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# BMJ Open

## Primary healthcare system readiness to prevent and manage non-communicable diseases in Bangladesh: A study protocol

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Complete List of Authors:	Kabir, Ashraful; Monash University, Department of Epidemiology and Preventive Medicine Karim, Md; Monash University, SPHPM; Billah, Baki; Monash University, SPHPM
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4 1 **Primary healthcare system readiness to prevent and manage non-**  
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7 2 **communicable diseases in Bangladesh: A study protocol**  
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14 4 **Short title**  
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17 5 Health system readiness for non-communicable diseases  
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24 7 Ashraful Kabir<sup>1</sup>, Md Nazmul Karim<sup>1</sup>, Baki Billah<sup>1\*</sup>  
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27 8 <sup>1</sup> Department of Epidemiology and Preventive Medicine, Monash University, Melbourne,  
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46 14 \* Corresponding author  
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49 15 Email: [md.kabir@monash.edu](mailto:md.kabir@monash.edu)  
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## 17 **Abstract**

18 **Introduction:** The burden of non-communicable diseases (NCDs) is rapidly increasing in  
19 Bangladesh. Currently, it contributes to 67% of annual deaths, and accounts for approximately  
20 64% of the disease burden. Since 70% of the Bangladeshi population residing in the rural area rely  
21 on the primary healthcare system, assessment of its capacity is crucial for guiding public health  
22 decisions to prevent and manage NCDs. This protocol is designed to recognize and assess the  
23 Bangladeshi health system's readiness to prevent and manage NCDs at the primary level.

24 **Methods and analysis:** The study discussed in this protocol will use a mixed-method design.  
25 Numerical data will be collected using households and health facilities surveys, while textual data  
26 will be collected by interviewing healthcare providers, policy planners, health administrators, and  
27 community members. The World Health Organization (WHO)'s Service Availability and  
28 Readiness Assessment (SARA) methodology, and Package of Essential Non-communicable  
29 (PEN) Disease Interventions for Primary Health Care reference manuals will be used to assess the  
30 readiness of the primary healthcare facilities for NCD services. Furthermore, Health System  
31 Dynamics Framework will be used to examine health system factors. Using the supportive items  
32 outlined in the WHO PEN package, and indicators proposed in WHO SARA methodology, a  
33 composite score will be created to analyze facility-level data. Two independent samples t-test,  
34 ANOVA and chi-square test methods will be used for univariate analysis, and multiple regression  
35 analysis will be used for multivariable analysis. Complementarily, the thematic analysis approach  
36 will be used to analyze textual data.

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3 38 **Ethics and dissemination:** The project has been approved by the Monash University Human  
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5 39 Research Ethics Committee (Project ID: 27112). The research findings will be shared through  
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7 40 research articles, conference proceedings, or in other scientific media. The reports or publications  
8  
9 41 will not have any information that can be used to identify any of the study participants.  
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13 42 **Keywords:** Bangladesh, Health system readiness, Mixed-method study, Non-communicable  
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15 43 diseases, Primary healthcare level  
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## 35 49 **Strengths and limitations of this study**

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39 50 • This study will employ a mix of recommended methodologies/reference manuals such as  
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41 51 World Health Organization (WHO)'s Service Availability and Readiness Assessment (SARA),  
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43 52 'Package of Essential Noncommunicable' (PEN) Disease Interventions for Primary Health Care  
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45 53 reference manuals, and the Health System Dynamics Framework. Use of these methods/manuals  
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47 54 will allow for a comprehensive assessment of health system readiness to manage non-  
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49 55 communicable diseases (NCDs) at the country's primary healthcare settings.  
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3 56 • The mixed-method design will allow analysis of health system readiness from the providers  
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5 57 (suppliers) and users (receivers) perspectives. Therefore, the study findings will present a holistic  
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7 58 understanding/assessment of barriers and facilitators associated with comprehensive, need-  
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9 59 oriented, patient-focused, and quality NCDs services, which will be useful for health system  
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11 60 updating in primary level.

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15 61 • The study participants (primary healthcare facilities, communities, and healthcare workers)  
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17 62 will be selected from different roles, backgrounds, and regions of the country, which will increase  
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19 63 the reliability and generalizability of the study findings.

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23 64 • One limitation of the study is that it includes WHO's defined four priority NCDs: diabetes  
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25 65 mellitus, cancer, chronic obstructive pulmonary diseases, and cardiovascular diseases. However,  
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27 66 NCDs are defined in a broader sense in Bangladesh, also including arsenicosis, kidney diseases,  
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29 67 mental health disorders, hearing disabilities, oral diseases, birth defects, road injuries, and violence  
30  
31 68 against women.

## 32 33 34 35 36 69 **Introduction**

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40 70 NCDs have become the dominant cause of disabilities and deaths globally, resulting in the loss of  
41  
42 71 41 million lives in 2018, and accounting for 71% of all deaths, over three-quarters of which  
43  
44 72 occurred in low and middle-income countries (1, 2). It has been projected that NCD-related deaths  
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46 73 will reach 52 million by 2030, if the current trends continue (3). A joint study conducted by the  
47  
48 74 World Economic Forum and Harvard University showed that NCD related costs will increase to  
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50 75 USD47 trillion, equivalent to 75% of global domestic product (GDP) from 2010 to 2030, if  
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52 76 appropriate measures are not taken (4).

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3 77 Primary healthcare (PHC) has been recognized as a powerful strategy as well as a practical  
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5 78 approach for preventing and managing NCDs because of its wide range of coverage, cost-  
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7 79 effectiveness, and healthcare infrastructure (5). As such, the WHO and the United Nations  
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10 80 Children's Fund (UNICEF) emphasized, in a joint declaration, the importance and adoption of the  
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12 81 PHC approach to achieve global health goals (6). In past decades, numerous efforts have also been  
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15 82 proposed and/or advocated to prepare the primary healthcare system as an effective mechanism  
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17 83 for preventing and managing NCDs at the individual and population levels (7-10).  
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20 84 In recent years, Bangladesh has made remarkable advances in health outcomes with declined  
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22 85 maternal as well as child mortality, and fertility rates, increased longevity, coverage of  
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24 86 vaccinations, and vitamin A and D supplementation (11-13). However, the World Bank (WB)  
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27 87 reported that the country is currently undergoing socio-demographic and epidemiological  
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29 88 transitions (14). Demographic transitions such as increasing longevity and decreasing fertility are  
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31 89 thus fuelling shifts in disease epidemiology, wherein NCDs are becoming evident, and infectious  
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33 90 diseases are taking a back seat (15, 16). Studies conducted in various geographical locations  
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35 91 (rural/urban settings), among different age groups, sexes, and ethnicities in Bangladesh showed  
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37 92 that the prevalence of NCDs had been rapidly increasing over the last decades (17-20). The Global  
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39 93 Burden of Diseases study reported that the proportion of deaths from NCDs gradually increased  
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41 94 in Bangladesh from 43.4% in 2000, to 66.9% in 2015 (21). In 2016, an estimated 8,56,000 deaths  
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43 95 (67% of total deaths) were attributed to NCDs, which was approximately 64% of the country's  
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45 96 disease burden (22). Previous studies also noted that an alarming increase of NCD-related factors  
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47 97 such as life-style changes (sedentary behavior), unhealthy diets (processed/highly flavored foods),  
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3 98 and harmful use of tobacco products (18, 23) will lead to the rise of NCDs in the coming years  
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5 99 unless appropriate measures are taken (24-27).  
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9 100 Historically, in Bangladesh, the primary healthcare system focused on responding to acute  
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11 101 conditions, primarily infectious diseases and parasitic infestations (15, 28). A large share of  
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13 102 healthcare resources and the primary healthcare workforce being deployed mainly for family  
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15 103 planning as well as maternal and child health services (15, 28). Consequently, the focus on NCDs  
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17 104 remained less prioritized over the decades. Studies showed that the shifting of epidemiological and  
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19 105 demographic conditions could pose new challenges (aging population, urban sprawl,  
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21 106 environmental degradation) for Bangladesh's primary healthcare system (14, 29, 30). NCD related  
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23 107 services are required for continuous facility-based healthcare and family support, involving higher  
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25 108 treatment costs, skilled and qualified healthcare workforces, constant supplies of medical  
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27 109 equipment, medicines, and so forth. Presumably, people living in rural settings (approximately  
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29 110 70% of the country's total population) (31) are likely to be substantially affected by NCDs due to  
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31 111 insufficient healthcare facilities and infrastructure, unavailability of healthcare professionals,  
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33 112 lower socio-economic conditions (e.g., poverty, and income inequality), and disadvantaged social  
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35 113 positions (e.g., illiteracy, lack of awareness, and poor health education) (32, 33).  
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45 115 The primary healthcare system in Bangladesh has an extensive network of healthcare facilities at  
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47 116 the Upazila (sub-district) level (Figure 1), which is responsible for delivering basic healthcare  
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49 117 services (vaccination, reproductive and child healthcare, nutrition and health education, screening  
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51 118 of NCDs, treating common disease, and referral to higher facilities) in both community and facility  
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3 119 levels (34). Although some recent studies addressed the prevalence of NCDs and its associated  
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5 120 factors (17-19, 29, 35, 36), the capacity of Bangladesh's primary healthcare system, which is the  
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7 121 first-line contact for the health needs of approximately two-thirds of the population (23, 35), has  
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9 122 not been adequately investigated. A few studies were conducted with a specific focus on service  
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11 123 availability or general readiness of the facilities at the Upazila Health Complex (UHC) (primary  
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13 124 level hospitals located at the sub-district), and District Hospitals (secondary-level hospitals located  
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15 125 in the district) for diabetes and/or hypertension (37, 38). However, a comprehensive analysis of  
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17 126 the readiness of the primary healthcare system (i.e., service, workforce, information systems,  
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19 127 supplies and logistics, leadership and governance, and financing) largely remain under-researched.  
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21 128 Given the importance of better planning, best use of resources, and ensuring complete health needs,  
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23 129 the readiness of the primary level healthcare system is vital to address the rising burden of NCDs.  
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25 130 Thus, this study protocol is designed to evaluate research questions/objectives regarding the  
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27 131 primary health system's readiness to prevent and manage NCDs. The outcomes of this study  
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29 132 protocol will address a critical information gap, and eventually help to guide public health  
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31 133 decisions for preventing and managing NCDs in Bangladesh and similar settings elsewhere.  
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### 39 134 **Research objective**

### 40 41 42 135 **General objective**

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46 136 The overall objective of this study protocol is to outline a study design to explore the primary  
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48 137 healthcare system's readiness to prevent and manage NCDs, which is comprised of the following  
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50 138 specific objectives.  
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## 139 **Specific objectives**

- 140 1. To assess the readiness of the Bangladesh primary healthcare system in preventing and  
 141 managing NCDs.
- 142 2. To evaluate the characteristics of community members and their contexts for receiving  
 143 services from the primary healthcare level for preventing and managing NCDs.
- 144 3. To identify gaps and opportunities in existing NCDs prevention and management services  
 145 at the primary healthcare system, and explore feasible ways for service optimization.

## 146 **Outcomes measure**

147 The outcomes of the current study will be the readiness (availability and functions) of a set of  
 148 supportive items that have been identified in the WHO PEN package, and indicators proposed in  
 149 the WHO SARA methodology. These items will be measured under three major categories: (i)  
 150 staff & guidelines, (ii) basic medicine and commodities, and (iii) diagnostic equipment.  
 151 Additionally, the capacity of several health system components, and community contexts that  
 152 influence NCDs related service organization and delivery will be assessed, as presented in Table  
 153 1.

154  
 155 Table 1. Overview of study objectives, outcomes, indicators, and data sources

Objectives	Questions to be answered	Outcomes to be measured	Indicators/ Possible codes (but not limited to what are presented here)	Data sources
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Objective 1	Is the primary healthcare level aware about the burden and magnitudes of NCDs?	Awareness and concern of the primary healthcare level regarding NCDs.	Facility-level NCD statistics; support, service utilization; qualitative codes/themes such as service providers' knowledge and about health seeking process, attitude, and practice of the affected population.	Survey of health facilities, and Key Informant Interviews
	Are the primary healthcare level facilities ready to manage NCDs, and if so, to what extent?	Capacity of primary healthcare level facilities to manage NCDs.	Three major categories (groups) of items viz. (i) staff & guideline (ii) basic medicine and commodities, and (iii) diagnostic equipments, which has been identified in the WHO SARA manual, qualitative codes/themes such as service provision and resource mobilization and allocation, service utilization challenges and solutions.	
	Are the primary healthcare level facilities ready to establish effective surveillance, information and referral systems to manage NCDs, and if so, to what extent?	Capacity of primary healthcare level facilities for surveillance, information management and referral systems to manage NCDs.	Facility-level NCD statistics, qualitative codes/themes such as NCD prevalence, individual risk factors identification and documentation, database creation and management.	
	Has the primary healthcare level facilities effective leadership, governance, and stewardship capacity, and if	Leadership, governance, and stewardship capacity of primary healthcare level facilities managers/administrators.	Qualitative codes/themes such as coordination and communicate among stakeholders/parties, work plan/job description for care providers/field staff, need assessment and professional trainings supports, non-monetary	Key Informant Interviews

	so, to what extent?		strategy (appreciation/motivation), challenge identification for services delivery, timely follow-up and review work progress, teamwork and collaboration, maximization of resource usages	
Objective 2	Are the community members ready to receive services from primary care settings to prevent and manage NCDs and if so, to what extent?	Community characteristics and contexts within which NCD services are received.	Qualitative codes/themes such as health-seeking process, self-management practice, perception, risk factors, barriers and enablers of the current NCD services	Survey of household, Focus Group Discussions, and In-depth Interviews
	Are the community members capable to bear NCD related cost and if so, to what extent?	NCD related healthcare expenditure	Out-of-pocket expenditure for NCDs. qualitative codes/themes (Out-of-pocket expenditure for treatment and travel, availability of supports at primary healthcare settings).	Survey of household, and Focus Group Discussions, and In-depth Interviews
Objective 3	Are there gaps and opportunities in the existing healthcare system to manage NCDs, and if so, to what extent services may be optimized?	Identification of gaps and opportunities, along with proposals for future directions	Facility-level NCD statistics such as service provision, resource limitation and allocation, household level health factors, qualitative codes/themes such as health-seeking process, attitude, and practice of the communities, service gaps and expectations.	Survey of household and facilities, and Focus Group Discussions, In-depth Interviews, Key Informant Interviews

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157 **Methods**

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3 158 **Study context, primary healthcare system, and health service delivery in**  
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6 159 **Bangladesh**  
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10 160 Bangladesh's health system is pluralistic, wherein multiple actors and providers play roles by  
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12 161 applying a mixed system of medical practices (39). The Ministry of Health and Family Welfare  
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14 162 (MoHFW) is the apex body for designing, formulating, and overseeing health relation actions, and  
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16 163 has two divisions: Health Services, and Medical Education and Family Welfare (40). The health  
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18 164 services are provided by four key formal providers: the government or public sector, private  
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20 165 operators for profit, non-governmental organizations (NGOs), and charities (not-for-profit) or  
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22 166 donor agencies (developing partners/aids). Apart from these, there is an extensive pervasiveness  
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24 167 across the country of informal health care providers (i.e., traditional healers, faith healers,  
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26 168 herbalists, quacks, and homeopaths). According to its administrative structure, Bangladesh has  
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28 169 approximately 87,310 villages, 40,977 wards, 4553 Unions, 490 Upazilas, 64 districts, 4  
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30 170 metropolitan cities, and 8 divisions) (32). Based on this, the healthcare services are organized and  
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32 171 delivered through three levels: tertiary, secondary, and primary levels (40). The tertiary level  
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34 172 facilities mostly exist at the divisional and national levels, providing specialized and advanced  
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36 173 care. The secondary level exists at the district level, providing specialized care in addition to  
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38 174 primary healthcare. Finally, the primary care level exists at the Upazila level, which provides basic  
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40 175 healthcare services (24, 41) There are various type of healthcare facilities in the primary care level  
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42 176 including 'Community Clinics (CC)' located at the village/ward, Union Health and Family  
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44 177 Welfare Centers (UHFWC), Rural Health Clinics (RHC), and Union Sub-centers (UHC) are set-  
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46 178 up at the union level (several villages comprise a union, which is the lowest administrative unit in  
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48 179 Bangladesh). The UHC hospitals are situated at the Upazila headquarters (several unions comprise  
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3 180 a Upazila, and a few Upazilas comprise a district) (Figure 1). According to the latest data, there  
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5 181 are 420 UHC hospitals with 15,958 inpatient beds (31–50 beds per UHC) across the country, which  
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8 182 are linked to the district level hospitals (100-250 beds) (Table 2) (32).  
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11 183 Figure 1: Health service delivery organizational structure in Bangladesh [to be inserted here]  
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31 189 Source: Adapted from Bangladesh Health System Review (41)  
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41 192 Table 2: Primary healthcare facilities in the public sector in Bangladesh  
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Level	Type of facility	Type of service	No. of facilities (n)
Upazila	Upazila health complex (50-bed)	Hospital	297
	Upazila health complex (31-bed)	Hospital	112
	Upazila health complex (10-bed)	Hospital	11
		<b>Total of Upazila health complexes</b>	<b>420</b>
	<b>Hospitals outside health complexes</b>		
	31-bed hospital	Hospital	4

	30-bed hospital	Hospital	1
	25-bed hospital	Hospital	1
	Mother and child welfare center	Hospital	12
<b>Union</b>	<b><i>Union-level facilities under DGHS</i></b>		
	20-bed hospital	Hospital	32
	10-bed hospital	Hospital	19
	Union subcenter	Outpatient only	1,275
	Union health and family welfare center	Outpatient only	87
	<b><i>Union-level facilities under DGFP</i></b>		
	Mother and child welfare center	Hospital	24
	Union health and family welfare center	Outpatient only	3,924
<b>Ward</b>	Community clinic	Outpatient only	13,442

Adapted from Bangladesh Health Facility Survey 2017 (42)

Abbreviation for Table 2. DGHS=Directorate General of Health Services, DGFP=Directorate General of Family Planning

## Study population

Bangladesh's health system is considerably uniform in terms of health service delivery, organization of the healthcare workforce, logistics and supplies. However, distinctive socio-demographic characteristics, geographic features, livelihood patterns, and sociocultural practices may affect different health outcomes. Taking this variation into account, this study will cover various regions applying a multi-stage cluster random sampling approach. At the first step of this process, four administrative divisions (out of eight) were randomly selected: *Dhaka, Khulna, Rajshahi, and Sylhet*. One administrative district was then randomly selected from each division: *Cumilla, Jhenaidah Rajshahi, and Sylhet respectively* (Figure 2). Finally, two sub-districts (locally



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3 205 known as Upazila) were selected at random from each of these four districts. Due to various factors  
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5 206 such as study budget and field constraints, complex healthcare delivery mechanisms, target groups,  
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8 207 resource mobilization and allocation modality, and relatively small coverage, we decided to  
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10 208 exclude metropolitan cities in this study.  
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17 210 Figure 2: Study site map [to be inserted here]  
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## 26 213 **Study design and conceptual frameworks**

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30 214 This study will use a mixed-method study design (Figure 3), which will include both quantitative  
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32 215 and qualitative approaches. A relevant theoretical framework will be implied to address each  
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35 216 objective/research question.  
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41 218 In the quantitative part, WHO's SARA methodology and PEN Disease Interventions for Primary  
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43 219 Health Care frameworks will be used to assess the readiness of healthcare facilities to deliver  
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46 220 NCD-related services. WHO's SARA methodology offers core indicators of general and service-  
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48 221 specific readiness, with service availability (physical presence of services), and readiness (capacity  
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50 222 to deliver services) being the two major domains. General and service specific indicators included  
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52 223 1) trained staff and guidelines, 2) availability of basic equipment, 3) medicines and commodities  
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3 224 and diagnostics, and 4) standard precaution for infection control (43). Likewise, PEN Disease  
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5 225 Interventions for Primary Health Care identified a set of core technologies, medicines, risk  
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7 226 prediction tools, and essential NCD interventions at the primary healthcare in low-resource settings  
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10 227 (44). These indicators will be used to assess the availability and readiness of relevant health system  
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12 228 components (i.e, health service delivery, healthcare workforce, supplies and logistics).  
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19 230 In the qualitative component, this study will apply the ‘health system dynamics framework’  
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21 231 (Figure 4) to assess the characteristics of community members and their contexts regarding NCD  
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23 232 related service organization and delivery. This framework builds on the WHO’s previous health  
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25 233 system framework, the six building block model and concurrent approaches (45). However, the  
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27 234 health system dynamics framework consists of ten components (i.e., goals and outcomes, values  
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29 235 and principles, service delivery, population, context, leadership and governance, finance, human  
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31 236 resources, infrastructure and supplies, knowledge and information). This framework can  
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33 237 adequately explain how and whether different health system elements within a broader societal  
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35 238 context interact and influence each other, and how population/individuals' behavior and choices,  
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37 239 and the process affect this mechanism. This framework will offer a comprehensive approach to  
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39 240 explore and explain how the primary health care system is constructed, and whether it is  
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41 241 functioning well within the study context (46).  
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Figure 3: Study design with data collection method and analysis [to be inserted here]

Abbreviation for Figure 3. FGD=Focus Group Discussions, KII=Key Informant Interviews, IDI=In-depth Interviews, WHO SARA=World Health Organization Service Availability and Readiness Assessment, NCD PEN= Noncommunicable Disease Package of Essential Interventions

Figure 4: Health system dynamics framework [to be inserted here]

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3 262 Source: Adapted from J. van Olmen et al. (46)  
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### 13 265 **Study participants and data collection** 14 15

16  
17 266 In the quantitative component, we will collect data from primary-level healthcare facilities and  
18  
19 267 households located in the randomly selected eight sub-districts. Using the WHO's SARA and PEN  
20  
21 268 interventions framework, facility-level data will be collected from both public (UHC, USC, RHC,  
22  
23 269 and CC) and privately-run healthcare facilities (private clinics/hospitals) (Table 3) to assess the  
24  
25  
26 270 readiness of the primary level healthcare facilities to prevent and manage NCDs. The heads of the  
27  
28 271 respective healthcare facilities such as managers, or any designated persons will be interviewed to  
29  
30  
31 272 collect health service data. Additionally, epidemiological, socio-demographic, and context-  
32  
33 273 specific data will be collected using household survey methods. Adult community members (aged  
34  
35 274  $\geq 18$  years) will be interviewed using cross-section survey design to obtain socio-demographic and  
36  
37 275 NCD-related data from the selected sub-districts.  
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44 277 In the qualitative component, we will collect data from community members, healthcare providers,  
45  
46 278 and policy-makers regarding the characteristics of communities, and their contexts that influence  
47  
48 279 access to and utilization of NCD related services at the primary level facilities. At the same time,  
49  
50  
51 280 information on the views, perceptions and understanding, life-style factors, perspectives, and  
52  
53 281 experiences of communities regarding NCD-related treatment access, adherence, follow-up, and  
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282 referral systems will be collected by interviewing (IDIs, FGDs, and KIIs) key stakeholders such  
 283 as policy planners, health administrators, physicians, researchers, and epidemiologists. Policy-  
 284 oriented and programmatic data will be collected through collating and appraising the relevant key  
 285 policy documents, strategy papers, guidelines, protocols, action plans, and related documents.

286

287 Table 3: Data collection processes and study participants

Methods	Participant(s)								Other(s)
	Rajshahi		Sylhet		Cumilla		Jhenaidah		
Household survey (n=1323)	Households (n=254)		Households (n=353)		Households (n=539)		Households (n=176)		X
	Tanore	Puthia	Kanaighat	Surma (Upazila)	Daudkandi	Homna	Shailkupa	Harinakunda	
Facility survey (n=125)	Upazila Health Complex (n=1), Private Hospital/Clinic (n=2), NGO Hospital/Clinic (n=2), Union Health Center/Union sub-centre (n=4), Community Clinic (n=6) [in each Upazila (n=16)]								X
In-depth Interviews (IDIs) [n=16]	IDI1: With front-line health staff [Health Assistant/Family Welfare Visitor/Sub Assistant Community Medical Officer (n=2)]; IDI2: With private vendor/pharmacist/traditional provider (Village Doctor, faith healers, Kabiraj (n=2)) [In each Upazila, (n=4)]								X
Focus Group Discussions (FGDs) [n=16]	FGD1: With community [people with at least one NCD] (n=2); FGD2: With community [people with no NCD] (n=2) [In each Upazila, (n=4)]								X
Key Informant Interviews (KIIs) [n=13-15]	KII1: With Upazila Health and Family Planning Officer/Medical Officer/Residential Medical Officer (n=1) [In each Upazila, (n=4)]				KII2: With district health manager [civil surgeon] (n=4); KII3: With director/line director/deputy director of IMS of Directorate General of Health Services (DGHS)(n=1); KII4: With director/line director/ deputy director of Non-Communicable Diseases Control (NCDC) of DGHS (n=1); KII5: With director/line director/ deputy director of primary healthcare of DGHS (n=1); KII6-7: Policy planner/independent				

		consultant/specialist (n=1-2); KII8-9: Private doctor/NGO workers at district (n=1-2)
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288 Abbreviation for Table 3. FGD=Focus Group Discussions, KII=Key Informant Interviews,  
 289 IDI=In-depth Interviews, MIS=Management Information System, NCD=Non-communicable  
 290 Disease

291

## 292 **Sample size calculation**

### 293 *Quantitative (household survey)*

294 For the household survey, we used the following formula.

295 Here,

296 n=the desired sample size (respondents)

297 p=the proportion of the target population. We took the nationally representative data that  
 298 reported the age-adjusted prevalence of diabetes as 9.7% (47) into account, which was the  
 299 highest in Bangladesh.

300 p=1-p

301 d=degree of accuracy desired, which is set at (0.02) 2%.

302  $Z^{1-\alpha/2}$ =the standard normal deviate usually set at 1.96 corresponds to the 95% confidence  
 303 interval)

304

$$305 \quad n = \frac{Z^2 * P(1 - P)}{d^2}$$

$$306 \quad n = \frac{(1.96)^2 * 0.097(1 - 0.097)}{(0.02)^2}$$

$$307 \quad n = \frac{3.84 * 0.097 * 0.903}{0.0004}$$

$$308 \quad n = \frac{3.84 * 0.087}{0.0004}$$

$$n = \frac{0.336}{0.0004}$$

n=840 (respondents)

This calculation provided the minimum required sample size of 840 respondents. Considering the nationwide coverage and socio-demographic heterogeneity of the population, the sample size was multiplied by the design effect of 1.5 (48), to adjust sampling variance caused by the multi-stage study design (49), which resulted in a sample size of  $840 \times 1.5 = 1260$ . Additionally, a 5% non-sampling error applied by another study (49) was considered, which increased the sample size by 63, resulting in a final sample size of 1323 respondents.

### ***Quantitative (healthcare facility survey)***

We have used the formula (below) taken from the sampling manual for facility surveys developed by MEASURE Evaluation (50) to calculate sample size for the healthcare facilities.

Here,

n=the desired sample size

p=anticipated proportion of the facilities with the attribute of interest as 50%, reported by a previous study (51).

d=design effect as 1.2 and the width of confidence interval for key estimates at  $\pm 0.2\%$ .

$V^2$ =the relative variance. It is the square of the relative error taken as 20%.

$Z^{1-\alpha/2}$ =the standard normal deviate usually set at 1.96 corresponding to the 95% confidence interval)

$$n = \frac{Z^2 * P * d^2}{V^2 * P}$$

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4 330 
$$n = \frac{(1.96)^2 * 0.5 * 1.2}{(0.2)^2 * 0.5}$$

5  
6 331 
$$n = \frac{3.84 * 0.6}{0.04 * 0.5}$$

7  
8  
9 332 
$$n = \frac{2.304}{0.02}$$

10  
11  
12 333 n=115 (healthcare facilities)

13  
14 334 This calculation yielded the minimum required sample size of 115 healthcare facilities.

15  
16 335 Anticipating a 10% non-response rate, the sample size was further increased by 15. Thus, the final  
17  
18 336 sample size was 125.

19  
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21  
22 337 ***Sample size for qualitative component (IDIs, FGDs, and KIIs)***

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24  
25 338 The number of interviews (IDIs, KIIs, and FGDs) will be determined on the principle of ‘data  
26  
27 339 saturation’ (a point of time when no new information, themes, dimensions emerge) (52). Based on  
28  
29 340 this principle, the final number of interviews may not be determined until the complete list of  
30  
31 341 interviews are conducted. However, we propose to conduct 16 IDIs, 13-15 KIIs, and 16 FGDs  
32  
33 342 according to Guest et al.’s (52) proposition to reach data saturation. This number may differ based  
34  
35 343 on the data redundancy noted during the data collection.  
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40 344 **Sampling strategy**

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43 345 ***Quantitative (household survey)***

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46  
47 346 For household surveys, this study will adopt a multi-stage stratified cluster sampling procedure  
48  
49 347 (Figure 5) to ensure nationwide coverage, effective management, and supervision of data  
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51 348 collection activities. Bangladesh is divided into eight administrative divisions: Barisal, Chittagong,  
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3 349 Dhaka, Khulna, Mymensingh, Rajshahi, Rangpur, and Sylhet. Each division consists of several  
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5 350 districts, and each district is further divided into sub-districts. Each sub-district has several *Union*  
6  
7 351 *Parishads* in rural areas, which are further subdivided into *mouzas*. In urban areas, each sub-district  
8  
9 352 is divided into several *mohallas*. The entire country has been divided by the Bangladesh Bureau  
10  
11 353 of Statistics (BBS) into 2,96,718 enumeration areas (EAs) according to the enumeration area map  
12  
13 354 in the latest 'Population and Housing Census' (53). On an average, each EA consists of 120  
14  
15 355 households (54). For its sampling frame, this study used the list of EAs provided by the BBS. In  
16  
17 356 the first stage, it randomly selected four administrative divisions. From each of the selected  
18  
19 357 divisions, a district was randomly selected. The number of participants required was determined  
20  
21 358 by the proportion of the population in the urban, and rural areas (53). Based on the latest estimated  
22  
23 359 population in the country, the rural and urban populations were categorized as 36% and 64%,  
24  
25 360 respectively (55). The sample size of 1323 were divided into all the four randomly chosen districts.  
26  
27 361 The smallest number of participants required in any single EA was 63 (in *Jhenaidah*). This number  
28  
29 362 was considered as the maximum sampling intensity in an available EA. Thereafter, 17 EAs in rural,  
30  
31 363 and nine EAs in urban areas were randomly chosen. In the next stage, a systematic random  
32  
33 364 sampling procedure will be used to select 63 households, starting from the center of an EA, which  
34  
35 365 will be located by asking local residents/community members. Field enumerators will reckon the  
36  
37 366 household closest to the center point as the first household to be enrolled. In the next stage,  
38  
39 367 applying inclusion criteria (age  $\geq$  18 years, not pregnant, no history of surgery for the last three  
40  
41 368 months) reported by a previous study, an adult aged 18 years and above will be interviewed (56).  
42  
43 369 Data will be collected from an eligible member in the selected household following the 'Kish Grid'  
44  
45 370 method (57), which will allow us to interview only a single member of the selected household. In  
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3 371 case of the unavailability of household members (i.e, household shut down during data collection,  
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5 372 or decline to participate), the next eligible household will be approached. The second eligible  
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7 373 household will be selected by skipping the next household, and choosing the subsequent household  
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10 374 (i.e, every alternate household). This process will be repeatedly followed until the expected sample  
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12 375 size is reached.  
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Figure 5: Sampling strategy [to be inserted here]

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3 387 Purposive sampling strategy will be adopted for selecting the interview participants (58, 59). Some  
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5 388 pre-defined inclusion criteria [(i) aged  $\geq 18$  years living in the community; (ii) persons who are  
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7 389 better aware of NCDs (i.e., school teachers, faith leaders, village head); (ii) person engaged in  
8  
9 390 NCD related policy formulation or having expertise (policy planners, individual consultants, NGO  
10  
11 391 activities, govt. official); (iv) willing to participate voluntarily] will be applied to select the  
12  
13 392 participants. However, we will take the following three basic principles, widely used in purposive  
14  
15 393 sampling, into account (12): (i) maximum variation (we will include participant from roles and  
16  
17 394 backgrounds, locations/sub-districts, gender, age), (ii) iterative process (we will consider re-  
18  
19 395 interviewing and revisiting the participant if required to probe or validate specific information),  
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21 396 and (iii) reflexivity (assess the self-roles/researchers).  
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## 30 **Data analysis**

### 31 ***Quantitative (household survey)***

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37 400 Household level quantitative data will be analyzed to uncover community related factors  
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39 401 associated with NCD related service organization and delivery. Numerical data will be presented  
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41 402 using means ( $\pm$ standard deviations (SD)) or medians (percentiles), where appropriate for  
42  
43 403 continuous data, and relative frequencies (percentages) for categorical data. Two independent  
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45 404 samples t-test, ANOVA and chi-square test methods will be used for univariate analysis, and  
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47 405 multiple regression analysis will be used for multivariable analysis.  
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3 407 ***Quantitative (healthcare facility survey)***  
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6 408 Facility-level quantitative data will be analyzed following the SARA manual to assess service  
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8 409 specific readiness of the primary healthcare facilities (60). The SARA manual included a list of  
9  
10 410 items grouped into three major categories: (i) essential medicine and commodities, (ii) diagnostic  
11  
12 411 equipment, and (iii) staff & guidelines. A composite score (0-100%) will be created to analyze  
13  
14 412 facility-level quantitative data where the total target will be 100%. As the expected target is 100%,  
15  
16 413 each individual category (staff & guideline, equipment, and basic medicine) will be given equal  
17  
18 414 weight, which is 33.3% (100%/3). Further, each individual category will comprise several  
19  
20 415 indicators such as (i) staff & guidelines (*diabetes management guidelines, hypertension*  
21  
22 416 *management guidelines, and trained staff*), (ii) equipment (*i.e., stethoscope, spacers, and oxygen*),  
23  
24 417 and (iii) basic medicines (*i.e., enalapril, procarbazine, methyldopa, and glibenclamide*). The  
25  
26 418 percent for each indicator within the domain will be equal to 33.3% divided by the number of  
27  
28 419 indicators within that domain. Then, the facility that scores at least half (equivalent to the median  
29  
30 420 value of 16.7% and above) in each domain, and adding up to the overall of 50% or more will be  
31  
32 421 considered to have “high readiness” for the outpatient management of NCDs, while those with less  
33  
34 422 than 50% are considered to have “low readiness (43).”  
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42 423 ***Qualitative (IDIs, FGDs, and KIIs)***  
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45 424 A thematic analysis approach will be used to analyze textual data (IDIs, KIIs, and FGDs) (61).  
46  
47 425 Initially, we will transcribe the interviews in verbatim fashion, and subsequently translate them  
48  
49 426 into English. At this step, all authors will independently read the interviews and familiarize  
50  
51 427 themselves with the information and contexts. In the next step, we will code the data in three steps  
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3 428 (open code, axial code, and selective codes). Once data coding is completed, we will form several  
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5 429 clusters (comprise a few codes), and then a few themes (comprise a few clusters). Finally, we will  
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7  
8 430 present the findings under several themes. A stepwise procedure will be followed in this process  
9  
10 431 (29). All authors will independently prepare some codes and themes, and any disagreements will  
11  
12 432 be resolved following a discussion or consensus. Text management software (i.e., Nvivo, Atlas-ti)  
13  
14 433 will be used to analyze data. A triangulation of methods and participants will be performed to  
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16  
17 434 increase data validity and research rigors.

### 20 435 **Patient and public involvement**

21  
22  
23  
24 436 No patient involved

### 27 437 **Participants' consent**

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31 438 At the beginning of the interview, data collectors will inform participants about the purpose of the  
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33 439 study. An Explanatory Statement will then be provided by to the participants, which they can read,  
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35 440 and then ask any questions they have. Participants are then required to read and sign a consent  
36  
37  
38 441 form, agreeing to participate. The consent form (written in Bangla) will explain the purpose of the  
39  
40 442 study, the freedom to participate, and how participants' information will be used while maintaining  
41  
42  
43 443 individual/facility confidentiality.

### 46 444 **Workshop for data collection team and pilot study**

47  
48  
49 445 Four university graduates with a background in research methods as well as data collection tools  
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51  
52 446 and techniques will be hired on an ad hoc basis. The first and second authors will train them on  
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3 447 data collection methods and techniques, and use the Research Electronic Data Capture (REDCap)  
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5 448 for collecting and recording data, and administering the questionnaire (62). REDCap is a secure  
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7 449 web-based application for completing electronic surveys and data collection for research studies.  
8  
9 450 It provides 1) a user-friendly interface with validated data entry; 2) audit trails for tracking data  
10  
11 451 manipulation; and 3) an automated export procedure for seamless data downloads to standard  
12  
13 452 statistical packages. All questionnaires, observation checklists, and interview guidelines will be  
14  
15 453 piloted in Sylhet and Rajshahi districts (beyond these sampled eight districts) to assess their  
16  
17 454 comprehensibility, appropriateness, and conformability to the participants and interviewers. Based  
18  
19 455 on the piloting, required changes will be made before finalizing the questionnaires, observation  
20  
21 456 checklists, and interview guidelines.  
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### 27 457 **Quality assurance measures for data collection**

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31 458 To ensure data quality, various steps such as accuracy, relevance, completeness, and consistency  
32  
33 459 of data will be monitored and checked by all investigators via REDCap application. In addition,  
34  
35 460 the student investigator will carry out a random consistency check for at least 5% of the  
36  
37 461 interviewed questionnaires. The student investigator will observe the interviews and group  
38  
39 462 discussion session by physical participation in the interview sessions. If physical presence of the  
40  
41 463 investigator becomes limited, the interview sessions will be observed via audio-visual technique  
42  
43 464 (Zoom Video Communication, Skype video chat or voice call). Supportive supervision will be  
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45 465 provided to the interviewers, if required.  
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### 50 466 **Ethical considerations**

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3 467 The project has been approved by the Monash University Human Research Ethics Committee  
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5 468 (Project ID: 27112). The ethical standards set by the ethics committee will be fully complied with  
6  
7 469 throughout the research process. Any sensitive and hidden issues will be addressed according to  
8  
9 470 the ethical values and standards established and exercised by the university and/or institution. The  
10  
11 471 study participants' confidentiality and anonymity will be maintained at all stages by removing  
12  
13 472 their names. During the data collection period, data will be saved in the secure REDCap web-based  
14  
15 473 application hosted at Monash University. The application will be accessible only by the research  
16  
17 474 team. When the data collection is completed, the data will be exported to IBM SPSS statistical  
18  
19 475 package, and will be saved in the secure faculty-allocated network storage (Monash (S:) drive).  
20  
21 476 Participants' identifiers such as names and designations will be removed from the main database  
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23 477 and saved in a separate secure electronic folder, and will not be used for data analysis.  
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## 29 478 **Dissemination of results and publications**

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32  
33 479 The research findings will be published in scientific public health journals. The published reports  
34  
35 480 will include group data only, and no individual data or information will be shared. Summary of  
36  
37 481 the research findings will be disseminated to the community through news media.  
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## 42 43 44 483 **Discussion**

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48 484 To the best of our knowledge, this is the first hybrid study that aims to provide a deeper analysis  
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50 485 and assessment of the primary healthcare system in Bangladesh in the context of NCD-related  
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52 486 services. Bangladesh's primary healthcare system is quite unitary (overly-centralized) in terms of  
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3 487 management structure, organizational hierarchy, resource allocation, workforce deployment,  
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5 488 health-seeking behavior, and sociocultural characteristics of the population (63). The proposed  
6  
7 489 study will fill critical information gaps in the NCD related service organization and delivery  
8  
9 490 mechanism. Since this study will reflect the holistic features of the primary healthcare system  
10  
11 491 currently functioning at sub-district level, it will constitute comprehensive information to assess  
12  
13 492 the current health system's extent of preparedness, and whether better NCD services at the  
14  
15 493 population level need to be provided. Therefore, the study findings will benefit policy planners,  
16  
17 494 program implementers, healthcare professionals, and community members to develop a need-  
18  
19 495 oriented, effective, and patient-centered NCD services mechanism at the primary healthcare level  
20  
21 496 in Bangladesh. Overall, the study findings will guide public health decisions for NCD prevention  
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23 497 and management efforts at the primary healthcare system.  
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### 29 498 **Abbreviations & acronyms**

30  
31  
32 499 CC=Community Clinic, DGHS=Directorate General of Health Services, FGD=Focus Group  
33  
34 500 Discussions, FWV=Family Welfare Visitor, KII=Key Informant Interviews, IDI=In-depth  
35  
36 501 Interviews, HA=Health Assistant, IMS=Information Management System, MO=Medical Officer,  
37  
38 502 NCDC=Non-Communicable Diseases, NCDC=Non-Communicable Diseases Control, , NCD  
39  
40 503 PEN= Noncommunicable Disease Package of Essential Interventions, NGOH/C=NGO  
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42 504 Hospital/Clinic, RMO=Residential Medical Officer, PH/C=Private Hospital/Clinic,  
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44 505 SACMO=Sub-Assistant Community Medical Officers, UHC= *Upazila* Health Complex,  
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46 506 (hospital), TBD= To Be Determined, UHC=*Union* Health Centre, USC=*Union* Sub-Centre  
47  
48 507 UHFPO=*Upazila* Health and Family Planning Officer, VD=Village Doctor, WHO SARA=World  
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50 508 Health Organization Service Availability and Readiness Assessment  
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3 509 **Author Contributions**  
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6 510 AK, NK, and BB conceived and designed the study. AK developed data collection tools, will  
7  
8 511 implement data collection activities, and prepare the first draft of the manuscript. NK and BB  
9  
10 512 revised the manuscript. BB provided overall stewardship. The final manuscript has been read and  
11  
12 513 approved by all authors.  
13  
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15

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17  
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19

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21  
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23 516  
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26 517 **Availability of data and materials**  
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30 518 Not applicable  
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36 520 **Conflicts of interest**  
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40 521 All the authors declare that they have no conflicts of interest.  
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42

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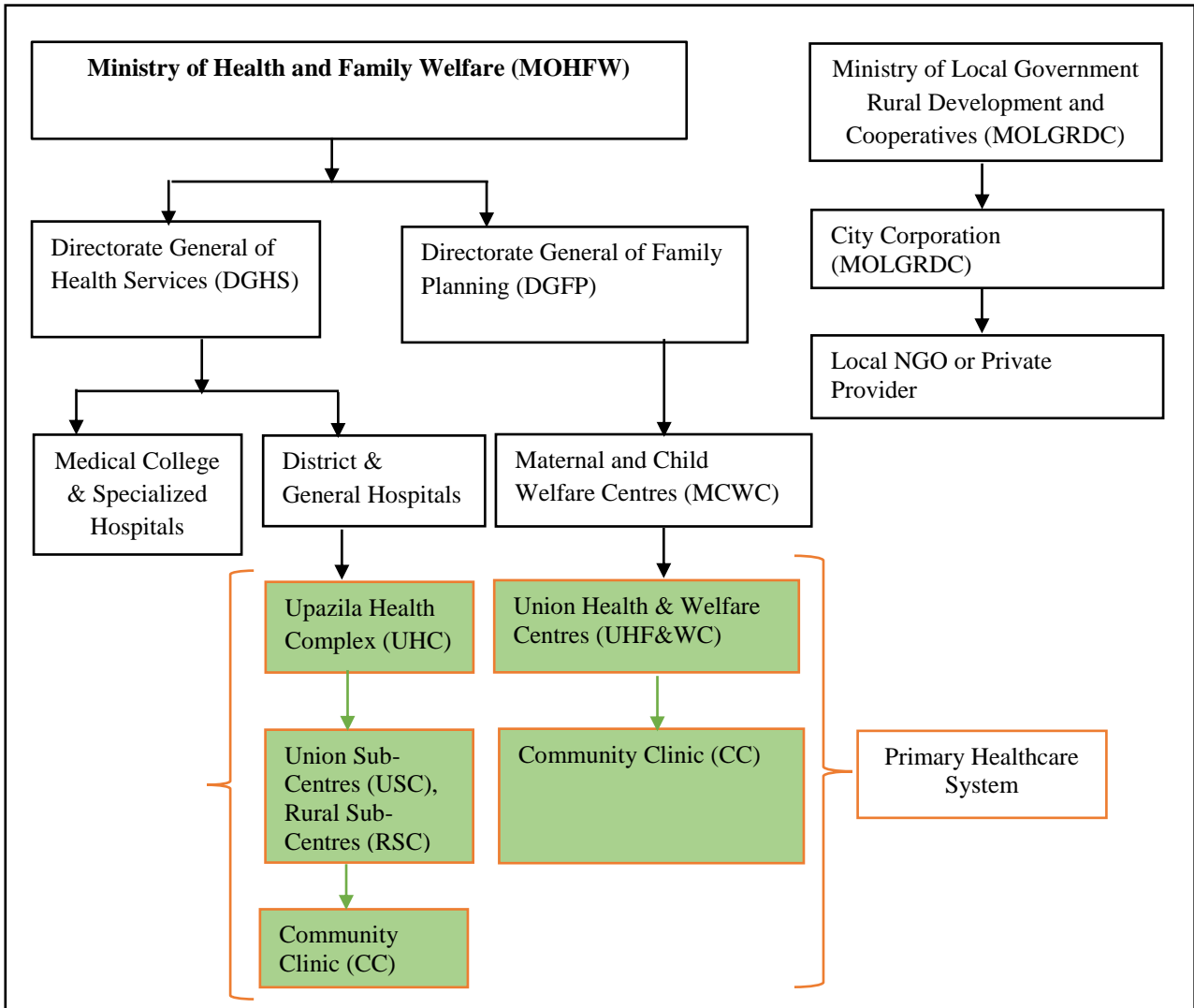
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Figure 1: Health service delivery organizational structure in Bangladesh





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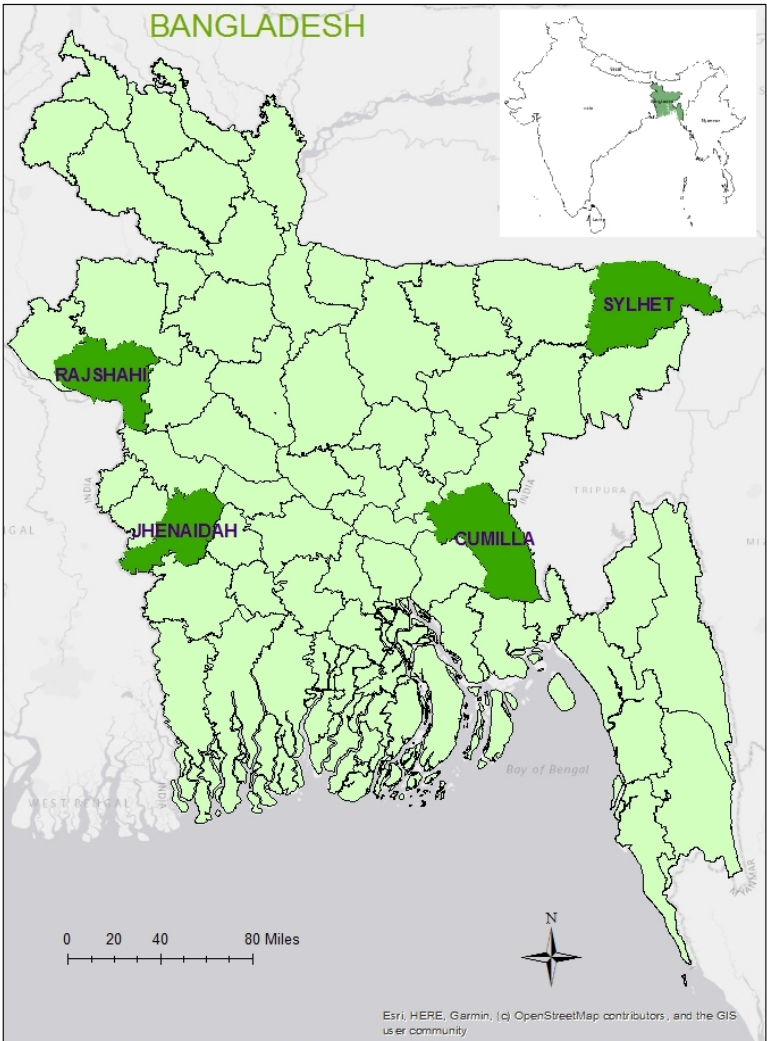


Figure 2

215x279mm (96 x 96 DPI)

Figure 3: Study design with data collection method and analysis

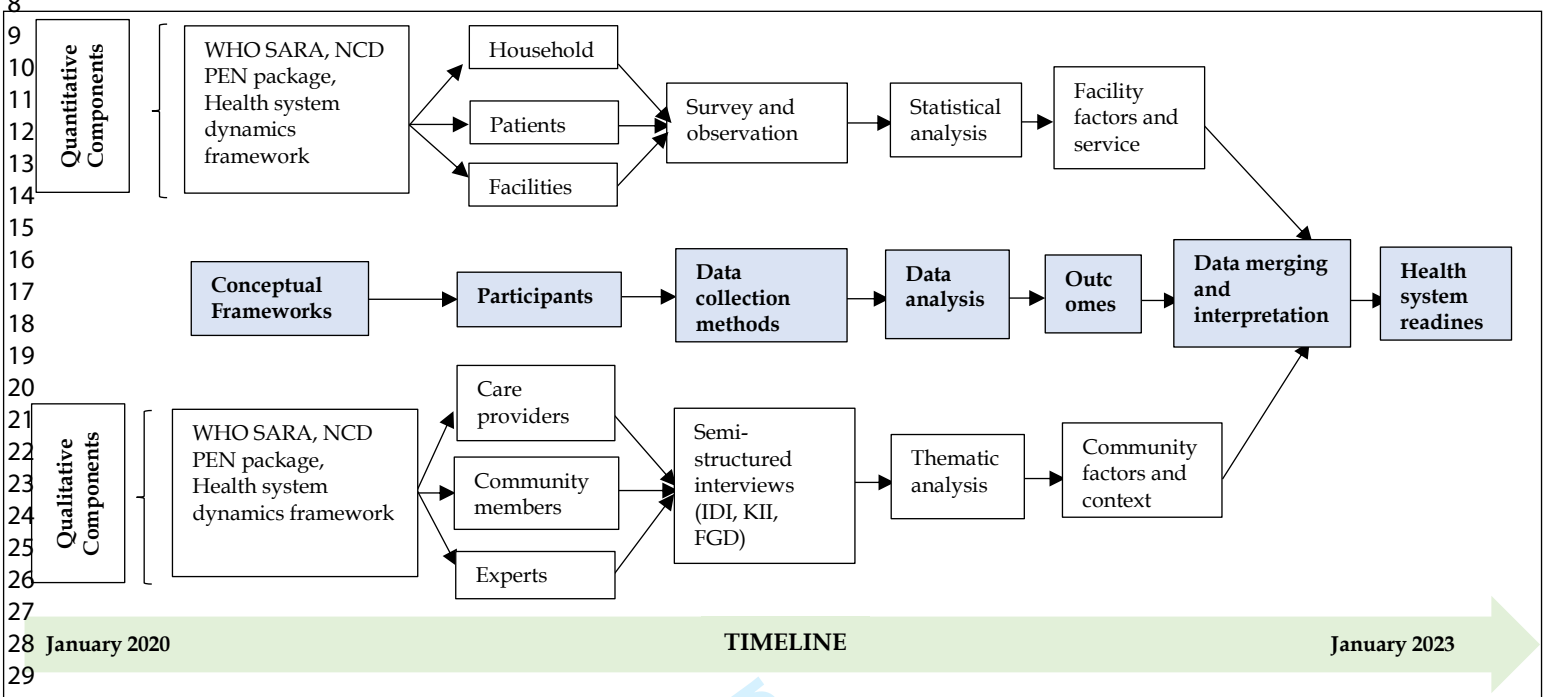




Figure 4: Health system dynamics framework

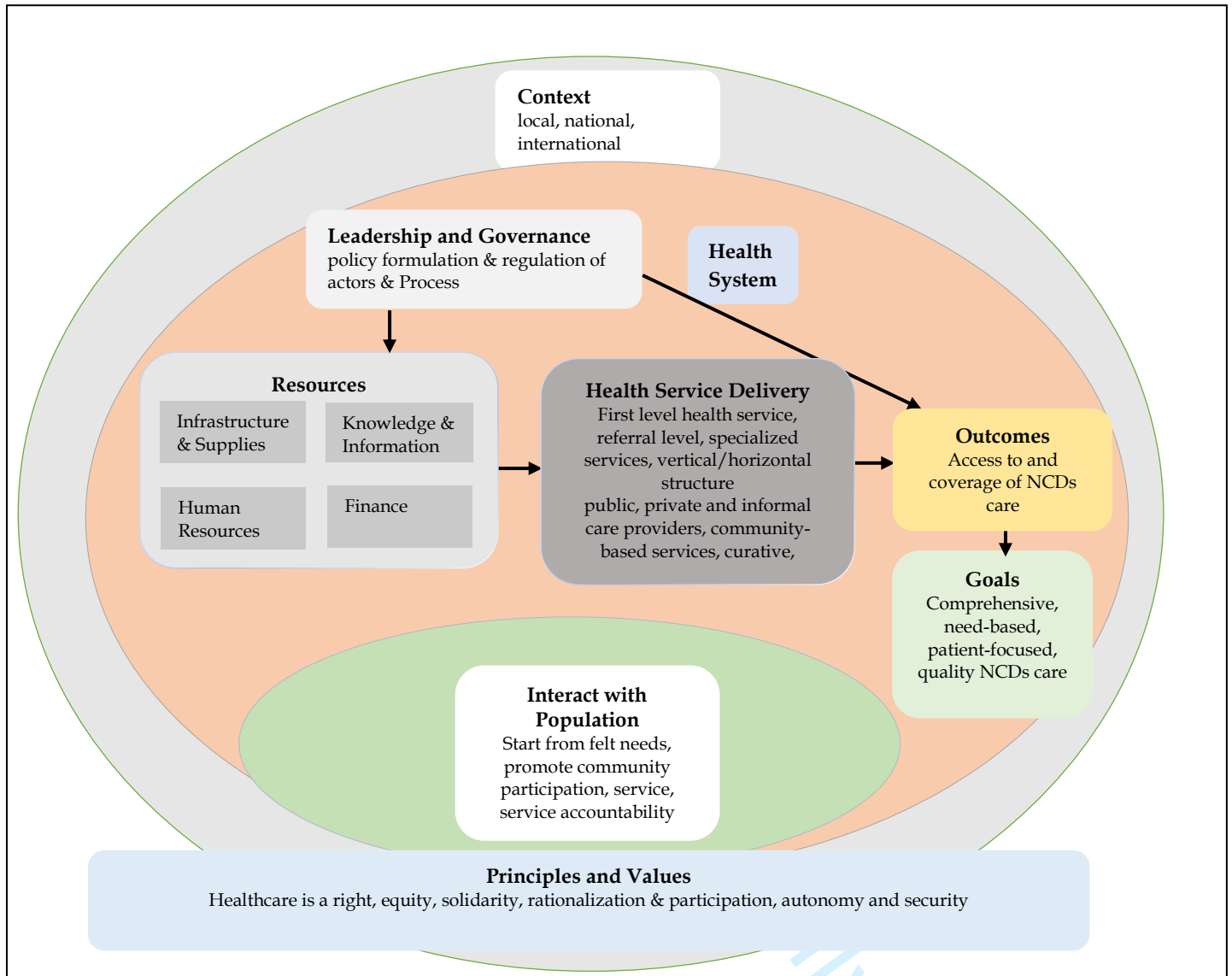
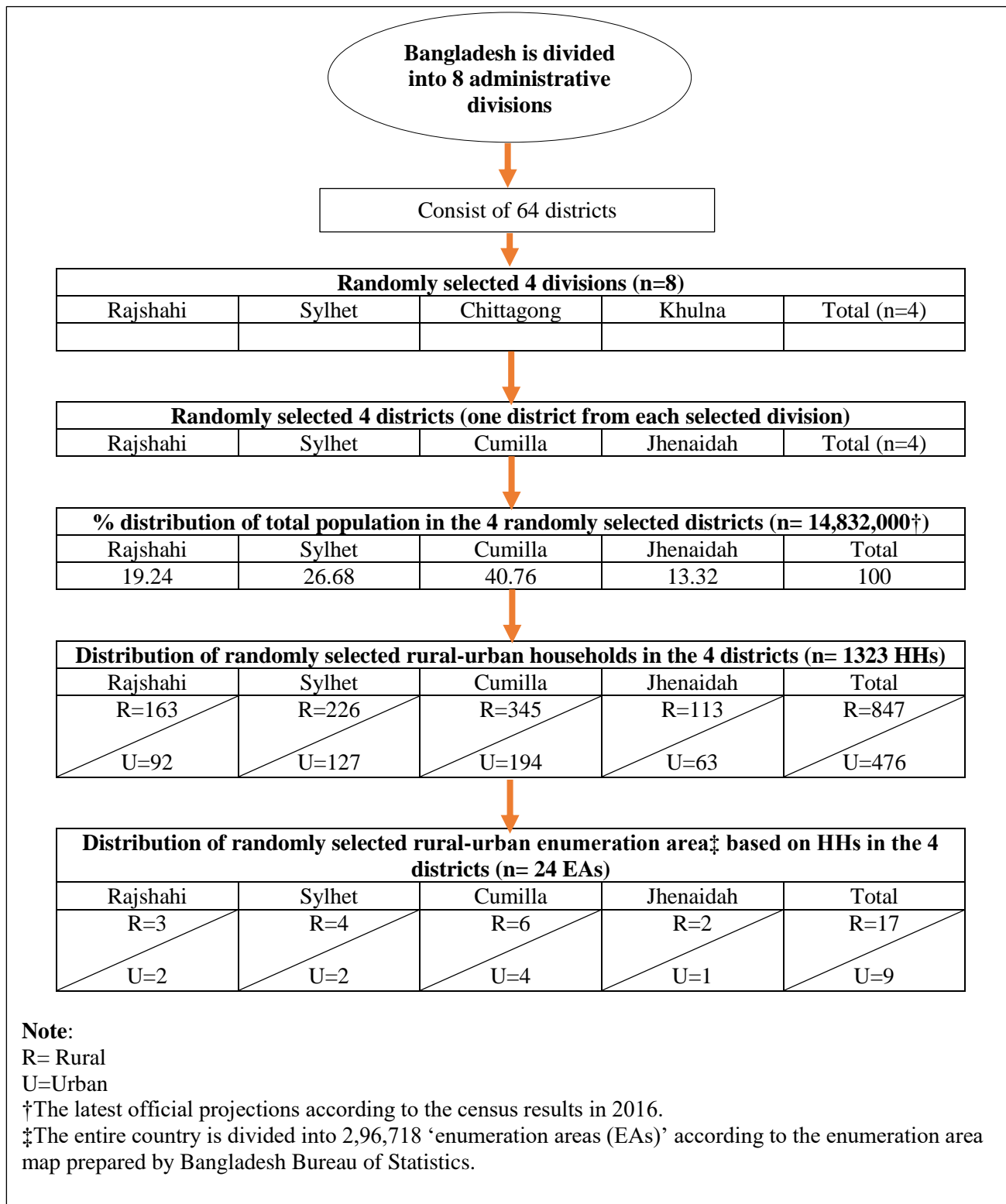


Figure 5: Sampling strategy



# BMJ Open

## Primary healthcare system readiness to prevent and manage non-communicable diseases in Bangladesh: A mixed-method study protocol

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24 7 Ashraful Kabir<sup>1</sup>, Md Nazmul Karim<sup>1</sup>, Baki Billah<sup>1\*</sup>  
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27 8 <sup>1</sup> Department of Epidemiology and Preventive Medicine, Monash University, Melbourne,  
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## 17 **Abstract**

18 **Introduction:** The burden of non-communicable diseases (NCDs) is rapidly increasing in  
19 Bangladesh. Currently, it contributes to 67% of annual deaths, and accounts for approximately  
20 64% of the disease burden. Since 70% of the Bangladeshi population residing in the rural area rely  
21 on the primary healthcare system, assessment of its capacity is crucial for guiding public health  
22 decisions to prevent and manage NCDs. This protocol is designed to recognize and assess the  
23 Bangladeshi health system's readiness for NCDs at the primary level.

24 **Methods and analysis:** The study will use a mixed-method design. Numerical data will be  
25 collected using households and health facilities surveys, while qualitative data will be collected by  
26 interviewing healthcare providers, policy planners, health administrators, and community  
27 members. The World Health Organization (WHO)'s Service Availability and Readiness  
28 Assessment (SARA) methodology, and Package of Essential Non-communicable (PEN) Disease  
29 Interventions for Primary Health Care reference manuals will be used to assess the readiness of  
30 the primary healthcare facilities for NCD services. Furthermore, Health System Dynamics  
31 Framework will be used to examine health system factors. Using the supportive items outlined in  
32 the WHO PEN package, and indicators proposed in WHO SARA methodology, a composite score  
33 will be created to analyze facility-level data. Two independent samples t-test, ANOVA and chi-  
34 square test methods will be used for bivariate analysis, and multiple regression analysis will be  
35 used for multivariable analysis. Complementarily, the thematic analysis approach will be used to  
36 analyze qualitative data.

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3 38 **Ethics and dissemination:** The project has been approved by the Monash University Human  
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5 39 Research Ethics Committee (Project ID: 27112), and Bangladesh Medical Research Council (Ref:  
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7 40 BMRC/NREC/2019-2022/270). The research findings will be shared through research articles,  
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9 41 conference proceedings, or in other scientific media. The reports or publications will not have any  
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11 42 information that can be used to identify any of the study participants.  
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15 43 **Keywords:** Bangladesh, Health system readiness, Mixed-method study, Non-communicable  
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17 44 diseases, Primary healthcare level  
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### 36 37 38 50 **Strengths and limitations of this study** 39

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41 51 • Mixed-method design offers a deeper and comprehensive understanding of the readiness  
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43 52 of the healthcare system to manage non-communicable diseases (NCDs) at the primary healthcare  
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45 53 settings of a country.  
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49 54 • The proposed methods and conceptual framework will examine demand and supply-side  
50  
51 55 enablers and barriers to the readiness of primary healthcare system, both essential considerations  
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53 56 in addressing NCDs  
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3 57 • The mixed-method design will gather data from the participants with various roles and  
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5 58 backgrounds and regions of the country, which will increase the validity and trustworthiness of  
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7 59 this study's findings.  
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11 60 • Considering high prevalence of the major NCDs (diabetes mellitus, chronic respiratory  
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13 61 diseases, cardiovascular disease, and cancer), the scope of service available at the primary health  
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15 62 care level, and the current strategic and programmatic priority, the proposed study will include  
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17 63 only the major NCDs, which means the findings of this study may not be generalizable to other  
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19 64 NCDs defined locally in Bangladesh.  
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## 23 65 **Introduction**

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27 66 NCDs have become the dominant cause of disabilities and deaths globally, resulting in the loss of  
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29 67 41 million lives in 2018, and accounting for 71% of all deaths, over three-quarters of which  
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31 68 occurred in low and middle-income countries (1, 2). It has been projected that NCD-related deaths  
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33 69 will reach 52 million by 2030, if the current trends continue (3). A joint study conducted by the  
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35 70 World Economic Forum and Harvard University showed that NCD related costs will increase to  
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37 71 USD47 trillion, equivalent to 75% of global domestic product (GDP) from 2010 to 2030, if  
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39 72 appropriate measures are not taken (4).  
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44 73 Primary healthcare (PHC) has been recognized as a powerful strategy as well as a practical  
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46 74 approach for preventing and managing NCDs because of its wide range of coverage, cost-  
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48 75 effectiveness, and healthcare infrastructure (5). As such, the WHO and the United Nations  
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50 76 Children's Fund (UNICEF) emphasized, in a joint declaration, the importance and adoption of the  
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52 77 PHC approach to achieve global health goals (6). In past decades, numerous efforts have also been  
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3 78 proposed and/or advocated to prepare the primary healthcare system as an effective mechanism  
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5 79 for preventing and managing NCDs at the individual and population levels (7-10). Several studies  
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8 80 in South Asia (11-13), Southeast Asia (14-16), and sub-Saharan Africa (17-19) investigated the  
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10 81 primary healthcare system readiness for NCDs from the supply-side perspective, mainly the  
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12 82 facility-level readiness using the WHO SARA reference manual and/or WHO PEN intervention  
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15 83 package. However, the demand-side aspect of primary healthcare system readiness, such as the  
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17 84 community characteristics and associated determinants, remains largely under-explored.  
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20 85 In recent years, Bangladesh has made remarkable advances in health outcomes with declined  
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22 86 maternal as well as child mortality, and fertility rates, increased longevity, coverage of  
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24 87 vaccinations, and vitamin A and D supplementation (20-22). However, the World Bank (WB)  
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27 88 reported that the country is currently undergoing socio-demographic and epidemiological  
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29 89 transitions (23). Demographic transitions such as increasing longevity and decreasing fertility are  
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31 90 thus fuelling shifts in disease epidemiology, wherein NCDs are becoming evident, and infectious  
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33 91 diseases are taking a back seat (24, 25). Studies conducted in various geographical locations  
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35 92 (rural/urban settings), among different age groups, sexes, and ethnicities in Bangladesh showed  
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37 93 that the prevalence of NCDs had been rapidly increasing over the last decades (26-29). The Global  
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39 94 Burden of Diseases study reported that the proportion of deaths from NCDs gradually increased  
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41 95 in Bangladesh from 43.4% in 2000, to 66.9% in 2015 (30). In 2016, an estimated 8,56,000 deaths  
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43 96 (67% of total deaths) were attributed to NCDs, which was approximately 64% of the country's  
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45 97 disease burden (31). Previous studies also noted that an alarming increase of NCD-related factors  
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47 98 such as life-style changes (sedentary behavior), unhealthy diets (processed/highly flavored foods),  
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49 99 and harmful use of tobacco products (27, 32) will lead to the rise of NCDs in the coming years  
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55 100 unless appropriate measures are taken (33-36).  
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3 101 Historically, in Bangladesh, the primary healthcare system focused on responding to acute  
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5 102 conditions, primarily infectious diseases and parasitic infestations (24, 37). A large share of  
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7 103 healthcare resources and the primary healthcare workforce being deployed mainly for family  
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9 104 planning as well as maternal and child health services (24, 37). Consequently, the focus on NCDs  
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11 105 remained less prioritized over the decades. Studies showed that the shifting of epidemiological and  
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13 106 demographic conditions could pose new challenges (aging population, urban sprawl,  
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15 107 environmental degradation) for Bangladesh's primary healthcare system (23, 38, 39). NCD related  
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17 108 services are required for continuous facility-based healthcare and family support, involving higher  
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19 109 treatment costs, skilled and qualified healthcare workforces, constant supplies of medical  
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21 110 equipment, medicines, and so forth. Presumably, people living in rural settings (approximately  
22  
23 111 70% of the country's total population) (40) are likely to be substantially affected by NCDs due to  
24  
25 112 insufficient healthcare facilities and infrastructure, unavailability of healthcare professionals,  
26  
27 113 lower socio-economic conditions (e.g., poverty, and income inequality), and disadvantaged social  
28  
29 114 positions (e.g., illiteracy, lack of awareness, and poor health education) (41, 42).  
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40 115  
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42 116 The primary healthcare system in Bangladesh has an extensive network of healthcare facilities at  
43  
44 117 the Upazila (sub-district) level (Figure 1), which is responsible for delivering basic healthcare  
45  
46 118 services (vaccination, reproductive and child healthcare, nutrition and health education, screening  
47  
48 119 of NCDs, treating common disease, and referral to higher facilities) in both community and facility  
49  
50 120 levels (43). Although some recent studies addressed the prevalence of NCDs and its associated  
51  
52 121 factors (26-28, 38, 44, 45), the capacity of Bangladesh's primary healthcare system, which is the  
53  
54 122 first-line contact for the health needs of approximately two-thirds of the population (32, 44), has  
55  
56 123 not been adequately investigated. A few studies were conducted with a specific focus on service  
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3 124 availability or general readiness of the facilities at the Upazila Health Complex (UHC) (primary  
4  
5 125 level hospitals located at the sub-district), and District Hospitals (secondary-level hospitals located  
6  
7 126 in the district) for diabetes and/or hypertension (12, 46). However, a comprehensive analysis of  
8  
9 127 the readiness of the primary healthcare system (i.e., service, workforce, information systems,  
10  
11 128 supplies and logistics, leadership and governance, and financing) largely remain under-researched.  
12  
13 129 Given the importance of better planning, best use of resources, and ensuring complete health needs,  
14  
15 130 the readiness of the primary level healthcare system is vital to address the rising burden of NCDs.  
16  
17 131 Thus, this study protocol is designed to evaluate research questions/objectives regarding the  
18  
19 132 primary health system's readiness to prevent and manage NCDs. The outcomes of this study  
20  
21 133 protocol will address a critical information gap, and eventually help to guide public health  
22  
23 134 decisions for preventing and managing NCDs in Bangladesh and similar settings elsewhere.  
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## 29 135 **Research objective**

### 30 31 32 33 136 **General objective**

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37 137 The overall objective of this study protocol is to outline a study design to explore the primary  
38  
39 138 healthcare system's readiness to prevent and manage NCDs, which is comprised of the following  
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41 139 specific objectives.  
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### 45 140 **Specific objectives**

- 46  
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48 141 1. To assess the readiness of the Bangladesh primary healthcare system in preventing and  
49  
50 142 managing NCDs.  
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3 143 2. To evaluate the characteristics of community members and their contexts for receiving  
4  
5 144 services from the primary healthcare level for preventing and managing NCDs.  
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9 145 3. To identify gaps and opportunities in existing NCDs prevention and management services  
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11 146 at the primary healthcare system, and explore feasible ways for service optimization.  
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14  
15 147 **Outcomes measure**  
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18 148 The outcomes of the current study will be the readiness (availability and functions) of a set of  
19  
20 149 supportive items that have been identified in the WHO PEN package, and indicators proposed in  
21  
22 150 the WHO SARA methodology. These items will be measured under three major categories: (i)  
23  
24 151 staff & guidelines, (ii) basic medicine and commodities, and (iii) diagnostic equipment.  
25  
26 152 Additionally, the capacity of several health system components, and community contexts that  
27  
28 153 influence NCDs related service organization and delivery will be assessed, as presented in Table  
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30 154 1.  
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42 156 Table 1. Overview of study objectives, outcomes, indicators, and data sources  
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Objectives	Questions to be answered	Outcomes to be measured	Indicators/ Possible codes (but not limited to what are presented here)	Data sources
Objective 1	Is the primary healthcare level aware about the burden and magnitudes of NCDs?	Awareness and concern of the primary healthcare level regarding NCDs.	Facility-level NCD statistics; support, service utilization; qualitative codes/themes such as service providers' knowledge and about health seeking process, attitude, and practice of the affected population.	Survey of health facilities, and Key Informant Interviews

	Are the primary healthcare level facilities ready to manage NCDs, and if so, to what extent?	Capacity of primary healthcare level facilities to manage NCDs.	Three major categories (groups) of items viz. (i) staff & guideline (ii) basic medicine and commodities, and (iii) diagnostic equipments, which has been identified in the WHO SARA manual, qualitative codes/themes such as service provision and resource mobilization and allocation, service utilization challenges and solutions.	
	Are the primary healthcare level facilities ready to establish effective surveillance, information and referral systems to manage NCDs, and if so, to what extent?	Capacity of primary healthcare level facilities for surveillance, information management and referral systems to manage NCDs.	Facility-level NCD statistics, qualitative codes/themes such as NCD prevalence, individual risk factors identification and documentation, database creation and management.	
	Has the primary healthcare level facilities effective leadership, governance, and stewardship capacity, and if so, to what extent?	Leadership, governance, and stewardship capacity of primary healthcare level facilities managers/administrators.	Qualitative codes/themes such as coordination and communicate among stakeholders/parties, work plan/job description for care providers/field staff, need assessment and professional trainings supports, non-monetary strategy (appreciation/motivation), challenge identification for services delivery, timely follow-up and review work progress, teamwork and collaboration, maximization of resource usages	Key Informant Interviews
Objective 2	Are the community	Community characteristics and contexts within which	Qualitative codes/themes such as health-seeking	Survey of household,

	members ready to receive services from primary care settings to prevent and manage NCDs and if so, to what extent?	NCD services are received.	process, self-management practice, perception, risk factors, barriers and enablers of the current NCD services	Focus Group Discussions, and In-depth Interviews
	Are the community members capable to bear NCD related cost and if so, to what extent?	NCD related healthcare expenditure	Out-of-pocket expenditure for NCDs. qualitative codes/themes (Out-of-pocket expenditure for treatment and travel, availability of supports at primary healthcare settings).	Survey of household, and Focus Group Discussions, and In-depth Interviews
Objective 3	Are there gaps and opportunities in the existing healthcare system to manage NCDs, and if so, to what extent services may be optimized?	Identification of gaps and opportunities, along with proposals for future directions	Facility-level NCD statistics such as service provision, resource limitation and allocation, household level health factors, qualitative codes/themes such as health-seeking process, attitude, and practice of the communities, service gaps and expectations.	Survey of household and facilities, and Focus Group Discussions, In-depth Interviews, Key Informant Interviews

157

## 158 **Methods**

### 159 **Study context, primary healthcare system, and health service delivery in**

#### 160 **Bangladesh**

161 Bangladesh's health system is pluralistic, wherein multiple actors and providers play roles by  
 162 applying a mixed system of medical practices (47). The Ministry of Health and Family Welfare  
 163 (MoHFW) is the apex body for designing, formulating, and overseeing health relation actions, and  
 164 has two divisions: Health Services, and Medical Education and Family Welfare (48). The health

1  
2  
3 165 services are provided by four key formal providers: the government or public sector, private  
4  
5 166 operators for profit, non-governmental organizations (NGOs), and charities (not-for-profit) or  
6  
7 167 donor agencies (developing partners/aids). Apart from these, there is an extensive pervasiveness  
8  
9  
10 168 across the country of informal health care providers (i.e., traditional healers, faith healers,  
11  
12 169 herbalists, quacks, and homeopaths). According to its administrative structure, Bangladesh has  
13  
14 170 approximately 87,310 villages, 40,977 wards, 4553 Unions, 490 Upazilas, 64 districts, 4  
15  
16 171 metropolitan cities, and 8 divisions) (32). Based on this, the healthcare services are organized and  
17  
18 172 delivered through three levels: tertiary, secondary, and primary levels (48). The tertiary level  
19  
20 173 facilities mostly exist at the divisional and national levels, providing specialized and advanced  
21  
22 174 care. The secondary level exists at the district level, providing specialized care in addition to  
23  
24 175 primary healthcare. Finally, the primary care level exists at the Upazila level, which provides basic  
25  
26 176 healthcare services (33, 49) There are various type of healthcare facilities in the primary care level  
27  
28 177 including ‘Community Clinics (CC)’ located at the village/ward, Union Health and Family  
29  
30 178 Welfare Centers (UHFWC), Rural Health Clinics (RHC), and Union Sub-centers (UHC) are set-  
31  
32 179 up at the union level (several villages comprise a union, which is the lowest administrative unit in  
33  
34 180 Bangladesh). The UHC hospitals are situated at the Upazila headquarters (several unions comprise  
35  
36 181 a Upazila, and a few Upazilas comprise a district) (Figure 1). According to the latest data, there  
37  
38 182 are 420 UHC hospitals with 15,958 inpatient beds (31–50 beds per UHC) across the country, which  
39  
40 183 are linked to the district level hospitals (100-250 beds) (Table 2) (32).  
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48 184 Figure 1: Health service delivery organizational structure in Bangladesh [to be inserted here]  
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Source: Adapted from Bangladesh Health System Review (49)

Table 2: Primary healthcare facilities in the public sector in Bangladesh

Level	Type of facility	Type of service	No. of facilities (n)	
Upazila	Upazila health complex (50-bed)	Hospital	297	
	Upazila health complex (31-bed)	Hospital	112	
	Upazila health complex (10-bed)	Hospital	11	
	<b>Total of Upazila health complexes</b>		<b>420</b>	
	<b>Hospitals outside health complexes</b>			
	31-bed hospital	Hospital	4	
	30-bed hospital	Hospital	1	
	25-bed hospital	Hospital	1	
	Mother and child welfare center	Hospital	12	
	Union	<b>Union-level facilities under DGHS</b>		
20-bed hospital		Hospital	32	
10-bed hospital		Hospital	19	
Union subcenter		Outpatient only	1,275	
Union health and family welfare center		Outpatient only	87	
<b>Union-level facilities under DGFP</b>				
Mother and child welfare center		Hospital	24	
Union health and family welfare center		Outpatient only	3,924	
Ward	Community clinic	Outpatient only	13,442	



1  
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3 194 Adapted from Bangladesh Health Facility Survey 2017 (50)  
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6 195 Abbreviation for Table 2. DGHS=Directorate General of Health Services, DGFP=Directorate  
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8 196 General of Family Planning  
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## 11 12 197 **Study population** 13 14

15  
16 198 Bangladesh's health system is considerably uniform in terms of health service delivery,  
17  
18 199 organization of the healthcare workforce, logistics and supplies. However, distinctive socio-  
19  
20 200 demographic characteristics, geographic features, livelihood patterns, and sociocultural practices  
21  
22 201 may affect different health outcomes. Taking this variation into account, this study will cover  
23  
24 202 various regions applying a multi-stage cluster random sampling approach. At the first step of this  
25  
26 203 process, four administrative divisions (out of eight) were randomly selected: *Dhaka, Khulna,*  
27  
28 204 *Rajshahi, and Sylhet*. One administrative district was then randomly selected from each division:  
29  
30 205 *Cumilla, Jhenaidah Rajshahi, and Sylhet respectively* (Figure 2). Finally, two sub-districts (locally  
31  
32 206 known as Upazila) were selected at random from each of these four districts. Due to various factors  
33  
34 207 such as study budget and field constraints, complex healthcare delivery mechanisms, target groups,  
35  
36 208 resource mobilization and allocation modality, and relatively small coverage, we decided to  
37  
38 209 exclude metropolitan cities in this study.  
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47 211 Figure 2: Study site map [to be inserted here]  
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## 214 **Study design and conceptual frameworks**

215 This study will use a mixed-method study design (Figure 3), which will include both quantitative  
216 and qualitative approaches. A mixed-method design implies combining quantitative and  
217 qualitative approaches to evaluate research questions (51). Mixed-method design is viewed as  
218 appropriate to get a comprehensive understanding as it examines the observed phenomena from  
219 multiple perspectives and to validate findings through triangulation of methods, participants, and  
220 sources (51, 52). The mixed-method study includes various designs: convergent design,  
221 explanatory sequential design, and exploratory sequential design. This study will use convergent  
222 design by collecting qualitative and quantitative data in parallel, then analyzing them separately,  
223 and finally merging qualitative and quantitative data (52, 53). A relevant theoretical framework  
224 will be implied to address each objective/research question.

225

226 In the quantitative part, WHO's SARA methodology and PEN Disease Interventions for Primary  
227 Health Care frameworks will be used to assess the readiness of healthcare facilities to deliver  
228 NCD-related services. WHO's SARA methodology offers core indicators of general and service-  
229 specific readiness, with service availability (physical presence of services), and readiness (capacity  
230 to deliver services) being the two major domains. General and service specific indicators included  
231 1) trained staff and guidelines, 2) availability of basic equipment, 3) medicines and commodities  
232 and diagnostics, and 4) standard precaution for infection control (54). Likewise, PEN Disease  
233 Interventions for Primary Health Care identified a set of core technologies, medicines, risk  
234 prediction tools, and essential NCD interventions at the primary healthcare in low-resource settings

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3 235 (55). These indicators will be used to assess the availability and readiness of relevant health system  
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5 236 components (i.e, health service delivery, healthcare workforce, supplies and logistics).  
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12 238 In the qualitative component, this study will apply the ‘health system dynamics framework’  
13  
14 239 (Figure 4) to assess the characteristics of community members and their contexts regarding NCD  
15  
16 240 related service organization and delivery. This framework builds on the WHO’s previous health  
17  
18 241 system framework, the six building block model and concurrent approaches (56). However, the  
19  
20 242 health system dynamics framework consists of ten components (i.e., goals and outcomes, values  
21  
22 243 and principles, service delivery, population, context, leadership and governance, finance, human  
23  
24 244 resources, infrastructure and supplies, knowledge and information). This framework can  
25  
26 245 adequately explain how and whether different health system elements within a broader societal  
27  
28 246 context interact and influence each other, and how population/individuals' behavior and choices,  
29  
30 247 and the process affect this mechanism. This framework will offer a comprehensive approach to  
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32 248 explore and explain how the primary health care system is constructed, and whether it is  
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34 249 functioning well within the study context (57).  
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50 253 Figure 3: Study design with data collection method and analysis [to be inserted here]  
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18 260 Abbreviation for Figure 3. FGD=Focus Group Discussions, KII=Key Informant Interviews,  
19 261 IDI=In-depth Interviews, WHO SARA=World Health Organization Service Availability and  
20 262 Readiness Assessment, NCD PEN= Noncommunicable Disease Package of Essential  
21 263 Interventions

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34 267 Figure 4: Health system dynamics framework [to be inserted here]

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44 270 Source: Adapted from J. van Olmen et al. (57)

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54 273 **Study participants and data collection**

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3 274 In the quantitative component, we will collect data from primary-level healthcare facilities and  
4  
5 275 households located in the randomly selected eight sub-districts. Using the WHO's SARA and PEN  
6  
7 276 interventions framework, facility-level data will be collected from both public (UHC, USC, RHC,  
8  
9 277 and CC) and privately-run healthcare facilities (private clinics/hospitals) (Table 3) to assess the  
10  
11 278 readiness of the primary level healthcare facilities to prevent and manage NCDs. The heads of the  
12  
13 279 respective healthcare facilities such as managers, or any designated persons will be interviewed to  
14  
15 280 collect health service data. Additionally, epidemiological, socio-demographic, and context-  
16  
17 281 specific data will be collected using household survey methods. Adult community members (aged  
18  
19 282  $\geq 18$  years) will be interviewed using cross-section survey design to obtain socio-demographic and  
20  
21 283 NCD-related data from the selected sub-districts.  
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29  
30 285 In the qualitative component, we will collect data from community members, healthcare providers,  
31  
32 286 and policy-makers regarding the characteristics of communities, and their contexts that influence  
33  
34 287 access to and utilization of NCD related services at the primary level facilities. At the same time,  
35  
36 288 information on the views, perceptions and understanding, life-style factors, perspectives, and  
37  
38 289 experiences of communities regarding NCD-related treatment access, adherence, follow-up, and  
39  
40 290 referral systems will be collected by interviewing (IDIs, FGDs, and KIIs) key stakeholders such  
41  
42 291 as policy planners, health administrators, physicians, researchers, and epidemiologists. Policy-  
43  
44 292 oriented and programmatic data will be collected through collating and appraising the relevant key  
45  
46 293 policy documents, strategy papers, guidelines, protocols, action plans, and related documents.  
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295 Table 3: Data collection processes and study participants

Methods	Participant(s)								Other(s)	
	Rajshahi		Sylhet		Cumilla		Jhenaidah			
Household survey (n=1386)	Households (n=266)		Households (n=370)		Households (n=565)		Households (n=185)		X	
	Tanore	Puthia	Kanaighat	Surma (Upazila)	Daudkandi	Homna	Shailkupa	Harinakunda		
Facility survey (n=125)	Upazila Health Complex (n=1), Private Hospital/Clinic (n=2), NGO Hospital/Clinic (n=2), Union Health Center/Union sub-centre (n=4), Community Clinic (n=6) [in each Upazila (n=16)]								X	
In-depth Interviews (IDIs) [n=16]	IDI1: With front-line health staff [Health Assistant/Family Welfare Visitor/Sub Assistant Community Medical Officer (n=2)]; IDI2: With private vendor/pharmacist/traditional provider (Village Doctor, faith healers, Kabiraj (n=2)) [In each Upazila, (n=4)]								X	
Focus Group Discussions (FGDs) [n=16]	FGD1: With community [people with at least one NCD] (n=2); FGD2: With community [people with no NCD] (n=2) [In each Upazila, (n=4)]								X	
Key Informant Interviews (KIIs) [n=13-15]	KII1: With Upazila Health and Family Planning Officer/Medical Officer/Residential Medical Officer (n=1) [In each Upazila, (n=4)]				KII2: With district health manager [civil surgeon] (n=4); KII3: With director/line director/deputy director of IMS of Directorate General of Health Services (DGHS)(n=1); KII4: With director/line director/ deputy director of Non-Communicable Diseases Control (NCDC) of DGHS (n=1); KII5: With director/line director/ deputy director of primary healthcare of DGHS (n=1); KII6-7: Policy planner/independent consultant/specialist (n=1-2); KII8-9: Private doctor/NGO workers at district (n=1-2)					

296 Abbreviation for Table 3. FGD=Focus Group Discussions, KII=Key Informant Interviews,  
 297 IDI=In-depth Interviews, MIS=Management Information System, NCD=Non-communicable  
 298 Disease

299

300 **Sample size calculation**301 ***Quantitative (household survey)***

302 For the household survey, we used the following formula.

303 Here,

304  $n$ =the desired sample size (respondents)

305  $p$ =the proportion of the target population. We took the nationally representative data that  
306 reported the age-adjusted prevalence of diabetes as 9.7% (58) into account, which was the  
307 highest in Bangladesh.

308  $p=1-p$

309  $d$ =degree of accuracy desired, which is set at (0.02) 2%.

310  $Z_{\alpha/2}$ =the standard normal deviate usually set at 1.96 corresponds to the 95% confidence  
311 interval)

312

$$313 \quad n = \frac{Z^2 * P(1 - P)}{d^2}$$

$$314 \quad n = \frac{(1.96)^2 * 0.097(1 - 0.097)}{(0.02)^2}$$

$$315 \quad n = \frac{3.84 * 0.097 * 0.903}{0.0004}$$

$$316 \quad n = \frac{3.84 * 0.087}{0.0004}$$

$$317 \quad n = \frac{0.336}{0.0004}$$

318  $n=840$  (respondents)

319 This calculation provided the minimum required sample size of 840 respondents. Considering the  
320 nationwide coverage and socio-demographic heterogeneity of the population, the sample size was  
321 multiplied by the design effect of 1.5 (59), to adjust sampling variance caused by the multi-stage  
322 study design (60), which resulted in a sample size of  $840 * 1.5 = 1260$ . Additionally, a 10% non-  
323 response rate was applied as it is less than 10% in individual study (60), as well as nationally  
324 representative demographic and health surveys (61, 62). which increased the sample size by 126,  
325 resulting in a final sample size of 1386 respondents.

326

327 ***Quantitative (healthcare facility survey)***

328 We have used the formula (below) taken from the sampling manual for facility surveys developed  
 329 by MEASURE Evaluation (63) to calculate sample size for the healthcare facilities.

330 Here,

331 n=the desired sample size

332 p=anticipated proportion of the facilities with the attribute of interest as 50%, reported by  
 333 a previous study (64).

334 d=design effect as 1.2 and the width of confidence interval for key estimates at  $p \pm 0.2\%$ .335  $V^2$ =the relative variance. It is the square of the relative error taken as 20%.

336  $Z_{\alpha/2}$ =the standard normal deviate usually set at 1.96 corresponding to the 95% confidence  
 337 interval)

$$338 \quad n = \frac{Z^2 * P * d^2}{V^2 * p}$$

$$339 \quad n = \frac{(1.96)^2 * 0.5 * 1.2}{(0.2)^2 * 0.5}$$

$$340 \quad n = \frac{3.84 * 0.6}{0.04 * 0.5}$$

$$341 \quad n = \frac{2.304}{0.02}$$

342 n=115 (healthcare facilities)

343 This calculation yielded the minimum required sample size of 115 healthcare facilities.

344 Anticipating a 10% non-response rate, the sample size was further increased by 15. Thus, the final

345 sample size was 125.

346 ***Sample size for qualitative component (IDIs, FGDs, and KIIs)***



1  
2  
3 347 The number of interviews (IDIs, KIIs, and FGDs) will be determined on the principle of ‘data  
4  
5 348 saturation’ (a point of time when no new information, themes, dimensions emerge) (65). Based on  
6  
7 349 this principle, the final number of interviews may not be determined until the complete list of  
8  
9 350 interviews are conducted. However, we propose to conduct 16 IDIs, 13-15 KIIs, and 16 FGDs  
10  
11 351 according to Guest et al.’s (65) proposition to reach data saturation. This number may differ based  
12  
13 352 on the data redundancy noted during the data collection.  
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15  
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17

## 18 353 **Sampling strategy**

### 19 20 21 354 *Quantitative (household survey)*

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24  
25 355 For household surveys, this study will adopt a multi-stage stratified cluster sampling procedure  
26  
27 356 (Figure 5) to ensure nationwide coverage, effective management, and supervision of data  
28  
29 357 collection activities. Bangladesh is divided into eight administrative divisions: Barisal, Chittagong,  
30  
31 358 Dhaka, Khulna, Mymensingh, Rajshahi, Rangpur, and Sylhet. Each division consists of several  
32  
33 359 districts, and each district is further divided into sub-districts. Each sub-district has several *Union*  
34  
35 360 *Parishads* in rural areas, which are further subdivided into *mouzas*. In urban areas, each sub-district  
36  
37 361 is divided into several *mohallas*. The entire country has been divided by the Bangladesh Bureau  
38  
39 362 of Statistics (BBS) into 2,96,718 enumeration areas (EAs) according to the enumeration area map  
40  
41 363 in the latest ‘Population and Housing Census’ (66). On an average, each EA consists of 120  
42  
43 364 households (61). For its sampling frame, this study used the list of EAs provided by the BBS. In  
44  
45 365 the first stage, it randomly selected four administrative divisions. From each of the selected  
46  
47 366 divisions, a district was randomly selected. The number of participants required was determined  
48  
49 367 by the proportion of the population in the urban, and rural areas (66). Based on the latest estimated  
50  
51 368 population in the country, the rural and urban populations were categorized as 36% and 64%,  
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3 369 respectively (67). The sample size of 1323 were divided into all the four randomly chosen districts.  
4  
5 370 The smallest number of participants required in any single EA was 63 (in *Jhenaidah*). This number  
6  
7 371 was considered as the maximum sampling intensity in an available EA. Thereafter, 17 EAs in rural,  
8  
9 372 and nine EAs in urban areas were randomly chosen. In the next stage, a systematic random  
10  
11 373 sampling procedure will be used to select 63 households, starting from the center of an EA, which  
12  
13 374 will be located by asking local residents/community members. Field enumerators will reckon the  
14  
15 375 household closest to the center point as the first household to be enrolled. In the next stage,  
16  
17 376 applying inclusion criteria (age  $\geq$  18 years, not pregnant, no history of surgery for the last three  
18  
19 377 months) reported by a previous study, an adult aged 18 years and above will be interviewed (68).  
20  
21 378 Data will be collected from an eligible member in the selected household following the 'Kish Grid'  
22  
23 379 method (69), which will allow us to interview only a single member of the selected household. In  
24  
25 380 case of the unavailability of household members (i.e, household shut down during data collection,  
26  
27 381 or decline to participate), the next eligible household will be approached. The second eligible  
28  
29 382 household will be selected by skipping the next household, and choosing the subsequent household  
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31 383 (i.e, every alternate household). This process will be repeatedly followed until the expected sample  
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33 384 size is reached.  
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Figure 5: Sampling strategy [to be inserted here]

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22  
23 396 ***Quantitative (healthcare facility survey)***

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25  
26 397 Healthcare facilities will be randomly selected for facility survey. We will prepare the list of  
27  
28 398 healthcare facilities at the primary care level by collecting basic information (facility type,  
29  
30 399 location, service availability, operating hours, etc.) from the ‘Directorate General of Health  
31  
32 400 Services’ database. From this list, we will randomly select healthcare facilities located at various  
33  
34 401 levels with the variation of size and patient load (e.g., UHC, UHC/Union sub-centre CC, private  
35  
36 402 clinic/hospital, NGO clinic/hospital). Facility-level data will be gathered by face-to-face  
37  
38 403 interviewing facility heads/designated personnel.  
39  
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42

43 404 ***Qualitative component (IDIs, FGDs, and KIIs)***

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45  
46 405 Purposive sampling strategy will be adopted for selecting the interview participants (70, 71). Some  
47  
48 406 pre-defined inclusion criteria [(i) aged  $\geq 18$  years living in the community; (ii) persons who are  
49  
50 407 better aware of NCDs (i.e., school teachers, faith leaders, village head); (ii) person engaged in  
51  
52 408 NCD related policy formulation or having expertise (policy planners, individual consultants, NGO  
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3 409 activities, govt. official); (iv) willing to participate voluntarily] will be applied to select the  
4  
5 410 participants. However, we will take the following three basic principles, widely used in purposive  
6  
7 411 sampling, into account (21): (i) maximum variation (we will include participant from roles and  
8  
9 412 backgrounds, locations/sub-districts, gender, age), (ii) iterative process (we will consider re-  
10  
11 413 interviewing and revisiting the participant if required to probe or validate specific information),  
12  
13 414 and (iii) reflexivity (assess the self-roles/researchers).  
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## 21 416 **Data analysis**

### 25 417 *Quantitative (household survey)*

28 418 Household level quantitative data will be analyzed to uncover factors associated with NCD related  
29  
30 419 service and care seeking. The outcome variable will be the ‘care-seeking for NCDs’, which will  
31  
32 420 be recorded in the following 3 categories: no care or self-care, semi-qualified professional care,  
33  
34 421 and qualified professional care. The potential explanatory variables will be the individual  
35  
36 422 characteristics (i.e., age, sex, education, comorbidity, occupation), household characteristics (i.e.,  
37  
38 423 socio-economic status, household size), and contextual characteristics (i.e., the distance of the  
39  
40 424 facility from the household, type of residence). The relationship of these variables with ‘care-  
41  
42 425 seeking for NCDs’ will be assessed by employing multiple multinomial logistic regression  
43  
44 426 analyses, as the outcome variable has more than 2 categories.  
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### 53 428 *Quantitative (healthcare facility survey)*

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3 429 Facility-level quantitative data will be analyzed following the SARA manual to assess service  
4  
5 430 specific readiness of the primary healthcare facilities (72). The primary outcome variable is  
6  
7 431 'readiness' of the primary healthcare system in Bangladesh, where it is measured in binary scale  
8  
9 432 (has two categories: 'ready' and 'not-ready'). The readiness variable will be rated as an index  
10  
11 433 grouped into following three domains as proposed in the WHO SARA methodology: (i) staff and  
12  
13 434 guidelines, (ii) diagnostic equipment, and (iii) medicines and essential commodities. Each of these  
14  
15 435 domains has multiple indicators, which will be measured in nominal scales: 'Yes' and 'No'. An  
16  
17 436 index for each domain will be calculated as the mean availability of indicators, which ranges from  
18  
19 437 0.00 to 100%. The facility readiness index (composite score) will then be calculated as the mean  
20  
21 438 of all these three domains and a facility will be considered as 'ready' if its index is above 50%  
22  
23 439 (54). The binary multiple logistic regression analysis will be performed to evaluate the relationship  
24  
25 440 between the outcome 'readiness' and several potential explanatory variables such as facility type  
26  
27 441 (e.g., inpatients, outpatient), facility location (e.g., rural, urban), and managing authority (e.g.  
28  
29 442 public, private) of the facility.  
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### 36 443 ***Qualitative (IDIs, FGDs, and KIIs)***

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40 444 A thematic analysis approach will be used to analyze qualitative data (IDIs, KIIs, and FGDs) (73).  
41  
42 445 Initially, we will transcribe the interviews in verbatim fashion, and subsequently translate them  
43  
44 446 into English. At this step, all authors will independently read the interviews and familiarize  
45  
46 447 themselves with the information and contexts. In the next step, we will code the data in three steps  
47  
48 448 (open code, axial code, and selective codes). Once data coding is completed, we will form several  
49  
50 449 clusters (comprise a few codes), and then a few themes (comprise a few clusters). Finally, we will  
51  
52 450 present the findings under several themes. A stepwise procedure will be followed in this process  
53  
54 451 (29). All authors will independently prepare some codes and themes, and any disagreements will  
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3 452 be resolved following a discussion or consensus. Text management software (i.e., Nvivo, Atlas-ti)  
4  
5 453 will be used to analyze data. A triangulation of methods and participants will be performed to  
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7  
8 454 increase data validity and research rigors.  
9

## 10 11 455 **Patient and public involvement**

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14  
15 456 No patient involved  
16

## 17 18 457 **Participants' consent**

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21  
22 458 At the beginning of the interview, data collectors will inform participants about the purpose of the  
23  
24 459 study. An Explanatory Statement will then be provided by to the participants, which they can read,  
25  
26 460 and then ask any questions they have. Participants are then required to read and sign a consent  
27  
28 461 form, agreeing to participate. The consent form (written in Bangla) will explain the purpose of the  
29  
30 462 study, the freedom to participate, and how participants' information will be used while maintaining  
31  
32  
33 463 individual/facility confidentiality.  
34

## 35 36 37 464 **Workshop for data collection team and pilot study**

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39  
40 465 Four university graduates with a background in research methods as well as data collection tools  
41  
42 466 and techniques will be hired on an ad hoc basis. The first and second authors will train them on  
43  
44 467 data collection methods and techniques, and use the Research Electronic Data Capture (REDCap)  
45  
46 468 for collecting and recording data, and administering the questionnaire (74). REDCap is a secure  
47  
48  
49 469 web-based application for completing electronic surveys and data collection for research studies.  
50  
51 470 It provides 1) a user-friendly interface with validated data entry; 2) audit trails for tracking data  
52  
53  
54 471 manipulation; and 3) an automated export procedure for seamless data downloads to standard  
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3 472 statistical packages. All questionnaires, observation checklists, and interview guidelines will be  
4  
5 473 piloted in Sylhet and Rajshahi districts (beyond these sampled eight districts) to assess their  
6  
7 474 comprehensibility, appropriateness, and conformability to the participants and interviewers. Based  
8  
9 475 on the piloting, required changes will be made before finalizing the questionnaires, observation  
10  
11 476 checklists, and interview guidelines.  
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### 16 477 **Quality assurance measures for data collection**

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19 478 To ensure data quality, various steps such as accuracy, relevance, completeness, and consistency  
20  
21 479 of data will be monitored and checked by all investigators via REDCap application. In addition,  
22  
23 480 the student investigator will carry out a random consistency check for at least 5% of the  
24  
25 481 interviewed questionnaires. The student investigator will observe the interviews and group  
26  
27 482 discussion session by physical participation in the interview sessions. If physical presence of the  
28  
29 483 investigator becomes limited, the interview sessions will be observed via audio-visual technique  
30  
31 484 (Zoom Video Communication, Skype video chat or voice call). Supportive supervision will be  
32  
33 485 provided to the interviewers, if required.  
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### 39 486 **Ethical considerations**

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42 487 The project has been approved by the Monash University Human Research Ethics Committee  
43  
44 488 (Project ID: 27112). The project also received ethical approval from the Bangladesh Medical  
45  
46 489 Research Council (Ref: BMRC/NREC/2019-2022/270). The ethical standards set by the ethics  
47  
48 490 committee will be fully complied with throughout the research process. Any sensitive and hidden  
49  
50 491 issues will be addressed according to the ethical values and standards established and exercised by  
51  
52 492 the university and/or institution. The study participants' confidentiality and anonymity will be  
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3 493 maintained at all stages by removing their names. During the data collection period, data will be  
4  
5 494 saved in the secure REDCap web-based application hosted at Monash University. The application  
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7  
8 495 will be accessible only by the research team. When the data collection is completed, the data will  
9  
10 496 be exported to IBM SPSS statistical package, and will be saved in the secure faculty-allocated  
11  
12 497 network storage (Monash (S:) drive). Participants' identifiers such as names and designations will  
13  
14 498 be removed from the main database and saved in a separate secure electronic folder, and will not  
15  
16  
17 499 be used for data analysis.  
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## 20 500 **Dissemination of results and publications**

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22  
23  
24 501 The research findings will be published in scientific public health journals. The published reports  
25  
26 502 will include group data only, and no individual data or information will be shared. Summary of  
27  
28 503 the research findings will be disseminated to the community through news media.  
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## 33 34 35 505 **Discussion**

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39 506 To the best of our knowledge, this is the first hybrid study that aims to provide a deeper analysis  
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41 507 and assessment of the primary healthcare system in Bangladesh in the context of NCD-related  
42  
43 508 services. Although NCDs lists in Bangladesh include some more diseases or conditions (including  
44  
45 509 arsenicosis, mental health disorders, hearing disabilities, birth defects, and road injuries), our study  
46  
47  
48 510 will include the major NCDs (diabetes mellitus, chronic respiratory diseases, cardiovascular  
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50 511 disease, and cancer) prioritised by the WHO. Therefore, we did not require to modify any tool to  
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53 512 include these locally defined NCDs.  
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3 513 The existing studies mainly investigated supply-side factors to assess the healthcare system  
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5 514 readiness for NCDs (i.e., medicine, basic amenities, medical products, and technologies) as  
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8 515 devised in the WHO SARA methodology and/or WHO PEN interventions. However, the demand-  
9  
10 516 side factors, which is an essential consideration in addressing NCDs, remain largely under-  
11  
12 517 explored. The proposed study will examine healthcare system readiness by adopting a mixed-  
13  
14 518 method approach and applying the relevant health system framework (57). In this present study,  
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16 519 use of a conceptual framework and combining various methods/tools will offer a deeper and  
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18  
19 520 comprehensive understanding of the healthcare system's readiness from both supply-side and  
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21 521 demand-side perspectives..  
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24  
25 522 Bangladesh's primary healthcare system is quite unitary (overly-centralized) in terms of  
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27 523 management structure, organizational hierarchy, resource allocation, workforce deployment,  
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29 524 health-seeking behavior, and sociocultural characteristics of the population (75). The proposed  
30  
31 525 study will fill critical information gaps in the NCD related service organization and delivery  
32  
33 526 mechanism. Since this study will reflect the holistic features of the primary healthcare system  
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35 527 currently functioning at sub-district level, it will constitute comprehensive information to assess  
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37  
38 528 the current health system's extent of preparedness, and whether better NCD services at the  
39  
40 529 population level need to be provided. Therefore, the study findings will benefit policy planners,  
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42  
43 530 program implementers, healthcare professionals, and community members to develop a need-  
44  
45 531 oriented, effective, and patient-centered NCD services mechanism at the primary healthcare level  
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47  
48 532 in Bangladesh. Overall, the study findings will guide public health decisions for NCD prevention  
49  
50 533 and management efforts at the primary healthcare system in Bangladesh and the similar contexts  
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52 534 elsewhere.  
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## 55 56 535 **Abbreviations & acronyms**

  
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3 536 CC=Community Clinic, DGHS=Directorate General of Health Services, FGD=Focus Group  
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5 537 Discussions, FWV=Family Welfare Visitor, KII=Key Informant Interviews, IDI=In-depth  
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7 538 Interviews, HA=Health Assistant, IMS=Information Management System, MO=Medical Officer,  
8  
9 539 NCDC=Non-Communicable Diseases, NCDC=Non-Communicable Diseases Control, , NCD  
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11 540 PEN= Noncommunicable Disease Package of Essential Interventions, NGOH/C=NGO  
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13 541 Hospital/Clinic, RMO=Residential Medical Officer, PH/C=Private Hospital/Clinic,  
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15 542 SACMO=Sub-Assistant Community Medical Officers, UHC= *Upazila* Health Complex,  
16  
17 543 (hospital), TBD= To Be Determined, UHC=*Union* Health Centre, USC=*Union* Sub-Centre  
18  
19 544 UHFPO=*Upazila* Health and Family Planning Officer, VD=Village Doctor, WHO SARA=World  
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21 545 Health Organization Service Availability and Readiness Assessment  
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## 27 546 **Author Contributions**

28  
29  
30 547 AK, NK, and BB conceived and designed the study. AK developed data collection tools, will  
31  
32 548 implement data collection activities, and prepare the first draft of the manuscript. NK and BB  
33  
34 549 revised the manuscript. BB provided overall stewardship. The final manuscript has been read and  
35  
36 550 approved by all authors.  
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41  
42  
43 552 This is a PhD project in Monash University. This project did not receive any external funding.  
44  
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## 48 49 50 554 **Availability of data and materials**

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52  
53 555 Not applicable  
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56 557 **Conflicts of interest**8  
9  
10 558 All the authors declare that they have no conflicts of interest.  
11  
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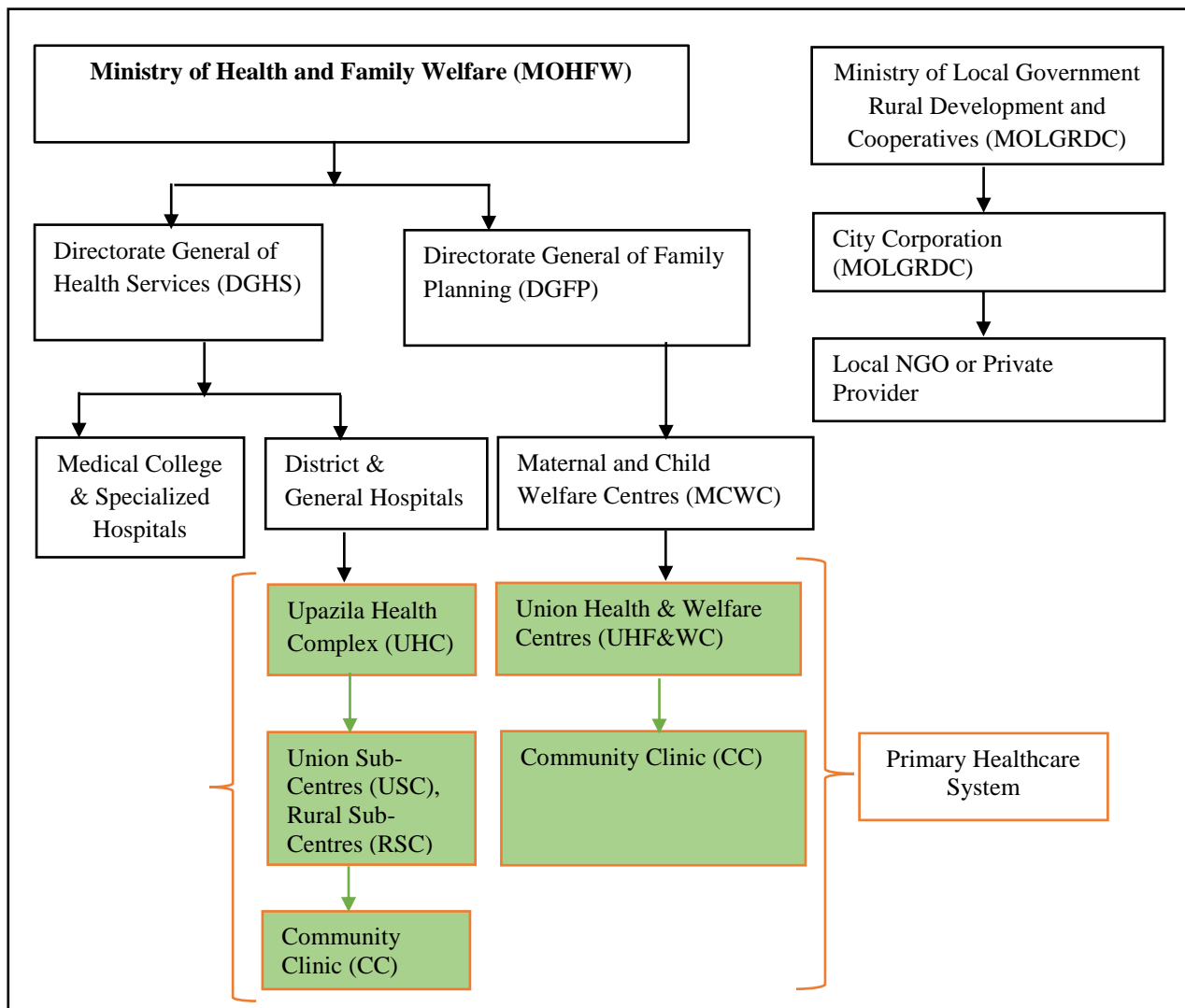
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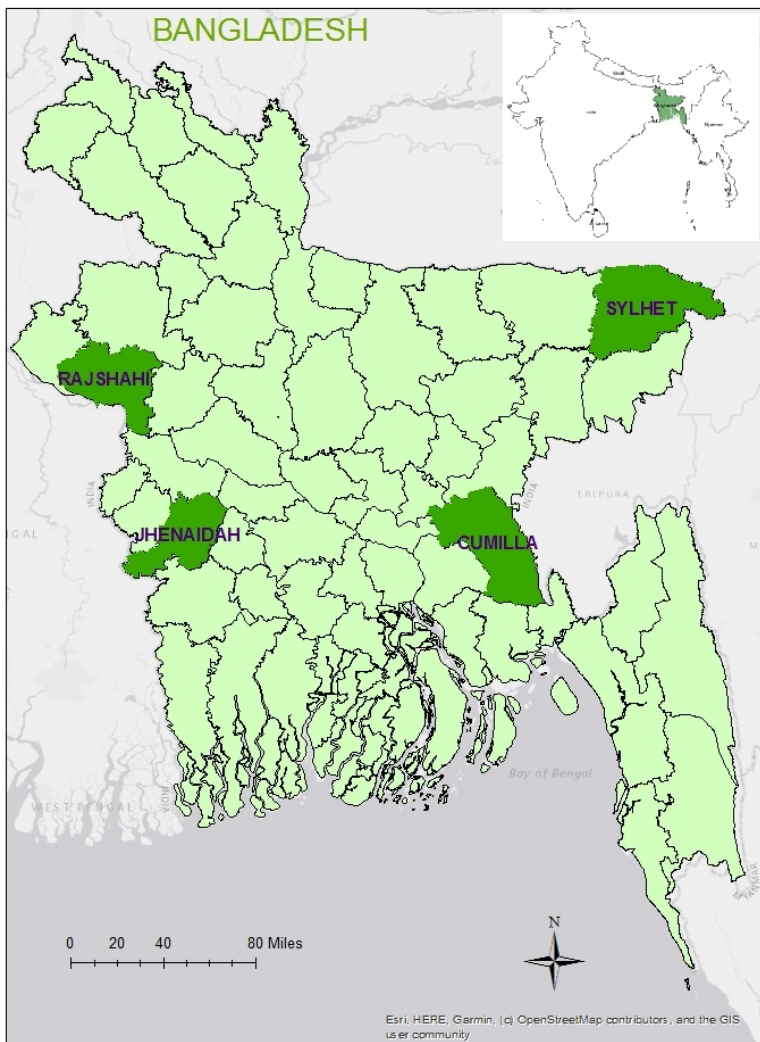
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Figure 1: Health service delivery organizational structure in Bangladesh



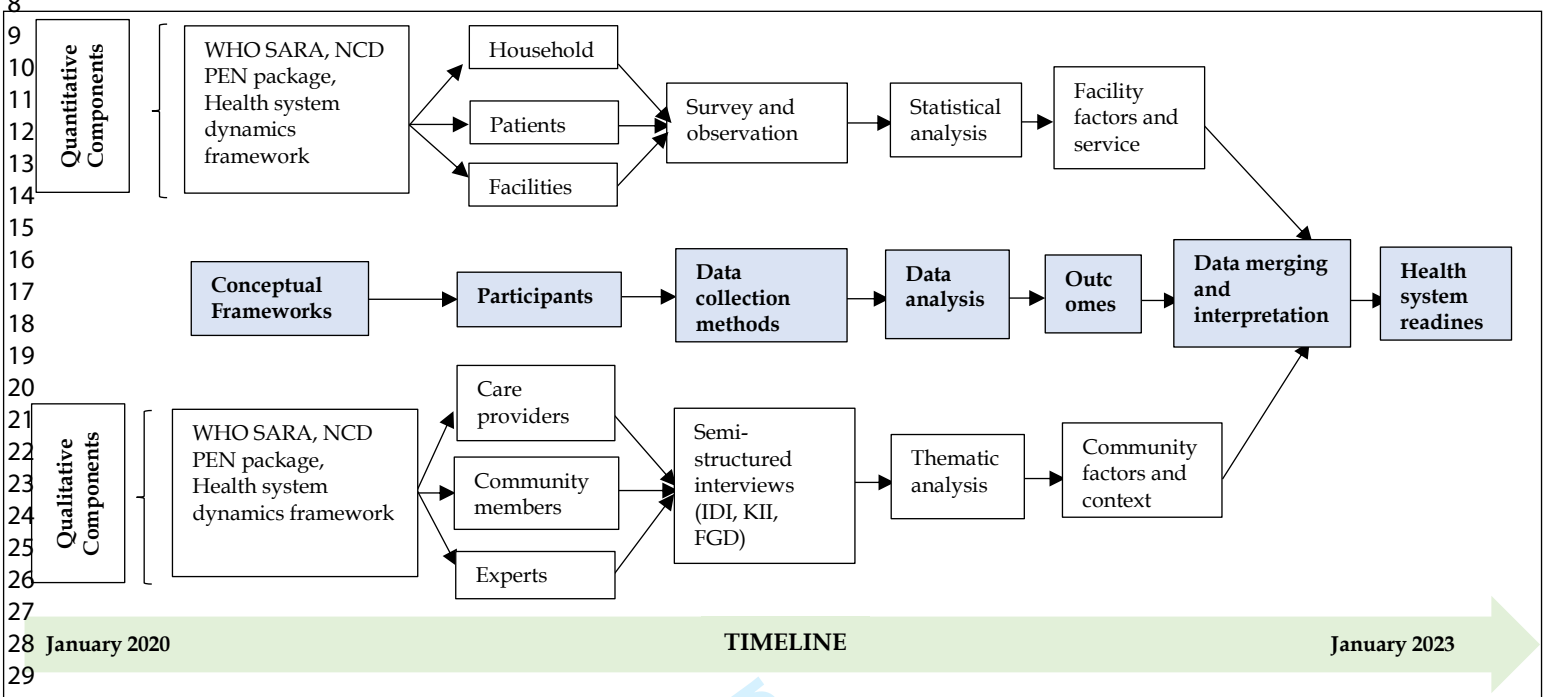


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Figure 3: Study design with data collection method and analysis



Review only

Figure 4: Health system dynamics framework

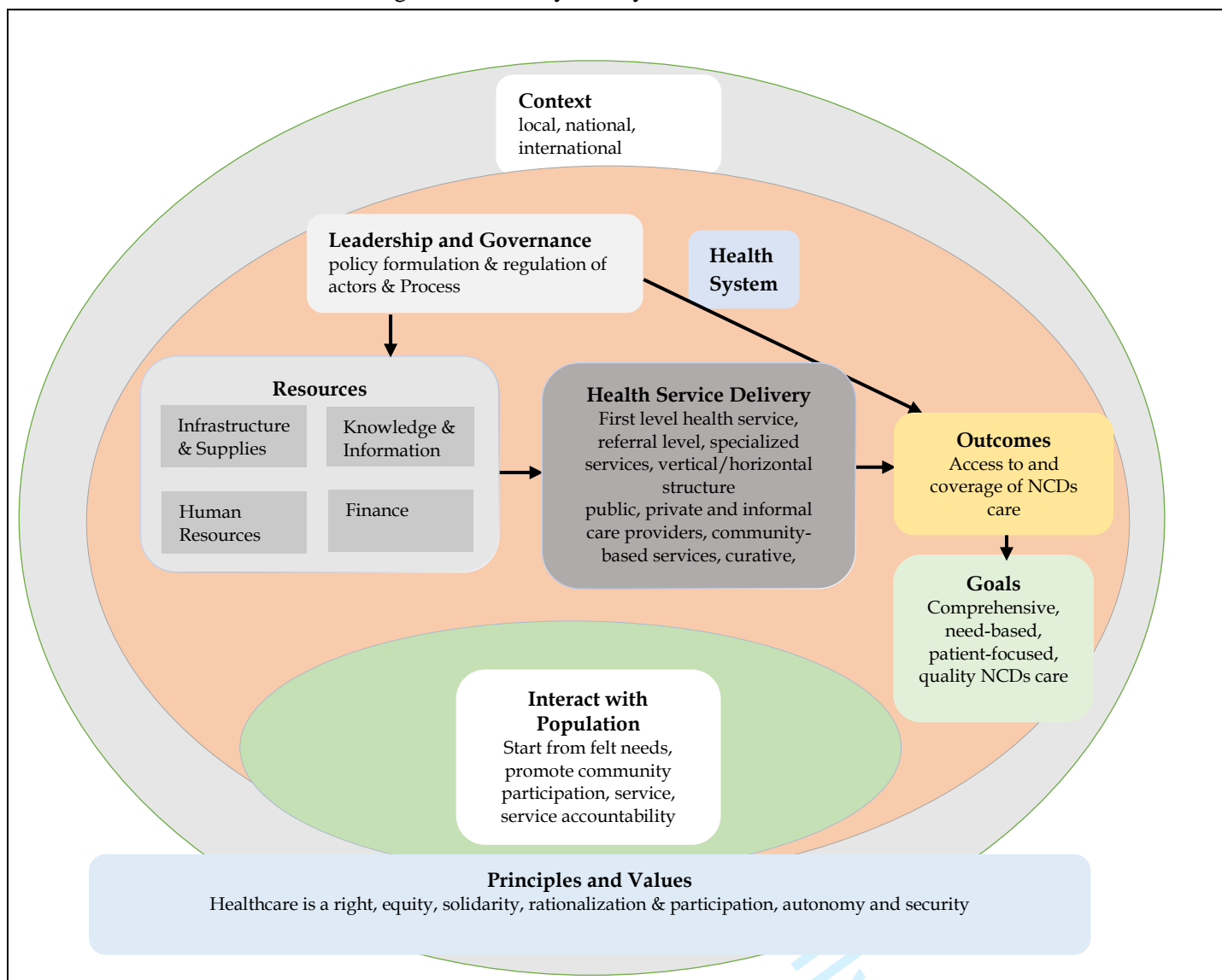
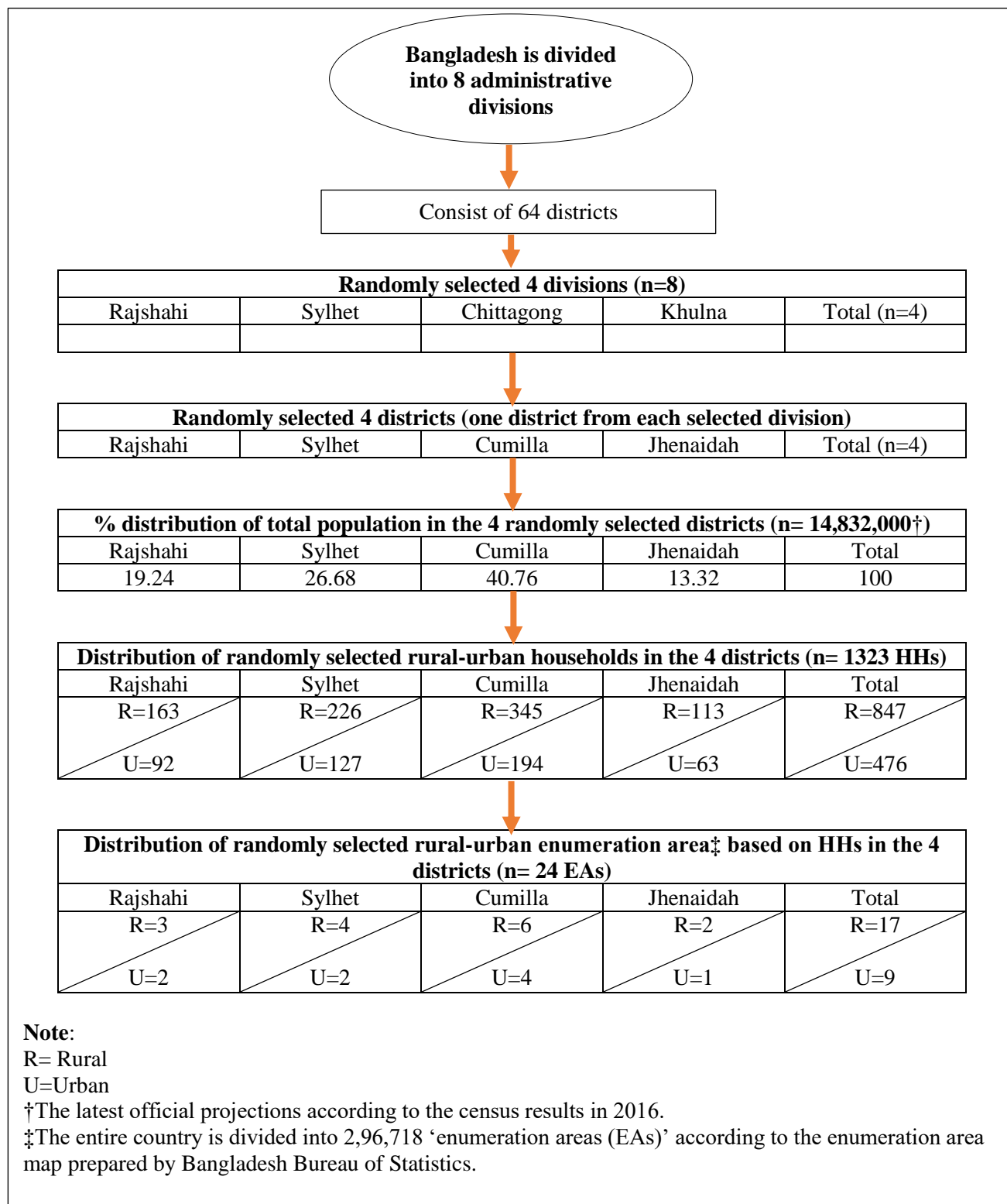


Figure 5: Sampling strategy



# BMJ Open

## Primary healthcare system readiness to prevent and manage non-communicable diseases in Bangladesh: A mixed-method study protocol

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4 1 **Primary healthcare system readiness to prevent and manage non-**  
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24 7 Ashraful Kabir<sup>1</sup>, Md Nazmul Karim<sup>1</sup>, Baki Billah<sup>1\*</sup>  
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27 8 <sup>1</sup> Department of Epidemiology and Preventive Medicine, Monash University, Melbourne,  
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## 17 **Abstract**

18 **Introduction:** The burden of non-communicable diseases (NCDs) is rapidly increasing in  
19 Bangladesh. Currently, it contributes to 67% of annual deaths, and accounts for approximately  
20 64% of the disease burden. Since 70% of the Bangladeshi population residing in the rural area rely  
21 on the primary healthcare system, assessment of its capacity is crucial for guiding public health  
22 decisions to prevent and manage NCDs. This protocol is designed to recognize and assess the  
23 Bangladeshi health system's readiness for NCDs at the primary level.

24 **Methods and analysis:** The study will use a mixed-method design. Numerical data will be  
25 collected using households and health facilities surveys, while qualitative data will be collected by  
26 interviewing healthcare providers, policy planners, health administrators, and community  
27 members. The World Health Organization (WHO)'s Service Availability and Readiness  
28 Assessment (SARA) methodology, and Package of Essential Non-communicable (PEN) Disease  
29 Interventions for Primary Health Care reference manuals will be used to assess the readiness of  
30 the primary healthcare facilities for NCD services. Furthermore, Health System Dynamics  
31 Framework will be used to examine health system factors. Using the supportive items outlined in  
32 the WHO PEN package, and indicators proposed in WHO SARA methodology, a composite score  
33 will be created to analyze facility-level data. Two independent samples t-test, ANOVA and chi-  
34 square test methods will be used for bivariate analysis, and multiple regression analysis will be  
35 used for multivariable analysis. Complementarily, the thematic analysis approach will be used to  
36 analyze qualitative data.

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3 38 **Ethics and dissemination:** The project has been approved by the Monash University Human  
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5 39 Research Ethics Committee (Project ID: 27112), and Bangladesh Medical Research Council (Ref:  
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7 40 BMRC/NREC/2019-2022/270). The research findings will be shared through research articles,  
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9 41 conference proceedings, or in other scientific media. The reports or publications will not have any  
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11 42 information that can be used to identify any of the study participants.  
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15 43 **Keywords:** Bangladesh, Health system readiness, Mixed-method study, Non-communicable  
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17 44 diseases, Primary healthcare level  
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### 36 37 50 **Strengths and limitations of this study**

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41 51 • Mixed-method design offers a deeper and comprehensive understanding of the readiness  
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43 52 of the healthcare system to manage non-communicable diseases (NCDs) at the primary healthcare  
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45 53 settings of a country.  
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49 54 • The proposed methods and conceptual framework will examine demand and supply-side  
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51 55 enablers and barriers to the readiness of primary healthcare system, both essential considerations  
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53 56 in addressing NCDs  
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3 57 • The mixed-method design will gather data from the participants with various roles and  
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5 58 backgrounds and regions of the country, which will increase the validity and trustworthiness of  
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7 59 this study's findings.  
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11 60 • Considering high prevalence of the major NCDs (diabetes mellitus, chronic respiratory  
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13 61 diseases, cardiovascular disease, and cancer), the scope of service available at the primary health  
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15 62 care level, and the current strategic and programmatic priority, the proposed study will include  
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17 63 only the major NCDs, which means the findings of this study may not be generalizable to other  
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19 64 NCDs defined locally in Bangladesh.  
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## 23 65 **Introduction**

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27 66 NCDs have become the dominant cause of disabilities and deaths globally, resulting in the loss of  
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29 67 41 million lives in 2018, and accounting for 71% of all deaths, over three-quarters of which  
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31 68 occurred in low and middle-income countries (1, 2). It has been projected that NCD-related deaths  
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33 69 will reach 52 million by 2030, if the current trends continue (3). A joint study conducted by the  
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35 70 World Economic Forum and Harvard University showed that NCD related costs will increase to  
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37 71 USD47 trillion, equivalent to 75% of global domestic product (GDP) from 2010 to 2030, if  
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39 72 appropriate measures are not taken (4).  
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44 73 Primary healthcare (PHC) has been recognized as a powerful strategy as well as a practical  
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46 74 approach for preventing and managing NCDs because of its wide range of coverage, cost-  
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48 75 effectiveness, and healthcare infrastructure (5). As such, the WHO and the United Nations  
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50 76 Children's Fund (UNICEF) emphasized, in a joint declaration, the importance and adoption of the  
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52 77 PHC approach to achieve global health goals (6). In past decades, numerous efforts have also been  
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3 78 proposed and/or advocated to prepare the primary healthcare system as an effective mechanism  
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5 79 for preventing and managing NCDs at the individual and population levels (7-10). Several studies  
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8 80 in South Asia (11-14), Southeast Asia (15-17), and sub-Saharan Africa (18-20) investigated the  
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10 81 primary healthcare system readiness for NCDs from the supply-side perspective, mainly the  
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12 82 facility-level readiness using the WHO SARA reference manual and/or WHO PEN intervention  
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15 83 package. However, the demand-side aspect of primary healthcare system readiness, such as the  
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17 84 community characteristics and associated determinants, remains largely under-explored.  
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20 85 In recent years, Bangladesh has made remarkable advances in health outcomes with declined  
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22 86 maternal as well as child mortality, and fertility rates, increased longevity, coverage of  
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24 87 vaccinations, and vitamin A and D supplementation (21-23) . However, the World Bank (WB)  
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27 88 reported that the country is currently undergoing socio-demographic and epidemiological  
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29 89 transitions (24). Demographic transitions such as increasing longevity and decreasing fertility are  
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31 90 thus fuelling shifts in disease epidemiology, wherein NCDs are becoming evident, and infectious  
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33 91 diseases are taking a back seat (25, 26). Studies conducted in various geographical locations  
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35 92 (rural/urban settings), among different age groups, sexes, and ethnicities in Bangladesh showed  
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37 93 that the prevalence of NCDs had been rapidly increasing over the last decades (27-30). The Global  
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39 94 Burden of Diseases study reported that the proportion of deaths from NCDs gradually increased  
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41 95 in Bangladesh from 43.4% in 2000, to 66.9% in 2015 (31). In 2016, an estimated 8,56,000 deaths  
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43 96 (67% of total deaths) were attributed to NCDs, which was approximately 64% of the country's  
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45 97 disease burden (32). Previous studies also noted that an alarming increase of NCD-related factors  
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47 98 such as life-style changes (sedentary behavior), unhealthy diets (processed/highly flavored foods),  
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49 99 and harmful use of tobacco products (28, 33) will lead to the rise of NCDs in the coming years  
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51 100 unless appropriate measures are taken (34-37).  
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3 101 Historically, in Bangladesh, the primary healthcare system focused on responding to acute  
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5 102 conditions, primarily infectious diseases and parasitic infestations (25, 38). A large share of  
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7 103 healthcare resources and the primary healthcare workforce being deployed mainly for family  
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9 104 planning as well as maternal and child health services (25, 38). Consequently, the focus on NCDs  
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11 105 remained less prioritized over the decades. Studies showed that the shifting of epidemiological and  
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13 106 demographic conditions could pose new challenges (aging population, urban sprawl,  
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15 107 environmental degradation) for Bangladesh's primary healthcare system (24, 39, 40). NCD related  
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17 108 services are required for continuous facility-based healthcare and family support, involving higher  
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19 109 treatment costs, skilled and qualified healthcare workforces, constant supplies of medical  
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21 110 equipment, medicines, and so forth. Presumably, people living in rural settings (approximately  
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23 111 70% of the country's total population) (41) are likely to be substantially affected by NCDs due to  
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25 112 insufficient healthcare facilities and infrastructure, unavailability of healthcare professionals,  
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27 113 lower socio-economic conditions (e.g., poverty, and income inequality), and disadvantaged social  
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29 114 positions (e.g., illiteracy, lack of awareness, and poor health education) (42, 43).  
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42 116 The primary healthcare system in Bangladesh has an extensive network of healthcare facilities at  
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44 117 the Upazila (sub-district) level (Figure 1), which is responsible for delivering basic healthcare  
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46 118 services (vaccination, reproductive and child healthcare, nutrition and health education, screening  
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48 119 of NCDs, treating common disease, and referral to higher facilities) in both community and facility  
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50 120 levels (44). Although some recent studies addressed the prevalence of NCDs and its associated  
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52 121 factors (27-29, 39, 45, 46), the capacity of Bangladesh's primary healthcare system, which is the  
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54 122 first-line contact for the health needs of approximately two-thirds of the population (33, 45), has  
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56 123 not been adequately investigated. A few studies were conducted with a specific focus on service  
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3 124 availability or general readiness of the facilities at the Upazila Health Complex (UHC) (primary  
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5 125 level hospitals located at the sub-district), and District Hospitals (secondary-level hospitals located  
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7 126 in the district) for diabetes and/or hypertension (12, 47). However, a comprehensive analysis of  
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9 127 the readiness of the primary healthcare system (i.e., service, workforce, information systems,  
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11 128 supplies and logistics, leadership and governance, and financing) largely remain under-researched.  
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13 129 Given the importance of better planning, best use of resources, and ensuring complete health needs,  
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15 130 the readiness of the primary level healthcare system is vital to address the rising burden of NCDs.  
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17 131 Thus, this study protocol is designed to evaluate research questions/objectives regarding the  
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19 132 primary health system's readiness to prevent and manage NCDs. The outcomes of this study  
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21 133 protocol will address a critical information gap, and eventually help to guide public health  
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23 134 decisions for preventing and managing NCDs in Bangladesh and similar settings elsewhere.  
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## 29 135 **Research objective**

### 30 31 32 33 136 **General objective**

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37 137 The overall objective of this study protocol is to outline a study design to explore the primary  
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39 138 healthcare system's readiness to prevent and manage NCDs, which is comprised of the following  
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41 139 specific objectives.  
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### 45 140 **Specific objectives**

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48 141 1. To assess the readiness of the Bangladesh primary healthcare system in preventing and  
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50 142 managing NCDs.  
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3 143 2. To evaluate the characteristics of community members and their contexts for receiving  
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5 144 services from the primary healthcare level for preventing and managing NCDs.  
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9 145 3. To identify gaps and opportunities in existing NCDs prevention and management services  
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11 146 at the primary healthcare system, and explore feasible ways for service optimization.  
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15 147 **Outcomes measure**  
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18 148 The outcomes of the current study will be the readiness (availability and functions) of a set of  
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20 149 supportive items that have been identified in the WHO PEN package, and indicators proposed in  
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22 150 the WHO SARA methodology. These items will be measured under three major categories: (i)  
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24 151 staff & guidelines, (ii) basic medicine and commodities, and (iii) diagnostic equipment.  
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26 152 Additionally, the capacity of several health system components, and community contexts that  
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28 153 influence NCDs related service organization and delivery will be assessed, as presented in Table  
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156 Table 1. Overview of study objectives, outcomes, indicators, and data sources

Objectives	Questions to be answered	Outcomes to be measured	Indicators/ Possible codes (but not limited to what are presented here)	Data sources
Objective 1	Is the primary healthcare level aware about the burden and magnitudes of NCDs?	Awareness and concern of the primary healthcare level regarding NCDs.	Facility-level NCD statistics; support, service utilization; qualitative codes/themes such as service providers' knowledge and about health seeking process, attitude, and practice of the affected population.	Survey of health facilities, and Key Informant Interviews

	Are the primary healthcare level facilities ready to manage NCDs, and if so, to what extent?	Capacity of primary healthcare level facilities to manage NCDs.	Three major categories (groups) of items viz. (i) staff & guideline (ii) basic medicine and commodities, and (iii) diagnostic equipments, which has been identified in the WHO SARA manual, qualitative codes/themes such as service provision and resource mobilization and allocation, service utilization challenges and solutions.	
	Are the primary healthcare level facilities ready to establish effective surveillance, information and referral systems to manage NCDs, and if so, to what extent?	Capacity of primary healthcare level facilities for surveillance, information management and referral systems to manage NCDs.	Facility-level NCD statistics, qualitative codes/themes such as NCD prevalence, individual risk factors identification and documentation, database creation and management.	
	Has the primary healthcare level facilities effective leadership, governance, and stewardship capacity, and if so, to what extent?	Leadership, governance, and stewardship capacity of primary healthcare level facilities managers/administrators.	Qualitative codes/themes such as coordination and communicate among stakeholders/parties, work plan/job description for care providers/field staff, need assessment and professional trainings supports, non-monetary strategy (appreciation/motivation), challenge identification for services delivery, timely follow-up and review work progress, teamwork and collaboration, maximization of resource usages	Key Informant Interviews
Objective 2	Are the community	Community characteristics and contexts within which	Qualitative codes/themes such as health-seeking	Survey of household,

	members ready to receive services from primary care settings to prevent and manage NCDs and if so, to what extent?	NCD services are received.	process, self-management practice, perception, risk factors, barriers and enablers of the current NCD services	Focus Group Discussions, and In-depth Interviews
	Are the community members capable to bear NCD related cost and if so, to what extent?	NCD related healthcare expenditure	Out-of-pocket expenditure for NCDs. qualitative codes/themes (Out-of-pocket expenditure for treatment and travel, availability of supports at primary healthcare settings).	Survey of household, and Focus Group Discussions, and In-depth Interviews
Objective 3	Are there gaps and opportunities in the existing healthcare system to manage NCDs, and if so, to what extent services may be optimized?	Identification of gaps and opportunities, along with proposals for future directions	Facility-level NCD statistics such as service provision, resource limitation and allocation, household level health factors, qualitative codes/themes such as health-seeking process, attitude, and practice of the communities, service gaps and expectations.	Survey of household and facilities, and Focus Group Discussions, In-depth Interviews, Key Informant Interviews

157

## 158 **Methods and Analysis**

### 159 **Study context, primary healthcare system, and health service delivery in**

#### 160 **Bangladesh**

161 Bangladesh's health system is pluralistic, wherein multiple actors and providers play roles by  
 162 applying a mixed system of medical practices (48). The Ministry of Health and Family Welfare  
 163 (MoHFW) is the apex body for designing, formulating, and overseeing health relation actions, and  
 164 has two divisions: Health Services, and Medical Education and Family Welfare (49). The health



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3 165 services are provided by four key formal providers: the government or public sector, private  
4  
5 166 operators for profit, non-governmental organizations (NGOs), and charities (not-for-profit) or  
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7 167 donor agencies (developing partners/aids). Apart from these, there is an extensive pervasiveness  
8  
9  
10 168 across the country of informal health care providers (i.e., traditional healers, faith healers,  
11  
12 169 herbalists, quacks, and homeopaths). According to its administrative structure, Bangladesh has  
13  
14 170 approximately 87,310 villages, 40,977 wards, 4553 Unions, 490 Upazilas, 64 districts, 4  
15  
16 171 metropolitan cities, and 8 divisions) (41). Based on this, the healthcare services are organized and  
17  
18 172 delivered through three levels: tertiary, secondary, and primary levels (49). The tertiary level  
19  
20 173 facilities mostly exist at the divisional and national levels, providing specialized and advanced  
21  
22 174 care. The secondary level exists at the district level, providing specialized care in addition to  
23  
24 175 primary healthcare. Finally, the primary care level exists at the Upazila level, which provides basic  
25  
26 176 healthcare services (34, 49). There are various type of healthcare facilities in the primary care level  
27  
28 177 including ‘Community Clinics (CC)’ located at the village/ward, Union Health and Family  
29  
30 178 Welfare Centers (UHFWC), Rural Health Clinics (RHC), and Union Sub-centers (UHC) are set-  
31  
32 179 up at the union level (several villages comprise a union, which is the lowest administrative unit in  
33  
34 180 Bangladesh). The UHC hospitals are situated at the Upazila headquarters (several unions comprise  
35  
36 181 a Upazila, and a few Upazilas comprise a district) (Figure 1). According to the latest data, there  
37  
38 182 are 420 UHC hospitals with 18,432 inpatient beds (31–50 beds per UHC) across the country, which  
39  
40 183 are linked to the district level hospitals (100-250 beds) (Table 2) (50).  
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48 184 Figure 1: Health service delivery organizational structure in Bangladesh [to be inserted here]  
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Source: Adapted from Bangladesh Health System Review (49)

Table 2: Primary healthcare facilities in the public sector in Bangladesh

Level	Type of facility	Type of service	No. of facilities (n)
Upazila	Upazila health complex (50-bed)	Hospital	297
	Upazila health complex (31-bed)	Hospital	112
	Upazila health complex (10-bed)	Hospital	11
	<b>Total of Upazila health complexes</b>		<b>420</b>
	<b>Hospitals outside health complexes</b>		
	31-bed hospital	Hospital	4
	30-bed hospital	Hospital	1
	25-bed hospital	Hospital	1
	Mother and child welfare center	Hospital	12
	Union	<b>Union-level facilities under DGHS</b>	
20-bed hospital		Hospital	32
10-bed hospital		Hospital	19
Union subcenter		Outpatient only	1,275
Union health and family welfare center		Outpatient only	87
<b>Union-level facilities under DGFP</b>			
Mother and child welfare center		Hospital	24
Union health and family welfare center		Outpatient only	3,924
Ward	Community clinic	Outpatient only	13,442

1  
2  
3 194 Adapted from Bangladesh Health Facility Survey 2017 (51)  
4  
5

6 195 Abbreviation for Table 2. DGHS=Directorate General of Health Services, DGFP=Directorate  
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8  
9 196 General of Family Planning  
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## 11 12 197 **Study population** 13

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16 198 Bangladesh's health system is considerably uniform in terms of health service delivery,  
17  
18 199 organization of the healthcare workforce, logistics and supplies. However, distinctive socio-  
19  
20 200 demographic characteristics, geographic features, livelihood patterns, and sociocultural practices  
21  
22 201 may affect different health outcomes. Taking this variation into account, this study will cover  
23  
24 202 various regions applying a multi-stage cluster random sampling approach. At the first step of this  
25  
26 203 process, four administrative divisions (out of eight) were randomly selected: *Dhaka, Khulna,*  
27  
28 204 *Rajshahi, and Sylhet*. One administrative district was then randomly selected from each division:  
29  
30 205 *Cumilla, Jhenaidah Rajshahi, and Sylhet respectively* (Figure 2). Finally, two sub-districts (locally  
31  
32 206 known as Upazila) were selected at random from each of these four districts. Due to various factors  
33  
34 207 such as study budget and field constraints, complex healthcare delivery mechanisms, target groups,  
35  
36 208 resource mobilization and allocation modality, and relatively small coverage, we decided to  
37  
38 209 exclude metropolitan cities in this study.  
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47 211 Figure 2: Study site map [to be inserted here]  
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## 214 **Study design and conceptual frameworks**

215 This study will use a mixed-method study design (Figure 3), which will include both quantitative  
216 and qualitative approaches. A mixed-method design implies combining quantitative and  
217 qualitative approaches to evaluate research questions (52). Mixed-method design is viewed as  
218 appropriate to get a comprehensive understanding as it examines the observed phenomena from  
219 multiple perspectives and to validate findings through triangulation of methods, participants, and  
220 sources (52, 53). The mixed-method study includes various designs: convergent design,  
221 explanatory sequential design, and exploratory sequential design. This study will use convergent  
222 design by collecting qualitative and quantitative data in parallel, then analyzing them separately,  
223 and finally merging qualitative and quantitative data (53, 54). A relevant theoretical framework  
224 will be implied to address each objective/research question.

225

226 In the quantitative part, WHO's SARA methodology and PEN Disease Interventions for Primary  
227 Health Care frameworks will be used to assess the readiness of healthcare facilities to deliver  
228 NCD-related services. WHO's SARA methodology offers core indicators of general and service-  
229 specific readiness, with service availability (physical presence of services), and readiness (capacity  
230 to deliver services) being the two major domains. General and service specific indicators included  
231 1) trained staff and guidelines, 2) availability of basic equipment, 3) medicines and commodities  
232 and diagnostics, and 4) standard precaution for infection control (55). Likewise, PEN Disease  
233 Interventions for Primary Health Care identified a set of core technologies, medicines, risk  
234 prediction tools, and essential NCD interventions at the primary healthcare in low-resource settings

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3 235 (56). These indicators will be used to assess the availability and readiness of relevant health system  
4  
5 236 components (i.e, health service delivery, healthcare workforce, supplies and logistics).  
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12 238 In the qualitative component, this study will apply the ‘health system dynamics framework’  
13  
14 239 (Figure 4) to assess the characteristics of community members and their contexts regarding NCD  
15  
16 240 related service organization and delivery. This framework builds on the WHO’s previous health  
17  
18 241 system framework, the six building block model and concurrent approaches (57). However, the  
19  
20 242 health system dynamics framework consists of ten components (i.e., goals and outcomes, values  
21  
22 243 and principles, service delivery, population, context, leadership and governance, finance, human  
23  
24 244 resources, infrastructure and supplies, knowledge and information). This framework can  
25  
26 245 adequately explain how and whether different health system elements within a broader societal  
27  
28 246 context interact and influence each other, and how population/individuals' behavior and choices,  
29  
30 247 and the process affect this mechanism. This framework will offer a comprehensive approach to  
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32 248 explore and explain how the primary health care system is constructed, and whether it is  
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34 249 functioning well within the study context (58).  
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50 253 Figure 3: Study design with data collection method and analysis [to be inserted here]  
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18 260 Abbreviation for Figure 3. FGD=Focus Group Discussions, KII=Key Informant Interviews,  
19 261 IDI=In-depth Interviews, WHO SARA=World Health Organization Service Availability and  
20 262 Readiness Assessment, NCD PEN= Noncommunicable Disease Package of Essential  
21 263 Interventions

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34 267 Figure 4: Health system dynamics framework [to be inserted here]

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44 270 Source: Adapted from J. van Olmen et al. (58)

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54 273 **Study participants and data collection**

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3 274 In the quantitative component, we will collect data from primary-level healthcare facilities and  
4  
5 275 households located in the randomly selected eight sub-districts. Using the WHO's SARA and PEN  
6  
7  
8 276 interventions framework, facility-level data will be collected from both public (UHC, USC, RHC,  
9  
10 277 and CC) and privately-run healthcare facilities (private clinics/hospitals) (Table 3) to assess the  
11  
12 278 readiness of the primary level healthcare facilities to prevent and manage NCDs. The heads of the  
13  
14  
15 279 respective healthcare facilities such as managers, or any designated persons will be interviewed to  
16  
17 280 collect health service data. Additionally, epidemiological, socio-demographic, and context-  
18  
19 281 specific data will be collected using household survey methods. Adult community members (aged  
20  
21 282  $\geq 18$  years) will be interviewed using cross-section survey design to obtain socio-demographic and  
22  
23  
24 283 NCD-related data from the selected sub-districts.  
25  
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29  
30 285 In the qualitative component, we will collect data from community members, healthcare providers,  
31  
32 286 and policy-makers regarding the characteristics of communities, and their contexts that influence  
33  
34  
35 287 access to and utilization of NCD related services at the primary level facilities. At the same time,  
36  
37 288 information on the views, perceptions and understanding, life-style factors, perspectives, and  
38  
39 289 experiences of communities regarding NCD-related treatment access, adherence, follow-up, and  
40  
41  
42 290 referral systems will be collected by interviewing (IDIs, FGDs, and KIIs) key stakeholders such  
43  
44 291 as policy planners, health administrators, physicians, researchers, and epidemiologists. Policy-  
45  
46 292 oriented and programmatic data will be collected through collating and appraising the relevant key  
47  
48  
49 293 policy documents, strategy papers, guidelines, protocols, action plans, and related documents.  
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295 Table 3: Data collection processes and study participants

Methods	Participant(s)								Other(s)	
	Rajshahi		Sylhet		Cumilla		Jhenaidah			
Household survey (n=1386)	Households (n=266)		Households (n=370)		Households (n=565)		Households (n=185)		X	
	Tanore	Puthia	Kanaighat	Surma (Upazila)	Daudkandi	Homna	Shailkupa	Harinakunda		
Facility survey (n=125)	Upazila Health Complex (n=1), Private Hospital/Clinic (n=2), NGO Hospital/Clinic (n=2), Union Health Center/Union sub-centre (n=4), Community Clinic (n=6) [in each Upazila (n=16)]								X	
In-depth Interviews (IDIs) [n=16]	IDI1: With front-line health staff [Health Assistant/Family Welfare Visitor/Sub Assistant Community Medical Officer (n=2)]; IDI2: With private vendor/pharmacist/traditional provider (Village Doctor, faith healers, Kabiraj (n=2)) [In each Upazila, (n=4)]								X	
Focus Group Discussions (FGDs) [n=16]	FGD1: With community [people with at least one NCD] (n=2); FGD2: With community [people with no NCD] (n=2) [In each Upazila, (n=4)]								X	
Key Informant Interviews (KIIs) [n=13-15]	KII1: With Upazila Health and Family Planning Officer/Medical Officer/Residential Medical Officer (n=1) [In each Upazila, (n=4)]				KII2: With district health manager [civil surgeon] (n=4); KII3: With director/line director/deputy director of IMS of Directorate General of Health Services (DGHS)(n=1); KII4: With director/line director/ deputy director of Non-Communicable Diseases Control (NCDC) of DGHS (n=1); KII5: With director/line director/ deputy director of primary healthcare of DGHS (n=1); KII6-7: Policy planner/independent consultant/specialist (n=1-2); KII8-9: Private doctor/NGO workers at district (n=1-2)					

296 Abbreviation for Table 3. FGD=Focus Group Discussions, KII=Key Informant Interviews,  
 297 IDI=In-depth Interviews, MIS=Management Information System, NCD=Non-communicable  
 298 Disease

299

300 **Sample size calculation**301 ***Quantitative (household survey)***



302 For the household survey, we used the following formula.

303 Here,

304  $n$ =the desired sample size (respondents)

305  $p$ =the proportion of the target population. We took the nationally representative data that  
306 reported the age-adjusted prevalence of diabetes as 9.7% (59) into account, which was the  
307 highest in Bangladesh.

308  $p=1-p$

309  $d$ =degree of accuracy desired, which is set at (0.02) 2%.

310  $Z_{\alpha/2}$ =the standard normal deviate usually set at 1.96 corresponds to the 95% confidence  
311 interval)

312

$$313 \quad n = \frac{Z^2 * P(1 - P)}{d^2}$$

$$314 \quad n = \frac{(1.96)^2 * 0.097(1 - 0.097)}{(0.02)^2}$$

$$315 \quad n = \frac{3.84 * 0.097 * 0.903}{0.0004}$$

$$316 \quad n = \frac{3.84 * 0.087}{0.0004}$$

$$317 \quad n = \frac{0.336}{0.0004}$$

318  $n=840$  (respondents)

319 This calculation provided the minimum required sample size of 840 respondents. Considering the  
320 nationwide coverage and socio-demographic heterogeneity of the population, the sample size was  
321 multiplied by the design effect of 1.5 (60), to adjust sampling variance caused by the multi-stage  
322 study design (61), which resulted in a sample size of  $840 * 1.5 = 1260$ . Additionally, a 10% non-  
323 response rate was applied as it is less than 10% in individual study (61), as well as nationally  
324 representative demographic and health surveys (62, 63) . which increased the sample size by 126,  
325 resulting in a final sample size of 1386 respondents.

326

327 ***Quantitative (healthcare facility survey)***

328 We have used the formula (below) taken from the sampling manual for facility surveys developed  
 329 by MEASURE Evaluation (64) to calculate sample size for the healthcare facilities.

330 Here,

331 n=the desired sample size

332 p=anticipated proportion of the facilities with the attribute of interest as 50%, reported by  
 333 a previous study (65).

334 d=design effect as 1.2 and the width of confidence interval for key estimates at  $p \pm 0.2\%$ .335  $V^2$ =the relative variance. It is the square of the relative error taken as 20%.

336  $Z_{\alpha/2}$ =the standard normal deviate usually set at 1.96 corresponding to the 95% confidence  
 337 interval)

$$338 \quad n = \frac{Z^2 * P * d^2}{V^2 * p}$$

$$339 \quad n = \frac{(1.96)^2 * 0.5 * 1.2}{(0.2)^2 * 0.5}$$

$$340 \quad n = \frac{3.84 * 0.6}{0.04 * 0.5}$$

$$341 \quad n = \frac{2.304}{0.02}$$

342 n=115 (healthcare facilities)

343 This calculation yielded the minimum required sample size of 115 healthcare facilities.

344 Anticipating a 10% non-response rate, the sample size was further increased by 15. Thus, the final  
 345 sample size was 125.

346 ***Sample size for qualitative component (IDIs, FGDs, and KIIs)***

1  
2  
3 347 The number of interviews (IDIs, KIIs, and FGDs) will be determined on the principle of ‘data  
4  
5 348 saturation’ (a point of time when no new information, themes, dimensions emerge) (66). Based on  
6  
7  
8 349 this principle, the final number of interviews may not be determined until the complete list of  
9  
10 350 interviews are conducted. However, we propose to conduct 16 IDIs, 13-15 KIIs, and 16 FGDs  
11  
12 351 according to Guest et al.’s (66) proposition to reach data saturation. This number may differ based  
13  
14  
15 352 on the data redundancy noted during the data collection.  
16  
17

## 18 353 **Sampling strategy**

### 19 20 21 354 *Quantitative (household survey)*

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24  
25 355 For household surveys, this study will adopt a multi-stage stratified cluster sampling procedure  
26  
27 356 (Figure 5) to ensure nationwide coverage, effective management, and supervision of data  
28  
29  
30 357 collection activities. Bangladesh is divided into eight administrative divisions: Barisal, Chittagong,  
31  
32 358 Dhaka, Khulna, Mymensingh, Rajshahi, Rangpur, and Sylhet. Each division consists of several  
33  
34 359 districts, and each district is further divided into sub-districts. Each sub-district has several *Union*  
35  
36 360 *Parishads* in rural areas, which are further subdivided into *mouzas*. In urban areas, each sub-district  
37  
38  
39 361 is divided into several *mohallas*. The entire country has been divided by the Bangladesh Bureau  
40  
41 362 of Statistics (BBS) into 2,96,718 enumeration areas (EAs) according to the enumeration area map  
42  
43 363 in the latest ‘Population and Housing Census’ (41). On an average, each EA consists of 120  
44  
45 364 households (62). For its sampling frame, this study used the list of EAs provided by the BBS. In  
46  
47  
48 365 the first stage, it randomly selected four administrative divisions. From each of the selected  
49  
50 366 divisions, a district was randomly selected. The number of participants required was determined  
51  
52 367 by the proportion of the population in the urban, and rural areas (41). Based on the latest estimated  
53  
54  
55 368 population in the country, the rural and urban populations were categorized as 36% and 64%,  
56  
57  
58  
59  
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1  
2  
3 369 respectively (67). The sample size of 1323 was divided into all the four randomly chosen districts.  
4  
5 370 The smallest number of participants required in any single EA was 63 (in *Jhenaidah*). This number  
6  
7 371 was considered as the maximum sampling intensity in an available EA. Thereafter, 17 EAs in rural,  
8  
9 372 and nine EAs in urban areas were randomly chosen. In the next stage, a systematic random  
10  
11 373 sampling procedure will be used to select 63 households, starting from the center of an EA, which  
12  
13 374 will be located by asking local residents/community members. Field enumerators will reckon the  
14  
15 375 household closest to the center point as the first household to be enrolled. In the next stage,  
16  
17 376 applying inclusion criteria (age  $\geq$ 18 years, not pregnant, no history of surgery for the last three  
18  
19 377 months) reported by a previous study, an adult aged 18 years and above will be interviewed (28).  
20  
21 378 Data will be collected from an eligible member in the selected household following the ‘Kish Grid’  
22  
23 379 method (68), which will allow us to interview only a single member of the selected household. In  
24  
25 380 case of the unavailability of household members (i.e, household shut down during data collection,  
26  
27 381 or decline to participate), the next eligible household will be approached. The second eligible  
28  
29 382 household will be selected by skipping the next household, and choosing the subsequent household  
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31 383 (i.e, every alternate household). This process will be repeatedly followed until the expected sample  
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33 384 size is reached.  
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Figure 5: Sampling strategy [to be inserted here]

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22  
23 396 ***Quantitative (healthcare facility survey)***

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25  
26 397 Healthcare facilities will be randomly selected for facility survey. We will prepare the list of  
27  
28 398 healthcare facilities at the primary care level by collecting basic information (facility type,  
29  
30 399 location, service availability, operating hours, etc.) from the ‘Directorate General of Health  
31  
32 400 Services’ database. From this list, we will randomly select healthcare facilities located at various  
33  
34 401 levels with the variation of size and patient load (e.g., UHC, UHC/Union sub-centre CC, private  
35  
36 402 clinic/hospital, NGO clinic/hospital). Facility-level data will be gathered by face-to-face  
37  
38 403 interviewing facility heads/designated personnel.

39  
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42  
43 404 ***Qualitative component (IDIs, FGDs, and KIIs)***

44  
45  
46 405 Purposive sampling strategy will be adopted for selecting the interview participants (69, 70). Some  
47  
48 406 pre-defined inclusion criteria [(i) aged  $\geq 18$  years living in the community; (ii) persons who are  
49  
50 407 better aware of NCDs (i.e., school teachers, faith leaders, village head); (ii) person engaged in  
51  
52 408 NCD related policy formulation or having expertise (policy planners, individual consultants, NGO  
53  
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2  
3 409 activities, govt. official); (iv) willing to participate voluntarily] will be applied to select the  
4  
5 410 participants. However, we will take the following three basic principles, widely used in purposive  
6  
7 411 sampling, into account (22): (i) maximum variation (we will include participant from roles and  
8  
9 412 backgrounds, locations/sub-districts, gender, age), (ii) iterative process (we will consider re-  
10  
11 413 interviewing and revisiting the participant if required to probe or validate specific information),  
12  
13 414 and (iii) reflexivity (assess the self-roles/researchers).  
14  
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18 415

## 21 416 **Data analysis**

### 25 417 *Quantitative (household survey)*

28 418 Household level quantitative data will be analyzed to uncover factors associated with NCD related  
29  
30 419 service and care seeking. The outcome variable will be the ‘care-seeking for NCDs’, which will  
31  
32 420 be recorded in the following 3 categories: no care or self-care, semi-qualified professional care,  
33  
34 421 and qualified professional care. The potential explanatory variables will be the individual  
35  
36 422 characteristics (i.e., age, sex, education, comorbidity, occupation), household characteristics (i.e.,  
37  
38 423 socio-economic status, household size), and contextual characteristics (i.e., the distance of the  
39  
40 424 facility from the household, type of residence). The relationship of these variables with ‘care-  
41  
42 425 seeking for NCDs’ will be assessed by employing multiple multinomial logistic regression  
43  
44 426 analyses, as the outcome variable has more than 2 categories.  
45  
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50 427

### 53 428 *Quantitative (healthcare facility survey)*

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3 429 Facility-level quantitative data will be analyzed following the SARA manual to assess service  
4  
5 430 specific readiness of the primary healthcare facilities (55). The primary outcome variable is  
6  
7 431 'readiness' of the primary healthcare system in Bangladesh, where it is measured in binary scale  
8  
9 432 (has two categories: 'ready' and 'not-ready'). The readiness variable will be rated as an index  
10  
11 433 grouped into following three domains as proposed in the WHO SARA methodology: (i) staff and  
12  
13 434 guidelines, (ii) diagnostic equipment, and (iii) medicines and essential commodities. Each of these  
14  
15 435 domains has multiple indicators, which will be measured in nominal scales: 'Yes' and 'No'. An  
16  
17 436 index for each domain will be calculated as the mean availability of indicators, which ranges from  
18  
19 437 0.00 to 100%. The facility readiness index (composite score) will then be calculated as the mean  
20  
21 438 of all these three domains and a facility will be considered as 'ready' if its index is above 50% (55)  
22  
23 439 . The binary multiple logistic regression analysis will be performed to evaluate the relationship  
24  
25 440 between the outcome 'readiness' and several potential explanatory variables such as facility type  
26  
27 441 (e.g., inpatients, outpatient), facility location (e.g., rural, urban), and managing authority (e.g.  
28  
29 442 public, private) of the facility.  
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### 36 443 ***Qualitative (IDIs, FGDs, and KIIs)***

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40 444 A thematic analysis approach will be used to analyze qualitative data (IDIs, KIIs, and FGDs) (71).  
41  
42 445 Initially, we will transcribe the interviews in verbatim fashion, and subsequently translate them  
43  
44 446 into English. At this step, all authors will independently read the interviews and familiarize  
45  
46 447 themselves with the information and contexts. In the next step, we will code the data in three steps  
47  
48 448 (open code, axial code, and selective codes). Once data coding is completed, we will form several  
49  
50 449 clusters (comprise a few codes), and then a few themes (comprise a few clusters). Finally, we will  
51  
52 450 present the findings under several themes. A stepwise procedure will be followed in this process  
53  
54 451 (71). All authors will independently prepare some codes and themes, and any disagreements will  
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3 452 be resolved following a discussion or consensus. Text management software (i.e., Nvivo, Atlas-ti)  
4  
5 453 will be used to analyze data. A triangulation of methods and participants will be performed to  
6  
7  
8 454 increase data validity and research rigors.  
9

## 10 11 455 **Patient and public involvement**

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14  
15 456 No patient involved  
16

## 17 18 457 **Participants' consent**

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21  
22 458 At the beginning of the interview, data collectors will inform participants about the purpose of the  
23  
24 459 study. An Explanatory Statement will then be provided by to the participants, which they can read,  
25  
26 460 and then ask any questions they have. Participants are then required to read and sign a consent  
27  
28 461 form, agreeing to participate. The consent form (written in Bangla) will explain the purpose of the  
29  
30 462 study, the freedom to participate, and how participants' information will be used while maintaining  
31  
32  
33 463 individual/facility confidentiality.  
34

## 35 36 37 464 **Workshop for data collection team and pilot study**

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39  
40 465 Four university graduates with a background in research methods as well as data collection tools  
41  
42 466 and techniques will be hired on an ad hoc basis. The first and second authors will train them on  
43  
44 467 data collection methods and techniques, and use the Research Electronic Data Capture (REDCap)  
45  
46 468 for collecting and recording data, and administering the questionnaire (72). REDCap is a secure  
47  
48  
49 469 web-based application for completing electronic surveys and data collection for research studies.  
50  
51 470 It provides 1) a user-friendly interface with validated data entry; 2) audit trails for tracking data  
52  
53  
54 471 manipulation; and 3) an automated export procedure for seamless data downloads to standard  
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3 472 statistical packages. All questionnaires, observation checklists, and interview guidelines will be  
4  
5 473 piloted in Sylhet and Rajshahi districts (beyond these sampled eight districts) to assess their  
6  
7 474 comprehensibility, appropriateness, and conformability to the participants and interviewers. Based  
8  
9 475 on the piloting, required changes will be made before finalizing the questionnaires, observation  
10  
11 476 checklists, and interview guidelines.  
12  
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### 16 477 **Quality assurance measures for data collection**

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19 478 To ensure data quality, various steps such as accuracy, relevance, completeness, and consistency  
20  
21 479 of data will be monitored and checked by all investigators via REDCap application. In addition,  
22  
23 480 the student investigator will carry out a random consistency check for at least 5% of the  
24  
25 481 interviewed questionnaires. The student investigator will observe the interviews and group  
26  
27 482 discussion session by physical participation in the interview sessions. If physical presence of the  
28  
29 483 investigator becomes limited, the interview sessions will be observed via audio-visual technique  
30  
31 484 (Zoom Video Communication, Skype video chat or voice call). Supportive supervision will be  
32  
33 485 provided to the interviewers, if required.  
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### 39 486 **Ethics and dissemination**

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42 487 The project has been approved by the Monash University Human Research Ethics Committee  
43  
44 488 (Project ID: 27112). The project also received ethical approval from the Bangladesh Medical  
45  
46 489 Research Council (Ref: BMRC/NREC/2019-2022/270). The ethical standards set by the ethics  
47  
48 490 committee will be fully complied with throughout the research process. Any sensitive and hidden  
49  
50 491 issues will be addressed according to the ethical values and standards established and exercised by  
51  
52 492 the university and/or institution. The study participants' confidentiality and anonymity will be  
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3 493 maintained at all stages by removing their names. During the data collection period, data will be  
4  
5 494 saved in the secure REDCap web-based application hosted at Monash University. The application  
6  
7  
8 495 will be accessible only by the research team. When the data collection is completed, the data will  
9  
10 496 be exported to IBM SPSS statistical package, and will be saved in the secure faculty-allocated  
11  
12 497 network storage (Monash (S:) drive). Participants' identifiers such as names and designations will  
13  
14  
15 498 be removed from the main database and saved in a separate secure electronic folder, and will not  
16  
17 499 be used for data analysis. The research findings will be published in scientific public health  
18  
19 500 journals. The published reports will include group data only, and no individual data or information  
20  
21 501 will be shared. Summary of the research findings will be disseminated to the community through  
22  
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24 502 news media.

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## 30 504 **Discussion**

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34 505 To the best of our knowledge, this is the first hybrid study that aims to provide a deeper analysis  
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36 506 and assessment of the primary healthcare system in Bangladesh in the context of NCD-related  
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39 507 services. Although NCDs lists in Bangladesh include some more diseases or conditions (including  
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41 508 arsenicosis, mental health disorders, hearing disabilities, birth defects, and road injuries), our study  
42  
43 509 will include the major NCDs (diabetes mellitus, chronic respiratory diseases, cardiovascular  
44  
45 510 disease, and cancer) prioritised by the WHO. Therefore, we did not require to modify any tool to  
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47  
48 511 include these locally defined NCDs.

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51 512 The existing studies mainly investigated supply-side factors to assess the healthcare system  
52  
53 513 readiness for NCDs (i.e., medicine, basic amenities, medical products, and technologies) as

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2  
3 514 devised in the WHO SARA methodology and/or WHO PEN interventions. However, the demand-  
4  
5 515 side factors, which is an essential consideration in addressing NCDs, remain largely under-  
6  
7 516 explored. The proposed study will examine healthcare system readiness by adopting a mixed-  
8  
9 517 method approach and applying the relevant health system framework (58). In this present study,  
10  
11 518 use of a conceptual framework and combining various methods/tools will offer a deeper and  
12  
13 519 comprehensive understanding of the healthcare system's readiness from both supply-side and  
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15 520 demand-side perspectives.  
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20 521 Bangladesh's primary healthcare system is quite unitary (overly-centralized) in terms of  
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22 522 management structure, organizational hierarchy, resource allocation, workforce deployment,  
23  
24 523 health-seeking behavior, and sociocultural characteristics of the population (73). The proposed  
25  
26 524 study will fill critical information gaps in the NCD related service organization and delivery  
27  
28 525 mechanism. Since this study will reflect the holistic features of the primary healthcare system  
29  
30 526 currently functioning at sub-district level, it will constitute comprehensive information to assess  
31  
32 527 the current health system's extent of preparedness, and whether better NCD services at the  
33  
34 528 population level need to be provided. Therefore, the study findings will benefit policy planners,  
35  
36 529 program implementers, healthcare professionals, and community members to develop a need-  
37  
38 530 oriented, effective, and patient-centered NCD services mechanism at the primary healthcare level  
39  
40 531 in Bangladesh. Overall, the study findings will guide public health decisions for NCD prevention  
41  
42 532 and management efforts at the primary healthcare system in Bangladesh and the similar contexts  
43  
44 533 elsewhere.  
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## 51 **Abbreviations & acronyms**

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3 535 CC=Community Clinic, DGHS=Directorate General of Health Services, FGD=Focus Group  
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5 536 Discussions, FWV=Family Welfare Visitor, KII=Key Informant Interviews, IDI=In-depth  
6  
7 537 Interviews, HA=Health Assistant, IMS=Information Management System, MO=Medical Officer,  
8  
9 538 NCDC=Non-Communicable Diseases, NCDC=Non-Communicable Diseases Control, , NCD  
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11 539 PEN= Noncommunicable Disease Package of Essential Interventions, NGOH/C=NGO  
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13 540 Hospital/Clinic, RMO=Residential Medical Officer, PH/C=Private Hospital/Clinic,  
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15 541 SACMO=Sub-Assistant Community Medical Officers, UHC= *Upazila* Health Complex,  
16  
17 542 (hospital), TBD= To Be Determined, UHC=*Union* Health Centre, USC=*Union* Sub-Centre  
18  
19 543 UHFPO=*Upazila* Health and Family Planning Officer, VD=Village Doctor, WHO SARA=World  
20  
21 544 Health Organization Service Availability and Readiness Assessment  
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#### 27 545 **Author Contributions**

28  
29  
30 546 AK, NK, and BB conceived and designed the study. AK developed data collection tools, will  
31  
32 547 implement data collection activities, and prepare the first draft of the manuscript. NK and BB  
33  
34 548 revised the manuscript. BB provided overall stewardship. The final manuscript has been read and  
35  
36 549 approved by all authors.  
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39

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41  
42  
43 551 This is a PhD project in Monash University. This project did not receive any external funding.  
44  
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47 552

#### 48 553 **Availability of data and materials**

49  
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51 554 Not applicable  
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## 556 Conflicts of interest

557 All the authors declare that they have no conflicts of interest.

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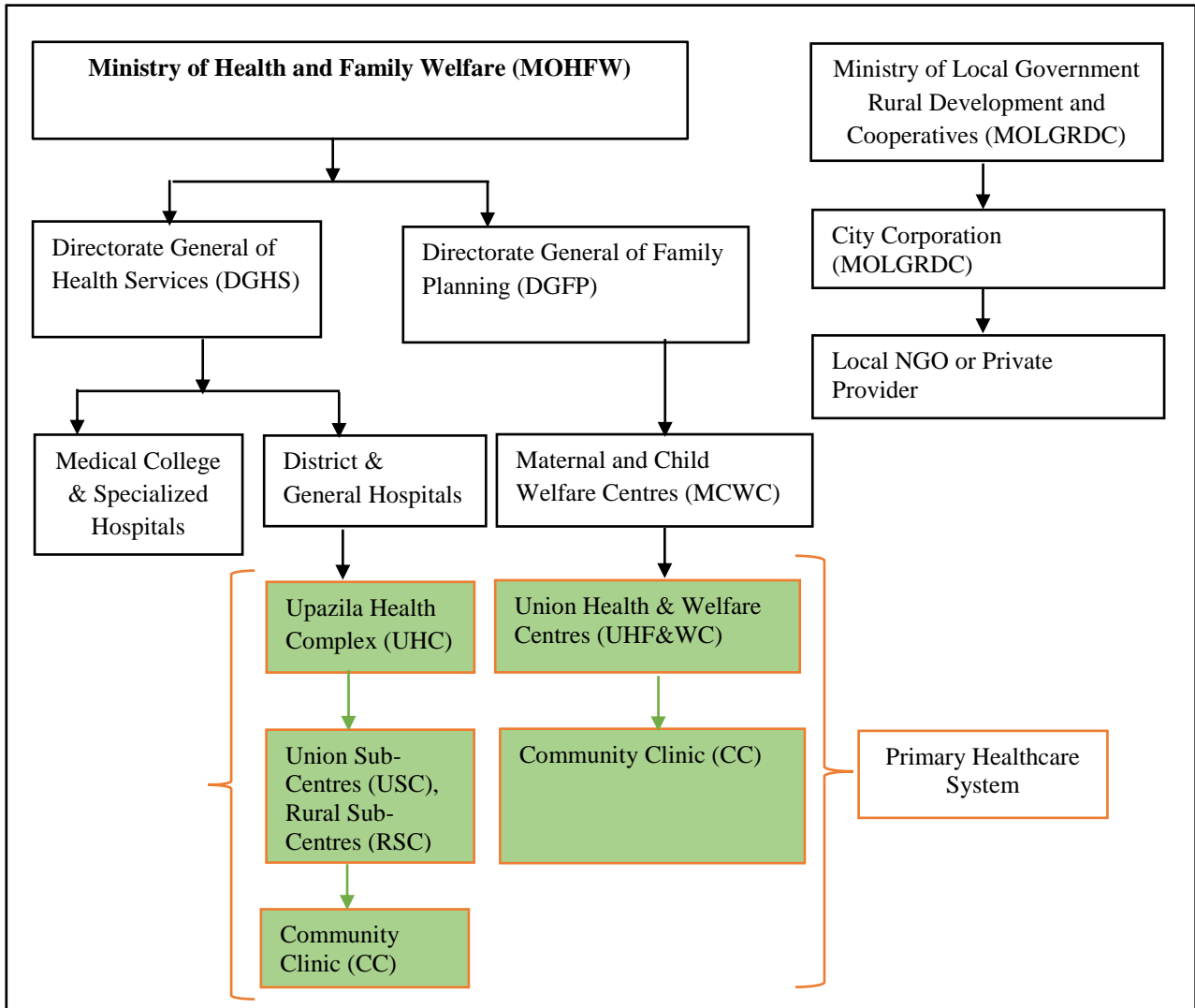


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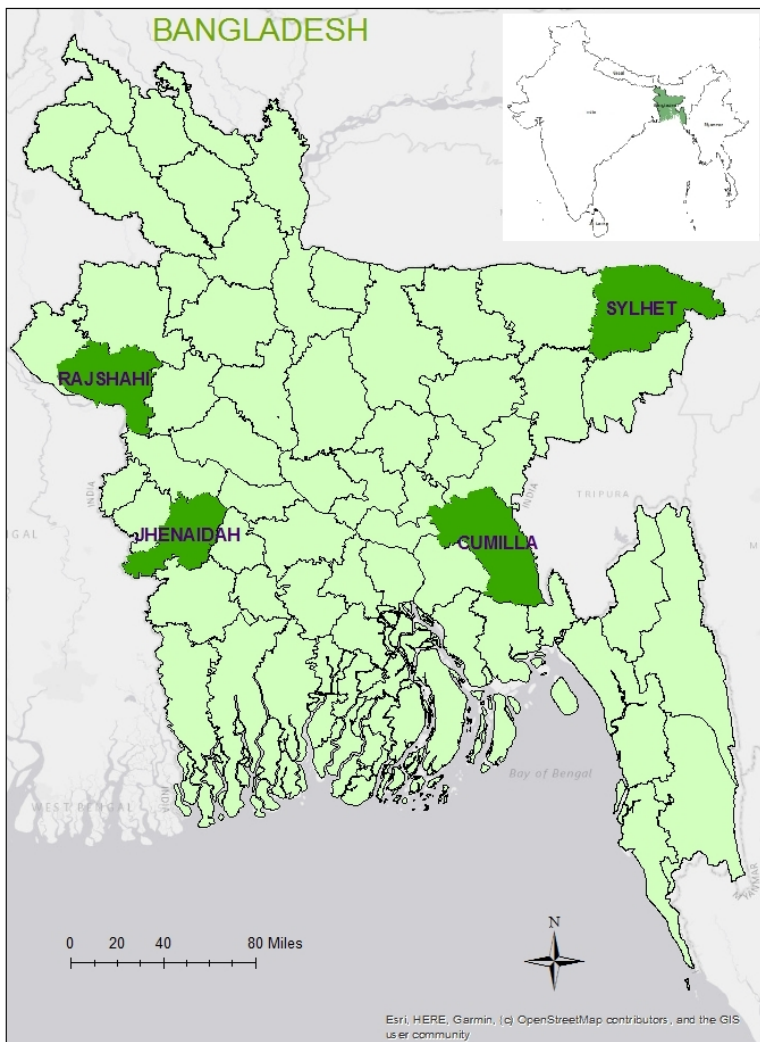
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Figure 1: Health service delivery organizational structure in Bangladesh

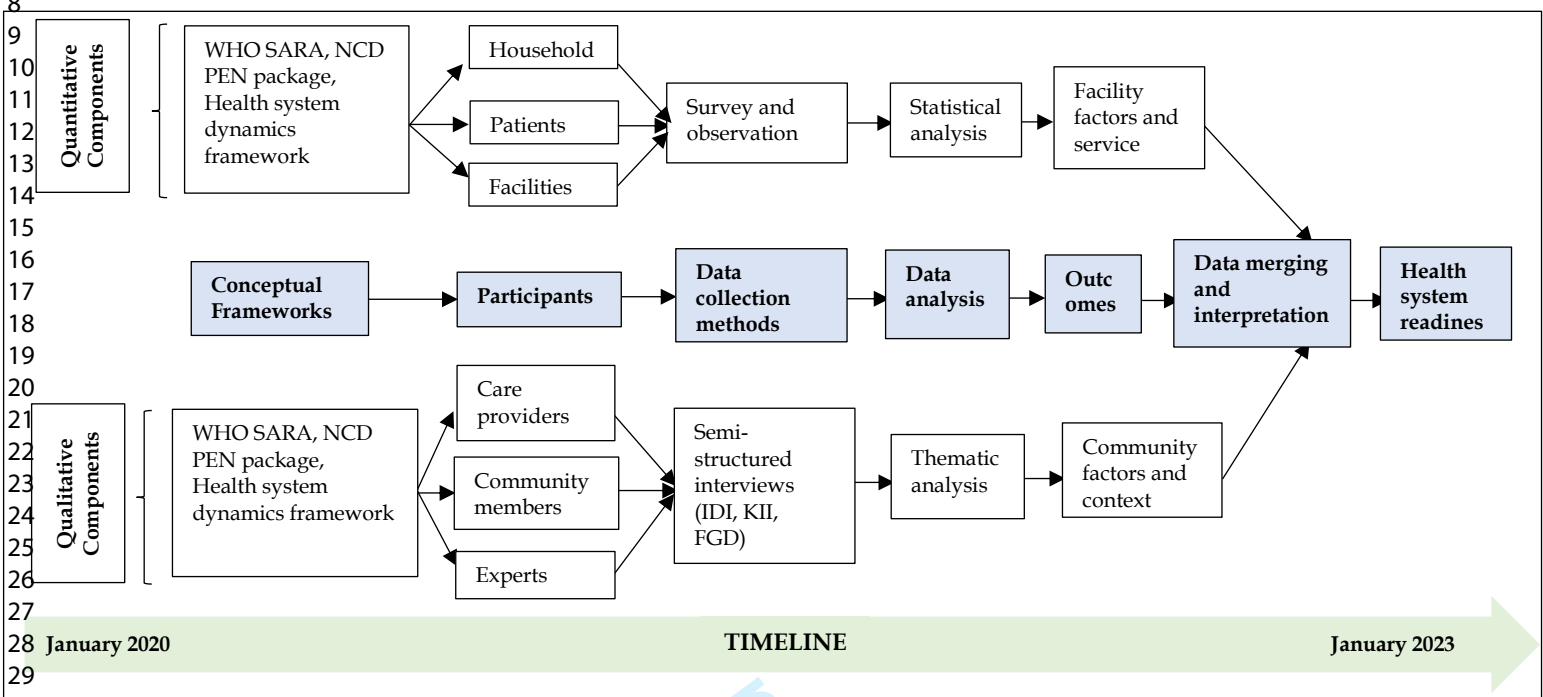


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Figure 3: Study design with data collection method and analysis



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Figure 4: Health system dynamics framework

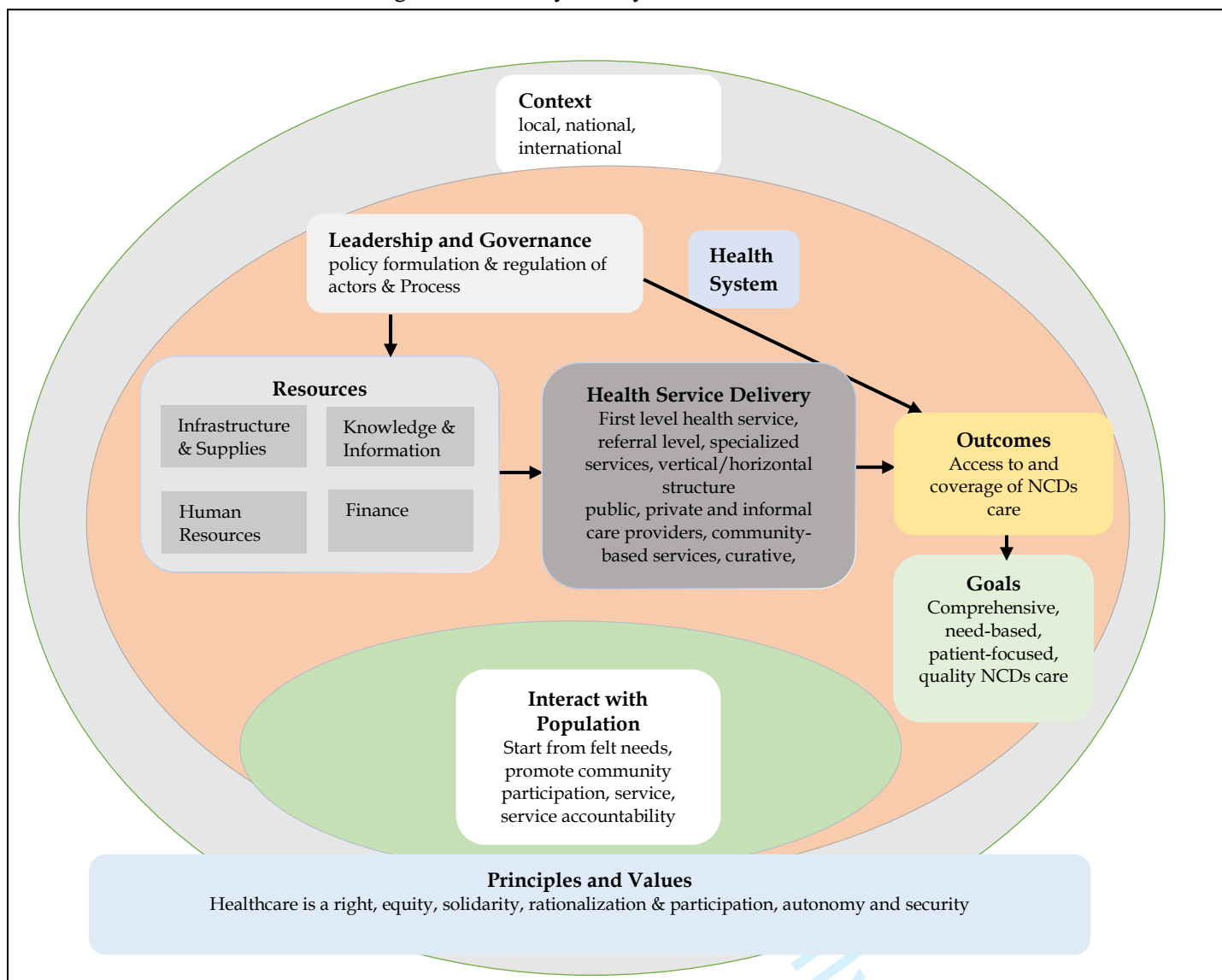


Figure 5: Sampling strategy

