COVID-19 and Health System Response for Management of Diabetes in Bangladesh

Shamim Hayder Talukder (✉ ceo@eminence-bd.org)

Eminence Associates for Social Development

Tasneem Islam

Eminence Associates for Social Development

Kazi Fayzus Salahin

Eminence Associates for Social Development

Shahin Akter

Eminence Associates for Social Development

Dina Farhana

Eminence Associates for Social Development

Ummay Farihin Sultana

Eminence Associates for Social Development

Md. Tasbir Ul Islam

Eminence Associates for Social Development

Zumin Shi

Qatar University

Akhtar Hussain

International Diabetes Federation

Research Article

Keywords: COVID-19, Diabetes, Healthcare Management, Health System Response, Bangladesh

Posted Date: July 16th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-579444/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Abstract

Background: As untreated diabetes can lead to an exacerbation of symptoms and life-threatening complications, there had been a study of such correlating variables in regards to COVID-19 treatments in Bangladesh. Therefore, the study assessed the health system response for the treatment and preventative care for diabetic patients amidst a pandemic situation under social distancing, and how it affects such health system responses in a developing country.

Method: By using a cross-sectional descriptive study and collecting information through qualitative methods, the study assesses the patient's ability to access medication, laboratory services, and preventative care. The study conducted twelve focus group discussions, 30 key informants' interviews (KII), and reviewed twelve daily newspapers to analyze the condition of the health system response related to the treatment of diabetic patients.

Results: Most responding patients were aged 55-60 years. Healthcare professionals stated that increasing incidence of COVID-19 infection is witnessed among older diabetic patients. The study also found that complications of uncontrolled diabetes result in increasing costs of treatment, creating a burden on healthcare systems, and preventing patients from proper treatment in this lockdown situation.

Conclusions: With the problems specifically halting access to treatment under social distancing conditions, as well as a reluctance from health care providers to treat due to high infection rates from improper personal protective equipment (PPE) resourcing, lead to a concerning conclusion regarding diabetic healthcare systems in Bangladesh, that can benefit from telemedicine, faster and cheaper medication delivery, and popularizing diabetic testing tools.

Introductions:

COVID-19 emerged as a rapidly evolving pandemic, impacting nearly 220 countries and more than 78,194,947 patients worldwide, with more than 1,736,752 deaths as of December 25, 2020. ("WHO Coronavirus Disease (COVID-19) Dashboard", 2020) A meta-analysis of eight studies from China, including 46,248 infected patients, showed the most prevalent co-morbidities were HTN ($17 \pm 7\%$, 95% CI 14–22%) followed by DM ($8 \pm 6\%$, 95% CI 6–11%) and CVD ($5 \pm 4\%$, 95% CI 4–7%) (Yang et al., 2020). Known risk factors for severe cases of COVID-19, DM, COPD, CVD and HTN, have a high prevalence in low- and middle-income countries, and these conditions are generally worse controlled in these settings than in high-income countries and therefore the potential associated risk might be higher. However, a rapid assessment survey of WHO found that 75% of countries reported interruptions to NCD services (Rapid assessment of service delivery for NCDs during the COVID-19 pandemic, 2020). Till 23rd December 2020 Bangladesh has identified 5, 04,868 COVID-19 cases among them death cases are 7,359 and about 80% of the deaths occurred above 50 years of age (DGHS, 2020). A recent study of 734 hospitalized patients diagnosed with COVID-19 found 19.8% had diabetes and the frequency of patients requiring insulin increased three-fold (Akter et al., 2020). This study was intended to explore the health system management components' response to the treatment of diabetes during the COVID-19 outbreak in Bangladesh. Almost eight million diabetic patients were diagnosed to visit diabetic centers to receive routine treatments and follow-ups regularly before the first confirmed case of COVID-19 all over the country. After the government implemented a lockdown in March that continued till May, all health service centers became stagnant. Many health service providers became infected with COVID-19; outdoor and indoor diabetic care centers were further inactive. Lockdown also reduced the means of physical exercise, as people were limited to the confines of their homes. Without regular checkups and maintenance of diabetic symptoms, complications become exacerbated. Many people began utilizing mobile health services for their diabetic management. Newspapers also covered the scarcity of drugs and their inaccessibility. A comprehensive study was still lacking to document the health system response for diabetic management, which is necessary for an in-depth understanding of diabetes and management of other diseases during COVID-19 to improve the healthcare system's response in a high diabetic prevalence country.

Objectives:

The objective of the study is to assess the response of the healthcare system for preventive care and treatment of people with diabetes during COVID-19, and to analyze the health-seeking behavior of diabetes patients amidst COVID-19's social distancing and lockdown.

Methodology:

A cross-sectional descriptive design was followed by collecting information through qualitative methods. Literature reviews, focus group discussions, and in-depth interviews with diabetes and health service providers of diabetic treatment in hospitals and diabetic care centers of Bangladesh were carried out. Literature reviews were included, such as patient management guidelines, scientific article reports, newspaper entries, etc. The study conducted 30 key informant interviews from national to local level health managers. The policymakers, senior diabetic physicians, and different diabetes-related associations' leaders were included for conducting key informant interviews and focus group discussions. Twelve focus group discussions were also conducted which included male and female patient groups and healthcare service providers. Different diabetic-related professional associations' leaders were included for conducting key informant interviews (KII) and focus

group discussions. Twenty national level newspapers were reviewed from March-August to gather information about the diabetic status and healthcare response. All the interviews and focus groups discussions are conducted by qualitative data collectors from July to August. Data collection was carried out through telephone interviewing and using Zoom calls.

Interview Guide:

Discussion Topic	Examples of Specific Probes
leadership and governance	What do you understand by leadership and governance?
	How would you evaluate leadership and governance in case of diabetes treatment during COVID-19?
Health Information System for Diabetes	Have you (physician/patient) been aware of any diabetes management related guideline/instruction during COVID-19?
	How effective do you (physician/patients) think telemedicine service have been for diabetes patients during COVID-19?
Health Financing for Diabetes	Do you think that specific budget should be allocated for Diabetes?
	What is your opinion regarding the drugs availability for diabetes during COVID-19?
	Do the expenses of treatment and drugs create strain on the economic-condition of a patient?
Health Resource for Diabetes	Did you get satisfactory treatment for diabetes during lockdown?
	Have you (physician) conducted any study/research on diabetes during COVID-19?
Essential Medical Products and Technology	Do you (physician) think technology have been used effectively to provide services to diabetes patients during COVID-19?
	Do you (physician) think the diabetes patients received required health services during COVID-19?
Health Service Delivery	How did you manage your health condition during lockdown?
	How the patients' investigations were addressed?
	Do hospitals arrange any specific service to provide emergency services to diabetes patients during COVID-19?

Materials and Data Management:

An in-depth interview checklist, focus group discussion guideline, and a literature review checklist were being used for the study. The checklists were tested for finalization and utilized during data collection from the target subjects. After conducting the interviews and focus group discussions, the data were transcribed for analysis, and then the transcribed reports were translated back and forth from Bengali to English until each translation became sufficiently similar to the previous language to ensure an accurate translation. The analysis was carried out by coding the keywords based on the six components of health systems such as leadership and governance, health information systems, health financing, health resources, essential medical products and technology, and health service delivery. Researchers conducted the analysis manually, following the logical framework of the study to achieve the objectives.

Data Analysis:

The transcripts were analyzed using qualitative content analysis (U.H. Graneheim et al. 2004 and M. Schreier, 2014). Each transcript was read several times, and irrelevant parts were extracted. The study employed each primary question as an overarching category (deductive coding). These broad categories were further broken down into subcategories based on the findings that emerged from analyses of the transcripts (inductive coding). Answers to a question bearing the same meaning and content were assembled and ascribed a common code. Initially, the study team analyzed all the transcripts to generate an initial series of codes for each of the six primary questions. Next, researchers independently coded all the focus group discussions, interviews and reviewed data. Afterwards, all these data have been transcribed. The analysis was discussed during consensus meetings, and any differences in interpretation were resolved by the researchers. After that, the second round of analysis was independently undertaken by the team leader and other researchers; wherein all the ascribed codes were again reviewed, followed by a final discussion among the study team members.

Results Of The Study:

Socio-demography of the respondents

A total of 126 participants participated in the study. Twelve diabetes patients' groups (96 in total) were select for FGDs. Among them more than 50% were male. The average ages of the respondents were 52.08 years ($SD \pm 13.02$). 44% of the respondents were in the age group 41–50 years. However, 48% of the respondent were highly educated (post-Graduate), 52% were private service holder. Furthermore, 47% of the respondents were in "Middle Income" group in the socio-economies context; in the view of the religious belief 80% were Muslim, and majority of them were married (83%). Interestingly, 65% of the respondent were took oral drugs and 16% of the respondent were took both insulin and oral drugs. From the service provider and the stakeholder ($N = 30$), the mean age of them were 55.33 ($SD \pm 9.31$). Around 50% of the respondents were in the age group 56–65 years. However, 62% of them were male and majority of them were physician (40%)

Socio-Demographic Status of the Beneficiaries (N = 96)		
Characteristic	N	%
Age (mean $\pm$ SD) = 52.08 $\pm$ 13.02 years		
Range		
18–30	5	5
31–40	7	7
41–50	20	21
51–60	42	44
≥ 61	22	23
Gender		
Male	50	52
Female	46	48
Educational Status		
Secondary	10	10
Higher Secondary	12	13
Graduation	28	29
Post-Graduation	46	48
Profession		
Government Service	16	17
Private Service	50	52
Housewife	30	31
Socio-Economic Status		
Lower Middle Income (Below 20,000)	6	6
Middle Income (21,000–40,000)	45	47
Upper Middle Income (41,000–60,000)	32	33
Upper Income (Above 60,000)	13	14
Marital Status		
Single	3	3
Married	80	83
Divorced	2	2
Widowed	11	11
Religious Status		
Muslim	77	80
Non-Muslim	19	20
Treatment Mode		
Oral Drugs	62	65
Insulin	19	20
Both	15	16
Socio-Demographic Status of the Service Provider and Stakeholder (N = 30)		
Age (mean $\pm$ SD) = 55.33 $\pm$ 9.31 years		

Socio-Demographic Status of the Beneficiaries (N = 96)		
Range		
35–45	3	10
46–55	10	33
56–65	15	50
Above 65	2	7
Gender		
Male	19	62
Female	11	38
Profession		
General Physicians	12	40
Consultant Physicians	10	33
Policymakers	3	10
Health Managers	5	17

Themes of participants

Themes	Probe	Demographics	Frequent Responses
Healthcare Service	Do hospitals arrange special healthcare service for diabetes patients during COVID-19?		Hospitals (those provide diabetes services) were being used to treat COVID-19 infected patients; hence it was difficult to get access for general patients. (Patients) heard of no special service for diabetes patients even in emergency case although (high-income) few received critical care on requirement-basis. Low-income (patients) service seekers have totally been ignored, despite their deteriorating health condition.
	Do the patients provided with any household Care Instruction of physician in result of any initiative taken either by the government or private sectors?		(Patients) did not received any structured instruction of health experts regarding household diabetes care, yet few social media platforms shared primary healthcare advice, aiming diabetes and other NCDs. (In case of low-income people) some who (reported to) are be the most vulnerable and exposed to COVID-19 get no health advice or support leaning on any initiative taken by the government and private sectors.
	Does telemedicine care provide diabetes patients with required treatment?		Since telemedicine service was not designed to provide any special service, targeting selected diseases like diabetes, (diabetes) patients received the same service so as to other patients. Furthermore, some (patients) reported being treated with less attention due to of being a free-of-cost service.
	How the patients' investigations were addressed?		(Patients) confronted with various obstacles when it came to investigation as most of the diagnostic centers were closed, and the investigation service providers of few (opened) centers expressed less interest to carry out the investigation to avoid the close contact with patients.
Drugs Access and Management	Do the prices of drugs create strain on the economic condition of diabetes patients during COVID-19?		Due to the shortage of drugs and obstruction in importing (selected) medicines, the prices increased, creating economic-burden in a circumstance when (most of) the people were jobless or experiencing decrement in income.
	Do the patients get drugs accessibility during COVID-19		A dire crisis of drugs (almost reported by all) have been experienced nearly by every diabetes patient, be it the high-middle or low-income people. The area-based dispensaries were also closed out of COVID-19 fear, hence no option left for the aged or support-less patients group but to seek for drugs in remote areas or to remain out-of-it. No special initiative has been carried out from government to mitigate such misery of diabetes patients.
	How do the drugs have been preserved?		On (patients') request for insulin, my neighbor opened his dispensary which was closed for days, and was out of electric connection- which indicates the drugs are not being preserved properly which reduce their effectiveness.

Health System Response for Diabetes

Leadership and Governance

Most (92%) of the respondents of the study show minimum satisfaction towards the leadership and governance for diabetes care during COVID-19.

Although a guideline for diabetic patients was published in April 2020, larger number (78%) of health service providers and receivers reported to be unaware of its existence. As a result, they experienced a lack of guidance from the responsible authorities during the lockdown in April and May. During lockdown hour, most (90%) of the healthcare professionals were under engaged and there was an acute shortage of personal protective equipment (PPE), resulting little or no opportunity for specialists to treat or attend patients in the diabetic healthcare centers. A number of patients (6%) also reported of having incomplete instruction when consulted with family doctors. During study period, 11 newspaper reports indicate no new deaths caused by COVID-19 until the end of March, however there was also very low (< 1%) COVID-19 diagnosis testing and patients monitoring for COVID-19. These newspaper reports also reveal that many physicians refused to see patients without having a COVID-19 test report. However, the study finds that the shortage of testing kits and restrictive COVID-19 diagnosis policies made it difficult for those diabetes patients who were given investigations that have been needed to be seen by their healthcare providers. Majority (88%) news reports reflect a lack in the regulation from the higher authority on how and who should be treated amongst the pandemic, which not only alarmed healthcare providers, rather hindered the possibilities of providing health care services as well. Nearly all (90%) of the respondents further reasoned that the actual rate of COVID-19 infection among diabetic patients might be higher than the reported data.

When respondents (service provider) were asked whether they received and aware of any diabetes treatment or service guideline aiming COVID-19, most of the general and consultant physicians provided a negative answer.

"A fright was developed inside as COVID-19 was all new then, I seek for guidance first but the sacrifice of patients' lives made me go without it" ... (p6)

Experts determined that the data needed for proper epidemiological analysis was severely lacking due to the lack of comprehensive testing (New Age BD, 2020), as announced on the 28th March 29 follows a similar suit with complaints of many patients dying with COVID-like symptoms, but no way of confirmation (New Age BD, 2020). The government established a national technical committee for COVID-19 to provide technical support for planning and managing health services throughout the country. This committee consisted of 21 members among whom only one member's expertise includes NCDs. Most (70%) of the respondents of KII shed light on the government's development of a clinical management guideline for COVID-19, which was updated eight times, but diabetes management was not addressed within its first few versions.

"As a doctor, it shocked me that most of the COVID-19 aimed guidelines allocated a very little ground for NCDs while people living with it are the most vulnerable one" ... (p12)

Moreover, many service provider participants (56%) (thought the public healthcare system lacked an adequate emphasis on physician and frontline healthcare workers' safety regarding diabetes management. The Diabetic Association Network (DAN) centers were unable to act upon proper guidance to manage their patients. On an individual level, many groups attempted to share guidelines in social media or television announcements which seem to attain a positive upshot on the public as they often mentioned during focus group discussions as helpful information they could use. Patients highly appreciated some of the individual physician's leadership, undertaking the job to inform the public regarding COVID-19 disease and safety.

Health Information System for Diabetes

Our study found that, public awareness towards diabetes was limited in the past six months. 78% of the service receiver participants reported not seeing any government-issued public announcements regarding diabetes management on television and newspapers. Though the government created an online telemedicine service platform to reach patients from remote locations 82% of the service provider participants on this telemedicine line responded not to be explicitly prepared regarding the management of diabetic patients, which led to further inadequate services and decreased the trust between diabetic patients and telemedicine healthcare services.

However, almost all (96%) the participants, both patients and service providers, mentioned about a dire communication gap in terms of providing and receiving telemedicine service.

"It was my first-time telemedicine service experience, I found it difficult to make understand my condition and complications neither understood the physicians' advice properly" ... (FDG-ph-p4)

"I prescribed the patient for high blood pressure, cough and fever after a complex explanation of condition, but immediately before cutting the call, she added of having diabetes which turned the table" ... (FGD-HCP-p21)

Bangabondhu Sheikh Mujib Medical University (BSMMU) and Bangladesh Diabetic Association (BDA) provided telemedicine that helped diabetes patients on varying levels of severity. Different pharmaceutical companies used social media to provide diabetic care information and share their activities to support diabetic patients whereas the government printed and disseminated posters regarding diabetes management. But it did not effectively reach the public as most were homebound, and did not see them hung up in various hospital locations. Information related to COVID-19 and test results were collected and distributed by the Institute of Epidemiology Disease Control and Research (IEDCR), but they did not release data, specifically targeting diabetes or other co-morbidities associated with it.

Participants who treated COVID-19 patients informed that most complicated COVID-19 cases had some diabetes related complications. Yet no study has been carried out due to the lack of accurate data.

"We (indicates health care professionals) need accurate data regarding COVID-19 tests and the infection rate to measure the severity to increase the service quality but hardly accuracy is being seen in existing data which if not considered would lead to upheaval" ... (p29)

Health Financing for Diabetes

While the government invested large amounts of money for COVID-19 treatments, most of it went towards logistical sectors such as ventilator, incubator, masks, and personal protective equipment (PPE) purchases. Although the government invested around BDT 100 billion for COVID-19 treatment and vaccine purpose, there were no specific allocations from these funds targeting diabetes management systems. The World Bank and ADB also provided an additional BDT 15 billion as COVID-19 emergency response finances which did not involve any separate funds for diabetes. Specifically, the Health Population Nutrition Sector Program (HPNSP) received no new public diabetes management finances in its annual budget review.

Together with the frequent mention of need for sufficient budget allocation, majority (89%) of the participants pointed at underlying corruption in health sector.

"Despite the need of more budget allocation aimed NCDs, corruption surged during COVID-19 which led to mismanagement and results a healthcare system more vulnerable" ... (p32)

We know that 70% of the public's total health costs have to be covered from pocket expenditures. Hence, without the government's regulation of price gouging and inflation, costs increased, causing strain on the people. Transportation systems further failed with increased mandatory social distancing, which caused medicine prices to soar, independent of the general economic setback due to the entire country being under compulsory lockdown. Importantly, the expense rate of insulin and other diabetic drugs increased well above the retail price at this time. Meanwhile, the innovative initiative of telemedicine has added on this financial train, making it much more expensive than in-person visits along with reported difficulties in managing patients' treatments.

Participants who belong to low-income group expressed their utter concern regarding livelihood than their health condition.

"When it has become really difficult for people like us to earn breads for survival in this COVID-19 situation, buying medicines for fancy disease like diabetes is beyond capacity" ... (P40)

Health Resources for Diabetes

Being one of the high prevalent NCDs and of alarming public health concern, Diabetes management has many components and investigations, including blood glucose monitoring that were severely hindered during the imposed lockdown. Beforehand, be it the study perspective for researchers or prescribed investigations from health professionals, the procedures of taking sample were not much inconvenient and the medicines, with store availability, could have been ordered online. However, the increasing fears of infection and governments' mandate have made all these services shut down, creating an unimaginable crisis for the diabetes patients, especially in the first four months of the outbreak, responded by most (66%) of the participants (service receivers and service providers). However, the study found that the expenses of investigations made it accessible only for the participants (service receivers) who belong to the higher economic level. In contrast, the participants (service receivers) in the lower socio-economic ground were unable to go through such management, as they relied on cheaper in-person systems.

In response to the question regarding the scope and necessity of research on COVID-19 and diabetes, participants mostly highlighted the deficiency of resource and shortage of accurate data.

"I together with some of my colleagues tried hard to carry out a study, investigating the relationship between diabetes and COVID-19, neither had we got financial support nor case related data, we delayed... (p24)

Compared to the requirement, the contribution of both the government and private pharmaceutical companies in resource mobilization for diabetes treatment research was disheartening. Meanwhile, physicians have suggested that by creating an online-based training platform for the frontline workers to enhance their skill and capacity, the diabetes related complications during COVID-19 can be handled.

Essential Medical Products and Technology

Diabetes-related medical products became increasingly limited during lockdown. Endocrinologists had deficient in quality Personal Protective Equipment (PPE), and diabetic complication related patients could not access various biological investigations needed to ensure proper checkups. The country witnessed a 4% coronavirus mortality rate and 2.1% infection rate among physicians and healthcare workers, creating a severe scenario in a developing country like Bangladesh, and as a result, further constrained the treatment availability. The physicians in focus group discussion opined that mobile phones and televisions can be used to spread information regarding diabetes management. Furthermore, due to the dire shortage of PPE, the healthcare service workers hardly carried out echocardiogram, MRI, ECG, and other essential tests as these involve close contact with patients during COVID-19.

"I believe, each one of us experienced a sense of dilemma for we too have feeling for family, at the meantime, it was hard to ignore the frightened eyes of our patients. The quality PPE seemed the only earthly rescuer then" ... (p55)

Cardiac diabetic complications can be properly investigated by echocardiograms, but Bangladesh has not developed a mobile testing system test for appropriate diagnosis. Hospitals lacked negative air pressure systems, so it was quite hard to prevent infection in the hospital premises. There was a lot of Hand-sanitizer and hydroxychloroquine tablet were sold for prevention of COVID-19 and Z-packs but DM and HTN treatment remain undersold. However, the poor slum and village people could not access the medical products due to the price. 92% of such participants responded not having the opportunity to buy the medications because of the price which was assumed higher in their critical financial situation. Among the service receiver participants, we found that 16% of them were not taking any antibiotics, insulin and other medications for diabetes control during lockdown.

Health Service Delivery

The severe impact of COVID-19 is mostly endured by various aspects of health service delivery, making health system infrastructure overburdened from high death tolls. Being a poverty-stricken country, Bangladesh has given a tough war-ground to fight against COVID-19 despite its incompetent healthcare system, resulting unimaginable public sufferings during this pandemic hour.

Mr. Rashid (pseudonym), a 60 years old diabetic patient who lives in Dhaka, takes insulin two times a day to keep his diabetic level in control and his daily routine involves morning and evening walk until lockdown has been imposed. He used to have a diet, including different types of fruits recommended by his physician. Mr. Rashid has no complain about life up to the period of lockdown when his neighborhood has suddenly detached from all basic services like other parts of the country.

The imposed lockdown during COVID-19 sharply interrupted the health management of diabetes patients, creating horrendous disruption in social-and-health service delivery.

Mr. Rashid also confronted difficulties in finding his medication for diabetes in the local medical stores for most of those being imported. He further couldn't continue his daily walk due to governments' incumbent on people to stop the spread of COVID-19, and regular diet has been hampered for the disruption in food supply. Moreover, these triple triggers of service disruption created deep tension in the household of Mr. Rashid that he might be in danger of Hyperglycemia and Hypoglycemia.

The mental pressure and physical turmoil of diabetic patients during lockdown in Bangladesh is even more horrific than the above portrayed scenario. Most (70%) of the participants (physicians) responded and newspaper articles reported that those with diabetes had worse complications with COVID-19 infection, and maximum cases of COVID-19 related deaths had diabetes-related co-morbidities.

Participants shared some of their sore and sufferings in middle of answering the question that, too, reflects defeat of our health service infrastructure.

"We (participant and his wife) have no son and our only daughter is married; in this age (53) I can't take the burdens of searching for medicines. She becomes extremely frightened and keeps asking me how we would cope with this kind of unprecedented situation" ... (p44)

"My parents diagnosed with COVID-19, and at the end my father (59) alone won the fight. Although my mother (46) was quite young, diabetes gave her a tough situation" ... (p48)

Health services for COVID-19 did not include any diabetes-related awareness programs specific to that cohort. Physicians reported that uncontrolled diabetic patients had a low recovery and high death rates. Various diabetic association centers had high physician infection rates,

which in turn disturbed their services.

Almost all (98%) of the participants of low-income and of low-educational status genuinely reflects of their knowledge gap.

"I do not clearly understand what diabetes is or its management except that it is not curable. My rickshaw stand is near a hospital where various posters of health issues are hung on but due to being unable to read, do not understand much from them" ... (p66)

It is hard to measure the social and economic complex caused by diabetes which lead both to the expensive maintenance and various life-threatening complications, most commonly stroke and neuropathy. However, governments' public health service infrastructure was closed from March to July 2020, and it was a critical time of inaccessibility to patients. Diabetic association hospitals had many undiagnosed COVID-19 patients, and diabetic patients also did not share signs and symptoms with their physicians due to negative stigmas associated with COVID-19. Furthermore, Diabetes Association Hospitals' ICU patients tested positive for COVID-19 were hospitalized, causing the spread of COVID-19 among health professionals that results a lockdown of ICU which in turn closed general services.

Ranu Begum (pseudonym), a working woman living in a well-sophisticated area of Dhaka, called her uncle, Mr. Zafor (pseudonym), and requested him to call her mother, Mrs. Roushon (pseudonym), to check on her as she was not picking up any calls from any of her children. She also informed about her mother being diabetes and other NCDs patient along with a high fever nowadays. Upon reaching Mr. Zafors' call, Mrs. Roushon received and informed about her current situation. When Mr. Zafor asked her about not answering calls from her children, she mentioned a sorrow that has been very common during this pandemic hour.

Social distancing and an underlying concept of fear regarding coronavirus wrack havoc on the mental health of general people in such way that ends up creating distance even in between blood-relationship. The parents living with NCDs under went the extra burden of stress and anxiety due to being ignored by their children.

Her sons live in the same building as her on different floors. Despite being informed that she has had a fever, they did not visit her even for once, rather insisted on taking over the phone, putting all the blame in the neck of the imposed lockdown. Hence, Mrs. Roushon became upset with her children's response and stopped receiving their calls.

Majority (82%) of the older adult participants confronted with both physical and psychological burden during the lockdown period, which indicates a worse and stressed circumstance for patients with non-communicable diseases. Lockdown and social distancing on diabetes care had many harmful side effects that may have been assuaged with proper diabetic patient guidelines. For example, many patients could not travel to health centers for care. Moreover, telemedicine was too expensive, and the CDC trained physicians have been too late regarding diabetes and hypertension management, as responded by most (68%) of the participants (service receivers)

Discussion:

The prevalence of diabetes is comparatively higher in the urban areas than the rural, where one in every 10 adults (Alam et al., 2018) has diabetes, and it increases steeply with BMI for both genders, which gleams of a situation which will disproportionately affect the more densely populated cities of Dhaka and Chittagong (Talukder et al., 2014), as they are the sites with most positive COVID-19 cases. The prevalence of diabetes among both women and men above 35 years increased similarly between 2011 and 2017 from 11–14%. Around 40% of diabetic women and men are aware of their elevated blood glucose levels whereas only 13% of diabetic Bangladeshis are aware of their condition and take medication to manage their blood glucose levels (Fottrell et al., 2018). This indicates the need of expanded diabetes awareness program all over the country which will possibly increase the relevant knowledge of the people.

There are many limitations, particularly to the vulnerable low socio-economic status (SES) populations that are exacerbated in low-income nations. COVID-19 risk factors include immunocompromised individuals, low SES status, as well as multiple common chronic illnesses, such as diabetes and hypertension. About 12 million Bangladeshis were recorded to have hypertension in 2010 (Zaman et al., 2010), along with 2.7 million diabetes mellitus. These numbers are increasing by 2020, creating further complication for COVID-19 patients. Besides, the fact that this data indicates a greater risk for a country with many high-risk individuals, managing and treating chronic illnesses becomes even more complicated under government-mandated quarantine.

Bangladesh government's expenditure in the health sector is the 3rd biggest investment in the country which has a total of 62 district-level hospitals, 421 Upazilla health complexes, 1312 Union healthcare sub-centers, and Community Clinics. Additionally, three private hospitals and health-care centers are available for treating Diabetic patients. Moreover, there are dedicated diabetes-care units in government hospitals in Bangladesh. A recent study shows that, among the diabetes patients 9.8% are reported not taking any antibiotic medication at all. Around 40.8% of the patients took insulin, 46.6% took metformin, 38.7% sulfonylurea, 38.7% any antihypertensive medication, and 14.2% took anti-lipids over the preceding 3 months (Shariful Islam, et. al., 2016). As COVID-19 outbreak disrupted the normal flow in the medication supply chain and income of the people, as our finding showed, the rates of taking medications has reduced to 6–10%. Similarly, despite of the Health Population

and Nutrition Sector Development Program (HPNSDP) which has started transforming the health-care centers in favor of NCDs by extending the model to 62 Upazilas with an expectation to provide Diabetes and HT care in the next 2 years, the services were limited due to the country-wide lockdown. This limitation in service resulted lack of satisfaction among the service receivers. The government's recent initiative of providing training to 13,000 CHCPs about diabetes care can become a progressive step towards mitigating the gaps in the service and bring back the satisfaction of the service receivers if the program be conducted in proper management.. Additionally, the sustainable health care model for diabetes and general patients created by Diabetic Association of Bangladesh (BADAS) is playing an effective role in reducing the gaps and ensuring quality service to the patients by treating more of the diabetic patients in Bangladesh, which has already expressed the expectation to increase the coverage to 75% patients by 2022. The Association currently manages over 100 institutions, ranging from small to large hospitals that provide primary, secondary, and tertiary care across all disciplines. BADAS employs over 1500 physicians and nurses, 118 health educators, and more than 2,000 lab technicians to provide comprehensive care throughout the country. Still, the consequences of COVID-19 pandemic and it's effect on the health system management is increasing risks of diabetes in Bangladesh at a steady pace.. Therefore, strengthening the healthcare system management is important to maximize the outcomes of existing diabetic care systems in Bangladesh.

When we interviewed the doctors, nurses, and other staffs almost all of them informed us that despite of their utmost interest to treat the patients they could not provided the expected service because of the lack of sufficient safety equipment. Their agitation is justified in the national statistics. As we reviewed Bangladesh Medical Association website and several newspapers we found that a total of 8,042healthcare professionals got affected by COVID-19 by October 01, 2020among them 35% were doctors, 24% were nurses, and 41% were other healthcare staffs. In the context of the geographical area, the infection rate of healthcare professionals by COVID-19 were reported in Dhaka division 45%, Barisal division 3%, Chittagong division 22%, Khulna division 6%, Rajshahi division 1%, Rangpur division 3%, Sylhet division 12%, and Mymensingh division 8%. Additionally, the data demonstrated that a large number of doctors (44%), nurses (56%), and other healthcare staff (40%) reported in the Dhaka division only. The prevailing situation indicates that healthcare professionals of the Dhaka division are more vulnerable than others. Additionally, the coronavirus mortality rate in Bangladeshi doctors is around 4%, the highest globally. In contrast, the average standard mortality rate in doctors is 2.5 percent worldwide and the highest in Italy (3%) which is still below than of Bangladesh (Jahangir, 2020). In these circumstances were reflected in our study too

Human Resource Management is another essential area along with the infrastructures for the development of diabetes treatment. In developing countries, diabetes is widespread, but there is a lack in organized care for patients living with diabetes, and other chronic conditions. Professional and civil society associations often help fill this gap. In Bangladesh, there are diploma, post-graduation, and MD courses for diabetes. But in comparison, there are limited institutional opportunities for the root-level and technical workers to develop their skills. Expanding the scope of opportunities to the root-level can play a vital role in effective approach towards COVID-like possible pandemics in the future.

Interview Key Finding on the Opinion on Diabetes Management during COVID-19

Thematic Area	Probe	Demographics	Frequent Responses
Understanding of leadership and governance	What do you understand by leadership and governance?		The health leadership and governance indicate a function, carried out by governments/decisions makers for achieving national health policy objectives.
	How would you evaluate leadership and governance during COVID-19?		No specific guideline has been developed for diabetes management, and during lockdown no special services related to diabetes been arranged for people living with it.
Health Information System for Diabetes	Have you been aware of diabetes management related guideline during COVID-19?		On my request my daughter searched for if any instruction have been shared in TV or social media for diabetes patients, found nothing- it was difficult to decide the dos and don'ts.
	How effective do you (physician) think telemedicine service have been during COVID-19?		Since the telemedicine service aimed to provide service generally rather designing any section for NCDs patients, it was difficult to provide diabetic and others NCDs patients with proper treatment.
Health Financing for Diabetes	Do you think that specific budget should be allocated for Diabetes?		Of course, since diabetes has becoming common disease name in every family, resource is required for its well management during this pandemic hour.
	What is your opinion regarding the drugs availability for diabetes during COVID-19?		(participant) prescribed to take insulin two times/day, so within 15 day new insulin requirement arises- during lockdown a dire crisis of drugs have been experienced by (patients), the government's concern regarding the medication availability during such circumstances is highly expected.
Health Resource for Diabetes	Did you get satisfactory treatment for diabetes during lockdown?		investigations were difficult to get during lockdown, being unable to follow the suggested diet for less access to healthy food, unavailability of medicines- all contributed to deteriorating health condition. (Patients reported) to receive less attention in from physician as the telemedicine service was free of cost.
	Have you (physician) conducted any study/research on diabetes during COVID-19?		It was difficult to have access to accurate data, and resource to conduct study on diabetes during such pandemic despite having tremendous interest to sort out the correlates.
Essential Medical Products and technology	Do you (physician) think technology have been used effectively to provide services to diabetes patients during COVID-19?		To some extends the technology have been used both by the government and private sectors to spread awareness regarding diabetes and COVID-19 by social media and TV promotion. Yet, many possible initiatives remain knocking, such as circulation of diabetes management guideline, capacity building of health service providers, webinar ensuring experts' engagement, and etc.
Health Service Delivery	Do you (physician) think the diabetes patients received required health services during COVID-19?		Since lockdown made it quite difficult for patients to physically visit their physician for treatment and advice, along with deteriorating diabetes condition, mental burden and stress arises dramatically, leading to other health complications. There have been no special arrangement for diabetes patients from government, and the scenario was more terrifying in care of low-income people.
	How did you manage your health condition during lockdown?		For lockdown the (Patients') daily-walk have been hampered, hence the front premises or roof top have been used (by mostly), the traditional food seeking behavior (herbal ingredients, daily use of plants like Orjun, Nim etc) raised in response to getting less access to marketized food. Yet, there was no substitute for medicines patient takes on a regular basis, even (some reported) purchased insulin from dispensaries that were shut-down for days, which indicates that the insulin were not kept in required temperature.

Conclusion:

In the present situation, Telemedicine service should be strengthened to ensure easy access to the services for diabetic patients. Moreover, appropriate measures should be taken to make the necessary medication available for the people living with diabetes along with popularizing the testing tools and technology among the mass people. Finally, necessary measures should be taken to motivate the people to follow a

healthy lifestyle and raise awareness about the potential risk factors of Diabetes Mellitus. Taking these measures can gradually bring some change in the healthcare system of diabetes treatment in Bangladesh. There is a scope for the development of institutional programs for the root-level and technical workers of diabetes treatment providing service.

Declarations:

Ethics approval and consent to participate

The study participation was completely voluntary. A valid informed consent was obtained from the participant(s) who were willing to participate in the study. Individual information was preserved to maintain the confidentiality as per IRB. The study protocol was approved by the authorities of Institutional Review Board (IRB) of Eminence Associates for Social Development containing number (Emi/IRB/Oct/2010011001).

Consent for publication

Title of manuscript: COVID-19 and Health System Response for Management of Diabetes in Bangladesh

Journal name: BMC Health Services Research

I, the undersigned, give my consent for the publication of identifiable details, which can include photograph(s) and/or videos and/or case history and/or details within the text ("Material") to be published in the above Journal and Article. I confirm that I have seen and been given the opportunity to read both the Material and the Article (as attached) to be published by BMC Health Services Research.

I have discussed this consent form with all authors and co-authors.

I understand that all BMC Health Services Research may be available in both print and on the internet, Therefore, anyone can read material published in the Journal.

I understand that readers may include not only medical professionals and scholarly researchers but also journalists and general members of the public.

Availability of data and materials

The data that support the findings of this study are available from Eminence Associates for Social Development but restrictions apply to the availability of these data, which were used under license (Emi/IRB/Oct/2010011001) for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of Eminence Associates for Social Development.

Competing interests

The authors have clarified that there are no possible conflicts of interest in the study, authorship, and/or publication of this research paper.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Acknowledgements

The authors are grateful to the anonymous referees of the Journal for their beneficial recommendations for developing the excellence of the paper. The standard disclaimers apply.

Authors' contributions

The correspondent author Dr Shamim Hayder Talukder[i] and his team members Tasneem Islam[ii], Dr. Shahin Akter[iii], Dina Farhana[iv], Ummay Farihin Sultana[v], Md. Tasbir Ul Islam Prodhan[vi], Zumin Shi[vii] and Akhtar Hussain[viii] and Kazi Fayzus Salahin[ix] have equally participated (Data analysis, Report writing, Literature review) in this study.

[i] Chief Executive Officer, Eminence Associates for Social Development

[ii] Assistant Coordinator, Eminence Associates for Social Development

[iii] Technical Operation Director, Eminence Associates for Social Development

[iv] Technical Coordination Director, Eminence Associates for Social Development

[v] Business Development Officer, Eminence Associates for Social Development

[vi] Business Development Officer, Eminence Associates for Social Development

[vii] Professor, Human Nutrition Department, College of Health Sciences, QU Health, Qatar University

[viii] Professor, NORD University & President-Elect of the International Diabetes Federation

[ix] Data Analyst and Communication Officer, Eminence Associates for Social Development

References:

1. Akter, F., Mannan, A., Mehedi, H., Rob, M., Ahmed, S., & Salauddin, A. et al. (2020). Clinical characteristics and short term outcomes after recovery from COVID-19 in patients with and without diabetes in Bangladesh. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 14(6), 2031-2038. doi: 10.1016/j.dsx.2020.10.016
2. Akter, S., Rahman, M. M., Abe, S. K., & Sultana, P. (2014). Prevalence of diabetes and prediabetes and their risk factors among Bangladeshi adults: A nationwide survey. *Bulletin of the World Health Organization*, 92(3). doi:10.2471/blt.13.128371
3. Alam, M. A., Chakraborty, N., Haider, M. M., Jamil, K., Khan, S., Reza, M. M., . . . Streatfield, P. K. (2018). BDHS 2017-18 PRELIMINARY FINDINGS Hypertension and Diabetes.
4. Another dies from coronavirus in Mirpur. (2020, March 22). Retrieved 2020, from <https://www.dhakatribune.com/bangladesh/dhaka/2020/03/22/mp-claims-another-dead-from-coronavirus-in-mirpur>
5. Bangladesh Medical Association (BMA), 2020. <https://bma.org.bd> (accessed October, 01 2020).
6. Bangladesh puts area in capital on lockdown after second coronavirus death. (n.d.). Retrieved June 06, 2020, from <https://www.newagebd.net/article/102849/bangladesh-puts-area-in-capital-on-lockdown-after-second-coronavirus-death>
7. Bangladesh receives medical logistics from Jack Ma Foundation. (2020, March 27). Retrieved from <https://www.dhakatribune.com/bangladesh/2020/03/27/bangladesh-receives-medical-logistics-from-jack-ma-foundation>
8. Bangladesh witnesses highest spike in Covid-19 cases in 24hrs. (2020, May 3). Retrieved from <https://www.dhakatribune.com/bangladesh/2020/05/03/coronavirus-2-more-die-another-665-test-positive-in-24hrs>
9. Community transmission of coronavirus found in Bangladesh: IEDCR. (n.d.54r672 families of 40 buildings under 'lockdown' in Dhaka . (2020, March 23). Retrieved from <https://tbsnews.net/bangladesh/health/672-families-40-buildings-under-lockdown-dhaka-59323>
10. Corona.gov.bd. (2020, April 12). Most Corona Patients Have Been Identified In The Last 24 Hours In The Country. [online] Available at: <<https://corona.gov.bd/storage/press-releases/April2020/1m8jcUtEl21LKnpf3hur.pdf>> [Accessed May 30 2020].
11. Coronavirus fatality rate highest in Bangladesh. (n.d.). Retrieved from <https://www.newagebd.net/article/103274/coronavirus-fatality-rate-highest-in-bangladesh>
12. Coronavirus Resource Centre. John Hopkins University & medicine. 2020 [Cited 2020 September 30]. Available from: <https://coronavirus.jhu.edu/map.html>.
13. Coronavirus: 3 more die in Bangladesh, total infected 123. (2020, April 6). Retrieved from <https://www.dhakatribune.com/health/coronavirus/2020/04/06/coronavirus-4-more-die-in-bangladesh-total-infected-117>
14. Coronavirus: 5 more infected, no new death in 24hrs. (2020, April 3). Retrieved from <https://www.dhakatribune.com/bangladesh/2020/04/03/coronavirus-5-more-infected-in-bangladesh-raising-total-to-61>
15. Coronavirus: 6 more die, 94 more test positive. (2020, April 10). Retrieved from <https://www.dhakatribune.com/health/coronavirus/2020/04/10/coronavirus-6-more-die-94-more-tested-positive>
16. Coronavirus: Bangladesh confirms first death, 4 new cases. (2020, March 18). BANGLANEWS24. Retrieved from Coronavirus: Bangladesh confirms first death, 4 new cases
17. Coronavirus: Bangladesh confirms first death, 4 new cases. (2020, March 18). Retrieved May 30, 2020, from <https://www.banglanews24.com/english/national/article/83210/Coronavirus-Bangladesh-confirms-first-death-4-new-cases>
18. Coronavirus: Bangladesh mass prayer event prompts alarm. (2020, March 19). BBC NEWS. Retrieved from <https://www.bbc.com/news/world-asia-51956510>
19. Coronavirus: Bangladesh reports 112 new cases as death toll climbs to 21. (2020, April 9). Retrieved from <https://www.dhakatribune.com/health/coronavirus/2020/04/09/coronavirus-1-more-dies-new-infected-112>
20. Coronavirus: Mosque attendance during Jumma prayer falls. (2020, March 27). Retrieved from <https://www.dhakatribune.com/bangladesh/2020/03/27/coronavirus-mosque-attendance-during-jumma-prayer-falls>
21. Correspondent, S. (2020, March 27). Biman folds its wings. Retrieved from <https://web.archive.org/web/20200328005121/https://www.thedailystar.net/frontpage/news/biman-folds-its-wings-1886875>
22. COVID-19 Bangladesh Update, May 28, 2020. (n.d.). Retrieved from <https://bd.ambafrance.org/COVID-19-Bangladesh-Update-28-May-2020-2000>
23. Covid-19 Status Bangladesh, May 11, 2020. (n.d.). Retrieved from <https://bd.ambafrance.org/Covid-19-Status-Bangladesh-11th-May-2020>

24. Covid-19 Status Bangladesh, May 15, 2020. (n.d.). Retrieved from <https://bd.ambafrance.org/Covid-19-Status-Bangladesh-15th-May-2020-1974>
25. Delta Hospital's ICU head tests positive with Covid-19. (2020, March 26). Retrieved May 30, 2020, from <https://tbsnews.net/coronavirus-chronicle/coronavirus-bangladesh/delta-hospital-icu-head-tests-positive-covid-19-61573>
26. DGHS, (2020). Retrieved 26 December 2020, from https://dghs.gov.bd/images/docs/Press%20Release/Press%20release%20of%2023_12_2020
27. DU, 7 other public universities suspend academic activities amid coronavirus fears. (2020, March 16). Unite News of Bangladesh. Retrieved from <https://unb.com.bd/category/bangladesh/dhaka-university-shut-down-over-coronavirus-fears/47156>
28. Educational institutions are closed till March 31. (2020, March 18). Prothomalo. Retrieved from <https://www.prothomalo.com/bangladesh/article/1645112/শিক্ষা-সংক্রান্ত-সংক্রান্ত-সংক্রান্ত-সংক্রান্ত-সংক্রান্ত>
29. Flora, D. S. (2020, March 13). [করোনা ভাইরাস প্রতিরোধ করুন, করোনা ভাইরাস প্রতিরোধ করুন](https://www.prothomalo.com/bangladesh/article/1644573/করোনা-ভাইরাস-প্রতিরোধ-করুন-করোনা-ভাইরাস-প্রতিরোধ-করুন). Retrieved May 30, 2020, from <https://www.prothomalo.com/bangladesh/article/1644573/করোনা-ভাইরাস-প্রতিরোধ-করুন-করোনা-ভাইরাস-প্রতিরোধ-করুন>
30. Fottrell, E., Ahmed, N., Shaha, S. K., Jennings, H., Kuddus, A., Morrison, J., . . . Azad, K. (2018). Distribution of diabetes, hypertension and non-communicable disease risk factors among adults in rural Bangladesh: A cross-sectional survey. *BMJ Global Health*, 3(6). doi:10.1136/bmjgh-2018-000787
31. Habib, W. B., & Sujan, M. A. (2020, March 31). Coronavirus Outbreak: Low test rate may be belying reality. Retrieved from <https://www.thedailystar.net/frontpage/news/coronavirus-outbreak-low-test-rate-may-be-belying-reality-1888327>
32. Harmachhi, A. R. (n.d.). Bangladesh Bank announces Tk 30b lending scheme for low-income groups. Retrieved from <https://bdnews24.com/economy/2020/04/20/bangladesh-bank-announces-tk-30b-lending-scheme-for-low-income-groups>
33. Hasan, K. (2020, March 17). 2 more coronavirus cases confirmed in Bangladesh. Retrieved May 30, 2020, from <https://www.dhakatribune.com/bangladesh/2020/03/17/2-more-coronavirus-cases-confirmed-in-bangladesh>
34. IEDCR. (2020, March). Retrieved May 25, 2020, from <http://www.iedcr.gov.bd/>
35. Islam, S. M., Purnat, T. D., Phuong, N. T., Mwingira, U., Schacht, K., & Fröschl, G. (2014). Non-Communicable Diseases (NCDs) in developing countries: A symposium report. *Globalization and Health*, 10(1), 144. doi:10.1186/s12992-014-0081-9
36. JAHANGIR ABDUR RAHMAN (2020). Coronavirus: Doctors' mortality rate in Bangladesh' highest.... unb.com.bd. Retrieved October 6 2020, from <https://unb.com.bd/category/Special/coronavirus-doctors-mortality-rate-in-bangladesh-highest-in-the-world/53378>
37. Kamal, A., Saha, N., Afroz, S., & Hossain, J. (n.d.). Bangladesh sees first lockdown in Madaripur. Retrieved June 06, 2020, from <https://unb.com.bd/category/Bangladesh/bangladesh-sees-first-lockdown-in-madaripur/47542>
38. Karim, N. (2020, March 23). Sex workers in one of world's largest brothel appeal for funds due coronavirus. Retrieved June 05, 2020, from <https://www.reuters.com/article/health-coronavirus-bangladesh/sex-workers-in-one-of-worlds-largest-brothel-appeal-for-funds-due-coronavirus-idUSL8N2BG6B1>
39. Khokon, S. H. (2020, March 15). Coronavirus outbreak: 5 confirmed cases in Bangladesh, 2,314 in quarantined, 10 in isolation. Retrieved May 30, 2020, from <https://www.indiatoday.in/world/story/coronavirus-outbreak-confirmed-cases-bangladesh-quarantined-isolation-1655755-2020-03-15>
40. Li Q, Med M, Guan X, Wu P, Wang X, Zhou L, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus–infected pneumonia. *N Engl J Med*. 2020 March 26; 382(13):1199-20.
41. Maswood, M. H. (2020, March 18). Bangladesh confirms first coronavirus death. NEWAGEBangladesh. Retrieved from <https://www.newagebd.net/article/102574/first-covid-19-death-reported-in-bangladesh>
42. Mohiuddin, A. K. (2019). Diabetes fact: Bangladesh perspective. *International Journal of Diabetes Research*, 2(1), 14-20. Available from: <http://www.ghrnet.org/index.php/ijhr/article/view/2457>
43. Newsupload. (2020, March 07). [করোনা ভাইরাস প্রতিরোধ করুন, করোনা ভাইরাস প্রতিরোধ করুন](https://matopath.com/2020/03/07/করোনা-ভাইরাস-প্রতিরোধ-করুন-করোনা-ভাইরাস-প্রতিরোধ-করুন): করোনাভাইরাস. Retrieved May 30, 2020, from <https://matopath.com/2020/03/07/করোনা-ভাইরাস-প্রতিরোধ-করুন-করোনা-ভাইরাস-প্রতিরোধ-করুন/>
44. Paul, R. (2020, March 08). Bangladesh confirms its first three cases of coronavirus. Retrieved June 02, 2020, from <https://www.reuters.com/article/us-health-coronavirus-bangladesh-idUSKBN20V0FS>
45. Paul, R. (2020, March 18). Bangladesh reports first coronavirus death -officials. Retrieved May 26, 2020, Retrieved from <https://www.reuters.com/article/health-coronavirus-bangladesh-idUSL4N2BB384>
46. People Who Are at Higher Risk for Severe Illness. (2020, May 14). Retrieved May 27, 2020, from <https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-at-higher-risk.html>
47. Prothom Alo. [করোনা ভাইরাস প্রতিরোধ করুন, করোনা ভাইরাস প্রতিরোধ করুন](https://www.prothomalo.com/bangladesh/article/1654060/করোনা-ভাইরাস-প্রতিরোধ-করুন-করোনা-ভাইরাস-প্রতিরোধ-করুন). (n.d.). Retrieved from <https://www.prothomalo.com/bangladesh/article/1654060/করোনা-ভাইরাস-প্রতিরোধ-করুন-করোনা-ভাইরাস-প্রতিরোধ-করুন>
48. Prothom-Alo, (2020). (2020, April 8). Retrieved May 30, 2020, from <https://www.prothomalo.com/bangladesh/article/1649492/>

49. Rapid assessment of service delivery for NCDs during the COVID-19 pandemic. (2020). Retrieved 26 December 2020, from <https://www.who.int/publications/m/item/rapid-assessment-of-service-delivery-for-ncds-during-the-covid-19-pandemic>
50. Regan, H., Marsh, J., Spark, L. S., Alfonso, F., & Vera, A. (2020, April 20). April 19 coronavirus news. Retrieved from <https://www.cnn.com/world/live-news/coronavirus-pandemic-04-19-20-intl/index.html>
51. Report, S. (2020, March 18). Bangladesh reports first coronavirus death, number of active cases now 14. Retrieved May 30, 2020, from <https://www.thedailystar.net/coronavirus-deadly-new-threat/news/1-dead-coronavirus-infection-1882474>
52. Report, S. (2020, March 23). 1 more dies of coronavirus, 6 new cases confirmed: IEDCR. Retrieved from <https://www.thedailystar.net/coronavirus-deadly-new-threat/news/coronavirus-6-new-cases-detected-1-more-dead-says-iedcr-1884718>
53. Report, S. (2020, March 23). Coronavirus outbreak: Govt orders closure of public, private offices from March 26 to April 4. Retrieved from <https://www.thedailystar.net/coronavirus-deadly-new-threat/news/govt-offices-closed-march-26-april-4-cabinet-secretary-1884730>
54. Report, S. O. (2020, April 1). 1 more dies of coronavirus, 3 new cases confirmed: health minister. Retrieved from <https://www.thedailystar.net/coronavirus-update-in-bangladesh-1-more-dies-3-new-cases-confirmed-1888420>
55. Report, S. O. (2020, April 13). Five more coronavirus patients die, 182 test positive in 24hrs: health minister. Retrieved from <https://www.thedailystar.net/coronavirus-deadly-new-threat/news/five-more-coronavirus-patients-die-182-test-positive-24hrs-health-minister-1892539>
56. Report, S. O. (2020, April 2). Two more infected with coronavirus: DGHS. Retrieved from <https://www.thedailystar.net/coronavirus-update-in-bangladesh-2-more-infected-1888798>
57. Report, S. O. (2020, April 3). Coronavirus outbreak: 100 N'ganj families put in self-isolation. Retrieved from <https://www.thedailystar.net/coronavirus-deadly-new-threat/news/coronavirus-outbreak-100-nganj-families-put-self-isolation-1889134>
58. Report, S. O. (2020, April 4). Bangladesh reports 2 more coronavirus deaths. Retrieved from <https://www.thedailystar.net/coronavirus-death-in-bangladesh-total-8-died-1889446>
59. Report, S. O. (2020, April 6). Bangladesh reports 3 more coronavirus deaths, 35 test positive in 24hrs: DGHS. Retrieved from <https://www.thedailystar.net/coronavirus-in-bangladesh-reports-4-more-deaths-1890109>
60. Report, S. O. (2020, April 7). Bangladesh reports 5 more coronavirus deaths, 41 test positive in 24hrs: IEDCR. Retrieved from <https://www.thedailystar.net/coronavirus-update-in-bangladesh-5-more-died-1890508>
61. Report, S. O. (2020, April 7). Bangladesh reports 5 more coronavirus deaths, 41 test positive in 24hrs: IEDCR. Retrieved from <https://www.thedailystar.net/coronavirus-update-in-bangladesh-5-more-died-1890508>
62. Senior Correspondent, bdnews24.com. (2020, April 5). Bangladesh confirms 18 more virus cases in highest single-day spike. Retrieved from <https://bdnews24.com/bangladesh/2020/04/05/bangladesh-confirms-18-more-virus-cases-in-highest-single-day-spike>
63. Shahin, H., & Jame, F. A. (2020, April 25). CoronaVirus (Covid - 19) in Bangladesh (Latest Update). Retrieved from <https://bangladeshus.com/coronavirus-in-bangladesh-latest-update/>
64. Shariful Islam SM, Lechner A, Ferreri U, et al. Healthcare use and expenditure for diabetes in Bangladesh. *BMJ Global Health* 2017;2:e000033. doi:10.1136/bmjgh-2016-000033
65. Six die with coronavirus symptoms, no new case reported in Bangladesh. (n.d.). Retrieved from <https://www.newagebd.net/article/103364/six-die-with-coronavirus-symptoms-no-new-case-reported-in-bangladesh>
66. Staff Correspondent, . (2020, March 11). Two Bangladeshi patients recover from coronavirus infection, no new cases detected: IEDCR. Retrieved May 30, 2020, from <https://bdnews24.com/health/2020/03/11/two-bangladeshi-patients-recover-from-coronavirus-infection-no-new-cases-detected-iedcr>
67. Sujan, M. A. (2020, April 29). Ramp up the response now. Retrieved from <https://www.thedailystar.net/frontpage/news/ramp-the-response-now-1898149>
68. Talukder, D., El Arifeen, D., Streatfield, P. K., & Khan, S. H. (2014, August 19). Diabetes and Pre-Diabetes in Bangladesh: Updated Numbers Based on the Bangladesh Demographic and Health Survey 2011. Retrieved May 30, 2020, from <https://wce.confex.com/wce/2014/webprogram/Paper2105.html>
69. The Financial Express. (n.d.). Coronavirus cases near 3,800 in Bangladesh; death toll stands at 120. Retrieved from <https://thefinancialexpress.com.bd/national/coronavirus-cases-near-3800-in-bangladesh-death-toll-stands-at-120-1587545779>
70. Tribune, D. (2020, March 12). Coronavirus: 10 people in isolation, 4 quarantined in Bangladesh. Retrieved May 30, 2020, from <https://www.dhakatribune.com/current-affairs/2020/03/>
71. WHO Coronavirus Disease (COVID-19) Dashboard. (2020). Retrieved 26 December 2020, from <https://covid19.who.int/>
72. Yang, J., Zheng, Y., Gou, X., Pu, K., Chen, Z., & Guo, Q. et al. (2020). Prevalence of comorbidities and its effects in patients infected with SARS-CoV-2: a systematic review and meta-analysis. *International Journal of Infectious Diseases*, 94, 91-95. doi: 10.1016/j.ijid.2020.03.017

73. Youtube link

74. Youtube. 2020. [৷৷ ৷ ৷৷৷৷ ৷৷৷ ৷৷৷৷ ; ৷৷৷ ৷৷৷, ৷৷৷ ৷৷৷ | COVID19. \[online\] Available at: <https://www.youtube.com/watch?v=qAvsk-0lbVo> \[Accessed 30 May 2020\].](https://www.youtube.com/watch?v=qAvsk-0lbVo)
75. Zaman, M., Rahman, M. M., Chowdhury, M. A., Rahman, M. R., Bhuiyan, M. R., Karim, M. N., . . . Sobhan, S. M. (2010). Non-Communicable Disease Risk Factor Survey Bangladesh 2010 (Rep.). Dhaka, Bangladesh: WHO.
76. ৷৷৷৷৷৷৷ ৷৷৷৷ ৷ ৷৷ ৷৷৷ ৷৷৷ ৷৷৷. (n.d.). Retrieved from <https://www.prothomalo.com/bangladesh/article/1646678/৷৷৷৷৷৷৷-৷৷৷৷-৷৷৷৷-৷৷৷৷-৷৷৷৷-৷৷৷৷>
77. ৷৷৷৷৷ ৷ ৷৷৷৷৷ ৷৷৷৷৷ ৷৷৷৷৷. (n.d.). Retrieved from <https://www.prothomalo.com/bangladesh/article/1646310/৷৷৷৷৷-৷৷৷৷৷-৷৷৷৷৷-৷৷৷৷৷>
78. ৷৷ ৷৷৷৷ ৷৷৷৷ ৷৷, ৷৷ ৷. (2020, April 9). Retrieved May 30, 2020, from <https://www.prothomalo.com/bangladesh/article/1649711>
79. ৷৷৷৷ ৷৷৷৷৷ ৷৷৷ ৷৷৷৷: Coronavirus Disease 2019 (COVID-19) Information Bangladesh corona.gov.bd [Cited 2020 September 30]. Available from: https://corona.gov.bd/?gclid=EAlaIqobChMlyojL46OT7AIVQn8rCh3wAgeBEAAYASAAEgLso_D_BwE
80. ৷৷৷৷৷৷৷: ৷৷৷৷৷৷ ৷৷৷৷৷ ৷৷ ৷ ৷, ৷৷৷৷ ৷৷৷৷ ৷৷৷৷৷৷. (2020, March 20). Retrieved June 06, 2020, from <https://www.bbc.com/bengali/news-51972235>
81. ৷৷৷৷ ৷৷ ৷৷৷৷ ৷৷৷৷, ৷৷৷ ৷৷৷ ৷. (2020, April 5). Retrieved May 30, 2020, from <https://www.banglatribune.com/national/news/617089>
82. ৷৷৷৷ ৷৷ ৷৷৷৷ ৷৷৷৷, ৷৷৷ ৷৷৷৷ ৷. (n.d.). Retrieved 2020, from <https://www.prothomalo.com/bangladesh/article/1646693/%E0%A6%95%E0%A6%B0%E0%A7%8B%E0%A6%A8%E0%A6%BE%E0%A7%9F%E0%A6%86%E0%A6%B0%E0%A6%93%E0%A6%8F%E0%A6%95%E0%A6%9C%E0%A6%A8%E0%A7%87%E0%A6%B0%E0%A6%AE%E0%A7%83%E0%A6%A4%E0%A7%8D%E0%A6%AF%E0%A7%81%E0%A6%A8%E0%A6%A4%E0%A7%81%E0%A6%A8%E0%A6%B6%E0%A6%A8%E0%A6%BE%E0%A6%95%E0%A7%8D%E0%A6%A4%E0%A7%AC>
83. ৷৷৷৷ ৷৷৷ ৷৷ ৷ ৷৷৷ ৷৷৷৷, ৷৷৷ ৷৷৷৷৷ ৷৷. (2020, April 14). Retrieved from <https://www.thedailystar.net/bangla/৷৷৷৷৷৷/৷৷৷৷-৷৷৷-৷৷৷-৷৷৷-৷৷৷৷-৷৷৷-৷৷৷৷৷৷৷৷-৷৷-144289>
84. ৷৷৷৷ ৷৷৷ ৷৷ ৷৷৷৷ ৷৷৷: ৷৷৷৷৷৷. (2020, March 29). Retrieved May 30, 2020, from <https://www.prothomalo.com/bangladesh/article/1647619>
85. ৷৷৷ ৷৷৷৷৷৷৷৷ ৷৷৷ ৷৷৷৷ ৷ ৷: ৷৷৷৷৷৷৷৷৷৷. (2020, April 3). Retrieved May 30, 2020, from <https://www.prothomalo.com/bangladesh/article/1648535>
86. ৷৷৷ ৷৷৷৷ ৷৷ ৷ ৷৷৷৷৷, ৷৷৷৷ ৷৷৷৷. (n.d.). Retrieved 2020, from <https://www.prothomalo.com/bangladesh/article/1646517/%E0%A6%A6%E0%A7%87%E0%A6%B6%E0%A7%87%E0%A6%95%E0%A6%B0%E0%A7%8B%E0%A6%A8%E0%A6%BE%E0%A7%9F%E0%A6%86%E0%A6%B0%E0%A6%93%E0%A7%AC%E0%A6%9C%E0%A6%A8%E0%A6%86%E0%A6%95%E0%A7%8D%E0%A6%B0%E0%A6%BE%E0%A6%A8%E0%A7%8D%E0%A6%A4%E0%A6%8F%E0%A6%95%E0%A6%9C%E0%A6%A8%E0%A7%87%E0%A6%B0%E0%A6%AE%E0%A7%83%E0%A6%A4%E0%A7%8D%E0%A6%AF%E0%A7%81>
87. ৷৷৷ ৷৷৷৷ ৷৷৷৷৷ ৷৷৷৷, ৷ ৷৷৷৷ ৷৷৷৷ ৷৷. (n.d.). Retrieved from <https://www.prothomalo.com/bangladesh/article/1646857/৷৷৷-৷৷৷৷-৷৷৷-৷৷৷৷-৷৷৷৷-৷৷-৷৷৷৷৷-৷৷>
88. ৷৷৷ ৷৷ ৷ ৷৷৷ ৷৷৷৷, ৷৷ ৷. (2020, April 4). Retrieved May 30, 2020, from <https://www.prothomalo.com/bangladesh/article/1648695>
89. ৷৷৷৷৷৷ ৷ ৷৷৷ ৷৷৷৷৷ ৷ ৷৷৷৷ ৷৷৷৷৷. (2020, March 16). Retrieved June 4, 2020, from <https://bangla.bdnews24.com/bangladesh/article1735213.bdnews>
90. ৷৷৷৷৷৷৷৷৷৷ ৷৷৷৷ ৷৷৷৷৷ ৷৷৷৷৷৷৷ ৷৷৷৷৷. (n.d.). Retrieved from <https://www.prothomalo.com/bangladesh/article/1647122/৷৷৷৷৷৷৷৷৷-৷৷৷৷৷-৷৷৷৷৷৷৷-৷৷৷৷>