OF ABBREVIATION

NCDs- Non-Communicable Diseases

USCs/RDs- Sub-Centers/Rural Dispensaries

ACPR- Community and Population Research

BHFS- Bangladesh Health Facility Survey

CVD- Cardiovascular Disease

DHs- District Hospitals

MOHFW- Ministry of Health and Family Welfare

SARA- Service Availability and Readiness Assessment

TB -Tuberculosis

UHCs- Upazila Health Complexes

UH&FWCs- Union Health and Family Welfare Centers

WHO- World Health Organization

Contributors

TB, MMH and MJU conceptualized the study. TB, MMH and RDG designed the study and acquired the data. TB and MMH conducted the data analysis. TB, RDG and MJU interpreted the data. TB, MMH, RDG prepared the first draft. TB, MMH, RDG and MJU participated in critical revision of the manuscript and contributed to its intellectual improvement. All authors went through the final draft and approved it for submission.

Funding

None.

Acknowledgments

The survey was funded by Government of the People's Republic of Bangladesh and US Agency for International Development (USAID), Bangladesh. The authors acknowledge the contributions of the BHFS 2014 team for their efforts in providing open access to the dataset; icddr,b is thankful to the Government of Bangladesh, Canada, Sweden, and the UK for providing core support.

Competing Interests

None declared.

Patient consent

None Declared

Disclaimer

The authors are alone responsible for the integrity and accuracy of data analysis and the writing the manuscript.

Ethics approval

The datasets were obtained from DHS Programme with proper procedure. The study exempt from collecting ethical approval because the survey protocols were reviewed and approved by Nepal Health Research Council)NHRC (and the ICF Institutional Review Board in Calverton, Maryland, USA.

Data sharing statement

The dataset of BHFS 2014 is available at the Demographic and Health Surveys Program. Extra data is available which is available on request at http://dhsprogram-com/what-we-do/survey/survey-display-349.cfm.

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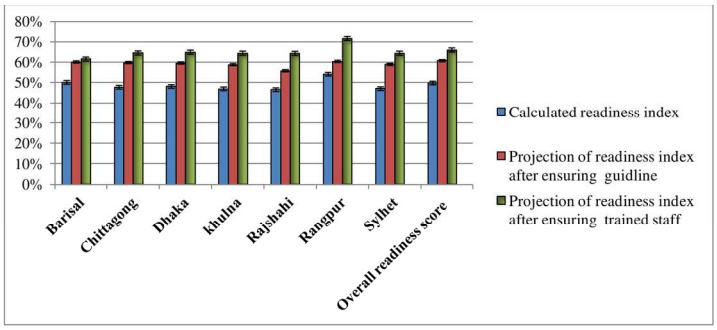
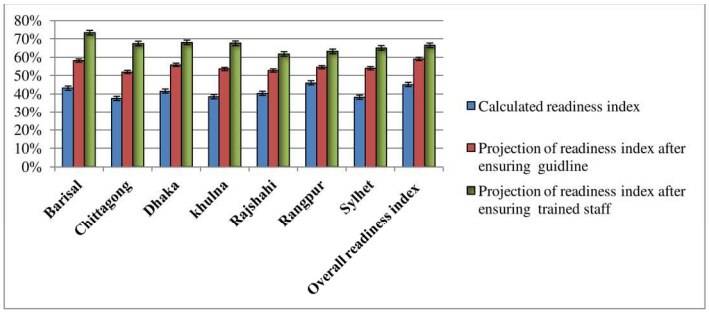
Figures

Figure 1. Readiness index specific to services for diabetes by administrative division and projected direction

Figure 2. Readiness index specific to services for CVD by administrative division and projected direction



143x186mm (300 x 300 DPI)



143x186mm (300 x 300 DPI)

BMJ Open

Assessing of the Readiness of Health Facilities for Diabetes and Cardiovascular Services in Bangladesh: A Cross-sectional Survey

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2018-022817.R2
Article Type:	Research
Date Submitted by the Author:	30-Aug-2018
Complete List of Authors:	Biswas, Tuhin; International Centre for Diarrhoeal Disease Research Bangladesh, Universal Health Coverage Haider , M Moinuddin ; International Centre for Diarrhoeal Disease Research Bangladesh Das Gupta, Rajat; BRAC University James P Grant School of Public Health, Centre for Science of Implementation and Scale-Up (SISU) Uddin, Jasim ; International Centre for Diarrhoeal Disease Research Bangladesh, Universal Health Coverage
Primary Subject Heading:	Health services research
Secondary Subject Heading:	Health services research, Health policy, Health economics, Health informatics, Global health
Keywords:	HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Quality in health care < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Human resource management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Organisational development < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

Title: Assessing of the Readiness of Health Facilities for Diabetes and Cardiovascular Services in Bangladesh: A Cross-sectional Survey

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ABSTRACT

Objectives: The objective of this study was to assess the readiness of health facilities for diabetes and cardiovascular services in Bangladesh.

Design: This study was a cross sectional survey.

Setting: This study used data from a nationwide Bangladesh Health Facility Survey (BHFS) conducted by the Ministry of Health and Social Welfare in 2014

Participants: A total of 319 health facilities delivering services focused on diabetes and cardiovascular diseases (CVD) were included in the survey. Some of these facilities were run by the public sector while others were managed by the private sector and NGOs. It was a mix of primary and secondary care facilities.

Primary and secondary outcome measures: The primary outcome was readiness of health facilities for diabetes and cardiovascular services. We analyzed relevant data following the Service availability and readiness assessment (SARA) manual of the world health organization (WHO) to assess the readiness of selected health facilities towards services for diabetes and CVD.

Results: 58% and 24.1% of the facilities had diagnosis and treatment services for diabetes and CVD respectively. Shortage of trained staff (18.8% and 14.7%) and lack of adequate medicine supply (23.5% and 43.9%) were identified to be factors responsible for inadequate services for diabetes and CVD. Among the facilities that offer services for diabetes and CVD, only 0.4% and

0.9% had all the four service-readiness factors (guideline, trained staff, equipment, and medicine).

Conclusions: The study suggests that health facilities suffered from numerous drawbacks, such as shortage of trained staff and required medicine. Most importantly, ~~unavailability of~~ they lack effective guidelines on diagnosis and treatment for diabetes and CVD. It is, therefore, essential now to ensure trained staff, adequate medicine supply, and appropriate guidelines on diagnosis and treatment for diabetes and CVD in Bangladesh.

Key words: CVD, Diabetes, Health facilities, Health services, NCDs. Readiness

STRENGTHS AND LIMITATIONS OF THE STUDY

- The study used 319 health facilities as sample covering all the administrative regions of Bangladesh making it representative of the socio-economic and cultural diversity of the country.
- The study sample includes a mix of public and private facilities that may strengthen greater generalizability across facility types.
- Information from tertiary care facilities nor other NCDs.

INTRODUCTION

Historically, health facilities in Bangladesh have focused on maternal, child and reproductive health, immunization and communicable diseases.[1] Overall, the health status of Bangladeshis has been continually improving over the past few decades.[2] In some cases, the country demonstrated more impressive progress in the health sector than many of its neighbors. Bangladesh's success in expanding immunization, improving maternal and child health, and in reducing malnutrition must be commended.[3] Nevertheless, simultaneous demographic and epidemiological transitions, coupled with rapid urbanization, have led Bangladesh to experience double burden of disease.[4 5]

The rising burden of non-communicable diseases (NCDs) has become a major challenge for the health systems in Bangladesh.[6] The prevailing health system of Bangladesh is still poorly organized with inadequate fiscal and human resources, lack of good governance, highly-centralized service delivery models and a weak management information system.[3] At the same time, Bangladesh is contemplating introducing universal health coverage (UHC) but the rising burden of NCDs imposes three dimensional challenges to of UHC (coverage, service provision, and financing).[1] To combat the rising burden of NCDs, a dedicated unit has been established within the Ministry of Health and Family Welfare (MOHFW) but access to and availability of essential services for NCDs remain fragmented.[6]

Readiness of the health system for NCDs is important in coping with the growing epidemic of NCDs and supporting policy-makers in planning appropriate sustainable responses.[7-9] In Bangladesh, preparedness of the health facilities for coping with the rising burden of NCDs

is insufficient.[6] To identify gaps and opportunities for further strengthening of health services for NCDs, a comprehensive assessment of health facilities is crucial. Such information is needed to guide policy-makers on how to strengthen health systems and reduce the overall burden of NCDs in resource-poor countries, like Bangladesh. The study, therefore, assessed the readiness in a representative sample of public, private and non-profit health facilities in Bangladesh.

METHODS

study design

This study was based on the secondary analysis of data from the Bangladesh Health Facility Survey (BHFS) 2014 carried out by the National Institute of Population Research and Training (NIPORT) with support from ICF International (USA) and the Associate for Community and Population Research (ACPR), Dhaka. [10] The 2014 BHFS was a cross-sectional study with a stratified random sample of 1,596 health facilities representing all formal-sector health facilities in Bangladesh. The aim of the survey was to ascertain the service availability and readiness of the health facilities in the areas of maternal and child health, family planning, selected NCDs (diabetes and cardiovascular diseases) and tuberculosis. The survey also assessed the availability of human resources, basic services, and logistics including equipment, essential drugs, laboratory services, infection control mechanisms following standard procedures, in the health facilities.[10]

sample-size

From a total of 19.184 health facilities in the formal sector, a total of 1,596 were selected were selected for the study using a stratified random sampling (stratified according to administrative unit and type of facilities) procedure. The sample for the 2014 BHFS was

designed to include facilities from seven administrative divisions (Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur, and Sylhet) of the country. All seven types of public facilities—district hospitals (DHs), maternal and child welfare centers (MCWCs), upazila health complexes (UHCs), upgraded union health and family welfare centers (upgraded UHFWCs), union health and family welfare centers (UHFWCs), union sub-centers/rural dispensaries (USCs/RDs), and community clinics (CCs)—as well as private hospitals with at least 20 beds and NGO static clinics/hospitals were included.[10] It may be mentioned that, in Bangladesh, health facilities up to the subdistrict level (upazila health complex) provide services for NCDs. The study, therefore, excluded facilities below the subdistrict level and also ~~excluded~~ those with missing values. In the final analysis 319 health care facilities were included.

data collection tools

Two types of questionnaires were used for data collection: facility inventory questionnaire and health care provider interview questionnaire. The facility inventory questionnaire was used to collect data related to service availability and general and specific service readiness. The health care provider interview questionnaire was used to collect information related to the credentials, training, clinical experience, level of education, supervision received, and perceptions of the service delivery environment from a sample of health care providers. The questionnaires were adapted, validated and pretested in the context of Bangladesh. The detailed questionnaires were published previously.[10]

data collection

Data were collected through an electronic structured questionnaire. After training (15 days), 40 data-collection teams, with two interviewers in each team, were formed. Data collection was done between 22 May and 20 July 2014. Supervision of data collection was coordinated by Associates for Community and Population Research (ACPR) and National Institute of Population Research and Training (NIPORT). Seven field supervision teams, each with a medical doctors (who served as master trainers) and a trained data-processing specialist, were formed. The field supervision teams made periodic visits to their assigned data-collection teams to review their work and monitor the quality of data. Ethics approval for the BHFS was obtained from the Institutional Review Board of the Medical Research Council of Bangladesh. Informed consent was obtained from the participants.[10] The authors followed 'Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement' to write the manuscript (Supplementary File 1).

data analysis

The study divided health facilities into two broad categories-public and private/NGO facilities and analyzed data following the Service Availability and Readiness Assessment (SARA) Manual of the World Health Organization (WHO)[11] to assess general service readiness in four domains (e.g. basic amenities, basic equipment, standard precautions for prevention of infection, and diagnostic capacity) in 319 facilities. Diabetes and CVD-specific readiness was also assessed following the WHO manual[11]. Moreover, an assessment of readiness index for diabetes and CVD-related services, stratified by seven administrative divisions was also carried out. Table-1 presents a detailed description of each domain. Score for each domain was calculated based on the mean availability of tracer items as percentage within that domain.

Finally, means (±SD) of all domain scores were calculated and expressed as general as well as diabetes and CVD service readiness index. In addition, the study also projected the facility-specific overall readiness on the basis of availability of appropriate guidelines on diagnosis and treatment ~~for~~ of diabetes. Data were weighted by administrative cluster and type of facilities during the analysis, and all the results were summarized and presented as frequencies and percentages by facility type. All analyses were conducted using SPSS version 21 and were adjusted for sample weight.

Table-1: Detail description of each domain (General readiness, Diabetes service readiness and CVD service readiness)

General readiness	Diabetes service readiness	CVD service readiness
Please tell me if the following amenities are available at this site today and is functioning. a) Power b) Generator c) Water source d) Room with privacy e) Adequate sanitation facilities f) Communication equipment g) Access to computer with Internet h) Emergency transportation (ambulance) **Please tell me if the following equipment are available at this site today and is functioning**. a) Blood pressure apparatus b) Stethoscope c) Adult scale d) Infant scale e) Child scale f) Thermometer g) Light source **Following standard precautions are available at this site today?** **a)** Safe final disposal of sharps b) Safe final disposal of infectious wastes c) Running water d) Handwashing soap e) Disposable latex gloves	**Do providers in this facility diagnose and/or manage diabetes?** a) Yes b) No **Do you have the national guidelines for the diagnosis and management of diabetes?** a) Yes b) No **Had at least one staff member who had received in service training in diabetes services during the 24 months before the survey** a) Yes b) No **Does this facility have bellow-listed equipment?** **a)** Blood pressure **b)** Adult weighing scale **c)** Height board/stadiometer **Does this facility do below listed testing in the facility?** **a)** Blood glucose **b)** Urine protein **c)** Urine glucose **Are any of the following medicines for the management of diabetes available in the facility/location today?** **a)** Metformin **b)** Gliben-clamide **c)** Injectable insulin **d)** Injectable glucose solution	**Do providers in this facility diagnose and/or manage CVD?** a) Yes b) No **Do you have the national guidelines for the diagnosis and management of CVD?** a) Yes b) No **Had at least one staff member who had received in service training in CVD services during the 24 months before the survey** a) Yes b) No **Does this facility have bellow-listed equipment?** **a)** Blood pressure **b)** Adult weighing scale **c)** Height board/stadiometer **Does this facility do below listed testing in the facility?** **a)** Blood pressure **b)** Adult weighing scale **c)** Height board/stadiometer **Are any of the following medicines for the management of CVD available in the facility/location today?** **d)** Amlodipine/nifedipine **e)** Beta-blockers (atenolol) **f)** Aspirin **g)** Nifedipine tablet **h)** Thiazide

f) Medical masks g) Gowns h) Eye protection i) Guidelines on standard precautions **Following laboratory capacity, are available at this site?** a) Hemoglobin tests b) Blood glucose tests c) Renal function tests d) Urine chemistry testing/urine pregnancy tests e) Syphilis f) TB		

patient involvement

Patients were not involved in the study.

RESULTS

Of the selected 319 facilities, 179 (56.1%) were public, and 140 (43.9%) were from the private and NGO sectors. Table 2 presents the results for all four domains under two broad categories (public and private, including NGO facilities) of general service readiness. In general, district hospitals exhibited higher availability of items in all four domains of readiness than other facilities. For basic amenities, the availability of individual items in facilities ranged between 62.8% and 100%, Overall, private facilities had the lowest emergency transport facility (ambulance) compared to public facilities. In the basic equipment domain, all items were available in most of the facilities, except child scale (58.5% in the public sector and 63.8% in NGO clinics/hospitals in the private sector). Although proper disposal of sharp and infectious

wastes was done in most of the facilities, 36.9% facilities had no guidelines on standard precautions. In terms of diagnostic capacity, availability of items was observed in all facilities. However, facilities for diagnosis of tuberculosis (TB) were comparatively low in district hospitals (72.9%) and in NGO clinics/hospitals (21.1%).

178 **Table 2. Status of general service-readiness indicators of the facilities**

General readiness	Public facilities (%)		Private/NGO facilities (%)		Total (%) (n=319)
	UHC (n=120)	District hospital (n=59)	Private clinic/hospital (n=71)	NGO clinic/hospital (n=69)	
Basic amenities					
Power	97.7	100.0	86.9	96.8	94.3
Generator	68.9	88.1	98.0	62.8	76.2
Water source	100.0	100.0	100.0	100.0	100.0
Room with privacy	100.0	100.0	100.0	100.0	100.0
Adequate sanitation facilities	98.0	98.3	100.0	100.0	99.3
Communication equipment	100.0	100.0	100.0	100.0	100.0
Access to computer with Internet	99.7	100.0	95.7	67.4	86.7
Emergency transportation (ambulance)	97.0	93.2	66.0	29.0	62.8
Mean domain score (±SD)	95.2 (9.9)	97.5 (4.1)	93.3 (11.14)	82.0 (24.7)	89.9 (12.9)
Basic equipment					
Blood pressure apparatus	93.0	93.2	98.0	100.0	97.0
Stethoscope	98.0	98.3	98.0	100.0	98.7
Adult scale	82.8	84.7	74.0	85.0	81.1
Infant scale	64.8	86.4	71.1	79.8	73.2
Child scale	58.5	71.2	69.3	63.8	64.2
Thermometer	94.6	94.9	98.0	98.1	96.9
Light source	74.7	86.4	87.6	78.6	80.5
Mean domain score	80.9 (14.2)	87.9 (8.2)	85.1(12.3)	86.5 (12.6)	84.5 (12.4)
Standard precautions					
Safe final disposal of sharps	99.7	100.0	100.0	98.4	99.3
Safe final disposal of infectious wastes	100.0	100.0	100.0	100.0	100.0
Running water	89.4	84.7	88.8	91.7	89.8
Handwashing soap	88.8	83.1	88.7	84.9	87.1

Disposable latex gloves	72.4	72.9	63.4	79.5	72.4
Medical masks	62.6	64.4	69.8	76.1	69.8
Gowns	41.4	52.5	57.0	65.6	55.4
Eye protection	21.7	35.6	32.4	45.1	34.1
Guidelines on standard precautions	27.3	52.5	28.5	49.0	36.9
Mean domain score (±SD)	67.0 (28.8)	71.8 (21.0)	69.8 (25.4)	76.7 (18.8)	71.6 (23.6)
Laboratory capacity					
Hemoglobin tests	96.0	100.0	98.7	97.7	97.6
Blood glucose tests	83.0	98.3	100.0	98.0	94.1
Renal function tests	30.9	69.5	91.4	50.3	58.2
Urine chemistry testing/urine pregnancy tests	75.2	81.4	88.0	82.2	81.8
Syphilis	43.1	91.5	88.4	60.8	65.7
TB	90.9	72.9	64.2	21.1	58.4
Mean domain score (±SD)	69.9 (24.3)	85.6 (11.8)	88.4 (11.7)	68.4 (27.5)	76.0 (16.1)

readiness index specific to services for diabetes

In total, 179 public and 140 private sector facilitates were involved in diagnosis and treatment of diabetes. Readiness index scores of facilities in terms of services for diabetes are presented in Table 3. Among the selected 319 facilities, 58.1% offered diagnosis and treatment for diabetes. Status of diagnosis and treatment for diabetes was low in upazila health complexes (53.1%) compared to district hospitals (72.9%). The status of diagnosis and treatment was also low in NGO clinics/hospitals (43.8%) compared to private clinics/hospitals (78.3%). As a whole, readiness index (18.8%) of the trained staff (those who received training during the 24 months before the survey) was low in all facilities. On the other hand, mean domain score for equipment and diagnosis was 77.2% and 84.1% respectively. In terms of readiness for medicine, all facilities had low availability of medicines. In public facilities, such as upazila health complexes, only 10.9% of them had adequate medicines available, while 29.7% of District Hospitals had medicines available.. It was reported that all items under medicine domain were less available. On the other hand, private facilities ~~was~~ were comparatively better in this respect. Private hospitals/clinics (58.4%) had higher availability of medicines compare to other facilities. The overall readiness index specific to services for diabetes was 49.8% (SD=26.8) taking into account all the five domains (guideline, trained staff, equipment, diagnosis capacity, and medicine).

197 **Table 3. Readiness index and domain scores specific to services for diabetes by facility**

Services for diabetes	Public facilities (%)		Private facilities (%)		Total (%) (n=319)
	UHC (n=120)	District hospital (n=59)	Private clinic/hospital (n=71)	NGO clinic/ hospital (n=69)	
Both diagnose and treatment facilities					
	53.1	72.9	78.3	43.8	58.1
Guidelines on the diagnosis and treatment					
Yes	60.5	72.9	31.0	40.8	45.3
Mean domain score	60.5	72.9	31.0	40.8	45.3
Trained staff					
Yes	37.0	30.5	11.6	8.7	18.8
Mean domain score	37.0	30.5	11.6	8.7	18.8
Equipment					
Blood pressure	94.2	94.9	98.0	100.0	97.5
Adult weighing scale	76.9	76.3	74.0	85.0	79.0
Height board/stadiometer	60.3	61.0	42.0	60.8	55.1
Mean domain score (±SD)	77.2 (13.8)	77.4(13.8)	71.3 (22.9)	81.9 (16.14)	77.2 (17.3)
Diagnostic capacity					
Blood glucose	83.0	98.3	100.0	98.0	94.1
Urine protein	56.2	64.6	96.1	87.5	80.4
Urine glucose	53.2	64.6	96.1	82.7	77.9
Mean domain score (±SD)	64.2 (13.4)	75.8 (15.8)	97.4 (1.8)	89.4 (6.3)	84.1(7.1)
Medicines					
Metformin	10.5	39.0	71.3	12.8	29.1
Gliben-clamide	19.8	25.4	42.4	2.4	19.7
Injectable insulin	1.6	20.3	64.1	4.6	20.5
Injectable glucose solution	11.8	33.9	55.6	11.6	24.6
Mean domain score (±SD)	10.9 (6.4)	29.7 (7.2)	58.4 (10.7)	7.8 (4.4)	23.5 93.5)

Readiness index for services specific to diabetes	50.0 (23.4)	57.3 (22.2)	53.9 (30.0)	45.7 (34.7)	49.8 (26.8)

readiness index specific to services for CVD

Readiness index scores of the facilities specific to services for CVD are presented in Table 4. Among the 319 facilities under study, only 24.1% ₹ had both diagnosis and treatment facilities and 44.5% adheres to national guidelines on CVD. In terms of diabetes, only 14.7% ~~facilities~~ had trained staff, and the rate was higher (47.5%) in public facilities compared to private facilities (18.8%). In terms of equipment, more than 70% of the facilities had appropriate equipment available. On the other hand, overall mean domain score for medicine was 43.9%. It was higher ~~in~~ for district hospitals (51.5%) compared to upazila health complexes (41.4%). The score was higher in private hospitals/clinics (62.9%) compared to NGO clinics/hospitals (31.2%). The overall readiness index specific to services for CVD (in terms of the five domains - guidelines, trained staff, equipment, diagnosis capacity, and medicine) was 45.1% (SD=22.1).

division-wise readiness index scores specific to services for diabetes and CVD

Figures 1 and 2 show the readiness index scores specific to services for diabetes and CVD. Readiness index specific to services for diabetes was higher in Rangpur division (54.1%) compared to Rajshahi division (46.5%). On the other hand, readiness index specific to services for CVD was higher in Rangpur division (46.0%) in in comparison to Sylhet division (38.2%). Figures 1 and 2 also demonstrate that, if guidelines on diagnosis and treatment for diabetes could be ensures in all facilities (n=319), the readiness index would rise from 49.8% to 60.7%. Like availability of guidelines, if training for at least one care provider in each facility could be ensured, the readiness index would increase more than 15% (i.e. 16.2%). For CVD, only ensuring guideline will increase the readiness index by 14.0%; while ensuring trained staff will increase the readiness index by 7.4%.

Table 4. Readiness index scores specific to services for CVD and domain scores by facility

Services for CVD	Public facilities (%)		Private facilities (%)		Total (%) (n=319)
	UHC (n=120)	District hospital (n=59)	Private clinic/hospital (n=71)	NGO clinic/ hospital (n=69)	
Both diagnosis and treatment facility					
	26.1	23.7	14.7	30.1	24.1
Guidelines on diagnosis and treatment					
Yes	47.1	61.0	41.2	42.3	44.5
Mean domain score	47.1	61.0	41.2	42.3	44.5
Trained staff					
Yes	25.5	22.0	8.6	10.2	14.7
Mean domain score	25.5	22.0	8.6	10.2	14.7
Equipment					
Blood pressure	94.2	94.9	98.0	100.0	97.5
Adult weighing scale	76.9	76.3	74.0	85.0	79.0
Height board/stadiometer	60.3	61.0	42.0	60.8	55.1
Mean domain score (±SD)	77.2 (13.8)	77.4 (13.8)	71.3 (22.9)	81.9 (16.1)	77.2 (17.3)
Medicines					
Amlodipine/nifedipine	29.7	54.2	88.1	27.1	45.7
Beta-blockers (atenolol)	59.8	71.2	76.8	24.5	51.8
Aspirin	18.9	25.4	42.1	15.8	24.3
Nifedipine tablet	24.4	32.2	34.9	17.7	25.2
Thiazide	74.1	74.6	72.4	70.7	72.4
Mean domain score (±SD)	41.4 (21.6)	51.5 (19.9)	62.9 (20.6)	31.2 (20.2)	43.9 (17.9)
Readiness index specific to services for CVD	47.8 (18.7)	53.0 (20.1)	46.0 (24.2)	41.4 (26.0)	45.1(22.1)

readiness of health facilities to provide services for diabetes and CVD

Among the facilities that offer services for diabetes and CVD, only 0.4% (n=2) had all the five items for service readiness (guidelines, trained staff, equipment, diagnosis capacity, and medicine) for services specific to diabetes. On the other hand, only 0.9% (n=4) facilities had four items of service readiness (guideline, trained staff, equipment, and medicine) for services specific to CVD.

DISCUSSION

The major findings from this study are as follows: (i) The healthcare facilities, in general, demonstrated quite high status of readiness was -with the exceptions of items related to standard precautions (eye protection and guideline for standard precautions); (ii) Critical gaps exist in key domains, such as guidelines on the diagnosis and treatment for diabetes; (iii) There is shortage of trained staff for services specific to diabetes and CVD; (iv) Supply of medicines for diabetes and CVD is inadequate; (v) Of the facilities that offer services for diabetes and CVD, only 0.4% have readiness for such services, and 0.8% had readiness regarding items/indicators for all services.

The Bangladeshi health care system is primarily designed to address maternal health, child health and infectious diseases. The Bangladesh Government provides primary healthcare services to all citizens through a three-tiered health service delivery system in rural areas: the community clinics, each for 6,000 people; the union health and family welfare centers (UH&FWCs), each for 25,000 people; and the upazila (subdistrict) health complexes (UHCs), with an outpatient and an emergency department, 10-50 inpatient beds and an operating room, each for 250,000 people.[12] In the context of Bangladesh, the UHC is the focal point for seeking services for NCDs. However, according to this study the overall readiness index of facilities offering services for diabetes was comparatively low in the UHCs compared to district hospitals. Availability of required medicines for diabetes was also low in the UHCs, which indicates the our primary healthcare system is still not fully prepared to combat diabetes and other NCDs. A recent study in Bangladesh also reported that relevant medicines for NCDs were either supplied inadequately or not supplied at all.[13]

Various studies in Bangladesh reported that the health system is still not integrated to combat NCDs[6]; and that availability of medicines in the facilities is still a major challenge in the public healthcare delivery system.[14] Cockroft and colleagues, in a study based on three national community-based surveys, identified lack of/poor quality of medicines as one of the major causes of patients' dissatisfaction with the government health facilities.[15] A study in neighboring India also reported discordance in the availability of recommended types of drugs for CVD.[16]

The present study reports that among the facilities only 18.8% and 14.7% respectively had trained staff for providing services for diabetes and CVD. This is not surprising because the health system of Bangladesh still faces shortage of trained human resources.[17] The current ratio of doctors-to-nurses-to-health technologists in Bangladesh is 1: 0.4: 0.24— in stark contrast to the WHO-recommended standards, i.e. doctors: nurses: technologists=1: 3: 5).[12] Trained staff plays a crucial role in services for NCDs. Numerous studies in the sub-Saharan Africa already reported that poor knowledge and experience of frontline healthcare workers have been recognized as a major barrier to care for NCDs.[18-20] It is also established that proper training for and supervision of non-medical-doctors, clinicians, or personnel in nurse-led clinics could provide effective primary care for NCDs.[21-23] In the context of Bangladesh, there is little provision for training of non-medical health workforce for services specific to NCDs.

Other studies also reported that the health system in Bangladesh is still ill-prepared to combat NCDs. A recent study in Bangladesh titled 'A scorecard for tracking actions to reduce the burden of non-communicable diseases' reported that, among the four domains i.e. governance, risk factor surveillance, research, and health system response, the country's performance score was low in three domains, except for the governance (moderate performance).[24]

strengths and limitations of the study

The strength of this study is that it involved analysis of a large national sample of facilities covering all the seven administrative divisions of Bangladesh. However, there are few

limitations of the study. BHFS 2014 collected information from primary and secondary-care facilities of the public sector and from private/NGO facilities, offering services only for diabetes and CVD. Another limitation of the study is that the facility readiness analyses in terms of care, such as adherence to guidelines, level of skilled workforce, medicine availability, infrastructure readiness, are all assessed using many survey questions that may somewhat compromise to reduce dimensionality. This makes it more challenging to identify the specific drivers within each broader health system area that requires intervention. Further research is recommended for collecting information on other NCDs and from higher-level facilities, including tertiary-level health facilities so that findings can give a clear direction to policy-makers and other stakeholders initiating appropriate policy/program initiatives.

CONCLUSIONS

The study findings suggest that both public and private health facilities in Bangladesh suffer from lack of readiness in various aspects, especially in guidelines on the diagnosis and treatment, trained staff, and shortage of medicine. Clearly it is time to ensure guidelines on the diagnosis and treatment for NCDs, availability of trained staff, and adequate medicine to make the facilities ready for strengthening the health system to combat NCDs and to achieve universal health coverage. Information provided in the study would help in generating evidence-based information for the policy-makers and related stakeholders in designing policies/programs that would ensure equitable access to health care services leading to improved overall population health outcomes.

LIST OF ABBREVIATION

NCDs- Non-Communicable Diseases

USCs/RDs- Sub-Centers/Rural Dispensaries

ACPR- Associates for Community and Population Research

BHFS- Bangladesh Health Facility Survey

CVD- Cardiovascular Disease

DHs- District Hospitals

MOHFW- Ministry of Health and Family Welfare

NIPORT- National Institute of Population Research and Training

SARA- Service Availability and Readiness Assessment

TB -Tuberculosis

UHCs- Upazila Health Complexes

UH&FWCs- Union Health and Family Welfare Centers

WHO- World Health Organization

Contributors

TB, MMH and MJU conceptualized the study. TB, MMH and RDG designed the study and acquired the data. TB and MMH conducted the data analysis. TB, RDG and MJU interpreted the data. TB, MMH, RDG prepared the first draft. TB, MMH, RDG and MJU participated in critical revision of the manuscript and contributed to its intellectual improvement. All authors went through the final draft and approved it for submission.

Funding

None.

Acknowledgments

The survey was funded by Government of the People's Republic of Bangladesh and US Agency for International Development (USAID), Bangladesh. The authors acknowledge the contributions of the BHFS 2014 team for their efforts in providing open access to the dataset; icddr,b is thankful to the Government of Bangladesh, Canada, Sweden, and the UK for providing core support.

Competing Interests

None Declared

Patient consent

None Declared

Disclaimer

The authors are alone responsible for the integrity and accuracy of data analysis and the writing the manuscript.

Ethics approval

The datasets were obtained from DHS Programme following proper procedure. The study was exempt from collecting ethical approval because the survey protocols were reviewed and approved by Nepal Health Research Council)NHRC (and the ICF Institutional Review Board in Calverton, Maryland, USA.

Data sharing statement

The dataset of BHFS 2014 is available at the Demographic and Health Surveys Program. Additional data is available on request at http://dhsprogram-com/what-we-do/survey/survey-display-349.cfm.

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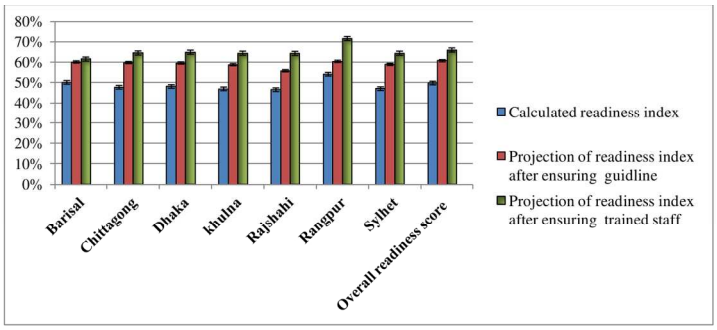
Figures

Figure 1. Readiness index specific to services for diabetes by administrative division and projected direction

Figure 2. Readiness index specific to services for CVD by administrative division and projected direction

Supplementary Materials

Supplementary File 1: STROBE Checklist



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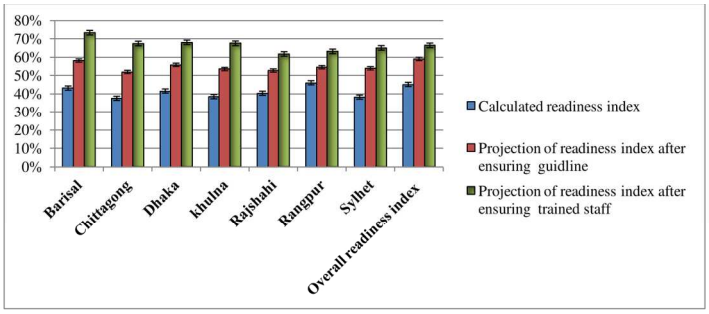

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Title of the study: **Assessing of the Readiness of Health Facilities for Diabetes and Cardiovascular Services in Bangladesh: A Cross-sectional Survey**

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3-4
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	6-7
Objectives	3	State specific objectives, including any prespecified hypotheses	7
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7-9
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	8
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	9-11
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9-11
Bias	9	Describe any efforts to address potential sources of bias	9
Study size	10	Explain how the study size was arrived at	8-9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9-11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	Not applicable

		(*d*) If applicable, describe analytical methods taking account of sampling strategy	Not applicable
		(*e*) Describe any sensitivity analyses	Not applicable
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	11-12
		(b) Give reasons for non-participation at each stage	Not applicable
		(c) Consider use of a flow diagram	Not applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11-14
		(b) Indicate number of participants with missing data for each variable of interest	Not applicable
Outcome data	15*	Report numbers of outcome events or summary measures	15
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	15-20
		(*b*) Report category boundaries when continuous variables were categorized	Not applicable
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not applicable
Discussion			
Key results	18	Summarise key results with reference to study objectives	20-21
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	23
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	20-23
Generalisability	21	Discuss the generalisability (external validity) of the study results	23
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	25

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.