

Transforming Bangladesh's Healthcare in the Fourth Industrial Revolution



**Fahmida Khatun
Syed Yusuf Saadat**

Dhaka: 11 November 2021

Outline

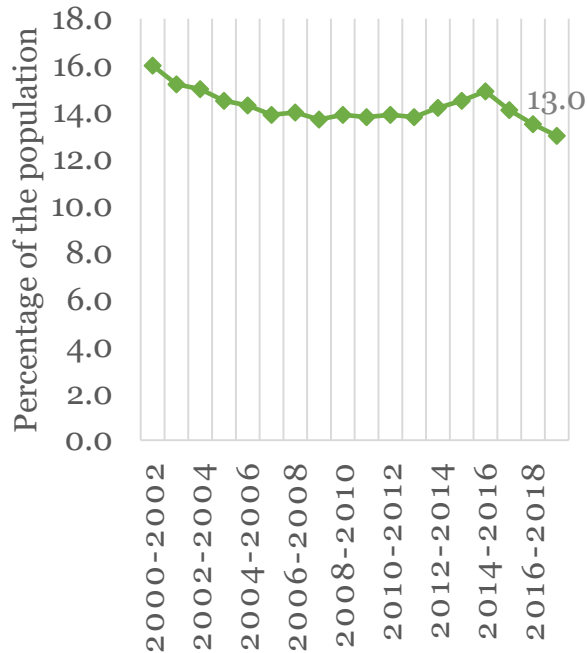
1. Introduction
2. Impact of technology and information services on health outcomes
3. Blockchain-based electronic health records system
4. Preventive healthcare with machine learning
5. Home hospital: A radical new platform for healthcare
6. Conclusions

1. INTRODUCTION

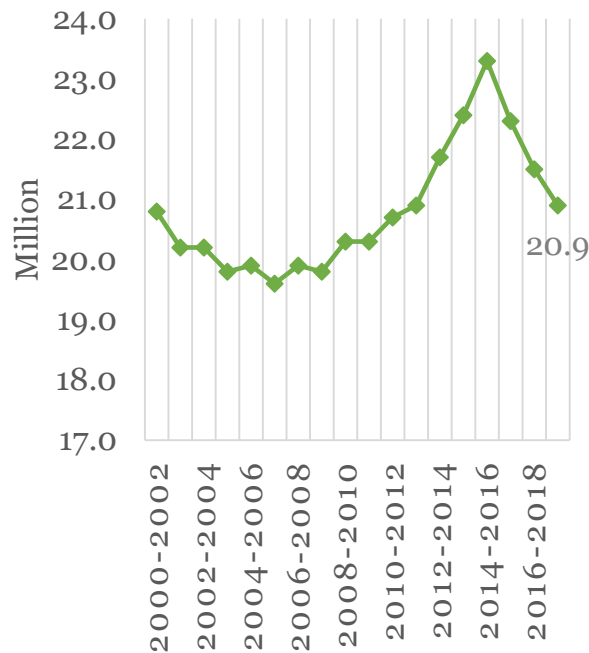
1.1 Bangladesh's progress in healthcare

- Since its emergence, Bangladesh has made major advancements in agriculture which have led to improvements in food security and increase in life expectancy.

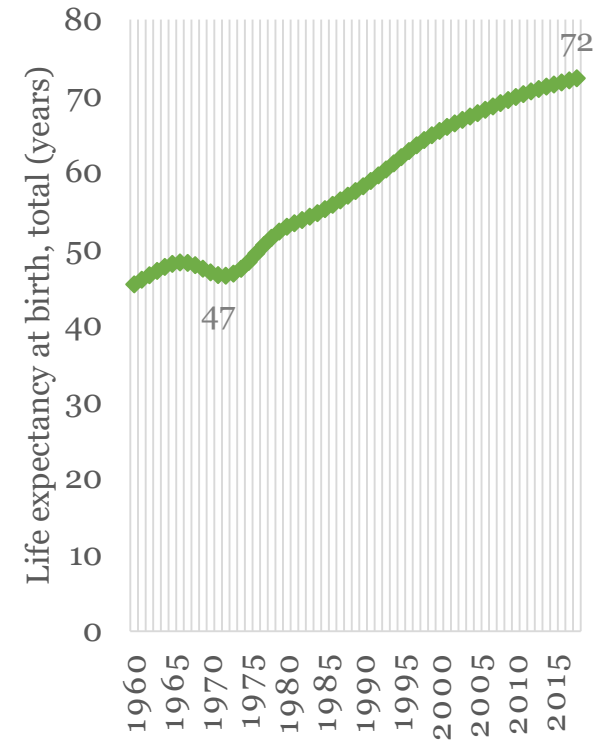
Prevalence of undernourishment (percent) (3-year average)



Number of people undernourished (million) (3-year average)



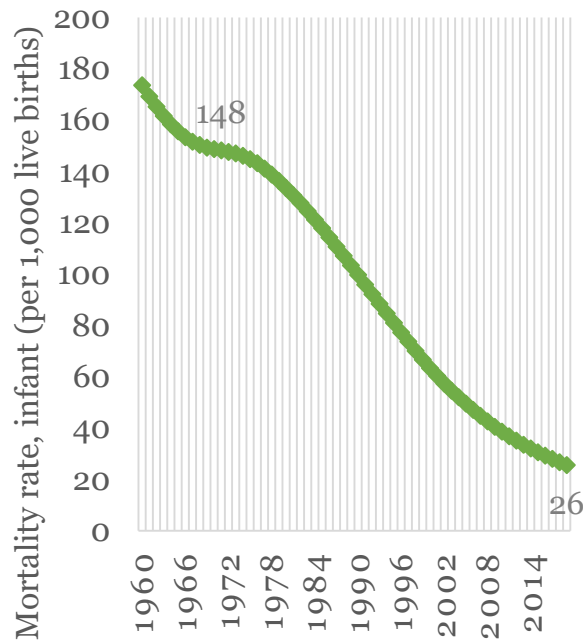
Life expectancy at birth, total (years)



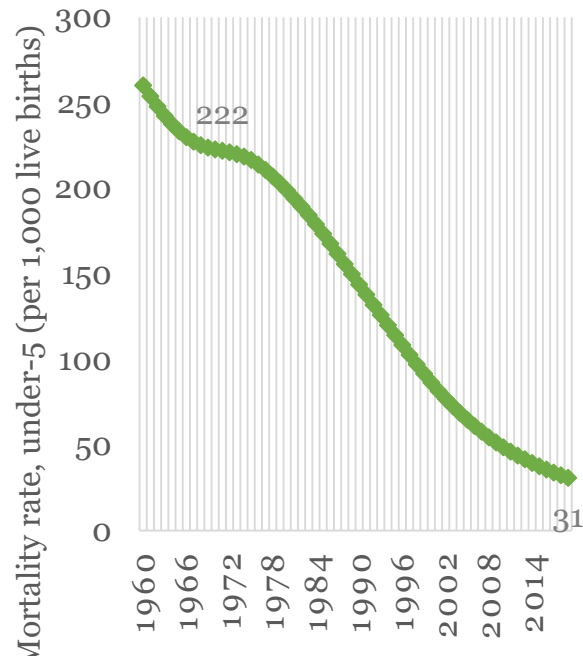
1.1 Bangladesh's progress in healthcare

- Infant, neonatal and under-five mortality rates have fallen continuously over the years, indicating that Improvements in access to food and water have had a positive impact on the health and wellbeing of children in Bangladesh

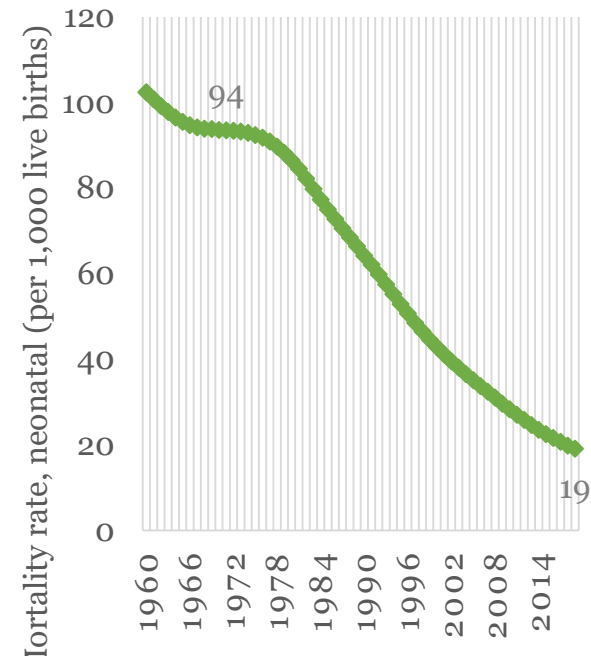
**Mortality rate, infant
(per 1,000 live births)**



**Mortality rate, under-5
(per 1,000 live births)**



**Mortality rate, neonatal
(per 1,000 live births)**



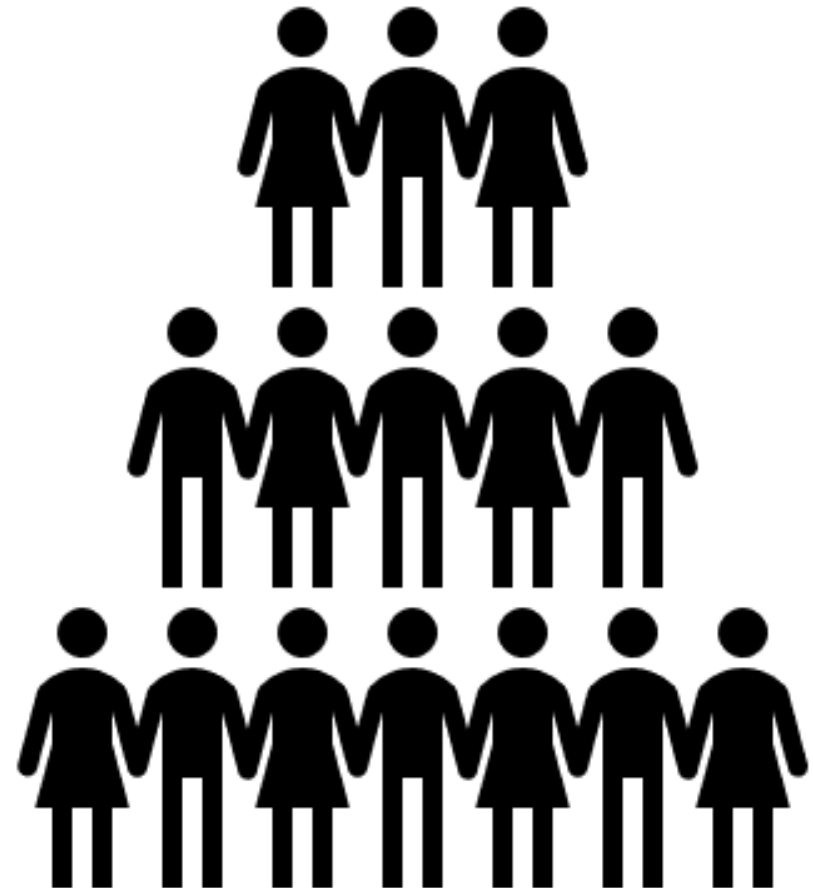
1.2 Preparedness of healthcare system: infrastructure, access, equipment

every 1,196 persons

1 hospital bed



for



1.2 Preparedness of healthcare system: infrastructure, access, equipment

Among the healthcare facilities in Bangladesh,



5.1% have emergency transport



21.5% have alcohol-based disinfectant



27.5% have medical masks



28% have all basic equipment



34.5% have lab facilities



43.1% have regular electricity



55.1% have soap and water



83.7% have paracetamol oral suspension



86.3% have thermometer



90.1% have improved water source

1.3 Preparedness of healthcare system: personnel

1 registered physician



for

every 1,581 persons



1.3 Preparedness of healthcare system: personnel

Among the healthcare facilities in Bangladesh,



28%

have
specialists



59.1%

have general
practitioners



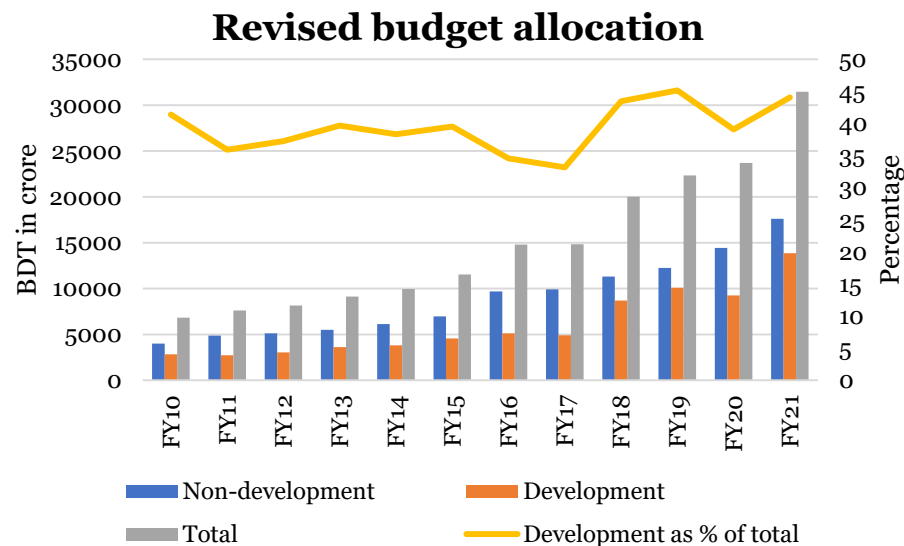
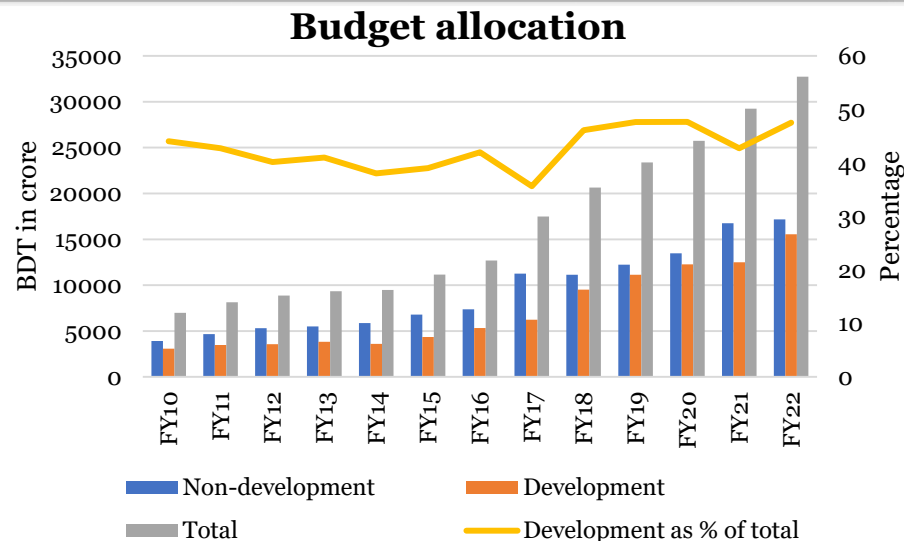
79.7%

have nurses

1.4 Budget allocation for health sector

□ Total budget allocation for health increased **only by 12%**, from BDT 29,247 crore in FY21 to BDT 32,731 in FY22, which was **lower than the 14% average annual increase in total budget allocation for health between FY11 and FY22**

- Increase in total budget allocation for health in FY22 followed a linear trend line, indicating that the **rise was business-as-usual** and nothing out of the ordinary, despite the fact that the healthcare sector is reeling from the shocks of COVID-19
- Development budget allocation increased by 24.46%, whereas non-development budget allocation increased 2.54%
- Share of development budget allocation in total budget allocation increased from 43% in FY21 to 48% in FY22
- Share of revised development budget allocation in total budget allocation increased from 39% in FY20 to 44% in FY21



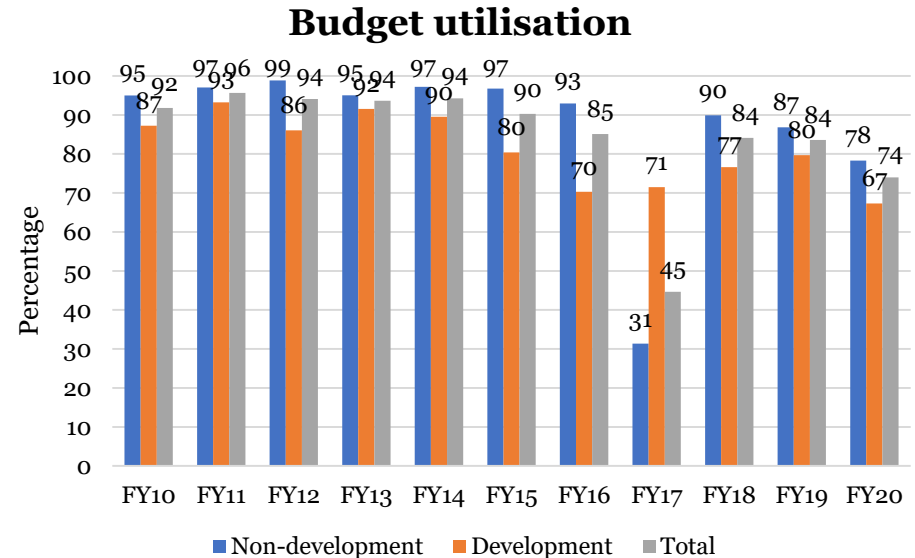
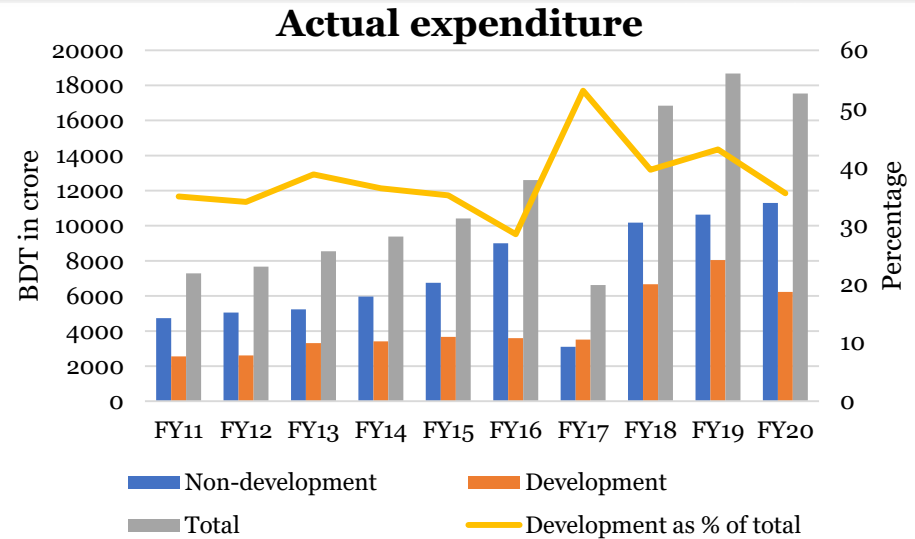
1.5 Health budget expenditure & utilisation

❑ **Actual expenditure decreased by -6% from BDT 18,677 in FY19 to BDT 17,532 crore in FY20**

❑ Budget utilisation (actual expenditure as a percentage of revised budget allocation) has worsened significantly over the past decade

- Non-development budget utilization decreased from 95% in FY10 to 78% in FY20
- Development budget utilization decreased from 87% in FY10 to 67% in FY20
- **Total budget utilization decreased from 92% in FY10 to 74% in FY20**

❑ Over the past several years, nondevelopment budget utilization has been consistently higher than development budget utilisation



1.6 Health budget as a share of GDP

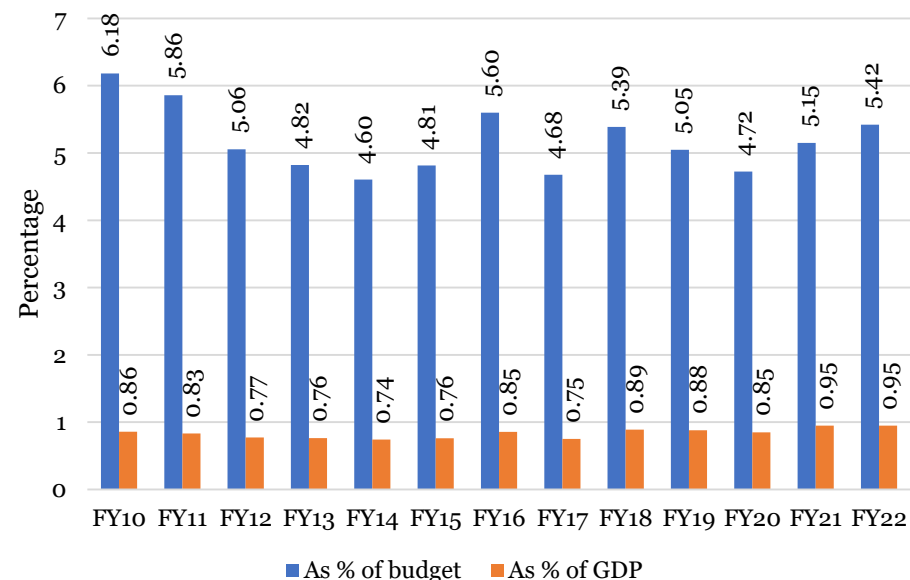
❑ Allocation for health as a share of the total budget has increased from 5.15% in FY21 to **5.42% in FY22**

➤ However, this is **lower than the allocation of 6.18% of budget in FY10** when there was no pandemic

❑ Allocation for health as a share of GDP remained the same between FY21 and FY22

➤ Such allocation is only marginally higher than the average allocation of 0.83% of GDP during FY10 to FY22

Health allocation as % of total budget and GDP



❑ **Budget allocation for health has been less than 1% of GDP for the past 13 years indicating that health was never a priority sector**

❑ **In 2017 at least 30 LDCs spent more than 1% of GDP on health**

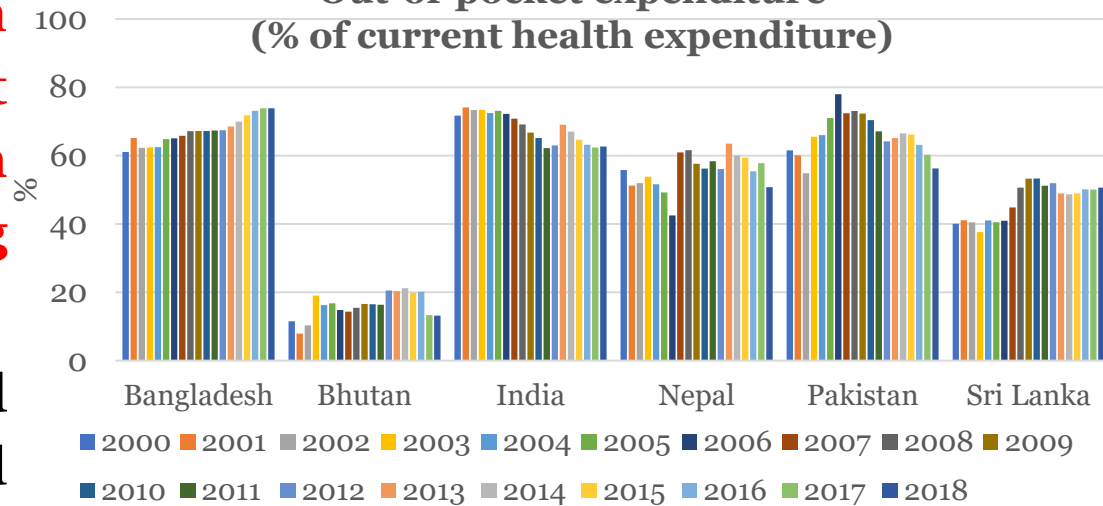
1.7 Burden of health expenses

❑ Out-of-pocket expenditure on health in Bangladesh is not only the **highest in South Asia**, but also **increasing over time**

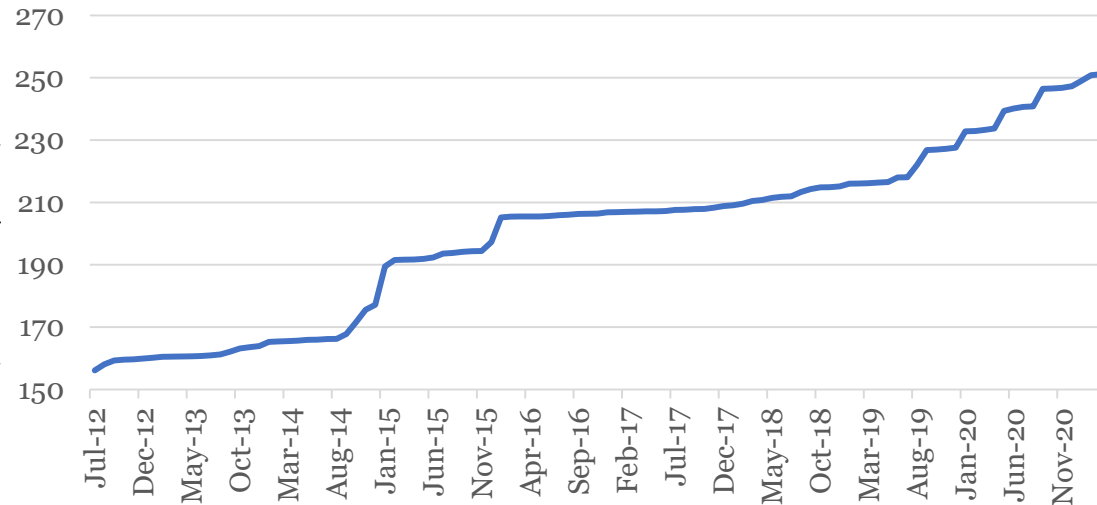
❑ CPI of medical care and health expenses increased from **156.1 in July 2012** to **251.13 in March 2021**

❑ Inflation rate of medical care and health expenses increased 0.18% in April 2020 to 2.42% in May 2020, due to the rise in COVID-19 cases

Out-of-pocket expenditure (% of current health expenditure)



CPI of medical care and health expenses



1.8 The 4 expected disruptions in the healthcare system during the 4IR

Speed of care



Ability to manage illness

Role of patients



Relationship between healthcare and stake holders

1.9 Research objectives

Assess

Assess the use of technology in the healthcare sector of Bangladesh

Identify

Identify the benefits of emerging technological advances and the challenges attached to the adoption of technology in the healthcare sector of Bangladesh

Evaluate

Evaluate the impact of using technology and information services in healthcare facilities on health outcomes

Recommend

Recommend policies for leveraging technology to improve the quality of healthcare services

2. IMPACT OF TECHNOLOGY AND INFORMATION SERVICES ON HEALTH OUTCOMES

2.1 Data

- ❑ Nationally representative microdata from the Bangladesh Health Facility Survey 2017 (BHFS 2017) was used to evaluate the impact of technology and information services on health outcomes.
- ❑ BHFS 2017 uses a stratified stratified random sampling methodology to select a sample of **1,600 healthcare facilities**
- ❑ Additionally, BHFS 2017 also provides microdata on **5,400 healthcare service providers** who were present in the health facility on the day of the survey



BANGLADESH Health Facility Survey 2017



Final Report



2.2 Dependent and control variables

Name	Description
Alive	Number of live discharges made in the last completed calendar month (the number of patients who were admitted and then discharged alive)
Computer	Availability of computer in the facility
Internet	Routine availability of internet for at least 2 hours on the working days in the facility
Statistician	A designated person, such as a statistician, is responsible for health services data
Training	In-service training, training updates or refresher training on Health Management Information Systems (HMIS) received by any

2.3 Independent variables

Name	Description
Services	Number of types of client services provided
Beds	Number of overnight or in-patient beds
Staff	Sum of number of staff currently posted at in the facility, number of staff attached to the facility, and number of staff working part-time in the facility
Ambulance	Availability of functional ambulance or other vehicle for emergency transportation for clients that is stationed at the facility and that operates from the facility
OPD	Number of outpatient client visits made to the facility in the last completed calendar month
Equipment	Number of types of equipment and infection control precautions available
Tests	Number of types of diagnostic tests available
Medicines	Number of types of medicines available
Cleanliness	Number of types of cleanliness indicators observed in the facility
Education	Number of years of education completed by health service providers in the facility

Cleanliness

Education

2.4 Results of propensity score matching model estimation

	Computer	Internet	Statistician	Training
Unmatched	-2451.85 (398.82)	342.02* (174.30)	425.03*** (90.58)	172.36 (106.37)
Average treatment effect on the treated	1020.90*** (65.15)	212.03** (96.21)	366.28*** (123.29)	227.32 (136.67)
Average treatment effect on the untreated	-3396.67 (344.38)	3.23 (252.90)	14.00 (111.85)	-72.48 (144.67)
Average treatment effect	974.55*** (64.65)	199.85** (94.71)	267.12*** (99.36)	-18.53 (130.96)

Note: (i) Standard errors in parentheses; (ii) *** p<0.01, ** p<0.05, * p<0.1; (iii) Propensity scores estimated using probit regression

3. BLOCKCHAIN-BASED ELECTRONIC HEALTH RECORDS SYSTEM

3.1 Implementation

- ❑ Blockchain technology may serve as the foundation for building an electronic health records system.
- ❑ In a blockchain-based electronic health records system, each block represents data ownership and viewership permissions shared by the members of the blockchain network.
- ❑ Members of the blockchain network include the patients, who are the owners of the health data, and healthcare service institutions such as hospitals, clinics, pharmacies, medical universities and public health research institutes, who are the viewers of the data.
- ❑ The privacy of the patient's sensitive health data on the blockchain-based electronic health record system is ensured since the data may only be retrieved using the secret private key owned by the patient.
- ❑ Viewers of the data on the blockchain network can see the health data, but cannot see the identity of the patients themselves since all the data is anonymised.

3.2 Potential services offering

- ❑ Enhancing interoperability of health and promoting health data sharing
- ❑ Strengthening security of sensitive medical data and protecting patients' identity
- ❑ Generating a socioeconomic database for designing effective population health management strategies
- ❑ Reducing inaccuracies and frauds in healthcare bills and financial transactions
- ❑ Allowing pharmaceutical drugs to become traceable and reducing drug counterfeiting
- ❑ Increasing transparency by enabling public review of authenticity of clinical trials
- ❑ Detecting complications from use of medicines
- ❑ Providing public health data for mapping the impact of epidemics and pandemics
- ❑ Connecting organ donors to organ recipients .

3.3 Benefits

- Data integrity and authenticity
- Privacy and anonymity
- Distribution across all participants of the network
- Security from decentralization
- Transparency and accountability
- Auditability of data

3.4 Challenges

- High initial cost of deployment
- Increase in electricity consumption
- Limitations on the size and types of data that can be stored on the blocks

4. PREVENTIVE HEALTHCARE WITH MACHINE LEARNING

4.1 Implementation

- ❑ Machine learning is useful in situations where it may not be feasible to immediately design a computer programme to tackle a problem.
- ❑ This may include situations where human expertise is insufficient or where the problem itself evolves over time.
- ❑ Machine learning algorithms may be deployed on a blockchain-based electronic health records database to obtain useful insights that will be able to design effective strategies for preventive healthcare.

4.2 Benefits

- ❑ Machine learning algorithms make it possible to predict diseases long before the onset of illness.
- ❑ Research has shown that machine learning algorithms can be able to produce highly accurate diabetes predictive healthcare systems.
- ❑ High-technology curative healthcare used in developed countries is capital intensive and requires enormous financial resources.
- ❑ In developing countries like Bangladesh, a commitment to disease prevention can be a successful public health strategy.
- ❑ Machine learning algorithms may be used in conjunction with epidemiologic studies which identify specific risk factors that increase people's likelihood of contracting specific diseases to design community interventions and individual counselling that promote behavioral change beneficial for disease prevention.

4.3 Challenges

- ❑ At present, the primary challenge in implementing machine learning algorithms for preventive healthcare in Bangladesh is the lack of health data.
- ❑ Machine learning algorithms are only as good as the data that they are provided with.
- ❑ Hence, the absence of a national electronic health database is preventing Bangladesh from availing the benefits of machine learning for preventive healthcare.

**5. HOME HOSPITAL:
A RADICAL NEW PLATFORM
FOR HEALTHCARE**

5.1 Implementation

- ❑ Patients who might normally be confined to hospital wards or cabins are allowed to remain at home.
- ❑ They register themselves with a doctor of their choosing from one of the nearby hospitals using a mobile-based application.
- ❑ Using the mobile-based application, the patient consults with the doctor through video-conferencing.
- ❑ Furthermore, the patient is visited on a regular basis by medical and nursing staff who ride their bicycles to the patient's house and give the same services that they would provide if the patient were admitted to the hospital.
- ❑ Small medical equipment is also rented and temporarily installed at the patient's house.
- ❑ If the patient's health deteriorates considerably, to the point that they require critical care, the consultant doctor suggests that them be transferred to an actual hospital's intensive care unit.

5.2 Benefits

- ❑ Patients would be able to obtain healthcare services at a lower cost compared to healthcare services received from a conventional hospital.
- ❑ Patients would also be able to obtain such healthcare services from the comfort of their home, which will save their time and reduce their risk of hospital-acquired infections and illnesses.
- ❑ The home hospital platform would be particularly beneficial for elderly patients in urban areas who are suffering from chronic illnesses.
- ❑ In times of epidemics and pandemics, a home hospital platform would be able to reduce the burden and pressure on regular hospitals.
- ❑ The launching of a home hospital platform will create employment opportunities for many doctors and nurses in Bangladesh.
- ❑ The home hospital platform would allow hospitals to increase their revenue by reaching out to patients who were otherwise not able to afford their regular services.

5.3 Challenges

- ❑ The lack of a universal inter-operable unique patient identification number and electronic health records system make it virtually impossible to implement a home hospital platform.
- ❑ A company providing a home hospital platform may be a third party digital platform which would make such a company difficult to classify or regulate.
- ❑ A home hospital platform may initially find it difficult to convince traditional hospitals to join their network.
- ❑ The quality of healthcare services provided through a home hospital platform would be difficult to monitor.
- ❑ A home hospital platform would be limited by the availability of high-speed broadband internet and the number of actual hospitals in the area where the patient is located. Since neither the availability of high-speed broadband internet nor the geographic distribution of hospitals is homogeneous across the country, it is likely that a home hospital platform would, at least initially, be effective only in urban areas. .

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

- ❑ Blockchains, artificial intelligence, robotics and the Internet of Medical Things (IoMT) are having profound impact on the health industry worldwide.
- ❑ While the healthcare sector of Bangladesh is generally considered to be technologically lagging behind many other countries, there is no time better than the present to leverage the technologies of the 4IR to improve health outcomes for all.
- ❑ From Bangladesh's perspective taking advantage of 4IR to make advances in healthcare will require large investments from the government, private sector, and international development partners.
- ❑ Without such investment in the healthcare sector, the targets under SDG 3 cannot be achieved by 2030.

6.1 Conclusions

- This study has utilised nationally representative microdata of 1,600 health facilities and 5,400 healthcare service providers from the Bangladesh Health Facility Survey 2017 to estimate the impact of use of technology and information services on health outcomes.
- The results from a propensity score matching model show that the number of live discharges per month was higher in health facilities where a computer, or an internet connection, or a dedicated statistician was available, compared to health facilities where these facilities were not available.

6.2 Recommendations

- ❑ In light of these findings, a blockchain-based electronic health records system for Bangladesh was proposed.
- ❑ Such a system would power machine learning driven preventive healthcare, and would serve as the basis for establishing home hospitals where patients would be able to remain at home and still obtain medical services from hospitals in their vicinity through a combination of location-based mobile applications and video conferencing.

THANK YOU



<https://cpd.org.bd>



cpd.org.bd



[cpdbd](https://twitter.com/cpdbd)



[CPDBangladesh](https://www.youtube.com/CPDBangladesh)



[Centre for Policy Dialogue
\(CPD\)](https://www.linkedin.com/company/centre-for-policy-dialogue)