DOI: https://doi.org/10.37075/EA.2025.1.10 Economic Alternatives, 2025, Issue 1, pp. 190-205

Revisiting the Role of Health Financing and Workforce on Public Health Outcomes in Low-, Middle- and High-Income Countries

Received: 01.11.2023
Available online: 31.03.2025

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Abstract

The role of health financing and healthcare workforce on public health outcomes is undeniable. The present study examines the role of domestic government health expenditure, private out-of-pocket health expenditure, physicians, pharmaceutical and nursing staff on life expectancy and under-five infant mortality rate. The comparison is made across three income groups i.e., high, middle-, and low- income countries. For estimation, panel data econometric techniques are applied using macro-level data based on 10 years (2010-2019). The Driscoll-Kraay and Prais-Winsten estimations are robust to heteroscedasticity and serial correlation. The empirical results show that health financing and healthcare workforce are positively related to life expectancy and negative with infant mortality rate. Furthermore, the marginal impact of health financing and workforce differ across countries by different income groups. The impact of pharmacists is higher in middle income countries. In high-income countries the impact of physicians is greater as compared to nurses. Lastly, the marginal impact of nurses among low-income countries is higher in reducing the under-5 mortality rate than increasing the life expectancy.

Keywords: public health, mortality, health financing, health professionals

JEL: I18, I12, H51, J44

1. Introduction

Public Health is considered as one of the most important ingredients in the development process (Bayati et al., 2013). Over the last few decades, dramatic growth has been observed globally in terms of longevity gains and expansion of the health sector. The increase in health expenditure is remarkable, which may not be considered a calamity rather a contribution towards socio-economic development (Fogel, 2004; Raeesi et al., 2018) as better health increases productivity. However, the spending on the health sector is highly unequal across countries. Countries that are unable to allocate a huge amount of budget in the health sector usually have a poorer health condition (Deaton, 2013).

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According to an OECD report (OECD, 2012), the share of spending by the poorest three quarters of the world was 7 percent of the total global health spending. Furthermore, at a regional level, Africa covers 10 percent of the total world population, but the share of its spending in world health spending is 3 percent. Likewise, Asia and the Pacific region, with almost 30 percent of population have a share in global health spending of 4 percent (WHO, 2015; Poullier et al., 2002). In addition to this, there is a perception that health spending affects health conditions, however, the efficacy of transforming the financing into health outcomes cannot be overlooked. There are some countries that have achieved a better health outcome even at low level of health expenditure per capita, while on the other hand, even among high income counties, sometimes additional spending has less impact in the improvement of life expectancy.

An effective and well-developed healthcare system, with proper utilization of resources, can have a positive and significant contribution to the public health outcomes. Well-trained human resource is more productive and can bring a significant change in the health output. Owing to the importance of the health sector, increased health spending is encouraged to achieve better health outcomes. Countries that are self-sufficient in health financing and inputs, have achieved better health outcomes while those facing resource constraints, both in health financing as well as in workforce availability, fail to achieve an effective healthcare system. Hence, there is widespread disparity in the health sector across nations which not only affects the individual health status but is also a cause of concern for the socio-economic development of a country.

According to a report by the World Health Organization (WHO, 2015), the worldwide health spending is highly unequal. The high-income countries spend a large chunk of their income on health while the upper-middle income countries', upper-lower middle- and low-income countries' share were 17 percent, 2.8 percent, and 0.24 percent, respectively. Figure 1 shows that in middle- and high-income countries, the health expenditures are steadily increasing. However, in low-income countries the health expenditure has not changed significantly.

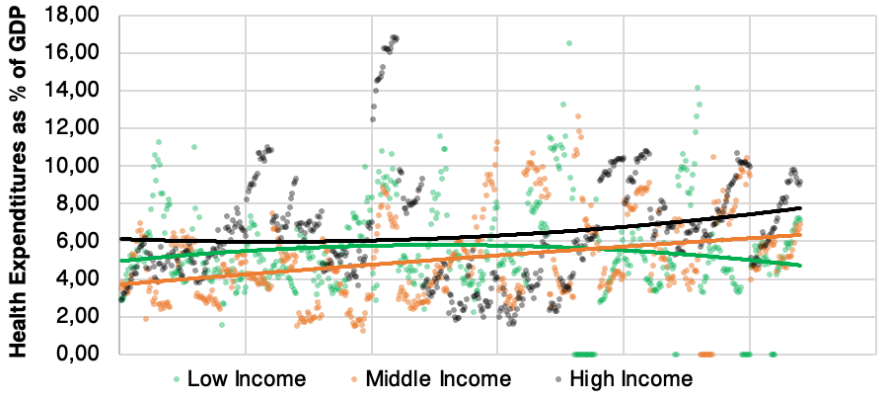

Figure 1. Country-Group Comparison of Health Expenditures
Note: Author's own compilation using data from World Health Organization

This study assesses the impact of health financing and health workforce on public health outcomes by undertaking a comparison of countries by different income groups i.e., low, middle, and high-income countries. Since countries that have resource constraints will be unable to allocate a large share of their budget in the health sector. Likewise, healthcare service provision in terms of the availability of the workforce is also a challenge faced by resource constraint countries. Thereby, health outcomes would differ substantially among countries owing to their health financing potential and service delivery in terms of workforce availability. Therefore, it is important to make a comparative analysis of countries by different income groups. The outcome of this study provides a new insight into the impact of public and private health expenditure and medical/non-medical human capital on public health outcome.

2. Literature Review

The relationship between healthcare expenditure and health outcomes has recently received attention in developing regions after observing its significant positive impact in the developed world. The association between health expenditure and health outcomes is still in debate especially at the macrolevel. Some conclude a positive and significant relationship between health expenditure and health outcomes **(**Akinkugbe and Mohanoe, 2009; Anyanwu and Erhijakpor, 2009; Nonvignon et al., 2012; Shetty et al., 2019, Anand and Ravallion, 1993, Patricio et al., 2008 and Imoughele and Ismaila, 2013), while others report that no significant association exists between health expenditure and health outcomes (Filmer and Pretchett 1997, Burnside and Dollar 1998, Berger and Messer, 2002, Santerre et al.,1991, Musgrove,1996). Cremieux et al. (1999) showed that in the case of low healthcare expenditures in Canada, the mortality rate is higher and there is a lower life expectancy at birth. Akinkugbe and Mohanoe (2009) examined that other than public healthcare expenditure, the density of physicians, child immunization and female literacy had a significant impact on health outcomes in Lesotho. Anyanwu et al. (2009) also concluded that total healthcare expenditure is significantly related to health outcomes. Novignon. et al. (2012) suggested that public and private health expenditure play a significant role in increasing life expectancy and reducing the infant mortality rate in Sub-Saharan Africa. Rahman et al., (2018) found similar evidence in a case of the SAARC and ASEAN region. Kim and Lane (2013) undertook a similar analysis on developing countries.

In the case of OECD countries, Anand and Ravallion (1993), Patricio et al., (2008), Imoughele & Ismaila (2013) and Rana et al., (2018) found a significant positive impact of health expenditure on health outcomes and Gani (2009) provided the same evidence for Pacific Island countries. Similar results are found by Barenberg et al. (2017) and Kumar et al. (2013) for India, Deluna & Peralta (2014) for the Philippines and Edeme et al. (2017) in the case of Nigeria. Shetty et al. (2019) found that private health expenditure has a greater impact on health outcomes. However, Day and Tousignant (2005) found a significant but weak impact of health spending and GDP per capita on the health status in Canada. Akinci et al. (2014) provided evidence for Middle East and North Africa countries that both public and private expenditure have a significant impact in reducing the infant mortality rate. Furthermore, this claim is supported by Farag et al. (2013) for low- and middle-income

countries. Likewise, Gupta et al. (2002) highlighted that increase in health spending significantly reduces the infant mortality rate. The evidence provided by Baldacci et al (2003) and Quattara (2005) also supports the same findings.

Boachie et al. (2015) and Oluwatoyin et al. (2015) found that health expenditure has a significant positive impact on the health outcome in Nigeria and Ghana. Adesoye et al. (2017) examined that public healthcare expenditure has a greater impact than private healthcare expenditure on health outcomes among children. Furthermore, Self et al. (2003) found that public healthcare expenditure is insignificant in developing countries but has a significant impact among middle-income and least developed countries. Rajkumar et al., (2008) emphasized that public health spending reduces the mortality rates under-five more effectively in those countries that have a better government system in place as compared to those who failed to have such. Further, the study revealed that the differences in the effectiveness of the health expenditure arise due to multiple reasons such as the crowding out effect and corruption. Kulkarni (2016) indicated a significant improvement in service delivery with efficacy of healthcare expenditure. Ahmad & Hasan (2016) revealed that there is a long-run relationship between health status, income level and healthcare expenditure. Becchetti et al. (2015) studied that total health expenditure and health expenditure per capita significantly contributes to controlling chronic diseases. Behera and Dash (2020) investigated the effectiveness of health expenditure on health-care goals in the Southeast Asian Region and concluded that aggregate health expenditure has a positive effect on improving the life expectancy and reducing the infant mortality rate. Mohanty and Behera (2023) conducted a study on twenty-eight Indian States and found that public health financing reduced infant and child mortality rates and malarial diseases and improved life expectancy and the immunization coverage in India.

Conversely, there are some studies that do not show any evidence of the relationship between healthcare expenditure and health outcomes. Filmer and Pritchett (1997) found that health spending is not the only factor that improves health outcomes. Some studies have identified that education, technological change, and income are the factors that can bring a positive change in health standards rather than just healthcare spending. Burnside et al. (1998) analyzed that there is no significant impact of healthcare expenditure on infant mortality in low-income countries. Similarly, Berger et al. (2002), Santerre et al. (1991) and Musgrove (1996) showed that public spending is not effective in the improvement of health status.

The literature also quotes a cross-country analysis on the relationship between health outcomes and health workforce. Robinson and Wharrad (2001) and Anand & Barnighausen (2004) showed that a high density of doctors has a significant impact on reducing the under-five mortality rate. Likewise, Farahani et al., (2009) and Or et al., (2005) mentioned that the increase in the number of doctors has a significant effect in the reduction of infant mortality rate. On the other hand, there are some studies that failed to find any significant association between health outcomes and workforce (Hertz et al., 1994; Kim et al., 1992; and Pinzón-Flórez et al., 2015). Among recent studies, Behera and Dash (2019) examined the elasticity of public health expenditure with respect to fiscal policy. The tax revenues have a positive and significant association with

public health outcomes whereas the fiscal deficit and debt services showed a negative relationship. Behera (2022) also found a positive association between spending efficiency and the coverage of tuberculosis treatment. The study concluded that restricted fiscal space is a major issue in lower middle-income countries to mobilize increased funds to healthcare services.

3. Data and Description of Variables

The study is based on panel data analysis covering the period from 2010 to 2019. The list of countries is provided in the appendix. The data sources used for data collection are the World Development Indicators, World Health Organization and Global Health Workforce Statistics database. The dependent variable is public health outcome measured by two proxy variables: life expectancy at birth and the under-five infant mortality rate. Life expectancy at birth is defined as the expected average number of years that a newborn could live, and under-five infant mortality rate refers to the probability for an infant to die before reaching the age of five years.

The explanatory variables include health expenditures (domestic government health expenditure and private out-of-pocket health expenditure) and health work force (physicians, pharmaceutical and nursing staff). The gross domestic product per capita is taken as a control variable. Domestic government health expenditure represents the share of direct government financing for the provision of universal health coverage, insurance, providing subsidies and transfer payments, and voluntary healthcare services. The out-of- pocket health expenditure refers to the sum of all those health expenditures that are not financed by a public source rather they include out-of-pocket private financing, which is mainly undertaken by households, corporates, and non-profit organizations (NGOs). Among the workforce, the variable physician is measured as the total number of medical doctors, including generalist and specialist medical practitioners, per 1000 population. Pharmaceutical staff measures the number of pharmacists per 1000 people in a country and nurses include the total number of nurses and midwives' staffs per 1000 people.

4. Model Specification and Estimation Techniques

The Grossman (1972) model of health output suggests that health capital depends on factors such as education, age, income, and overall health status while also emphasizing that health capital serves as both a consumption good and a production good (Hartwig et al., 2018). This model gives an insight into the investment in health capital. Government health expenditure and income are used as inputs in the production function (Bidzha et al., 2017). In addition, the poor are more likely to obtain those services from a public facility (Gwatkin, 2000). It is shown by various studies that the poor are significantly less healthy as compared to the rich; the rich are in a better position to acquire medical care when they become sick (Makinen et al., 2000). Furthermore, the health production function involves the combination of inputs to produce the outputs. Figure 2 describes the relationship between financing, workforce, and public health outcomes.

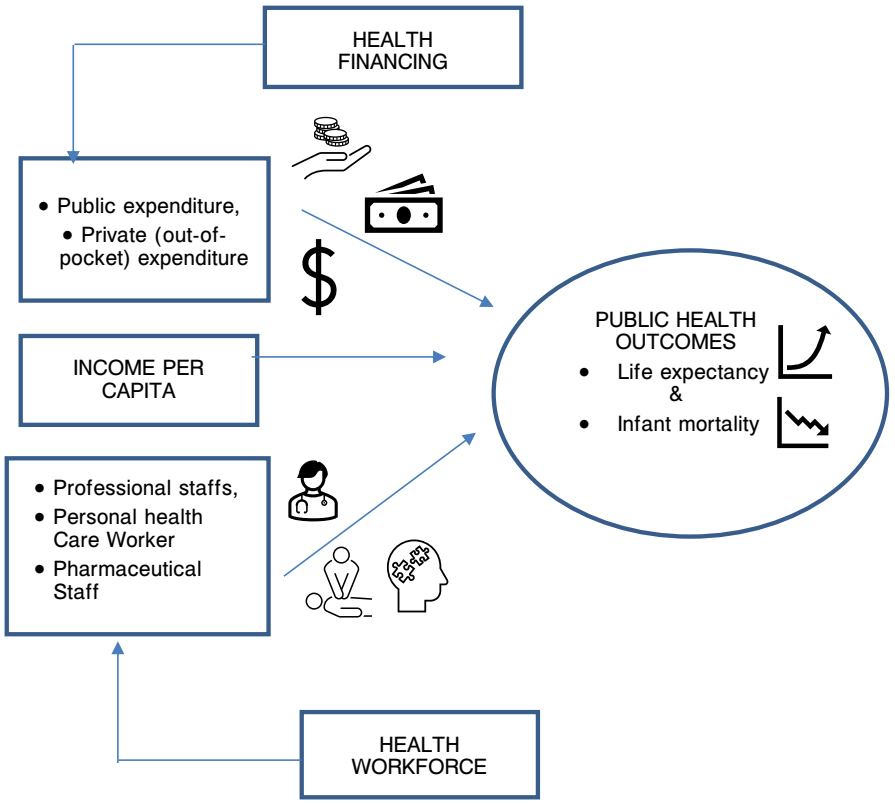

Figure 2. Schematic Representation of the Theoretical Framework

Source: Author's own compilation based on past literature (Anyanwu and Erhijakpor., 2009; Cremieux et al., 1999; Nonvignon et al., 2012; Shetty et al., 2019; Akinci et al., 2015; Gupta et al., 2002; Gani, 2009; Kaur. A., 2020; Robinson and Wharrad, 2001; Or et al., 2005

The study estimates the two models as under:

Model 1:

$$LE_{it} = \beta_0 + \beta_1 NMW_{it} + \beta_2 Phy_{it} + \beta_3 Pharm_{it} + \beta_4 OPE_{it} + \beta_5 DGGHE_{it} + \beta_6 GDPPC_{it} + \varepsilon_{it} \quad (1)$$

Model 2:

$$MRU\text{-}5_{it} = a_0 + a_1 NMW_{it} + a_2 Phy_{it} + a_3 Pharm_{it} + a_4 OPE_{it} + a_5 DGGHE_{it} + a_6 GDPPC_{it} + \varepsilon_{it} \quad (2)$$

Where LE = Life expectancy at birth and MRU-5= mortality rate under-five; NMW = Nurses and midwives per 1000 people; Phy= Physicians per 1000 people; Pharm= Pharmacists per 1000 people; OPE= Out-of-Pocket health expenditure; DGGHE= Domestic government health expenditure; GDPPC= Gross domestic product per capita; μ= error term; t = Time and i = Country; β_0 and α_0 are the intercept terms for each model. The expected signs of the slope coefficients for model 1 and model 2 are given as $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 > 0$, $\beta_4 > 0$, $\beta_5 > 0$, $\beta_6 > 0$, $\alpha_1 > 0$, $\alpha_2 > 0$, $\alpha_3 > 0$, $\alpha_4 > 0$, $\alpha_5 > 0$, $\alpha_6 > 0$.

The preliminary estimation starts with pooled OLS with some distributional

assumptions. The violation of these assumptions provides an inconsistent result and parameter estimates become inefficient and biased. Furthermore, pooled OLS ignores country-specific heterogeneity which may lead to omitted variable bias. The diagnostics tests show the presence of heteroskedasticity, omitted variable bias and the presence of country-specific heterogeneity. Therefore, the parameters are re-estimated with a suitable panel data methodology. There is presence of group-wise heteroskedasticity, serial correlation and cross-sectional dependency in panel fixed effect estimates. Therefore, a more robust estimation technique is applied using Driscoll-Kraay (1998) and panel corrected standard errors (Beck and Katz, 1995; 1996) regression. Baltagi (2008) and Baltagi, Kao & Peng (2016) state that cross sectional dependency is a concern in macro-panel data analysis which consists of a large number of time series but not a problem in micro-panel data analysis.[1] In the current study, the T and N both are not large.

5. Results

This study examines the relationship of healthcare workforce and financing on public health outcome by making a comparison across countries by income group i.e., high-income countries (HIC), middle-income countries (MIC) and low-income countries (LIC). The results are provided in Table 1 and Table 2. The analysis showed that the impact of nurses and midwives is higher in middle-income countries as compared to high-income countries which represents a higher marginal effect. The nurse density ratio is low i.e., a higher number of patients per nurse, so a minor change brings a significant improvement in life expectancy in middle income countries. Contrary to this, in the case of high-income countries the nurse density is high and due to diminishing marginal returns the change is lower as compared to middle income countries. The argument is in line with the study of McCue et al. (2003). Likewise, nurses have a positive impact but owing to the insufficient number of nurses and over workload it has insignificant impact on life expectancy in low-income countries. As Spector et al. (1996) examined, that nurse-to-patient ratio is very low in low-income countries, which greatly impacts their productivity.

The findings show that nursing staff has an inverse relation with infant mortality rate but has an insignificant impact in HIC. However, it is observed from the given analysis that the marginal impact of nurses is higher in reducing the under-5 mortality rate rather than increasing the life expectancy in LIC. As the density of nurses is lower in LIC as compared to MIC and HIC, a minor change in the number of nurses can cause a greater impact on the reduction of infant mortality due to increasing return. Higher staffing of nurses is positively associated with improving health status as examined by Spector and Cohen, (1996) and Robinson et al. (2001).

[1] The cross-sectional correlation in panel residuals is the phenomenon commonly observed in very large panel i.e., N and T $\rightarrow \infty$ or conversely N is very large in comparison to T (Baltagi, Kao, & Peng, 2016).

The sign of physicians shows a greater impact in LIC as compared to MIC and HIC. Furthermore, among the healthcare workforce, the impact of physicians is greater in HIC as compared to nurses due to skill development and the provision of quality medical advice and service provision to the patients which increases the health standards. Likewise, physicians' services are under a strict government regulatory mechanism, which contributes to increasing life expectancy and reducing mortality rate. The findings are consistent with the studies of Kim et al. (1992); Hertz et al. (1994).

Likewise, the impact of pharmacists is higher in MIC. The number of pharmacists per 1000 people is lower than the optimal level of requirement that's why the marginal return is higher as compared to higher-income countries where the nurse-to-patient ratio is high. On the other side, pharmacists have a positive but insignificant impact in low-income countries where the heath sector is short of nurses and the burden of patients is higher. In addition, the profession of pharmacy is still not receiving appropriate attention in low-income countries as suggested by Olsson et al., (2014). The impact of pharmacists is insignificant due to the limited number of pharmacists in LIC as supported by the findings of Farahani et al. (2009).

Furthermore, the findings of the study indicate that out-of-pocket health expenditure (OPE) and domestic government general health expenditure (DGGHE) have a positive and greater marginal impact on increasing the life expectancy and reducing infant mortality rate in LIC. The results also show that public health expenditure has a greater impact than private health expenditure. The role of government in the provision of health facilities such as, providing health insurance, subsiding the health facilities, and funding for the construction of hospitals and research laboratories have a positive link with the better health outcomes. On the other hand, people are hardly able to spend their cash on health due to income constraints. They spend only when they are left with no other option. The findings are in accordance with the studies of Rajkumar et al., (2008); Kaur. A. (2020); Rana et al. (2018).

Similarly, the study indicates that income per capita is positively associated with life expectancy and negatively with infant mortality rate. Furthermore, the marginal impact of the GDP per capita is greater in middle income countries and followed by low- and high-income countries and the marginal impact on infant mortality is significant in middle income countries. The findings are consistent with the study of Rahman et al. (2018); Gupta et al. (2002).

Table 1. Estimation of Model 1 for country groups by income (Dependent variable: Life expectancy)

Variables	High income countries				Middle income countries				Low-income countries			
	Pooled OLS	FE	Driscoll-Kraay	PCSE	Pooled OLS	RE	Driscoll-Kraay	PCSE	Pooled OLS	RE	Driscoll-Kraay	PCSE
NMW	-0.062 (0.035) [0.078]	0.034 (0.023) [0.141]	0.034*** (0.009) [0.007]	0.059 (0.046) [0.203]	-0.144 (0.101) [0.153]	0.276** (0.114) [0.016]	0.276* (0.129) [0.062]	-0.050 (0.051) [0.322]	0.741 (0.808) [0.360]	0.924 (0.651) [0.156]	0.924 (0.959) [0.361]	0.420 (0.466) [0.36]
Phy	0.361*** (0.091) [0.000]	0.412*** (0.116) [0.000]	0.412** (0.135) [0.016]	0.274*** (0.090) [0.002]	0.485** (0.231) [0.037]	0.002 (0.179) [0.989]	0.002 (0.070) [0.972]	0.522*** (0.105) [0.000]	14.78 (2.94) [0.000]	4.433 (1.763) [0.012]	4.433 (2.907) [0.162]	4.439*** (1.535) [0.004]
Pharm	0.144*** (0.038) [0.00]	0.107*** (0.026) [0.000]	0.107*** (0.016) [0.000]	0.227*** (0.032) [0.000]	0.398*** (0.067) [0.000]	0.315*** (0.079) [0.000]	0.315*** (0.072) [0.002]	0.373*** (0.033) [0.000]	-1.272 (0.507) [0.013]	-0.342 (0.271) [0.208]	-0.342 (0.507) [0.517]	0.003 (0.285) [0.98]
OPE	0.002 (0.000) [0.00]	0.0018 (0.000) [0.00]	0.001*** (0.00) [0.00]	0.001*** (0.000) [0.004]	0.010*** (0.001) [0.000]	0.002** (0.001) [0.012]	0.0025*** (0.0003) [0.000]	0.0087*** (0.0009) [0.000]	-0.015 (0.009) [0.109]	0.024 (0.009) [0.011]	0.024** (0.009) [0.031]	-0.009 (0.008) [0.989]
DGGHE	0.485*** (0.072) [0.000]	-0.013 (0.058) [0.819]	-0.013 (0.08) [0.873]	0.473*** (0.075) [0.000]	1.011*** (0.130) [0.000]	0.435*** (0.122) [0.000]	0.435*** (0.089) [0.006]	0.666*** (0.088) [0.000]	2.394 (0.462) [0.000]	1.763 (0.337) [0.000]	1.763*** (0.310) [0.000]	1.084*** (0.24) [0.000]
GDPPC	0.0001 (7.210) [0.000]	0.0001 (0.0002) [0.00]	0.0001*** (7.60) [0.000]	0.0001*** (8.33) [0.000]	0.00026 (0.00008) [0.002]	0.00067 (0.0001) [0.000]	0.00066 (0.0001) [0.006]	0.0040*** (0.00005) [0.000]	0.002** (0.001) [0.048]	0.00059 (0.0008) [0.460]	0.00059 (0.0004) [0.23]	0.0033*** (0.0006) [0.000]
Constant	71.25 (0.400) [0.000]	73.93 (0.65) [0.00]	73.93*** (0.438) [0.000]	70.14*** (0.547) [0.000]	63.03 (0.379) [0.000]	64.02 (0.701) [0.000]	64.01*** (3.86) [0.000]	63.28 (0.277) [0.000]	53.89 (0.944) [0.000]	54.97 (1.17) [0.000]	54.97*** (6.04) [0.000]	55.91 (0.587) [0.000]
F-test	0.000				0.000				0.000			
Hausman Test		0.000				0.253				0.687		
Hetero	Yes	Yes	Corrected	Corrected	Yes	Yes	Corrected	Corrected	Yes	Yes	Corrected	Corrected
Autocorrelation		Yes		Corrected		Yes		Corrected		Yes		Corrected
CD		Yes	Corrected			Yes	Corrected			Yes	Corrected	

Note: Author's own compilation. The standard error are given in ( ) and p-values are given in [ ]. ***, ** and * indicates the significance level at 1 percent,5 percent, and 10 percent level, respectively.

Table 2. Estimation of Model 2 for country groups by income (Dependent Variable: Mortality rate under-five)

Variables	High income countries				Middle income countries				Low-income countries			
	Pooled OLS	RE	Driscoll-Kraay	PCSE	Pooled OLS	FE	Driscoll-Kraay	PCSE	Pooled OLS	RE	Driscoll-Kraay	PCSE
NMW	0.052 (0.070) [0.461]	-0.023 (0.031) [0.462]	-0.023 (0.012) [0.100]	-0.091 (0.140) [0.515]	-0.719* (0.416) [0.085]	-1.68*** (0.474) [0.000]	-1.684*** (0.350) [0.001]	-1.460*** (0.221) [0.000]	-18.53*** (4.74) [0.000]	-7.51* (4.064) [0.065]	-7.52 (4.83) [0.155]	-9.36*** (3.17) [0.003]
Phy	-0.343** (0.176) [0.053]	-0.072 (0.137) [0.599]	-0.072 (0.096) [0.47]	-0.807*** (0.269) [0.003]	-4.598*** (0.956) [0.000]	0.250 (0.70) [0.72]	0.250 (0.226) [0.297]	-3.084*** (0.511) [0.000]	-106.6*** (17.25) [0.000]	-24.80** (11.16) [0.026]	-24.80 (16.13) [0.16]	-25.65*** (9.29) [0.006]
Pharm	-0.295*** (0.067) [0.000]	-0.074*** (0.026) [0.005]	-0.074** (0.031) [0.048]	-0.393*** (0.131) [0.003]	-0.842 (0.277) [0.003]	-1.43*** (0.32) [0.000]	-1.432*** (0.233) [0.000]	-1.183*** (0.151) [0.000]	12.75 (2.97) [0.000]	3.697 (1.725) [0.032]	3.69 (2.80) [0.22]	2.27 (1.73) [0.18]
OPE	-0.004*** (0.000) [0.00]	-0.001*** (0.000) [0.000]	-0.001*** (0.003) [0.000]	-0.009** (0.003) [0.010]	-0.015** (0.006) [0.02]	-0.015*** (0.004) [0.000]	-0.015*** (0.001) [0.000]	-0.008** (0.004) [0.044]	0.170*** (0.055) [0.003]	-0.15*** (0.05) [0.01]	-0.153** (0.06) [0.058]	0.070 (0.05) [0.177]
DGGHE	-0.429*** (0.128) [0.001]	-0.287*** (0.074) [0.000]	-0.287* (0.146) [0.086]	-0.098 (0.410) [0.811]	-4.13*** (0.53) [0.000]	-0.946 (0.48) [0.053]	-0.946*** (0.227) [0.002]	0.001 (0.005) [0.788]	-12.57*** (2.70) [0.000]	-10.78*** (2.12) [0.000]	-10.77*** (1.487) [0.000]	-5.68*** (1.71) [0.001]
GDPPC	-0.00003*** (0.00001) [0.009]	-0.00005 (0.00001) [0.00]	-0.0005 (0.002) [0.13]	-0.0002 (0.00002) [0.524]	-0.0019 (0.0003) [0.000]	-0.0009 (0.0004) [0.032]	-0.0009*** (0.0002) [0.001]	-0.003*** (0.0003) [0.000]	-0.006 (0.006) [0.993]	-0.001 (0.005) [0.83]	-0.0012 (0.003) [0.75]	-0.010** (0.004) [0.014]
Constant	14.95 (0.798) [0.000]	12.44 (1.06) [0.000]	12.44** (4.03) [0.015]	19.97 (2.49) [0.000]	65.45 (1.562) [0.000]	50.84 (1.87) [0.000]	50.83*** (1.524) [0.000]	60.27 (1.18) [0.000]	114.95 (5.53) [0.000]	115.08 (6.38) [0.000]	115.08*** (31.86) [0.006]	105.89*** (3.68) [0.000]
F-test	0.000				0.000				0.000			
Hausman Test		0.955				0.014				0.170		
Hetero	Yes	Yes	Corrected	Corrected	Yes	Yes	Corrected	Corrected	Yes	Yes	Corrected	Corrected
Autocorrelation		Yes		Corrected		Yes		Corrected		Yes		Corrected
CD		Yes	Corrected			Yes	Corrected			Yes	Corrected	

Note: Author's own compilation. The standard error are given in ( ) and p-values are given in [ ]. ***, ** and * indicates the significance level at 1 percent, 5 percent, and 10 percent level, respectively.

6. Conclusion and Policy Recommendations

The study examines the impact of health financing and workforce on life expectancy and infant mortality rate. The empirical result shows that the impact of nurses is significant in middle- and high-income countries but insignificant in low-income countries. Physicians have a greater impact on life expectancy in low-income countries, followed by middle- and high-income countries. On the other hand, pharmacists have a significantly greater impact in the middle-income countries followed by high income countries but insignificant in low-income countries. The private out-of-pocket health expenditure has a greater marginal impact on life expectancy in low-income countries. Likewise, government health spending has a larger positive and significant impact in low-income countries, followed by middle- and high-income countries. The empirical results show that nurses and physicians have a greater marginal impact on the reduction of infant mortality in low-income countries and are followed by middle- and high-income countries. The marginal impact of a pharmacist is higher in middle income countries, followed by high income countries while it has an insignificant impact in low-income countries. Besides this, out-of-pocket health expenditure and domestic government health expenditure have had a greater influence in the reduction of infant mortality in low-income countries and are followed by middle- and high-income countries. Similarly, the results of cross comparison of income groups shows that income per capita is having a greater impact in the reduction of infant mortality in low-income countries, followed by middle-income countries.

The findings of the study suggest some key practical implications. First, the cross countries analysis in the study accentuates the importance of an effective and an efficient use of health spending. At the same time, it shows that the workforce plays a significant role in the efficacy of healthcare provision. Therefore, investment in health workforce and raising the health financing should be the central and key policy objective to improve the health standard and achieve SGDs goals related to the health sector. It is especially important for low- and middle-income countries that are lagging in achieving those fundamental targets. Furthermore, from a global point of view, it is an urgent and a task in hand to change the status of the health workforce and divert more resources to health-related targets. According to the World Health Organization (2017), about half of the member countries failed to attain 80 percent coverage of health-related SGDs. In addition, the finding of this study highlights that it is still difficult to overcome the the prevailing disparities among countries. The present study has discussed the impact of availability of health workforce on health outcomes. Besides, health workforce can be studied from various dimensions such as availability, acceptability, accessibility and above all its quality which can give some vital insights for future research. Likewise, there are many types of health workforce other than physicians, nurses, and pharmacists such as community health workers and health management staffs.

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Appendix:

Table A: List of Countries

High Income countries

Andorra, Antigua and Barbuda, Austria, Australia, Bahamas, Bahrain, Barbados, Belgium, Brunei Darussalam, Canada, Chile, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Rep., Kuwait, Kyrgyz Republic, Latvia, Lithuania, Luxembourg, Malta, Monaco, Nauru, Netherland, North Macedonia, Norway, Oman, Palau, Poland, Portugal, Qatar, San Marino, Saudi Arabia, Seychelles, Singapore, Slovak, Republic, Slovenia, Spain, Sweden, Switzerland, Trinidad and Tobago, United Arab Emirates, United Kingdom, United States

Middle Income Countries

Armenia, Azerbaijan, Belarus, Bangladesh, Belize, Benin, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Cabo Verde, Cambodia, Cameroon, Comoros, Congo, Rep., China, Costa Rica, Egypt, Arab Rep., El Salvador, Eswatini, Ecuador, Fiji, Georgia, Guatemala, Guyana, Mongolia, Morocco, Myanmar, Maldives, Nigeria, Panama, Pakistan, Philippines, Peru, India, Indonesia, Iraq, Jamaica, Jordan, Kenya, Kiribati, Lebanon, Lao, Malaysia, Mauritius, Mauritania, Romania, Russian Federation, South Africa, Samoa, Senegal, Sri Lanka, Tunisia, Vietnam, Zambia, Namibia, Nepal

Low Income Countries

Afghanistan, Albania, Burkina Faso, Burundi, Central African Republic, Chad, Ethiopia, Gambia, The Guinea, Guinea-Bissau, Liberia, Madagascar, Malawi, Mali, Mozambique, Niger, Rwanda, Sierra, Leone, Uganda, Yemen

Source: World Bank