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## Article

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# Investigating the role of foreign aid, FDI, and remittance on the public health of selected South Asian countries

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## ABSTRACT

Foreign aid, remittance, and foreign direct investment have a significant role in shaping and promoting globalization and these factors also play a vital role in determining health quality in developing countries. Developing countries, especially South Asian countries still need research and policies to efficiently utilize the contributions of these external capital sources in their health sector. For this reason, the present study examined the effects of different globalization-related factors (remittances, foreign direct investment, foreign aid) and health spending from 2000 to 2020 on the quality of healthcare in six South Asian countries: Bangladesh, India, Nepal, Pakistan, Maldives, and Sri Lanka. Moreover, this investigation introduces an unprecedented facet to the realm of health sector research by introducing a novel health quality index that incorporates life expectancy, newborn mortality rate, maternal mortality rate, and illness prevalence (specifically tuberculosis). This study used Augment Mean Group (AMG) estimation for data analysis. To ensure the precision and dependability of the findings, this research utilizes sophisticated statistical methodologies, including the Common Correlated Effect of Mean Group (CCEMG), Driscoll-Kraay Robust Standard Error approaches, and Dumitrescu and Hurlin (D-H) causality test, thereby establishing their dependability. The findings of the study demonstrate that foreign aid and health spending have a significant beneficial impact on the health quality of South Asia. In contrast, remittances tend to harm health quality. Furthermore, the influence of FDI on the quality of health in South Asia is equivocal. South Asian countries must allocate more of their budget to the health sector and ensure that foreign aid is properly utilized for its development. On the other hand, these countries are required to take policy and create an environment that will help to improve health quality through effective use of remittance and FDI.

## 1. Introduction

A nation's healthcare system is crucial for its economic growth (Islam et al., 2020) and social welfare. A healthy population can actively participate in the economy and drive growth, while poor health reduces productivity and strains public resources. Even health spending itself is positively associated with economic growth (Islam & Alhamad, 2022), but In South Asia, the health sector is one of the least essential sectors to look after. Average spending on the health sector in South Asia is lower than 3 % of the country's budget (Bidin, 2017). This low health spending can be covered by wise use of the capital inflow from external factors. That is why the relationship between economic factors like foreign aid, FDI, remittance, health expenditure, and health outcomes has become a crucial area of study in developing nations, particularly in South Asia.

Researchers have been paying attention to the impact of foreign aid, remittance, and FDI on human development metrics, such as health quality and healthcare service accessibility. This issue has garnered attention from policymakers and academics alike in recent times. Although there have been efforts to improve public health in low and middle-income countries through foreign aid, FDI, and remittances from migrant workers, the impact of these economic factors has been contested in existing literature. It remains unclear whether these factors alone can be credited for societal gains in public health or whether other determinants of health also play a significant role. Further research is needed to understand better the specific impact of these economic elements on advancing health systems in these countries.

Foreign direct investment (FDI) and remittances are two external financial flows, which are important in mitigating economic growth and

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health outcomes' importance, particularly in developing nations (Islam, 2024). But like any other thing, human capital development is essential for economic progress (Islam & Alam, 2023; Islam & Muneer, 2018; Islam & Shindaini, 2022), and personal remittances frequently enhance family income, increasing household access to healthcare services (Islam, 2022, 2020b, 2024; Islam & Alam, 2023). Furthermore, research shows that remittances help narrow the gap in receiving health care and education by reducing inequality and helping to positively impact income distribution (Islam & Azad, 2024; Islam & Keramat, 2012). A study of remittance-sending countries shows that effective governance helps maximize the remittance benefits by directing them toward productive sectors such as healthcare and sustainable energy (Hasan et al., 2019; Islam, 2020a; Pradhan & Khan, 2015). FDI can facilitate technology transfer and infrastructure development – which include health facilities. FDI has a role in economic growth, income redistribution, and improving healthcare services (Nagel et al., 2015). FDI and remittances help recipient nations participate in the global market and the capital flows into the country (Shahid et al., 2021).

Improving health outcomes is still a significant development concern in South Asia due to the region's ongoing health system inadequacies and uneven progress toward essential health goals. To make informed and evidence-based reforms, it is crucial to comprehend the primary determinants that impact the functioning of the healthcare system. South Asia's inadequate health systems and variable progress toward SDG target attainment require priority attention to improve health outcomes. Therefore, policymakers are working towards understanding and enhancing the health outcomes of the population in South Asia. Significant health issues, notably high rates of infectious illnesses, malnutrition, and maternal and infant mortality, exist in this region. Bloom et al. (2004) analyze how important economic factors impact the quality of health across six major economies in South Asia. Rahman et al. (2013) examine the factors that contribute to high healthcare costs and financial disasters associated with healthcare in Bangladesh and make urgent recommendations for lowering the burden of out-of-pocket expenditures to lower levels of catastrophic health spending. Progress across the region has been uneven despite improvements in life expectancy and other health indicators (Burns et al., 2017). In addition, healthcare systems are still facing financial insufficiencies and difficulties in keeping up with the increasing demand for their services (Prinja et al., 2017). South Asian governments, as lower-middle-income economies, have limited fiscal capacity to invest in healthcare. In the

context of the health challenges faced by South Asia, it is crucial to use all financing sources effectively to improve the performance and quality of healthcare systems. External financing plays an important role.

A health quality index is a metric that evaluates and quantifies the effectiveness of healthcare systems or the state of health in a community. That evaluates multiple factors, such as population health outcomes, access to care, and the efficiency of the health system. An effective healthcare system can be measured by a higher score on the health index, which represents better life expectancy, lower frequency of illnesses, and fewer preventable deaths. This demonstrates that the population's health status improvements are partly due to broader socioeconomic progress. HQI is a better measurement of the health status of a country than several other single variables like mortality rate, infant mortality, life expectancy, etc., because this variable shows a single dimension of a country's health sector. In contrast, HQI is the metrics that merge all these dimensions. Fig. 1 shows the improvements in the health quality index in South Asia.

Healthcare expenditures provide the necessary funding to enhance the accessibility and quality of healthcare services (Bhalotra, 2007; Bein et al., 2017; Mohapatra, 2022; Rahman et al., 2018). Enhancing health results is a significant policy concern, particularly in environments with limited resources. It is thought that health spending affects how well the health system functions. Empirical evidence, however, has produced conflicting findings about the connection between health outcomes and medical costs. One reason is that corruption and inefficiency may hinder the performance of further investments. Second, poor diet, hygiene, education, and economic development can hinder the progress of health. Lastly, gains in marginal spending may be offset by the significant disease burden from HIV/AIDS, malaria, and other infectious diseases. Despite this, there is still a lot of debate around these fundamental causes. As there is a bidirectional relationship between economic growth and health spending (Islam, 2020a,b,c), lower GDP growth in South Asian countries means lower health spending. This is why external economic factors like foreign aid, FDI, and remittance are essential to improve the health quality of this region.

The link between foreign direct investment (FDI) inflows and health quality has important implications for economic growth and development. Research on how globalization affects health outcomes, particularly increased foreign investment flows, has been vital. In both industrialized and developing nations, Regarding the connection between inward FDI stocks and population health quality, there are still

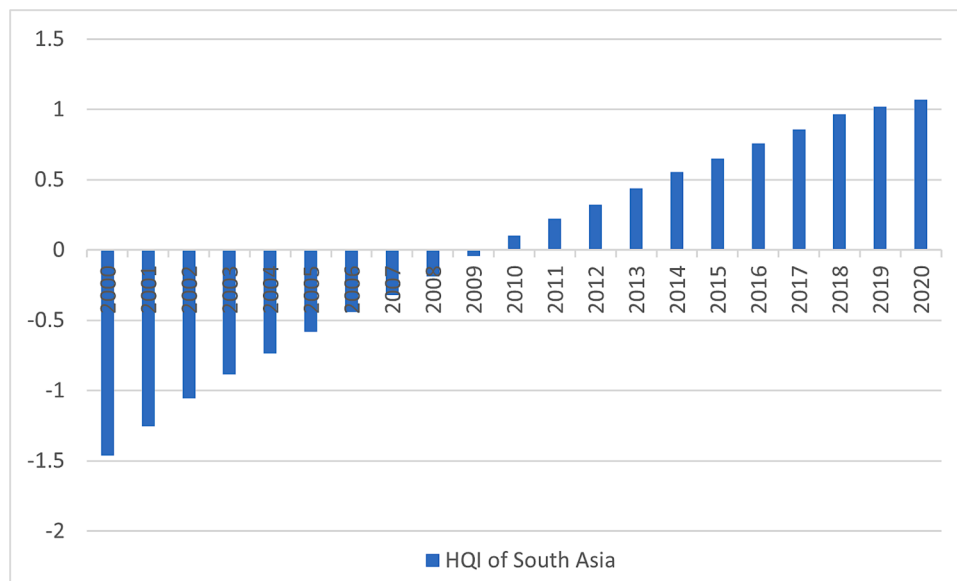


Fig. 1. HQI of South Asia for the selected countries ().  
Source: calculated by authors

contradictory findings. FDI growth can affect health in several ways. Public health expenditures and access to high-quality treatment may rise as a result of FDI-related development and higher earnings. Also, the availability and delivery infrastructure of medical technology are significantly improved by foreign direct investment (FDI) (Burns et al., 2017). However, foreign direct investment (FDI) may also contribute to the spread of illness or have unfavorable environmental effects that could worsen medical issues (Baker et al., 2014; Barlow et al., 2017; Labonté, 2019a). Therefore, the overall consequences probably rely on the socioeconomic circumstances unique to each nation.

Remittances can increase an individual's purchasing power for healthcare expenses (Rahman et al., 2013). Remittances from migrants to their home countries, particularly developing nations, have been shown in several studies to boost local populations' health results. Studies have indicated that these remittances, particularly in low- and middle-income nations, can considerably lower newborn mortality rates and enhance the health of children. Improving health outcomes and their quality in developing regions is a significant consequence of foreign aid that is allocated toward health programs. Remittance can affect health not only in a direct way but also in indirect ways. For example, remittance inflow helps to raise GDP (Islam & Shindaini, 2022), and higher GDP may lead to improved health quality.

The impact of foreign aid on the health of developing nations has been an area of global debate over the past several decades. The question is whether additional funding and health-related initiatives will result in better healthcare quality and access. Aid can provide a boost to domestic health spending and resources, which can lead to higher allocations to health systems and improved access to high-quality care (Botting et al., 2010; Johri et al., 2012). Assistance can also enable the development of enhanced health infrastructure, transfer of medical technology, improved surveillance programs, and a more capable health workforce. Also, foreign aid allows governments to fund public health programs they cannot afford otherwise, and recipient governments are unable to afford it (Farag et al., 2013). But despite receiving a lot of aid, there hasn't been any noticeable improvement in terms of health and other health-related indicators for many developing countries, especially from Africa and South Asia. Adhikari et al. (2018) suggest that rather than depending on middlemen, foreign funding should be directed at bolstering and assisting the domestic healthcare system. Many individuals think that foreign aid may help developing nations with their health issues. On the other hand, there is disagreement over the contribution of aid to economic growth and its ability to improve health outcomes. Fig. 2 shows the link between economic and globalization factors with good health.

This research will enhance the discourse on strengthening health systems and population health in South Asia. The previous study by Mohanty and Behera (2020) investigated the correlation between healthcare costs and patient outcomes. However, this study included

more economic variables in its analysis. It's essential to understand the connection between external finances and health, as this can help with deciding which areas need funding the most, prioritizing global development partnerships, and improving investment promotion strategies. South Asia faces significant health challenges, so it's crucial to make the most of all funding sources to improve the performance and quality of healthcare systems. This study primarily utilizes the Health Quality Index (HQI) as the dependent variable, reflecting a holistic measure of health system effectiveness over time. Using a composite metric like HQI, which consolidates multifaceted health domains into a standardized score, helps evaluate overall performance. This study makes use of panel data from the years 2000 to 2020, concentrating on the six largest South Asian nations: Bangladesh, India, Pakistan, Sri Lanka, the Maldives, and Nepal. These nations were chosen because they account for more than 95 % of South Asia's population and GDP, as well as data availability.

The main objective of this study is to provide helpful information for health policy decisions in South Asia. About the South Asian economies, the research will specifically examine how health spending, and globalization-related factors (foreign direct investment, remittance inflows, and development aid for health) have affected the health quality index between 2000 and 2020. By examining the relationship between these economic factors and health performance measures, the study aims to prioritize funding areas that have had the most significant impact in the past. The development of a novel health quality index to fully capture the actual contribution of dependent variables on health quality is the second purpose of this study. Because only life expectancy or mortality is inefficient in capturing the actual health quality of a region. The inclusion of policies regarding the development of regional and national health finance strategies is the third goal. The study intends to support policymakers in improving resource allocation to optimize future health benefits by quantifying the historical correlations between observed health quality and external health spending. This study is expected to facilitate health policy and governance dialogues in South Asia by providing a clear understanding of the context of development financing.

The Novelty of this study is embedded in that, it introduces a unique health quality index to capture the health quality of South Asian nations. Along with this, this study used robust approaches that effectively capture the complex dynamics and heterogeneity of health quality with health spending, foreign direct investment, and remittance inflows. We use the augmented mean group (AMG) estimator, the common correlated effect of mean group (CCEMG), and the Discroll and Karry standard error approach. All of these methods can handle the cross-sectional dependency and slope homogeneity problems of the data. With the help of this methodology, we can investigate the underlying mechanisms as well as the statistical relationships between the chosen variables. Our goals are to give policymakers helpful information and a thorough understanding of the ways that foreign aid affects health outcomes.

The remaining part of this study is organized as follows: Section 2 briefly discusses past literature related to this study whereas Section 3 represents the estimation strategies of this study. Results from data analysis are represented in Section 4. Section 5 states a brief discussion of estimated results. A causality analysis is also illustrated in section 6. The conclusion and policy recommendation based on this study's findings are discussed in section 7. Finally, Section 8 demonstrates the limitations of this study and future research guidelines on this topic.

## 2. Literature review

Several studies have been conducted to analyze how different economic factors, such as health spending, foreign direct investment (FDI), remittances, and foreign aid, affect the standard of health in developing nations. This section will summarize those previous discussions.

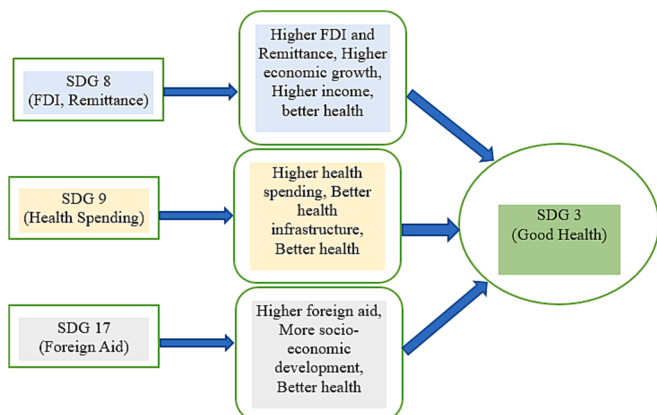


Fig. 2. Link between the selected variables.

### 2.1. Health quality and health expenditure Nexus

A study by Mohapatra (2022) found that health expenditure positively affects health outcomes in the SAARC region. In the SAARC-ASEAN area, overall health spending, state health spending, and private health spending all greatly lowered newborn mortality rates (Rahman et al., 2018). According to the findings of Akbar et al. (2021), public health expenditure helps to minimize the infant mortality rate. Alziyani and Bein (2021) and Bein et al. (2017) discovered that public health initiatives are essential, and more health spending is a significant contributor to longer life expectancies. A review by Jutkowitz (2009) discovered mixed findings, with some research demonstrating a negative correlation between Medicare spending and care quality and others finding a positive correlation between total healthcare costs and health quality. Barber et al. (2017) review previous research that used amenable mortality as a proxy for access to and quality of healthcare.

Increased health spending should lead to improved access to high-quality care, but the empirical evidence shows conflicting results. According to this review paper, previous cross-national research in the OECD found only weak correlations between health spending and amenable mortality. In the meantime, research by Akinkugbe and Mohanoe (2009) Dickson et al. (2021); Dieleman et al. (2020) demonstrated that increased public health investment resulted in lower infant mortality and longer life expectancies. However, no significant causal correlations were discovered between various health spending variables and health outcomes in Africa by other analyses. Among these are research works by (Baldacci et al., 2003; Gyimah-Brempong & Wilson, 2004; Novignon et al., 2012). All of the above studies point to the need for careful management and balancing health spending with other issues, even though it can contribute to better health.

### 2.2. Health quality and FDI Nexus

Many studies have examined how foreign direct investment (FDI) and health are related, utilizing indicators like life expectancy and newborn mortality rates. Research on developing nations revealed that foreign direct investment (FDI) increased health spending and results, but some studies also found that adverse environmental effects offset these advantages. Immurana (2020) find out foreign direct investment (FDI) has a favorable effect on health outcomes, including life expectancy and death rates. They propose that to enhance health outcomes, such as life expectancy and mortality rates, countries should concentrate on luring more foreign direct investment (FDI). Both Immurana (2020) and Shahid et al. (2019) also discovered a favorable correlation between foreign direct investment (FDI) and health since FDI raises life expectancy and lowers the death rate. However, a conflicting result was also found regarding the impact of increasing FDI on health quality indicators and its outcomes when this link was examined in developing countries, especially those in South Asia (Shahid, 2021).

Research from developed countries indicates that because of employment uncertainty, more significant FDI may be harmful to public health, economic inequality, and psychosocial stress (Chiappini et al., 2022a). FDI appears to have a favorable impact on health at lower income levels but a detrimental impact at higher income levels, according to Nagel et al. (2015), who indicates that this relationship is nonlinear. Emphasizing the role of population health in luring foreign direct investment (FDI) and the correlation between improved health and FDI inflows into low- and middle-income nations (Maiti & Bidinger, 1981). The connection between population health and foreign direct investment (FDI) in low- and middle-income countries (LMICs) has sparked a lot of interest in the literature and conversation. Despite the widespread perception that economic expansion has positive long-term effects on health, the impact of short-term macroeconomic adjustments, particularly those brought on by foreign direct investment (FDI), on health is not widely recognized (Burns et al., 2017). Zhang et al., (2023) examine the association between foreign direct investment (FDI) inflow and the

quality of population health in China. According to the findings, FDI helps to improve health quality when they are invested in carbon-minimizing projects.

### 2.3. Health quality and foreign aid Nexus

According to Bendavid and Bhattacharya (2014), each 1 % increase in health aid was associated with improvements in life expectancy and under-5 mortality. And the association between health aid and health improvements strengthened over time. Health assistance has improved life expectancy and child mortality rates, according to cross-country assessments (Akinbode et al., 2021; Asiama & Quartey, 2009; Rashed et al., 2024). Health results are significantly and favorably impacted by foreign aid, especially in nations with solid institutional quality (Zulaikha, 2016). It has been discovered that assistance lowers the productivity cost of illness, especially in regions adjacent to assistance initiatives (Odokonyero et al., 2018). Investments in essential medical technology, disease surveillance, health worker training, and infrastructure can enable developing countries to shore up access to high-quality care (Burns et al., 2017; Lim et al., 2023).

Mishra and Newhouse (2009) looks at the connection between health outcomes in developing countries and foreign help, specifically health aid. Foreign aid had little to no effect on population health overall since 2000, with only a minimal improvement in life expectancy observed. 1 % increase in foreign aid, life expectancy goes up by 0.004 %. Findings showed that although there isn't enough evidence to draw a definite connection between help and economic growth, the study does show that foreign aid can improve health outcomes (Toseef et al., 2019). Nonetheless, there is a complicated relationship between globalization, health, and aid, with a negative correlation between the three at high levels of globalization overall (Welander et al., 2012). Institutional risks also affect the effectiveness of aid in the health sector (Maruta et al., 2020). Supporters of foreign assistance assert that it may improve the delivery of health care and save lives through programs like immunization campaigns. At the same time, opponents contend that it may have unfavorable effects like encouraging reliance or being dispersed inefficiently.

### 2.4. Health quality and remittance Nexus

Recognizing the vital contribution that personal remittances make to bettering health outcomes is essential, especially in countries facing economic hardship. Shafiq and Gillani (2020) assessed how remittances affected child health and concluded that personal remittances have a beneficial impact on child health in developing nations. Terrelonge, (2014) shows that the rise in remittances might be partly responsible for the decrease in baby and child mortality rates. Between 1995 and 2009, remittances and public health spending in poor nations increased more than two-fold. However, child and newborn mortality in these nations decreased by 33.5 % and 30.9 % respectively during the same period (Terrelonge, 2014). It has been discovered that remittances have a favorable effect on health outcomes, such as in the case of babies and under-5 mortality rates (Zulaikha, 2016). They also contribute to lowering newborn mortality, raising life expectancy, and raising achievement in elementary and secondary (Zhunio et al., 2012). Remittances have been connected to higher health costs in Ecuador, as well as the cost of prescription drugs during illness and preventive treatments like immunizations and deworming (Ponce et al., 2011).

Remittances boost health outcomes in developing countries, with governance and maternal education identified as crucial routes, according to a recent study utilizing a panel vector autoregressive model (Djeunankan & Tekam, 2022). Lindstrom and Ramírez (2010) discovered that remittance-receiving households might put consumption ahead of investments in health and education, which could have a detrimental impact on health, especially for children. A recent study conducted in Bangladesh by Pradhan and Khan (2015) investigated the

**Table 1**  
 Summary of the literature.

| Literature                      | Country                  | Period    | Method                     | Variable                               | Findings |
|---------------------------------|--------------------------|-----------|----------------------------|----------------------------------------|----------|
| (Immurana, 2020)                | Africa                   | 1997–2017 | IVFE and GMM               | FDI and Health Outcome                 | positive |
| (Zhang et al., 2023)            | China                    | 1980–2020 | VECM                       | FDI and Health Outcome                 | Positive |
| (Shahid et al., 2019)           | South Asia               | 1990–2016 | Fixed Effect (FE)          | FDI and Health Outcome                 | Negative |
| (Chiappini et al., 2022a)       | 143 countries            | 1990–2016 | Instrumental Variable (IV) | FDI and Health Outcome                 | Positive |
| (Shafiq & Gillani, 2020)        | 132 countries            | 1980–2015 | System GMM                 | Remittance and Child Health            | Positive |
| (Terrelonge, 2014)              | 138 developing countries | 1995–2009 | OLS and 2SLS               | Remittance and Health Outcome          | Positive |
| (Pradhan & Khan, 2015)          | Bangladesh               | 1981–2011 | VECM                       | Remittance and Health Outcome          | Positive |
| (Asiama & Quartey, 2009)        | Sub-Saharan Africa       |           | OLS and GMM                | Aid and Health Outcome                 | Positive |
| (Mishra & Newhouse, 2009)       | 118 countries            | 1973–2004 | OLS and GMM                | Aid and Health Outcome                 | Negative |
| (Bendavid & Bhattacharya, 2014) | 140 countries            | 1974–2010 | OLS                        | Foreign Aid and Health Outcome         | Positive |
| (Anyanwu & Erhijakpor, 2007)    | Africa                   | 1999–2004 | ROLS and R2SLS             | Health Expenditure and Child Mortality | Positive |
| (Akinkugbe & Mohanoe, 2009)     | Lesotho                  | 1975–2007 | VAR                        | Health Expenditure and Life Expectancy | Positive |
| (Mohapatra, 2022)               | SAARC                    | 1993–2012 | GLS                        | Health Expenditure and Health Outcome  | Positive |

correlation between remittance earnings and health quality. The study’s conclusions demonstrated a long-term causal link between remittances and the Human Development Index (HDI). This implies that remittances eventually result in better living conditions. It is worth noting that remittances are a reliable predictor of healthy functioning and demonstrate a strong and nonlinear relationship with healthy functioning (Păunică et al., 2019). Table 1 represents the summary of the literature review.

2.6. Literature gap

Numerous studies have already been conducted on the health sector outcome in South Asia. However, none of those researchers try to create a health quality index. Somewhat different, the literature tries to calculate health outcomes by considering different proxy variables like child mortality, maternal mortality, and life expectancy. However, this study, for the first time, tries to create a unique health quality index by using child mortality, maternal mortality, life expectancy, and disease prevalence. The existing literature fails to adequately explain the link between external capital inflow-related variables and health outcomes in South Asian countries. The effects of government health spending, FDI, foreign aid, and remittances on health outcomes have been examined in the past, but separately. To better understand how external economic factors, affect public health in South Asian countries, it is crucial to investigate how household-level remittance inflows, industry-level FDI inflow, and international aid interact with government policies and healthcare investments. By doing so, we can gain a more comprehensive understanding of the mechanisms that impact population health in this region.

3. Methodology

3.1. Data and sources

3.1.1. Development of health quality index

Several previous studies tried to model health quality with economic aspects. Still, one of the significant gaps in the earlier studies was the determinant of health quality that they used, which was a poor representation of a country’s health sector quality. Most of the previous studies use dependent variables like life expectancy, maternal mortality rate, or disease prevalence. However, one single variable can’t express the real health scenario of a country. That’s why this study makes an index by combining all of this. To do this study, I followed the following procedure:

- Step 1:

After collecting data on life expectancy, infant mortality, maternal mortality, and tuberculosis prevalence, we take the inverse of these to transfer them into positive attributes. Now, the variables become life expectancy, maternal survival rate, infant survival rate, and tuberculosis-free population. All of them show positive attributes.

(continued on next column)

(continued)

- Step 2:

As the ranges of all these variables were different, this study applied a widely used standardization method to convert all the variables within the same range.
- Step 3:

After standardization, this study applied the principal component analysis (PCA) method to create a unique health quality index.

3.1.2. Data definition

Our study’s econometric estimate was predicated on secondary data, namely the World Bank’s WDI and Our World in Data sources. We examined vital factors such as FDI inflow, personal remittances received, foreign aid, and health spending as independent variables to find out what affects health outcomes. We confined our study and examined data for South Asian nations (Bangladesh, India, Maldives, Nepal, Pakistan, and Sri Lanka) from 2000 to 2020, as data for Afghanistan and Bhutan were not available. The information is yearly panel data—a more thorough analysis of the data for South Asian economies from 2000 to 2020. Four primary variables were selected to measure the inputs of the healthcare system, which are independent of each other. These include Health expenditure (HE), which is the amount spent on medical care by the public and private sectors. Foreign aid (FA) represents the net official development assistance for health, which is external financing. Remittances are defined as personal payments made by foreign workers back to their home nations in South Asia. This serves as an additional source of health financing. Foreign direct investment (FDI) inflows are capital investments from abroad that are linked to healthcare capacity. A list of the variables and their definition are given in Table 2.

3.1.3. Summary statistics

The variable’s descriptive statistics from 2000 to 2020 are shown in Table 3. Standard deviations, max, min, skewness, kurtosis, sum, sum,

**Table 2**  
 List of all variables.

| Variable | Indicator                    | Measurement                                                                                                                                     | Source                    |
|----------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| HQI      | Health Quality Index         | This index includes four variables: Life expectancy at birth, Mortality rate (infant), Maternal mortality ratio, and incidence of tuberculosis. | World Bank, (2023)        |
| HE       | Health Expenditure           | Current health expenditure per capita (current US\$)                                                                                            | World Bank, (2023)        |
| FDI      | Foreign Direct Investment    | Foreign direct investment, net (Bop current US\$)                                                                                               | World Bank, (2023)        |
| FA       | Foreign Aid                  | Foreign aid (current US\$)                                                                                                                      | Our World in Data, (2023) |
| PRR      | Personal remittance received | Personal remittances received (current US\$)                                                                                                    | World Bank, (2023)        |

**Table 3**

Summary statistics.

|              | HQI       | HE       | FDI        | FA         | PRR        |
|--------------|-----------|----------|------------|------------|------------|
| Mean         | -7.94E-10 | 135.0841 | 5.41E + 09 | 8.61E + 08 | 2.76E + 08 |
| Median       | -0.526273 | 42.23648 | 7.12E + 08 | 5.79E + 08 | 7.593543   |
| Maximum      | 3.538248  | 993.4720 | 6.44410    | 3.47709    | 3.066009   |
| Minimum      | -3.16603  | 8.338082 | -6647984   | 5170000.   | 0.077343   |
| Std.Dev      | 1.671682  | 229.4762 | 1.250010   | 8.1000008  | 7.020008   |
| Skewness     | 0.52974   | 2.339349 | 2.765608   | 1.158262   | 2.535668   |
| Kurtosis     | 2.426585  | 7.257731 | 9.774297   | 3.614196   | 8.281825   |
| Sum          | -1.00E-07 | 17020.60 | 6.81E + 11 | 1.08E + 11 | 3.48E + 10 |
| Sum Sq.Dev   | 349.3152  | 6582418. | 1.95E + 22 | 8.20E + 19 | 6.17E + 19 |
| Observations | 126       | 126      | 126        | 126        | 126        |

sq., and means are among them. For every series, developments and observations are available. Outlines some of the variables' most significant features and gives the results of the descriptive statistics. The components have varying average values; remittances have the lowest mean value, while health expenses have the greatest mean value. The skewness of all the variables is positive. While most variables have few outliers and display platykurtosis or negative kurtosis, FDI displays leptokurtosis or positive excess kurtosis.

### 3.2. Theoretical model

This study explores the impact of government health spending on health outcomes in South Asian countries, excluding Afghanistan and Bhutan, using Grossman's health production model. According to Grossman (2017), the cost of healthcare and other consumer goods can affect people's satisfaction with producing and consuming health. A lot of other research also uses Grossman's health production function as their theoretical model, for example (Bala et al., 2022; Bolin & Caputo, 2017; Hwang & Sakong, 2019; Labonté, 2019b; Liljas, 1998; Mhlanga, 2021; Novignon et al., 2012), etc. The Grossman model provides a formula for measuring health production function.

$$H = f(x) \quad (1)$$

The equation below shows how each person's health output is measured. The letter H represents a measure of the health quality index (HQI). The letter X represents a collection of different inputs to the health production function. These inputs in our study include government health expenditures (HE), foreign aid (FA), inflows of foreign direct investment (FDI), and personal remittances received (PRR) in this study as the main focus of this study is to examine the relationship between external economic factors and health quality. In previous studies like Immurana (2020), Shafiq and Gillani (2020), Asiama and Quartey (2009), and Anyanwu and Erhijakpor (2007), the effect of these variables was calculated separately on health outcomes. The H vector represents health outcome or quality, and it may include any factor that can show the scenario of health status. In our study, we include four components in the H vector to represent health quality: incidence of tuberculosis, life expectancy, infant mortality rate, and maternal mortality ratio. However, in previous studies, such as (Chiappini et al., 2022b; Novignon et al., 2012; Pradhan and Khan (2015)), health outcomes were measured by only one or two of these variables. It is possible to define the empirical links between health inputs and health outcomes as follows.

$$HQI_{it} = \beta_0 + \beta_1 HE_{it} + \beta_2 FA_{it} + \beta_3 FDI_{it} + \beta_4 PRR_{it} + \varepsilon_{it} \quad (2)$$

Equation (3) HQI is used to measure the health quality index in this study. This index is determined by several factors such as the incidence of tuberculosis, maternal mortality ratio, infant mortality rate, and life expectancy at birth. Furthermore, foreign aid (FA), foreign direct investment inflows (FDI), health expenditure (HE), and personal remittance received (PRR) are considered independent variables. Here  $\beta_0$  is the intercept and  $\beta_1$  to  $\beta_4$  are slope coefficients for different independent

variables and  $\varepsilon_{it}$  is the error term to measure deviations.

### 3.3. Econometric estimation

#### 3.3.1. Augmented mean group test

To ensure that cross-sectional dependence and parameter heterogeneity are taken into consideration (Sencer Atasoy, 2017), the AMG proposed by (Eberhardt et al., 2010; Eberhardt & Bond, 2009) is used. When analyzing panel data, the Augmented Mean Group (AMG) estimator has several benefits. First off, it efficiently captures both cross-sectional variation and time-series dynamics by permitting heterogeneous parameter estimates across individual units while also pooling information across units (Eberhardt & Teal, 2010). Second, by including lagged variables and other control variables, the AMG estimator mitigates possible endogeneity problems and improves the robustness of the estimation results (Othman et al., 2018). Thirdly, the AMG estimator minimizes bias and increases efficiency in predicting long-run coefficients by adding lagged variables to the group mean estimator. This is especially useful when there is a short time-series dimension compared to the cross-sectional dimension (Pesaran & Smith, 1995). How these estimators estimate the unobserved standard components is the primary distinction. The AMG estimator permits cross-sectional dependence by estimating the unobserved joint dynamic impact while accounting for the standard dynamic effect parameter. After adding time dummies to the formula, the first difference OLS is used to estimate.

$$\Delta y_{it} = \alpha_{1i} + \beta_1 \Delta X_{it} + \varphi_1 f_t + \sum_{t=2}^T \tau_t \text{DUMMY}_t + \varepsilon_{it} \quad (3)$$

We assign a unit coefficient to every group member to build a regression model that is unique to that group. The AMG estimator is subtracted from the dependent variable to achieve this. The intercept captures the time-invariant fixed effects in each regression. We apply the mean group estimate for AMG.

$$AMG = N^{-1} \sum_{i=1}^N \tilde{\beta}_i \quad (4)$$

Here  $\tilde{\beta}_i$  is the coefficient estimator.

#### 3.3.2. Robustness check

This study utilizes three recent panel data estimators to address the cross-sectional dependency and slope heterogeneity problems of the dataset. To assess the consequences of AMG regression, we included the Driscoll-Kraay standard error (D-K SE) method as a robustness test, proposed by (Driscoll & Kraay, 1998). Unlike other regression procedures, this technique yields reliable and immaculate findings even when dealing with CSD. The method is capable of addressing missing values as well (Danish et al., 2019). The D-K standard error is also a useful method for dealing with heteroscedasticity or longitudinal and serial dependence within the paradigm of fixed effects (Danish et al., 2019). Moreover, it applies to both balanced and imbalanced panel data sets, allowing for a more extended period and more flexibility due to its use of

a non-parametric method. Equation (6) representing the regression of Driscoll Kraay's standard error is as follows:

$$V(\hat{\alpha}) = (X'X)^{-1} \hat{S}_T (XX)^{-1} \quad (6)$$

When slope heterogeneity and cross-sectional dependence are key issues to address, the CCEMG estimator is a robust choice in panel data models. Even in the face of those econometric challenges, it delivers unbiased and consistent estimates. To determine the mean group estimator for the CCE, compute the average of every coefficient across all individual regression as described below:

$$CCEMG = N^{-1} \sum_{i=1}^N \hat{\beta}_i \quad (7)$$

where  $\hat{\beta}_i$  represents the coefficient estimations.

Finally, this study applied the Generalized Method of Moment (GMM) approach to check whether there is any lagged effect of the dependent variable exists or not. Several notable advantages of the GMM method are available. Firstly, first, it does not need the assumption of normality. Second, the applied model is robust to heteroscedasticity within the model. Third, GMM can provide estimation of parameters even when the model cannot be solved fully analytically, and with some flexibility in how to choose the set of instrumental variables. GMM then, is particularly good at dealing with endogeneity in the dependent variable, the independent variable, or the error term. This study applied the following GMM proposed by (Arellano & Bond, 1991),

$$HQI_{it} = \beta_0 + \beta_1 HQI_{it-1} + \beta_2 HE_{it} + \beta_3 FA_{it} + \beta_4 FDI_{it} + \beta_5 PRR_{it} + \varepsilon_{it} \quad (8)$$

### 3.3.3. Causality test

Granger (1969) created a test to determine whether the variables are causally related. However, it has several shortcomings, such as the test's inaccuracy when cross-sectional dependency (CSD) is present. For this reason, this study employed a more advanced version of the D-H causality assessment, developed by (Dumitrescu & Hurlin, 2012). As a result, the D-H assessment is applied, which is better at taking CSD into account than the panel Granger causality analysis. One approach to express the D-H panel causality would be as follows:

$$Z_{in} = \delta_i + \sum_{k=1}^k Y_i^k Z_{i(n-k)} + \sum_{k=1}^k \theta_i^k X_{i(n-k)} + \varepsilon_{in} \quad (9)$$

where  $X$  and  $z$  represent the observables,  $Y_i^k$  represents an autoregressive parameter, and  $\theta_i^k$  denotes the estimations of the regression coefficient. Fig. 3 represents the data analysis process and technique of this study.

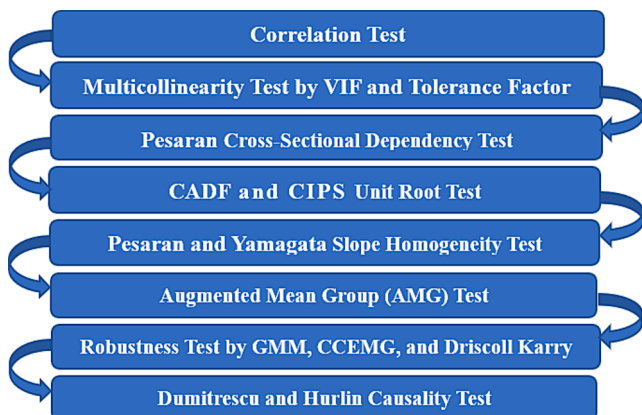


Fig. 3. Data analysis techniques.

## 4. Results and discussion

### 4.1. Correlation metrics

The results of the correlation analysis will show if the variables have a positive or negative connection. Table 4 shows that HE and HQI have a positive connection (0.2340), whereas FA and HE have the greatest and most significant negative correlation (−0.4305). Higher remittances are typically linked to worse health quality, as shown by the statistically significant negative association between remittance received and the health quality index (−0.2540). It is significant to note that the correlation coefficients for all variables are less than 0.70, except for FDI and remittance received. This suggests the absence of multicollinearity.

### 4.2. Multi-collinearity test

The chosen variables show no multi-collinearity, as supported by a variance inflation factor of less than 10. The correlation results also indicate no multi-collinearity, except for foreign aid, which correlates with other independent variables greater than 0.5. The results of the multicollinearity test are stated in Table 5.

### 4.3. Cross-Sectional dependency test

Table 6 represents the cross-sectional dependency test suggested by Pesaran. There is strong evidence that contradicts the null hypothesis of cross-sectional independence for all variables, as indicated by the CD-test statistics and corresponding p-values. The average joint T value is the same (21.0) across all variables. The mean  $\rho$  (rho) values, which represent the average pair-wise correlation coefficients between cross-sectional units, vary from 0.12 (PRR) to 0.94 (HE). Similarly, the mean  $\text{abs}(\rho)$  values, which represent the average absolute pair-wise correlations, vary from 0.37 (PRR) to 0.95 (HQI). All of these findings suggest that there is a significant cross-sectional dependency in the data, with the variables PRR and HQI showing the least cross-sectional dependence among those considered and HE and HQI showing the most.

### 4.4. Unit root test

Due to having CSD in the dataset, this study employs two 2nd generation unit root tests, CADF and CIPS. The 2nd generation unit root test results for the variables PRR, FDI, FA, HE, and HQI are displayed in Table 7. CADF test shows that all the variables except HQI are non-stationary at the level, but they become stationary after taking the first difference. But HQI is stationary at level. CIPS test shows that two variables (PRR and HQI) are stationary at the level, and the remaining variables are stationary at the difference.

### 4.5. Slope homogeneity test

The results of the slope homogeneity test are shown in Table 8. There are significant differences in the slopes of the data between groups or over time, as indicated by the tests for slope homogeneity. the  $\hat{\alpha}$  and  $\hat{\alpha}_{adj}$  tests reject the null hypothesis of slope homogeneity, as their p-values are very low (0.000). It is crucial to consider these variations

Table 4  
Correlation test.

|     | HQI       | HE         | FDI       | FA        | PRR    |
|-----|-----------|------------|-----------|-----------|--------|
| HQI | 1.0000    |            |           |           |        |
| HE  | 0.2340*** | 1.0000     |           |           |        |
| FDI | 0.1059    | −0.1524*   | 1.0000    |           |        |
| FA  | 0.0175    | −0.4305*** | 0.5891*** | 1.0000    |        |
| PRR | −0.2510** | −0.1800**  | −0.1037   | 0.3149*** | 1.0000 |

\*\*\*p < 0.1, \*\*p < 0.5, \*p < 0.10.

**Table 5**

Variance Inflation Factor (VIF) for Inquiring Multi-collinearity.

| Variable | VIF  | 1/VIF    |
|----------|------|----------|
| HE       | 1.25 | 0.798973 |
| FDI      | 1.82 | 0.550867 |
| FA       | 2.30 | 0.434493 |
| PRR      | 1.29 | 0.772760 |
| Mean VIF | 1.67 |          |

**Table 6**

Cross-Section Dependency Test.

| Variable | CD-test   | p-value | average joint T | mean $\rho$ | mean abs( $\rho$ ) |
|----------|-----------|---------|-----------------|-------------|--------------------|
| HQI      | 6.597***  | 0.000   | 21.00           | 0.37        | 0.95               |
| HE       | 16.613*** | 0.000   | 21.00           | 0.94        | 0.94               |
| FDI      | 8.913***  | 0.000   | 21.00           | 0.50        | 0.51               |
| FA       | 3.713***  | 0.000   | 21.00           | 0.21        | 0.38               |
| PRR      | 2.098***  | 0.036   | 21.00           | 0.12        | 0.37               |

\*\*\*p &lt; 0.1, \*\*p &lt; 0.5, \*p &lt; 0.10.

while analyzing and interpreting the data since they imply different correlations between the variables across groups or periods.

#### 4.6. Augmented mean group (AMG) estimator test

The AMG estimator results display the estimated coefficients, standard errors, and z-values for the independent variables HE, FDI, FA, and PRR along with the constant component ( $\_cons$ ) in Table 9. The coefficient for HE is  $-0.0004316$  with a z-value of  $-1.85$ , and it is statistically insignificant at a 5 % level as the p-value is 0.064. It refers that a rise in health expenditure will causes a small deterioration in heal quality. This may occur due to corruption and mismanagement in health sector in South Asia. Similarly, the coefficient for PRR is  $-0.0078775$  with a z-value of  $-2.21$ , which is statistically significant at 5 % level. This implies that a 1 % increase in PRR is associated with a 0.78775 % reduction in the dependent variable, ceteris paribus. According to the AMG finding remittance contribute positively to rise health standard of South Asian countries although it is very small. In south Asian countries remittance usually not being directed for the improvement of heal sector as heal is the least priority sector in these countries. On the other hand, the coefficient for FDI is  $3.94e-12$  with a z-value of 1.80, which is statistically significant at a 10 % level with a p-value of 0.071. It indicates that FDI have a small positive role on health quality of South Asia. FDI helps to rise income level and living standard of the people which contribute positively to rise heal quality in South Asian countries. The FA coefficient is  $8.83e-11$ , and the z-value of 3.03 indicates that it is statistically significant at a 1 % level. This means that a 1 % increase in FA is linked to a 0.0000000883 % increase in the dependent variable, given that all other variables remain constant. It implies that foreign aid has small but significant positive role in developing health quality of South Asian countries. Because foreign aid often comes to these countries as a form of medical assistance. Furthermore, the constant term ( $\_cons$ ) has a coefficient of  $-1.965414$ , which is statistically significant at a 1 % level with a z-value of  $-3.22$ . When all independent variables are zero, this

**Table 7**

CADF and CIPS unit root test.

| Variables | CADF          |                   |              | CIPS           |                   |              |
|-----------|---------------|-------------------|--------------|----------------|-------------------|--------------|
|           | Level         | At 1st Difference | Stationarity | Level          | At 1st Difference | Stationarity |
| HQI       | $-0.610^{**}$ |                   | I (0)        | $-2.865^{***}$ |                   | I (0)        |
| HE        | 0.722         | $-2.142^{***}$    | I (1)        | $-1.383$       | $-3.966^{***}$    | I (1)        |
| FDI       | $-0.446$      | $-2.937^{***}$    | I (1)        | $-2.326$       | $-4.488^{***}$    | I (1)        |
| FA        | 1.114         | $-1.293^{*}$      | I (1)        | $-1.233$       | $-3.892^{***}$    | I (1)        |
| PRR       | 1.144         | $-1.362^{*}$      | I (1)        | $-1.481^{*}$   |                   | I (0)        |

\*\*\*p &lt; 0.1, \*\*p &lt; 0.5, \*p &lt; 0.10.

constant term represents the value of the dependent variable. In conclusion, the results indicate that while HE and FDI are not strong predictors in this model, FA and PRR have a significant impact on the dependent variable.

#### 4.7. Robustness test

Table 10 presents three distinct techniques for estimating the coefficients of the given variables – GMM, Driscoll-Kraay, and CCEMG. The variables HE, PRR, and FA show statistical significance in all techniques, with PRR having a negative coefficient but HE and FA having a positive coefficient. The variables HE, FA, and PRR are significant at the 1 % levels in both Driscoll-Kraay and CCEMG approaches but the significance varies in the GMM approach. All approaches indicate that the constant term ( $\_cons$ ) is statistically significant. However, it is negative in both Driscoll Kraay and CCEMG tests but positive according to the GMM method.

### 5. Discussion

This study investigates the impact of foreign aid, FDI inflows, remittances, and health expenditures on the health quality index of South

**Table 8**

Slope Homogeneity Tests.

|                           | $\Delta$  | p-value |
|---------------------------|-----------|---------|
| $\hat{\Delta}$ test       | 10.951*** | 0.000   |
| $\hat{\Delta}_{adj}$ test | 12.957*** | 0.000   |

\*\*\*p &lt; 0.1, \*\*p &lt; 0.5, \*p &lt; 0.10.

**Table 9**

AMG estimator.

| Variable             | Coefficient       | Standard error | Z-value | P value |
|----------------------|-------------------|----------------|---------|---------|
| HE                   | $-0.0004316^{*}$  | 0.0028407      | $-1.85$ | 0.064   |
| FDI                  | $3.94e-12^{*}$    | 2.36e-11       | 1.80    | 0.071   |
| FA                   | $8.83e-11^{***}$  | 2.92e-11       | 3.03    | 0.002   |
| PRR                  | $-0.0078775^{**}$ | 0.003566       | $-2.21$ | 0.027   |
| $\_cons$             | $-1.965414^{***}$ | 0.6112609      | $-3.22$ | 0.001   |
| Wald chi2(2) = 4.90  |                   |                |         |         |
| Prob > chi2 = 0.0863 |                   |                |         |         |

\*\*\*p &lt; 0.1, \*\*p &lt; 0.5, \*p &lt; 0.10.

**Table 10**

GMM, Driscoll Kraay, and CCEMG Test.

| Variables | GMM              | CCEMG              | Driscoll-Kraay    |
|-----------|------------------|--------------------|-------------------|
| HE        | 0.0013832**      | 0.0047595***       | 0.0020681***      |
| FDI       | $-1.47e-12$      | $-8.15e-12$        | $-2.96e-12$       |
| FA        | $1.82e-11^{*}$   | $2.02e-11^{***}$   | $4.98e-10^{***}$  |
| PRR       | $-1.11e-12^{**}$ | $-0.0217629^{***}$ | $-6.69e-10^{***}$ |
| $\_cons$  | 0.1024126***     | $-0.1109265^{*}$   | $-0.5076288^{*}$  |

\*\*\*p &lt; 0.1, \*\*p &lt; 0.5, \*p &lt; 0.10.

Asian nations over the period 2000 to 2020 using panel data analysis. We have examined the most recent data available. This study's main analysis uses the Augmented Mean Group (AMG) estimator to look into how different economic factors affect the health quality index in countries in South Asia. The AMG model provides reliable estimates because it considers the non-stationarity, slope heterogeneity, and cross-sectional dependence that are frequently found in panel data.

According to the AMG model, health spending hurts the health quality index, but this finding is not acceptable as the P-value is higher than the minimum threshold level of 5 %. However, according to DK and CCEMG estimators, health spending has a positive effect on health quality, which is also statistically significant. Whenever there is more healthcare spending, the quality of healthcare will rise because higher healthcare spending means higher value addition to this sector and lower cost of service. As the per capita income of South Asian people is not high and many poor people are living under the poverty line, any additional health spending by maybe from the government or maybe from the private sector will always make the service more easy-going for them. Grossman (2017) also noted that government expenditure on health should increase to reduce the cost of health inputs, raise optimum capital stock, and eventually enhance health outcomes since high-paid workers desire a larger optimal health stock due to the increased advantages of excellent health. (Guisan & Exposito, 2010). Justifying health expenditure can also improve the health quality index. Investing in healthcare can lower child mortality rates in underdeveloped nations, according to studies by Bokhari et al. (2007) and Farag et al. (2013). However, the low coefficient indicates that increasing expenditure alone has little effect. Therefore, spending on healthcare must also be efficient and of high-quality (Kim & Lane, 2013).

The significantly favorable influence of foreign aid on the health quality index is a major finding of the AMG estimator. A 1 % increase in foreign assistance inflows is linked, holding other variables constant, to a 0.0000000883 % improvement in health quality. This finding supports the idea that improving capacity building, medical supplies, and healthcare facilities purchased with foreign aid will improve recipient nations' health results. Targeted assistance aimed at improving healthcare systems and providing access to medication and services can lead to better health outcomes, such as increased life expectancy and reduced child mortality rates in recipient countries (Ayre et al., 2021; Wilson, 2011). According to Barber et al. (2017), foreign aid directed toward health projects can have a positive impact on health indices by expanding access to healthcare services, improving healthcare infrastructure, and facilitating the spread of medical knowledge and technology. According to a thorough meta-analysis conducted in 2019, foreign aid allocated to health initiatives greatly enhanced several health indicators, particularly outcomes related to mother and child health. This is consistent with our findings and suggests that increased health quality is a result of foreign help.

It's interesting to note that the study shows a statistically significant negative correlation between the health quality index and remittances received. Ceteris paribus, a 1 % rise in remittances is associated with a 0.78775 % reduction in health quality, according to the coefficient of  $-0.0078775$  with a z-value of  $-2.21$ . The unexpected result might be explained by remittances being diverted from investments in healthcare to consumption or by a decrease in domestic healthcare spending due to remittance reliance. Remittances have a detrimental impact on health quality, which runs counter to some previous research that has portrayed them as a possible source of funding for recipient countries' healthcare expenses. Remittances, for example, can improve household welfare and reduce poverty, which may indirectly improve health outcomes (Adams & Page, 2005). Amuedo-Dorantes and Pozo (2014) contended that remittances boost household well-being and aid in the fight against poverty, which may have a knock-on effect on health outcomes. Our research indicates that increased remittances may not always result in better health, potentially because of several issues, such as restricted access to healthcare facilities or the use of remittance funds

for non-health-related expenses. This can happen due to the prevailing inequality and bad governance in this region, which do not help remittance be effective in the health sector. Emigrants from these areas mostly go to the Middle East and Europe, and low-skilled workers are working in unhealthy situations. Emigrant health conditions may also be reflected in these results (Al-Abri et al., 2021; Amuedo-Dorantes & Pozo, 2014). Husbands who migrate for work, especially those who migrate abroad, are linked to greater rates of obesity and reduced rates of underweight among left-behind wives in rural Bangladesh (Sznajder et al., 2021). Conflicting research exists regarding the impact of remittances on health outcomes. Some argue that they improve healthcare access, while others link them to a decline in the labor pool or the brain drain of medical professionals.

The AMG model shows that the coefficients for foreign direct investment and health expenditure are statistically significant at a 10 % level. It was statistically insignificant in both DK and CCEMG estimation, which is contrary to predictions. This might be the result of FDI concentration in non-healthcare industries or inefficiencies in healthcare spending. It is crucial to remember that these associations might change depending on the model's parameters or the specific nation. Although foreign aid has shown to be a good factor in promoting health quality, remittances seem to have the opposite effect, maybe as a result of usage patterns or unintentional effects on national healthcare policy. To optimize the beneficial effects of external financial flows on public health, policymakers must carefully evaluate how to allocate and manage these flows, as our findings highlight. It is important to remember that the AMG estimator produces reliable results by taking non-stationarity, slope variability, and cross-sectional dependency into consideration.

## 6. Causality test

Table 11 presents the striking outcomes of the panel causality test conducted by Dumitrescu and Hurlin. At the 1 % level of significance, the findings in this instance are primarily significant. Research is being conducted to determine if each pair of variables has a consistent causal relationship. A study has shown that increasing health expenditure leads to an improvement in the health quality index, implying a bidirectional homogeneous causal relationship between the two. The relationship between FDI inflow and health quality index is unidirectional, with FDI inflows leading to improved health outcomes. The relationship between foreign aid and the health quality index is unidirectional, with increases in foreign aid being driven by improvements in health quality. Foreign aid increases are influenced by improvements in health quality. The relationship between foreign aid and the health quality index is one-way. Increased health care costs are caused by an increase in remittances as a percentage of GDP, but not the other way around. There is bidirectional causality between foreign aid and FDI inflow. There is no significant evidence of homogenous causation in either direction for the remaining pairings. The study suggests that there are relationships between economic variables such as foreign aid, FDI, remittances, health spending, and health quality. Over time, growth in one variable appears to encourage development in the other.

**Table 11**  
D-H causality test.

| Null Hypothesis:                     | W-Stat.    | Zbar-Stat. | Prob.  |
|--------------------------------------|------------|------------|--------|
| HE does not homogeneously cause HQI  | 4.19722*   | 1.65369    | 0.0982 |
| HQI does not homogeneously cause HE  | 5.26288*** | 2.59918    | 0.0093 |
| FDI does not homogeneously cause HQI | 1.40285    | -0.82555   | 0.4091 |
| HQI does not homogeneously cause FDI | 5.81465*** | 3.08872    | 0.0020 |
| FA does not homogeneously cause HQI  | 2.97768    | 0.57168    | 0.5675 |
| HQI does not homogeneously cause FA  | 11.6821*** | 8.29451    | 0.0000 |
| PRR does not homogeneously cause HQI | 3.61801    | 1.13980    | 0.2544 |
| HQI does not homogeneously cause PRR | 1.42714    | -0.80400   | 0.4214 |

\*\*\*p < 0.1, \*\*p < 0.5, \*p < 0.10.

## 7. Conclusion and policy recommendations

This study investigates the impact of remittances, foreign direct investment (FDI), and foreign aid on the health quality index of a few South Asian countries between 2000 and 2020. It used robust econometric approaches such as Augmented Mean Group (AMG) estimators, GMM, Common Correlated Effect of Mean Group (CCEMG), and the Driscoll-Kraay robust standard error method. The findings of the AMG estimator show that there is a significant positive correlation between foreign aid and the health quality index in the selected nations. This research highlights the importance of foreign aid in strengthening the infrastructure, medical supplies, and capacity building of the healthcare industry, all of which contribute to better national health outcomes. According to the findings, there is a noteworthy negative correlation between remittances received and the health quality index. This unexpected result could be attributed to the possibility that remittances are being spent on consumption rather than healthcare investments or that reliance on remittances has led to a decrease in domestic healthcare spending. The coefficients of the AMG model for both foreign direct investment and health expenditure are statistically insignificant. The results from alternative estimation methods, such as the CCEMG and Driscoll-Kraay, largely corroborated the AMG estimator's findings regarding the significance and direction of the effects.

As foreign aid helps to improve health quality in South Asia policymakers need to prioritize the allocation of foreign aid towards improving healthcare infrastructure, particularly in underserved and remote areas. This can be achieved by constructing and upgrading hospitals, clinics, and medical facilities and investing in procuring medical equipment, supplies, and technology. Collaborating with international organizations and donor agencies can help direct foreign aid towards these critical healthcare initiatives. To ensure long-term improvement, governments must allocate a significant portion of foreign aid for capacity building. This can be done through funding extensive training programs, skill development initiatives, and incentives to attract and retain healthcare professionals, particularly in remote regions.

As health spending help to improve health quality South Asian countries must need to rise their budget for health sector. Additionally, it is vital to support cutting-edge research and development in disease prevention, treatment, and healthcare innovation through maximum budget allocation. To oversee the utilization of budget in the healthcare sector, they should implement community-based monitoring mechanisms, mandate independent audits, and request regular progress reports.

As the finding of this study demonstrates that remittance hamper health quality, it is signifying that remittance is not being used properly for health sector development in South Asia. So, South Asian countries must need to take initiative to insure proper utilization or remittance for the development of health sector. Incentivizing remittance receivers with attractive tax breaks, subsidies, or matching funds for investing their remittances in healthcare infrastructure, education, or related small businesses can help them contribute to the healthcare industry. Extensive financial literacy initiatives and widespread awareness campaigns can educate remittance beneficiaries on how to allocate their funds towards long-term healthcare savings, preventive care, and health insurance.

Additionally, foreign direct investment in the healthcare sector should be encouraged through attractive incentives, simplified rules, and increased public-private collaborations. This will lead to better health outcomes by facilitating the development of specialized healthcare facilities, knowledge transfer, and technological advancements. Governments could explore innovative funding options like healthcare bonds, social impact bonds, and healthcare levies to increase the funds for the healthcare industry. Additionally, to support healthcare practitioners, raising public health awareness through national campaigns and including health education in school curriculums can help people make

informed decisions and choose healthier lifestyles.

The study provides new empirical evidence on how economic factors influence health outcomes in South Asia. Based on these findings, we recommend that foreign aid should prioritize activities related to research and development, capacity building, and improving healthcare facilities. Additionally, policies should encourage the productive investment of remittances in healthcare and promote financial literacy among recipients. It is also essential to take steps to improve the effectiveness of healthcare expenditure and attract foreign direct investment into the industry. Additionally, the results highlight the importance of efficient healthcare spending and targeted policies to enhance the potential benefits of foreign direct investment in improving health quality. Policymakers should take note of the findings and carefully manage external financial flows like foreign aid and remittances to maximize the positive impact on public health. Although the study provides valuable insights, it is vital to recognize its limitations and the necessity for additional research to examine the underlying mechanisms, factors that mediate, and country-specific dynamics that impact the observed relationships. Ongoing attempts to comprehend and tackle the determinants of public health in developing regions are critical to achieving sustainable development goals and safeguarding the welfare of populations.

## 8. Limitations and future research direction

It is important to note that the health quality measure has certain limitations. The health quality index may not account for certain aspects of the health system's performance. To gain a better understanding of the system, more comprehensive metrics such as the UHC service coverage index could be utilized. The health spending data only employs aggregate health spending and does not include government health expenditures and out-of-pocket expenses. The list of control variables also does not consider several other social, institutional, and environmental factors that affect health, such as access to infrastructure, governance, and income. Qualitative aspects such as historical, political, or social characteristics that affect the provision of health services are also not included. The study does not evaluate short- or long-term effects using dynamic models with lags, and the temporal sensitivity of results is not examined in restricted panel methods. The regional analysis of the study is not able to differentiate between countries due to the absence of a country-specific analysis. Additionally, the small sample size of just six countries could skew the results and reduce the robustness of econometric estimates.

## Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

## CRedit authorship contribution statement

**Md. Atik Hasan:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Investigation, Formal analysis, Data curation, Conceptualization. **Shabikunnahar Suborna:** Writing – original draft, Methodology, Formal analysis, Data curation. **Afrida Jinnurain Urbee:** Writing – review & editing, Resources, Formal analysis.

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## Declaration of competing interest

The authors declare that they have no known competing financial

interests or personal relationships that could have appeared to influence the work reported in this paper.

## References

- Adams, R. H., & Page, J. (2005). Do international migration and remittances reduce poverty in developing countries? *World Development*, 33(10), 1645–1669. <https://doi.org/10.1016/j.worlddev.2005.05.004>
- Adhikari, R., Smith, P., Sharma, J. R., & Chand, O. B. (2018). New forms of development: Branding innovative ideas and bidding for foreign aid in the maternal and child health service in Nepal. *Globalization and Health*, 14(1), 1–12. <https://doi.org/10.1186/s12992-018-0350-0>
- Akbar, M., Hussain, A., Akbar, A., & Ullah, I. (2021). The dynamic association between healthcare spending, CO2 emissions, and human development index in OECD countries: Evidence from panel VAR model. *Environment, Development and Sustainability*, 23(7), 10470–10489. <https://doi.org/10.1007/s10668-020-01066-5>
- Akinbode, S. O., Oseni, I. O., & Odusanya, I. A. (2021). Foreign aid for health and infant mortality in Sub-Saharan Africa.
- Akinkugbe, O., & Mohanoe, M. (2009). Public health expenditure as a determinant of health status in Lesotho. *Social Work in Public Health*, 24(1–2), 131–147. <https://doi.org/10.1080/19371910802569716>
- Al-Abri, A., Genc, I. H., & Naufal, G. S. (2021). The impact of government spending on GDP in a remitting country. *SSRN Electronic Journal*, 11676. <https://doi.org/10.2139/ssrn.3217494>
- Alziyani, A. N., & Bein, M. (2021). Foreign direct investment, health expenditures, HIV/Aids and good convergence in Africa. *Revista Argentina de Clínica Psicológica*, 30(1), 336. <https://doi.org/10.24205/03276716.2020.2031>
- Shahid, A., Siddique, H. M. A., Kini, A. K., & Shafique, U. (2021). Human health, FDI and economic growth nexus: a panel data analysis. In *International Journal of Business, Economics and Finance*, 2(1). <http://thessri.com/Archives.php54http://thessri.com/Archives.php>
- Amuedo-Dorantes, C., & Pozo, S. (2014). Remittance income uncertainty and asset accumulation. *IZA Journal of Labor & Development*, 3(1), 3. <https://doi.org/10.1186/2193-9020-3-3>
- Anyanwu, J. C., & Erhijakor, A. E. O. (2007). African development bank economic research working paper series health expenditures and health outcomes in Africa, 91(91).
- Asiama, J. P., & Quartey, P. (2009). Foreign aid and the human development indicators in Sub-Saharan Africa. *Journal of Developing Societies*, 25(1), 57–83. <https://doi.org/10.1177/0169796X0902500103>
- Ayre, K., Bittar, A., Kam, J., Verma, S., Howard, L. M., & Dutta, R. (2021). Developing a Natural Language Processing tool to identify perinatal self-harm in electronic healthcare records. *PLoS ONE*, 16(8 August), 1–13. <https://doi.org/10.1371/journal.pone.0253809>
- Baker, P., Kay, A., & Walls, H. (2014). Trade and investment liberalization and Asia's noncommunicable disease epidemic: A synthesis of data and existing literature. *Globalization and Health*, 10(1). <https://doi.org/10.1186/s12992-014-0066-8>
- Bala, M. M., Singh, S., Kumar, N., & Janor, H. (2022). Predicting key drivers for health care expenditure growth in the Middle East region: A Grossman-PLS modeling approach. *Expert Review of Pharmacoeconomics and Outcomes Research*, 22(6), 1021–1031. <https://doi.org/10.1080/14737167.2022.2073222>
- Baldacci, E., Guin-Siu, M. T., & de Mello, L. (2003). More on the effectiveness of public spending on health care and education: A covariance structure model. *Journal of International Development*, 15(6), 709–725. <https://doi.org/10.1002/jid.1025>
- Barber, R. M., Fullman, N., Sorensen, R. J. D., Bollyky, T., McKee, M., Nolte, E., Abajobir, A. A., Abate, K. H., Abbafati, C., Abbas, K. M., Abd-Allah, F., Abdulle, A. M., Abdurrahman, A. A., Abera, S. F., Abraham, B., Abreha, G. F., Adane, K., Adelekan, A. L., Adetifa, I. M. O., & Murray, C. J. L. (2017). Healthcare access and quality index based on mortality from causes amenable to personal health care in 195 countries and territories, 1990–2015: A novel analysis from the global burden of disease study 2015. *The Lancet*, 390(10091), 231–266. [https://doi.org/10.1016/S0140-6736\(17\)30818-8](https://doi.org/10.1016/S0140-6736(17)30818-8)
- Barlow, P., McKee, M., Basu, S., & Stuckler, D. (2017). The health impact of trade and investment agreements: A quantitative systematic review and network co-citation analysis. *Globalization and Health*, 13(1), 1–9. <https://doi.org/10.1186/s12992-017-0240-x>
- Bein, M. A., Unlucan, D., Olowu, G., & Kalifa, W. (2017). Healthcare spending and health outcomes: Evidence from selected East African countries. *African Health Sciences*, 17(1), 247–254. <https://doi.org/10.4314/ahs.v17i1.30>
- Bendavid, E., & Bhattacharya, J. (2014). The relationship of health aid to population health improvements. *JAMA Internal Medicine*, 174(6), 881–887. <https://doi.org/10.1001/jamainternmed.2014.292>
- Bhalotra, S. (2007). Spending to save? State health expenditure and infant mortality in India. *Health economics*, 16(9), 911–928. <https://doi.org/10.1002/hec.1260>
- Bidin A. (2017). Опыт аудита обеспечения качества и безопасности Медицинской деятельности в Медицинской организации по разделу «Эпидемиологическая безопасность» No Title. In *Вестник Росздравнадзора* (Vol. 4, Issue 1).
- Bloom, D. E., Canning, D., & Sevilla, J. (2004). The effect of health on economic growth: A production function approach. *World Development*, 32(1), 1–13. <https://doi.org/10.1016/j.worlddev.2003.07.002>
- Bokhari, F. A. S., Gai, Y., & Gottret, P. (2007). Government health expenditures and health outcomes. *Health Economics*, 16(3), 257–273. <https://doi.org/10.1002/hec.1157>
- Bolin, K., & Caputo, M. R. (2017). Consumption and Investment Demand when Health Evolves Stochastically.
- Botting, M. J., Porbeni, E. O., Joffres, M. R., Johnston, B. C., Black, R. E., & Mills, E. J. (2010). Water and sanitation infrastructure for health: The impact of foreign aid. *Globalization and Health*, 6(1), 2–9. <https://doi.org/10.1186/1744-8603-6-12>
- Burns, D. K., Jones, A. P., Goryakin, Y., & Suhrcke, M. (2017). Is foreign direct investment good for health in low and middle income countries? An instrumental variable approach. *Social Science and Medicine*, 181, 74–82. <https://doi.org/10.1016/j.socscimed.2017.03.054>
- Chiappini, R., Coupaud, M., & Viaud, F. (2022a). Does attracting FDI affect population health? New evidence from a multi-dimensional measure of health. *Social Science and Medicine*, 301, 36. <https://doi.org/10.1016/j.socscimed.2022.114878>
- Chiappini, R., Coupaud, M., & Viaud, F. (2022b). Does attracting FDI affect population health? New evidence from a multi-dimensional measure of health. *Social Science & Medicine*, 301, Article 114878. <https://doi.org/10.1016/j.socscimed.2022.114878>
- Danish, Baloch, M. A., Mahmood, N., & Zhang, J. W. (2019). Effect of natural resources, renewable energy and economic development on CO 2 emissions in BRICS countries. *Science of the Total Environment*, 678, 632–638. <https://doi.org/10.1016/j.scitotenv.2019.05.028>
- Dickson, K., Wilson, R., Parfrey, O., & Parfrey, P. S. (2021). Changing Health-Related Behaviors 2: On Improving the Value of Health Spending. In P. S. Parfrey, & B. J. Barrett (Eds.), *Clinical Epidemiology: Practice and Methods* (pp. 553–569). US: Springer. [https://doi.org/10.1007/978-1-0716-1138-8\\_30](https://doi.org/10.1007/978-1-0716-1138-8_30)
- Dieleman, J. L., Cao, J., Chapin, A., Chen, C., Li, Z., Liu, A., Horst, C., Kaldjian, A., Matyas, T., Scott, K. W., Bui, A. L., Campbell, M., Duber, H. C., Dunn, A. C., Flaxman, A. D., Fitzmaurice, C., Naghavi, M., Sadat, N., Shieh, P., & Murray, C. J. L. (2020). US health care spending by payer and health condition, 1996–2016. *JAMA*, 323(9), 863–884. <https://doi.org/10.1001/jama.2020.0734>
- Djeunankan, R., & Tekam, H. (2022). Do remittances matter for health outcomes in developing countries? Fresh evidence from a panel vector autoregressive (PVAR) model. *International Journal of Development Issues*, 21(3), 458–482. <https://doi.org/10.1108/IJDI-04-2022-0079>
- Driscoll, J. C., & Kraay, A. C. (1998). Consistent covariance matrix estimation with spatially dependent panel data. *Review of Economics and Statistics*, 80(4), 549–559. <https://doi.org/10.1162/003465398557825>
- Dumitrescu, E.-I., & Hurlin, C. (2012). Testing for granger non-causality in heterogeneous panels to cite this version: HAL Id: Halshs-00224434 testing for granger non-causality in heterogeneous panels. *Economic Modelling*, 29(4), 450–460.
- Eberhardt, M., & Bond, S. (2009). Cross-Section Dependence in Nonstationary Panel Models: A Novel Estimator Cross-section dependence in nonstationary panel models: a novel estimator \*. <https://www.researchgate.net/publication/46445608>
- Eberhardt, M., & Teal, F. (2010). Productivity analysis in global manufacturing production. *University of Oxford Discussion Paper Series, No.*, 515, 1–32.
- Eberhardt, M., Teal, F., Binder, M., Bond, S., Durlauf, S., Hendry, D., Muellbauer, J., Pesaran, H., & Smith, R. (2010). Department of economics discussion paper series productivity analysis in global manufacturing production productivity analysis in global manufacturing production.
- Farag, M., Nandakumar, A. K., Wallack, S., Hodgkin, D., Gaumer, G., & Erbil, C. (2013). Health expenditures, health outcomes and the role of good governance. *International Journal of Health Care Finance and Economics*, 13(1), 33–52. <https://doi.org/10.1007/s10754-012-9120-3>
- Granger, C. W. J. (1969). Investigating causal relations by econometric models and cross-spectral. *Methods*, 37(3).
- Grossman, M. (2017). 2. The human capital model. *Determinants of Health*, 1, 42–110. <https://doi.org/10.7312/gros17812-005>
- Guisan, M. C., & Exposito, P. (2010). Health expenditure, education, government effectiveness and quality of life in Africa and Asia. *Regional and Sectoral Economic Studies*, 10(1), 71–80.
- Gyimah-Brempong, K., & Wilson, M. (2004). Health human capital and economic growth in Sub-Saharan African and OECD countries. *Quarterly Review of Economics and Finance*, 44(2), 296–320. <https://doi.org/10.1016/j.qref.2003.07.002>
- Hasan, S. B., Akhter, R., Abbasi, A. A., & Saha, S. (2019). Impact of remittance on economic growth in bangladesh. *American Journal of Trade and Policy*, 6(1), 41–48. <https://EconPapers.repec.org/RePEcris:ajotap:0041>
- Hwang, Y., & Sakong, J. (2019). An analysis on the health and the medical demand in korea: using the grossman model. *Health Policy and Management*, 29(3), 332–341. <https://doi.org/10.4332/KJHPA.2019.29.3.332>
- Immunana, M. (2020). How does FDI influence health outcomes in Africa? *African Journal of Science, Technology, Innovation and Development*, 1–11. <https://doi.org/10.1080/20421338.2020.1772952>
- Islam, M. S. (2020a). Human Capital and per capita income linkage in South Asia: a heterogeneous dynamic panel analysis. *Journal of the Knowledge Economy*, 11(4), 1614–1629. <https://doi.org/10.1007/s13132-020-00637-1>
- Islam, M. S. (2020b). Do education and health influence economic growth and food security Evidence from Bangladesh. *International Journal of Happiness and Development*, 6(1), 59. <https://doi.org/10.1504/ijhd.2020.10030680>
- Islam, M. S. (2020c). Human capital formation and economic growth in South Asia: Heterogeneous dynamic panel cointegration. *International Journal of Education Economics and Development*, 11(4), 335–350. <https://doi.org/10.1504/IJEED.2020.110593>
- Islam, M. S. (2022). Do personal remittances influence economic growth in South Asia? A panel analysis. *Review of Development Economics*, 26(1), 242–258. <https://doi.org/10.1111/rode.12842>
- Islam, M. S., & Alam, F. (2023). Influence of human capital formation on the economic growth in bangladesh during 1990–2019: An ARDL approach. *Journal of the Knowledge Economy*, 14(3), 3010–3027. <https://doi.org/10.1007/s13132-022-00998-9>

- Islam, M. S., & Alhamad, I. A. (2022). Impact of financial development and institutional quality on remittance-growth nexus: Evidence from the topmost remittance-earning economies. *Heliyon*, 8(12), Article e11860. <https://doi.org/10.1016/j.heliyon.2022.e11860>
- Islam, M. S., & Azad, A. K. (2024). The impact of personal remittance and RMG export income on income inequality in Bangladesh: Evidence from an ARDL approach. *Review of Economics and Political Science*, 9(2), 134–150. <https://doi.org/10.1108/REPS-01-2023-0004>
- Islam, M. S., & Muneer, S. (2018). Human Development and Economic Growth Nexus: A Comparative Study between Bangladesh and Pakistan. [www.pbr.co.in](http://www.pbr.co.in)
- Islam, M. S., & Mustafa Shindaini, A. J. (2022). Impact of institutional quality and human capital creation on economic growth in Bangladesh: Evidence from an ARDL approach. *International Journal of Social Economics*, 49(12), 1787–1802. <https://doi.org/10.1108/IJSE-12-2021-0732>
- Islam, M. S. (2024). The remittance-growth nexus in leading remittance-earning nations, controlling regulatory quality, trade openness, energy use, and financial expansion. *Review of Development Economics*, 28(4), 1676–1694. <https://doi.org/10.1111/rode.13120>
- Johri, M., Chung, R., Dawson, A., & Schrecker, T. (2012). Global health and national borders: The ethics of foreign aid in a time of financial crisis. *Globalization and Health*, 8, 1–10. <https://doi.org/10.1186/1744-8603-8-19>
- Jutkowitz, E. (2009). Stimulus money and health care research and investment. *Health Policy Newsletter*, 22(2), 2.
- Kim, T. K., & Lane, S. R. (2013). Government health expenditure and public health outcomes: a comparative study among 17 countries and implications for US health care reform. *American International Journal of Contemporary Research*, 3(9), 8–13.
- Labonté, R. (2019a). Trade, investment and public health: compiling the evidence, assembling the arguments. *Globalization and Health*, 15(1), 1–12. <https://doi.org/10.1186/s12992-018-0425-y>
- Labonté, R. (2019b). Trade, investment and public health: compiling the evidence, assembling the arguments. *Globalization and Health*, 15(1). <https://doi.org/10.1186/s12992-018-0425-y>
- Liljas, B. (1998). The demand for health with uncertainty and insurance. In: *Journal of Health Economics*, 17.
- Lim, Y., Kim, Y., & Connolly, D. (2023). Assessing the impact of aid on public health expenditure in aid recipient countries. *Development Policy Review*, 41(1), Article e12635. <https://doi.org/10.1111/dpr.12635>
- Lindstrom, D. P., & Ramírez, A. L. (2010). Pioneers and followers: Migrant selectivity and the development of U.S. migration streams in Latin America. *Annals of the American Academy of Political and Social Science*, 630(1), 53–77. <https://doi.org/10.1177/0002716210368103>
- Maiti, & Bidinger. (1981). The Effect of Population Health on Foreign Direct Investment. *Journal of Chemical Information and Modeling*, 53(9), 1689–1699.
- Maruta, A. A., Banerjee, R., & Cavoli, T. (2020). Foreign aid, institutional quality and economic growth: Evidence from the developing world. *Economic Modelling*, 89, 444–463. <https://doi.org/10.1016/j.econmod.2019.11.008>
- Mhlanga, D. (2021). Article a dynamic analysis of the demand for health care in post-apartheid south africa. *Nursing Reports*, 11(2), 484–494. <https://doi.org/10.3390/nursrep11020045>
- Mishra, P., & Newhouse, D. (2009). Does health aid matter? *Journal of Health Economics*, 28(4), 855–872. <https://doi.org/10.1016/j.jhealeco.2009.05.004>
- Mohanty, R., & Behera, D. (2020). How effective is public health care expenditure in improving health outcome? an empirical evidence from the indian states. *Working Papers*, 1–29.
- Mohapatra, S. (2022). Health expenditures, health infrastructure and health status in SAARC countries: A panel data analysis. *Vikalpa*, 47(3), 205–216. <https://doi.org/10.1177/02560909221113382>
- Nagel, K., Herzer, D., & Nunnenkamp, P. (2015). How does FDI affect health? *International Economic Journal*, 29(4), 655–679. <https://doi.org/10.1080/10168737.2015.1103772>
- Novignon, J., Olakojo, S. A., & Nonvignon, J. (2012). The effects of public and private health care expenditure on health status in sub-Saharan Africa: New evidence from panel data analysis. *Health Economics Review*, 2(1), 1–8. <https://doi.org/10.1186/2191-1991-2-22>
- Odokonyero, T., Marty, R., Muhumuza, T., Ijjo, A. T., & Owot Moses, G. (2018). The impact of aid on health outcomes in Uganda. *Health Economics (United Kingdom)*, 27(4), 733–745. <https://doi.org/10.1002/hec.3632>
- Othman, N., Andaman, G., Yusop, Z., & Ismail, M. M. (2018). Impact of public expenditures on FDI inflows into developing countries. *Pertanika Journal of Social Sciences and Humanities*, 26(2), 751–768.
- Our World in Data. (2023). Data Catalog - Our World in Data. <https://ourworldindata.org/data>
- Păunici, M., Manole, A., Motofei, C., & Tănase, G. L. (2019). The impact of remittances on gdp and household consumption. An European Union countries analysis. *Economic Computation and Economic Cybernetics Studies and Research*, 53(4), 97–114. <https://doi.org/10.24818/18423264/53.4.19.06>
- Pesaran, M. H., & Smith, R. (1995). Estimating long-run relationships from dynamic heterogeneous panels. In *Journal of Econometrics*, 68(1). [https://doi.org/10.1016/0304-4076\(94\)01644-F](https://doi.org/10.1016/0304-4076(94)01644-F)
- Ponce, J., Olivieri, I., & Onofa, M. (2011). The role of international remittances in health outcomes in Ecuador: Prevention and response to shocks. *International Migration Review*, 45(3), 727–745. <https://doi.org/10.1111/j.1747-7379.2011.00864.x>
- Pradhan, M. A. H., & Khan, G. U. (2015). Role of Remittance for Improving Quality of Life: Evidence from Bangladesh. *Turkish Economic Review*, 2(3), 160–168. <https://doi.org/10.1453/ter.v2i3.328>
- Prinja, S., Chauhan, A. S., Karan, A., Kaur, G., & Kumar, R. (2017). Impact of publicly financed health insurance schemes on healthcare utilization and financial risk protection in India: A systematic review. *PLoS ONE*, 12(2), 1–19. <https://doi.org/10.1371/journal.pone.0170996>
- Rahman, M. M., Gilmour, S., Saito, E., Sultana, P., & Shibuya, K. (2013). Health-related financial catastrophe, inequality and chronic illness in Bangladesh. *PLoS ONE*, 8(2). <https://doi.org/10.1371/journal.pone.0056873>
- Rahman, M. M., Khanam, R., & Rahman, M. (2018). Health care expenditure and health outcome nexus: New evidence from the SAARC-ASEAN region. *Globalization and Health*, 14(1), 113. <https://doi.org/10.1186/s12992-018-0430-1>
- Rashed, N., Shabanikiya, H., Alizamani, L., Jamali, J., & Kokabisaghi, F. (2024). International aid management in Afghanistan's health sector from the perspective of national and international managers. *BMC Health Services Research*, 24(1). <https://doi.org/10.1186/s12913-024-11260-0>
- Saiful Islam, M., & Afroz Keramat, S. (2012). Remittance inflow into rural economy of Bangladesh. <https://www.researchgate.net/publication/323869086>
- Sencer Atasoy, B. (2017). Testing the environmental Kuznets curve hypothesis across the U.S.: Evidence from panel mean group estimators. *Renewable and Sustainable Energy Reviews*, 77(February), 731–747. <https://doi.org/10.1016/j.rser.2017.04.050>
- Shafiq, M. N., & Gillani, S. (2020). Health Outcomes of Remittances in Developing Economies: An Empirical Analysis Health Outcomes of Remittances in Developing Economies : An Empirical Analysis. June 2018, 1–20.
- Shahid, A. (2021). Human health, FDI and economic growth Nexus: A panel data. *Analysis*, 2(1), 54–66.
- Shahid, A., Siddique, H. M. A., & Liaqat, R. (2019). Human health and foreign direct investment nexus: Evidence From South Asia. *Asian Development Policy Review*, 7(3), 209–218. <https://doi.org/10.18488/journal.107.2019.73.209.218>
- Sznajder, K. K., Wander, K., Mattison, S., Medina-Romero, E., Alam, N., Raqib, R., Kumar, A., Haque, F., Blumenfeld, T., & Shenk, M. K. (2021). Labor migration is associated with lower rates of overweight and higher rates of obesity among left-behind wives in rural Bangladesh: A cross-sectional study. *Globalization and Health*, 17(1), 1–11. <https://doi.org/10.1186/s12992-021-00712-5>
- Terrelonge, S. C. (2014). For health, strength, and daily food: the dual impact of remittances and public health expenditure on household health spending and child health outcomes. *Journal of Development Studies*, 50(10), 1397–1410. <https://doi.org/10.1080/00220388.2014.940911>
- Toseef, M. U., Jensen, G. A., & Tarraf, W. (2019). How effective is foreign aid at improving health outcomes in recipient countries? *Atlantic Economic Journal*, 47(4), 429–444. <https://doi.org/10.1007/s11293-019-09645-2>
- Welander, A., Lyttkens, C. H., & Nilsson, T. (2012). Do Foreign Aid and Globalization Affect Health in Developing Countries? August.
- Wilson, S. E. (2011). Chasing success: Health sector aid and mortality. *World Development*, 39(11), 2032–2043. <https://doi.org/10.1016/j.worlddev.2011.07.021>
- World Bank. (2023). World Development Indicators | DataBank. <https://databank.worldbank.org/source/world-development-indicators>
- Zhang, Z., Nuță, F. M., Dimen, L., Ullah, I., Xuanye, S., Junchen, Y., Yihan, Z., & Yi, C. (2023). Relationship between FDI inflow, CO2 emissions, renewable energy consumption, and population health quality in China. *Frontiers in Environmental Science*, 11(February), 1–10. <https://doi.org/10.3389/fenvs.2023.1120970>
- Zhunio, M. C., Vishwasrao, S., & Chiang, E. P. (2012). The influence of remittances on education and health outcomes: A cross country study. *Applied Economics*, 44(35), 4605–4616. <https://doi.org/10.1080/00036846.2011.593499>
- Zulaikha, S. (2016). No 主観的健康感を中心とした在宅高齢者における健康関連指標に関する共分散構造分析Title. *Revista Brasileira de Ergonomia*, 9(2), 10.