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

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6 2 **Cardiovascular Services in Bangladesh: Analysis of Data from Nationwide**
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10 11 12 22 **ABSTRACT** 13

14
15 23 **Objectives:** The objective of this study was to assess the readiness of health facilities for
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17 24 diabetes and cardiovascular services in Bangladesh.
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21 25 **Design:** This study was a cross sectional survey.
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24 26 **Setting:** This study used data from a nationwide bangladesh health facility survey (bhfs) 2014
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28 27 **Participants:** One thousand five hundred and ninety six (1,596) health facilities were included
29
30 28 primary and secondary-care facilities of the public sector and from private/NGO facilities,
31
32 29 offering services only for diabetes and cardiovascular diseases (CVD).
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36 30 **Primary and secondary outcome measures:** The primary outcome was readiness of health
37
38 31 facilities for diabetes and cardiovascular services. We analyzed those data following service
39
40 32 availability and readiness assessment (SARA), manual of the world health organization (WHO)
41
42 33 to assess the readiness of selected health facilities towards services for diabetes and CVD.
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45
46 34 **Results:** Fifty-eight and 24.1% of the facilities had diagnosis and treatment services for diabetes
47
48 35 and CVD respectively. Shortage of trained staff (18.8% and 14.7%) and meager medicine supply
49
50 36 (23.5% and 43.9%) were identified to be factors responsible for inadequate services for diabetes
51
52 37 and CVD. Among the facilities that offer services for diabetes and CVD, only 0.4% and 0.9%
53
54 38 had all the four service-readiness items (guideline, trained staff, equipment, and medicine).
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3 39 **Conclusions:** our study suggested that health facilities suffered from the lack of readiness in
4
5 40 various aspects, such as shortage of trained staff and required medicine, unavailability of
6
7 41 guidelines on diagnosis and treatment for diabetes and CVD. It is, therefore, essential now to
8
9 42 ensure trained staff, required medicine, and guidelines on diagnosis and treatment for diabetes
10
11 43 and CVD in Bangladesh.
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18 45 **Key words:** CVD, Diabetes, Health facilities, Health services, NCDs. Readiness
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46 STRENGTHS AND LIMITATIONS OF THE STUDY

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

54

55 INTRODUCTION

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

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

73
74 Readiness of the health system is important for coping with the growing epidemic of
75 NCDs and supporting policy-makers to plan appropriate responses and make this sustainable.⁷⁻⁹
76 In Bangladesh, preparedness of the health facilities for coping with the rising burden of NCDs is
77 insufficient.⁶ To identify gaps and opportunities for further strengthening of health services for

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3 78 NCDs, assessment of health facilities is crucial. Information from research is needed to guide
4
5 79 policy-makers on how to strengthen health systems and reduce the overall burden of NCDs in
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8 80 resource- poor countries, like Bangladesh. In response to this issue, we assessed the readiness of
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10 81 health facilities in a representative sample of public, private and non-profit health facilities in
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12 82 Bangladesh.
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17 84 **METHODS**

20 85 **study design**

23 86 This study was based on the secondary analysis of data from the Bangladesh Health
24
25 87 Facility Survey (BHFS) 2014. The BHFS 2014 was conducted during March-October 2014, in
26
27 88 collaboration among the National Institute of Population Research and Training (NIPORT); ICF
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29 89 International (USA); and Associate for Community and Population Research (ACPR), Dhaka,
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31
32 90 Bangladesh.¹⁰
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37 92 **sample-size**

39 93 A total of 1,596 health facilities from all formal-sector health facilities were selected
40
41 94 from 19,184, using stratified random sample procedure. The sample for the 2014 BHFS was
42
43 95 designed to include facilities from seven administrative divisions (Barisal, Chittagong, Dhaka,
44
45 96 Khulna, Rajshahi, Rangpur, and Sylhet) of the country. All seven types of public facilities—
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47 97 district hospitals (DHs), maternal and child welfare centers (MCWCs), upazila health complexes
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49 98 (UHCs), upgraded union health and family welfare centers (upgraded UHFWCs), union health
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51 99 and family welfare centers (UHFWCs), union sub-centers/rural dispensaries (USCs/RDs), and
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55 100 community clinics (CCs)—as well as private hospitals with at least 20 beds and NGO static

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3 101 clinics/hospitals were included.¹⁰ It may be mentioned that, in Bangladesh, health facilities up to
4
5 102 the subdistrict level (upazila health complex) provide services for NCDs. Considering this; we
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8 103 excluded the facilities below subdistrict level and also excluded those with missing values.
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11 12 105 **data collection**

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15 106 Data were collected through an electronic structured questionnaire. After training (15
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17 107 days), 40 data-collection teams, with two interviewers in each team, were formed. Data
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19 108 collection was done from 22 May to 20 July 2014. Supervision of data collection was
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21
22 109 coordinated by ACPR and NIPORT. Seven field supervision teams, with seven medical doctors
23
24 110 (who were master trainers) and seven trained data-processing specialists, were formed. The field
25
26 111 supervision teams made periodic visits to their assigned data-collection teams to review their
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28 112 work and monitor quality of data. Ethics approval for the BHFS was obtained from the
29
30
31 113 Institutional Review Board of the Medical Research Council of Bangladesh. Informed consent
32
33 114 was given by the participants.¹⁰

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35 36 37 38 116 **data analysis**

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40 117 We divided health facilities into two broad categories--public and private/NGO facilities
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42 118 and analyzed data following Service Availability and Readiness Assessment (SARA) Manual
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44 119 of the World Health Organization (WHO)¹¹ to assess general service readiness in four domains
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46
47 120 (e.g. basic amenities, basic equipment, standard precautions for prevention of infection, and
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49 121 diagnostic capacity) in 319 facilities. We assessed diabetes and CVD-specific readiness
50
51 122 following the said WHO manual. Moreover, we did assessment of readiness index for diabetes
52
53
54 123 and CVD-related services, stratified by seven administrative divisions. Overall readiness was

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3 124 calculated by the mean of proportion of each domain. Data were weighted during the analysis,
4
5 125 and all the results were summarized and presented as frequencies and percentages by facility
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8 126 types. All analyses were adjusted for sample weight and conducted using SPSS version 21.
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11 12 128 **patient involvement**

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15 129 Patient's were not involved in the study.
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18 19 130 **RESULTS**

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22 131 Of the selected 319 facilities, 179 (56.1%) were public, and 140 (43.9%) were from the
23
24 132 private and NGO sectors. Table 1 presents the results for all four domains under two broad
25
26 133 categories (public and private, including NGO facilities) of general service readiness. In general,
27
28 134 district hospitals exhibited higher availability of items in all four domains of readiness than other
29
30 135 facilities. For basic amenities, the availability individual items ranged between 62.8% and 100%
31
32 136 for all facilities, and, overall, private facilities had the lowest emergency transport facility
33
34 137 (ambulance) compared to public facilities. In the basic equipment domain, all items were
35
36 138 available in most of the facilities, except child scale at upazila health complexes (58.5%) in the
37
38 139 public sector and at NGO clinics/hospitals (63.8%) in the private sector. Although proper
39
40 140 disposal of sharp and infectious wastes were done in most of the facilities, 36.9% facilities had
41
42 141 no guidelines on standard precautions. In terms of diagnosis capacity, availability of items was
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44 142 observed in all facilities but facilities for diagnosis of tuberculosis (TB) were comparatively low
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46 143 in district hospitals (72.9%) and in NGO clinics/hospitals (21.1%).
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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

145 **readiness index specific to services for diabetes**

146 In total, 179 public and 140 private facilities were involved in diabetes-specific services,
147 such as diagnosis and treatment of diabetes. Readiness index scores specific to services for
148 diabetes according to facilities are presented in Table 2. Among the selected 319 facilities,
149 58.1% offered diagnosis and treatment for diabetes. Status of diagnosis and treatment for
150 diabetes was low in upazila health complexes (53.1%) compared to district hospitals (72.9%). On
151 the other hand, the status of diagnosis and treatment was low in NGO clinics/hospitals (43.8%)
152 compared to private clinics/hospitals (78.3%). As a whole, readiness index (18.8%) of the trained
153 staff (those who received training during the 24 months before the survey) was low in all
154 facilities. On the other hand, mean domain score for equipment and diagnosis was 77.2% and
155 84.1% respectively. In terms of readiness for medicine, all facilities had low availability of
156 medicines. In public facilities, such as upazila health complexes, only 10.9% medicines were
157 available, and district hospitals had 29.7% of medicines available. It was reported that all items
158 under medicine domain were less available. On the other hand, scenario at the private facilities
159 was comparatively better than at the public facilities. Private hospitals/clinics (58.4%) had higher
160 availability of medicines compare to other facilities. The overall readiness index specific to
161 services for diabetes was 49.8% in the consideration of five domains (guideline, trained staff,
162 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

164 **readiness index specific to services for CVD**

165 Readiness index scores specific to services for CVD according to facilities are presented
166 in Table 3. Among the 319 facilities under study, only 24.1% facilities had both diagnosis and
167 treatment facilities and 44.5% had national guidelines on CVD. As in the case of diabetes, only
168 14.7% facilities had trained staff, and the rate was higher (47.5%) in public facilities compared to
169 private facilities (18.8%). In terms of equipment, more than 70% facilities had appropriate
170 equipment available. On the other hand, overall mean domain score for medicine was 43.9%, and
171 the score was higher in district hospitals (51.5%) compared to upazila health complexes (41.4%);
172 and the score was higher in private hospitals/clinics (62.9%) compared to NGO clinics/hospitals
173 (31.2%). The overall readiness index specific to services for CVD, in the consideration of five
174 domains (guideline, trained staff, equipment, diagnosis capacity, and medicine) was 45.1%.

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

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

183 **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

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

188

189 **readiness of health facilities to provide services for diabetes and CVD**

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

195

196 **DISCUSSION**

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

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5 206 The Bangladesh Government provides primary healthcare services to all citizens through
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8 207 a three-tiered health service delivery system in rural areas: the community clinics, each for 6,000
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10 208 people; the union health and family welfare centers (UH&FWCs), each for 25,000 people; and
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12 209 the upazila (subdistrict) health complexes (UHCs), with an outpatient and an emergency
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14 210 department, 10-50 inpatient beds and an operating room, each for 250,000 people.¹² In the
15
16 211 context of Bangladesh, the UHC is the main point for seeking services for NCDs but, according
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18 212 to our findings, it was reported that overall readiness index of facilities offering services for
19
20 213 diabetes was comparatively low in the UHCs compared to district hospitals. Availability of
21
22 214 required medicines for diabetes was also low in the UHCs, which indicates that our primary
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24 215 healthcare system is still not ready to combat diabetes and other NCDs. A recent study in
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26 216 Bangladesh also reported that relevant medicines for NCDs were either supplied inadequately or
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28 217 not supplied at all.¹³
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35 219 Various studies in Bangladesh reported that the health system is still not integrated to
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37 220 combat NCDs⁶; availability of medicines in the facilities is still a major challenge in the public
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39 221 healthcare delivery system.¹⁴ Cockroft and colleagues, in a study based on three national
40
41 222 community-based surveys, identified lack of/poor quality of medicines as one of the major
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43 223 causes of patients' dissatisfaction with the government health facilities.¹⁵ A study in our
44
45 224 neighboring country India also reported discordance in the availability of recommended class of
46
47 225 drugs for CVD.¹⁶
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3 227 Our study reports that trained staff for providing services for diabetes and cardiovascular
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5 228 diseases was only 18.8% and 14.7% respectively. This is not surprising because the health
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7 229 system of Bangladesh still faces shortage of trained human resources.¹⁷ The current ratio of
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9 230 doctors-to-nurses-to-health technologists in Bangladesh is 1: 0.4: 0.24—being stark opposite to
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11 231 the WHO-recommended standards, i.e. doctors: nurses: technologists=1: 3: 5).¹² Trained staff
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13 232 plays a crucial role in services for NCDs. Different studies in the sub-Saharan Africa already
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15 233 reported that poor knowledge and experience of frontline healthcare workers have been
16
17 234 recognized as a major barrier to care for NCDs.¹⁸⁻²⁰ It is also established that proper training to
18
19 235 and supervision of non-medical-doctors, clinicians, or personnel in nurse-led clinics could
20
21 236 provide effective primary care for NCDs.²¹⁻²³ In the context of Bangladesh, there is no provision
22
23 237 of training for non-medical health workforce for services specific to NCDs.
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31 239 In our study, we also project how only a single guideline and trained staff could increase
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33 240 the overall readiness index, which can give some direction to policy-makers as well as related
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35 241 stakeholders to take necessary actions for strengthening the health facilities in Bangladesh.
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40 243 Other studies also reported that the health system in Bangladesh is still not ready to
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42 244 combat NCDs. A recent study in Bangladesh titled “A scorecard for tracking actions to reduce
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44 245 the burden of non-communicable diseases” reported that, among the four domains i.e.
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46 246 governance, risk factor surveillance, research, and health system response, the country’s
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48 247 performance score was low in three domains, except for the governance (moderate
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50 248 performance).²⁴
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250 **strengths and limitations of the study**

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

259

260 **CONCLUSIONS**

261

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

270

271 **LIST OF ABBREVIATION**

272 NCDs- Non-Communicable Diseases

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3 273 USCs/RDs- Sub-Centers/Rural Dispensaries
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5 274 ACPR- Community and Population Research
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7
8 275 BHFS- Bangladesh Health Facility Survey
9
10 276 CVD- Cardiovascular Disease
11
12 277 DHs- District Hospitals
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14 278 MOHFW- Ministry of Health and Family Welfare
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16 279 SARA- Service Availability and Readiness Assessment
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19 280 TB -Tuberculosis
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21 281 UHCs- Upazila Health Complexes
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23 282 UH&FWCs- Union Health and Family Welfare Centers
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26 283 WHO- World Health Organization
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31 285 **Contributors**

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34 286 TB, MMH and MJU conceptualized the study. TB, MMH and RDG designed the study and
35
36 acquired the data. TB and MMH conducted the data analysis. TB, RDG and MJU interpreted the
37
38 data. TB, MMH, RDG prepared the first draft. TB, MMH, RDG and MJU participated in critical
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40 288 revision of the manuscript and contributed to its intellectual improvement. All authors went
41
42 289 through the final draft and approved it for submission.
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24 302 **Competing Interests**25
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27 303 None declared.
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31 30432
33 305 **Patient consent**34
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36 306 None Declared
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42 308 **Disclaimer**

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45 309 The authors are alone responsible for the integrity and accuracy of data analysis and the writing
46
47 310 the manuscript.
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52 312 **Ethics approval**
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3 313 The datasets were obtained from DHS Programme with proper procedure. The study exempt
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5 314 from collecting ethical approval because the survey protocols were reviewed and approved by
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7 315 Nepal Health Research Council)NHRC (and the ICF Institutional Review Board in Calverton,
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9 316 Maryland, USA.
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16 318 **Data sharing statement**

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19 319 The dataset of BHFS 2014 is available at the Demographic and Health Surveys Program. Extra
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22 320 data is available which is available on request at [http://dhsprogram-com/what-we-](http://dhsprogram-com/what-we-do/survey/survey-display-349.cfm)
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24 321 [do/survey/survey-display-349.cfm](http://dhsprogram-com/what-we-do/survey/survey-display-349.cfm).
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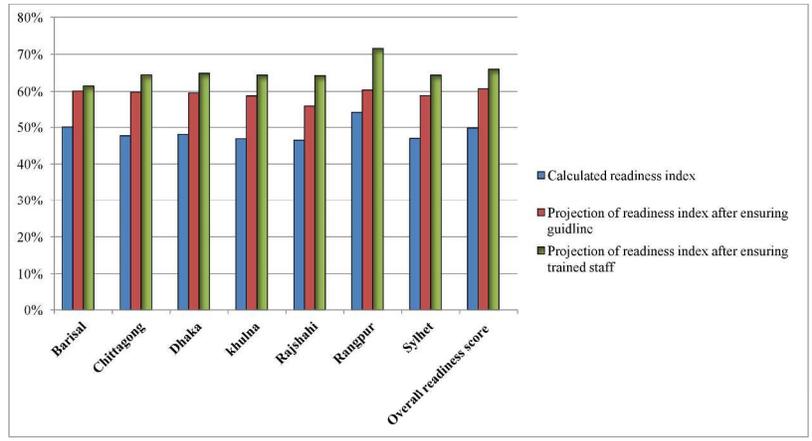
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3 **389 Figures**
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7 390 Figure 1. Readiness index specific to services for diabetes by administrative division and
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9 391 projected direction
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12 392 Figure 2. Readiness index specific to services for CVD by administrative division and projected
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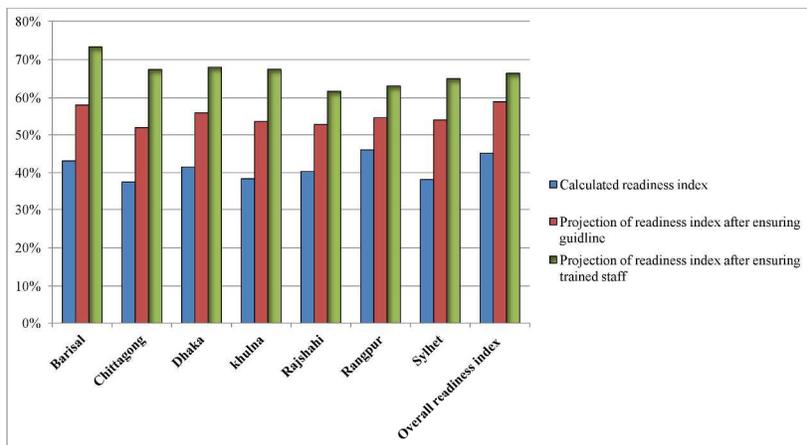
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Readiness index specific to services for diabetes by administrative division and projected direction

279x215mm (300 x 300 DPI)



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

279x215mm (300 x 300 DPI)

BMJ Open

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

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Manuscripts

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3 1 **Title: Assessment of the Readiness of Health Facilities for Diabetes and**
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10 11 12 **ABSTRACT**

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15 23 **Objectives:** The objective of this study was to assess the readiness of health facilities for
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17 24 diabetes and cardiovascular services in Bangladesh.
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21 25 **Design:** This study was a cross sectional survey.
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24 26 **Setting:** This study used data from a nationwide Bangladesh Health Facility Survey (BHFS)
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26 27 2014
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30 28 **Participants:** Three hundred nineteen (319) health facilities were included primary and
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32 29 secondary-care facilities of the public sector and from private/NGO facilities, offering services
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34 30 only for diabetes and cardiovascular diseases (CVD).
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38 31 **Primary and secondary outcome measures:** The primary outcome was readiness of health
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40 32 facilities for diabetes and cardiovascular services. We analyzed those data following service
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42 33 availability and readiness assessment (SARA) manual of the world health organization (WHO)
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44 34 to assess the readiness of selected health facilities towards services for diabetes and CVD.
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48 35 **Results:** 58% and 24.1% of the facilities had diagnosis and treatment services for diabetes and
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50 36 CVD respectively. Shortage of trained staff (18.8% and 14.7%) and meager medicine supply
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52 37 (23.5% and 43.9%) were identified to be factors responsible for inadequate services for diabetes
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3 38 and CVD. Among the facilities that offer services for diabetes and CVD, only 0.4% and 0.9%
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5 39 had all the four service-readiness items (guideline, trained staff, equipment, and medicine).
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9 40 **Conclusions:** Our study suggested that health facilities suffered from the lack of readiness in
10
11 41 various aspects, such as shortage of trained staff and required medicine, unavailability of
12
13 42 guidelines on diagnosis and treatment for diabetes and CVD. It is, therefore, essential now to
14
15 43 ensure trained staff, required medicine, and guidelines on diagnosis and treatment for diabetes
16
17 44 and CVD in Bangladesh.
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23 46 **Key words:** CVD, Diabetes, Health facilities, Health services, NCDs. Readiness
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47 STRENGTHS AND LIMITATIONS OF THE STUDY

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

56 INTRODUCTION

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

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

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

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3 79 insufficient.⁶ To identify gaps and opportunities for further strengthening of health services for
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5 80 NCDs, assessment of health facilities is crucial. Such information is needed to guide policy-
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8 81 makers on how to strengthen health systems and reduce the overall burden of NCDs in resource-
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10 82 poor countries, like Bangladesh. In response to this issue, we assessed the readiness of health
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12 83 facilities in a representative sample of public, private and non-profit health facilities in
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14 84 Bangladesh.
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16 17 85 18 19 86 **METHODS**

20 21 22 23 87 **study design**

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25 88 This study was based on the secondary analysis of data from the Bangladesh Health Facility
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27 89 Survey (BHFS) 2014. The BHFS 2014 was conducted during March-October 2014, in
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29 90 collaboration among the National Institute of Population Research and Training (NIPORT); ICF
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31 91 International (USA); and Associate for Community and Population Research (ACPR), Dhaka,
32
33 92 Bangladesh.¹⁰ The 2014 BHFS is a cross-sectional study with a stratified random sample of
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35 93 1,596 health facilities selected from all formal-sector health facilities in Bangladesh. The BHFS
36
37 94 2014 was a cross sectional-study. The aim of the survey was to ascertain the service availability
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39 95 and readiness of maternal and child health, family planning, selected NCDs (diabetes and
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41 96 cardiovascular diseases) and tuberculosis in the health facilities of Bangladesh. The survey also
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43 97 assessed the availability of human resources, basic services, and logistics including equipment,
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45 98 essential drugs, laboratory services, infection control mechanisms following standard procedures,
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47 99 at the health facilities of Bangladesh.¹⁰ **sample-size**

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53 100 A total of 1,596 health facilities from all formal-sector health facilities were selected
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55 101 from 19,184, using stratified random sampling (stratified according to administrative unit and

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3 102 type of facilities) procedure. The sample for the 2014 BHFS was designed to include facilities
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5 103 from seven administrative divisions (Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur,
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7 104 and Sylhet) of the country. All seven types of public facilities—district hospitals (DHs), maternal
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9 105 and child welfare centers (MCWCs), upazila health complexes (UHCs), upgraded union health
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11 106 and family welfare centers (upgraded UHFWCs), union health and family welfare centers
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13 107 (UHFWCs), union sub-centers/rural dispensaries (USCs/RDs), and community clinics (CCs)—as
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15 108 well as private hospitals with at least 20 beds and NGO static clinics/hospitals were included.¹⁰ It
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17 109 may be mentioned that, in Bangladesh, health facilities up to the subdistrict level (upazila health
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19 110 complex) provide services for NCDs. Considering this; we excluded the facilities below
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21 111 subdistrict level and also excluded those with missing values.
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27 28 113 **data collection**

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31 114 Data were collected through an electronic structured questionnaire. After training (15
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33 115 days), 40 data-collection teams, with two interviewers in each team, were formed. Data
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35 116 collection was done from 22 May to 20 July 2014. Supervision of data collection was
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37 117 coordinated by ACPR and NIPORT. Seven field supervision teams, with seven medical doctors
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39 118 (who were master trainers) and seven trained data-processing specialists, were formed. The field
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41 119 supervision teams made periodic visits to their assigned data-collection teams to review their
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43 120 work and monitor the quality of data. Ethics approval for the BHFS was obtained from the
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45 121 Institutional Review Board of the Medical Research Council of Bangladesh. Informed consent
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47 122 was given by the participants.¹⁰
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52 53 124 **data analysis**

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3 125 We divided health facilities into two broad categories--public and private/NGO facilities
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5 126 and analyzed data following Service Availability and Readiness Assessment (SARA) Manual
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7 127 of the World Health Organization (WHO)¹¹ to assess general service readiness in four domains
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9 128 (e.g. basic amenities, basic equipment, standard precautions for prevention of infection, and
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11 129 diagnostic capacity) in 319 facilities. We assessed diabetes and CVD-specific readiness
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13 130 following the said WHO manual. Moreover, we did an assessment of readiness index for
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15 131 diabetes and CVD-related services, stratified by seven administrative divisions. A detailed
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17 132 description of each domain described in Table-1. Score for each domain was calculated based on
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19 133 the mean availability of tracer items as percentage within that domain. Finally, mean (SD) of all
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21 134 domain scores were calculated and expressed as general service, diabetes and CVD service
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23 135 readiness index. In addition, we also projected the facility overall readiness, if we would ensure
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25 136 guidelines on diagnosis and treatment for diabetes in all facilities. Data were weighted by
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27 137 administrative cluster and type of facilities during the analysis, and all the results were
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29 138 summarized and presented as frequencies and percentages by facility types. All analyses were
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31 139 adjusted for sample weight and conducted using SPSS version 21.
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141 **Table-1: Detail description of each domain (General readiness, Diabetes service readiness and**
 142 **CVD service readiness)**
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General readiness	Diabetes service readiness	CVD service readiness
<p data-bbox="94 478 462 604">Please tell me if the following amenities are available at this site today and is functioning.</p> <ul style="list-style-type: none"> 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) <p data-bbox="94 1079 462 1205">Please tell me if the following equipment are available at this site today and is functioning.</p> <ul style="list-style-type: none"> a) Blood pressure apparatus b) Stethoscope c) Adult scale d) Infant scale e) Child scale f) Thermometer g) Light source <p data-bbox="94 1516 462 1612">Following standard precautions are available at this site today?</p> <ul style="list-style-type: none"> a) Safe final disposal of sharps b) Safe final disposal of infectious wastes c) Running water d) Handwashing soap e) Disposable latex gloves 	<p data-bbox="488 478 950 541">Do providers in this facility diagnose and/or manage diabetes?</p> <ul style="list-style-type: none"> a) Yes b) No <p data-bbox="488 613 950 709">Do you have the national guidelines for the diagnosis and management of diabetes?</p> <ul style="list-style-type: none"> a) Yes b) No <p data-bbox="488 781 998 907">Had at least one staff member who had received in service training in diabetes services during the 24 months before the survey</p> <ul style="list-style-type: none"> a) Yes b) No <p data-bbox="488 1012 933 1075">Does this facility have bellow-listed equipment?</p> <ul style="list-style-type: none"> a) Blood pressure b) Adult weighing scale c) Height board/stadiometer <p data-bbox="488 1213 982 1276">Does this facility do below listed testing in the facility?</p> <ul style="list-style-type: none"> a) Blood glucose b) Urine protein c) Urine glucose <p data-bbox="488 1415 998 1512">Are any of the following medicines for the management of diabetes available in the facility/location today?</p> <ul style="list-style-type: none"> a) Metformin b) Gliben-clamide c) Injectable insulin d) Injectable glucose solution 	<p data-bbox="1032 478 1421 541">Do providers in this facility diagnose and/or manage CVD?</p> <ul style="list-style-type: none"> a) Yes b) No <p data-bbox="1032 613 1421 709">Do you have the national guidelines for the diagnosis and management of CVD?</p> <ul style="list-style-type: none"> a) Yes b) No <p data-bbox="1032 781 1469 907">Had at least one staff member who had received in service training in CVD services during the 24 months before the survey</p> <ul style="list-style-type: none"> a) Yes b) No <p data-bbox="1032 978 1469 1041">Does this facility have bellow-listed equipment?</p> <ul style="list-style-type: none"> a) Blood pressure b) Adult weighing scale c) Height board/stadiometer <p data-bbox="1032 1146 1437 1209">Does this facility do below listed testing in the facility?</p> <ul style="list-style-type: none"> a) Blood pressure b) Adult weighing scale c) Height board/stadiometer <p data-bbox="1032 1314 1469 1440">Are any of the following medicines for the management of CVD available in the facility/location today?</p> <ul style="list-style-type: none"> d) Amlodipine/nifedipine e) Beta-blockers (atenolol) f) Aspirin g) Nifedipine tablet h) Thiazide

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

146 Patients were not involved in the study.

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148 RESULTS

149 Of the selected 319 facilities, 179 (56.1%) were public, and 140 (43.9%) were from the
 150 private and NGO sectors. Table 2 presents the results for all four domains under two broad
 151 categories (public and private, including NGO facilities) of general service readiness. In general,
 152 district hospitals exhibited higher availability of items in all four domains of readiness than other
 153 facilities. For basic amenities, the availability of individual items ranged between 62.8% and
 154 100% for all facilities, and, overall, private facilities had the lowest emergency transport facility
 155 (ambulance) compared to public facilities. In the basic equipment domain, all items were
 156 available in most of the facilities, except child scale at upazila health complexes (58.5%) in the
 157 public sector and at NGO clinics/hospitals (63.8%) in the private sector. Although proper

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3 158 disposal of sharp and infectious wastes were done in most of the facilities, 36.9% facilities had
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5 159 no guidelines on standard precautions. In terms of diagnosis capacity, availability of items was
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8 160 observed in all facilities but facilities for diagnosis of tuberculosis (TB) were comparatively low
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10 161 in district hospitals (72.9%) and in NGO clinics/hospitals (21.1%).
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162 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)

163 **readiness index specific to services for diabetes**

164 In total, 179 public and 140 private facilities were involved in diabetes-specific services,
165 such as diagnosis and treatment of diabetes. Readiness index scores specific to services for
166 diabetes according to facilities are presented in Table 3. Among the selected 319 facilities,
167 58.1% offered diagnosis and treatment for diabetes. Status of diagnosis and treatment for
168 diabetes was low in upazila health complexes (53.1%) compared to district hospitals (72.9%). On
169 the other hand, the status of diagnosis and treatment was low in NGO clinics/hospitals (43.8%)
170 compared to private clinics/hospitals (78.3%). As a whole, readiness index (18.8%) of the trained
171 staff (those who received training during the 24 months before the survey) was low in all
172 facilities. On the other hand, mean domain score for equipment and diagnosis was 77.2% and
173 84.1% respectively. In terms of readiness for medicine, all facilities had low availability of
174 medicines. In public facilities, such as upazila health complexes, only 10.9% medicines were
175 available, and district hospitals had 29.7% of medicines available. It was reported that all items
176 under medicine domain were less available. On the other hand, scenario at the private facilities
177 was comparatively better than at the public facilities. Private hospitals/clinics (58.4%) had higher
178 availability of medicines compare to other facilities. The overall readiness index specific to
179 services for diabetes was 49.8% (SD=26.8) in the consideration of five domains (guideline,
180 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)

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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)
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182 **readiness index specific to services for CVD**

183 Readiness index scores specific to services for CVD according to facilities are presented
184 in Table 4. Among the 319 facilities under study, only 24.1% facilities had both diagnosis and
185 treatment facilities and 44.5% had national guidelines on CVD. As in the case of diabetes, only
186 14.7% facilities had trained staff, and the rate was higher (47.5%) in public facilities compared to
187 private facilities (18.8%). In terms of equipment, more than 70% facilities had appropriate
188 equipment available. On the other hand, overall mean domain score for medicine was 43.9%, and
189 the score was higher in district hospitals (51.5%) compared to upazila health complexes (41.4%);
190 and the score was higher in private hospitals/clinics (62.9%) compared to NGO clinics/hospitals
191 (31.2%). The overall readiness index specific to services for CVD, in the consideration of five
192 domains (guideline, trained staff, equipment, diagnosis capacity, and medicine) was 45.1%
193 (SD=22.1).

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

196 Figure 1 and 2 show the readiness index scores specific to services for diabetes and CVD.
197 Readiness index specific to services for diabetes was high in Rangpur division (54.1%) and low
198 in Rajshahi division (46.5%). On the other hand, readiness index specific to services for CVD
199 was high in Rangpur division (46.0%) and low in Sylhet division (38.2%). Figure 1 and 2 also
200 project that, if we would ensure guidelines on diagnosis and treatment for diabetes in all facilities
201 (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)

203

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

207

208 **readiness of health facilities to provide services for diabetes and CVD**

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

214

215 **DISCUSSION**

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

223

224 In the context of Bangladesh healthcare system of Bangladesh, typically designed to

225 address maternal health, child health and infectious diseases. The Bangladesh Government

226 provides primary healthcare services to all citizens through a three-tiered health service delivery

227 system in rural areas: the community clinics, each for 6,000 people; the union health and family

228 welfare centers (UH&FWCs), each for 25,000 people; and the upazila (subdistrict) health

229 complexes (UHCs), with an outpatient and an emergency department, 10-50 inpatient beds and

230 an operating room, each for 250,000 people.¹² In the context of Bangladesh, the UHC is the main

231 point for seeking services for NCDs but, according to our findings, it was reported that overall

232 readiness index of facilities offering services for diabetes was comparatively low in the UHCs

233 compared to district hospitals. Availability of required medicines for diabetes was also low in the

234 UHCs, which indicates that our primary healthcare system is still not ready to combat diabetes

235 and other NCDs. A recent study in Bangladesh also reported that relevant medicines for NCDs

236 were either supplied inadequately or not supplied at all.¹³

237

238 Various studies in Bangladesh reported that the health system is still not integrated to

239 combat NCDs⁶; availability of medicines in the facilities is still a major challenge in the public

240 healthcare delivery system.¹⁴ Cockroft and colleagues, in a study based on three national

241 community-based surveys, identified lack of/poor quality of medicines as one of the major

242 causes of patients' dissatisfaction with the government health facilities.¹⁵ A study in our

243 neighboring country India also reported discordance in the availability of recommended class of

244 drugs for CVD.¹⁶

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3 246 Our study reports that trained staff for providing services for diabetes and cardiovascular
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5 247 diseases was only 18.8% and 14.7% respectively. This is not surprising because the health
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7 248 system of Bangladesh still faces shortage of trained human resources.¹⁷ The current ratio of
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9 249 doctors-to-nurses-to-health technologists in Bangladesh is 1: 0.4: 0.24—being stark opposite to
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11 250 the WHO-recommended standards, i.e. doctors: nurses: technologists=1: 3: 5).¹² Trained staff
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13 251 plays a crucial role in services for NCDs. Different studies in the sub-Saharan Africa already
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15 252 reported that poor knowledge and experience of frontline healthcare workers have been
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17 253 recognized as a major barrier to care for NCDs.¹⁸⁻²⁰ It is also established that proper training to
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19 254 and supervision of non-medical-doctors, clinicians, or personnel in nurse-led clinics could
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21 255 provide effective primary care for NCDs.²¹⁻²³ In the context of Bangladesh, there is no provision
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23 256 of training for non-medical health workforce for services specific to NCDs.
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31 258 In our study, we also project how only a single guideline and trained staff could increase
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33 259 the overall readiness index, which can give some direction to policy-makers as well as related
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35 260 stakeholders to take necessary actions for strengthening the health facilities in Bangladesh.
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40 262 Other studies also reported that the health system in Bangladesh is still not ready to
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42 263 combat NCDs. A recent study in Bangladesh titled “A scorecard for tracking actions to reduce
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44 264 the burden of non-communicable diseases” reported that, among the four domains i.e.
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46 265 governance, risk factor surveillance, research, and health system response, the country’s
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48 266 performance score was low in three domains, except for the governance (moderate
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50 267 performance).²⁴
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269 **strengths and limitations of the study**

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

283

284 **CONCLUSIONS**

285

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

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

294

295 **LIST OF ABBREVIATION**

296 NCDs- Non-Communicable Diseases

297 USCs/RDs- Sub-Centers/Rural Dispensaries

298 ACPR- Community and Population Research

299 BHFS- Bangladesh Health Facility Survey

300 CVD- Cardiovascular Disease

301 DHs- District Hospitals

302 MOHFW- Ministry of Health and Family Welfare

303 SARA- Service Availability and Readiness Assessment

304 TB -Tuberculosis

305 UHCs- Upazila Health Complexes

306 UH&FWCs- Union Health and Family Welfare Centers

307 WHO- World Health Organization

308

309 **Contributors**

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

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33 326 **Competing Interests**34
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36 327 None declared.
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43 329 **Patient consent**44
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46 330 None Declared
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52 332 **Disclaimer**53
54 333 The authors are alone responsible for the integrity and accuracy of data analysis and the writing
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56 334 the manuscript.
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56 336 **Ethics approval**
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9 337 The datasets were obtained from DHS Programme with proper procedure. The study exempt
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11 338 from collecting ethical approval because the survey protocols were reviewed and approved by
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13 339 Nepal Health Research Council)NHRC (and the ICF Institutional Review Board in Calverton,
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15 340 Maryland, USA.
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2122 342 **Data sharing statement**
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26 343 The dataset of BHFS 2014 is available at the Demographic and Health Surveys Program. Extra
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28 344 data is available which is available on request at [http://dhsprogram-com/what-we-](http://dhsprogram-com/what-we-do/survey/survey-display-349.cfm)
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30 345 [do/survey/survey-display-349.cfm](http://dhsprogram-com/what-we-do/survey/survey-display-349.cfm).
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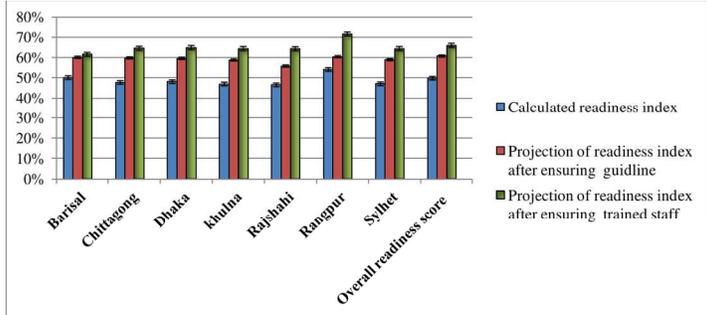
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3 **415 Figures**
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7 416 Figure 1. Readiness index specific to services for diabetes by administrative division and
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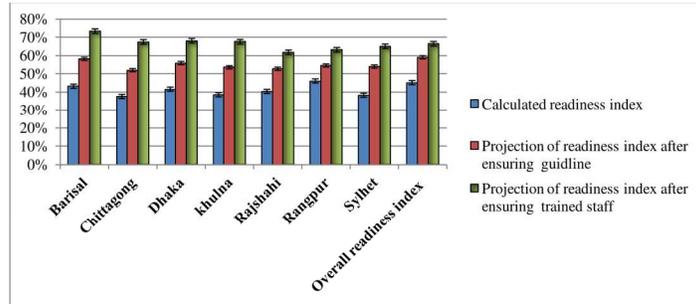
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12 418 Figure 2. Readiness index specific to services for CVD by administrative division and projected
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Assessing of the Readiness of Health Facilities for Diabetes and Cardiovascular Services in Bangladesh: A Cross-sectional Survey

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4 1 **Title: Assessing of the Readiness of Health Facilities for Diabetes and**
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6 2 **Cardiovascular Services in Bangladesh: A Cross-sectional Survey**
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For peer review only

21 ABSTRACT

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

24 **Design:** This study was a cross sectional survey.

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

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

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

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

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3 40 0.9% had all the four service-readiness factors (guideline, trained staff, equipment, and
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5 41 medicine).

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9 42 **Conclusions:** The study suggests that health facilities suffered from numerous drawbacks, such
10
11 43 as shortage of trained staff and required medicine. Most importantly, ~~unavailability~~ of they lack
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13 44 effective guidelines on diagnosis and treatment for diabetes and CVD. It is, therefore, essential
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15 45 now to ensure trained staff, adequate medicine supply, and appropriate guidelines on diagnosis
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17 46 and treatment for diabetes and CVD in Bangladesh.

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23 48 **Key words:** CVD, Diabetes, Health facilities, Health services, NCDs. Readiness
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49 STRENGTHS AND LIMITATIONS OF THE STUDY

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

56

57 INTRODUCTION

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

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

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

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3 80 is insufficient.⁶ To identify gaps and opportunities for further strengthening of health services for
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5 81 NCDs, a comprehensive assessment of health facilities is crucial. Such information is needed to
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8 82 guide policy-makers on how to strengthen health systems and reduce the overall burden of NCDs
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10 83 in resource-poor countries, like Bangladesh. The study, therefore, assessed the readiness in a
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12 84 representative sample of public, private and non-profit health facilities in Bangladesh.
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17 86 **METHODS**

20 87 **study design**

23 88 This study was based on the secondary analysis of data from the Bangladesh Health Facility
24
25 89 Survey (BHFS) 2014 carried out by the National Institute of Population Research and Training
26
27 90 (NIPORT) with support from ICF International (USA) and the Associate for Community and
28
29 91 Population Research (ACPR), Dhaka.¹⁰ The 2014 BHFS was a cross-sectional study with a
30
31 92 stratified random sample of 1,596 health facilities representing all formal-sector health facilities
32
33 93 in Bangladesh. The aim of the survey was to ascertain the service availability and readiness of
34
35 94 the health facilities in the areas of maternal and child health, family planning, selected NCDs
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37 95 (diabetes and cardiovascular diseases) and tuberculosis. The survey also assessed the availability
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39 96 of human resources, basic services, and logistics including equipment, essential drugs, laboratory
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41 97 services, infection control mechanisms following standard procedures, in the health facilities.¹⁰
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48 99 **sample-size**

50 100 From a total of 19,184 health facilities in the formal sector, a total of 1,596 were selected
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52 101 were selected for the study using a stratified random sampling (stratified according to
53
54 102 administrative unit and type of facilities) procedure. The sample for the 2014 BHFS was

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3 103 designed to include facilities from seven administrative divisions (Barisal, Chittagong, Dhaka,
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5 104 Khulna, Rajshahi, Rangpur, and Sylhet) of the country. All seven types of public facilities—
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8 105 district hospitals (DHs), maternal and child welfare centers (MCWCs), upazila health complexes
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10 106 (UHCs), upgraded union health and family welfare centers (upgraded UHFWCs), union health
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12 107 and family welfare centers (UHFWCs), union sub-centers/rural dispensaries (USCs/RDs), and
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14 108 community clinics (CCs)—as well as private hospitals with at least 20 beds and NGO static
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17 109 clinics/hospitals were included.¹⁰ It may be mentioned that, in Bangladesh, health facilities up to
18
19 110 the subdistrict level (upazila health complex) provide services for NCDs. The study, therefore,
20
21 111 excluded facilities below the subdistrict level and also ~~excluded~~ those with missing values. In the
22
23 112 final analysis 319 health care facilities were included.
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27 28 114 **data collection tools**

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30 115 Two types of questionnaires were used for data collection: facility inventory questionnaire
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32 116 and health care provider interview questionnaire. The facility inventory questionnaire was used
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34 117 to collect data related to service availability and general and specific service readiness. The
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36 118 health care provider interview questionnaire was used to collect information related to the
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38 119 credentials, training, clinical experience, level of education, supervision received, and
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40 120 perceptions of the service delivery environment from a sample of health care providers. The
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42 121 questionnaires were adapted, validated and pretested in the context of Bangladesh. The detailed
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44 122 questionnaires were published previously.¹⁰
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52 53 125 **data collection**

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3 126 Data were collected through an electronic structured questionnaire. After training (15
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5 127 days), 40 data-collection teams, with two interviewers in each team, were formed. Data
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7 128 collection was done between 22 May and 20 July 2014. Supervision of data collection was
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10 129 coordinated by Associates for Community and Population Research (ACPR) and National
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12 130 Institute of Population Research and Training (NIPORT). Seven field supervision teams, each
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15 131 with a medical doctors (who served as master trainers) and a trained data-processing specialist,
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17 132 were formed. The field supervision teams made periodic visits to their assigned data-collection
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19 133 teams to review their work and monitor the quality of data. Ethics approval for the BHFS was
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21 134 obtained from the Institutional Review Board of the Medical Research Council of Bangladesh.
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24 135 Informed consent was obtained from the participants.¹⁰ The authors followed ‘Strengthening the
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26 136 Reporting of Observational Studies in Epidemiology (STROBE) Statement’ to write the
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28
29 137 manuscript (Supplementary File 1).
30

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33 139 **data analysis**

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36 140 The study divided health facilities into two broad categories-public and private/NGO
37
38 141 facilities and analyzed data following the Service Availability and Readiness Assessment
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40 142 (SARA) Manual of the World Health Organization (WHO)¹¹ to assess general service readiness
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42 143 in four domains (e.g. basic amenities, basic equipment, standard precautions for prevention of
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44 144 infection, and diagnostic capacity) in 319 facilities. Diabetes and CVD-specific readiness was
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46 145 also assessed following the WHO manual¹¹. Moreover, an assessment of readiness index for
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48 146 diabetes and CVD-related services, stratified by seven administrative divisions was also carried
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51 147 out. Table-1 presents a detailed description of each domain. Score for each domain was
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54 148 calculated based on the mean availability of tracer items as percentage within that domain.
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3 149 Finally, means (\pm SD) of all domain scores were calculated and expressed as general as well as
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5 150 diabetes and CVD service readiness index. In addition, the study also projected the facility-
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7 151 specific overall readiness on the basis of availability of appropriate guidelines on diagnosis and
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9 152 treatment for of diabetes. Data were weighted by administrative cluster and type of facilities
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11 153 during the analysis, and all the results were summarized and presented as frequencies and
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13 154 percentages by facility type. All analyses were conducted using SPSS version 21 and were
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15 155 adjusted for sample weight.
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157 **Table-1: Detail description of each domain (General readiness, Diabetes service readiness and**
 158 **CVD service readiness)**
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General readiness	Diabetes service readiness	CVD service readiness
<p data-bbox="94 474 461 604">Please tell me if the following amenities are available at this site today and is functioning.</p> <ul style="list-style-type: none"> <li data-bbox="142 611 266 638">a) Power <li data-bbox="142 644 310 672">b) Generator <li data-bbox="142 678 347 705">c) Water source <li data-bbox="142 711 415 739">d) Room with privacy <li data-bbox="142 745 461 806">e) Adequate sanitation facilities <li data-bbox="142 812 380 873">f) Communication equipment <li data-bbox="142 879 461 940">g) Access to computer with Internet <li data-bbox="142 947 355 1041">h) Emergency transportation (ambulance) <p data-bbox="94 1079 461 1209">Please tell me if the following equipment are available at this site today and is functioning.</p> <ul style="list-style-type: none"> <li data-bbox="142 1215 461 1276">a) Blood pressure apparatus <li data-bbox="142 1283 334 1310">b) Stethoscope <li data-bbox="142 1316 326 1344">c) Adult scale <li data-bbox="142 1350 326 1377">d) Infant scale <li data-bbox="142 1383 326 1411">e) Child scale <li data-bbox="142 1417 350 1444">f) Thermometer <li data-bbox="142 1451 339 1478">g) Light source <p data-bbox="94 1516 461 1610">Following standard precautions are available at this site today?</p> <ul style="list-style-type: none"> <li data-bbox="142 1617 461 1677">a) Safe final disposal of sharps <li data-bbox="142 1684 461 1745">b) Safe final disposal of infectious wastes <li data-bbox="142 1751 363 1778">c) Running water <li data-bbox="142 1785 412 1812">d) Handwashing soap <li data-bbox="142 1818 461 1879">e) Disposable latex gloves 	<p data-bbox="488 474 948 535">Do providers in this facility diagnose and/or manage diabetes?</p> <ul style="list-style-type: none"> <li data-bbox="537 541 623 569">a) Yes <li data-bbox="537 575 623 602">b) No <p data-bbox="488 609 976 703">Do you have the national guidelines for the diagnosis and management of diabetes?</p> <ul style="list-style-type: none"> <li data-bbox="537 709 623 737">a) Yes <li data-bbox="537 743 623 770">b) No <p data-bbox="488 777 992 907">Had at least one staff member who had received in service training in diabetes services during the 24 months before the survey</p> <ul style="list-style-type: none"> <li data-bbox="537 913 623 940">a) Yes <li data-bbox="537 947 623 974">b) No <p data-bbox="488 1012 922 1073">Does this facility have bellow-listed equipment?</p> <ul style="list-style-type: none"> <li data-bbox="537 1079 760 1106">a) Blood pressure <li data-bbox="537 1113 829 1140">b) Adult weighing scale <li data-bbox="537 1146 878 1173">c) Height board/stadiometer <p data-bbox="488 1211 976 1272">Does this facility do below listed testing in the facility?</p> <ul style="list-style-type: none"> <li data-bbox="537 1278 748 1306">a) Blood glucose <li data-bbox="537 1312 737 1339">b) Urine protein <li data-bbox="537 1346 745 1373">c) Urine glucose <p data-bbox="488 1411 987 1505">Are any of the following medicines for the management of diabetes available in the facility/location today?</p> <ul style="list-style-type: none"> <li data-bbox="537 1543 708 1570">a) Metformin <li data-bbox="537 1577 769 1604">b) Gliben-clamide <li data-bbox="537 1610 786 1638">c) Injectable insulin <li data-bbox="537 1644 894 1671">d) Injectable glucose solution 	<p data-bbox="1032 474 1419 535">Do providers in this facility diagnose and/or manage CVD?</p> <ul style="list-style-type: none"> <li data-bbox="1081 541 1167 569">a) Yes <li data-bbox="1081 575 1167 602">b) No <p data-bbox="1032 609 1425 703">Do you have the national guidelines for the diagnosis and management of CVD?</p> <ul style="list-style-type: none"> <li data-bbox="1081 709 1167 737">a) Yes <li data-bbox="1081 743 1167 770">b) No <p data-bbox="1032 777 1468 907">Had at least one staff member who had received in service training in CVD services during the 24 months before the survey</p> <ul style="list-style-type: none"> <li data-bbox="1081 913 1167 940">a) Yes <li data-bbox="1081 947 1167 974">b) No <p data-bbox="1032 980 1468 1041">Does this facility have bellow-listed equipment?</p> <ul style="list-style-type: none"> <li data-bbox="1081 1047 1304 1075">a) Blood pressure <li data-bbox="1081 1081 1373 1108">b) Adult weighing scale <li data-bbox="1081 1115 1425 1142">c) Height board/stadiometer <p data-bbox="1032 1148 1430 1209">Does this facility do below listed testing in the facility?</p> <ul style="list-style-type: none"> <li data-bbox="1081 1215 1304 1243">a) Blood pressure <li data-bbox="1081 1249 1373 1276">b) Adult weighing scale <li data-bbox="1081 1283 1425 1310">c) Height board/stadiometer <p data-bbox="1032 1316 1463 1446">Are any of the following medicines for the management of CVD available in the facility/location today?</p> <ul style="list-style-type: none"> <li data-bbox="1081 1453 1393 1480">d) Amlodipine/nifedipine <li data-bbox="1081 1486 1414 1514">e) Beta-blockers (atenolol) <li data-bbox="1081 1520 1214 1547">f) Aspirin <li data-bbox="1081 1554 1325 1581">g) Nifedipine tablet <li data-bbox="1081 1587 1227 1614">h) Thiazide

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

162 Patients were not involved in the study.

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164 RESULTS

165 Of the selected 319 facilities, 179 (56.1%) were public, and 140 (43.9%) were from the
 166 private and NGO sectors. Table 2 presents the results for all four domains under two broad
 167 categories (public and private, including NGO facilities) of general service readiness. In general,
 168 district hospitals exhibited higher availability of items in all four domains of readiness than other
 169 facilities. For basic amenities, the availability of individual items in facilities ranged between
 170 62.8% and 100%. Overall, private facilities had the lowest emergency transport facility
 171 (ambulance) compared to public facilities. In the basic equipment domain, all items were
 172 available in most of the facilities, except child scale (58.5% in the public sector and 63.8% in
 173 NGO clinics/hospitals in the private sector). Although proper disposal of sharp and infectious

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3 174 wastes was done in most of the facilities, 36.9% facilities had no guidelines on standard
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5 175 precautions. In terms of diagnostic capacity, availability of items was observed in all facilities.
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8 176 However, facilities for diagnosis of tuberculosis (TB) were comparatively low in district
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10 177 hospitals (72.9%) and in NGO clinics/hospitals (21.1%).
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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)

179 **readiness index specific to services for diabetes**

180 In total, 179 public and 140 private sector facilities were involved in diagnosis and
181 treatment of diabetes. Readiness index scores of facilities in terms of services for diabetes are
182 presented in Table 3. Among the selected 319 facilities, 58.1% offered diagnosis and treatment
183 for diabetes. Status of diagnosis and treatment for diabetes was low in upazila health complexes
184 (53.1%) compared to district hospitals (72.9%). The status of diagnosis and treatment was also
185 low in NGO clinics/hospitals (43.8%) compared to private clinics/hospitals (78.3%). As a whole,
186 readiness index (18.8%) of the trained staff (those who received training during the 24 months
187 before the survey) was low in all facilities. On the other hand, mean domain score for equipment
188 and diagnosis was 77.2% and 84.1% respectively. In terms of readiness for medicine, all
189 facilities had low availability of medicines. In public facilities, such as upazila health complexes,
190 only 10.9% of them had adequate medicines available, while 29.7% of District Hospitals had
191 medicines available.. It was reported that all items under medicine domain were less available.
192 On the other hand, private facilities was were comparatively better in this respect. Private
193 hospitals/clinics (58.4%) had higher availability of medicines compare to other facilities. The
194 overall readiness index specific to services for diabetes was 49.8% (SD=26.8) taking into
195 account all the five domains (guideline, trained staff, equipment, diagnosis capacity, and
196 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)

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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)
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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 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 comparison to Sylhet division (38.2%). Figures 1 and 2 also demonstrate that, if guidelines on diagnosis and treatment for diabetes could be ensured 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%.

1 **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)

4 readiness of health facilities to provide services for diabetes and CVD

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

11 DISCUSSION

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

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5 20 The Bangladeshi health care system is primarily designed to address maternal health,
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8 21 child health and infectious diseases. The Bangladesh Government provides primary healthcare
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10 22 services to all citizens through a three-tiered health service delivery system in rural areas: the
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12 23 community clinics, each for 6,000 people; the union health and family welfare centers
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14 24 (UH&FWCs), each for 25,000 people; and the upazila (subdistrict) health complexes (UHCs),
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16 25 with an outpatient and an emergency department, 10-50 inpatient beds and an operating room,
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18 26 each for 250,000 people.¹² In the context of Bangladesh, the UHC is the focal point for seeking
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20 27 services for NCDs. However, according to this study the overall readiness index of facilities
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22 28 offering services for diabetes was comparatively low in the UHCs compared to district hospitals.
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24 29 Availability of required medicines for diabetes was also low in the UHCs, which indicates the
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26 30 our primary healthcare system is still not fully prepared to combat diabetes and other NCDs. A
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28 31 recent study in Bangladesh also reported that relevant medicines for NCDs were either supplied
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30 32 inadequately or not supplied at all.¹³
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38 34 Various studies in Bangladesh reported that the health system is still not integrated to
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40 35 combat NCDs⁶; and that availability of medicines in the facilities is still a major challenge in the
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42 36 public healthcare delivery system.¹⁴ Cockroft and colleagues, in a study based on three national
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44 37 community-based surveys, identified lack of/poor quality of medicines as one of the major
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46 38 causes of patients' dissatisfaction with the government health facilities.¹⁵ A study in neighboring
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48 39 India also reported discordance in the availability of recommended types of drugs for CVD.¹⁶
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3 41 The present study reports that among the facilities only 18.8% and 14.7% respectively
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5 42 had trained staff for providing services for diabetes and CVD. This is not surprising because the
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7 43 health system of Bangladesh still faces shortage of trained human resources.¹⁷ The current ratio
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9 44 of doctors-to-nurses-to-health technologists in Bangladesh is 1: 0.4: 0.24— in stark contrast to
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11 45 the WHO-recommended standards, i.e. doctors: nurses: technologists=1: 3: 5).¹² Trained staff
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13 46 plays a crucial role in services for NCDs. Numerous studies in the sub-Saharan Africa already
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15 47 reported that poor knowledge and experience of frontline healthcare workers have been
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17 48 recognized as a major barrier to care for NCDs.¹⁸⁻²⁰ It is also established that proper training for
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19 49 and supervision of non-medical-doctors, clinicians, or personnel in nurse-led clinics could
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21 50 provide effective primary care for NCDs.²¹⁻²³ In the context of Bangladesh, there is little
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23 51 provision for training of non-medical health workforce for services specific to NCDs.
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33 54 Other studies also reported that the health system in Bangladesh is still ill-prepared to
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35 55 combat NCDs. A recent study in Bangladesh titled ‘A scorecard for tracking actions to reduce
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37 56 the burden of non-communicable diseases’ reported that, among the four domains i.e.
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39 57 governance, risk factor surveillance, research, and health system response, the country’s
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41 58 performance score was low in three domains, except for the governance (moderate
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43 59 performance).²⁴
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49 61 **strengths and limitations of the study**

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51 62 The strength of this study is that it involved analysis of a large national sample of
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53 63 facilities covering all the seven administrative divisions of Bangladesh. However, there are few
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3 64 limitations of the study. BHFS 2014 collected information from primary and secondary-care
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5 65 facilities of the public sector and from private/NGO facilities, offering services only for diabetes
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8 66 and CVD. Another limitation of the study is that the facility readiness analyses in terms of care,
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10 67 such as adherence to guidelines, level of skilled workforce, medicine availability, infrastructure
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12 68 readiness, are all assessed using many survey questions that may somewhat compromise to
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14 69 reduce dimensionality. This makes it more challenging to identify the specific drivers within
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16 70 each broader health system area that requires intervention. Further research is recommended for
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19 71 collecting information on other NCDs and from higher-level facilities, including tertiary-level
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21 72 health facilities so that findings can give a clear direction to policy-makers and other
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24 73 stakeholders initiating appropriate policy/program initiatives.
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27 28 75 **CONCLUSIONS**

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33 77 The study findings suggest that both public and private health facilities in Bangladesh
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35 78 suffer from lack of readiness in various aspects, especially in guidelines on the diagnosis and
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37 79 treatment, trained staff, and shortage of medicine. Clearly it is time to ensure guidelines on the
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39 80 diagnosis and treatment for NCDs, availability of trained staff, and adequate medicine to make
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41 81 the facilities ready for strengthening the health system to combat NCDs and to achieve universal
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43 82 health coverage. Information provided in the study would help in generating evidence-based
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45 83 information for the policy-makers and related stakeholders in designing policies/programs that
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47 84 would ensure equitable access to health care services leading to improved overall population
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49 85 health outcomes.
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87 LIST OF ABBREVIATION

88 NCDs- Non-Communicable Diseases

89 USCs/RDs- Sub-Centers/Rural Dispensaries

90 ACPR- Associates for Community and Population Research

91 BHFS- Bangladesh Health Facility Survey

92 CVD- Cardiovascular Disease

93 DHs- District Hospitals

94 MOHFW- Ministry of Health and Family Welfare

95 NIPORT- National Institute of Population Research and Training

96 SARA- Service Availability and Readiness Assessment

97 TB -Tuberculosis

98 UHCs- Upazila Health Complexes

99 UH&FWCs- Union Health and Family Welfare Centers

100 WHO- World Health Organization

101

102 Contributors

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

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30 **119 Competing Interests**
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33 120 None Declared
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40 **122 Patient consent**
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48 **125 Disclaimer**
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51 126 The authors are alone responsible for the integrity and accuracy of data analysis and the writing
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53 127 the manuscript.
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3 **129 Ethics approval**
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6 130 The datasets were obtained from DHS Programme following proper procedure. The study was
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8 131 exempt from collecting ethical approval because the survey protocols were reviewed and
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10 132 approved by Nepal Health Research Council)NHRC (and the ICF Institutional Review Board in
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13 133 Calverton, Maryland, USA.
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19 **135 Data sharing statement**
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22 136 The dataset of BHFS 2014 is available at the Demographic and Health Surveys Program.
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24 137 Additional data is available on request at [http://dhsprogram-com/what-we-do/survey/survey-
26 display-349.cfm](http://dhsprogram-com/what-we-do/survey/survey-
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3 **208 Figures**
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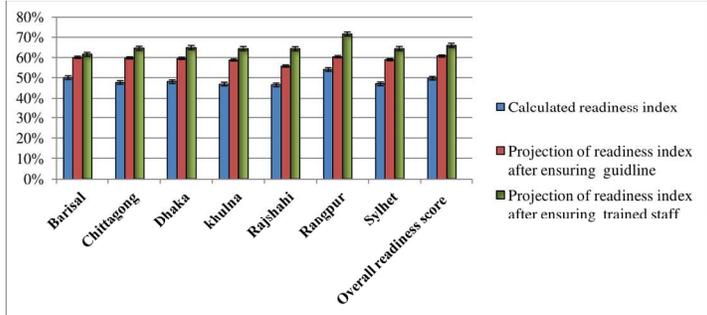
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7 **209** Figure 1. Readiness index specific to services for diabetes by administrative division and
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9 **210** projected direction
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12 **211** Figure 2. Readiness index specific to services for CVD by administrative division and projected
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14 **212** direction
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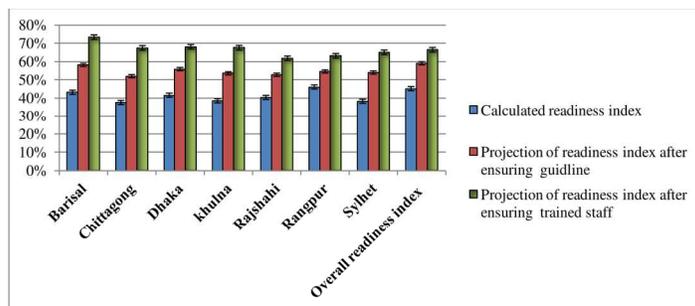
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17 **213 Supplementary Materials**
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21 **214** Supplementary File 1: STROBE Checklist
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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of cross-sectional studies

Title of the study: Assessing 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.

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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.

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