The Factors Affecting Public Spending Allocative Efficiency in Bangladesh: An Assessment Study on the Health Services

Final Report

Submitted to

Strengthening Public Financial Management Program to Enable Service Delivery (SPFMS),
Finance Division, Ministry of Finance

Submitted by

Bangladesh Institute of Governance and Management (BIGM)

Date of Submission: January 2026

This study, titled **The Factors Affecting Public Spending Allocative Efficiency in Bangladesh: An Assessment Study on Health Services** was implemented by the Bangladesh Institute of Governance and Management (BIGM) as part of its ongoing commitment to evidence-based policy research and public sector reform. The study was funded by the Strengthening Public Financial Management Program to Enable Service Delivery (SPFMS), Finance Division, Ministry of Finance, Government of Bangladesh.

For additional information about this study, please contact:

Bangladesh Institute of Governance and Management (BIGM)
E-33, Sher-E-Bangla Nagar, Agargaon Administrative Area, Dhaka – 1207,
PABX: 880-2-223374040-44 (Ext: 102, 106, 107, 114),
Email: info@bigm.edu.bd, Website: www.bigm.edu.bd

Cover Design:

A S M Rafad Asgar and Samira Tasnim, BIGM

Recommended Citation:

Bangladesh Institute of Governance and Management. (2026). *The factors affecting public spending allocative efficiency in Bangladesh: An assessment study on the health services*. Dhaka, Bangladesh: BIGM.

Disclaimer:

Message from the Director, BIGM

The Government of Bangladesh has articulated a strong commitment to achieving Universal Health Coverage and ensuring equitable, efficient, and sustainable use of public resources in the health sector. In recent years, rising healthcare demands, fiscal constraints, and systemic inefficiencies have posed significant challenges to the optimal allocation of public health spending. These challenges have underscored the urgent need for evidence-based analysis to guide policy decisions and strengthen health system performance.

The Strengthening Public Financial Management Program to Enable Service Delivery (SPFMS) initiated this important research. Following the Terms of Reference received from the SPFMS, the Bangladesh Institute of Governance and Management (BIGM) formed a dedicated research team that carried out a rigorous process, including proposal development, inception reporting with a comprehensive literature review and methodology, stakeholder consultation through a validation workshop, and collection of both primary and secondary data. This report presents a detailed assessment of allocative efficiency in public health spending across districts, highlighting significant inefficiencies caused by fragmented budgeting, rigid allocation systems, and human resource imbalances.

Addressing these challenges requires systemic reforms, including better integration of operating and development budgets, strengthened decentralization with accountability, improved human resource deployment, and greater prioritization of primary and preventive care aligned with population health needs. This report, prepared by BIGM, presents key findings and actionable recommendations to support more responsive, equitable, and efficient health financing strategies within existing fiscal constraints, serving as a significant milestone and a robust evidence base for policy evaluation and reform in the health sector. BIGM expresses its sincere appreciation to the Strengthening Public Financial Management Program to Enable Service Delivery (SPFMS), Finance Division, Government of Bangladesh, for their continued support and collaboration. We remain committed to working closely with government institutions and development partners to strengthen health sector governance and contribute to a more efficient, equitable, and resilient health system for Bangladesh.

Dr Sultan Ahmed
Director
Bangladesh Institute of Governance and Management (BIGM)

Foreword

Bangladesh's health sector stands at a critical juncture where improvements in health outcomes must be matched by more efficient and equitable use of limited public resources. Despite notable gains from past investments, persistent inefficiencies in resource allocation continue to constrain system performance and exacerbate regional and social disparities. This study addresses these challenges through a systematic, evidence-based assessment of allocative efficiency in public health spending. Following the formation of the BIGM research team, a rigorous research process was undertaken in line with the Terms of Reference. Upon its approval, an inception report was developed with a detailed methodological framework. A methodology validation workshop was subsequently conducted to obtain feedback from key stakeholders, and the study design was refined accordingly.

This study goes beyond analyzing trends in allocative efficiency to examine how public health resources are distributed across districts and how these allocations relate to service utilization, workforce deployment, and population health needs. The findings demonstrate that allocative inefficiency is not merely a technical issue but a systemic challenge. Strengthening allocative efficiency will require better integration of operating and development budgets, enhanced decentralization with accountability, reforms in human resource deployment, and greater prioritization of primary and preventive care in line with population health needs, thereby supporting improved value for money within existing fiscal constraints.

On behalf of the research team, and as Lead Researcher, I extend my sincere appreciation to all stakeholders who generously contributed their time, insights, and data to this study. I am also grateful for the funding support provided by the Strengthening Public Financial Management Program to Enable Service Delivery (SPFMS), Finance Division, Government of Bangladesh. In addition, I would like to acknowledge the Institute of Public Finance (IPF), Finance Division, Government of Bangladesh, for its regular feedback and intensive review throughout the study, which greatly strengthened the quality and rigor of the analysis. The findings presented in this report, however, are those of the study team and do not necessarily reflect the views of the funding agency. I hope that this report will serve as a practical and analytical resource for strengthening allocative efficiency and advancing equitable and sustainable health system performance in Bangladesh.

Dr. Nasim Ahmed
Lead Researcher (Team Leader)
of the project "The Factors Affecting Public Spending Allocative Efficiency in Bangladesh: An Assessment Study on the Health Services."
and
Associate Professor
Bangladesh Institute of Governance and Management (BIGM)

Team Composition

	**Dr. Nasim Ahmed** Lead Researcher (Team Leader) of the project "The Factors Affecting Public Spending Allocative Efficiency in Bangladesh: An Assessment Study on the Health Services" and Associate Professor Bangladesh Institute of Governance and Management (BIGM)
	**Md. Injamul Haq Methun** Researcher-1 (Associate Team Leader) of the project "The Factors Affecting Public Spending Allocative Efficiency in Bangladesh: An Assessment Study on the Health Services" and Assassistant Professor Bangladesh Institute of Governance and Management (BIGM)
	**Samira Tasnim** Researcher-2 of the project "The Factors Affecting Public Spending Allocative Efficiency in Bangladesh: An Assessment Study on the Health Services" and Research Associate Bangladesh Institute of Governance and Management (BIGM)
	**Nafis Sadik** Research Associate of the project "The Factors Affecting Public Spending Allocative Efficiency in Bangladesh: An Assessment Study on the Health Services" and Research Associate Bangladesh Institute of Governance and Management (BIGM)
	**A S M Rafad Asgar** Research Associate of the project "The Factors Affecting Public Spending Allocative Efficiency in Bangladesh: An Assessment Study on the Health Services" and Research Associate Bangladesh Institute of Governance and Management (BIGM)

Acronyms and Abbreviations

AC	Average Cost
ADP	Annual Development Program
AE	Allocative Efficiency
AIC	Akaike Information Criterion
AWE	Adjusted Wald Entropy
BBS	Bangladesh Bureau of Statistics
BIC	Bayesian Information Criterion
CAIC	Consistent Akaike Information Criterion
CC	Community Clinics
CE	Cost Efficiency
CHE	Current Health Expenditure
CLC	Classification Likelihood Criterion
DALE	Disability-Adjusted Life Expectancy
DEA	Data Envelopment Analysis
e-GP	Electronic Government Procurement
EE	Economic Efficiency
FDH	Free Disposal Hull
FGD	Focus Group Discussion
FY	Fiscal Year
FYP	Five Year Plan
GAVI	Global Alliance for Vaccines and Immunization
GDP	Gross Domestic Product
GoB	Government of Bangladesh
HALE	Health Adjusted Life Expectancy
HCFS	Health Care Financing Strategy
HEU	Health Economics Unit
HIES	Household Income and Expenditure Survey
HPNSP	Health, Population, and Nutrition Sector Program
IBAS^{++}	Integrated Budget and Accounting System
ICL	Integrated Classification Likelihood
IMF	International Monetary Fund
JICA	Japan International Cooperation Agency
KII	Key Informant Interview
LPA	Latent Profile Analysis

LRAC	Long Run Average Cost
KIC	Kullback Information Criterion
MC	Marginal Cost
MDG	Millennium Development Goal
MIS	Management Information System
MMR	Maternal Mortality Raito
MoF	Ministry of Finance
MoHFW	Ministry of Health and Family Welfare
MTBF	Medium-Term Budgetary Framework
MU	Marginal Utility
NBR	National Board of Revenue
NCD	Non-communicable Disease
NHP	National Health Policy
NIPORT	National Institute of Population Research and Training
OOP	Out-of-Pocket
PP	Perspective Plan
PFM	Public Financial Management
PHC	Primary Health Care
PHE	Public Health Expenditure
PYLL	Potential Years of Life Lost
SABIC	Sample-Size Adjusted BIC
SDG	Sustainable Development Goals
SFA	Stochastic Frontier Analysis
SHI	Social Health Insurance
SRAC	Short Run Average Cost
TE	Technical Efficiency
THE	Total Health Expenditure
UHC	Upazila Health Complex
UHFWC	Union Health and Family Welfare Center
UNICEF	United Nations Children's Fund
WASH	Water, Sanitation, and Hygiene
WHO	World Health Organization

Table of Contents

List of Tables

List of Figures

Executive Summary

Bangladesh has achieved remarkable progress in economic and social development over the past few decades, marked by rapid poverty reduction and sustained GDP growth. This progress is also reflected in major improvements in health outcomes, such as maternal and child health, immunization coverage, and life expectancy. These advances have been driven by investments in public health services, family planning, and community-based interventions that have become internationally recognized models. Yet, the country's health system remains constrained by low per capita spending, high out-of-pocket (OOP) expenditures, shortages of trained health professionals, and significant inequities between urban and rural populations. With the health sector consistently consuming over five percent of the national budget but delivering uneven outcomes, the question is not only how much Bangladesh spends on health, but also how well those resources are allocated to maximize population welfare.

Allocative efficiency, defined as the degree to which public expenditures are directed to programs and interventions that produce the greatest gains in social welfare, is critical for Bangladesh at this juncture. Inadequate allocative efficiency implies that resources are locked into areas of lower impact, while priority needs remain underfunded. This reduces the value-for-money of public health spending, limits the system's responsiveness to new challenges such as non-communicable diseases (NCDs), and exacerbates inequities in service coverage. Past assessments have examined efficiency in broad terms, but there has been little systematic analysis of allocative efficiency in the Bangladeshi health sector. This study seeks to fill that gap through a mixed-methods approach that integrates quantitative measurement of efficiency with qualitative insights from policymakers, administrators, and service providers. The objective of this study is to evaluate the allocative efficiency of public spending in Bangladesh's Health Services, with a view to understanding whether resources are being directed to areas that maximize health outcomes and social welfare. Specifically, the study seeks to measure the current levels of allocative efficiency across districts, identify the key factors that influence the effective use of resources, and diagnose the systemic and institutional constraints that hinder efficient allocation. Beyond diagnosis, the study also aims to recommend practical, evidence-based measures that can guide policymakers in improving allocative efficiency, ensuring that scarce public resources are deployed in ways that enhance equity, expand access, and strengthen the overall performance of the health sector.

This study adopted a mixed-methods research design to comprehensively assess allocative efficiency in Bangladesh's health sector. By combining empirical modeling with stakeholder perspectives, the study sought to capture not only how efficiently resources were allocated, but also why inefficiencies persist and what systemic factors influence them. On the quantitative side, the analysis drew upon secondary data spanning the years 2019 to 2023, covering district-level health expenditures, service utilization indicators, and demographic profiles. A three-stage Data Envelopment Analysis (DEA) was

applied to estimate efficiency scores across districts and over time. This method allowed for the adjustment of environmental and contextual factors that may influence efficiency but are not under the control of local health managers. To further validate the results and identify determinants of efficiency, regression-based Stochastic Frontier Analysis (SFA) was employed. This econometric technique enabled the separation of inefficiency effects from random noise, providing a more precise understanding of the factors driving allocative efficiency. Complementary spatial analysis was also undertaken to examine geographic patterns and disparities across districts, while Latent Profile Analysis (LPA) was used to classify districts into performance clusters, highlighting heterogeneity in efficiency outcomes.

The qualitative component was designed to explore institutional and governance factors that quantitative modeling alone could not capture. Key Informant Interviews (KIIs) were conducted with senior officials from the Ministry of Health and Family Welfare, the Finance Division, and the Planning Commission, as well as with health administrators, facility managers, and development partners. Focus Group Discussions (FGDs) were organized with frontline providers and community representatives to capture local perspectives and ground-level realities. In-depth interviews were also conducted with selected participants to further probe issues of budgeting practices, procurement, workforce deployment, and community engagement. Purposive and maximum variation sampling strategies were applied to ensure diversity in perspectives, with particular attention to districts representing high, medium, and low efficiency scores.

Data analysis followed a sequential explanatory strategy. Quantitative findings established the baseline patterns of allocative efficiency and identified variations across time and geography. These findings were then complemented by qualitative thematic analysis, conducted using MAXQDA software, which uncovered recurrent governance issues, structural bottlenecks, and political economy factors that shape allocation decisions. This integration of quantitative and qualitative strands allowed for triangulation, ensuring that efficiency measures were not interpreted in isolation but situated within the broader institutional and systemic context of Bangladesh's health sector.

The quantitative analysis revealed an average allocative efficiency score of approximately 0.60, indicating that the same level of services could have been maintained with about 40 percent fewer resources if inputs had been optimally distributed. The trend analysis shows an initial decline in efficiency from 2019 to 2022, followed by a modest recovery in 2023. Although there was improvement, efficiency did not return to 2019 levels, reflecting structural bottlenecks that had become entrenched.

Spatial analysis highlighted deep inequities in allocative efficiency across districts. Some areas consistently scored higher, benefiting from stronger management systems, better infrastructure, and easier access to supplies and logistics. In contrast, northern districts persistently lagged, facing chronic

workforce shortages, difficult terrain, and weak health information systems. Latent profile analysis further confirmed that districts clustered into distinct categories: consistently high performers that maintained near-optimal efficiency, moderately strong districts that recovered after pandemic disruptions, chronically underperforming districts that struggled to utilize resources effectively, and highly volatile districts whose efficiency fluctuated dramatically due to their sensitivity to shocks. These patterns underscore that allocative efficiency is not uniform but shaped by governance, structural inequities, and demanding targeted policy responses.

The qualitative findings add critical depth to this picture by uncovering the systemic and institutional constraints behind inefficiency. A recurrent theme was the fragmentation between operating and development budgets, which are managed by different authorities and often fail to align. This leads to duplication of activities, underfunded operational needs, and delays in implementation. Budget rigidity and complex approval processes were also found to slow fund release and procurement, reducing the system's ability to adapt to emerging needs. Political interference in staffing and financial allocations was repeatedly cited as a major barrier, with resources often influenced by patronage rather than population health indicators.

Stakeholders emphasized that outdated allocation formulas and the absence of program-specific performance indicators further weakened efficiency. Many budgets are still based on legacy criteria such as bed counts and staff numbers rather than service demand or disease burden. Procurement inefficiencies were also identified as a persistent problem, with centralized processes often delivering irrelevant or mismatched supplies to facilities. While digital procurement has improved transparency, mismatches between supply and local health needs remain common.

Human resource deployment emerged as another major determinant of inefficiency. Respondents described uneven specialist distribution, underutilization of infrastructure due to staff shortages, and poorly functioning referral systems that break continuity of care. Facility-level managers often lack adequate training in financial management, procurement, and planning, compounding the problem of underutilized budgets. At the same time, community perspectives are seldom included in planning, leaving local priorities unreflected in allocations. Rural health workers and beneficiaries stressed that the exclusion of community voices perpetuates mismatches between services delivered and services actually needed.

Despite these constraints, the qualitative findings also pointed to clear reform pathways. Stakeholders strongly advocated for integrating operating and development budgets into a unified framework, enabling greater flexibility and responsiveness. Decentralization of financial authority to facility managers, coupled with stronger accountability systems, was seen as essential to ensure timely and context-sensitive allocations. Human resource reform through strategic deployment, better career planning, and the establishment of professional public health management cadres was identified as

critical to improving efficiency. Many respondents also emphasized the need to rebalance investments towards primary and preventive care, which are highly cost-effective and equitable compared to the current tertiary-care bias.

Broader governance reforms were also highlighted, including the cultivation of ethical leadership, greater transparency in budgetary decisions, and the use of digital health systems for real-time monitoring of resource flows. Strengthening institutional mandates, clarifying decision-making authority, and enhancing coordination across government agencies were cited as necessary steps to reduce fragmentation and duplication. Participants expressed optimism that with such reforms, efficiency gains could be achieved without substantial increases in overall spending, thereby expanding coverage and equity within existing fiscal space.

Taken together, the study demonstrates that allocative inefficiency in Bangladesh's health sector is both a technical and institutional challenge. It arises not only from misaligned spending patterns but also from deeper governance constraints, political economy dynamics, and limited responsiveness to population needs. Quantitative analysis shows that efficiency remains moderate and uneven, while qualitative evidence highlights why inefficiencies persist and what reforms could address them. The findings underline that improving allocative efficiency requires more than optimizing budgets; it demands systemic change. Integrating budgets, empowering local managers, reforming human resource systems, prioritizing preventive care, and cultivating a culture of accountability and ethical leadership are all necessary steps to ensure that scarce public resources are used in ways that maximize health outcomes and equity.

Combining robust empirical analysis with the lived experiences of key stakeholders, this study provides policymakers with evidence-based insights into how Bangladesh can strengthen its health system. In conclusion, the findings highlight that improving allocative efficiency is both a technical and strategic priority. Strengthening the efficiency of resource allocation enables the government to deliver greater value for money, reduce inequities, expand access to quality health services, and sustain progress toward universal health coverage and inclusive economic growth.

Basic Information

1.	Study Title	The Factors Affecting Public Spending Allocative Efficiency in Bangladesh: An Assessment Study on the Health Services
2.	(a) Sponsoring Ministry/Division (b) Implementing Agency	Finance Division, Ministry of Finance Bangladesh Institute of Governance and Management (BIGM)
3.	Study Objectives	The study aims to assess the allocative efficiency of public spending in health services at present and identify its determinants from Bangladesh's perspective. The study will cover the allocation, activities, and spending of the Health Services Division of Bangladesh. The specific objectives of the study are: 1. To assess the allocative efficiency of public spending on Health Services in Bangladesh. 2. To identify key factors influencing public spending allocative efficiency in health services. 3. To identify constraints hindering public spending allocative efficiency in health services. 4. To suggest measures to improve public spending allocative efficiency in health services in Bangladesh.
4.	Agreement Signed	28 July 2024
5.	Estimated Study Cost	Tk. 24,50000.00 (Excluding AIT, Tax & VAT)
6.	Study Duration	Start Date: 28 July 2024 End Date: 15 February, 2026

Chapter 1: Introduction

1.1 Background of the Study

Bangladesh has achieved significant progress in both economic growth and poverty alleviation over recent decades. Alongside these economic improvements, Bangladesh has also made significant progress in maternal and child health, reproductive health and life expectancy (NIPORT & ICF, 2024; Akhter, 2021; Lam, 2021; Sultana et al., 2021). This progress can be attributed to several critical factors, including health system strengthening (Matin et al., 2023), widespread immunization efforts (Sharmin et al., 2023), the implementation of effective WASH interventions (Billah et al., 2019), and effective family planning programs. In addition to these programs, several factors have contributed to the improvements in health outcomes, including increased female education, higher health expenditures, enhanced health literacy, and addressing socioeconomic determinants of health (Huda et al., 2018; Sultana et al., 2021).

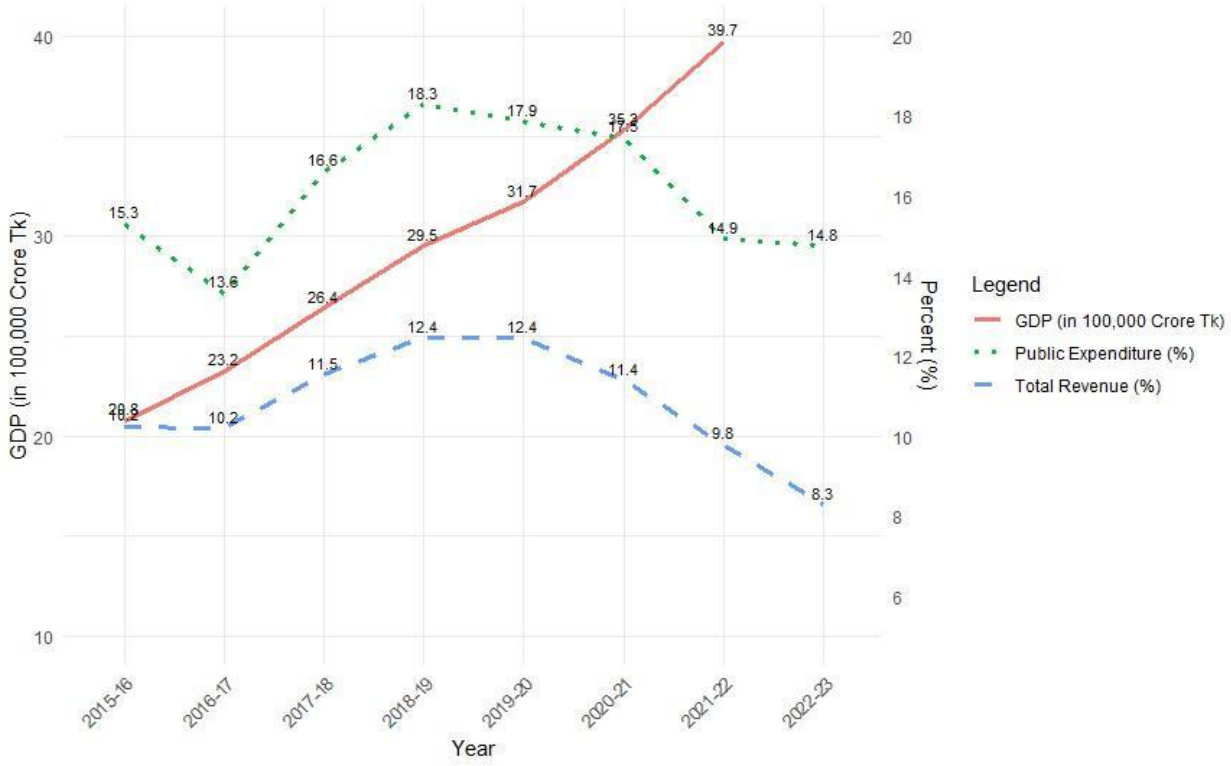
Despite these achievements, the health sector faces challenges in ensuring universal access to primary healthcare (Fahim et al., 2019; Joarder et al., 2019); prevention and control of non-communicable diseases (Jahan et al., 2023; Rawal et al., 2021); supply and distribution of essential drugs and vaccines (Islam et al., 2020; Kabir et al., 2022); and reducing the financial burden on households due to increasing healthcare costs (Fahim et al., 2019). For instance, as of 2021, the density of physicians and of nursing and midwifery personnel is 6.5 and 6.1 per 10,000 people, respectively (WHO, 2021), while the density of hospital beds stands at 3.36 per 10,000 people. [1]

Due to the limited healthcare facilities in Bangladesh, people are underserved and face high out-of-pocket expenditures. For example, only 21% of pregnant women receive quality antenatal care, while 66% of women encounter difficulties in accessing healthcare services (NIPORT & ICF, 2024, p. 125). Additionally, 43.65% of children do not receive essential newborn care (NIPORT & ICF, 2024, p. 125). The prevalence of non-communicable diseases (NCDs) is rising steadily, and only 20% of hypertensive individuals and approximately 5% of those with diabetes are aware of their condition and are receiving treatment (NIPORT & ICF, 2024, p. 245). Despite the underutilization of critical maternal health and NCD care, a substantial portion of healthcare costs is borne directly by patients, with 72.99% of total healthcare expenditure being out-of-pocket in 2021-22. This heavy reliance on out-of-pocket payments has led to catastrophic healthcare costs for 24.6% of households (Ahmed et al., 2022). Therefore, the inadequate healthcare infrastructure of the country resulted in poor outcomes of key health indicators and a significant economic burden.

[1] https://data.who.int/indicators

The healthcare system requires substantial public funding to enhance facilities, improve outcomes, and strengthen financial protection for the population. To mobilize additional resources for health, there are five potential sources of fiscal space that the government can explore.

Firstly, an expanding economy generally increases government revenue, which can provide more funds for the health sector. However, as shown in Figure 1, although the GDP of Bangladesh has been growing over time, the percentage of total tax revenue relative to GDP has been declining. This indicates that economic expansion is not necessarily creating additional fiscal space for increased budget allocation to healthcare.



Source: World Bank Data

Figure 1.1 *Trends of GDP, Public Expenditure and Total Revenue of Bangladesh*

Secondly, the government could enhance its fiscal space for health sector by prioritizing allocations to the health sector. In Bangladesh, however, prioritizing health in the national budget is challenging due to competing demands from other sectors, such as infrastructure development and debt servicing, which consume a significant share of government resources (World Bank, 2016).

When economic growth does not result in substantial fiscal space for health sector and prioritizing the health sector is not feasible, a common proposal is to introduce a new tax solely for healthcare financing which is health insurance. Although social health insurance is widely considered as a strategy for mobilizing extra domestic resources for health, its implementation is not automatic. In Bangladesh, expanding health insurance faces challenges due to the large informal sector, which limits the tax base

and complicates enrollment efforts. This may result in reallocating funds from the general health budget to support insurance schemes aimed at covering the entire population (World Bank, 2016).

In addition to these sources of fiscal space for health sector, long-standing development partner support has been a crucial factor in health sector funding of Bangladesh. However, development partner's contributions have declined due to Bangladesh's economic growth, change in the priorities of the development partners, and shifting global economic conditions.

Given that the initial four sources do not provide sufficient fiscal space for mobilizing extra fund in healthcare services, the fifth source becomes critical. It focuses on optimizing the existing budget to achieve better value, ensuring that health outcomes can be improved efficiently without relying on additional funding. As shown in Figure 1.2, there is a significant portion of the budget allocated to the Ministry of Health and Family Welfare (MoHFW) that remains unutilized. Despite the limited budget, this underutilization suggests that the focus should shift towards achieving greater value from existing resources rather than seeking additional funds.

Source: Health Bulletin

Figure 1.2 *Percentage of MoHFW Budget Utilization*

The MoHFW manages its services through two key divisions: the Health Services Division and the Medical Education and Family Welfare Division.[2] The Health Service Division is responsible for providing affordable healthcare for all to build a healthy population. Meanwhile, our country's inadequate healthcare infrastructure resulted in poor outcomes of key health indicators. Therefore, to enhance the nation's health outcomes, getting better value for money from public spending on health service divisions is essential. Before this can be done, however, it is necessary to assess the current allocative efficiency score and determine how it can be improved. Therefore, understanding and

[2] A comprehensive overview of the budgeting system and structure of the health sector in Bangladesh is provided in Section 1.2.

enhancing the allocative efficiency of public spending is essential for improving health outcomes in the country.

Before getting the evidence of allocative efficiency from the existing literature, it is important to clear the concept of efficiency. Efficiency, the concept of utilizing resources in the most effective way to meet human needs, is essential in this context. In the health sector, allocative and technical efficiency are particularly important in understanding the effectiveness of resource allocation (Gyrd-Hansen, 2014). Allocative efficiency assesses whether resources are distributed in a manner that generates the optimal combination of health outputs to maximize societal health outcomes (Bose, 2021). It is mathematically derived as the ratio of cost efficiency to technical efficiency (Haynes & Dinc, 2005), reflecting the effectiveness of resource allocation in achieving the greatest possible improvement in population health. Public spending allocative efficiency refers to the effective allocation of government resources to meet societal needs and preferences, ensuring that the distribution of those resources maximizes population well-being while aligning with societal priorities and expectations. It emphasizes whether public funds are directed toward goods and services that provide the greatest benefit to the population.

Theoretically, markets can achieve allocative efficiency if certain conditions are met. On the demand side, consumers must be able to make informed decisions with complete and perfect information about the product they are purchasing and must be presented with the full price of the good when making a purchase. However, in healthcare markets, these conditions are often not met. Information asymmetry is a significant issue, as individuals seeking healthcare services may struggle to determine the necessary treatments or evaluate their effectiveness.

In theory, patient preferences must also be considered when assessing allocative efficiency. This involves collecting data on preferences related to healthcare services, treatment options, and outcomes, using methods such as patient surveys, focus group discussions, and preference elicitation techniques. These preferences can then be quantified and incorporated into decision-making through tools like utility analysis or econometric models. By accounting for patient preferences, healthcare providers and policymakers can allocate resources toward services and interventions that align with patients' needs, values, and priorities. Integrating these preferences into resource allocation enhances patient satisfaction, improves health outcomes, and increases allocative efficiency in healthcare delivery.

Considering above theoretical points of allocative efficiency, the literature was searched for evidence of current allocative efficiency status of public spending in health services. However, despite the utmost importance of allocative efficiency in improving overall health indicators, to the best of our knowledge, no studies have comprehensively measured the allocative efficiency of public spending in Bangladesh in recent years. Most of the studies on allocative efficiency of health services have been conducted in

Africa, developing Asia, and high-income settings like Europe, Australia, the UK, and Canada (Bajaro et al., 2023; Nabyonga-Orem et al., 2023; Neri et al., 2022). Ahmed et al. (2019a) found that 91.3% of Asian countries were inefficient with respect to using healthcare system resources. They also discovered that by optimizing the health system efficiency of lower middle-income countries 8.7% of health system outcomes can be improved using the existing level of resources (Ahmed et al., 2019a).

In a discussion paper, Ahmed et al. (2019b) highlight several critical barriers to allocative efficiency in Bangladesh's healthcare sector. These include delays in the release of funds and procurement processes, inadequate operational financing at the facility level, and the absence of a legal framework to support the implementation of a social health protection scheme. They also note the lack of laws to retain user fees at health facilities or to modify financial regulations to introduce "Flexible Cash at Facilities." This mechanism would enable healthcare facilities, such as district hospitals and union health centers, to access cash resources immediately, empowering them to manage operational expenses efficiently and respond swiftly to urgent needs. Such an approach would improve budget utilization without the delays associated with centralized fund disbursement processes, thereby enhancing the overall effectiveness of healthcare delivery and addressing service gaps within the public health system. Additionally, the authors point out issues such as district-level health providers lacking delegated financial power, noncompliance with audit observations, and the need for strengthening public financial management capacity. However, the authors did not measure allocative efficiency, and their findings may reflect a biased perspective. Despite these identified barriers, significant gaps remain in understanding the efficiency levels of public spending in health services and how these can be improved to ensure that the limited resources allocated to the health service division are utilized effectively to enhance health outcomes. There are also severe limitations in the available evidence on these issues.

Given these persistent knowledge gaps and institutional constraints, a comprehensive assessment of how efficiently public resources are allocated and utilized in the health sector is essential to optimizing health resource utilization. Therefore, this research aims to fill existing gaps by examining the allocative efficiency of public spending in Bangladesh's health services, ultimately contributing to more effective resource utilization and improved health outcomes in the country.

Measuring allocative efficiency involves assessing the relative importance of healthcare services and identifying the components that individuals value most. Allocative efficiency can be empirically assessed using methods such as Data Envelopment Analysis (DEA), the Malmquist Index, and Stochastic Frontier Analysis (SFA). These approaches provide distinct ways of measuring efficiency and offer valuable insights into resource allocation within healthcare systems. For instance, the DEA evaluates the efficiency of decision-making units, such as hospitals or clinics, by comparing their inputs and outputs, while the Malmquist Index examines changes in efficiency over time. SFA, in contrast, estimates the efficiency frontier of production, accounting for random factors that may impact

efficiency. Each method has specific strengths and limitations, and the choice of approach depends on the study's context and objectives.

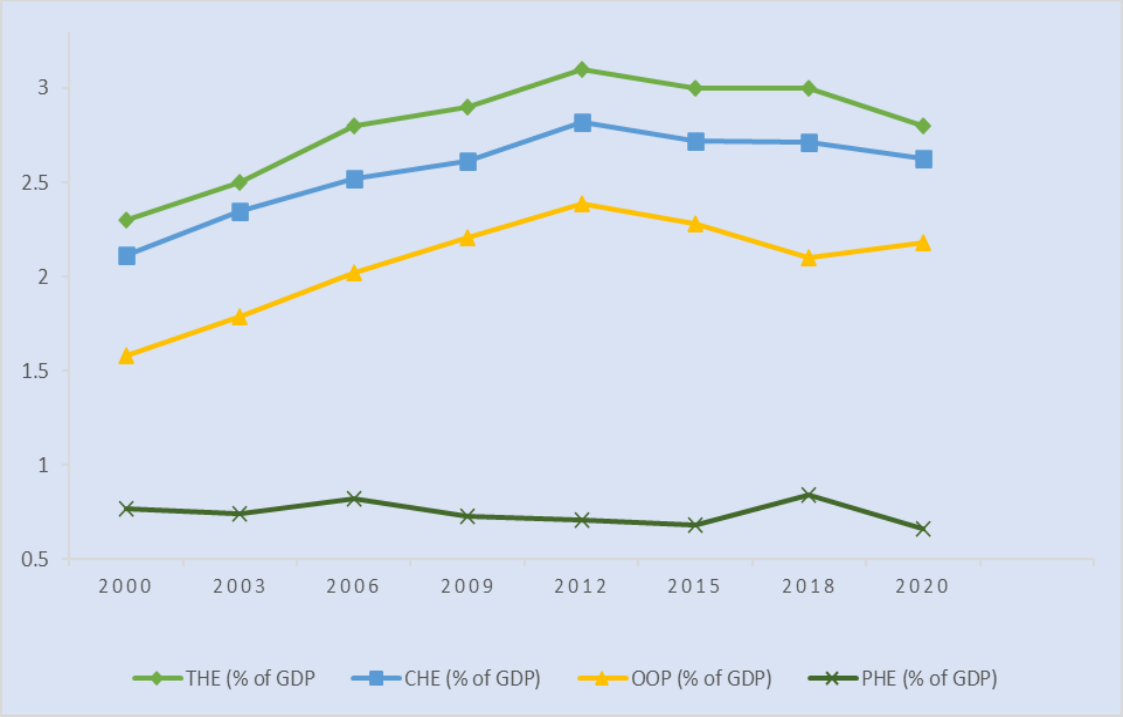
Most previous studies have utilized one-stage Data Envelopment Analysis (DEA), which may not adequately capture the complexities of the healthcare system. Additionally, they have acknowledged limitations related to data availability and representativeness. Further research should examine the long-term impacts of specific interventions on health service delivery, as well as the equity implications of efficiency gains to ensure that improvements benefit all segments of the population.

This study used a three-stage Data Envelopment Analysis (DEA), combining regression-based Stochastic Frontier Analysis (SFA) with non-parametric DEA, to offer a more detailed assessment of the allocative efficiency of public spending in Bangladesh's health sector. Additionally, qualitative methods, such as focus group discussions (FGDs) and key informant interviews (KIIs) with stakeholders, will help identify factors that affect allocative efficiency in health budgeting and provide recommendations for improvement present scenario. This mixed-methods approach aims to offer valuable insights for improving the allocative efficiency of health spending, ultimately enhancing the overall health condition of the population. The study will also assist the Government of Bangladesh in meeting its constitutional responsibility to provide quality healthcare for all.

1.2 Budgeting System and Structure of the Health Sector in Bangladesh

Bangladesh's government prioritizes the well-being of its citizens by investing in healthcare initiatives that promote a healthy and productive population.[3] These efforts have resulted in positive health outcomes, including lower birth and death rates, increased life expectancy, and reduced infant and maternal mortality. Over the years total health expenditure (THE) as a percentage of GDP has demonstrated an increasing trend but public health expenditure does not exhibit an upward change and it has caused an increase in out-of-pocket expenditure (OOP). (Figure 1.3)

[3] *Health Bulletin 2023. Ministry of Health and Family Welfare.*



Source: Authors' compilation from World Bank Open Data and Public Expenditure Review 1997-2020
(THE= Total Health Expenditure, CHE= Current Heath Expenditure, OOP= Out-of-Pocket Expenditure, PHE=Public Health Expenditure)

Figure 1. 3 *Trends of Total Health Expenditure, Current Health Expenditure, Out-of-Pocket Expenditure, and Public Health Expenditure of Bangladesh*

1.2.1 Budgetary System of MoHFW in Bangladesh

The budgetary system of Bangladesh consists of a wide array of revenue streams aimed at financing government expenditures and development initiatives. The government prepares two distinct types of budgets: the operating budget (also known as the non-development budget) and the development budget.

The government's total resource mobilization includes tax revenues, non-tax revenues, foreign grants, foreign loans, and domestic borrowing. Tax revenues are further divided into collections by the National Board of Revenue (NBR) and non-NBR tax revenues. External financing is sourced through foreign loans and grants from bilateral donors, multilateral institutions like the World Bank, the Asian Development Bank, the International Monetary Fund (IMF), and commercial lenders. Domestic borrowing is obtained from various financial institutions, including commercial banks, non-banking financial institutions, and domestic savings schemes.

Prior to FY 2005-06, Bangladesh followed a single-year budgeting framework with a top-down, input based approach, which lacked alignment between ministry priorities, resource ceilings, and performance outcomes. As part of the Public Financial Management (PFM) reform agenda, the

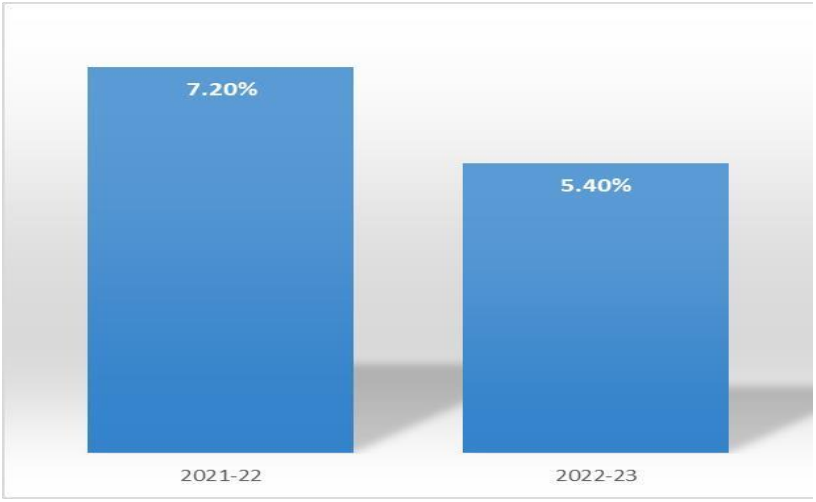
government introduced the Medium-Term Budgetary Framework (MTBF) in FY 2005-06. This shift from an input-based to a results-based budgeting system emphasized aligning resource allocation with performance and long-term priorities.

The MTBF integrates with the annual budget process, offering a policy-driven framework for financial planning and resource distribution. It covers both revenue and expenditure for the operating and development budgets, ensuring that fiscal planning aligns with national priorities, sectoral goals, and economic forecasts.

MoHFW serves as the primary financial intermediary of the Government of Bangladesh (GoB), playing a pivotal role in the allocation of funds within the health sector. It receives financial allocations from the Ministry of Finance (MoF) and subsequently distributes these funds to health facilities and centers at various levels.

In 2017, the MoHFW underwent a structural refinement, splitting into two distinct divisions: the Health Services division and the Medical Education and Family Welfare division. The Health Services Division is responsible for overseeing policies related to healthcare delivery, nursing care management, health financing, and other areas within the health sector. In contrast, the Medical Education and Family Welfare Division focuses on policies concerning medical education, family planning, and vital statistics as maternal mortality rate, infant mortality rate, total fertility rate, including birth and death registrations.

The MoHFW receives funding through both the development and operating budgets. The operating budget primarily caters to recurrent operational expenditures within the health sector, ensuring the continuous provision of essential services which is prepared internally by the offices of the Director General of Health Services and the Director General of Family Planning Services. Conversely, the development budget allocates funds for project-related initiatives aimed at enhancing healthcare infrastructure and services. For FY 2022-23, the MoHFW budget constitutes 5.40% of the total operating and development budget, which is lower than the previous year. (Figure 1.4)



Source: Authors' compilation from Budget in Brief

Figure 1. 4 *MoHFW Budget Share in the National Budget of Bangladesh*

1.2.2 Structure of the Health Care System in Bangladesh

The healthcare system in Bangladesh is organized into three main tiers: primary, secondary, and tertiary care. The Ministry of Health and Family Welfare (MoHFW) oversees the operations of the healthcare system. This tiered structure ensures that healthcare services are provided across different levels, from local communities to specialized hospitals in major cities. At the foundation of the system is primary care, which is delivered through community clinics (CCs), Union Health and Family Welfare Centers (UHFWCs), and Upazila Health Complexes (UHCs). These facilities offer basic healthcare services, focusing on maternal and child health, immunizations, and general medical treatments. Over the years, the government has expanded these primary healthcare centers to improve access for rural and underserved populations in Bangladesh (World Health, 2016).

The secondary care level includes district hospitals and larger Upazila Health Complexes. These facilities handle more complex medical cases that cannot be treated at the primary level, offering inpatient and outpatient services. They also provide surgeries and treatment for various health conditions. The secondary tier plays a crucial role in providing intermediary healthcare services between the basic care offered at the primary level and the advanced care available at tertiary centers.

At the top of the healthcare hierarchy is tertiary care, which is provided by medical college hospitals and specialized hospitals in major cities. These hospitals are equipped with advanced medical technologies and highly trained specialists, offering treatments for complex medical conditions, including specialized surgeries, advanced diagnostics, and intricate treatments. Tertiary care facilities serve as the final referral points for patients requiring highly specialized interventions. However, the referral system across the different tiers of the healthcare system in Bangladesh is ineffective, as patients

often bypass primary and secondary care facilities to seek services directly from tertiary hospitals, leading to overcrowding and inefficiencies in the system.

In addition to the public healthcare system, the private sector and non-governmental organizations (NGOs) play a significant role in the healthcare landscape, particularly in urban areas. Private hospitals and clinics provide quicker access to services and higher-quality care, though often at a higher cost, which creates a reliance on out-of-pocket payments. While the structure of the healthcare system in Bangladesh is designed to cover multiple levels of care, challenges persist in terms of resource allocation, maintaining an appropriate referral system, shortages in the healthcare workforce, and ensuring equitable access to quality services across both urban and rural areas (Adams et al., 2013; Ahmed, 2022; Joarder et al., 2019). Addressing these challenges is key to improving the overall effectiveness and inclusivity of the healthcare system in Bangladesh.

1.3 Policies and Priorities of Government Targeting Health Services

Understanding the allocation of resources for different health care services, it is important to recognize the policies and priorities of the government as formulated in the National Health Policy 2011, 8th Five Year Plan (8th FYP), 4th Health, Population, and Nutrition Sector Program (4th HPNSP), Perspective Plan of Bangladesh 2021–2041 along with sustainable development goals and targets.

The National Health Policy is a set of guidelines that helps a nation prioritize its healthcare needs, allocate resources accordingly, and meet its goals in this domain (Murshid & Haque, 2020). With three specific objectives and 19 primary goals, the GoB formulated the first health policy in 2011 (MOHFW, 2012).

The Bangladesh National Health Policy 2011 has the following three specific objectives:

1. Ensure accessibility of primary health care and emergency medical care for all.
2. Ensure availability of quality healthcare services for all based on equity and extend its coverage.
3. Encourage community demand for health care considering rights and dignity to prevent diseases and restrain their spread.

The goals of National Health Policy 2011 emphasized ensuring health services for all sections of society, establishing community clinics, reducing child and maternal mortality rates, ensuring emergency medical care and gender equality, the right to availability of information on the health system, integrating nutrition programs to health services and so on (MOHFW, 2012).

The 4th HPNSP in Bangladesh is implemented from 2017 to 2024. It aims to strengthen the healthcare system and focuses on improving health services delivery, governance, and institutional efficiency. It

targets key health indicators such as maternal and child health, family planning, nutrition, and healthcare access. The program involves multiple stakeholders, including international development partners like the World Bank, JICA, UNICEF, WHO, and GAVI.

A significant component of the 4th HPNSP includes improving financial and administrative management systems while scaling up essential health services across rural and urban areas. The program also aims to enhance the country's mental health services and promote access to quality healthcare for vulnerable populations. To ensure no interruption of services, its closing date was extended to June 2024, giving room for continued implementation before transitioning to the upcoming 5th Sector Program. This program aligns with Bangladesh's goals under its Five-Year Plans and SDGs, reinforcing efforts to improve the health and nutrition sectors comprehensively.

As part of the Perspective Plan of Bangladesh (2021-2041), the government is also working to improve certain health and nutrition indicators. The main elements of the population, health, and nutrition strategy in perspective plan 2041 include expanding public health clinics and improving their quality, strengthening district-level hospital care, national hospital, private health care delivery system, and health sector governance, eliminating child nutrition gaps, introducing health insurance schemes, improving the quality and quantity of health care professionals, safe disposal of medical waste and so on. Alongside, by 2041, this plan seeks to increase public healthcare spending to at least 1.5% of GDP by FY 2031 and 2.0% of GDP by FY 2041 from 0.7% of GDP (General Economics Division, 2021). The targets related to health and population, as formulated in PP 2021-2041 are given in Table 1.1:

Table 1. 1 *Targets on Health and Population in Perspective Plan of Bangladesh 2021-2041*

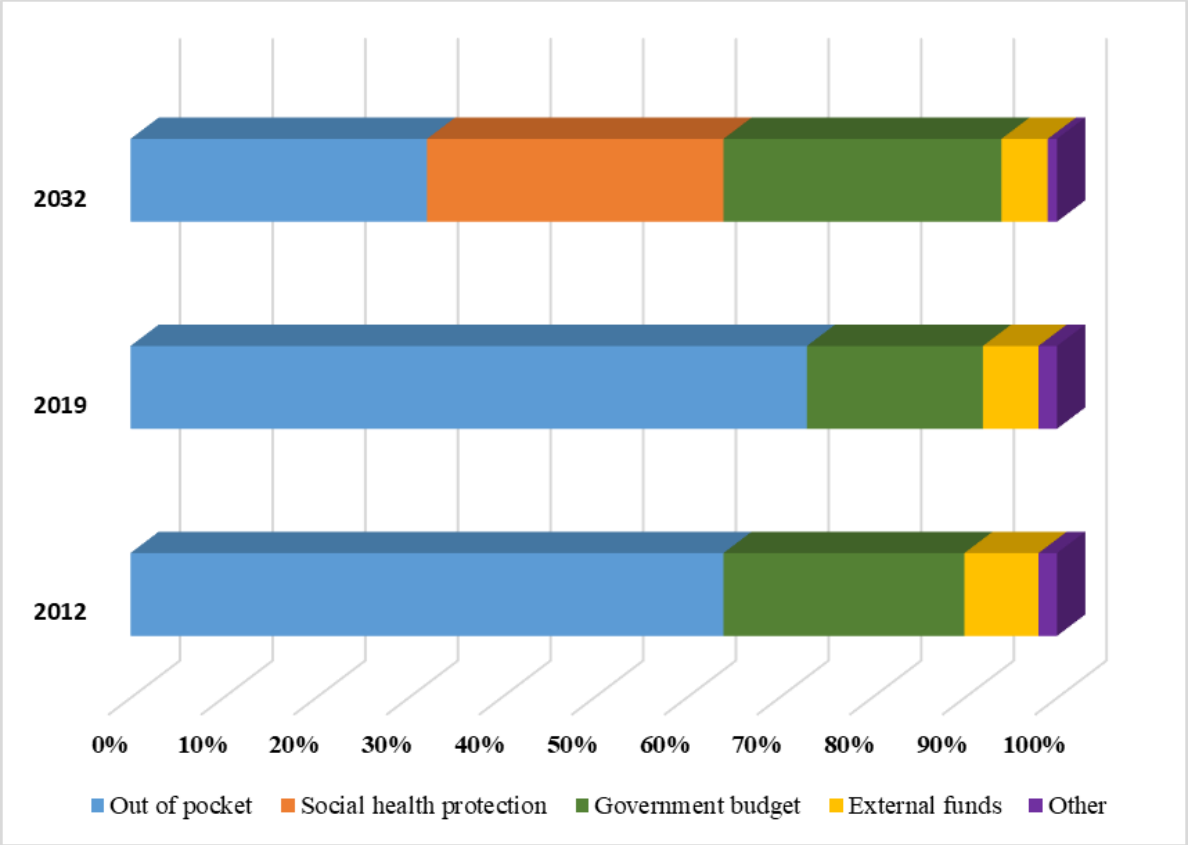
Indicators	FY 2018 (Base Year)	FY 2031 (Mid-Term)	FY 2041 (Target)
Life Expectancy (years)	72.3	75	80
Population Growth Rate (%)	1.2	1.0	1.0
Maternal Mortality Ratio (MMR) (per 100,000 live births)	169	70	36
Infant Mortality Rate (per 1000 live births)	22	15	4
Underweight of Under 5 children (6-59 months) (%)	33	5	2
Stunting (%)	31	15	2
Total Fertility Rate (TFR) (%)	2.05	1.8	1.8
Coverage of Health Insurance (%)	Insignificant	50	75
Public Spending on Health (% of GDP)	0.7	1.5	2.0

Source: General Economics Division 2021, *Perspective Plan of Bangladesh 2021-2041*, p.55

One of the six main themes of the 8th FYP highlights "Human Health is Development" (Bangladesh Planning Commission, 2020). The goal of the 8th FYP is to ensure that all citizens enjoy health and well-being by expanding access to quality and equitable health care in a healthy environment, whereas the objective is to build on existing achievement to improve equity, quality, and efficiency to gradually move towards Universal Health Coverage (UHC) and achieve the health, population, and nutrition related SDGs (Bangladesh Planning Commission, 2020). The 8th FYP has specific strategies for achieving universal health care and reducing out-of-pocket expenditures. It also contains directions for improving urban health services, controlling communicable and non-communicable diseases, strengthening health systems, and so on. Alongside targets on 12 specific indicators of health and nutrition, other priorities of the government are also elaborately formulated in the 8th FYP.

With a target of increasing the level of funding for health, ensuring an equitable distribution of the health financing burden, improving access to essential health services, reducing the incidence of impoverishment due to catastrophic healthcare expenditures, and improving the quality and efficiency of service delivery, the Government of Bangladesh has also adopted the Health Care Financing Strategy 2012-2032. This healthcare financing strategy includes a framework for developing and advancing health financing in Bangladesh (Health Economics Unit, 2012).

Healthcare financing or health budgeting is a crucial strategy for governments as it directly influences the accessibility, quality, and sustainability of healthcare services for the population. Adequate and well-allocated funding ensures that healthcare systems have the necessary resources to provide essential services, such as primary healthcare, maternal and child health, disease prevention, and specialized medical care. Without proper financial planning, healthcare systems may face resource shortages, leading to insufficient medical supplies, understaffed facilities, and long wait times, which can compromise the quality of care. Figure 1.5 shows the targets of the healthcare financing strategy where 2012 was the base year. The updated scenario is shown in the year 2019.



Source: Healthcare Financing Strategy 2012-2032, p.11 & Health Financing Progress Matrix assessment: Bangladesh 2021, p.25

Figure 1. 5 *Targets of Healthcare Financing Strategy*

The revised budget allocation (Operating and Development) from FY 2018-19 to FY 2023-24 and the proposed allocation (Operating and Development) for FY 2021-22 of the Health Services Division are shown in **Table 1.2**:

Table 1.2 *The Budget for the Health Services Division for FY 2014-2015 to 2023-2024*

Financial Year	Total Allocation in the Budget (Taka in Thousand)	Percentage Change (%) in the Allocation of the Budget Compared to the Previous Year	Current Total Health Expenditure (% Of GDP)	Out-Of-Pocket Expenditure (%)
2014-15	11176,24,00	-	2.73	70.76
2015-16	12725,63,00	28.29	2.72	72.68
2016-17	17516,05,00	-8.63	2.86	71.49
2017-18	16203,36,00	9.57	2.78	70.09

Financial Year	Total Allocation in the Budget (Taka in Thousand)	Percentage Change (%) in the Allocation of the Budget Compared to the Previous Year	Current Total Health Expenditure (% Of GDP)	Out-Of-Pocket Expenditure (%)
2018-19	18166,31,00	16.23	2.72	70.68
2019-20	19944,30,00	7.77	2.62	72.05
2020-21	22883,86,00	38.27	2.63	74
2021-22	25913,97,00	1.67	2.63	-
2022-23	29282,00,00	-11.90	2.62	-
2023-24	29429,57,00	-	2.61	-

Source: Health Services Division (https://hsd.gov.bd) and World Bank (https://data.worldbank.org/indicator) [Accessed on February 13, 2024]

Furthermore, Bangladesh has attained significant success in achieving Millennium Development Goals (MDGs), and in line with SDG goal 3: Good health and well-being, the country hopes to achieve the targets by 2030 (Directorate General of Health Services, 2023). To track progress against its 13 targets, SDG 3 includes 28 indicators. The targets include reducing maternal and child mortality, achieving universal health coverage (UHC), ensuring universal access to sexual and reproductive healthcare services, and reducing deaths from traffic accidents, hazardous chemicals, and environmental pollution.

After analyzing the Perspective Plan of Bangladesh 2021-2041, 8th Five-Year Plan, Sustainable Development Goals (SDGs), and National Health Policy 2011, some indicators have been identified from the targets of these documents that have been already discussed above. Among these indicators, some common indicators have been identified that have been used by the representative authorities to measure health outcomes and to set goals and targets for future coverage. These common indicators will help this study to assess the allocative efficiency of public spending on health services. The list of these indicators and the list of common indicators from Perspective Plan 2021-2041, 8th Five-Year Plan, Sustainable Development Goals (SDGs), and National Health Policy 2011 are shown simultaneously in Table A1 and Table A2 of Annex A. Among these indicators, the present study employs Years of Life Lost, Infant Mortality Rate, Under-Five Mortality Rate, Maternal Mortality Rate, and Replacement Fertility for the assessment of health system efficiency.

1.4 Objectives of the Study

The study aims to assess the allocative efficiency of public spending in health services at present and identify its determinants from Bangladesh's perspective. The study will cover the allocation, activities, and spending of the Health Services Division of Bangladesh.

The specific objectives of the study are:

1. To assess the allocative efficiency of public spending on Health Services in Bangladesh.
2. To identify key factors influencing public spending allocative efficiency in health services.
3. To identify constraints hindering public spending allocative efficiency in health services.
4. To suggest measures to improve public spending allocative efficiency in health services in Bangladesh.

By integrating advanced analytical techniques with stakeholder insights, the study generates evidence-based recommendations for optimizing resource allocation in health services. The findings will not only contribute to the academic discourse on public spending allocative efficiency but also offer practical guidance for policymakers, supporting the government's efforts to improve healthcare delivery.

Following the introduction in Chapter 1, the report is structured for a coherent progression: Chapter 2 presents a thorough review of the existing literature on the topic, highlighting the research gap and the contributions of this study, along with the research questions and the scope of the study. Chapter 3 outlines the research methodology, including the conceptual framework and overall research design, accompanied by an explanation of both quantitative and qualitative analyses. Chapter 4 showcases the overall findings of the study following a discussion section in Chapter 5. The last chapter presents the conclusion of the report.

Chapter 2: Review of Literature and Research Gap

2.1 Review of Literature

The pursuit of various forms of efficiency, essential for delivering quality healthcare, has long been a key focus of global health policy and research. By optimizing resource allocation and utilization, healthcare systems can improve care quality while reducing costs. This chapter presents a series of studies that examine different types of efficiency in the health sector across diverse contexts, uncovering the factors that influence them and offering practical guidance for policymakers and healthcare providers.

Evans et al. (2000) initiated a comprehensive analysis of national health systems across 191 countries, employing the stochastic frontier production function to estimate the relationship between health inputs and outputs and revealed a positive correlation between health expenditure per capita and health system efficiency, emphasizing the role of factors such as good governance, equitable resource distribution, and effective technology utilization in fostering efficient health systems. This study underscored the multifaceted nature of healthcare efficiency but further study is needed to identify the specific policies and interventions that can lead to improvements in efficiency.

Zhou et al. (2021) focuses on emerging countries, categorizing them by income levels to explore the factors influencing healthcare efficiency. Using the Data Envelopment Analysis (DEA) model it assesses technical efficiency. Then by utilizing Tobit regression the study identifies public healthcare expenditure as a key indicator for increasing efficiency in healthcare. Other factors, such as research and development, the number of physicians, income, and education, are found to have a significant positive association with increased efficiency. However, corruption emerges as a barrier to achieving optimal efficiency. While the DEA method was employed, future studies could benefit from incorporating sensitivity analysis using Stochastic Frontier Analysis (SFA) to provide more robust insights.

The study by Mills (1997) examines the efficiency of public sector health services in developing countries comparing bureaucratic and market approaches by analyzing existing literature, case studies, and theoretical frameworks to identify the strengths and weaknesses of each approach. While the bureaucratic approach can ensure universal access and address equity concerns, it often suffers from inefficiencies. Conversely, the market approach can introduce competition and improve overall efficiency but risks excluding poorer populations and creating inequalities in access and quality of care. Although the study acknowledges equity concerns, it does not analyze them in detail. A more comprehensive examination of equity considerations and their interaction with efficiency goals is

necessary to provide a more complete understanding of the trade-offs involved in improving public sector health services in developing countries.

The study by O'Donnell et al. (2007) examined the distribution of public healthcare spending in 11 Asian countries to assess whether poorer populations benefit proportionally more than wealthier ones. Using household survey and public health expenditure data, the study employed concentration and Lorenz curves to visualize spending distribution and regression analysis to identify factors influencing pro-poor incidence. The findings revealed varying distribution across countries, with pro-poor incidence observed in some. Factors associated with pro-poor incidence included user fees, public health facility availability, and national income levels. However, the study's limitations, including data and methodological constraints, may not fully capture the complexities of public healthcare financing and utilization.

Economics & Series (2023) conducted an assessment of health spending efficiency in Developing Asia using DEA. The study identified factors such as economic growth, political stability, good governance, and higher public health expenditure per capita as contributors to greater efficiency. The findings offer valuable insights for shaping informed policy decisions suggesting that inefficient countries could enhance their health outcomes by allocating resources more effectively and adopting best practices from more efficient countries. However, a more in-depth analysis is required to achieve robust findings by applying methods beyond DEA.

Asandului et al. (2014) examined public healthcare systems across European countries, using DEA to estimate efficiency scores and Tobit regression to analyze the relationships with explanatory variables such as higher public health expenditures per capita and the number of doctors per capita, which have positive relationship with higher efficiency. But the findings revealed no significant relationship between income levels and efficiency. Future research could delve deeper into identifying additional factors influencing efficiency and offer recommendations for further improvements.

A technical efficiency assessment in the Slovak Republic, using Data Envelopment Analysis (DEA) to generate efficiency scores across different regions, found that factors like bed occupancy rates, nursing hours, and the use of advanced medical technology were linked to higher efficiency. Future research could explore the scenario of allocative efficiency and the impact of non-quantifiable factors, such as the quality of the healthcare workforce and management practices, to gain a more holistic understanding of what drives both technical and allocative efficiency in healthcare systems.(Stefko et al., 2018)

The study by Zeng et al. (2022) examined the performance variation among county health systems in Kenya. Through a mixed-method approach, the study investigated performance determinants of five counties and conducted a stakeholder analysis using focus group discussions and key informant interviews and revealed a shortage of funding as a common complaint among counties, leading to

inefficiencies such as delayed funding disbursement, lack of autonomy in procurement, insufficient lab tests and equipment, low health insurance enrollment, rigid procurement policies, lack of motivation and incentives, and poor economic status. However, a methodological limitation of the study is that it did not include an analysis specifically measuring technical or allocative efficiency in health services.

The study by Nyawira et al. (2023) examines the influence of budget execution processes on the efficiency of county health systems in Kenya. Using a mixed-method approach, the study reveals that inefficient budget execution processes are linked to several negative consequences, including poor budget credibility, delayed resource availability, limited provider autonomy, and suboptimal procurement practices. The study also shows that counties with more efficient budget execution tend to have better health outcomes. However, the study acknowledges limitations in data availability and representativeness, particularly for qualitative findings.

Su et al. (2023) conducted an analysis on primary healthcare (PHC) institutions in China. Employing a three-stage Data Envelopment Analysis (DEA) approach, the study uncovered significant variations in efficiency among PHC institutions across provinces and over time. Provinces with higher levels of economic development and more advanced healthcare infrastructure tended to exhibit higher efficiency scores. Factors such as economic development and healthcare infrastructure were associated with higher efficiency scores, highlighting the importance of addressing resource disparities to enhance efficiency nationwide.

Sun et al. (2023) conducted an evaluation of the allocative efficiency of healthcare resource allocation at the county level in China, examining trends in convergence and the factors influencing variations in allocative efficiency. Using Data Envelopment Analysis (DEA), the study compared allocative efficiency across counties. Additionally, the researchers employed a spatial panel model to assess spatial dynamics and identify variables impacting allocative efficiency convergence. Their findings revealed the dynamic nature of healthcare resource allocation, showing both convergence and divergence in allocative efficiency over time. Moreover, they identified certain factors associated with increased productivity and convergence, providing valuable insights for policymakers aiming to optimize resource distribution and improve county-level healthcare delivery.

The 1998 Bangladesh Health Facility Efficiency Study assessed how efficiently public hospitals utilize resources. Researchers surveyed various facility types and estimated efficiency scores using Data Envelopment Analysis (DEA). This score indicates how well a facility delivers services (outputs like patient numbers and procedures) with its resources (inputs like staff, equipment, budget). While limitations like constant return to scale assumptions in DEA exist, the report offers valuable insights for improving resource allocation and overall healthcare delivery in Bangladesh.

Ahmed et al. (2019) explored the effectiveness of public financial management in Bangladesh, identifying challenges hindering health financing and service delivery. The research aimed to identify key PFM challenges hindering the implementation of Bangladesh's Health Care Financing Strategy 2012-2032 and proposed specific reforms to strengthen health financing and improve service delivery. Employing a mixed-methods approach, including semi-structured interviews with stakeholders from the Ministry of Health, Ministry of Finance, and health facility staff, as well as discussions with healthcare providers, patients, and community representatives, the study brought light on PFM challenges and their repercussions on service delivery. By examining budget allocation, disbursement patterns, and utilization data, the research uncovered potential inefficiencies and inequities in resource allocation. Their study provided critical insights into the interplay between financial management practices, health financing, and service delivery, offering recommendations for reforms to enhance healthcare accessibility, efficiency, and equity.

The study by Sattar (2021) examines the legal and institutional framework governing the health sector in Bangladesh. Using a qualitative approach, the study analyzes existing literature, policy documents, and reports from national and international organizations. The findings reveal that the framework is characterized by complexity, fragmentation, and inadequate implementation. These shortcomings lead to several challenges, including a lack of policy coherence, inefficient resource allocation, weak accountability mechanisms, and limited access to healthcare for vulnerable populations. However, the study does not explicitly mention conducting any specific data analysis or empirical research.

The study by Ali (2020) examines the existing regulatory framework for healthcare services in Bangladesh. Using a qualitative approach, the study analyzes existing literature, policy documents, and media reports. The findings reveal that the framework is fragmented, outdated, and poorly implemented. The study also identifies a lack of effective mechanisms for enforcement, accountability, and transparency. These shortcomings contribute to widespread inequity, poor service coverage, and ethical concerns within the healthcare system. The study proposes recommendations for improving the regulatory framework.

This study by Shariful and Khandakar (2014) examines patient satisfaction with medical care in Bangladesh's rural healthcare system. It explores the system's current state, factors influencing satisfaction (like access, provider interaction, and wait times), and areas for improvement. The research, likely using surveys or interviews, aims to identify links between the system's quality and patient satisfaction, ultimately informing ways to enhance care delivery and patient experiences in these settings.

The study by McKay and Parker (2016) examines the efficiency of primary health care (PHC) services in Bangladesh. Using a mixed-method approach that includes quantitative data analysis and qualitative methods, the study assesses the relative efficiency of different PHC units using Data Envelopment

Analysis (DEA). The findings reveal variations in efficiency among different PHC models or facilities in Bangladesh. The study also identifies key factors influencing efficiency, such as financing mechanisms, human resource management, and service delivery models. However, the study acknowledges challenges in measuring and comparing efficiency across different contexts.

A paper by Shahen et al. (2020) analyzes challenges hindering healthcare services in Bangladesh. It reviews existing research and data to provide an overview of the current system's limitations. Key issues include limited access, especially in rural areas, shortages of qualified personnel and essential resources, financial burdens on patients, and potential quality concerns. By highlighting these challenges, the study aims to raise awareness and inform solutions for improving healthcare delivery in Bangladesh.

2.2 Research Gap

Despite the critical need for effective health resource utilization to ensure equitable healthcare access for all, a substantial portion of these resources in Bangladesh remains underutilized or wasted. To ensure optimum utilization of health resources thorough investigation is required on the allocative efficiency of public funds in the health sector. So far there are a few studies (Rannan-eliya & Somanathan, 2003; Mckay & Parker, 2016) that have assessed the efficiency of health budgeting in Bangladesh. Some studies (Sattar, 2021; Ali, 2020) have tried to portray the scenario of health budgeting, health facilities along the efficiency of public spending in this sector; however, no studies have done it comprehensively. While some other studies (Ali, 2020; Shariful & Khandakar, 2014; Shahen et al., 2020) on Bangladesh's healthcare system have identified efficiency, financial management, and regulation as key areas for improvement. These aspects have been studied independently but a comprehensive understanding of their interconnections is lacking. This leaves a significant gap in understanding how regional factors such as resource allocation mechanisms, healthcare infrastructure, and administrative practices contribute to differential efficiency outcomes.

Consequently, to optimize the use of health resources, a more in-depth analysis of the allocative efficiency of public funds in the health sector is essential. Therefore, a new study is needed to analyze the allocative efficiency of public spending in health services, identify factors hindering this efficiency, and provide policy recommendations to enhance future allocative efficiency.

A deeper investigation into the allocative efficiency of health resources is justified, as different districts in Bangladesh may exhibit varying levels of efficiency due to localized factors. Current research lacks a nuanced, district-level analysis that examines why certain regions may perform better in terms of efficiency. This district-level focus is essential for understanding the specific barriers and enablers of efficient resource use and for tailoring policy interventions accordingly.

To ensure an efficient distribution of public funds, policymakers require a rigorous evaluation of allocative efficiency, utilizing advanced econometric tools like the Malmquist Productivity Index (Grifell-Tatjé & Lovell, 2018), Stochastic Frontier Analysis (Kumbhakar et al., 2015), Data Envelopment Analysis (Banker et al., 1989), and Free Disposal Hull (Lim et al., 2001). Methodologically, this study added value by integrating both quantitative and qualitative analyses. From a quantitative perspective, the study utilized advanced econometric techniques, including a three-stage Data Envelopment Analysis (DEA), which combines Stochastic Frontier Analysis (SFA) and non-parametric DEA to capture a more comprehensive picture of allocative efficiency. This approach improves upon previous studies that primarily relied on one-stage DEA, which may oversimplify the complexities of healthcare systems. Previous studies also acknowledged limitations in data availability and representativeness.

On the qualitative side, this research incorporated insights from focus group discussions (FGDs) and key informant interviews (KIIs) with stakeholders, including healthcare providers, policymakers, and academicians. By gathering expert opinions and patient satisfaction from qualitative survey, our recommendations are robust and well-rounded, reflecting both operational and experiential perspectives.

The policy recommendations generated from this study are based on a combination of rigorous quantitative analysis and in-depth qualitative insights. This mixed-method approach offers a holistic understanding of the factors affecting allocative efficiency in Bangladesh's healthcare system. Ultimately, the findings and recommendations are designed to support evidence-based policy implementation, helping to enhance the equitable distribution and effective utilization of public health funds across different districts. This not only improves healthcare efficiency but also ensures that reforms are aligned with the needs of both healthcare professionals and patients, contributing to more sustainable and inclusive healthcare policies in Bangladesh.

In the long run, this research aims to contribute valuable insights for improving healthcare efficiency, equity, and overall performance in Bangladesh using a mixed-method analysis.

2.3 Research Questions

In line with the above objectives, the study will address the following research questions:

1. How efficiently are public funds allocated to different health service institutions in Bangladesh?
2. How do budget formulation and execution processes influence the allocative efficiency of public spending in health services?
3. What are the health system characteristics and exogenous factors that influence public spending allocative in health service?
4. Are there any budgetary limitations that contribute to constraints in the allocative efficiency of public spending on health services?
5. What health system characteristics and exogenous factors hinder the allocative efficiency of public spending in health services?
6. How public spending allocative efficiency in the health service of Bangladesh can be improved?

2.4 Scope of the Study

This study encompasses a comprehensive assessment of allocative efficiency in public spending within Bangladesh's health sector, with a specific focus on the Health Services Division under the Ministry of Health and Family Welfare. Addressing the existing research gap, it seeks to evaluate how effectively public funds are allocated and utilized to deliver equitable and quality healthcare services. The analysis

will examine both the degree of allocative efficiency in budget distribution and the key determinants shaping it, including institutional arrangements, budgetary processes, and health system characteristics at national and sub-national levels.

The geographical scope will capture variations across districts and healthcare facilities to identify region-specific drivers and bottlenecks, while the temporal scope will rely on recent multi-year fiscal data to highlight patterns and trends in spending efficiency.

Methodologically, the study adopts a mixed-method approach, combining advanced econometric tools such as Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) with qualitative insights from Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs). This approach ensures that the analysis is both statistically rigorous and grounded in stakeholder perspectives, including policymakers, healthcare providers, and service beneficiaries.

Beyond measuring allocative efficiency, the scope extends to diagnosing the constraints that undermine efficient resource allocation and identifying feasible policy options for improvement. In doing so, the study aims not only to contribute to the academic understanding of allocative efficiency but also to generate actionable policy recommendations. These insights are expected to strengthen fiscal governance, optimize the use of scarce public resources, and advance the goal of achieving equitable and sustainable healthcare outcomes in Bangladesh.

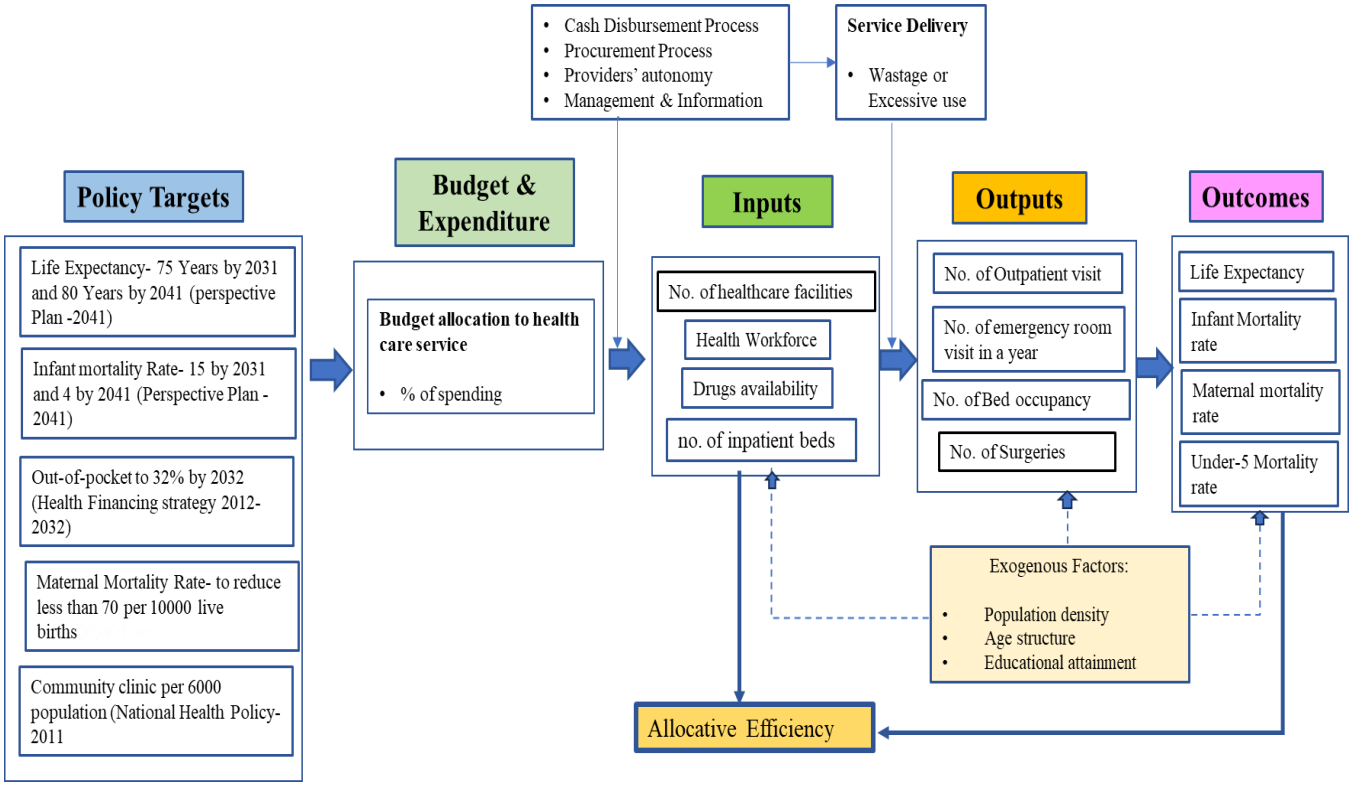
Chapter 3: Conceptual Framework and Methodology

3.1 Conceptual Framework

The conceptual framework presented in Figure 3.1 delineates a series of interrelated components designed to assess allocative efficiency within the health service sector. It emphasizes the progression from policy targets to budget and expenditure, health system inputs, outputs, and the ultimate health outcomes to assess the allocative efficiency of public spending in health services in Bangladesh.

The process initiates with policy targets, representing the specific health objectives that the Government of Bangladesh (GoB) seeks to accomplish. These targets are intrinsically connected to the allocation of financial resources, which is critical for achieving the desired goals. In Bangladesh, the challenge of low budgetary allocation significantly below the World Health Organization's recommended 15% constrains public spending on health. The GoB allocates an annual budget for both operational and developmental purposes, which acts as a vital input in generating essential health services inputs, such as workforce, equipment, medications, and overall service delivery. These inputs collectively contribute to the outputs that ultimately lead to the desired health outcomes. The outputs are the direct results of the inputs which include the actual service delivery to the population such as the number of outpatient visits, emergency room visits, and bed occupancy rates.

Next, the framework examines the outcomes, which are the broader impacts of the healthcare system on public health. Key outcomes include life expectancy, infant mortality rates, maternal mortality rate, children vaccination rate, stunning and tuberculosis incidence rates, all of which serve as indicators of healthcare system performance. These outcomes are tied to policy targets, which set specific goals for improving public health metrics, such as increasing life expectancy and reducing infant mortality rates and out-of-pocket expenditure, as well as ensuring the availability of community clinics to meet the population's needs. Finally, the framework acknowledges the role of exogenous factors**,** external influences that can impact healthcare outcomes. These include population density, age structure, educational attainment, lifestyle risk factors, and financial burdens such as out-of-pocket expenditure.



Source: authors' compilation

Figure 3.1 *Conceptual Framework*

.

Overall, the framework presented in Figure 3.1 explains efficiency in a health policy context by linking policy targets, inputs, outputs, and outcomes. This allows for a comprehensive assessment of how resources are allocated and utilized to achieve desired health goals. A guide to efficient resource allocation is cost-benefit analysis. Cost-benefit analysis is based on the Kaldor–Hicks criterion, where an outcome is more efficient if those that are made better off could in theory compensate those that are made worse off. (Gyrd-Hansen, 2014) Efficiency in health services pertains to the optimal use of resources to achieve the best possible health outcomes, ensuring that services are delivered in a manner that maximizes benefits like improved health, patient satisfaction, and access to care while minimizing costs and waste. Efficiency can be assessed through two dimensions: technical efficiency and allocative efficiency. Technical Efficiency refers to the ability to reduce input quantities proportionally without affecting output quantities (input-oriented) or to increase output quantities proportionally without changing input quantities (output-oriented) in order to achieve cost, revenue, or profit efficiency (Haynes & Dinc, 2005). The idea of allocative efficiency captures whether health inputs are allocated in a way that produces the optimal mix of health outputs to maximize the health of society (Bose, 2021). It is calculated by the ratio of cost efficiency to technical efficiency (Haynes & Dinc, 2005) and involves distributing resources in a way that maximizes overall population health. For example, prioritizing investment in preventive care might be more allocatively efficient than spending on costly treatments for preventable conditions.

The most efficient point of service provision depends on the choice of treatment. The goal is to deliver the most cost-effective treatment (allocative efficiency) with maximum effectiveness (technical efficiency) within the constraints of the budget (Papanicolas & Smith, 2014). Given the often-limited information about potential outcomes for many treatments, along with the practical challenges of tailoring treatment choices to individual patients, clinical guidelines and payment mechanisms at a higher organizational level are crucial for ensuring technically and allocatively efficient distribution of resources. The allocatively efficient point is the one that offers a combination of health services that maximizes overall health gain across all services (Papanicolas & Smith, 2014). The framework helps to identify whether resources are being allocated to the areas where they will have the greatest impact on improving health.

In reference to the approaches and differences discussed above for measuring technical and allocative efficiency in public health spending, this study employed health outcomes or overall health gain as the metric for evaluating allocative efficiency, utilizing a three-stage Data Envelopment Analysis (DEA) approach. Additionally, we account for external factors that may influence efficiency scores to enhance the robustness of our analysis.

3.2 Research Design

This study is underpinned by a combination of positivist and interpretivist worldviews, reflecting the complexity of evaluating public spending efficiency in the health sector. The nature of this research problem requires understanding both the objective reality of how efficiently resources are allocated and the subjective perspectives of stakeholders involved in the system.

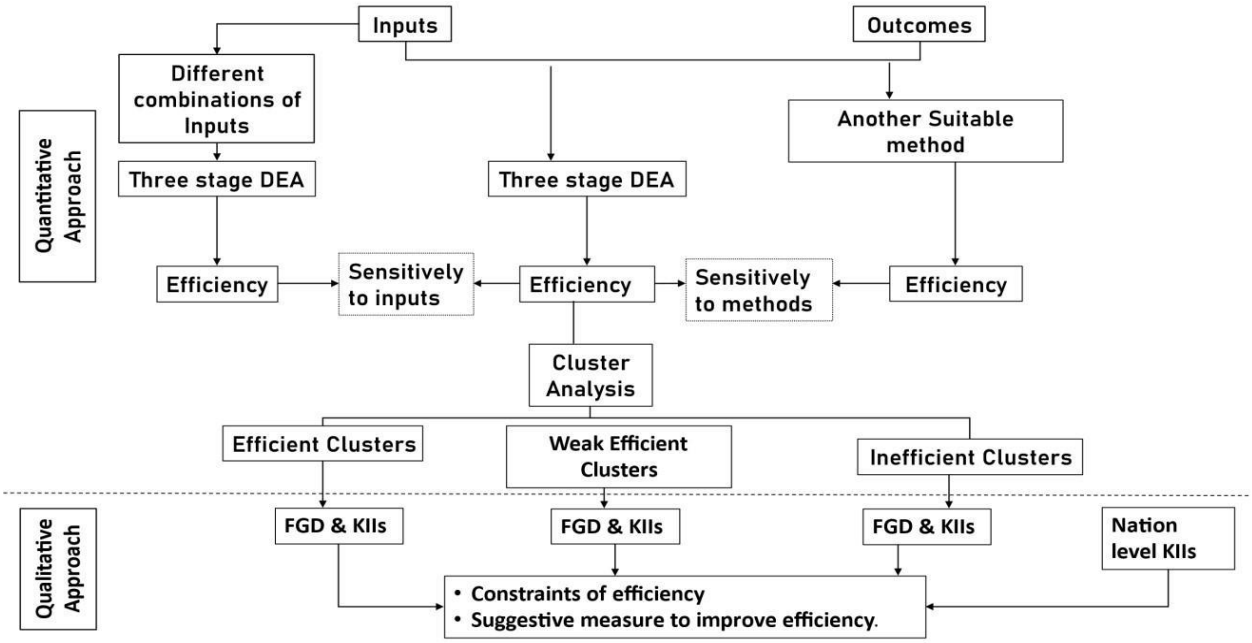
The positivist philosophy assumes that social phenomena can be measured, quantified, and analyzed objectively. In this study, the positivist approach is applied to quantify the allocative efficiency of public spending on health services in Bangladesh, using empirical data and mathematical models to generate measurable and generalizable results.

Conversely, the interpretivist philosophy acknowledges that human behavior, decision-making processes, and institutional practices are influenced by social contexts, experiences, and perceptions. Therefore, the interpretivist approach is employed to explore the views, experiences, and insights of healthcare administrators, policymakers, and stakeholders regarding the factors affecting allocative efficiency and strategies for its improvement.

Adopting a pragmatic worldview, this study integrates both philosophies through a mixed-methods approach, recognizing that no single method is sufficient to fully capture the multi-dimensional nature of public spending efficiency. The quantitative analysis part objectively assesses allocative efficiency

using secondary data, while the qualitative analysis provides deeper insights into the contextual, administrative, and policy-level determinants that are not directly observable in quantitative data.

By combining these approaches, the study aims to produce a more comprehensive understanding that not only identifies the extent of allocative efficiency but also uncovers the underlying reasons and pathways for improving public spending efficiency in the health sector of Bangladesh.



Source: Authors' compilation

Figure 3.2 *Overall Analytical Framework of the Study*

The analytical framework given in figure 3.2 is closely aligned with the conceptual framework, which outlines the relationship between policy targets, budget allocation, health system inputs, service outputs, and health outcomes in assessing allocative efficiency. The first stage of the DEA model operationalizes the pathway from inputs to outputs and outcomes, estimating technical efficiency based on how effectively resources are transformed into service delivery and health outcomes. The second stage employs Stochastic Frontier Analysis (SFA) to account for exogenous factors, including population demographics, education levels, and financial burdens like out-of-pocket expenses, thereby isolating environmental influences, statistical noise, and managerial inefficiencies. The DEA is then rerun in the third stage using adjusted input values to produce refined allocative efficiency scores, which better reflect the true performance of the health system independent of external constraints. These efficiency scores are further analyzed through cluster analysis to categorize regions or facilities into efficient, average, and inefficient groups. This categorization informs the qualitative component, where Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) are conducted with stakeholders from

different performance clusters to explore contextual barriers, institutional practices, and policy gaps. This integrated mixed-methods approach not only measures efficiency quantitatively but also contextualizes the findings qualitatively, offering comprehensive insights for evidence-based policy recommendations to improve the allocative efficiency of public health spending in Bangladesh.

3.3 Quantitative approach

The details of the analytical procedure of this study are depicted in Figure 3.2. Before developing a satisfactory empirical model of efficiency in the healthcare sector, some conceptual and practical issues need to be defined. These are –

1. What is the appropriate unit of analysis?
2. What are the inputs of health care services?
3. What are the outcomes of health care services?
4. What are the exogenous constraints faced by healthcare facilities?

Unit of analysis: As the scope of this study is limited to public spending allocative efficiency in Bangladesh, this study considers only public health facilities of the country. Bangladesh has a public health service system consisting of primary, secondary, and tertiary health facilities. Primary healthcare facilities under the health service division consist of community clinics, union sub-centers, union health and family welfare centers, and upazila health complex. District-level hospitals, general hospitals, and 100-250-bed hospitals are considered secondary care facilities. Health facilities that provide advanced medical investigation and treatment are considered tertiary care facilities. Medical college and university hospitals, specialized institutes, and maternity hospitals are the tertiary care facilities.

Since data for inputs, outputs, and outcomes are not consistent and complete below the district level in Bangladesh; therefore, we consider "district" as a unit of analysis in this study.

Input: Resources that enable the functioning of health systems are referred to as inputs (Nyawira et al., 2023). The existing literature identifies labor and capital as the two fundamental components of health system inputs (Liu et al., 2023). A recent systematic review by Mbau et al. (2022) further highlights that the most commonly used input indicators in studies of health system efficiency are financial resources, the number of healthcare facilities, and medical equipment.

Building on this evidence, the present study uses these three indicators which are district-level public health expenditure, the number of healthcare facilities, and hospital beds. Because detailed information on medical equipment was unavailable, the number of hospital beds was used as a proxy for equipment capacity.

The data were aggregated at the district level. The counts of primary, secondary, tertiary, and specialized facilities, along with hospital beds, were summed across all public providers within each district.

District-level public health expenditures were also aggregated across facilities and converted to real terms using the Consumer Price Index (CPI). Importantly, these expenditures include the cost of human resources, reflecting the total financial commitment of the public sector to health service delivery. The operating part of the budget has been used to measure the district-level allocative efficiency.

Outcome: Health efficiency studies have generally employed two categories of outcome measures: composite indices of health outcomes and single health outcome indicators (Mbau et al., 2022). Composite measures such as Potential Years of Life Lost (PYLL), Health-Adjusted Life Expectancy (HALE), and Disability-Adjusted Life Expectancy (DALE) are complex to construct and are not consistently available across all units of analysis. By contrast, single measures of health outcomes are more accessible, straightforward to compute, and widely comparable across contexts. Examples include infant mortality rate (per 1,000 live births), under-five mortality rate (per 1,000 live births), maternal mortality rate (per 100,000 live births), replacement fertility rate (the average number of children per woman required to maintain a stable population), child immunization coverage, prevalence of stunting (%), and incidence of tuberculosis (per 100,000 people).

In light of the availability and comparability, the present study incorporates both composite and single health outcome measures in assessing health system efficiency. Outputs included actual years of life lived per 10,000 individuals, infant and under-five survival rates, replacement fertility rate, and contraceptive prevalence rate. These survival-based indicators were derived from conventional mortality measures such as Years of Life Lost (YLL), infant mortality rate (IMR), under-five mortality rate (U5MR), and maternal mortality rate (MMR). Since lower mortality reflects better health system performance, these indicators were reversed into survival-oriented measures to align with the DEA framework, ensuring that higher values consistently represented improved allocative efficiency. Furthermore, these indicators were chosen because the corresponding health outcomes are explicitly targeted in several national and international policy frameworks in Bangladesh, such as the Perspective Plan 2041, the Eighth Five-Year Plan, and the National Health Policy 2011.

Exogenous variables:

Factors that may not have a direct relationship with the resources of the health sector but can influence the relationship between the input and output of the health sector are defined as exogenous factors. Exogenous factors in past efficiency studies of the health sectors were chosen based on the evidence of previous studies, completeness and consistency of data, and potential influence on efficiency. Considering the above criteria, we considered population density, age structure, educational attainment, and out-of-pocket expenditure as exogenous factors in this study.

3.3.1 Quantitative Data Collection (Secondary Data)

To assess public spending allocative efficiency in health services, data on inputs, outputs and exogenous factors of health services have been collected from several sources. This data has been collected for the period 2019 – 2023. Sources are described as follows:

1. ***SPFMS:*** Data on budget and expenditure is collected from the Integrated Budget and Accounting System (iBAS^{++}).
2. ***Directorate General of Health Service:*** The Number of health facilities, their geographical location, types, and output is provided by the Management Information System (MIS) of the Directorate General of Health Service.
3. ***BBS:*** Microdata of Household Income and Expenditure Survey (HIES) and Bangladesh Sample Vital Statistics (SVRS) were provided by BBS. Using those data, we estimate the health outcomes and extraneous factors.

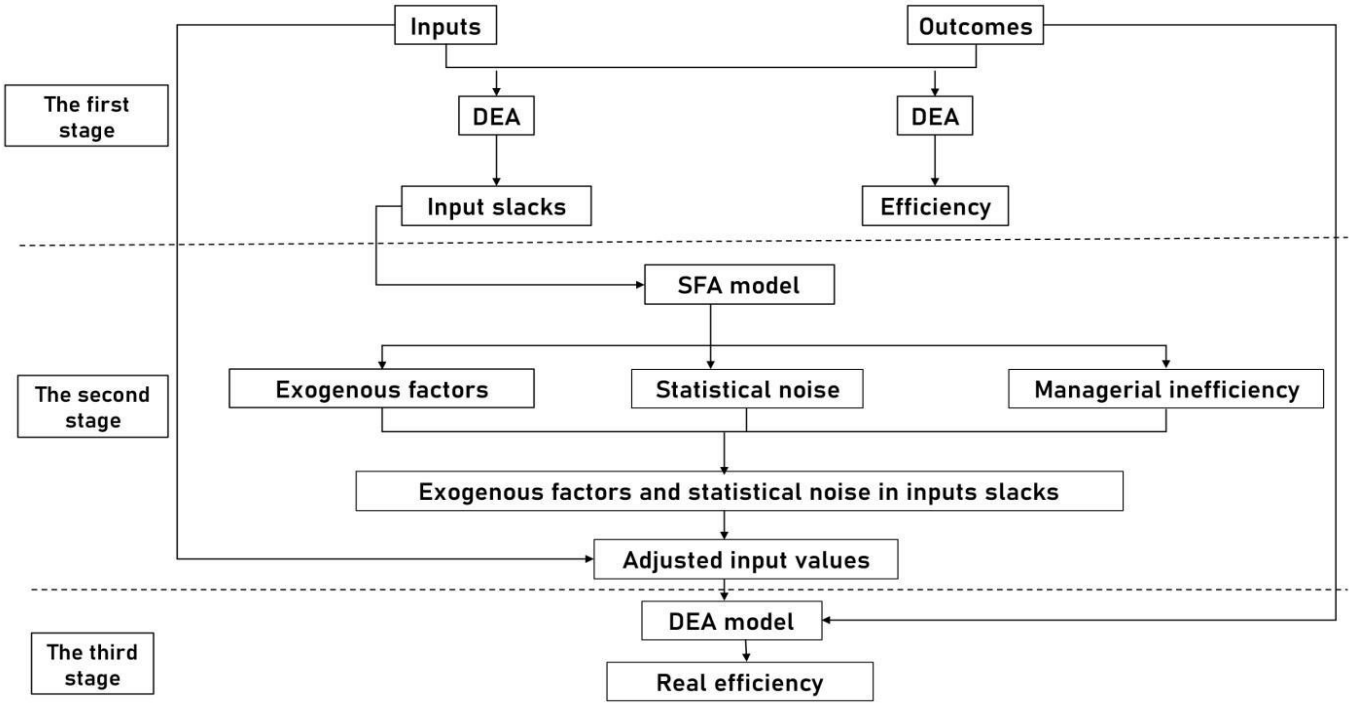
3.3.2 Quantitative Data Analysis

An improved three-stage data envelopment analysis (DEA) was applied to calculate the allocative efficiency of public spending on health services in Bangladesh. The three-stage Data Envelopment Analysis (DEA) systematically addresses and controls the effects of exogenous factors. Thus, it calculates the allocative efficiency more precisely than other methods. Stochastic frontier analysis (SFA) relies on specific distributional assumptions and may not adequately capture inefficiencies in the public sector. Additionally, the Free Disposal Hull (FDH) method and Malmquist analysis focus on different aspects of efficiency measurement; they often lack the comprehensive framework that three-stage DEA offers by separating the effects of exogenous variables. Moreover, there-stage DEA is a nonparametric method that handles multiple outputs and inputs better than the other methods. This makes three-stage DEA more suitable than other methods in this study.

In the first stage, the original efficiency has been calculated using the input-oriented DEA model. In the second stage, the Stochastic Frontier Analysis (SFA) model has been applied to adjust the effect of exogenous variables. In the third stage, real efficiency has been calculated using DEA by excluding the influence of extraneous variables and stochastic disturbance. The details of the three-stage DEA are described in Fig. 4.3 and mathematical expressions for the three-stage DEA are included in Annex C.

After calculating the real efficiency, the sensitivity of the efficiency was checked. To investigate the efficiency score's sensitivity to input, the efficiency score was calculated using different combinations of input. On the other hand, sensitivity to efficiency estimation tools will be checked by comparing the estimated efficiency score of three-stage DEA with the estimated efficiency resulting from the two-

stage DEA. After checking the sensitivity of the efficiency scores. Latent profile analysis has been performed to find the cluster of districts based on the hidden patterns of allocative efficiency scores.



Source: Authors' compilation

Figure 3.3 *Three-stage DEA Analysis Framework*

3.4 Qualitative Approach

3.4.1 Qualitative Data Collection

Following the quantitative analysis, the qualitative phase employed Key Informant Interviews (KIIs), Focus Group Discussions (FGDs), and in-depth interviews to explore the key factors influencing allocative efficiency in public health spending in Bangladesh. A stakeholder analysis was conducted beforehand to systematically identify and map relevant participants based on their roles, expertise, and influence within the health sector. The selection of KII respondents was guided by purposive sampling, targeting policymakers, senior government officials, health administrators, financial planners, and development partners who possess in-depth knowledge of health budgeting, governance, and policy implementation. This approach ensures the collection of strategic and institutional perspectives crucial for understanding systemic challenges and opportunities for improving allocative efficiency.

For FGDs, maximum variation sampling was applied to capture a diverse range of experiences across different efficiency clusters identified from the quantitative analysis (i.e., efficient, moderately efficient, and inefficient groups). Participants included facility managers, frontline healthcare providers, and local health administrators, whose operational insights are critical for understanding on-the-ground barriers

and practices affecting resource utilization. Additionally, in-depth interviews with healthcare professionals and beneficiaries from primary healthcare facilities provided firsthand insights into service quality, the effectiveness of resource allocation, and patient-level challenges.

A list of respondents KII, FGD, and in-depth interviews has been added in annex D. Through these in-depth interviews; insights has been gained on the effectiveness of allocated public funds, quality of health care, and suggestive measures to improve the effectiveness of the health care facilities.

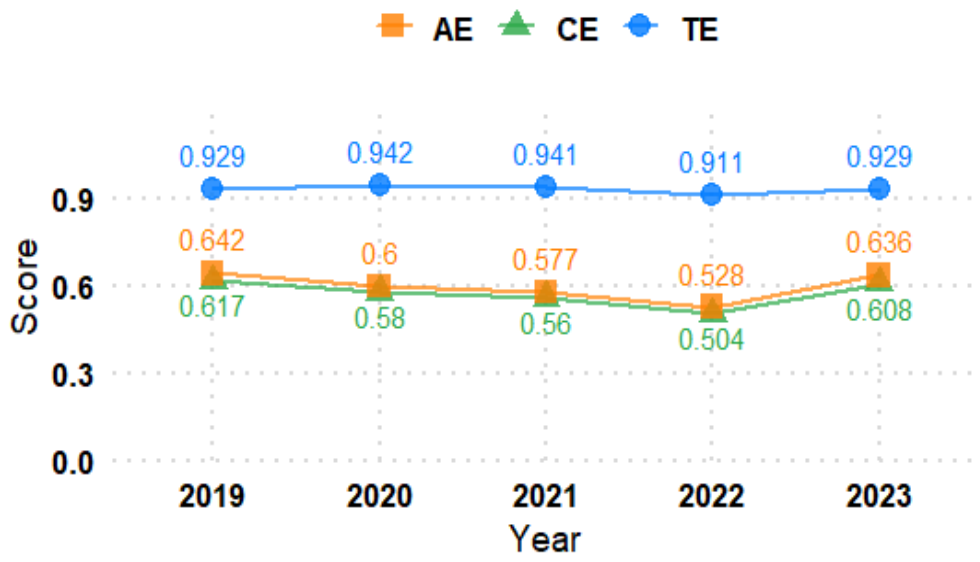
3.4.2 Qualitative Data Analysis

At first, the key informant interviews (KIIs) and focus group discussions (FGDs) was transcribed, and then the data will be transferred to MAXQDA for analysis. The qualitative data was analyzed under a thematic approach to identify the factors that influence public spending allocative efficiency in health. The qualitative analysis also helps to identify the measures to improve the spending allocative efficiency in health services. An inductive approach was used to allow themes to emerge from participants' lived experiences, followed by a deductive lens to interpret the findings in relation to existing policy frameworks and international literature.

Chapter 4: Findings

4.1 Allocative Efficiency Score

The quantitative analysis of allocative efficiency of public spending in health service sectors of Bangladesh, between 2019 and 2023 shows persistent underutilization of resources, considerable year-to-year fluctuations, and wide disparities across districts. The average efficiency score over this period was about 0.60, indicating that the same level of health service delivery could have been achieved with roughly 40% fewer resources if inputs had been distributed more optimally.



Note: AE= Allocative Efficiency, CE= Cost Efficiency, TE= Technical Efficiency;
Source: Author's calculations (based on secondary data)

Figure 4. 1 *The trend of efficiency Scores from 2019 to 2023*

The analysis of allocative efficiency (AE) in Bangladesh's health sector between 2019 and 2023 shows an overall trend of decline followed by partial recovery, as presented in Table 4.1 and Figure 4.1. Efficiency scores fell from 0.642 in 2019 to 0.577 in 2021, before rebounding moderately to 0.636 in 2023. Results from Bonferroni paired t-tests indicate that some year-to-year differences were statistically significant, particularly between 2019 and 2021 ($p < 0.05$).

Table 4. 1 *Differences in Allocative Efficiency by Year*

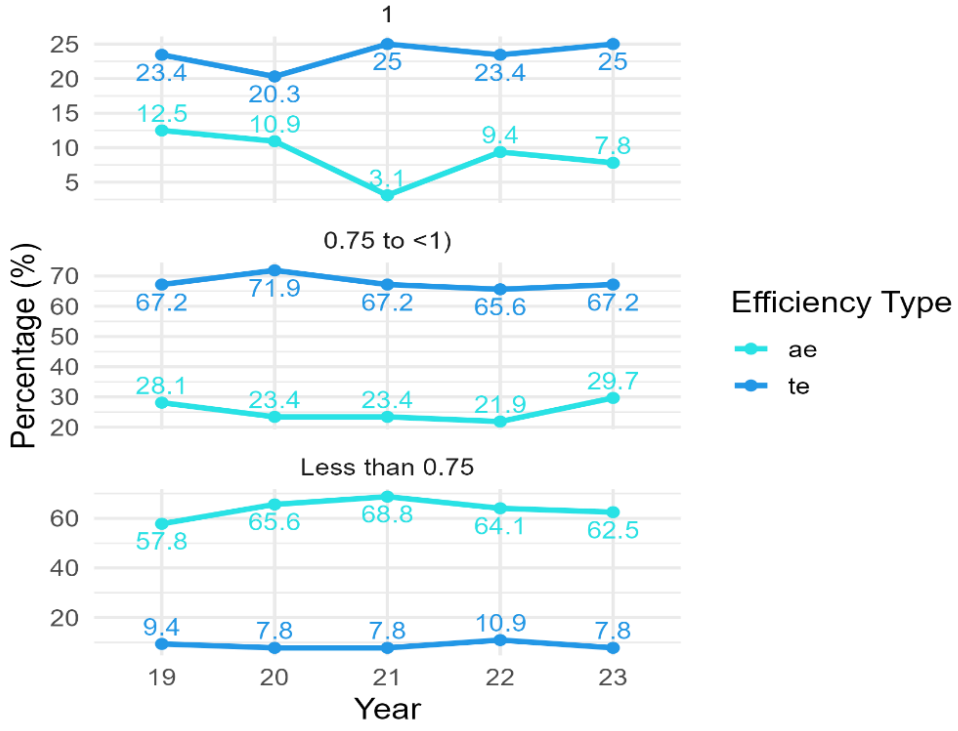
	2019	**2020**	**2021**	**2022**	**2023**
Average	0.642	0.6	0.577	0.528	0.636
Differences					
2019	0	-0.042	-0.066**	-0.051	-0.021
2020		0	-0.023	-0.009	0.022
2021			0	0.015	0.022

	2019	2020	2021	2022	2023
2022				0	0.03
2023					0

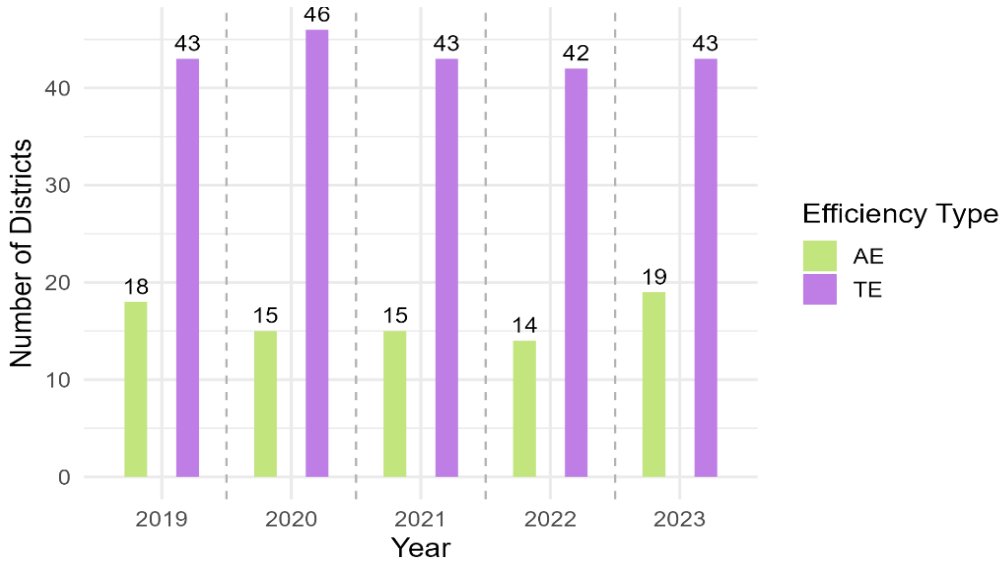
Note. p-values are denoted as follows: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10.
Source: Author's calculations (based on secondary data)

The steep drop in 2021 coincides with the second year of the COVID-19 pandemic. This reallocation likely constrained inputs available for routine and preventive health services, resulting in efficiency losses. Allocative efficiency was lowest in 2022 because it reflected a transition period marked by maximum misalignment due to post-COVID health needs. This is due to delayed service utilization recovery and adjustment lags in budgeting and planning.

Although efficiency improved in 2023, it has yet to return to pre-pandemic (2019) levels. This lingering gap may reflect structural inefficiencies that became embedded during the pandemic, such as disrupted referral pathways, workforce imbalances, and continued reliance on emergency procurement practices that do not necessarily align with cost-effective allocation principles.



Source: Author's calculations (based on secondary data)
Figure 4. 2 *Trends in District-Level Efficiency Categories from 2019 to 2023*



Source: Author's calculations (based on secondary data)

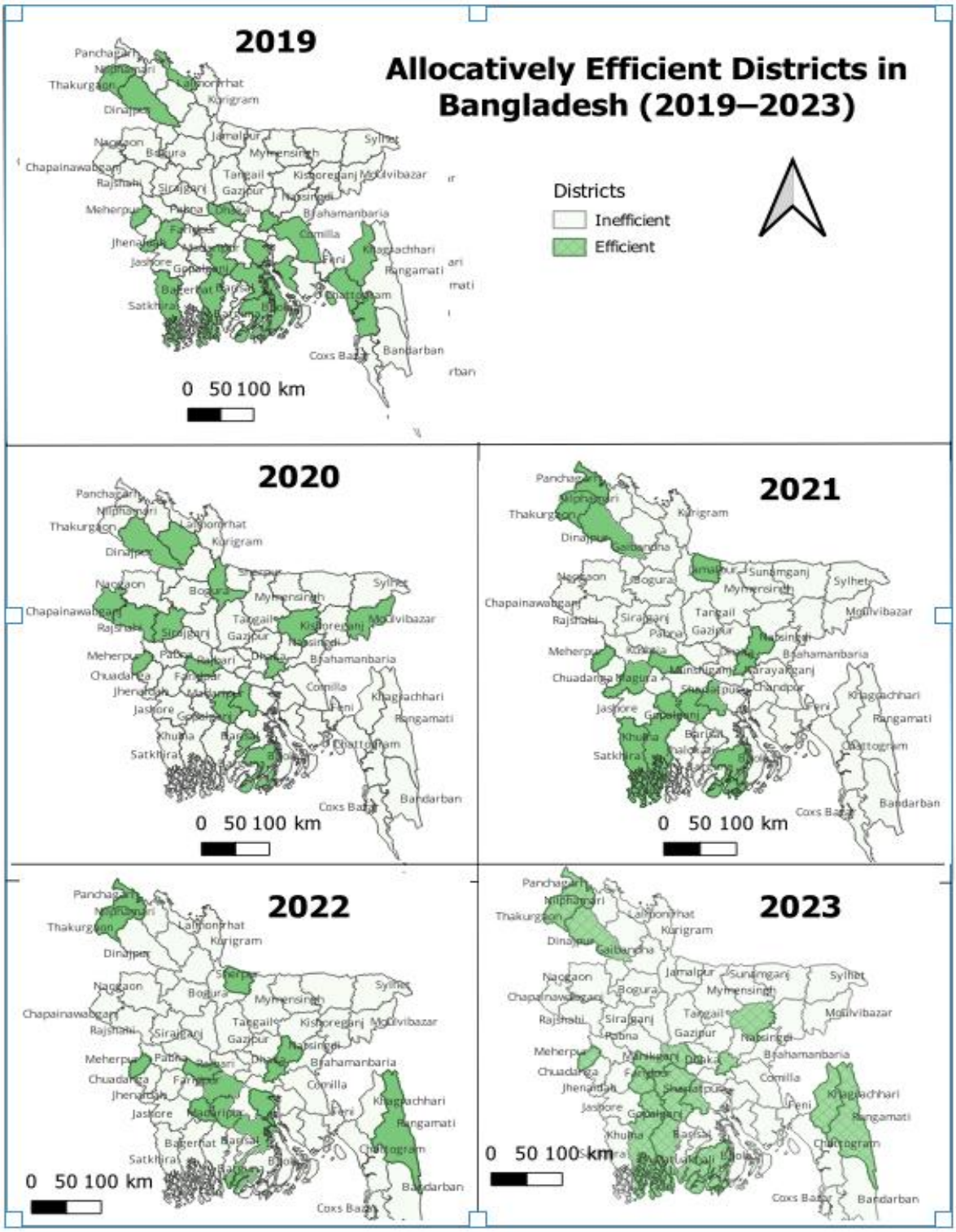
Figure 4.3 *Districts with Efficiency Score of 1*

Figure 4.2 illustrates that districts frequently shifted between efficiency categories over time, reflecting instability in allocative performance across the country. The proportion of fully allocatively efficient districts (score = 1) was 12.5% initially, but declined sharply to 3.1% in 2021. This was followed by a partial recovery to 9.4% in 2022, before declining again to 7.8%. Districts with allocative efficiency scores between 0.75 and 1 remained relatively stable, comprising approximately 25% of districts throughout the period. In contrast, those with scores below 0.75 consistently represented the majority, ranging between 57% and 62% over the years.

Figure 4.3 shows that the number of districts with an allocative efficiency score of 1 remained moderately consistent, ranging between 14 and 19 over the study period. This pattern is broadly consistent with the trends observed in Figure 4.2. The number of fully efficient districts peaked in 2019, declined steadily between 2020 and 2022, and then increased slightly in 2023 to 19 districts.

The spatial distribution of allocative efficiency (Figure 4.4) indicates that most districts exhibited inconsistency in their efficiency scores, with the exception of two or three districts that maintained relatively stable performance. In particular, districts located in the northern region consistently lagged behind during almost all years of the study period. The spatial analysis reveals a notable pattern: remote and socioeconomically disadvantaged districts, such as some districts in Chittagong Hill Tracts, some southern coastal areas, and certain northern border districts, demonstrate comparatively higher allocative efficiency than many better-resourced regions. This does not represent an anomaly, but rather reflects structural advantages in how resources are deployed. These districts often receive targeted and closely monitored investments that are channelled toward essential, high-impact primary and preventive care. In addition, these districts often benefit from targeted NGO and international donor funding

focused on essential health services, and their relatively smaller populations allow limited resources to be deployed more intensively and effectively, further enhancing measured allocative efficiency. Lower population density, less fragmented delivery systems, and stronger local accountability further minimize inefficiencies and ensure better alignment of spending with local needs.



Source: Author's calculations (based on secondary data)

Figure 4.4 *Spatial Trends of Allocatively Efficient Districts from 2019 to 2023*

Overall, the spatial analysis shows that allocative efficiency is unevenly distributed across Bangladesh's districts. Such disparities suggest that inefficiency is not merely a technical issue but also reflects deeper geographic and socio-economic inequalities within Bangladesh's health system.

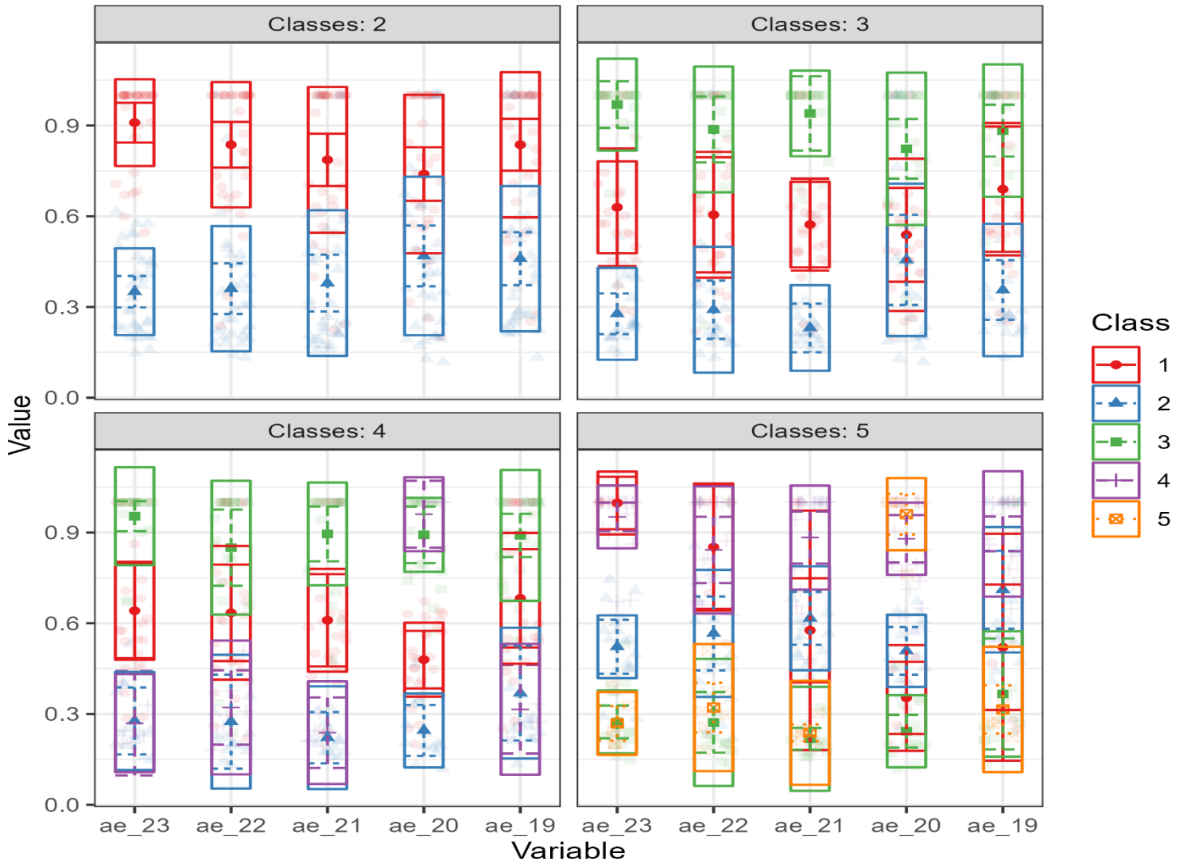
Table 4.2 *Fit Indices of Latent Profile Analysis*

Number of classes	Log-Likelihood	AIC	AWE	BIC	CAIC	CLC	KIC	SABIC	ICL	Entropy	Pro_min[$]
2	-3.58	39.20	186	73.7	89.7	9.09	58.20	23.30	-74.6	0.965	0.992
3	12.50	18.90	222	66.4	88.4	-23.20	43.90	-2.81	-69.8	0.930	0.967
4	25.90	4.27	263	64.7	92.7	-49.80	35.30	-23.40	-67.0	0.964	0.978
5	47.90	-27.70	287	45.7	79.7	-93.80	9.29	-61.30	-46.9	0.977	0.953

Source: Author's calculations (based on secondary data)
Note: $ Minimum average posterior probability of class membership

To capture heterogeneity in allocative efficiency, a latent profile analysis (LPA) was conducted, testing models with two to five classes (Table 4.2 and Figure 4.5). The analysis aimed to identify latent profiles subgroups of districts based on the patterns of efficiency scores from 2019 to 2023.

Model fit indices for the latent class analysis are presented in Table 4.2 and Figure 4.5. Among the estimated models, the four-class solution provided the most appropriate fit. Specifically, the four-class model demonstrated a higher log-likelihood value (25.90) and lower AIC (4.27) and SABIC (–23.40) compared to the two- and three-class solutions, while also showing improvement in other information criteria (CAIC = –49.80; CLC = 35.30; ICL = –67.0). Moreover, entropy for the four-class model was 0.964, indicating a high degree of classification accuracy, and the minimum class probability was 0.978, further supporting the reliability of class membership assignment. Although the five-class model yielded slightly lower AIC and CAIC values, it showed a less favorable CLC (9.29) and ICL (–46.9), and its entropy (0.977) was only marginally higher than the four-class solution. Considering both statistical criteria and parsimony, the four-class model was selected as the best-fitting and most interpretable solution.

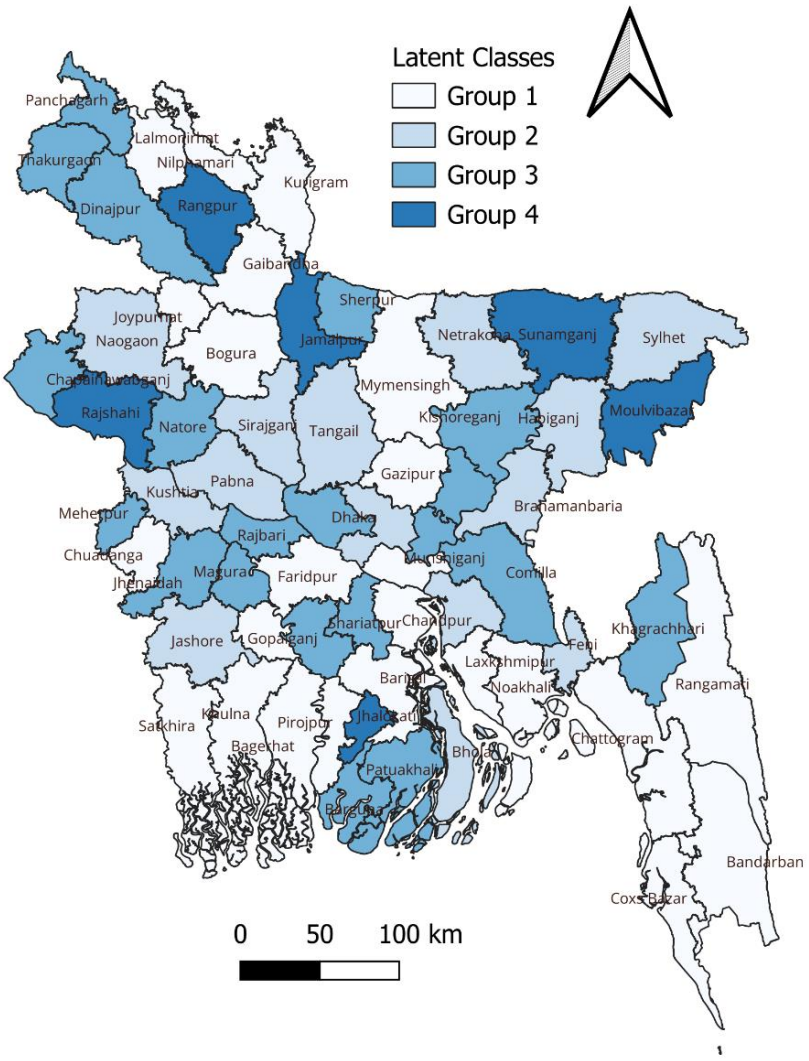


Source: Author's calculations (based on secondary data)

Figure 4.5 *Fit indices of latent profile analysis*

The classification highlights that allocative efficiency challenges in Bangladesh are not uniform. Identifying these profiles allows policymakers to design more targeted strategies, for instance, prioritizing infrastructure and workforce investments in persistently low-performing districts, while focusing on innovation and scaling-up approaches in districts showing improvement.

The spatial distribution of four latent classes is depicted in figure 4.6. However, Moran's I = 0.0093 (p = 0.3812) indicates no significant spatial autocorrelation, suggesting that class membership is spatially random. Detailed results are presented in Annex F.



Source: Author's calculations (based on secondary data)

Figure 4.6 *Spatial Distribution of the latent classes*

Districts assigned to the first latent class experienced year-to-year fluctuations in allocative efficiency scores, as illustrated in Figure 4.7. Despite this variability, the majority of districts within this cluster maintained relatively high efficiency levels in 2019 and 2023. Allocative efficiency scores ranged from a low of 0.478 in 2020 to a high of 0.679 in 2019, with most annual values remaining above the national average.

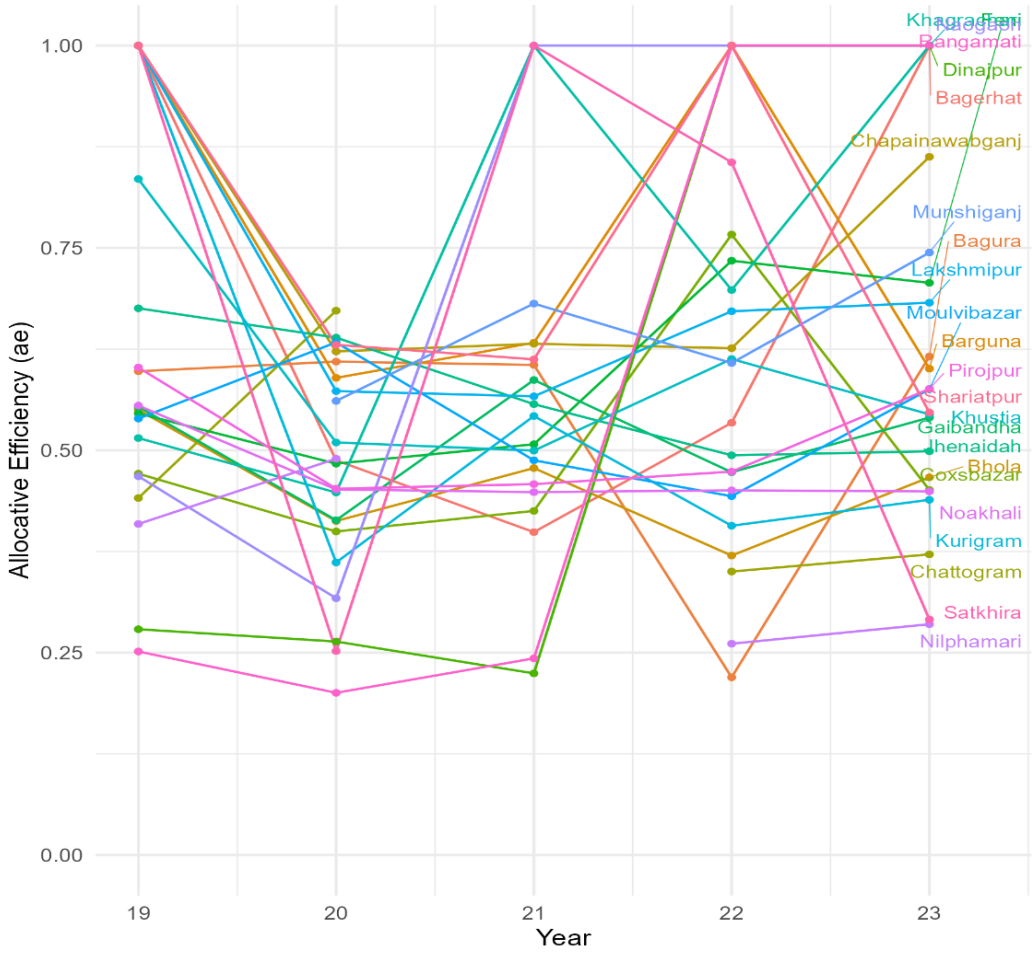
The peak efficiency in 2019 (0.679) indicates that these districts were close to optimal allocation before the pandemic. However, efficiency fell sharply in 2020 (–0.201) due to systemic disruptions, including emergency resource reallocations, workforce diversion, and delays in routine services. A rebound followed in 2021, with efficiency rising to 0.608 (+0.13 from 2020), reflecting adaptation measures such as the resumption of services, improved supply chains, and partial restoration of preventive programs. Efficiency then stabilized in 2022 (0.627) and 2023 (0.635), with only minor year-to-year variation.

Table 4.3 *Allocative Efficiency Among Moderately High-Performing Districts*

	2019	2020	2021	2022	2023
Average	0.679	0.478	0.608	0.627	0.635
Differences					
2019	0	-0.201***	-0.071	-0.052	-0.043
2020		0	0.13	0.149	0.157
2021			0	0.019	0.028
2022				0	0.008
2023					0

Note. p-values are denoted as follows: *** *p*-value < 0.01; ** *p*-value < 0.05; * *p*-value < 0.10.
Source: Author's calculations (based on secondary data)

Overall, Class 1 districts illustrate both resilience and vulnerability. Starting from a strong position in 2019, they experienced a sharp decline during the pandemic in 2020 but recovered quickly in the following years. Their relatively strong performance can be attributed to better governance, skilled personnel, stronger infrastructure, and more effective budget planning compared to weaker clusters.



Source: Author's calculations (based on secondary data)

Figure 4.7 *Allocative Efficiency Among Moderately High-Performing Districts*

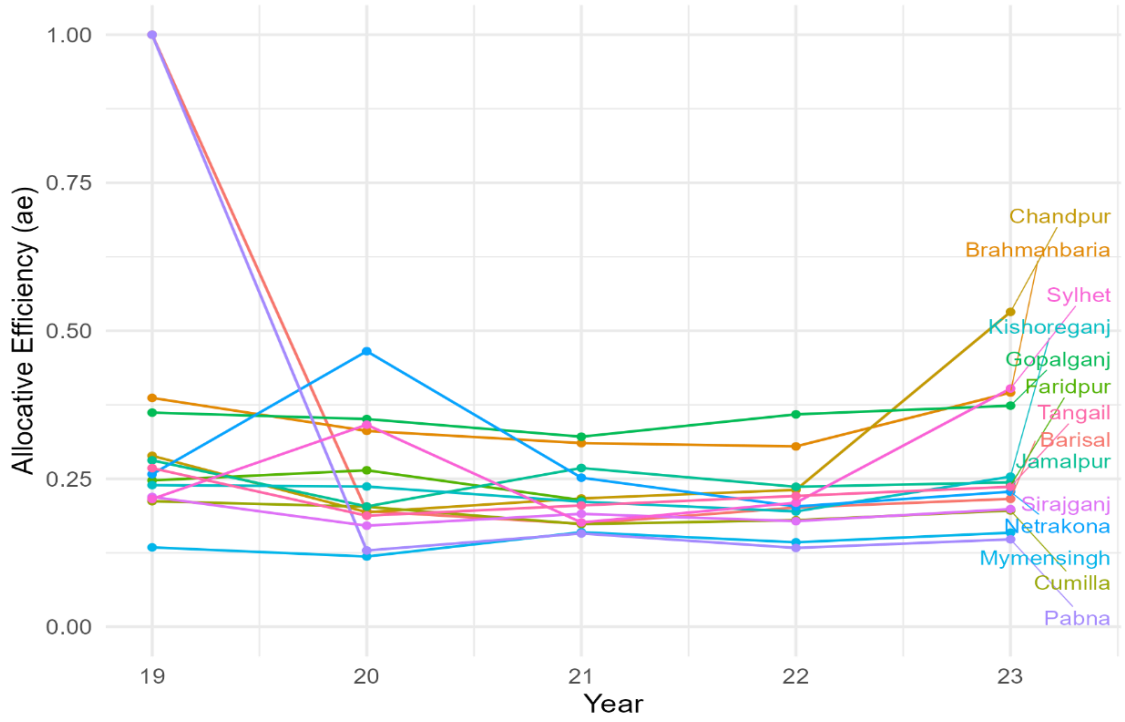
In Bangladesh's context, these districts can serve as benchmarks for efficiency-focused management, offering valuable lessons in adaptive resource allocation, procurement, and workforce deployment that could be scaled up to strengthen lower-performing districts.

Table 4.4 Allocative Efficiency Among Mid-to-Low-Performing Districts

	2019	**2020**	**2021**	**2022**	**2023**
Average	0.365	0.242	0.216	0.271	0.273
Differences					
2019	0	0.123***	0.149	0.094	0.092
2020		0	0.026	-0.029	-0.031
2021			0	-0.055	-0.057
2022				0	-0.002
2023					0

Note. p-values are denoted as follows: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10.
Source: Author's calculations (based on secondary data)

Class 2 districts (Table 4.4, Figure 4.8) fall into a moderate-to-low efficiency group, consistently performing below Class 1 and, in most years, below the national average. Between 2019 and 2023, efficiency ranged from 0.365 in 2019 to a low of 0.216 in 2021, highlighting considerable scope for improvement. The baseline score in 2019 (0.365) was already well below Class 1's 0.679, and efficiency declined sharply in 2020 to 0.242 (–0.123, $p < 0.01$). This drop reflects early pandemic disruptions, when routine programs were suspended, staff diverted, and resources concentrated on emergency response.



Source: Author's calculations (based on secondary data)

Figure 4.8 *Allocative Efficiency Among Mid-to-Low-Performing Districts*

Efficiency fell further in 2021 (0.216), marking the lowest point, as prolonged supply chain disruptions, workforce shortages, and limited flexibility in reallocating resources continued to undermine performance. A modest recovery was observed in 2022 (0.271) and 2023 (0.273), but scores remained below the 2019 baseline. Year-to-year changes during this recovery were small and statistically insignificant (e.g., –0.002 between 2022 and 2023), indicating incremental rather than transformative gains.

Overall, Class two districts reflect the vulnerability of mid-tier health systems in Bangladesh: less resilient than Class one, but not as structurally constrained as the lowest-performing clusters. Without targeted reforms, they risk remaining trapped in chronic under-optimization, limiting their ability to expand service coverage. Strengthening health information systems, increasing budgetary flexibility,

and enhancing managerial capacity will be essential for improving efficiency and building resilience against future shocks.

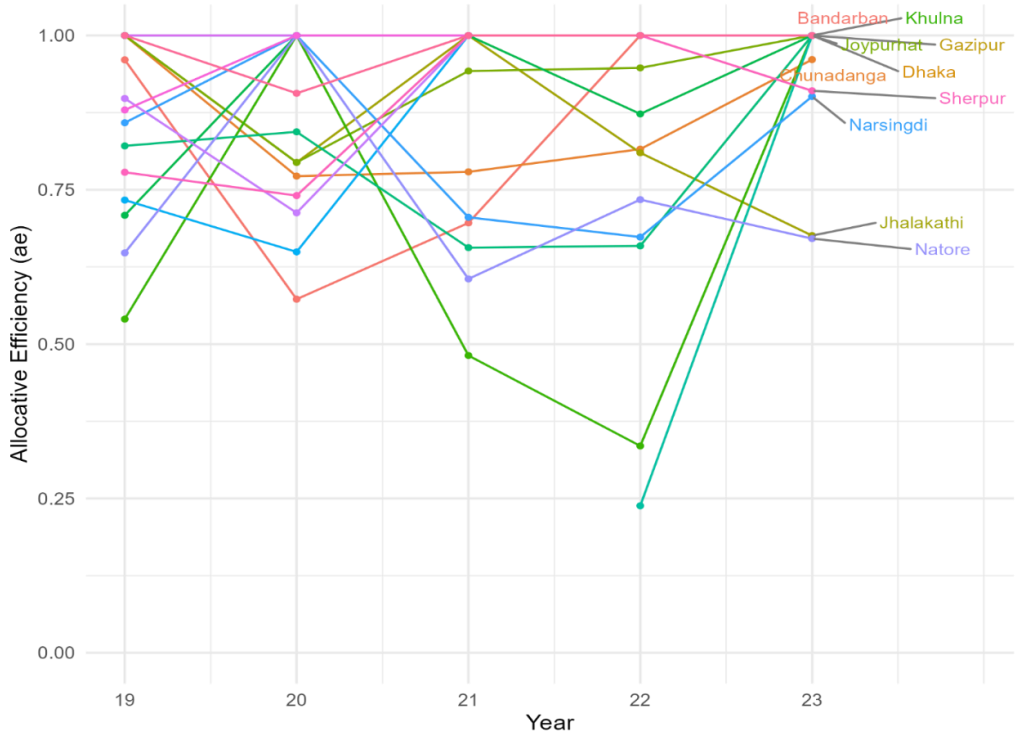
Latent Class three districts (Table 4.5 and Figure 4.9) form the highest-efficiency cluster, consistently maintaining allocative efficiency well above the national average from 2019 to 2023. Scores ranged from 0.854 in 2022 to 0.956 in 2023, indicating that these districts operated at or near optimal resource allocation. Efficiency in 2019 (0.891) was almost identical to 2020 (0.889), with only a negligible difference (0.002). This stability across the pre-pandemic and first pandemic year reflects strong resilience, supported by robust planning, efficient procurement, and well-established management structures.

Table 4.5 Allocative Efficiency Among Consistently High-Performing Districts

	2019	**2020**	**2021**	**2022**	**2023**
Average	0.891	0.889	0.893	0.854	0.956
Differences					
2019	0	-0.002	0.002	-0.037	0.065
2020		0	0.102	-0.035	0.067
2021			0	0.004	0.063
2022				0	-0.039
2023					0

Note. p-values are denoted as follows: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10.
Source: Author's calculations (based on secondary data)

A slight increase was observed in 2021 (0.893), followed by a small dip in 2022 (0.854), a decrease of just –0.037 from 2019, possibly due to post-pandemic adjustments such as shifting resource priorities or temporary workforce mismatches. By 2023, efficiency surged to 0.956, the highest score across all years, suggesting not only recovery but also performance improvements beyond pre-pandemic levels, likely driven by stronger coordination, accumulated crisis management experience, and targeted investments.



Source: Author's calculations (based on secondary data)

Figure 4.9 *Allocative Efficiency Among Consistently High-Performing Districts*

Year-to-year differences were statistically insignificant, underscoring the stability of Class 3 compared to the volatility observed in Class 1 and Class 2. Structural advantages, such as advanced infrastructure, a skilled workforce, and effective governance, explain their resilience. From a policy standpoint, Class 3 districts can serve as efficiency exemplars, offering practical lessons in data-driven allocation, robust monitoring, and adaptive procurement strategies that could be scaled up to strengthen weaker districts across Bangladesh.

Districts of latent Class four exhibited the most volatile efficiency patterns, with sharp fluctuations from 2019 to 2023 (Table 4.6 and Figure 4.10). Scores ranged from a low of 0.238 in 2021 to a peak of 0.960 in 2020, highlighting their sensitivity to systemic and external shocks. Efficiency in 2019 was 0.315, below the national average, but climbed to 0.960 in 2020, an increase of 0.645 ($p < 0.01$). This abrupt change likely reflects COVID-19–related emergency funding, the prioritization of critical services, and the suspension of many routine activities, which redirected resources toward immediate, high-need demands.

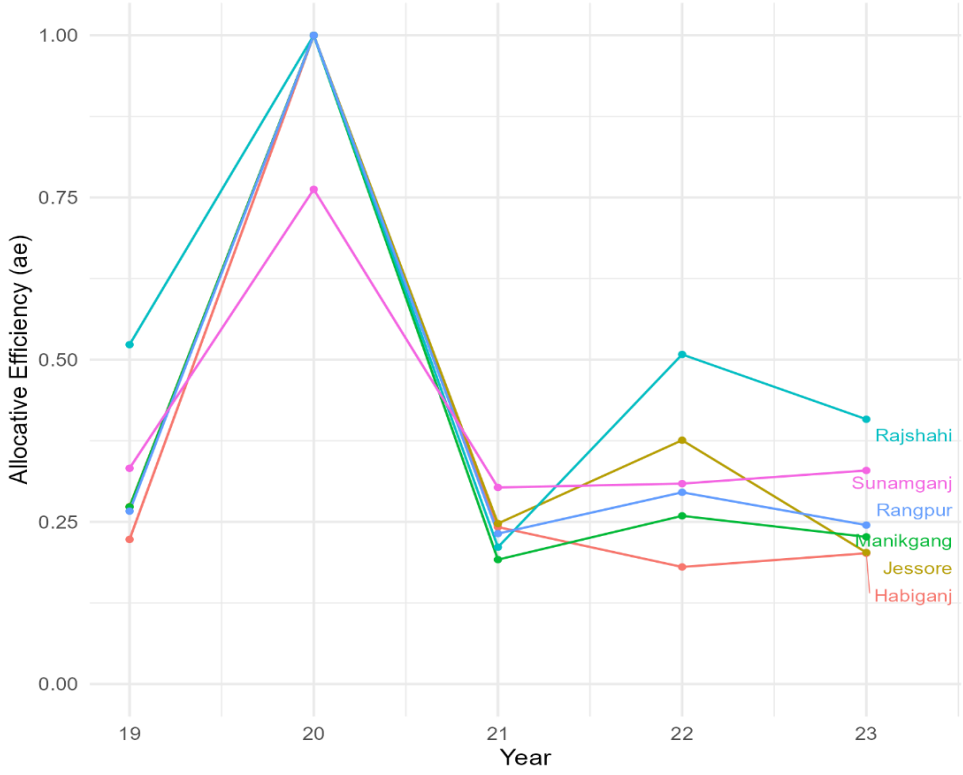
However, the surge proved unsustainable: efficiency plummeted in 2021 to 0.238, a significant drop of –0.723 ($p < 0.01$) from 2020, as routine services resumed and underlying inefficiencies such as weak supply chains, poor planning, and workforce imbalances re-emerged. A modest recovery occurred in 2022 (0.321) and 2023 (0.269), but year-to-year changes were small, and efficiency remained far below the 2020 peak.

Table 4.6 *Allocative Efficiency Among Volatile-Performing Districts*

	2019	2020	2021	2022	2023
Average	0.315	0.96	0.238	0.321	0.269
Differences	0	0	0	0	0
2019	0	0.645***	-0.077	0.006	-0.046
2020		0	-0.723***	-0.639***	-0.692***
2021			0	0.083	0.031
2022				0	-0.052
2023					0

Note. p-values are denoted as follows: *** *p*-value < 0.01; ** *p*-value < 0.05; * *p*-value < 0.10.
Source: Author's calculations (based on secondary data)

Overall, Class 4 districts represent the most unstable efficiency group. While they can achieve high efficiency temporarily under special circumstances, sustaining these gains requires systemic reforms, including stronger budgetary and planning capacity, stable governance beyond project-based interventions, and more reliable workforce deployment. Without such changes, efficiency improvements in Class 4 are likely to be short-lived and unsustainable.



Source: Author's calculations (based on secondary data)
Figure 4. 10 *Allocative Efficiency Among Volatile-Performing Districts*

The observed patterns indicate that allocative inefficiency in Bangladesh is both a systemic and localized challenge. At the national level, reforms should focus on strengthening planning and budgeting frameworks, ensuring that resource allocation is guided by disease burden, population needs, and service utilization data, rather than historical patterns or political considerations. At the subnational level, interventions must be tailored to the specific realities of each district. We have conducted an additional spatial analysis to examine whether districts within similar latent classes exhibit spatial clustering. Specifically, we computed Moran's I for the Class variable using queen contiguity spatial weights (first-order). This suggests that the classification of districts is spatially random and that neighboring districts do not systematically share similar or dissimilar efficiency characteristics. The flat regression line and the random pattern of scatter further support the absence of spatial structure. (Annex F, Figure F1)

In a context where per capita health expenditure is low, out-of-pocket payments are high, and public facilities often face resource shortages, improving allocative efficiency carries important equity implications. More efficient allocation can expand service coverage without increasing overall expenditure, thereby enhancing access for marginalized and underserved populations. In summary, the five-year analysis shows that while some districts have consistently maintained high allocative efficiency.

4.2 Factors affecting Allocative Efficiency

In Bangladesh's health sector, budget expenditure is divided into two principal streams: the operating budget covers recurrent costs such as salaries, maintenance, and medical supplies; and the development budget funds multi-year programs aligned with national priorities. Distinct entities administer these streams and follow different planning paradigms. Operating budgets rely on fixed formulas and annual increments, typically based on metrics such as bed capacity or staffing norms, often overlooking regional variations in need. In contrast, development budgets restructured since the 1990s are linked to five-year operational plans and adjusted annually to reflect changing objectives. While this dual model indicates strategic intent, field-level evidence reveals persistent planning gaps and ineffectiveness that undermine allocative efficiency.

With the objective of identifying the factors influencing allocative efficiency, six themes were developed based on the analysis. These themes capture the factors affecting efficiency and are organized as follows: (i) Budgeting Practices and Financial Structures, (ii) Planning and Implementation Challenges, (iii) Procurement and Resource Distribution, (iv) Community Engagement and Representation, (v) Health System Performance and Capacity, and (vi) Policy Effectiveness and Execution.

Theme I. Budgeting Practices and Financial Structures

Data from KIIs and FGDs revealed that the division between budget types frequently creates redundancies and complicates service delivery. Managed independently, the operating and development budgets often result in duplications and fragmented program implementation. As one respondent observed:

"Our budget is split into different types development and operational. But our needs don't come in such neat categories. For training alone, we need transport, accommodation, meals, and materials these fall under different budget types. The split robs us of flexibility."

This rigid segmentation hampers timely and context-sensitive responses. The problem is made worse by the lack of program-level indicators to track efficiency. Although development budgeting is now more structured and linked to sectoral programs and operational plans, its execution is still mostly top-down.

Allocation remains driven by standardized norms rather than service-specific needs, with year-on-year increases typically around 5%. These formulaic methods restrict adaptability, contributing to inefficiencies and inadequate responsiveness to changing health demands. National Health Policy and Five-Year Plans do provide guiding frameworks, but respondents highlighted persistent constraints in implementation due to bureaucratic inertia and limited institutional capacity. The resource allocation formula, designed to reflect service volume and facility readiness, was criticized for not using real-time data and for missing strategic detail. One informant noted:

"We allocate funds, but there's limited understanding among planners about whether those funds actually address priorities. It's more about spending than strategic impact."

Respondents further emphasized the disproportionate focus on infrastructure, often at the expense of workforce development and operational capacity. As one practitioner articulated:

"Buildings get attention, but skill upgrades and facility operations are underfunded. Infrastructure without readiness is half the solution."

Theme II. Planning and Implementation Challenges

Health sector planning relies heavily on Operational Plans (OPs), which have expanded from 29 to nearly 38 and target key domains such as maternal care and nutrition. Respondents appreciated this targeted approach but noted limited financial flexibility. One official stated:

"*The OP structure allows focus on key areas, but adjusting midstream is hard. We launch something like a TB initiative, and it takes years before it transitions into the operational budget."*

Despite these strategic frameworks, execution delays persist, affecting program efficiency. Long-term planning efforts, such as SWAp programs, often suffer from poor timeline alignment and implementation delays. As another stakeholder observed:

"The SWAp from 2017 to 2022 barely got going in its first year. Then again in the 2022–2023 phase, we saw similar delays. And if we can't spend the budget within one year, it gets returned."

These delays, combined with duplication across development and revenue budgets, contribute to allocative inefficiencies. Outdated budgeting practices remain entrenched, with continued emphasis on incremental fund requests rather than results-oriented planning. A stakeholder commented:

"*We still follow the old practice: just ask for more funds without aligning them to expected outcomes."*

Procedural bottlenecks further slow progress, as sequential reviews through central ministries delay local fund release, reducing utilization. Digital innovations, such as health ID systems supported by development partners, show promise but face operational barriers, especially the lack of documentation for vulnerable populations. Reference models from India and Thailand were considered relevant, though requiring adaptation to local context.

While some service gains are recognized, such as improvements in nutrition programs, broader systemic transformation remains necessary. One respondent noted:

"Yes, things are better in some areas like nutrition programs. But the whole system needs stronger local grounding."

Theme III. Procurement and Resource Distribution

Despite technical improvements in procurement frameworks, inefficiencies persist across supply chains, regional relevance, and responsiveness. While some respondents acknowledged reforms, including the rollout of electronic Government Procurement (e-GP), most emphasized systemic disconnects between supply decisions and ground-level needs. Medicines are often distributed without reference to regional disease patterns, resulting in either shortages or irrelevant stock. Facilities such as those in Bogura reported mismatched supply profiles:

"Bogura often provides less than what we require. Sometimes, they supply items not needed for our facility. To some extent, they try but it's never really enough."

Upazila clinics echoed these concerns, highlighting uniform medicine sets regardless of disease burden:

"We all get the same medicines EDCL supplies them without checking what each clinic actually needs. There's no differentiation."

This current approach neglects local data. Practitioners stressed the value of disease mapping to inform procurement:

"Our experience on the ground is ignored. If policymakers asked us what diseases we actually treat, they'd understand what medicines we need and what we don't."

While e-GP has improved transparency and cost control, centralization has constrained autonomy. Clinics face delays when unable to locally procure urgent resources:

"e-GP helped make things cleaner, but it also tied our hands. We can't buy what we need in real-time, and EDCL often can't supply properly."

Although EDCL oversees 75% of the medicine budget, its distribution performance was widely criticized. A more recent shift, enabling Upazila-level procurement, was hailed for enhancing relevance and responsiveness:

"Earlier, procurement was designed for district hospitals. So, we ended up with unnecessary medicines. Now, Upazilas can buy what's actually needed."

These insights affirm the need for greater localized autonomy and integrated supply planning, grounded in frontline realities.

Theme IV. Community Engagement and Representation

Community voices remain largely absent from the budgeting and planning ecosystem. Respondents described a pervasive exclusion of grassroots and ethnic communities, resulting in misaligned priorities and planning inefficiencies. FGDs frequently referenced a deep-seated sense of neglect, where patients expressed unmet needs through simple but powerful appeals:

"To tell you the truth, people often come to us and just say one word 'hospital.' What they're expressing is a deep need."

Despite this clarity from the field, policy and media narratives remain dominated by elite voices from urban and academic institutions:

"In media TV, newspapers you'll hear from professors. But nobody ever asks us what diseases we actually see, what medicines we need. We're invisible."

Respondents underscored how the exclusion of frontline experiences distorts planning and weakens the system's equity. Health workers noted their lack of involvement in surveys or strategic dialogues:

"Nobody surveys us yet we're the ones facing the reality every day. Our insights aren't part of the planning."

This gap reinforces a top-down model, limiting the relevance and effectiveness of public health investments in vulnerable communities.

Theme V. Health System Performance and Capacity

Findings revealed that budget efficiency hinges on systemic performance, particularly workforce deployment, specialist availability, referral systems, and data capture.

While salaries are standardized, participants argued that strategic deployment could significantly enhance productivity:

"All doctors are paid the same, but with better planning, we could maximize their impact. Recruitment isn't the issue it's how we deploy and manage them that matters."

General specialists are adequately available, but sub-specialists remain concentrated in urban centers, intensifying inequities:

"We don't lack generalists anymore, but specialized care is still concentrated in major hospitals. Peripheral areas are underserved."

The absence of a structured referral system compounds inefficiencies, prompting overuse of tertiary care:

"We need a proper referral system. Patients jump from one level to another without guidance, wasting time and resources."

Equally pressing is the lack of bottom-up data integration. Practitioners emphasized that daily service data is rarely documented, impeding evidence-informed budgeting:

"We treat dozens of cases daily, but none of this gets captured. Planning without this data is blind budgeting."

Across responses, execution emerged as the core challenge, despite sound policy design:

"Policy is not the problem but the implementation is."

Theme VI. Policy Effectiveness and Execution

While Bangladesh's health policy structure is considered strategically robust, its practical execution remains fraught with delays and capacity shortfalls. Respondents attributed inefficiencies not to policy design but to operational deficits:

"We already have strong policy frameworks in place. The issue lies in implementation. Policies alone are not sufficient."

Digital tools such as e-GP and electronic health records show promise in enhancing transparency, yet their efficacy is undermined by inadequate staffing and preparedness:

"Digital systems are great for improving efficiency, but without skilled people, they're just skeletons. We need capacity at every level."

Despite these barriers, some respondents noted gradual cultural shifts in accountability and transparency:

"Improvements aren't because the government got stricter it's because people's mindset is evolving. Accountability is becoming a shared expectation."

This evolution presents a meaningful entry point for reforms, provided they are grounded in capacity building and implementation support.

4.3 Factors Hindering Allocative Efficiency

This section presents eight key themes that emerged from the qualitative analysis, shedding light on the structural and operational barriers affecting the allocative efficiency of public health spending in Bangladesh. Drawing on stakeholder perspectives and contextual evidence, the findings illustrate how systemic constraints particularly in workforce planning, financial management, and service delivery limit the translation of budgetary inputs into effective health outcomes.

Theme I. Fragmentation, Duplication, and Low Public Investment

Respondents consistently characterized public financial systems in Bangladesh's health sector as structurally rigid, fragmented, and disconnected from local priorities. Several interrelated sub-themes emerged, highlighting how both operational challenges and systemic inefficiencies limit budget responsiveness and effectiveness. One recurring issue was duplication in development budgets, particularly in training and promotional activities, due to poor coordination among implementing bodies. Public investment in health remains critically low, keeping Bangladesh well below global benchmarks and contributing to high out-of-pocket (OOP) spending. As one key informant explained:

"Public health spending has stagnated at about 0.6% of GDP, while WHO prescribes a benchmark of 5%. 68.5% of health expenditure is OOP… World Bank data shows an even higher figure of 74%. We argue that health is an investment, not just an expenditure."

Theme II. Budget Execution Challenges and Coding Rigidity

Budget underuse is common, mainly due to frequent transfers of key staff that weaken institutional memory, and a rigid coding system that limits shifting funds between expenditure items.

"Some codes require significantly higher allocations… funds cannot be reallocated across budget codes. There are fixed limits on how much budget can be used for certain products… we face frequent problems with procuring injections and saline. To utilize this unspent amount under a different code, permission from the Ministry is required, which creates bureaucratic complexity."

Fund disbursement delays are structural, with several respondents noting that funds become available months after the start of the fiscal year. These delays cascade into long procurement timelines, often surpassing the annual budget cycle.

"The budget is passed in June, but usable funds only arrive by January or February. Tender processes and purchases can take 18 months… exceeding the budget cycle of 12 months."

Theme III. Procurement Bottlenecks and Risk-Averse Culture

Complex procurement processes, coupled with fear of audit repercussions, lead to further hesitancy in spending, particularly on large or specialized items.

"Procurement processes are overly complicated… officials delay decisions or wait for successors. There's a fear of making mistakes that could trigger disciplinary action. This mindset prevents proactive decision-making."

Stockouts are frequent due to central supply failures, particularly from EDCL. Even when local procurement is possible, it is contingent on a formal N/A certificate, which is often delayed.

"EDCL fails to deliver supplies in time or sufficient quantity… local demand is not met." "If EDCL does not issue an N/A certificate… medicines cannot be procured through local tender."

Procurement systems are widely criticized for being slow and bureaucratic. CMSD, the central agency, processes only a fraction of requests, and minor administrative errors delay procurement for months.

"Tender processes and purchases can take 18 months… exceeding the budget cycle of 12 months. CMSD may handle only a fraction of requests in a year… the rest are deferred."

Theme IV. Political Influence and Inequitable Resource Allocation

Budgeting processes are constrained by ceilings on local proposals, limiting the flexibility of facility managers to express real needs. Political interference further exacerbates inequities in allocation and service delivery. Political interests routinely override technical planning. Budgeting often caters to visible short-term outputs rather than long-term investment in system strengthening:

"It's difficult to explain what we need in the way the system wants… we're cautious. We do face political pressure during budgeting or fund allocation, but without political or personal reference, approvals are delayed or denied this undermines accountability. Politicians want quick results during

their term… long-term health planning doesn't fit their agenda. Political influence affects hospital management… administrators are hesitant to speak out."

Facilities with greater lobbying capacity secure more funds, while rural centers struggle to advocate for their needs. As a result, budget allocations frequently fail to reflect actual demand or operational capacity:

"Operating expenses increase by 5% annually without linking to specific outcomes."

Theme V. Corruption, Weak Oversight, and Accountability Gaps

Respondents pointed to political appointments of outsourced staff, often resulting in underperformance. Corruption is not limited to high-level actors but includes routine delays, demands for unofficial payments, and pressure on staff to make exceptions.

"Even when I try to do the right thing, I'm pressured by influential people to make unfair adjustments. Middlemen take unethical payments from outsourced staff… this has become common practice."

Accountability systems were widely seen as ineffective. Staff performance is rarely monitored, and procurement systems are prone to manipulation by brokers who exploit bureaucratic slowdowns.

The procedural rigidity of the system, combined with overlapping institutional mandates, creates significant delays even for minor adjustments. Respondents highlighted a lack of transparency, where ground realities fail to reach decision-makers.

"Health budgeting is spread across various ministries… each has its own priorities. The procurement process is so complex, accessing allocated funds becomes a challenge. Minor adjustments require lengthy approvals, delaying urgent decisions."

Theme VI. Weak Institutional Capacity and Workforce Shortages

Even when funds are increased, limited planning and weak institutional capacity constrain meaningful utilization. Many facilities lack the technical skills to prepare and execute procurement or budget plans efficiently.

"Facility readiness encompasses machines, doctor availability, and training for staff. Without this, efficiency and service delivery will always suffer."

Critical posts remain vacant across roles from consultants to cleaners. Due to staffing shortages, hospitals rely on untrained volunteers, often compromising hygiene and safety.

"At many facilities, there is no superintendent… even with allocations for eight consultants, only two may be in place."

Managerial capacity remains weak. Doctors feel ill-prepared or reluctant to take on administrative responsibilities, while many senior officials are demotivated. Budget codes are poorly understood, and few offices have dedicated financial units.

"We don't always understand the codes and categories… yet auditors hold us accountable. Many offices lack dedicated budget management units." "Hospitals should have dedicated teams for financial reporting, procurement, and compliance."

Theme VII. Misaligned Planning and Inflexible Budget Structures

Spending pressure at year-end leads to last-minute expenditures on trainings or foreign visits, often disconnected from pressing health needs.

"Not every hospital requires 100 beds… the number of patients remains low despite significant investment. There's a rush for trainings or quick fixes, just to show the funds were used up."

Planning frameworks prioritize construction and equipment, while neglecting operational and human resource needs undermining long-term sustainability. Delays in equipment approval or misaligned staff transfers further diminish impact.

"We need structured training tracks for future civil surgeons and administrators…….Requests for equipment or staff become irrelevant once approved… doctors may have already been transferred."

Strict procedural constraints prevent field-level responsiveness. For instance, despite patient loads increasing or bed capacity expanding, budget ceilings remain unchanged.

"Budgets still reflect 31 beds, even after expanding to 50… medical officers are absent, reducing service delivery. We treat 200 patients, but the budget covers only 57."

Theme VIII. Data Limitations, Centralization, and Regional Disparities

Respondents expressed frustration that policymakers often lack rural exposure and exclude clinical leadership in planning, resulting in impractical decisions. Field-level voices are not adequately reflected in budgeting or policy reform. They also pointed to major limitations in data availability. Health planning relies on outdated statistics, with minimal integration of private sector data or forecasting for medicines and service delivery.

"Health statistics from 2018 might only become available in 2022… real-time decision-making is almost impossible. We do not have adequate information about the private health sector."

The current system is heavily centralized, limiting the autonomy of Upazilas to address logistical or personnel challenges. Respondents noted systemic gaps in oversight, service coordination, and accountability mechanisms.

"I am not the policymaker… decisions are taken centrally, leaving little flexibility."

Overlaps in program responsibilities and weak inter-agency coordination disrupt service delivery. Midwifery, nursing, and other cadres operate in silos, while urban healthcare remains structurally weaker than rural systems.

Facilities continue to prioritize infrastructure over operational feasibility. Equipment is often procured without planning for staffing or maintenance, leading to underutilization.

"We invest heavily in construction… but facilities lack doctors and nurses to ensure service delivery."

Budgeting remains disconnected from demand patterns. While some facilities are overstretched, others remain underutilized but still receive substantial funds. Regional disparities are a key concern.

"Health infrastructure is capital-centric… patients from Rangpur must sell assets to travel to Dhaka. We need decentralization to ensure equitable access to specialists and services."

4.4 Enhancing Allocative Efficiency of Public Spending in the Health Sector

This section synthesizes insights from key informant interviews (KIIs) across nine thematic areas. The findings reflect critical system-level challenges and propose strategic reforms to improve allocative efficiency through better planning, budgeting, workforce optimization, and cross-sectoral collaboration.

Key informant interviews highlighted a complex web of interrelated challenges that constrain the efficient allocation of public resources in Bangladesh's health sector. Respondents identified systemic flaws in budgeting, human resource planning, governance structures, and inter-ministerial coordination. Their reflections emphasized that meaningful reform requires simultaneous restructuring across nine thematic areas.

Theme I. Budget Reform and Flexibility

Participants consistently criticized the rigidity of health budgeting in Bangladesh, which largely follows a supply-side, incremental model with limited responsiveness to real-time needs. One respondent described the limitations of this approach:

"This budget follows an incremental approach... usually 5% more than the previous year. It doesn't reflect actual demand."

Facilities often struggle when patient loads surge or unforeseen events demand urgent spending, yet existing codes and ceilings cannot be adjusted without higher-level approvals. A manager highlighted the consequences of this inflexibility:

"If we had the flexibility to reallocate between codes when patient numbers rise, our outcomes would be significantly better."

The disconnect between development and operational budgets was seen as a core obstacle to efficient spending. Capital investments such as hospital construction and procurement of equipment are often executed without ensuring operational readiness, leading to underutilization. A district health officer illustrated this issue:

"We build state-of-the-art hospitals and procure expensive equipment that sits idle because there are no trained staff to run them."

Multiple informants called for mechanisms to harmonize planning processes between these two streams, noting successful pilot efforts from 2012 and recommending their scale-up.

Respondents also highlighted the misalignment between budgeting and actual service intensity. One informant pointed out the inefficiencies in allocation:

"A kidney hospital needs operation theatres and dialysis centers more money than a mental hospital, obviously. But we don't allocate based on service demands."

one informant explained. Calls were made to transition toward a demand-driven and performance-linked budgeting model, integrating data on patient volumes and disease burden into allocation decisions.

Theme II. Human Resource Optimization

Workforce deployment and career progression were identified as major inefficiencies in the health system. Key informants described a system that expects doctors to simultaneously manage clinical work, teaching responsibilities, administrative duties, and public health programs. One respondent noted:

"It's unrealistic for a single person to excel in clinical services, teach, manage programs, and handle administrative tasks simultaneously."

This multi-burden approach leads to poor service outcomes and low morale. Respondents advocated for structured career pathways whereby doctors begin with general postings and, after acquiring experience, enter specialized streams such as clinical service, teaching, public health, or administration**.** One participant emphasized the importance of early training for administrative roles:

"If a doctor wants to be an administrator, they should be trained early and not be appointed randomly to management roles."

Several informants pointed to the need for a dedicated public health management institute to groom future managers in budgeting, procurement, and leadership. Others noted that politically influenced appointments often result in poor skills match, weakening both service delivery and budget utilization. As one respondent explained:

"Those who didn't qualify for clinical postgraduate education often became health managers not out of passion, but as a backup plan."

Needs-based planning was also stressed in terms of clinical specialties. While Bangladesh no longer faces shortages in certain disciplines, gaps persist in others especially sub-specialties such as neurosurgery and endocrinology. An academic interviewee highlighted this mismatch:

"We keep producing more general surgeons when we actually need endocrine specialists. It's a mismatch that wastes public investment."

Theme III. Public Financial Management Capacity

Respondents voiced concerns about the limited financial literacy among health managers, particularly at local and district levels. Many administrators lacked a working understanding of public spending mechanisms, including economic codes, procurement platforms like e-GP, and fiscal rules. One manager noted the resulting dependency on administrative officers:

"Our civil surgeons are intimidated by the system, they depend entirely on admin officers."

This dependency creates bottlenecks and restricts the proactive use of resources. To address these gaps, informants proposed targeted training programs and continuous capacity building for both new and experienced officers. One contributor stressed the need for structured training linked to outcome measurement:

"Workshops must be outcome-oriented. Right now, we do them without clear goals or follow-up it's a waste of money."

Others emphasized the distinction between clinical and non-clinical roles, arguing that managers should be trained in logistics, budgeting, and team coordination skills rarely taught in medical schools. One respondent underscored the urgency of training:

"A well-trained doctor can make a huge difference, but currently they have little authority and limited education," said one respondent."

Theme IV. Structural Reform and Accountability

Informants linked inefficient spending to governance flaws, particularly the lack of real-time data and weak decision-making authority at the facility level. A regional director described the limitations faced by managers:

"Leadership is about making systems work, not just following orders. But our managers lack access and autonomy."

Respondents proposed empowering institutional leaders, such as hospital directors, to adjust budget codes within defined parameters and under audit oversight. One informant illustrated the problem with a specific example:

"If the director of a mental hospital equivalent to a Joint Secretary can't adjust his budget for emergencies, something's wrong."

Moreover, several participants criticized Bangladesh's dual-secretary model, with separate secretaries for health services and medical education. A policy advisor suggested a more unified approach:

"Two secretaries with overlapping portfolios only create confusion and delay. One unified leadership could improve coherence."

Respondents stressed that structural reform must begin with clarity in accountability and decentralization of decision-making.

Theme V. Need-Based Workforce Planning

Beyond broader human resource issues, informants raised concerns about recruitment that fails to reflect actual health system needs. A hospital administrator described the consequences of uneven distribution:

"In some areas, we have surplus specialists; in others, none at all. This mismatch is costing us."

Calls were made to revise seat distributions in medical colleges and postgraduate programs based on long-term service projections and local disease patterns. Respondents proposed five-year datasets on patient loads and treatment types to guide recruitment policy. They also urged more collaboration between medical education planners and health system managers to avoid workforce saturation in certain specialties and underproduction in others.

Theme VI. Shift from Outsourced to Government Recruitment

Participants described the outsourcing of support roles as an obstacle to cost-effectiveness and accountability One district officer criticized the lack of continuity among contractual staff:

"Outsourced staff rotate too often. They don't take ownership, and service suffers."

Several informants recommended transitioning to government-led recruitment, particularly for routine and locally anchored roles. An operations manager advocated for permanent staffing:

"Permanent in-house staff would reduce costs and improve service consistency."

Local recruitment was seen as a way to build institutional loyalty and enhance long-term workforce stability.

Theme VII. Primary Healthcare Prioritization

Respondents were deeply concerned about the disproportionate investment in tertiary care, which they argued comes at the expense of community-based and preventive services. A senior doctor highlighted the imbalance:

"We still focus on treating sickness tests, surgeries but ignore prevention."

Several informants advocated reallocating budgets to strengthen immunization programs, maternal care, nutrition interventions, and outreach. One respondent emphasized the potential impact of accessible public care:

"If the poor know they'll get free medicine and care in government hospitals even after hours they'll stop going to private clinics. That's real impact."

Others pointed to historical successes such as the wide-scale use of oral saline, noting that simple, low-cost interventions had outsized benefits. A public health expert reflected on this legacy:

"Oral saline changed child mortality overnight. We need to fund the basics again, not just shiny hospitals."

Theme VIII. Interministerial Coordination and Innovation

Participants unanimously agreed that health outcomes depend on collaboration across ministries, education, water, sanitation, disaster management, and more. However, real coordination remains elusive. One informant lamented the lack of actionable planning:

"We meet across ministries, but it's mostly ceremonial. No one has authority or clear deliverables."

The absence of integrated planning leads to duplications, missed opportunities, and fragmented program execution. To strengthen inter-sectoral coordination, respondents recommended creating joint task forces with clearly defined roles, responsibilities, and timelines. One respondent stressed the importance of aligning procurement with actual needs:

"We must shift from procurement-centric to needs-based planning. Buying equipment is pointless if we don't have people or capacity."

Participants also called for logistics pooling, shared transport, and co-managed outreach efforts to reduce duplication and improve coverage. Digitization was widely viewed as essential to improving coordination and efficiency. The current ICT architecture is siloed, with poor interoperability even within the public sector. An officer illustrated this disconnect:

"Health and family planning don't share data. It's absurd vaccination and maternal care could be integrated easily"

Several informants proposed the rollout of a national electronic health record system, allowing patients' medical histories to be accessed across facilities. One interviewee described the vision for seamless data access:

"If a patient in Tetulia visits a hospital in Teknaf, their data should follow them"

Although pilot systems exist, full-scale implementation will require significant investment and political will. Respondents also addressed the sensitive topic of public-private partnerships (PPPs). While acknowledging potential benefits, they warned against over-commercialization. While acknowledging potential benefits, one policymaker cautioned against over-commercialization:

"Commercializing healthcare can cause major problems. We must tread carefully."

Theme IX. Reform Culture and Behavioral Shifts

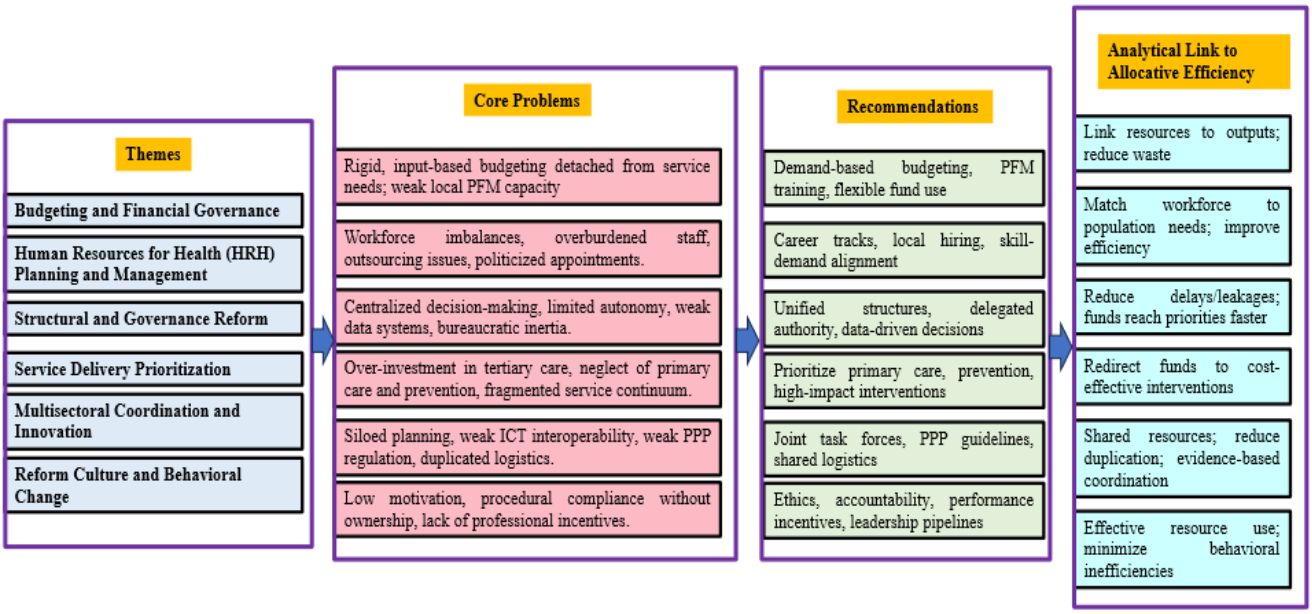
Underlying systemic inefficiencies is a persistent challenge of mindset. Respondents argued that without a shift in attitudes around professionalism, transparency, and ethical conduct, policy reforms would fail to achieve impact. One key informant observed the limits of procedural reform:

"No matter how well-designed the procedures are, without behavioral change, nothing will improve on the ground."

Incremental gains were noted, especially in accountability among clinicians, but were attributed to external pressure rather than intrinsic motivation. A long-term transformation requires cultural change, embedded in training, leadership development, and institutional norms.

The insights gathered underscore that improving allocative efficiency is not a challenge of finance alone it is a matter of governance, planning, and institutional design. Respondents pointed to persistent fragmentation between capital and operational budgets, mismatches between workforce supply and service needs, insufficient management capacity, and a lack of behavioral ownership among key actors. Equally important, they identified practical, actionable solutions: the adoption of demand-driven budgeting models; establishment of structured career paths and administrative training institutions; expansion of managerial autonomy with clear accountability safeguards; and the development of interoperable digital infrastructure to streamline decision-making and service delivery.

To consolidate the qualitative findings, two analytical matrices have been developed and presented in Annex E (Table 1). The first matrix synthesizes the key factors influencing allocative efficiency in Bangladesh's health sector, highlighting the core problem areas, their underlying constraints, and corresponding reform recommendations emerging from key informant interviews and document analysis. The second matrix (Table 2 in Annex E) builds on this thematic synthesis by classifying the observed institutional patterns into four latent efficiency classes, ranging from high to low efficiency. It traces how varying degrees of institutional capacity, autonomy, and behavioral norms influence allocative efficiency outcomes across the same six reform dimensions. By mapping these classes to corresponding reform flows and policy trajectories, the framework in Figure 4.11 provides a dynamic view of system evolution, showing how incremental improvements in governance, workforce planning, and coordination can gradually transition the health system toward higher allocative efficiency and institutional maturity.



Source: Developed by the authors

Figure 4.11 *Summary Matrix on Factors, Constraints, and Reform Directions for Enhancing Allocative Efficiency*

Ultimately, allocative efficiency must be seen as a holistic pursuit, one that bridges fiscal structures with frontline realities, integrates community voices, and empowers institutions to act decisively. By embracing reforms across all nine thematic areas, Bangladesh can move toward a health system that not only spends wisely but delivers meaningfully for all.

Chapter 5: Discussion

Efficient allocation of public resources is a cornerstone of effective health system performance, especially in settings where fiscal space is constrained yet population health demands are rising. In Bangladesh, despite notable improvements in health indicators, persistent underutilization of allocated budgets within the Health Services Division signals a deeper structural issue one that goes beyond mere funding shortfalls and demands critical evaluation of how existing resources are distributed and used.

The study employed a mixed-methods design to comprehensively assess the factors affecting allocative efficiency of public health spending in Bangladesh. The quantitative component applied a three-stage Data Envelopment Analysis (DEA) supplemented by regression-based Stochastic Frontier Analysis (SFA), enabling a robust evaluation of technical and allocative efficiency across health facilities. This approach provided a data-driven understanding of spending patterns and performance variations, highlighting clusters of efficient, moderately efficient, and inefficient institutions within the Health Services Division. These findings established a baseline for further inquiry into the systemic factors influencing resource use and service delivery outcomes.

The five-year analysis of allocative efficiency (AE) in Bangladesh's health sector from 2019 to 2023 reveals a system grappling with persistent underutilization of resources, marked year-to-year fluctuations, and pronounced regional disparities. With an average efficiency score of approximately 0.60, the data suggest that the same level of health service delivery could have been achieved using roughly 40% fewer resources had inputs been distributed more optimally. Country-specific studies show more variation. According to a study in Nigeria, the average public health spending efficiency score was 0.979, indicating relatively high efficiency, albeit with some room for further gains (Jibir et al., 2024). However, in India, mean efficiency scores ranged widely from 0.60 (40% inefficiency) to 0.935 (SD = 0.131), highlighting considerable disparities across states (Dar & Raina, 2024; Sinimole, 2019). In the Middle East and North Africa (MENA) region, average efficiency scores ranged between 78.7% and 98.2%, depending on the year and measurement approach (Dhaoui, 2019).

National trends of Bangladesh show a decline in efficiency after 2019 coinciding with the second year of the COVID-19 pandemic. This drop reflects the reallocation of resources toward emergency response measures, such as procurement of protective equipment, expansion of testing, and establishment of isolation facilities (Government of Bangladesh, 2020; World Bank, 2021; Asian Development Bank, 2021). These constraints reduced the inputs are available for routine and preventive services. Although efficiency rebounded moderately in 2023, it remained below pre-pandemic levels, suggesting that structural inefficiencies, such as disrupted referral pathways, workforce imbalances, and reliance on emergency procurement. These became embedded during the crisis and continued to affect

performance. In developing Asia, efficiency levels are also reported as suboptimal, with significant scope for improvement, though specific average scores are not consistently available (Bajaro et al., 2023). Another cross-country study of 50 Organization of Islamic Cooperation (OIC) countries covering the period 2004–2018 found an average allocative efficiency score of 0.551, suggesting nearly 45% inefficiency on average (Helwa & Rima, 2024).

Spatial analysis further highlights the uneven distribution of efficiency across districts. Only a few areas consistently achieved higher scores, supported by stronger health management systems, skilled personnel, and logistical advantages. In contrast, northern districts recorded lower and unstable efficiency due to persistent challenges such as difficult terrain, limited access to real-time data, and shortages of trained health workers. These disparities underscore that inefficiency is not merely a technical issue. The instability in district-level performance, illustrated by frequent shifts between efficiency categories, points to systemic fragility and the need for tailored interventions that address local realities. In Bangladesh, rising public health expenditure has contributed to longer life expectancy and declines in maternal, child, and infectious disease mortality. Despite these gains, the effectiveness of spending remains constrained by insufficient and uneven allocation (Fardoush, 2020; Sultana et al., 2024). More than 20% of the population still lacks adequate access to care, and wealthier groups disproportionately benefit from public health services, particularly at the secondary care level, while the poorest segments often fail to receive their fair share (Mamun et al., 2025; Sultana et al., 2024).

Several remote and disadvantaged districts, such as the Chittagong Hill Tracts, southern coastal districts and northern border areas, show comparatively higher allocative efficiency than many better-resourced regions. This outcome is driven by targeted, closely monitored investments that prioritize essential primary and preventive care over costly tertiary services (Schenkman & Bousquat, 2024). Lower population density, less fragmented delivery, and stronger community-level accountability reduce congestion and administrative burdens, enabling expenditure to align more directly with local needs (Meng et al., 2024; Schenkman & Bousquat, 2024). Evidence from other countries reinforces this dynamic: in Brazil, rural municipalities achieved higher efficiency by emphasizing primary health care and community health workers (Schenkman & Bousquat, 2024). In China, focused primary care investment similarly improved efficiency in rural and western regions (Liu & Guo, 2023; Zhao et al., 2025). Ultimately, needs-based allocation formulas and targeted donor funding improve efficiency in poorer, remote regions, but this does not necessarily translate to better overall system performance (Binyaruka & Anselmi, 2020).

Latent profile analysis identified five distinct district clusters, highlighting varied performance patterns. Class 3 districts consistently achieved high efficiency, while Class 4 showed extreme volatility, peaking in 2020 but collapsing in 2021. This abrupt change likely reflects COVID-19–related emergency funding and resource reallocation, the prioritization of high-need or urgent services, and the widespread

suspension or disruption of many routine and elective activities, which together redirected resources toward immediate, high-need demands (Gurley et al., 2021; Zeitouny et al., 2023). Many countries rapidly increased and reallocated health spending, with urgent pandemic services displacing other care and creating opportunity costs for non-COVID patients (Arsenault et al., 2022). Class 1 demonstrated resilience, and Class 2 remained chronically under-optimized. These findings suggest that improving allocative efficiency requires both national reforms, focused on planning, budgeting, and data use and district-specific strategies tailored to local constraints. Enhancing efficiency is not only a technical goal but also a path toward greater equity in health service delivery. This kind of classification has been done in other studies where districts in Bangladesh were grouped into distinct efficiency profiles. Some are consistently high-performing (Class 3), while others are volatile (Class 4), showing large swings in efficiency over time. A third group is resilient (Class 1), able to maintain steady performance despite challenges, and the last group remains chronically under-optimized (Class 2), struggling with persistent inefficiency (Bajaro et al., 2023; Kedziora et al., 2019). This kind of variation is typical in decentralized health systems and underscores the limitations of one-size-fits-all reforms. For example, volatile districts are highly sensitive to external shocks such as pandemics, abrupt funding changes, and frequent staff transfers, whereas resilient districts demonstrate the capacity to sustain performance under pressure. In contrast, chronically under-optimized districts often face deep-rooted structural or resource barriers that require long-term, targeted interventions (Bajaro et al., 2023; Kedziora et al., 2019).

Recognizing that budgetary efficiency is shaped not only by financial metrics but also by institutional behavior and contextual challenges, the study incorporated qualitative methods grounded in interpretivism and pragmatic paradigms. Key Informant Interviews (KIIs), Focus Group Discussions (FGDs), and in-depth interviews captured diverse viewpoints from policymakers, health administrators, facility managers, and service beneficiaries.

The thematic analysis reveals several interlinked factors that significantly influence allocative efficiency within Bangladesh's public health system. One of the most recurrent determinants is the fragmentation between operating and development budgets. Participants described how the dual-budget structure, governed by separate institutional actors, leads to duplication of activities and misaligned investments. For instance, capacity-building efforts under the development budget are often overshadowed by infrastructure-focused spending within the operating budget. This imbalance affects allocative efficiency by channeling resources into physical inputs rather than functional improvements in service delivery. Different studies have noted a misalignment between operating (recurrent) and development (capital) budgets, which are often planned and managed separately. This separation leads to projects lacking necessary operational funds or, conversely, operational activities without adequate development support. Additionally, fragmented budgets reduce flexibility, making it hard to reallocate resources quickly in response to changing needs or emergencies, thereby limiting the health system's overall responsiveness (Klein & Meckling, 1958; Patz & Goetz, 2019).

Another crucial factor is the absence of program-specific performance indicators and outdated allocation formulas. Respondents pointed out that health budgets are often allocated using outdated metrics like bed counts or staffing norms, which do not reflect the actual demand for services. KII participants noted that top-down decision-making and the use of old data limit how effectively budgets respond to current health needs. As a result, facilities struggle to align resources with changing epidemiological trends or local health priorities, weakening the impact of spending. Different studies also emphasized that smarter allocation approaches, such as using cost-effectiveness analysis or mathematical modeling, could enhance health outcomes without increasing total spending (Fraser-Hurt et al., 2021; Ralaidovy, 2019; Wilson & Gorgens, 2023). Moreover, adopting allocation formulas that prioritize high-impact, cost-effective interventions based on local health needs is key to improving allocative efficiency (Fraser-Hurt et al., 2021; Ralaidovy, 2019; J. Sun et al., 2023). Some studies highlighted that the absence of program-specific performance indicators significantly limits the ability to monitor, evaluate, and improve program effectiveness. This gap undermines accountability and impedes efforts toward quality improvement (Agarwal et al., 2019; Langarizadeh et al., 2024). Additionally, reliance on outdated allocation formulas fails to capture current population needs, often resulting in the misallocation of resources (Radinmanesh et al., 2021).

Procurement and supply chain inefficiencies also emerged as a key determinant. While e-GP has improved transparency, respondents noted that medicine distribution is still uniform and misaligned with local disease needs. Facilities often receive irrelevant stock or face shortages, showing how centralized procurement reduces allocative efficiency. Many praised the introduction of procurement autonomy at Upazila hospitals as a positive move toward more responsive, need-based supply. Others also pointed out that inefficiencies in procurement and supply chain systems lead to frequent drug stockouts, inflated costs, and limited availability of essential health products, ultimately disrupting service delivery and patient care (Ayodimeji-Alaba et al., 2025; Langarizadeh et al., 2024; Seidman & Atun, 2017).

Furthermore, the lack of strategic deployment of human resources and fragmented referral systems compromises the value derived from public spending. Participants cited uneven distribution of specialists and inadequate coordination between primary and tertiary care facilities. This leads to underuse of infrastructure and poor continuity of care, both symptomatic of inefficient resource use. The absence of bottom-up data flow, wherein local service patterns fail to inform budgeting decisions, reinforces this disconnect. Researchers highlighted that poor strategic deployment of human resources results in staff shortages, uneven workloads, and lower service quality (Agarwal et al., 2019; Nyakure & Kavale, 2022). Moreover, Agarwal et al. (2019) also pointed out that fragmented referral systems disrupt continuity of care and weaken overall health system efficiency.

Finally, limited community engagement in health planning emerged as a systemic constraint. FGDs revealed that rural health workers and underserved populations are often excluded from consultations, resulting in skewed priorities and distorted service delivery. When allocative decisions are shaped by elite urban narratives, they fail to capture ground-level realities, reducing the relevance and impact of spending. Despite promising institutional reforms and digital modernization efforts, stakeholders emphasized that without meaningful inclusion and facility-level capacity strengthening, allocative efficiency will remain elusive. Jithitikulchai (2022) noted that better distribution and consolidation of the health workforce, such as through network consolidation, can help address workload imbalances and reduce labor costs, thereby directly enhancing allocative efficiency

The qualitative findings reveal a complex governance and operational terrain that consistently undermines allocative efficiency in Bangladesh's public health sector. Multiple factors emerged from the KIIs and FGDs that clarify why public health spending often fails to translate into effective service delivery.

One of the most prominent constraints is the **rigidity of budgeting systems**. Participants emphasized that the separation between operating and development budgets creates procedural silos that restrict coordination and lead to chronic underutilization. Budget codes are inflexible, preventing reallocations within the fiscal cycle, while layered approval processes delay fund disbursement and procurement. These delays are especially problematic in emergency contexts, where responsiveness is critical. The inability to adapt budgets in real time affects allocative efficiency by misaligning resources with service needs. Other studies also explained that when budgeting systems are fragmented and rigid, such as having separate, inflexible budget lines for different programs or administrative levels, it becomes difficult to shift funds where they're most needed (Mbau et al., 2022). This lack of flexibility prevents timely responses to emerging health challenges and leads to siloed spending, where resources are locked into specific areas regardless of evolving priorities, ultimately reducing overall system efficiency (Zeng et al., 2020).

A second major factor is **political interference in financial and staffing decisions**. Respondents described an informal patronage system where resource allocations, particularly staff placements and budget approvals are influenced by political networks rather than population health indicators. This undermines transparency and results in skewed investments. Facilities serving rural populations are disproportionately affected, with urban centers often receiving outsized attention regardless of epidemiological evidence. Such distortions directly reduce the equity and effectiveness of public health financing. Studies have highlighted that weak governance and political interference in financial and staffing decisions often lead to resource allocation based on political agendas rather than actual health priorities. This distorts planning, favors certain regions or services for non-health reasons, and undermines the effective and efficient use of limited resources (Mbau et al., 2022; Zeng et al., 2020).

The findings also highlight **supply-side biases in planning and budgeting processes**. Planning practices remain incremental, anchored in historical spending patterns with little consideration for health outcomes. Budget forecasting rarely uses current epidemiological data, and private sector insights are almost entirely absent. Instead, allocations tend to follow lobbying capacity or visibility, rather than actual service gaps. This leads to procurement decisions, such as acquiring medical equipment or constructing buildings, without plans for maintenance, staffing, or usage, resulting in resource wastage and diminished system efficiency. Mbau et al. (2022) and Zeng et al. (2020) also noted that supply-side biases in planning and budgeting tend to prioritize provider interests or maintain existing structures instead of focusing on the actual health needs of the population.

Another determinant is the **limited managerial capacity at the facility level**. Clinical staff often lack training and willingness to take on administrative responsibilities, while health managers are unfamiliar with public financial management and procurement tools. These limitations delay implementation and inhibit facilities from making timely, data-driven decisions about resource deployment, and reducing the ability to plan, monitor, and adapt resource use effectively (Nyakure & Kavale, 2022; Zeng et al., 2020).

Finally, **institutional inflexibility and poor responsiveness to service needs** further impair allocative efficiency. Facilities are locked into budgeting frameworks based on outdated indicators, such as static bed counts and legacy staffing norms. They have little autonomy to reallocate budgets, adjust procurement volumes, or respond to local stockouts. This disconnect between centralized decision-making and local realities reduces the relevance and impact of health spending, ultimately weakening patient care and system resilience. Researchers also emphasized that institutional inflexibility and poor responsiveness hinder timely adaptation to evolving service needs and health priorities (Zeng et al., 2020). Combined with fragmented service delivery and inefficient workforce deployment, this leads to a mismatch between resources and actual demand, reducing overall system efficiency (Jithitikulchai, 2022; Mbau et al., 2022).

Insights from respondents reveal a pressing demand for reform measures aimed at maximizing the impact of public health expenditures in Bangladesh. Their recommendations, rooted in lived experience and system-level observation, converged on the need for greater flexibility, decentralization, and accountability in spending decisions.

Respondents expressed strong concerns about the current public health budgeting framework, highlighting the need for **Flexible and Needs-Based Budgeting**. They described existing practices as overly rigid and disconnected from local realities, often hampering the ability of facilities to respond to shifting demands. Many emphasized that integrating operational and development budgets, and offering greater financial autonomy at the facility level, would allow for more adaptive and timely resource allocation especially during emergent health crises. Other studies also advocated for a shift toward

flexible, needs-based budgeting, moving away from rigid and fragmented systems (Fraser-Hurt et al., 2021; Gong & Kang, 2023). Such an approach allows resources to align more closely with health priorities and evolving population needs, improving both responsiveness and efficiency (Baumann, 2021; Murray, 1995).

The theme of **Human Resource Reform and Institutional Restructuring** surfaced frequently. Respondents noted that fragmented career tracks and politicized recruitment have caused major misalignments in the system. They recommended creating a public health management institute with clear professional streams and emphasized strengthening procurement and budgeting skills among frontline staff, especially nurses, who are often excluded from administrative roles despite their community insight. Researchers also emphasized the need to consolidate and strategically deploy the health workforce across facility networks. This approach helps reduce workload imbalances and labor costs while better aligning staff with actual service demand (Chai et al., 2021; Jithitikulchai, 2022). They noted that network consolidation of both facilities and workforce can generate substantial economic benefits and enhance the overall quality of service delivery (Jithitikulchai, 2022).

Concerns around **Strengthening Local Governance and Accountability Mechanisms** were also prevalent. Respondents described a lack of clarity in leadership roles and decision-making authority, which often led to duplication and inefficiencies. They felt that decentralizing power to facility managers and clarifying institutional mandates would enhance both responsiveness and transparency. Improved coordination across health and administrative agencies was seen as key to enabling cohesive planning and reducing structural fragmentation. Different studies recommended decentralizing decision-making, empowering local managers, and strengthening accountability mechanisms to improve the effective use of resources and better respond to local health needs (Baumann, 2021; Chansa et al., 2008; X. Sun et al., 2023).

In terms of **Workforce Planning and Policy Alignment**, respondents highlighted gaps between recruitment practices and service delivery needs. They proposed adopting data-driven forecasting methods to ensure personnel deployment aligns with health burdens and service utilization trends. There was widespread criticism of outsourcing models, that were seen as expensive and disconnected from local realities; instead, participants advocated for community-rooted hiring approaches led by government institutions. Other researchers also emphasized the importance of aligning workforce policies with overall health system goals. They recommended using data-driven planning to ensure that staff skills and numbers are matched to actual service demands, improving efficiency and service quality (Chai et al., 2021; Jithitikulchai, 2022).

The emphasis on **Prioritizing Primary and Preventive Care** stood out as a shared conviction across respondent groups. Many suggested that the health system remains overly focused on tertiary services, overlooking the cost-effectiveness and wide reach of primary care interventions. Several pointed to

examples like oral rehydration therapy as proof that simple, community-based programs can yield significant public health benefits when properly scaled and supported. Findings from other studies stressed the need to prioritize primary and preventive care by increasing investment in these areas, as they offer greater health gains and help reduce the burden and cost of avoidable hospitalizations (Baumann, 2021; Simic et al., 2010).

With regard to **Institutional Integration and Digital Solutions**, respondents proposed strengthening cross-sectoral collaboration through joint planning platforms and interoperable information systems. Digital health records were seen as essential tools for minimizing duplication and improving continuity of care. Although private partnerships were cautiously welcomed, there was consensus around the need for robust regulatory mechanisms to prevent commercialization from undermining public service values. Researchers recommended integrating fragmented services and leveraging digital tools to improve resource tracking, planning, and performance monitoring, ultimately enhancing coordination and system efficiency (Baumann, 2021; Jithitikulchai, 2022).

Finally, the theme of **Cultivating Ethical Leadership and Cultural Shifts** resonated deeply with many informants. They stressed that without transparency, integrity, and a genuine sense of institutional ownership, even technically sound reforms would struggle to take root. Building a culture of accountability and ethical leadership was viewed not just as a complement to structural reform, but as its foundation. Different studies also highlighted the need to cultivate ethical leadership that prioritizes transparency, evidence-based decision-making, and fosters a culture of continuous learning and improvement within the health system (Baumann, 2021).

Findings highlighted significant disparities in spending and efficiency across health facilities, pointing to uneven performance in service delivery. The analysis revealed that inefficiencies stem from entrenched structural issues, such as rigid budgeting systems, procurement delays, political interference, and a lack of strategic workforce planning. Researchers recommended moving toward integrated budgeting, a single unified budget covering both operating and development expenses, to enhance planning, coordination, and performance evaluation while lowering the costs associated with managing separate budgets (Arnold & Artz, 2018). These are not isolated problems but part of a broader pattern of institutional fragmentation, weak use of data, and limited decision-making autonomy at the local level. The study has also highlighted some reform priorities based on stakeholder experiences, including the need to integrate budgeting processes, decentralize authority, strengthen financial and managerial capacity, and elevate the role of primary care. Other studies also emphasized that centralizing procurement and asset management can reduce costs and improve resource use, particularly when budgets are uncertain (Fard et al., 2019). Yet, as respondents consistently emphasized, technical fixes alone will not suffice. Achieving true allocative efficiency requires a shift in mindset, toward ethical leadership, transparent decision-making, and a culture of accountability and continuous improvement.

Respondents pointed out that comprehensive medical reforms, such as those piloted in China, have demonstrated sustained improvements in resource allocation efficiency, particularly when adapted to local contexts and backed by strong policy and governance frameworks (Gong & Kang, 2023; Guo et al., 2021; X. Sun et al., 2023).

Ultimately, improving allocative efficiency in Bangladesh's health sector demands more than optimizing budgets, it calls for systemic reform. A truly efficient health system must be financially prudent, strategically adaptive, and, above all, aligned with the needs of the people it serves.

This study offers important insights into allocative efficiency in Bangladesh's health districts. Still, some gaps remain. The analysis relied on secondary data due to the scope of the study. The analysis used a limited set of health outcomes, so not all dimensions of system performance were captured during the measurement of allocative efficiency scores. We could not assess which budget codes need more or fewer resources, as different inputs lead to different outcomes that secondary data cannot directly compare. Patient satisfaction, service quality, and frontline experiences were not captured fully. Efficiency scores, while helpful, may simplify complex realities, such as the influence of politics or informal care networks. Even with these gaps, the study builds a strong base for policy dialogue. Future research should widen outcome measures, bring in primary data, and include patient-level feedback to guide more effective reforms.

Chapter 6: Conclusion

The Health Services Division is responsible for providing affordable healthcare and improving population health in Bangladesh. However, limited infrastructure and inefficient resource use have constrained progress on key health indicators. Understanding allocative efficiency (AE), whether resources are distributed to maximize health outcomes, is therefore critical. Achieving AE in healthcare is challenging due to information asymmetry and underrepresentation of patient preferences, which can be addressed through surveys, focus groups, or modeling.

Efficient resource allocation is essential for strengthening health systems, particularly where fiscal space is limited and demands are rising. In Bangladesh, underutilization of budgets within the Health Services Division highlights structural inefficiencies beyond funding shortages. To assess this, the study applied a mixed-methods design, combining stakeholder insights with quantitative analysis. A three-stage Data Envelopment Analysis (DEA), supported by Stochastic Frontier Analysis (SFA), was used to evaluate technical and allocative efficiency across health facilities. The findings identified clusters of efficient, moderately efficient, and inefficient institutions, providing a baseline for understanding systemic drivers of resource use and service delivery outcomes.

Efficient allocation of public resources is fundamental to health system performance, particularly in contexts where fiscal space is limited but population health demands are expanding. In Bangladesh, despite commendable progress in health outcomes, persistent underutilization of allocated budgets within the Health Services Division points to deeper structural challenges issues that extend beyond funding shortages and raise critical questions about the distribution and utilization of existing resources.

To address this gap, the study employed a mixed-methods design that combined empirical modeling with stakeholder perspectives. This integrated approach enabled a comprehensive evaluation of spending patterns and performance variation, revealing clusters of efficient, moderately efficient, and inefficient institutions within the Health Services Division. These results provided a robust baseline for understanding systemic drivers of resource use and their implications for service delivery outcomes.

The qualitative analysis revealed a complex and layered set of factors influencing allocative efficiency in Bangladesh's public health sector. Stakeholders consistently pointed to fragmentation in budgeting systems, particularly the disconnect between operating and development budgets, which leads to duplication, underutilization, and limited flexibility in responding to local service demands. Budgeting practices remain largely supply-driven, with outdated allocation formulas and static metrics, such as bed counts and staffing norms, failing to reflect current epidemiological needs.

Governance challenges emerged as a central theme. Political interference in financial and staffing decisions, opaque accountability structures, and poor inter-ministerial coordination were cited as major

barriers to effective resource use. Respondents emphasized that rural and underserved areas are disproportionately disadvantaged, with urban centers receiving preferential attention and investment. Planning processes were described as incremental and disconnected from health outcomes, often driven by historical spending patterns or lobbying capacity rather than actual service gaps.

Operational constraints further compound inefficiencies. Procurement systems, though partially digitized, remain slow and misaligned with local needs. Human resource deployment is uneven, with specialist shortages, mismatched roles, and limited strategic oversight. Facility-level managers often lack training in financial management and procurement, and leadership turnover disrupts continuity. Many facilities operate without dedicated budget offices, relying on administrative staff with limited capacity.

Respondents offered a range of reform suggestions to address these challenges. They advocated for demand-driven, performance-based budgeting models, decentralization of authority, and structured career pathways for health professionals. Capacity-building initiatives were recommended for both clinical and non-clinical staff, with particular emphasis on empowering nurses and facility managers. Strengthening primary healthcare, improving multisectoral coordination, and investing in interoperable digital systems were also highlighted as priorities. Underpinning all technical reforms was a call for behavioral change, embedding transparency, ethical leadership, and institutional ownership as core values across the health system.

This study addresses a critical gap by evaluating AE in Bangladesh's health sector, identifying systemic and operational barriers, and offering targeted policy recommendations. The findings aim to inform more strategic and equitable public health investments, ultimately enhancing the effectiveness of service delivery and population outcomes. Taken together, these insights underscore that improving allocative efficiency is not simply a matter of reallocating funds, but of reimagining how decisions are made, who makes them, and how institutions respond to the needs of the communities they serve.

Chapter 7: Future Research Scope

The findings of this study lay a strong empirical and conceptual foundation for understanding allocative efficiency in Bangladesh's public health sector. However, several critical gaps remain that warrant further investigation. Future research should focus on deepening causal understanding, expanding data coverage, and developing actionable tools to inform policy and planning. The following directions outline a forward-looking research agenda aimed at strengthening efficiency, equity, and responsiveness in the health system.

First, future studies should move beyond descriptive efficiency measurement toward identifying causal drivers of allocative efficiency. This requires examining how changes in budget flexibility, procurement autonomy, and workforce deployment directly influence efficiency outcomes. Employing quasi-experimental and longitudinal approaches such as difference-in-differences, event studies, or synthetic control methods can provide robust causal evidence. Such analyses should draw on integrated administrative datasets, including iBAS++ expenditure records, e-GP procurement logs, and DHIS2 service outputs, to capture both financial and performance dimensions over time.

Second, there is an urgent need to link micro-level spending with patient outcomes. Current analyses rely heavily on secondary, aggregated data and omit quality-of-care and patient-experience dimensions. Future research should incorporate patient-level data to evaluate the marginal productivity of spending on specific health services such as maternal, neonatal, and non-communicable disease programs. Including clinical quality indicators, waiting times, and patient satisfaction measures would offer a more holistic understanding of efficiency and service effectiveness.

Third, procurement efficiency and supply-chain dynamics merit deeper exploration. Despite the positive impact of e-GP systems on transparency, significant inefficiencies persist in medicine distribution and inventory management. Comparative studies of centralized versus decentralized procurement models could clarify which arrangements yield better value for money and service continuity. Analytical designs such as instrumental-variable regressions or portfolio analyses can quantify differences in price variation, stockout frequency, and lead times across facilities.

Fourth, workforce optimization and deployment remain key determinants of allocative efficiency. Research should assess the cost-effectiveness of alternative staffing configurations, team-based service models, and task-sharing strategies. Operations research simulations and longitudinal workforce tracking could guide evidence-based posting and retention policies. In addition, specialized training and structured career pathways for health managers, nurses, and technical officers should be evaluated for their impact on both service quality and spending efficiency.

Fifth, the classification of districts into efficiency profiles through latent profile analysis (LPA) offers new opportunities for targeted interventions. Future work should validate these classifications across larger datasets and test profile-specific reform models, for instance, introducing volatility buffers for unstable districts and innovation grants for improving ones.

Seventh, future studies should strengthen the equity and community perspectives in efficiency measurement. Incorporating patient-reported outcomes and experience measures (PROMs and PREMs) into efficiency analyses will ensure that allocative decisions reflect user needs and social justice principles. Participatory approaches, such as community scorecards or citizen feedback mechanisms, can enhance accountability and improve the responsiveness of budget planning.

In summary, advancing allocative efficiency research in Bangladesh requires integrating causal inference, microdata analysis, and participatory governance. Future studies should focus on transforming empirical evidence into decision-support systems, such as data dashboards or simulation tools, that enable policymakers to allocate resources dynamically and equitably. Such evidence-driven reform will help build a health system that is not only cost-effective but also adaptive, transparent, and aligned with the needs of all citizens.

References

Abel, A. B., Mankiw, N. G., Summers, L. H., & Zeckhauser, R. J. (1989). Assessing Dynamic Efficiency: Theory and Evidence. The Review of Economic Studies, 56(1), 1–19. https://doi.org/10.2307/2297746

Adams, A. M., Ahmed, T., El Arifeen, S., Evans, T. G., Huda, T., & Reichenbach, L. (2013). Innovation for universal health coverage in Bangladesh: a call to action. *The Lancet, 382(9910),* 2104–2111.

Ahmed, M. (2022). Unequal access to health care facilities and its impact on achieving Sustainable Development Goals: Bangladesh perspective. *Jurnalul Practicilor Comunitare Pozitive, 22(2),* 120144.

Agarwal, S., Sripad, P., Johnson, C., Kirk, K., Bellows, B., Ana, J., Blaser, V., Kumar, M. B., Buchholz, K., Casseus, A., Chen, N., Dini, H., Deussom, R., Jacobstein, D., Kintu, R., Kureshy, N., Meoli, L., Otiso, L., Pakenham-Walsh, N., … Warren, C. (2019). A conceptual framework for measuring community health workforce performance within primary health care systems. *Human Resources for Health, 17.* https://doi.org/10.1186/s12960-019-0422-0

Ahmed, S., Ahmed, M. W., Hasan, M. Z., Mehdi, G. G., Islam, Z., Rehnberg, C., Niessen, L. W., & Khan, J. A. M. (2022). Assessing the incidence of catastrophic health expenditure and impoverishment from out-of-pocket payments and their determinants in Bangladesh: evidence from the nationwide Household Income and Expenditure Survey 2016. International Health, 14(1), 84–96. https://doi.org/10.1093/inthealth/ihab015

Ahmed, S., Begum, T., & Smith, O. (2019). Diagnostic Study of Public Financial Management. *Diagnostic Study of Public Financial Management, April.* https://doi.org/10.1596/31768

Ahmed, S., Hasan, M. Z., Laokri, S., Jannat, Z., Ahmed, M. W., Dorin, F., Vargas, V., & Khan, J. A. M. (2019). Technical efficiency of public district hospitals in Bangladesh: A data envelopment analysis. *Cost Effectiveness and Resource Allocation, 17(1),* 1–10. https://doi.org/10.1186/s12962-019-0183-6

Ahmed, S., Hasan, M. Z., MacLennan, M., Dorin, F., Ahmed, M. W., Hasan, M. M., Hasan, S. M., Islam, M. T., & Khan, J. A. M. (2019). Measuring the efficiency of health systems in Asia: a data envelopment analysis. *BMJ Open, 9(3),* e022155. https://doi.org/10.1136/bmjopen-2018-022155

Akhter, N. (2021). Enduring Response in Embracing Urgency in Community Care: A Critical Perspective On Social Empowerment of Bangladesh. *Academia Letters.* https://doi.org/10.20935/AL593

Ali, M. A. (2020). Healthcare Services in Bangladesh: Revisiting the Existing Regulatory Framework. *Southeast University Journal of Arts and Social Sciences, 3(2),* 131–147.

Arnold, M., & Artz, M. (2018). The Use of a Single Budget or Separate Budgets for Planning and Performance Evaluation. *2.7. Budgets for Performance Evaluations.* https://doi.org/10.2139/ssrn.2823350

Arsenault, C., Gage, A., Kim, M. K., Kapoor, N., Akweongo, P., Amponsah, F., Aryal, A., Asai, D., Awoonor-Williams, J., Ayele, W., Bedregal, P., Doubova, S., Dulal, M., Gadeka, D., Gordon-Strachan, G., Mariam., D., Hensman, D., Joseph, J. P., Kaewkamjornchai, P., … Kruk, M. (2022). COVID-19 and resilience of healthcare systems in ten countries. *Nature Medicine*, *28*, 1314–1324. https://doi.org/10.1038/s41591-022-01750-1

Asandului, L., Roman, M., & Fatulescu, P. (2014). The Efficiency of Healthcare Systems in Europe: A Data Envelopment Analysis Approach. *Procedia Economics and Finance, 10(14),* 261–268. https://doi.org/10.1016/s2212-5671(14)00301-3

Asian Development Bank ADB. (2021). Bangladesh: COVID-19 Response Emergency Assistance Project. Manila: Asian Development Bank.

Ayodimeji-Alaba, H., Balogun, A. K., Shodimu, O. A., Adebayo, K. T., & Udokporo, C. F. (2025). Transforming healthcare delivery through strategic procurement and business management in medicare and medicaid-focused institutions. *International Journal of Science and Research Archive.* https://doi.org/10.30574/ijsra.2025.14.1.0286

Bajaro, D. F., Jinjarak, Y., Myoda, Y., Park, D., & Quising, P. (2023). Health Spending Efficiency in Developing Asia. https://doi.org/10.22617/WPS230471-2

Bangladesh Planning Commission. (2020). *Eighth Five Year Plan (July 2020-June 2025)*. General Economics Division (GED), Bangladesh Planning Commission, Government of the People's Republic of Bangladesh. https://plancomm.gov.bd/site/files/8ec347dc-4926-4802-a839-7569897e1a7a/8th-Five-Year-Plan

Banker, R., Charnes, A., Cooper, W. W., Swarts, J., & Thomas, D. A. (1989). An Introduction to Data Envelopment Analysis with Some of Ist Models and Their Uses. *Research in Governmental and Nonprofit Accounting: A Research Annual, 5,* 125–163.

Baumann, A. (2021). Health Reforms Should Focus on Improving Services and Systems, Not Just Containing Costs. *International Journal of Public Health, 66.* https://doi.org/10.3389/ijph.2021.1604332

Billah SM, Raihana S, Ali NB, Iqbal A, Rahman MM, Khan ANS, Karim F, Karim MA, Hassan A, Jackson B, Walker N, Hossain MA, Sarker S, Black RE, El Arifeen S. Bangladesh: a success case in combating childhood diarrhoea. J Glob Health. 2019 Dec;9(2):020803. doi: 10.7189/jogh.09.020803. PMID: 31673347; PMCID: PMC6816141.

Binyaruka, P., & Anselmi, L. (2020). Understanding efficiency and the effect of pay-for-performance across health facilities in Tanzania. *BMJ Global Health*, *5*. https://doi.org/10.1136/bmjgh-2020-002326

Biswas, T. K., Sujon, H., Rahman, M. H., Perry, H. B., & Chowdhury, M. E. (2019). Quality of maternal and newborn healthcare services in two public hospitals of Bangladesh: identifying gaps and provisions for improvement. *BMC Pregnancy and Childbirth, 19(1),* 488. https://doi.org/10.1186/s12884-019-2656-1

Bose, B. (2021). A Guide to Assessing the Efficiency of Health Systems.

Chai, P., Wan, Q., & Kinfu, Y. (2021). Efficiency and productivity of health systems in prevention and control of non-communicable diseases in China, 2008–2015. *The European Journal of Health Economics,* 1–13. https://doi.org/10.1007/s10198-020-01251-3

Chansa, C., Sundewall, J., Mcintyre, D., Tomson, G., & Forsberg, B. (2008). Exploring SWAp's contribution to the efficient allocation and use of resources in the health sector in Zambia. *Health Policy and Planning, 23(4),* 244–251. https://doi.org/10.1093/heapol/czn013

Dar, K., & Raina, S. H. (2024). Public healthcare efficiency in India: Estimates and determinants using two stage DEA approach. *Evaluation and Program Planning, 106,* 102472. https://doi.org/10.1016/j.evalprogplan.2024.102472

Directorate General of Health Services (DGHS). (2023). *DGHS Health Bulletin 2021*. https://old.dghs.gov.bd/index.php/en/publications/health-bulletin/dghs-health-bulletin

D Dhaoui, I. (2019). Healthcare system efficiency and its determinants: A two-stage Data Envelopment Analysis (DEA) from MENA countries. https://consensus.app/papers/healthcare-system-efficiency-and-its-determinants-a-dhaoui/e028e53af05451f8abbe9d43dd618e5f/

Dodd, M., Ivers, R., Zwi, A. B., Rahman, A., & Jagnoor, J. (2019). Investigating the process of evidence informed health policymaking in Bangladesh: a systematic review. *Health Policy and Planning, 34(6),* 469–478. https://doi.org/10.1093/heapol/czz044

Economics, A. D. B., & Series, W. P. (2023). Health Spending Efficiency In Adb Economics. 699.

Et. al., N. A. (2021). Forecasting the Patterns and Trends in Age-Specific Fertility in South Asia. *Turkish Journal of Computer and Mathematics Education (TURCOMAT), 12(8),* 2595–2600. https://doi.org/10.17762/turcomat.v12i8.3821

Evans, D. B., Tandon, A., Murray, C. J. L., & Lauer, J. A. (2000). The comparative efficiency of National of Health Systems in producing health: An analysis of 191 countries. *World Health Organization, 29(29),* 1–36.

Fahim, S. M., Bhuayan, T. A., Hassan, Md. Z., Abid Zafr, A. H., Begum, F., Rahman, Md. M., & Alam, S. (2019). Financing health care in Bangladesh: Policy responses and challenges towards achieving universal health coverage. The International Journal of Health Planning and Management, 34(1). https://doi.org/10.1002/hpm.2666

Fard, M. K., Eftekhar, M., & Papier, F. (2019). An Approach for Managing Operating Assets for Humanitarian Development Programs. *Production and Operations Management*, *28*, 2132–2151. https://doi.org/10.1111/poms.13028

Färe, R., Grosskopf, S., & Lovell, C. A. K. (2013). The Measurement of Efficiency of Production. In Google Books. Springer Science & Business Media.

Farrell, M. J. (1957). The Measurement of Productive Efficiency. Journal of the Royal Statistical Society. Series a (General), 120(3), 253–290. https://doi.org/10.2307/2343100

Fardoush, Z. (2020). Impact of Public Spending on the Quality of Life in Rural Bangladesh. *Advances in Social Sciences Research Journal*, *7*, 47–61. https://doi.org/10.14738/assrj.74.8067

Fraser-Hurt, N., Hou, X., Wilkinson, T., Duran, D., Jaoude, G. A., Skordis, J., Chukwuma, A., Pena, C. L., Matala, O. T., Gorgens, M., & Wilson, D. (2021). Using allocative efficiency analysis to inform health benefits package design for progressing towards Universal Health Coverage: Proof-of-concept studies in countries seeking decision support. *PLoS ONE*, *16*. https://doi.org/10.1371/journal.pone.0260247

General Economics Division (GED). (2021). *Perspective Plan of Bangladesh, Bangladesh Planning Commission, Ministry of Planning, Government of the People's Republic of*

Bangladesh. http://oldweb.lged.gov.bd/UploadedDocument/UnitPublication/1/1049/vision 2021-2041.pdf

Gong, C., & Kang, H. (2023). Resource Allocation Efficiency of Urban Medical and Health Financial Expenditure Under the Background of Employees' Health. *Risk Management and Healthcare Policy*, *16*, 1059–1074. https://doi.org/10.2147/RMHP.S412514

Guo, X., Zhang, J., Xu, Z., Cong, X., & Zhu, Z. (2021). The efficiency of provincial government health care expenditure after China's new health care reform. *PLoS ONE*, *16*. https://doi.org/10.1371/journal.pone.0258274

Government of Bangladesh (2020). COVID-19 Preparedness and Response Plan for Bangladesh. Directorate General of Health Services (DGHS), Ministry of Health and Family Welfare. Dhaka.

Grifell-Tatjé, E., Lovell, C. K., & Sickles, R. C. (2018). Overview of Productivity Analysis. In *The Oxford Handbook of Productivity Analysis* (pp. 3-73). Oxford University Press.

Gurley, N., Ebeling, E., Bennett, A., Kashondo, J.-J. K., Ogawa, V., Couteau, C., Felten, C., Gomanie, N., Irungu, P., Shelley, K., & Shearer, J. (2021). National policy responses to maintain essential health services during the COVID-19 pandemic. *Bulletin of the World Health Organization*, *100*, 168–170. https://doi.org/10.2471/blt.21.286852

Gwatkin, D. (2001). The need for equity-oriented health sector reforms. *International Journal of Epidemiology*, *30 4*, 720–723. https://doi.org/10.1093/IJE/30.4.720

Gyrd-Hansen, D. (2014). Efficiency in Health Care, Concepts of (A. J. Culyer, Ed.; pp. 267–271). Elsevier.

Hamid, S. A. (n.d.). Financing Health Care When Social Health Insurance is not an Option. 1–27.

Haynes, K. E., & Dinc, M. (2005). Data Envelopment Analysis (DEA). In K. Kempf-Leonard (Ed.), Encyclopedia of Social Measurement (pp. 609–616). Elsevier. https://doi.org/https://doi.org/10.1016/B0-12-369398-5/00348-0

Hazarika, I. (2013). Health workforce in Bangladesh: shortage, maldistribution, and innovative solutions. *Health Policy and Planning, 28(3),* 325–333. https://doi.org/10.1093/heapol/czs051

Health Economics Unit, Ministry of Health & Family Welfare. (2012). *Expanding Social Protection for Health Towards Universal Coverage Health Care Financing Strategy 2012-2032 Health Economics Unit*. http://oldweb.heu.gov.bd/pdf/Health Care Financing Strategy 2012-2032.pdf

Helwa, L. A. F., & Rima, H. (2024). Efficiency of Health Expenditure in Organization of Islamic Cooperation (OIC) Countries: A Data Envelopment Analysis Approach. *Jurnal Ilmu Ekonomi Dan Pembangunan*. https://doi.org/10.20961/jiep.v24i2.93080

Hicks, J. R. (1939). The Foundations of Welfare Economics. The Economic Journal, 49(196), 696–712. https://doi.org/10.2307/2225023

Hooda, S. K. (2022). Technical Efficiency of Healthcare System in India: An Analysis by Data Envelopment Approach. *Journal of Health Management, 24(2),* 253–267. https://doi.org/10.1177/09720634221099360

Hu, H. C., Lee, Y. H., Yen, G. F., & Lan, S. L. (2020). The efficiency of regional public hospitals in Taiwan: Measurement and policy implications. *Health Policy and Technology, 9(1),* 65–72. https://doi.org/10.1016/j.hlpt.2019.11.004

Huda, T. M., Khan, J., Ahsan, K. Z., Jamil, K., El Arifeen, S., & Pettigrew, J. (2018). Monitoring and evaluating progress towards Universal Health Coverage in Bangladesh. *PLOS Medicine, 15(8),* e100223. https://doi.org/10.1371/journal.pmed.100223

Islam, S., Islam, R., Mannan, F., Rahman, S., & Islam, T. (2020). COVID-19 pandemic: An analysis of the healthcare, social and economic challenges in Bangladesh. Progress in Disaster Science, 8, 100135. https://doi.org/10.1016/j.pdisas.2020.100135

Islam, A., & Biswas, T. (2014). Health System in Bangladesh: Challenges and Opportunities. *American Journal of Health Research, 2(6),* 366. https://doi.org/10.11648/j.ajhr.20140206.18

Islam, R., & Hossain, M. N. (2016). Managerial Efficiency of the Upazila Health Complexes in Bangladesh: A Stochastic Frontier Analysis. *Medeniyet Medical Journal, 31(3),* 153–160. https://doi.org/10.5222/MMJ.2016.153

Jaba, E., Balan, C. B., & Robu, I. B. (2014). The efficiency of healthcare systems in Europe: A data envelopment analysis approach. *Procedia Economics and Finance, 10(14),* 261–268. https://doi.org/10.1016/s2212-5671(14)00301-3

Jahan, F., Ahmed, A., Mohsin, F. Md., Rahman, S., Sayeed, A., Nahar, L., & Mitra, D. K. (2023). Changes in the readiness of healthcare systems to provide diabetes- and cardiovascular disease-related services: A comparison of indices using data from the 2014 and 2017 Bangladesh Health Facility Surveys. F1000Research, 12, 898. https://doi.org/10.12688/f1000research.138772.1

Jakovljevic, M., Sugahara, T., Timofeyev, Y., & Rancic, N. (2020). Predictors of (in) efficiencies of Healthcare Expenditure Among the Leading Asian Economies – Comparison of OECD and non-OECD Nations. *Risk Management and Healthcare Policy, 13,* 2261–2280. https://doi.org/10.2147/RMHP.S266386

Jannat, Z., Khan, J. A. M., Haider, M. R., Ahmed, S., Sarker, A. R., Islam, Z., Papir, C., & Hasan, M. Z. (2023). Technical efficiency of Upazila Health Complexes in Bangladesh: Results from two data envelopment analyses. *Frontiers in Public Health, 11,* 1145683. https://doi.org/10.3389/fpubh.2023.1145683

Jibir, A., Bello, A., & Amos, A. (2024). Assessment of Public Spending Efficiency of Health and Education in Nigeria. *Lapai Journal of Economics*. https://doi.org/10.4314/lje.v8i1.2

Jithitikulchai, T. (2022). Improving allocative efficiency from network consolidation: a solution for the health workforce shortage. *Human Resources for Health*, *20*. https://doi.org/10.1186/s12960-022-00732-1

Joarder, T., Chaudhury, T. Z., & Mannan, I. (2019). Universal Health Coverage in Bangladesh: Activities, Challenges, and Suggestions. Advances in Public Health, 2019, 1–12. https://doi.org/10.1155/2019/4954095

Joumard, I., André, C., & Nicq, C. (2010). Health care systems: Efficiency and institutions. *OECD Economics Department Working Papers.* https://doi.org/10.1787/5kmfp51f5f9t-en

Kabir, A., Karim, M. N., & Billah, B. (2022). Health system challenges and opportunities in organizing non-communicable diseases services delivery at primary healthcare level in Bangladesh: A qualitative study. Frontiers in Public Health, 10. https://doi.org/10.3389/fpubh.2022.1015245

Kakeman, E., Rasekh, H. R., Arabloo, J., & Harirchi, I. (2016). Health care system efficiency in Iran: A data envelopment analysis in different regions. *Iranian Journal of Public Health, 45(2),* 199–207.

Kamaruddin, N., Hamid, S. A., & Masdek, N. R. (2019). Technical efficiency of public district hospitals in Malaysia. *The International Journal of Social Sciences and Humanities Invention, 6(10).* https://doi.org/10.18535/ijsshi/v6i10.04

Khan, J. A. M., Ahmed, S., Evans, T. G., & Anand, S. (2018). Macroeconomic Determinants of Health Care Expenditure: A Two-Stage Data Envelopment Analysis of Asian Countries. *Health Systems & Reform, 4(2),* 114–124. https://doi.org/10.1080/23288604.2018.1447342

Khan, J. A. M., & Mahumud, R. A. (2015). Is Healthcare a "Necessity" or "Luxury"? An Empirical Evidence from Public and Private Sector Analyses of South-East Asian Countries. *Health Economics Review, 5(1),* 1–12. https://doi.org/10.1186/s13561-015-0079-8

Khan, J. A. M., Mehdi, G. G., Sarker, A. R., & Sikder, M. J. U. (2018). Equity in Health Care Financing in Bangladesh: Who Pays More? *International Journal of Health Economics and Management, 18,* 387–406. https://doi.org/10.1007/s10754-018-9237-4

Kedziora, D., Stuart, R., Pearson, J., Latypov, A., Dierst-Davies, R., Duda, M., Avaliani, N., Wilson, D., & Kerr, C. (2019). Optimal allocation of HIV resources among geographical regions. *BMC Public Health*, *19*. https://doi.org/10.1186/s12889-019-7681-5

Klein, B., & Meckling, W. (1958). Application of Operations Research to Development Decisions. *Operations Research*, *6*, 352–363. https://doi.org/10.1287/OPRE.6.3.352

Kounetas, K., & Papathanassopoulos, F. (2009). How efficient are Greek hospitals? A case study using a double bootstrap DEA approach. *The European Journal of Health Economics, 10,* 335–345. https://doi.org/10.1007/s10198-008-0136-8

Kumar, S., Ghodeswar, B. M., & Jagdale, S. (2018). Developing sustainable healthcare systems in developing countries: Examining the role of innovative business models. *Journal of Health Management, 20(1),* 38–52. https://doi.org/10.1177/0972063417747696

Kumbhakar, S. C., Wang, H. J., & Horncastle, A. P. (2015). *A Practitioner's Guide to Stochastic Frontier Analysis Using Stata.* Cambridge University Press.

Lam, D. (2021). Reduced fertility from better access to contraception may not improve women's health. *Proceedings of the National Academy of Sciences*, *118*(29). https://doi.org/10.1073/pnas.2110170118

Langarizadeh, M., Fallahnezhad, M., & Vahabzadeh, A. (2024). Key performance indicators of hospital supply chain: a systematic review. *BMC Health Services Research*, *24*. https://doi.org/10.1186/s12913-024-11954-5

Lim, B., Lee, K., & Lee, C. (2016). Free Disposal Hull (FDH) analysis for efficiency measurement: An update to DEA. *The Stata Journal*, *10*(2), 1-8.

Lim, B., Lee, K., & Lee, C. (2001). Free Disposal Hull (FDH) Analysis for Efficiency Measurement: An update to dea. *The Stata Journal (Yyyy) vv, Number Ii*, *ii*, 1–8.

Liu, Q., & Guo, Y. (2023). Regional differences of individual and allocation efficiencies of health resources in China. *Frontiers in Public Health*, *11*. https://doi.org/10.3389/fpubh.2023.1306148

Madden, D., & Nolan, A. (2007). Performance assessment in the health sector. In *Oxford Review of Economic Policy* (Vol. 23, Issue 2, pp. 250–269). https://doi.org/10.1093/oxrep/grm014

Majeed, M. T., & Zainab, A. (2016). Efficiency of Health Care System in SAARC Countries. *Pakistan Journal of Social Sciences (PJSS), 36(2),* 1133–1146.

Mamun, T., Abdur, R. M., Hassan, M. S., Amin, M. Bin, & Ol'ah, J. (2025). *Public Sector Efficiency in Delivering Social Services and Its Impact on Human Development: A Comparative Study of Healthcare and Education Spending in India, Pakistan, and Bangladesh*. https://consensus.app/papers/public-sector-efficiency-in-delivering-social-services-olah-hassan/8c53191e172a5b91800ba549322848ca/

Mangahas, F. T., Caisip, A. F., Dela Cruz, D. C., Dumaguing, R. B., & Villacorte, D. P. (2021). Analyzing the efficiency of national healthcare systems of Asian countries: A two-stage data envelopment analysis. *Journal of Asian Finance, Economics and Business, 8(2),* 757–766. https://doi.org/10.13106/jafeb.2021.vol8.no2.0757

Masiye, F. (2007). Investigating health system performance: An application of data envelopment analysis to Zambian hospitals. *BMC Health Services Research, 7(1),* 58. https://doi.org/10.1186/1472-6963-7-58

Mashi, F., & Onovae, J. (2022). Exploring the impact of budgeting on healthcare service delivery in Nigeria. *Journal of Economic Policy Researches, 9(1),* 41–60.

Matin, Md. Z., Sharmin, S., Kim, M., Sayem, A., Rahman, F., Abdullah, A. S. M., Sheikh, S. P., Khan, M. I., & Halim, M. (2023). Role of health system strengthening (HSS) in reducing neonatal mortality in Bangladesh: A document review. F1000Research, 12, 412. https://doi.org/10.12688/f1000research.133251.1

Mbau, R., Musiega, A., Nyawira, L., Tsofa, B., Mulwa, A., Molyneux, S., Maina, I., Jemutai, J., Normand, C., Hanson, K., & Barasa, E. (2022). Analysing the Efficiency of Health Systems: A Systematic Review of the Literature. *Applied Health Economics and Health Policy*, *21*, 205–224. https://doi.org/10.1007/s40258-022-00785-2

Mckay, G., & Parker, M. (2016). LSHTM Research Online Epidemics. *ResearchOnline*, *38*(1), 81–95.

Medeiros, J., & Schwierz, C. (2013). Estimating the drivers and efficiency of public spending in healthcare. *European Economy, Economic Papers 2013.*

Meng, N., Shen, K., Zheng, X., Li, C., Lin, X., Pei, T., Wu, D., & Meng, X. (2024). Spatial effects of township health centers' health resource allocation efficiency in China. Frontiers in Public Health, 12. https://doi.org/10.3389/fpubh.2024.1420867

Mills, A. (1997). Improving the efficiency of public sector health services in developing countries: bureaucratic versus market approaches. Marketizing Education and Health in Developing Countries: Miracle or Mirage, 17, 245–74

Mirmirani, S., & Li, H. C. (2014). Health care system efficiency analysis of G20 countries by using DEA model. *International Business & Economics Research Journal (IBER), 13(5),* 1107–1114. https://doi.org/10.19030/iber.v13i5.8687

Mitchell, A. D., Bossert, T. J., & Yip, W. (2018). Lessons from Hong Kong for using financial incentives to reform public hospitals. *Health Systems & Reform, 4(1),* 70–79. https://doi.org/10.1080/23288604.2017.1411179

MOHFW (Ministry of Health & Family Welfare). (2012). *National Health Policy 2011*. http://www.mohfw.gov.bd/index.php?option=com_content&view=article&id=74&Itemid=92

Mobarak, A. M., & Rajkumar, A. S. (2001). The Political Economy of Health Care in Bangladesh: Policy Reform in Developing Countries.

Moscelli, G., Gravelle, H., Siciliani, L., & Gutacker, N. (2018). The effect of hospital ownership on quality of care: Evidence from England. *Journal of Economic Behavior & Organization, 153,* 322–344. https://doi.org/10.1016/j.jebo.2018.06.011

Murray, C. (1995). Toward an analytical approach to health sector reform. *Health Policy*, *32 1-3*, 93–109. https://doi.org/10.1016/0168-8510(95)00729-C

Murshid, Munzur; Haque, Mainul (2020),. Hits and misses of Bangladesh National Health Policy 2011. Journal of Pharmacy and Bioallied Sciences 12(2):p 83-93, Apr–Jun 2020. | DOI: 10.4103/jpbs.JPBS_236_19

Mustafa, K. S., & Rizov, M. (2022). Efficiency of Health Systems in South and Southeast Asia: A DEA analysis. *Applied Economics, 54(42),* 4890–4907. https://doi.org/10.1080/00036846.2022.2064859

Mutizwa-Mangiza, D. (1998). The impact of health sector reform on public sector health worker motivation in Zimbabwe. *Health Policy and Planning, 13(2),* 132–137. https://doi.org/10.1093/heapol/13.2.132

Nabilou, B., Yusefzadeh, H., & Rezapour, A. (2016). The efficiency of social security hospitals in Iran: An application of a combined approach of data envelopment analysis and ratio analysis. *Iranian Journal of Public Health, 45(1),* 122–130.

Nabyonga-Orem, J., Christmal, C., Addai, K. F., Mwinga, K., Aidam, K., Nachinab, G., Namuli, S., & Asamani, J. A. (2023). The state and significant drivers of health systems efficiency in Africa: A systematic review and meta-analysis. Journal of Global Health, 13, 04131. https://doi.org/10.7189/jogh.13.04131

National Institute of Population Research and Training (NIPORT), Medical Education and Family Welfare Division, Ministry of Health and Family Welfare, & ICF. (2024). *Bangladesh Demographic and Health Survey 2022: Final Report*. NIPORT and ICF. https://www.dhsprogram.com/pubs/pdf/FR386/FR386.pdf

Neri, M., Cubi-Molla, P., & Cookson, G. (2022). Approaches to Measure Efficiency in Primary Care: A Systematic Literature Review. Applied Health Economics and Health Policy, 20(1), 19–33. https://doi.org/10.1007/s40258-021-00669-x

Nippert, K. (2022). The evolution of health systems in the United States: A historical perspective. *Journal of Health Systems Research, 34(2),* 145–162.

Novignon, J., & Lawanson, A. O. (2017). Efficiency of healthcare systems in Sub-Saharan Africa: A comparative analysis of stochastic frontier analysis and data envelopment analysis. *Health Economics Review, 7(1),* 1–13. https://doi.org/10.1186/s13561-017-0159-z

Nyakure, B. O., & Kavale, S. (2022). STRATEGIC RESOURCE ALLOCATION AND PERFORMANCE OF PUBLIC HEALTH REFERRAL FACILITIES IN MOMBASA COUNTY. *Strategic Journal of Business & Change Management*. https://doi.org/10.61426/sjbcm.v9i4.2458

Nyawira, L., Njuguna, R. G., Tsofa, B., Musiega, A., Munywoki, J., Hanson, K., Mulwa, A., Molyneux, S., Maina, I., Normand, C., Jemutai, J., & Barasa, E. (2023). Examining the influence of health sector coordination on the efficiency of county health systems in Kenya. *BMC Health Services Research*, *23*(1), 351–362. https://doi.org/10.1186/s12913-023-09344-4

O'Donnell, O., van Doorslaer, E., Rannan-Eliya, R. P., Somanathan, A., Adhikari, S. R., Harbianto, D., Garg, C. C., Hanvoravongchai, P., Huq, M. N., Karan, A., Leung, G. M., Ng, C. W., Pande, B. R., Tin, K., Tisayaticom, K., Trisnantoro, L., Zhang, Y., & Zhao, Y. (2007). The incidence of public spending on healthcare: Comparative evidence from Asia. World Bank Economic Review, 21(1), 93–123. https://doi.org/10.1093/wber/lhl009

Ogloblin, C., & Brock, G. (2003). The socioeconomic determinants of health in transition economies. *Economics of Transition, 11(1),* 205–235. https://doi.org/10.1111/1468-0351.00144

Oral, M., & Yolalan, R. (1990). An empirical study on measuring operating efficiency and profitability of bank branches. *European Journal of Operational Research, 46(3),* 282–294. https://doi.org/10.1016/0377-2217(90)90002-Q

Or, Z., & Wang, J. (2018). The effects of hospital ownership and input mix on hospital productivity in China. *Health Economics, 27(3),* 471–487. https://doi.org/10.1002/hec.3609

Ozcan, Y. A. (2014). *Health Care Benchmarking and Performance Evaluation: An Assessment using Data Envelopment Analysis.* Springer.

Ozcan, Y. A., & Khushalani, J. (2017). Assessing efficiency of public health and medical care provision: Data envelopment analysis approach. *Health Services Management Research, 30(2),* 67–74. https://doi.org/10.1177/0951484817697594

Pahwa, P., Kumar, A., & Thakur, R. (2021). Health care system efficiency in BRICS countries: DEA based analysis. *International Journal of Health Care Quality Assurance, 34(4),* 362–373. https://doi.org/10.1108/IJHCQA-03-2020-0053

Papanicolas, I., & Smith, P. C. (2014). Theory of System Level Efficiency in Health Care. In A. J. Culyer (Ed.), *Encyclopedia of Health Economics* (pp. 386–394). Elsevier. https://doi.org/https://doi.org/10.1016/B978-0-12-375678-7.00203-0

Palmer, S., & Torgerson, D. J. (1999). Economics notes: Definitions of efficiency. BMJ, 318(7191), 1136. https://doi.org/10.1136/bmj.318.7191.1136

Paris, V., Devaux, M., & Wei, L. (2010). Health systems institutional characteristics: A survey of 29 OECD countries. *OECD Health Working Papers.* https://doi.org/10.1787/5kmfxfq9qbnr-en

Parkin, D., & Hollingsworth, B. (1997). Measuring production efficiency of acute hospitals in Scotland, 1991–94: Validity issues in data envelopment analysis. *Applied Economics, 29(11),* 1425–1433. https://doi.org/10.1080/00036849700000029

Patz, R., & Goetz, K. (2019). UNESCO: Between Sectoral Fragmentation and Budget Crisis. *Managing Money and Discord in the UN*. https://doi.org/10.1093/OSO/9780198838333.003.0007

Paul, A., & Chawla, M. (2017). Assessing hospital performance in India using DEA. *Journal of Health Management, 19(1),* 1–12. https://doi.org/10.1177/0972063416682570

Piabuo, S. M., & Tieguhong, J. C. (2017). Health expenditure and economic growth – A review of the literature and an analysis between the economic community for central African states (CEMAC) and selected African countries. *Health Economics Review, 7(1),* 23. https://doi.org/10.1186/s13561-017-0159-1

Prinja, S., Jeet, G., & Kumar, R. (2012). Validity of self-reported morbidity. *Asian Pacific Journal of Public Health, 24(2),* 263–272. https://doi.org/10.1177/1010539510394868

Radinmanesh, M., Azar, F. E., Hashjin, A. A., Najafi, B., & Majdzadeh, R. (2021). A review of appropriate indicators for need-based financial resource allocation in health systems. *BMC Health Services Research*, *21*. https://doi.org/10.1186/s12913-021-06522-0

Rahman, H. Z., & Ahmed, N. (2019). Strategy on Public Financial Management Reforms in Bangladesh: 2016–2021. *BIGD Working Paper.*

Rahman, M. M., Robbani, M. G., & Islam, M. R. (2022). Efficiency of healthcare systems in South Asia: An application of data envelopment analysis. *International Journal of Health Planning and Management, 37(6),* 3143–3156. https://doi.org/10.1002/hpm.3558

Rahman, M. M., & Shamsuddin, A. K. M. (2019). Efficiency of health systems in SAARC countries: A DEA analysis. *Health Policy and Technology, 8(4),* 399–408. https://doi.org/10.1016/j.hlpt.2019.09.004

Ralaidovy, A. (2019). *Efficiency in health ressource allocation: three empirical studies in Eastern Sub-Sahara Africa and Southeast Asia*. https://consensus.app/papers/efficiency-in-health-ressource-allocation-three-ralaidovy/f7571237c0e457e298d5bb823591b1b4/

Ramesh, M., Wu, X., & He, A. J. (2014). Health governance and healthcare reforms in China. *Health Policy and Planning, 29(6),* 663–672. https://doi.org/10.1093/heapol/czt051

Rannan-eliya, R. P., & Somanathan, A. (2003). The Bangladesh health facility efficiency study. *Health Policy Research in South Asia: Building Capacity for Reform*, *12*, 195–226.

Rashid, S. F., Theobald, S., Ozano, K., Akhter, S., & Hasan, A. (2019). From evidence generation to policy formulation and implementation: Addressing barriers to maternal, neonatal and child health services in rural Bangladesh. *Health Research Policy and Systems, 17(1),* 1–11. https://doi.org/10.1186/s12961-019-0440-5

Ravangard, R., Hatam, N., & Teimourizad, A. (2014). Efficiency and productivity in public and private hospitals in Iran: Data envelopment analysis. *HealthMED, 8(10),* 1151–1160.

Rawal, L., Jubayer, S., Choudhury, S. R., Islam, S. M. S., & Abdullah, A. S. (2021). Community health workers for non-communicable diseases prevention and control in Bangladesh: a qualitative study. Global Health Research and Policy, 6(1), 1. https://doi.org/10.1186/s41256-020-00182-z

Roberts, M., Hsiao, W., Berman, P., & Reich, M. (2004). Getting Health Reform Right: A Guide to Improving Performance and Equity. Oxford University Press.

Rogers, H. E., Akiteng, A. R., Mutatina, B., Opio, M., Bangdiwala, S. I., & Slusher, T. M. (2018). Uganda's health system: Improving maternal and neonatal outcomes. *International Journal of Gynecology & Obstetrics, 143(3),* 432–438.

Ross, S. A. (1976). Options and efficiency. The Quarterly Journal of Economics, 90(1), 75-89.

Ruggeri, K., & Nolte, E. (2013). Comparative efficiency of health systems, corrected for selected lifestyle factors. *European Journal of Health Economics, 14(4),* 457–465.

Sachs, J. D. (2012). Achieving universal health coverage in low-income settings. *The Lancet, 380(9845),* 944–947.

Samarasekera, U., & Horton, R. (2017). Improving health in Bangladesh: Innovation, empowerment, and recognition. *The Lancet, 390(10102),* 1670–1671. https://doi.org/10.1016/S0140-6736(17)32678-1

Shahen, M. A., Islam, M. R., & Ahmed, R. (2020). Challenges for Health Care Services in Bangladesh: An Overview. Issue 1 Ser. I, 9(1), 13–24. https://doi.org/10.9790/1959-0901011324

Shariful, M., & Khandakar, A. (2014). Rural Health Care System and Patients' Satisfaction towards Medical Care in Bangladesh: An Empirical Study. *Journal of Business Studies*, *XXXV*(2).

Sattar, M. P. (2021). Health Sector Governance: An Overview of the Legal and Institutional Framework in Bangladesh. *Open Journal of Social Sciences*, *09*(11), 395–414. https://doi.org/10.4236/jss.2021.911027

Schenkman, S., & Bousquat, A. (2024). Intersectional equity in Brazil's remote rural municipalities: the road to efficiency and effectiveness in local health systems. *Frontiers in Public Health*, *12*. https://doi.org/10.3389/fpubh.2024.1401193

Schenkman, S., & Bousquat, A. (2024). Intersectional equity in Brazil's remote rural municipalities: the road to efficiency and effectiveness in local health systems. *Frontiers in Public Health*, *12*. https://doi.org/10.3389/fpubh.2024.1401193

Schick, A. (1999). A contemporary approach to public expenditure management. World Bank Institute, 68(1), 2-11.

Seidman, G., & Atun, R. (2017). Do changes to supply chains and procurement processes yield cost savings and improve availability of pharmaceuticals, vaccines or health products? A systematic review of evidence from low-income and middle-income countries. *BMJ Global Health*, *2*. https://doi.org/10.1136/bmjgh-2016-000243

Sen, A. (1999). Development as Freedom. Oxford University Press.

Sharmin, S., Nurunnabi, A. S. M., Ashique, S. S., Jahan, A., & Begum, M. (2023). Health Literacy: Intervention and Outcome in Child Healthcare in Bangladesh. Community Based Medical Journal, 12(1), 124–128. https://doi.org/10.3329/cbmj.v12i1.64396

Siddiqui, N., & Khandaker, S. (2007). Comparison of Services of Public, Private and Foreign Hospitals from the Perspective of Bangladeshi Patients. *Journal of Health, Population, and Nutrition, 25(2),* 221–230.

Simic, S., Milicevic, M., Matejic, B., Marinkovic, J., & Adams, O. (2010). Do we have primary health care reform? The story of the Republic of Serbia. *Health Policy*, *96 2*, 160–169. https://doi.org/10.1016/j.healthpol.2010.01.015

Sinimole, K. (2019). A Study of Health Expenditure Efficiency in India:A Data Envelopment Analysis. *Artha Vijnana: Journal of The Gokhale Institute of Politics and Economics*, *61*, 175–188. https://doi.org/10.21648/ARTHAVIJ/2019/V61/I2/183614

Smith, P. C., & Street, A. (2005). Measuring the efficiency of public services: the limits of analysis. *Journal of the Royal Statistical Society: Series A (Statistics in Society), 168(2),* 401–417. https://doi.org/10.1111/j.1467-985X.2005.00355.x

Soucat, A., Tandon, A., & Rao, K. D. (2014). Public Health: Universal Health Coverage and Health Systems. In *Disease Control Priorities (3rd Edition, Vol. 9).* Washington, DC: World Bank.

Stefko, R., Gavurova, B., & Kocisova, K. (2018). Healthcare efficiency assessment using DEA analysis in the Slovak Republic. *Health Economics Review*, *8*(1). https://doi.org/10.1186/s13561-018-0191-9

Stiglitz, J. E. (2000). Economics of the Public Sector (3rd ed.). W. W. Norton & Company.

Stuckler, D., Basu, S., McKee, M., & King, L. (2008). Mass privatisation and the post-communist mortality crisis: A cross-national analysis. *The Lancet, 371(9624),* 371–378.

Su, W., Hou, Y., Huang, M., Xu, J., Du, Q., & Wang, P. (2023). Evaluating the efficiency of primary health care institutions in China: an improved three-stage data envelopment analysis approach. BMC Health Services Research, 23. https://doi.org/10.1186/s12913-023-09979-3

Sun, J., Sun, Z., Yang, C., & Shen, Y. (2023). Estimating the Distribution and Convergence of County-level Healthcare Resources Allocative Efficiency in China Based on DEA and Spatial Panel Model. *Inquiry (United States)*, *60*. https://doi.org/10.1177/00469580231178122

Sultana, T., Ahmed, F., & Tareque, M. (2021). An inquiry into the achievements in health outcomes of Bangladesh: role of health expenditure, income, governance and female education. International Journal of Human Rights in Healthcare. https://doi.org/10.1108/IJHRH-02-2021-0027

Sultana, S., Hossain, M., Khan, M., Saha, S. M., Amin, M. R., & Prodhan, M. M. H. (2024). Effects of healthcare spending on public health status: An empirical investigation from Bangladesh. *Heliyon*, *10*. https://doi.org/10.1016/j.heliyon.2024.e24268

Sun, X., Xu, L., Adnan, K., & Luo, Y. (2023). Can Comprehensive Medical Reform Improve the Efficiency of Medical Resource Allocation? Evidence From China. *International Journal of Public Health*, *68*. https://doi.org/10.3389/ijph.2023.1606602

Tandon, A., Murray, C. J. L., Lauer, J. A., & Evans, D. B. (2000). Measuring overall health system performance for 191 countries. *GPE Discussion Paper, No. 30.* World Health Organization.

Tang, C., Luo, Z., & Fang, P. (2017). What determines health system efficiency? A case study of 31 provinces in China. *Global Health Research and Policy, 2(1),* 1–10. https://doi.org/10.1186/s41256-017-0026-5

UNDP. (2015). Human Development Report 2015: Work for Human Development. United Nations Development Programme.

United Nations. (2015). Transforming Our World: The 2030 Agenda for Sustainable Development. *United Nations Resolution A/RES/70/1.*

Van Doorslaer, E., O'Donnell, O., Rannan-Eliya, R. P., Somanathan, A., Adhikari, S. R., Garg, C. C., … Zhao, Y. (2007). Catastrophic payments for health care in Asia. *Health Economics, 16(11),* 1159–1184. https://doi.org/10.1002/hec.1209

Wagstaff, A., & Culyer, A. J. (2012). Four decades of health economics through a bibliometric lens. *Journal of Health Economics, 31(2),* 406–439.

Wilson, D., & Gorgens, M. (2023). Lessons Learned in Using Mathematical Modeling for Priority Setting in Health. *Health Systems & Reform*, *9*. https://doi.org/10.1080/23288604.2024.2357113

WHO. (2000). The World Health Report 2000: Health Systems: Improving Performance. Geneva: World Health Organization.

WHO. (2010). World Health Report: Health systems financing: The path to universal coverage. Geneva: World Health Organization.

WHO. (2021). Global Spending on Health: Weathering the Storm. Geneva: World Health Organization.

World Bank. (2005). Bangladesh: Country Financial Accountability Assessment. *World Bank Report No. 26191-BD.*

World Bank, 2016. Fiscal space for health in Bangladesh: towards universal health coverage (English). Washington, D.C.: World Bank Group. http://documents.worldbank.org/curated/en/268141537541184327

World Bank. (2020). Bangladesh Health Sector Support Project (P160846). Washington, DC: World Bank.

World Bank. (2021). World Development Indicators. Washington, DC: World Bank

Zeitouny, S., Cheung, D., Bremner, K., Pataky, R., Pequeno, P., Matelski, J., Peacock, S., Elisabeth, M., Giudice, D., Lapointe-Shaw, L., Tomlinson, G., Mendlowitz, A., Mulder, C., Tsui, T., Perlis, N., Walker, J., Sander, B., Wong, W., Krahn, M., … Mendlowitz. (2023). The impact of the early COVID-19 pandemic on healthcare system resource use and costs in two provinces in Canada: An interrupted time series analysis. *PLOS ONE*, *18*. https://doi.org/10.1371/journal.pone.0290646

Zeng, W., Musiega, A., Oyasi, J., Di Giorgio, L., Chuma, J., Lu, R., & Ahn, H. (2022). Understanding the performance of county health service delivery in Kenya: a mixed-method analysis. *Health Policy and Planning*, *37*(2), 189–199. https://doi.org/10.1093/heapol/czab129

Zhao, D., Huang, H., Zhang, Y., & Li, S. (2025). Study on the efficiency of health resource allocation in the western region of China–based on three-stage DEA and Tobit regression analysis. *BMC Health Services Research*, *25*. https://doi.org/10.1186/s12913-025-12630-y

Zhou, L., Ampon-Wireko, S., Dauda, L., Xu, X., Antwi, M. O., & Larnyo, E. (2021). Empirical analysis of factors influencing healthcare efficiency among emerging countries. Healthcare (Switzerland), 9(1). https://doi.org/10.3390/healthcare9010031

Annex A

Table A1: List of Indicators

Policy Document	Included health indicators	Common Indicators
Perspective Plan 2041 (2021 to 2041)	1. Life Expectancy (years) 2. Population Growth Rate (%) 3. Maternal Mortality Ratio (MMR) (per 4. 100,000 live births) 5. Infant Mortality Rate (per 1000 live births) 6. Underweight of Under 5 children (6-59 months) (%) 7. Stunting (%) 8. Total Fertility Rate (TFR) (%) 9. Coverage of health insurance (%) 10. Public spending on health (% of GDP)	• Maternal mortality • rate • Child (under-5 and neonatal) mortality rate • Life Expectancy
8th Five-Year Plan (July 2020 to June 2025)	1. Life expectancy at birth 2. Proportion of stunting among under-five children (%) 3. Prevalence of other aspects of malnutrition among children under five 4. proportion of wasting 5. proportion of underweight 6. proportion of overweight 7. Maternal mortality ratio (per 100,000 live births) 8. Proportion of births attended by skilled health personnel 9. Neonatal mortality rate (per 1,000 live births) 10. Infant mortality Rate (per 1,000 live births) 11. Under-five mortality rate (per 1,000 live births) 12. Tuberculosis incidence per 100,000 population 13. Mortality rate attributed to NCDs (cardiovascular disease, cancer, diabetes, or chronic respiratory disease) 14. Proportion of children fully vaccinated by 12 months (%) 15. Proportion of births in health facilities by wealth quintiles (ratio of lowest and highest quintiles) 16. Total Fertility Rate (TFR) 17. Contraceptive Prevalence Rate (%) 18. Proportion of women of reproductive age (aged 15-49 years) who have their need for family planning satisfied with modern methods (%) 19. Adolescent birth rates	

Sustainable Development Goals (SDGs) (2015 to 2030) (Goal 3: Good health and well-being)	**3.1.1** Maternal mortality ratio (less than 70 per 100,000 live births) **3.1.2** Skilled birth attendance **3.2.1:** Under-5 mortality rate (at least as low as 25 per 1,000 live births) **3.2.2:** Neonatal mortality rate (at least as low as 12 per 1,000 live births) **3.3.1:** Number of new HIV infections per 1,000 uninfected population, by sex, age, and key populations **3.3.2:** Tuberculosis incidence per 100,000 population **3.3.3:** Malaria incidence per 1,000 population **3.3.4:** Hepatitis B incidence per 100,000 population **3.3.5:** Number of people requiring interventions against neglected tropical diseases **3.4.1:** Mortality rate attributed to cardiovascular disease, cancer, diabetes or chronic respiratory disease **3.4.2:** Suicide mortality rate **3.5.1:** Coverage of treatment interventions (pharmacological, psychosocial rehabilitation, and aftercare services) for substance use disorders **3.5.2:** Alcohol per capita consumption (aged 15 years and older) within a calendar year in liters of pure alcohol **3.6.1:** Death rate due to road traffic injuries **3.7.1:** Proportion of women of reproductive age (aged 15–49 years) who have their need for family planning satisfied with modern methods **3.7.2:** Adolescent birth rate (aged 10–14 years; aged 15–19 years) per 1,000 women in that age group **3.8.1:** Coverage of essential health services **3.8.2:** Proportion of population with large household expenditures on health as a share of total household expenditure or income **3.9.1:** Mortality rate attributed to household and ambient air pollution **3.9.2:** Mortality rate attributed to unsafe water, unsafe sanitation, and lack of hygiene (exposure to unsafe Water, Sanitation, and Hygiene for All (WASH) services) **3.9.3:** Mortality rate attributed to unintentional poisoning **3.a.1:** Age-standardized prevalence of current tobacco use among persons aged 15 years and older **3.b.1:** Proportion of the target population covered by all vaccines included in their national programme **3.b.2:** Total net official development assistance to medical research and basic health sectors **3.b.3:** Proportion of health facilities that have a core set of relevant essential medicines available and affordable on a sustainable basis **3. c.1:** Health worker density and distribution **3.d.1:** International Health Regulations (IHR) Capacity and Health Emergency Preparedness	

	3.d.2: Percentage of bloodstream infections due to selected antimicrobial-resistant organisms	
National Health Policy 2011	1. One community clinic per 6000 population 2. Prioritizing emergency medical care 3. Reducing maternal and child mortality rate 4. Raising budget allocation in the health sector and per capita medical expenditure to 24 dollar 5. Increasing the ratio of doctors to nurses	

Table A-2: Common Indicators

Included health indicators	Perspective Plan 2041	8th Five-year Plan	Sustainable Development Goals (SDGs)	National Health Policy 2011
Life Expectancy (years)	**ü**	**ü**		
Maternal Mortality Ratio (MMR) (per 100,000 live births)	**ü**	**ü**	**ü**	**ü**
Infant Mortality Rate (per 1000 live births)	**ü**	**ü**		
Underweight of Under 5 children (659 months)	**ü**	**ü**		
Stunting (%)	**ü**	**ü**		
Total Fertility Rate (TFR) (%)	**ü**	**ü**		
Proportion of births attended by skilled health personnel		**ü**	**ü**	
Neonatal mortality rate (per 1,000 live births)		**ü**	**ü**	**ü**
Under-five mortality rate (per 1,000 live births)		**ü**	**ü**	**ü**
Tuberculosis incidence per 100,000 population		**ü**	**ü**	
Mortality rate attributed to NCDs (cardiovascular disease, cancer, diabetes, or chronic respiratory disease)		**ü**	**ü**	
The proportion of women of reproductive age (aged 15-49 years) who have their need for family planning satisfied with modern methods (%)		**ü**	**ü**	
Adolescent birth rate		**ü**	**ü**	
Number of outpatients				
Out-of-pocket expenditure				

Annex B

Understanding Efficiency

The concept that represents the goal of using resources in the most effective way to satisfy human wants and needs is called efficiency. In a perfectly efficient market, resources are allocated to their highest-valued uses, and both producers and consumers achieve the maximum level of satisfaction given the available resources (Palmer & Torgerson, 1999).

The term "efficiency" itself refers to the maximum degree of performance that requires the minimum inputs to produce the maximum output. Efficiency entails lowering the number of unnecessary inputs used to create a specific output. It is a measurable notion that can be expressed as a ratio or percentage by using the following formula:

$$\text{Efficiency} = \text{Output}/\text{Input}$$

With the increase in the value of percentage or ratio, the amount of efficiency rises. Increased efficiency reduces wastage of inputs while producing the intended output.

Efficiency in Economics and Its Types

There are different types of efficiency. When we try to understand and explain efficiency through theories and methods in economics, it is termed as "Economic efficiency". In microeconomics, economic efficiency is defined as the state characterized by optimal resource allocation, where the cost of providing commodities and services is the lowest, and the maximum outcome is achieved. In other words, it demonstrates a state where both overproduction and underproduction are absent (Farrell, 1957).

Economic efficiency prioritizes utilizing production factors near capacity to fulfill societal needs effectively. This ideal state, achieved through efficient resource distribution, fosters maximum welfare for the population given available resources (Ross, 1976).

There are different types of efficiency, which can be categorized as:

I. Allocative efficiency,
II. Technical efficiency,
III. Productive efficiency,
IV. Pareto efficiency and
V. Dynamic efficiency.

The major types of efficiency in economics are explained below:

i. Allocative Efficiency:

Allocative efficiency occurs when there is an optimal distribution of goods and services taking into account consumer preferences. A more precise definition of allocative efficiency is at an output level where the Marginal Utility (MU) equals the Marginal Cost (MC) of production. Here the marginal utility that they get is equivalent to the price they pay. Therefore, the optimal distribution is achieved when the price of the good equals the marginal cost (Fried et al., 2008).

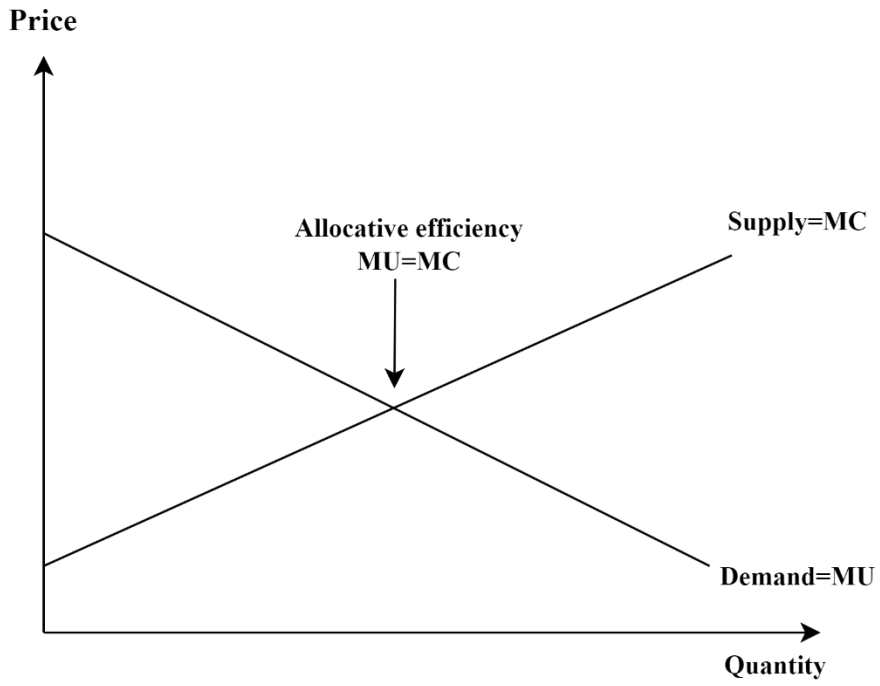


Figure B1 Allocative efficiency

For allocative efficiency to hold, a market must function efficiently. An efficient market exhibits complete transparency of information to all players in the market. It indicates that all information is easily accessible to everyone and that market prices fairly reflect the information. Another feature of an efficient market is that transaction costs are either negligible or non-existent. It permits equal participation from all players in a market, and capital will flow to the point where maximum utility is realized.

Similar to firms, consumers aim for efficiency by maximizing utility within their budget constraint. They do this by choosing combinations of goods that provide the most value for their money. This consumer demand, driven by individual preferences, guides firms (operating productively) to produce the optimal quantities of goods, aligning production

with consumer desires. When resources flow across firms and industries based on this principle, resulting in the production of goods that best satisfy consumer needs, this state is known as allocative efficiency.

Most of the time, efficient markets are hypothetical and assume a perfect world. A number of factors exist in the real world that impede the free flow of information and lead to inefficiencies regarding the optimal distribution of capital and resources.

ii. Technical Efficiency:

Technical efficiency talks about how a program or activity is carried out at the most efficient and competitive cost possible way. It is sometimes also called Operational efficiency. The effectiveness with which a specific set of inputs is employed to produce an output is known as technical efficiency. When a company produces the most output with the least number of inputs such as labor, capital, and technology it is considered technically efficient (Färe et al., 2013).

Technical efficiency requires that no resource will remain

unemployed.

iii. Productive Efficiency:

The type of economic efficiency in which the production of goods and services takes place at the lowest point of the average cost curve, using the fewest resources is called productive efficiency.

Firms achieve productive efficiency by optimizing their resource allocation to minimize production costs while maximizing output, ultimately maximizing profits. This widespread adoption across the economy leads to an overall state of productive efficiency (Farrell, 1957).

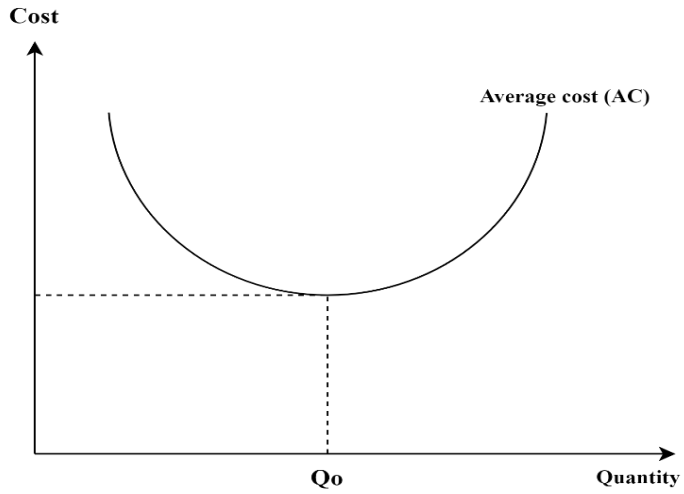


Figure B2 Productive efficiency

In the above graph, the amount of output is plotted on the horizontal axis (x-axis) and the cost is plotted on the vertical axis (y-axis). The productive efficiency is demonstrated by the lowest point on the average cost curve (AC), which indicates that the output Q_0 is generated at the lowest possible average cost (AC_0).

To understand the differences between productive and allocative efficiency, let us take help of another graph.

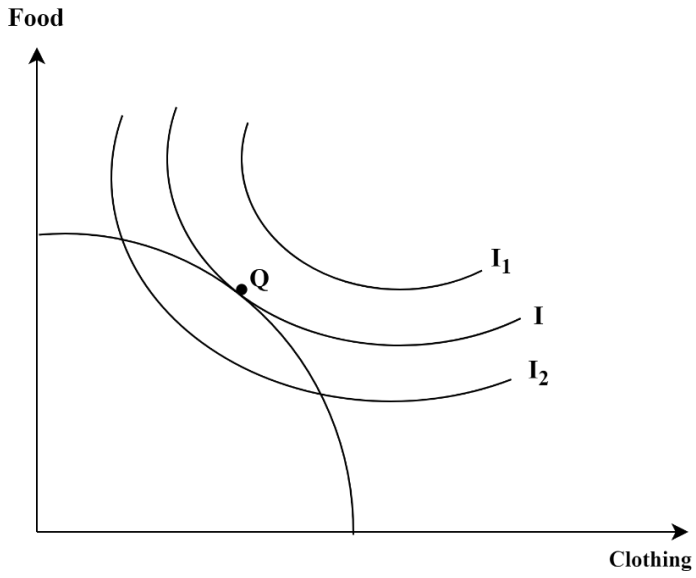


Figure B3 Difference between allocative efficiency and productive efficiency

Let us consider an economy, where only food and clothing are produced. Here all points along the production possibility frontier are productively efficient, and all points along a community indifference curve yield the same satisfaction. For this graph, allocative

efficiency will be achieved at the point on the production possibility frontier that intersects with the community indifference curve yielding the greatest satisfaction.

Curve I represents the maximal indifference curve. If we try to shift outwards to another indifference curve, say I_2, no point on that curve will meet the production possibility frontier; thus we cannot obtain this level of satisfaction. On the other hand, shifting inwards to, say, I_1, reduces the overall amount of satisfaction that may be gained, even if we select a productively efficient combination of items. So there is only one point, Q on the production possibility frontier that is both productively efficient (since it is on the frontier) and allocatively efficient because it is located on an indifference curve tangential to the production possibility frontier.

iv. Pareto efficiency:

In a perfectly efficient economy, where both productive and allocative efficiency is achieved, no individual's well-being can be improved without negatively impacting another's. This optimal state is known as Pareto efficiency.

Determining economic efficiency can be complex, as it hinges on subjective notions of societal wellbeing and how well it serves consumers. This concept of "welfare" encompasses the standard of living and quality of life experienced by individuals. Pareto efficiency means that resources are allocated in the most economically efficient way possible, but it does not imply equality or fair treatment. An economy is said to be in a Pareto optimal state when no economic change can make one individual better off without making at least one other person worse off.

v. Dynamic efficiency:

Dynamic efficiency refers to the ability of an economy to grow and adapt over time. This includes innovation, investment in new technologies, and education and training for workers. When a country constantly develops new products and services, and where workers are always learning new skills, it is called dynamic efficiency (Abel et al., 1989).

A dynamically efficient corporation will lower its cost curves by deploying innovative manufacturing techniques. Dynamic efficiency will allow SRAC and LRAC to be reduced simultaneously. Therefore, dynamic efficiency is concerned with the optimal rate of innovation and investment to improve production processes which helps to reduce the long-run average cost curves.

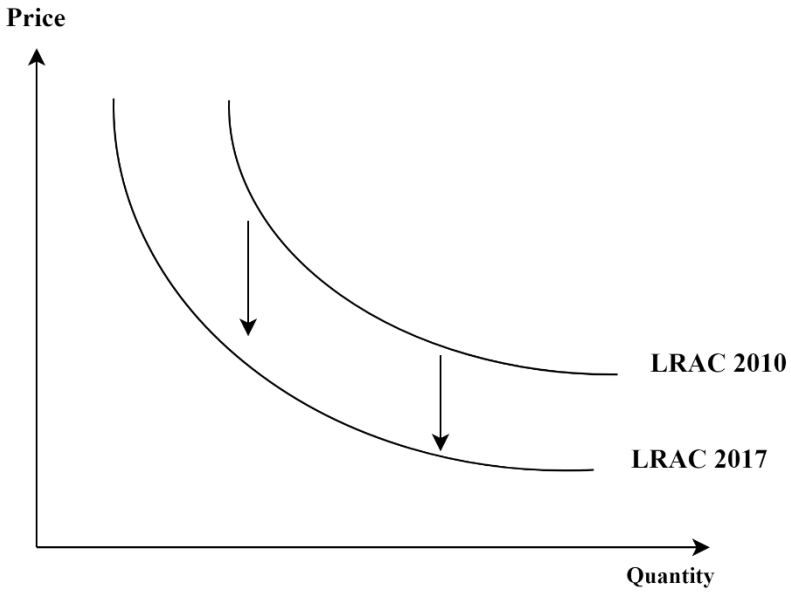


Figure B4 Dynamic efficiency

In the above figure, as the long-run average cost reduced from the year 2010 to 2017, dynamic efficiency is achieved in this case.

Other than the above-mentioned categories, there are many other types of efficiency, such as social efficiency, distributive efficiency, static efficiency, etc. Definitions and their types change with the disciplines in which it is being discussed.

Measures of Efficiency in the Health Sector

Among the different types of efficiency, allocative efficiency and technical efficiency are particularly useful in the health sector since they allow us to understand the effectiveness of resource allocation.

Schick (1999) defined allocative efficiency as allocating the budget to finance programs, activities or projects based on priority needs. Depending upon preferences, the optimal distribution of healthcare resources to maximize social well-being is called allocative efficiency in the health sector. It entails allocating funds in a way that a given amount of healthcare spending results in the greatest health benefits for the population. On the other hand, technical efficiency concentrates on the delivery of healthcare services within the framework of the system. It entails providing healthcare services at the most affordable price point without compromising their efficacy or quality. To put it simply, it is about providing healthcare services utilizing the available resources most efficiently (Palmer & Torgerson, 1999).

An allocative efficient distribution may be Pareto efficient, while a non-Pareto efficient resource distribution suggests that a particular shift in the distribution of products could make some people "better off" while leaving no one worse off. Thus, redistributing resources can increase total welfare, and achieving a Pareto improvement is possible. The Kaldor–Hicks efficiency criterion is a less stringent measure of allocative efficiency, which states that a result is more efficient if the individuals who benefit theoretically can compensate the individuals who suffer, even in cases when compensation is not realized (Hicks, 1939).

Measurement of different types of efficiency began with a concept put forward by Farell (1957), which defined efficiency as the firm's ability to produce maximum output by using a certain number of inputs.
Maximum potential production (also known as "best practice frontier") is defined by the production frontier. Efficiency measurement involves measuring the distance from the observed data point to the frontier.

The frontier function model was first introduced by Farell by using isoquant curves to describe technical, allocative, and economic efficiency (EE) as in Figure 2.5 technical efficiency (TE) is defined as a firm's ability to produce maximum output by using a certain number of inputs. Allocative efficiency (AE) measures the input combination at the minimum cost combination in producing a certain output. AE will be achieved when the ratio of the marginal product for each input is equal to the price ratio of the input. In Farrell's framework, EE measures all performance and is equal to TE × AE or EE = TE × AE.

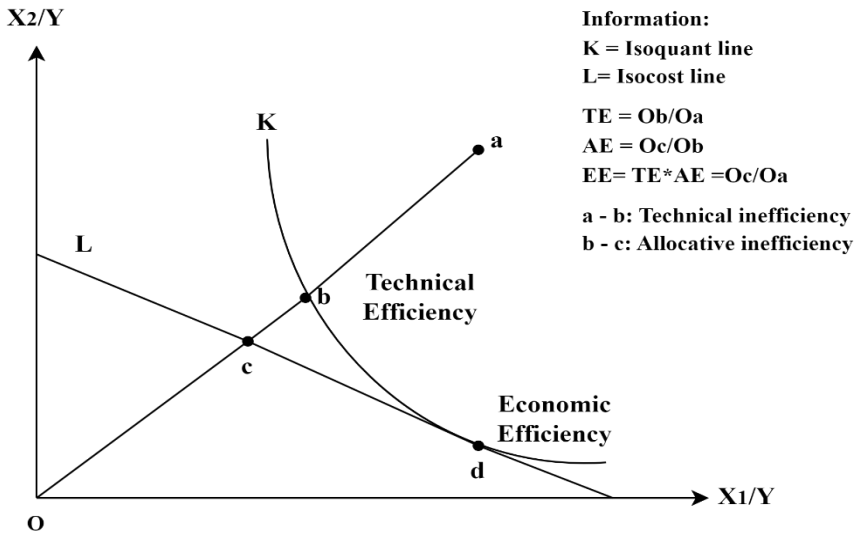


Figure B5 *Technical, allocative, and economic efficiency*

Using the above Figure 2.5, the concepts of TE, AE, and EE can be illustrated. The K isoquant can be used to illustrate the relationship between two inputs at a given output level. Inputs X_1 and X_2 are used to produce the same number of outputs (Y). Each observation on an isoquant achieves TE, while the observation above the frontier is technical inefficiency. From the illustration, it can be seen that in observation "a" to produce an output of Y, inputs X_1, and X_2 are used, which are bigger than in observation "b". Here point "b" represents an efficient firm that uses the same proportion of inputs as "a'. In other words, the TE of the observation "a" is 0b/0a.

TE = 0b/0a

= 1- ba/0a

If the information on prices is known, and certain behavioral assumptions (such as cost minimization) are appropriate, AE can be calculated. AE is a combination of X_1 and X_2 that minimizes costs. In the above figure, all observations on the iso-cost L are the AE. The observation "b" is technically efficient but has an AE that is less than 1. AE is defined as AE = 0c/0b.

The combination of TE and AE yields a measure of EE. Only the observation "d" is economically efficient, at which point the isoquant will intersect with the iso-cost. Thus, the economic efficiency:

EE = TE × AE

= 0b/0a × 0c/0b

= 0c/0a

The value of EE ranges between 0 and 1. A value of 1 indicates that the farm has fully achieved EE, while EE < 1 indicates that it is economically inefficient. Over the past three decades, this methodology by Farrell has been widely applied.

Annex C

Mathematical Equations:

Output maximization:

Let there are *N* DMUs whose efficiencies need to be compared. Let us take one of the DMUs, say the r[th] DMU, we want to maximize its efficiency subject to the condition that the efficiencies of other DMUs is restricted to values between 0 and 1. The mathematical program is,

Subject to $\boldsymbol{JE_r = \sum_{j=1}^{J} v_{jr} y_{jr}}$

$$\boldsymbol{\sum_{i=1}^{I} u_{ir} x_{ir} = 1}$$

$$\boldsymbol{\sum_{j=1}^{J} v_{jr} y_{jn} - \sum_{i=1}^{I} u_{ir} x_{in} \leq 0; \quad n = 1, 2, \dots, N} \qquad \textbf{(1)}$$

$$v_{jr},\ u_{ir} \geq \varepsilon; \quad i = 1,2,\dots,I;\ j = 1,2,\dots,J$$

Where

E_r is the efficiency of the r[th] DMU,

y_{jr} is the j[th] output of the r[th] DMU,

v_{jr} is the weight of the j[th] output of r[th] DMU,

x_{ir} is the i[th] input of the r[th] DMU,

u_{ir} is the weight of the i[th] input of the r[th] DMU,

y_{jn} and x_{in} are j[th] output and i[th] input, respectively, of the nth DMU,

n = 1,2,…… , N.

The program can be presented in matrix form as shown below.

$$E_r = V_r' Y_r$$

Subject to

$$'YUr-'XUr_{r'}=X1\leq 0$$

V_r

$$V_r', U_r' \geq \varepsilon \qquad (2)$$

Where **X** is the matrix of inputs and **Y** is the matrix of outputs**.**

The problem is solved for N times, once for each DMU in the comparison set.

The optimal solutions to the envelopment problem (2) provide initial performance evaluations for each producer and the nonnegative slacks in the $I+J$ functional constraints. However actual performance are likely to be attributable to some combination of managerial inefficiencies, environmental effects, and statistical noise, and it is desirable to isolate the three effects. This cannot be accomplished within the framework of the above problem, from which the environmental variables and statistical noise are both missing.

Stage :2 Using SFA to Decompose stage 1.

The objective of second stage analysis was to decompose Stage 1 slacks (environmental influences, managerial inefficiencies, and statistical noises) which were arised from measurement errors in the input and output data. Following Fried et al., we built up SFA regression formulation as:

$$s_{jr} = f_j(z_r; \beta_j) + v_{jr} + \mu_{jr} \qquad (3)$$

Where,

s_{jr} represents the slack variable of output item j of the r^{th} DMU;

$z_r = (z_{1r}, z_{2r}, \dots \dots , z_{pr})$ represents the observable environmental variables in the amount p;

$f_j(z_r; \beta_j)$ represents the effect of environmental variable on output slack variable, s_{jr};

v_{jr} represents statistical noise, and $v_{jr} \sim N(0, \sigma_{vj}^2)$;

μ_{jr} represents managerial inefficiency and assumes it follows a truncated normal distribution as

$\mu_{jr} \sim N^{+}(0, \sigma_{\mu j2})$,

v_{jr} and μ_{jr} are distributed independently of each other.

Let $=\frac{\sigma_{v_j}^2}{\sigma_{v_j}^2+\sigma_{\mu_j}^2}$. The closer value of γ is to 1, the more managerial inefficiency dominates the composite error part of the model; the closer the value of γ is to 0, the more statistical noise dominates the error part of the model.

In the case that the maximum likelihood estimation method is used to calculate the parameters β_j, σ^2 and γ, it is necessary to calculate the estimated value of statistical noise v_{jr} and managerial inefficiency μ_{jr} for effective adjustment of input slacks.

Fried et al. (2002) adopted Jondrow et al. (1982) approach to decompose composed error structure

$v_{jr} + \mu_{jr}$ as:

$$E[v_{jr}|v_{jr} + \mu_{jr}] = s_{jr} - f_j(z_r; \beta_j) + E[\mu_{jr}|v_{jr} + \mu_{jr}] \quad (4)$$

However, Fried et al. provided no solution of calculating $E[\mu_{jr}|v_{jr} + \mu_{jr}]$. Current literatures have usually applied Jondrow et al. (1982) formula for managerial inefficiency, which was based on the assumption of $\varepsilon_j = v_j - \mu_j$ (ε_j for composed error), while Fried et al. was $\varepsilon_j = v_j - \mu_j$.

This study applied Dengyue L. (2012)[31] approach as following:

$$E\left[\mu_{jr} \mid v_{jr} + \mu\right] = \left[\frac{\sigma_{jr}\,\lambda\,\phi!\left(\frac{\varepsilon_{jr}\,\lambda}{\sigma_{rr}}\right)}{1+\lambda^2\,\Phi!\left(\frac{\varepsilon_{jr}\,\lambda}{\sigma_{rr}}\right)} + \varepsilon_{jr}\,\sigma_r\,\lambda\right] \quad (5)$$

Where, $\lambda = {}^{\sigma}\_\_\_{\sigma^{\mu}v}$, $\varepsilon_r = v_{jr} + \mu_{jr}$, and $\sigma^2 = {\sigma_\mu}^2 + {\sigma_v}^2$; $\phi(.)$ and $\varphi(.)$ are the density function and distribution function for the standard normal variables, respectively.

The adjusted input value is obtained through the following formula:

$$y_{jr^*} = y_{jr} + [(z_r\beta_j) - z_r\beta_j] + [(v_{jr}) - v_{jr}] \quad (6)$$

Where, y_{jr^*} and y_{jr} represents the adjusted output quantity and original output quantity respectively;

$[(z_r\beta_j) - z_r\beta_j]$ adjusts the DMU to external environment; $[(v_{jr}) - v_{jr}]$ adjusts the DMU with regards to the statistical noise. The adjustments place the DMUs in the most beneficial situation with regards to the operation environment and statistical noise.

Stage 3: Recalculation of the Efficiency Scores

In the third stage, we replace the original input quantities with the adjusted input quantities from (6), and repeat the first stage analysis by applying DEA in (2) to the adjusted data. Then the efficiency scores from the third stage are compared to those from the first stage.

Input minimization:

Let there are *N* DMUs whose efficiencies need to be compared. Let us take one of the DMUs, say the r[th] DMU, we want to maximize its efficiency subject to the condition that the efficiencies of other DMUs is restricted to values between 0 and 1. The mathematical program is,

$$E_r = \sum_{i=1}^{I} u_{ir}x_{ir}$$

Subject to

$$\sum_{j=1}^{J} v_{jr}y_{jr} = 1$$

$$\sum_{j=1}^{J} v_{jr}y_{jn} - \sum_{i=1}^{I} u_{ir}x_{in} \leq 0; \quad n = 1,2,\dots,N \quad (1)$$

$$v_{jr},\ u_{ir} \geq \varepsilon; \quad i = 1,2,\dots,I;\ j = 1,2,\dots,J$$

Where

E_r is the efficiency of the r[th] DMU,

y_{jr} is the j[th] output of the r[th] DMU,

v_{jr} is the weight of the j[th] output of r[th] DMU,

x_{ir} is the i[th] input of the r[th] DMU,

u_{ir} is the weight of the i[th] input of the r[th] DMU,

y_{jn} and x_{in} are j[th] output and i[th] input, respectively, of the nth DMU, n = 1,2,

… … , N.

The program can be presented in matrix form as shown below.

$$E_r = U_r'Y_r$$

Subject to

$$'YVr-'YrUr='X1\leq 0$$

V_r

$$V_r',U_r' \geq \varepsilon \qquad (2)$$

Where **X** is the matrix of inputs and **Y** is the matrix of outputs**.**

The problem is solved for N times, once for each DMU in the comparison set.

The optimal solutions to the envelopment problem (2) provide initial performance evaluations for each producer and the nonnegative slacks in the *I*+*J* functional constraints. However actual performance are likely to be attributable to some combination of managerial inefficiencies, environmental effects, and statistical noise, and it is desirable to isolate the three effects. This cannot be accomplished within the framework of the above problem, from which the environmental variables and statistical noise are both missing.

Stage: 2 Using SFA to Decompose stage 1.

The objective of second stage analysis was to decompose Stage 1 slacks (environmental influences, managerial inefficiencies, and statistical noises) which were arised from measurement errors in the input and output data. Following Fried et al., we built up SFA regression formulation as:

$$s_{ir} = f_i(z_r; \beta_i) + v_{ir} + \mu_{ir} \qquad (3)$$

Where,

s_{ir} represents the slack variable of input item i of the rth DMU;

$z_r = (z_{1r}, z_{2r}, \dots \dots , z_{pr})$ represents the observable environmental variables in the amount p;

$f_i(z_r; \beta_i)$ represents the effect of environmental variable on output slack variable, s_{ir};

v_{ir} represents statistical noise, and $v_{ir} \sim N(0, \sigma_{vi}^2)$;

μ_{ir} represents managerial inefficiency and assumes it follows a truncated normal distribution as

$\mu_{ir} \sim N^+(0, \sigma_{\mu i2})$,

v_{ir} and μ_{ir} are distributed independently of each other.

Let = $(\sigma_{vi2}\sigma_{+}{}^{vi2}\overline{\sigma_{\mu i2}})$. The closer value of γ is to 1, the more managerial inefficiency dominates the composite error part of the model; the closer the value of γ is to 0, the more statistical noise dominates the error part of the model.

In the case that the maximum likelihood estimation method is used to calculate the parameters β_i, σ^2 and γ, it is necessary to calculate the estimated value of statistical noise v_{jr} and managerial inefficiency μ_{ir} for effective adjustment of input slacks.

Fried et al. (2002) adopted Jondrow et al. (1982) approach to decompose composed error structure

$v_{ir} + \mu_{ir}$ as:

$$E[v_{ir}|v_{ir} + \mu_{ir}] = s_{ir} - f_i(z_r; \beta_i) + E[\mu_{ir}|v_{ir} + \mu_{ir}] \quad (4)$$

However, Fried et al. provided no solution of calculating $E[\mu_{ir}|v_{ir} + \mu_{ir}]$. Current literatures have usually applied Jondrow et al. (1982) formula for managerial inefficiency, which was based on the assumption of $\varepsilon_i = v_i - \mu_i$ (ε_i for composed error), while Fried et al. was $\varepsilon_i = v_i - \mu_i$.

This study applied Dengyue L. (2012) approach as following:

$$E[\,\mu_{ir} \mid v_{ir} + \mu_{ir}\,] = \frac{\sigma_r \lambda\, \phi(\varepsilon\lambda/\sigma_r)}{1+\lambda^2}[\phi(\varepsilon\lambda/\sigma_r) + \sigma_r\lambda] \quad (5)$$

Where, $\lambda = {}^{\sigma}\_\__{\sigma^{\mu_v}}$, $\varepsilon_r = v_{ir} + \mu_{ir}$, and $\sigma^2 = \sigma_\mu{}^2 + \sigma_v{}^2$; $\phi(.)$ and $\varphi(.)$ are the density function and distribution function for the standard normal variables, respectively.

The adjusted input value is obtained through the following formula:

$$y_{ir}{}^* = y_{ir} + [(z_r\beta_i) - z_r\beta_i] + [(v_{ir}) - v_{ir}] \quad (6)$$

Where, $y_{ir}{}^*$ and y_{ir} represents the adjusted output quantity and original output quantity respectively;

$[(z_r\beta_i) - z_r\beta_i]$ adjusts the DMU to external environment; $[(v_{ir}) - v_{ir}]$ adjusts the DMU with regards to the statistical noise. The adjustments place the DMUs in the most beneficial situation with regards to the operation environment and statistical noise.

Stage 3: Recalculation of the Efficiency Scores

In the third stage, we replace the original input quantities with the adjusted input quantities from (6), and repeat the first stage analysis by applying DEA in (2) to the adjusted data. Then the efficiency scores from the third stage are compared to those from the first stage.

Allocative efficiency:

The economic efficiency score for r^{th} DMU is obtained by first solving the following cost-minimization linear programming model:

$$MC_r = \min_{\theta, x^*_{ir}} \sum_{i=1}^{I} p_{ir} x^*_{ir}$$

Subject to,

$$\sum_{n=1}^{N} \theta_n x_{in}$$

$$\sum_{n=1}^{N} \theta_n y_{jn} - y_{jr} \geq 0$$

$$\sum_{n=1}^{N} \theta_n = 1$$

$$\theta_n \geq 0$$

(7)

Where, MC_r = the minimum total cost for r^{th} DMU, p_{ir} = the price for input of the r^{th} DMU, and x^*_{ir} = the cost-minimizing level of i^{th} input of the r^{th} DMU given its input price. The constraint $\sum^{N}_{n=1} \theta_n = 1$ in the equation (7) ensures that the minimum total costs for the field are calculated under the VRS assumption (REF, Agriculture article page – 95). Economic efficiency (EE_r) for each DMU is then calculated using following equation:

$$EE_r = \sum_{i=1}^{I} p_{ir} x^*_{ir} \qquad (8)$$

Where the numerator $\sum^{I}_{i=1} p_{ir} x^*_{ir}$ = the minimum total cost obtained for rth DMU using the equation

(8) and the denominator $\sum^{I}_{i=1} p_{ir} x_{ir}$ = the actual total cost observed for the rth DMU.

The EE for a DMU can also be represented as the product of both the TE and the AE for the DMU, mathematically, $EE_r = TE_r \times AE_r$ (Farrel, 1957). Thus, the AE score for field n can be determined given both the EE and TE for the field using the following relationship:

$$AE_r = EE / TE_r$$

Annex D

Probable list of FGD and KII, and in-depth interviews (IDIs)

FGD:

Four FGDs have been conducted in each District/DMU. One FGD has been conducted with responsible persons at the Civil Surgeon's Office or District-level hospitals, while another has been conducted with patients and attendants of patients (both outdoor and indoor). This study has selected four Districts/DMUs; therefore, a total of six FGDs have been conducted.

KII and in-depth interviews:

Table D1: *Distribution of the probable respondents of KII and in-depth interviews*

District Level			
Participants	**Institute**	**No. of KII KII/In-depth interview**	**Cumulative No. of KII/In-depth interview**
Civil Surgeon/ Deputy Civil Surgeon	Civil Surgeon office	4	4
Superintend	District Hospital	3	7
Upazila Health and Family Planning Officer	Upazila Health Complex	5	12
Medical Officer/ Assistant Surgeon/ Sub-assistant Community Medical Officer /Health Inspector/ Assistant Health Inspector	Union Sub-center/ Union Family and Welfare Center	5 (In-depth interview)	17 (In-depth interview)
Community Health Provider/ Health Assistant	Community Health Clinic	5 (In-depth interview)	22 (In-depth interview)
NGO	District level	4	26

National Level		
Participants / Institute	**No. of KII**	**Cumulative No. of KII**
Ministry of Health and Family welfare	3	29
Directorate General of Health Services	2	31
Finance Division	2	33
Health Economics Unit	2	35
Medical University / Medical College Hospitals	2	37
Specialized Health Center	1	38
Public Health Institute	1	39
Health Economist	2	41
NGO	2	43
International Donner	2	45
Total KII and in-depth interviews in the Study		**45**

Annex E

Table E1: *Summary Matrix of Key Factors, Challenges, and Reform Recommendations for Allocative Efficiency in Bangladesh's Health Sector*

Factors affecting Allocative Efficiency		***Factors hindering Allocative Efficiency***		***Recommendations***	
Budgeting Practices and Financial Structures	Fragmentation of Budget Types and Its Operational Consequences	Fragmentation, Duplication, and Low Public Investment	Structural Fragmentation in Budgeting and Planning	Budget Reform and Flexibility	Transition from Incremental to Demand-Driven Budgeting
	Formulaic Allocation and Limited Responsiveness to Health Priorities		Duplication and Inefficiencies in Programmatic Spending		Introduce Flexible Budget Reallocation Mechanisms at Facility Level
	Gaps in Strategic Planning and Data-Driven Resource Allocation		Critically Low Public Investment in Health		Harmonize Development and Operational Budget Planning
	Infrastructure-Centric Investment at the Expense of Operational Readiness		High Out-of-Pocket Expenditure		Allocate Resources Based on Service Intensity and Functional Needs
Planning and Implementation Challenges	Rigidity in Operational Planning and Limited Budget Integration	Budget Execution Challenges and Coding Rigidity	Frequent Staff Transfers and Loss of Institutional Memory	Multisectoral Coordination and Innovation	Establish Joint Task Forces with Mandated Authority and Shared Deliverables
	Delayed Execution and Misalignment in Long-Term Planning Frameworks		Rigid Budget Coding and Limited Reallocation Flexibility		Integrate Planning and Logistics Across Sectors to Minimize Duplication
	Entrenched Budgeting Norms and Weak Outcome Orientation		Structural Delays in Fund Disbursement		Fragmented ICT Systems and Poor Data Interoperability
	Operational Bottlenecks and Uneven Adoption of Digital Innovations		Procurement Timelines Misaligned with Budget Cycles		Public-Private Partnerships and the Risk of Over-Commercialization
			Bureaucratic Complexity and Centralized Permissions		
Procurement and Resource Distribution	Disconnect Between Centralized Procurement and Local Health Needs	Procurement Bottlenecks and Risk-Averse Culture	Procedural Complexity and Hesitancy in Decision-Making	Structural Reform and Accountability	Delegate Budgetary Authority to Facility-Level Leaders
	Limited Use of Local Data and Disease Mapping				Redefine Leadership Roles to Include Operational Stewardship
	Constraints and Trade-offs of e-GP Implementation		Central Supply Failures and Stockout Risks		Consolidate Governance Under Unified Health Leadership

Factors affecting Allocative Efficiency		***Factors hindering Allocative Efficiency***		***Recommendations***	
	Performance Gaps in EDCL's Distribution Role		Delays in Local Procurement Due to N/A Certificate Dependencies		Invest in Real-Time Data Systems for Facility-Level Decision-Making
	Emerging Local Procurement Models and Decentralized Autonomy		CMSD Bottlenecks and Administrative Rigidities		Operationalize Decentralization Through Policy and Capacity Building
Community Engagement and Representation	Systemic Exclusion of Grassroots and Ethnic Communities	Political Influence and Inequitable Resource Allocation	Ceiling Constraints and Limited Local Budget Flexibility	Primary Healthcare Prioritization	Reallocate Budget Toward Community-Based and Preventive Services
	Neglect of Frontline Health Worker Insights		Political Interference in Budget Approval and Fund Allocation		
	Consequences of Top-Down Planning on Local Relevance and Equity		Short-Termism in Budget Prioritization		
	Urban-Centric Narratives and the Silencing of Frontline Realities		Disconnected Budget Growth from Performance Outcomes		Reallocating Budgets Toward Essential Primary Services
			Political Appointments and Outsourced Staff Underperformance		Reviving Proven, Low-Cost Public Health Interventions
		Data Limitations, Centralization, and Regional Disparities	Limited Inclusion of Field-Level and Clinical Voices in Planning		
			Outdated and Fragmented Health Data Systems		
			Weak Inter-agency Coordination and Siloed Service Delivery		
Health System Performance and Capacity	Strategic Deployment Over Standardized Staffing	Misaligned Planning and Inflexible Budget Structures	Infrastructure-Heavy Investments Without Operational Readiness	Shift from Outsourced to Government Recruitment	Outsourcing Undermines Service Quality and Accountability
	Urban Concentration and Unequal Access to Specialized Care		Year-End Spending Pressure and Misaligned Expenditures		Government-Led and Local Recruitment for Workforce Stability
	Absence of Structured Referral Pathways and Overuse of Tertiary Care		Infrastructure-Centric Planning at the Expense of Operational Needs	Need-Based Workforce Planning	Conduct Regular Workforce Mapping to Address Geographic and Specialty Gaps
	Weak Data Capture and Bottom-Up Integration		Delays and Disconnects in Equipment and Staffing Approvals		Align Medical Education Intake with Health System Demand
	Execution Gaps Despite Sound Policy Frameworks		Lack of Strategic Workforce Planning and Career Pathways		Develop Long-Term Workforce Forecasting Tools
	Linking Performance Metrics to Budget Efficiency				

Factors affecting Allocative Efficiency		***Factors hindering Allocative Efficiency***		***Recommendations***	
Policy Effectiveness and Execution	Execution Gaps	Weak Institutional Capacity and Workforce Shortages	Limited Technical Capacity for Budget and Procurement Execution	Human Resource Optimization	Introduce Structured Career Pathways for Medical Professionals
			Chronic Vacancies and Reliance on Untrained Staff		Create Joint Platforms Between Health and Education Ministries
			Weak Managerial Capacity and Reluctance to Lead		Establish Structured Financial Training for Health Managers
	Human Resource Deficits in the Digital Transition		Absence of Dedicated Financial and Compliance Units	Public Financial Management Capacity	Differentiate Clinical and Managerial Roles in Facility Leadership
	Institutional Readiness and Local Ownership		Poor Understanding of Budget Codes and Compliance Requirements		Strengthen Nursing Education and Operational Authority
	Cultural Shifts in Accountability and Public Expectations	Corruption, Weak Oversight, and Accountability Gaps	Ineffective Oversight and Performance Monitoring	Reform Culture and Behavioral Shifts	Shifting Mindsets for Systemic Change
	Implementation Support as a Reform Imperative		Transparency Deficits and Disconnect from Ground Realities		
			Procedural Rigidity and Institutional Overlap		Embedding Ethics and Accountability in Practice

Source: Developed by the authors

Table E2: *Latent Class–Based Efficiency Profiles and Reform Trajectories in Bangladesh's Health Sector*

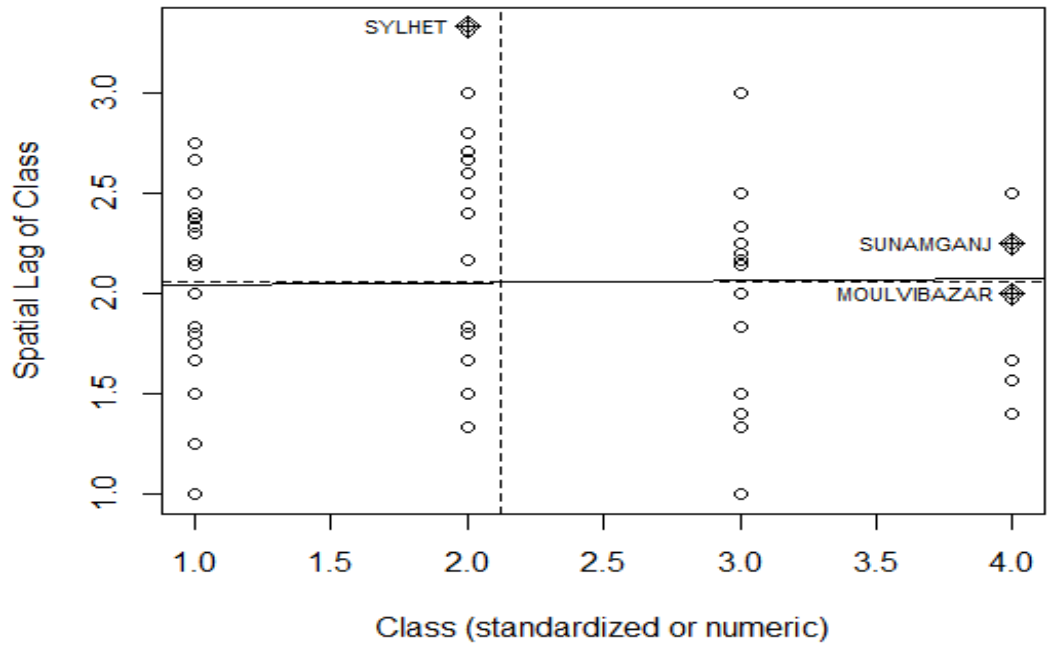
Cluster	Latent Class 1 (High Efficiency)	Latent Class 2 (Moderately High Efficiency)	Latent Class 3 (Moderate Efficiency)	Latent Class 4 (Low Efficiency)	Reform Flow / Policy Trajectory
1. Budgeting and Financial Governance	Functional demand-based budgeting partially practiced; local managers use flexibility within codes.	Budget prepared with some service data but constrained by ceilings and approval delays.	Incremental and input-based budgeting dominates; weak data link.	Highly rigid, top-down budgeting; minimal local discretion.	Move from *compliance-oriented* to *performance-linked budgeting* → gradually integrate data-based allocations and empower facility-level adjustments.
2. Human Resources for Health (HRH)	Balanced workforce distribution; HR planning somewhat aligned with service mix; trained managers in place.	Some mismatch in HR deployment; management training ad-hoc.	Serious misalignment in specialist mix; ad-hoc transfers common.	Severe shortages or oversupply; outsourcing dominates; politicized postings.	Transition from *random assignment → strategic placement → needs-based and career-stream planning*.
3. Structural and Governance Reform	Facility-level autonomy institutionalized with strong audit mechanisms.	Some decision autonomy; accountability mechanisms inconsistent.	Central control dominant; directors lack fiscal authority.	Fragmented governance (dual-secretary model); little to no autonomy.	Flow: *Decentralization + Accountability* → unified structures → empowered managers with transparent audit trails.
4. Service Delivery Prioritization	Resource allocation reflects population health priorities; strong PHC and prevention programs.	Balanced but tertiary-care bias persists.	Skewed toward urban tertiary facilities; weak community outreach.	Neglected PHC; focus on curative spending; high out-of-pocket dependence.	Move from *hospital-centric* to *community-centric* investment logic emphasizing prevention and primary care.
5. Multisectoral Coordination and Innovation	Functional inter-ministerial platforms and digital integration (e.g., shared HMIS).	Coordination through ad-hoc committees; partial ICT integration.	Siloed ministries; fragmented data systems.	No coordination; duplication of logistics; no digital systems.	Evolve from *fragmented planning → coordinated digital ecosystems → joint accountability frameworks*.

Cluster	Latent Class 1 (High Efficiency)	Latent Class 2 (Moderately High Efficiency)	Latent Class 3 (Moderate Efficiency)	Latent Class 4 (Low Efficiency)	Reform Flow / Policy Trajectory
6. Reform Culture and Behavioral Change	Strong culture of professionalism, ethics, and ownership.	Moderate accountability; motivated individuals drive reforms.	Procedural compliance without intrinsic motivation.	Low morale, politicization, and poor accountability norms.	Cultivate *behavioral transformation* through incentives, leadership development, and ethics integration at all levels.

Source: Developed by the authors

Annex F

To examine global spatial autocorrelation of the Class variable, Moran's I was computed using queen contiguity spatial weights (first-order). The observed Moran's I value was 0.0093, slightly higher than the expected random value of –0.0159, with a variance of 0.0069. The corresponding standard deviate (Z) = 0.3023 and p = 0.3812 (one-tailed test for positive autocorrelation). Since the result is statistically insignificant at the 5% level, it indicates the absence of meaningful spatial dependence, suggesting that Class values are spatially random and that neighboring districts do not systematically share similar or dissimilar characteristics. The flat regression line and the random scatter visually reinforce the absence of strong spatial structure.



Source: Authors' Compilation

Figure F1: *Moran Scatter Plot of the Latent Class Across Districts*

Funding

This study was funded and received overall support from the **Strengthening Public Financial Management Program to Enable Service Delivery (SPFMS)**.

Review

Institute of Public Finance Bangladesh (IPF) provided technical review and expert feedback on both the inception report and the final report of the project.

Methodological Validation Workshop Details

Methodological Validation Workshop on ***The Factors Affecting Public Spending Allocative Efficiency in Bangladesh: An Assessment Study on the Health Services***

Time & Date: 10.00 AM, 23 March 2025 (Sunday)

Venue: Multi-purpose Hall Room, BIGM

Chairperson: Dr. Mohammad Tareque, Director, BIGM

Participants of the Workshop

No	Names, Designations, and Offices of the Officials (not in order of seniority)
1.	**Dr. Shah Md. Helal Uddin**, Additional Secretary (Budget Wing), Health Services Division, Ministry of Health and Family Welfare (MoHFW),
2.	**Dr. Syed Abdul Hamid** Professor, Institute of Health Economics, University of Dhaka
3.	**Dr. Md. Sheikh Giash Uddin** Registrar (In-charge), Office of the Registrar, Jagannath University.
4.	**Mr. S.M. Ahsanul Aziz** Joint Secretary (Budget Wing), Medical Education & Family Welfare Division, Ministry of Health and Family Welfare (MoHFW)
5.	**Ms. Rownak Jahan** Joint Secretary (Budget-2 BR), Finance Division, Ministry of Finance
6.	**Dr. Abdur Rahim** Program Executive & Coordinator (Joint Secretary), SPFMS Program, Finance Division, Ministry of Finance
7.	**Ms. Milia Sharmin** Deputy Secretary (Budget-7), Finance Division, Ministry of Finance
8.	**Mr. Md. Shafiul Islam** Deputy Secretary, Budget-4, Finance Division, Ministry of Finance
9.	**Mr. Muhammad Anisuzzaman** Program Executive & Coordinator (Deputy Secretary), SPFMS Program, Finance Division, Ministry of Finance
10.	**Dr. Sheikh Touhidul Haque** Senior Consultant, SPFMS Program, Finance Division, Ministry of Finance
11.	**Mr. Mohammad Rizwanul Islam** ISC, SPFMS Program, Finance Division**,** Ministry of Finance
12.	**Mr. Sohag Hossain** IPF, Finance Division, Ministry of Finance
13.	**Mr. Mohammad Meshbahur Rahman** Assistant Professor, NIPSOM
14.	**Dr. Shaikh Iftekhar Rahman** Director (Finance) , Directorate General of Health Services (DGHS)
15.	**Dr Nazma Akther** Assistant Director (Planning and Research), Directorate General of Health Services (DGHS)
16.	**Dr. Md. Samiul Huda,** Assistant Surgeon (Attached), Health Economics Unit, Health Services Division, Ministry of Health and Family Welfare (MoHFW).

Participants of the Workshop from BIGM

No	Names, Designations, and Offices of the Officials (not in order of seniority)
1.	**Dr. Mohammad Tareque** Director, BIGM
2.	**Dr. Md. Golam Faruque** Professor, BIGM
3.	**Dr. Sheikh Ashiqur Rahman Prince** Professor, BIGM
4.	**Dr. Md. Moniruzzaman** Professor, BIGM
5.	**Dr. Muhammad Golam Sarwar** Associate Professor, BIGM
6.	**Dr. Krishna Gayen** Sr. Research Fellow , BIGM
7.	**Nazmun Naher** Associate Professor , BIGM
8.	**Dr. Zobayer Ahmed** Associate Professor, BIGM
9.	**Dr. Md. Abdul Latif** Additional Director, BIGM
10.	**Mohammad Al-Amin** Additional Director, BIGM
11.	**Dr. Munshi Muhammad Abdul Kader Jilani** Assistant Professor, BIGM
12.	**Fataraz Zahan** Assistant Professor, BIGM
13.	**Tamanna Tabassum** Assistant Professor, BIGM
14.	**Tasfia Tasneem Ahmed** Assistant Professor, BIGM
15.	**Md. Mominur Rahman** Assistant Professor
16.	**Dr. Anwar Hossain Chowdhury** Assistant Professor, BIGM
17.	**Ruhul Amin** Research Associate, BIGM
18.	**Mahadee Al Mobin** Research Associate, BIGM
19.	**Arju Manara Begum** Research Associate, BIGM
20.	**Bithe Rani Aich** Research Associate, BIGM
21.	**Muhammad Raihan Uddin** Research Associate, BIGM
22.	**Shirin Sultana** Research Associate, BIGM
23.	**Syed Mahin** Research Associate, BIGM