Health care expenditure and health outcome nexus: New evidence from SAARC-ASEAN region.

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Abstract:

Background/ Objective: The main health status indicators in the SAARC-ASEAN region are far behind than those of OECD group and world average. Similarly, total health expenditure (% of GDP) in the region is also lower than that of OECD region and world. Therefore, this study aims to investigate a relationship between the healthcare expenditures and three main health status outcomes (life expectancy at birth, crude death rate and infant mortality rate) in the region.

Methods: Using the World Bank data set for 20 years (1995-2014) in 15 countries of the region, a panel data analysis is conducted where relevant fixed and random effect models are estimated to determine the effects of healthcare expenditures on health outcomes. The separate effects of private and public health expenditures were also explored.

Results: Total health expenditure, public health expenditure and private health expenditure have significant effect in reducing infant mortality rate and the extent of effect of private health expenditure is greater than that of public health expenditure. Private health expenditure also has significant role in reducing crude death rate. However, the study has not found any significant effect of health expenditure on life expectancy at birth. Per capita income growth and improved sanitation facilities have also significant positive roles in improving population health in the region.

Conclusion: Healthcare expenditures, along with income growth rate and improved sanitation facilities, should be considered as an important determinant in improving population heath status in the region. The government and private joint initiatives should continue side by side to take the right actions for improving the health status outcomes.

Keywords: Healthcare expenditures; health status outcomes; panel data; SAARC; ASEAN.

JEL Codes: I10; I15; I18; C23.

1. Introduction

Enriched human capital is considered as one of the important factors for achieving desired economic growth and development (Novignon, et al 2012; Romer, 1996) in any country. According to the neoclassical growth model, growth in human capital, in terms of education and health, positively affects per capita income in the long run (Romer, 1996). Bloom and Canning (2000 and 2003) and Bloom et al (2004) identified four mechanisms through which healthier individuals contribute to the economy: (i) at the workplace, healthier individuals are more productive and thus generally earn higher income; (ii) their working time in the workforce is longer and hence retire late, and take fewer sick leave; (iii) they are likely to invest more in their own education and training that enhance the productivity; and (iv) they are likely to save and invest more with the expectation of longer life. So health is the integral part of sustainable development, and attempts for its improvement and expansion should always be the main development goal for a nation (WHO 2000). Furthermore, good health provides a kind of empowerment that adds value to human life (Sen 1999), and it also ensures economic security for the individuals and families (Karim 2016).

Therefore, it is vital for all countries to invest in the health sector properly. Evidence show that investing in health brings a lot of benefits for the economy (Anyanwu and Erhijakpor 2007; Bloom et al 2004). For example, a WHO report (Commission on Macroeconomics and Health, 2001) reveals that economic growth rate will increase by 0.35% per year with the increasing life expectancy at birth by 10%. Similarly, ill health is considered as a huge financial burden, and it is the major cause of 50% of the growth differential between developed and developing countries. Despite the importance of health investment, health expenditure in government budgets in developing regions like South Asian Association for Regional Cooperation (SAARC) and Association for South East Asian Nations (ASEAN) could not attract adequate attention due to the scarcity of resources (WHO 2010).

Realizing the importance of population health and its contribution to national economy, researchers have been conducting studies to explore the link between healthcare expenditures and health sector outcomes for more than two decades. However, the most of these studies are based on the developed countries (see, for example, Anderson and Poullier, 1999; Babazono and Hillman 1994; Beger and Messer, 2002; Cochrane et al, 1978; Crémieux et al 1999; Crémieux et al 2005; Elola et al. 1995; Hitiris and Possnett,1992; Or, 2000; Nixon and Uimann, 2006; Wolfe and Gabay, 1987) but such studies on developing countries/region are limited. To the best of our knowledge, no such study that uses macro data, has yet been conducted in SAARC-ASEAN region. Moreover, the health sector and health expenditures have been changed a lot during the last decade. So a recent study is warranted. This is our main motivation for conducting current research on a panel of 15 countries that will fill up the gap in the literature. Furthermore, the debate on the relationship between health care expenditures and health outcomes are still inconclusive (Novignon et at 2012). This study will help mitigate this debate by providing new evidence from a new region. Our additional contributions are that we have addressed the endogeneity issue of the concerned variables, and looked for the effects of healthcare expenditures on three health status indicators while most of the studies investigate the effect only on one or two indicators.

Therefore, the main purpose of this study are: (i) to explore the impact of total health care expenditure on three health outcomes - life expectancy at birth, crude death rate and infant mortality rate in SAARC-ASEAN region, and (ii) to find out the differentiated influences of public and private health care expenditures on these health outcomes. We have also explored the impact of two controlled variables- real GDP per capita and improved sanitation facilities.

The rest of the paper is structured as follows: section 2 outlines the past empirical literature, section 3 briefly highlights the regional profiles, section 4 describes model, data and methodology; section 5 presents and analyses empirical results, and section 6 concludes the paper with policy implications.

2. Past literature

The past empirical studies on the relationship between healthcare expenditures and health sector outcomes provide conflicting views. For example, the studies of Anand and Ravallion (1993), Patricio (2008) and Imoughele et al (2013) revealed a positive relationship between public healthcare expenditure and health sector performance for Sri Lanka, Russia and Nigeria, respectively. On the other hand, Filmer and Pritchett (1997), Musgrove (1996) and Kim and Moody (1992) found no relationship on these variables. Filmer and Pritchett (1997) identified that rather than the public health expenditure, the level of poverty, income inequality, female education, and other socio-economic factors are the main determining factors of child mortality. Further, a World Bank study on Indian states during 1980-99 used panel data, and found no effects of healthcare expenditure on infant mortality rates (World Bank 2004), which are similar to the findings of Burnside and Dollar (1998). Some other studies like Zakir and Wunnava (1999), Nolte and Mckec (2004) and Young (2001) also found no significant and consistent relationship between health spending and health outcomes.

In a separate study in Brazil, Alves and Belluzzo (2005) employed static panel data models to explore the determinants of infant mortality rates where they used census data for the period of 1970-2000. They found that the levels of education, sanitation and poverty are the main factors of infant mortality rates. The same experience is also noted by the studies of Meara (2001), Currie and Moretti (2003) and Filmer (2003).

In relation to the positive effects of healthcare expenditures on health outcomes, more empirical evidences are found worldwide. In a study on 47 African countries between 1999 and 2004, Anyanwu and Erhijakpor

(2007) found that total healthcare expenditure significantly affect health outcomes as expected: a 1% increase of total health care expenditure per capita decreases 2.1% and 2.2% under five and infant mortality rates, respectively. Similarly, Akinkugbe and Mohanoe (2009) also found significant effect of healthcare expenditure, along with other variables, on health outcomes. From the cross-country data on the relationship between public health expenditure and health status, Gupta et al (2001) further found significant and stronger effects for the poor people. In another study on 50 developing and transition countries, Gupta et al (1999) revealed that health expenditures reduced child mortality rates in 1994. Similarly, Issa and Ouattara (2005) found a strong negative relationship between health spending and infant mortality rates in a panel study of 160 countries where they separated the health expenditure into public and private. The same results on infant and child mortality rates are also observed by the studies of Paxson and Scady (2005) and Wang (2002) in relation to private health expenditure and public health expenditure, respectively. Significant negative effects of health care expenditure on mortality rate were also revealed by Berger and Messer (2002) for 20 OECD countries over the period of 1960-1992, Gani (2009) for Pacific Island countries over the period of 1990-2002 and Farag (2010) for Eastern Mediterranean region during the 1995-2006 period.

3. Brief profile of SAARC-ASEAN region

SAARC or South Asian population are 1744 million which is 23.75% of the world population. ASEAN Population are 625 million which is 8.8% of the world population. Together SAARC-ASEAN region comprises 32.55% of the world population, and 5.81% of the world GDP (WDI 2016). Hence the region has significant position in the world, and therefore the current study on the region is critical. Moreover, the economic, political and social structures of the countries in the region are more or less similar.

Table 1 highlights the trend of health care expenditures of South Asia (SAARC countries) and South East Asia (ASEAN countries) against the OECD group and the world for selected years. It is observed that though total health expenditure (% of GDP) has an increasing trend over the years in SAARC-ASEAN regions it is far below than the health expenditure in the OECD region and world. In 2014, while share of total health expenditure was 12.36% of GDP in OECD countries and 9.97% in the word, it is only 4.37% in South Asia and 4.72% in South East Asia. Between 2005 and 2014, the growth rate of total health expenditure in OECD countries was 12.5%, but this growth rate is only 7% in South Asia and 11% in South East Asia.

The condition of public health expenditure (% of government expenditure) is very poor is South Asia. All along it is less than one third of the OECD countries, and more or less half of the South East Asian countries. Even it is one third of the world average. Although the share of South East Asia is better than that of South Asia, it is still half of the OECD and World average. The growth rate of public health expenditure over the years is not convincing at all for South Asia (increased to 5.25% only in 2014 from 4.80% in 2005) against the increase of South East Asia (increased to 10.42% in 2014 from 8.18% in 2005) and the OECD countries (increased to 17.76% in 2014 from 16.23% in 2005). Poverty in the region especially in South Asia may be the main reason for this low public health expenditure which is a major concern for expected heath status outcomes.

Out of pocket health expenditure (% of private expenditure on health) in both South Asia and South East Asia has decreased slightly over the years along the line of OECD countries; however this is still too high in SAARC and ASEAN regions compared to the OECD and world average. For South Asia, out of pocket health expenditure is double of world average, and for South East Asia, it is almost double. While this share is just 36.01% in OECD group in 2014, it is 89.41% for South Asia and 80.07% for South East Asia. This high proportion of out-of-pocket health spending is a great concern which will aggravate existing poverty and welfare of the vast population.

Table1: Trend in health care expenditure for selected regions (selected years)

Regions	Total health expenditure (% of GDP)			Public health expenditure (% of government expenditure)			Out of pocket health expenditure (% of private expenditure on health)		
	1995	2005	2014	1995	2005	2014	1995	2005	2014
South Asia	3.76	4.07	4.37	4.43	4.80	5.25	92.17	89.36	89.41
South East Asia	3.69	4.24	4.72	7.64	8.18	10.42	86.41	84.60	80.07
OECD group	9.23	10.99	12.36	13.41	16.23	17.76	41.42	37.58	36.01
World	8.52	9.80	9.97	--	15.39*	15.61**	45.90	43.33	45.80

Note: * data for 2010; ** data for 2011.

Source: World Development Indicators, World Bank (2016).

Table 2 provides the trend of health status outcomes of the SAARC and ASEAN regions in comparison with the OECD group and world. It is observed that though total life expectancy at birth (years) has increasing trend over the years in SAARC-ASEAN region, it is always lower than that of OECD group. Especially total life expectancy in South Asia is always lower than that of the world average, indicating the poor health status in the region. While world average is 71.45 years in 2014, it is just 68.12 years in South Asia.

Infant mortality rate per 1000 live birth has improved tremendously in SAARC-ASEAN region over the years. It has decreased from 80.10 in 1995 to 43.30 in 2014 in South Asia. In South East Asia, it has decreased to 20.26 in 2014 from 42.44 in 1995. However, it (especially for South Asia) is still much higher than the OECD average (6.09) and the world average (32.60) in 2014, implying again the poor health status in the study region.

Crude death rate per 1000 people in the region has the similar trend like the OECD group and the world. Over the years it has been declining slightly. In 2014, it was 7.16 for the South Asia, 6.27 for the South East Asia, 8.10 for the OECD group and 7.75 for the world.

Table 2: Health status outcomes for selected regions (selected years)

Health outcome	**South Asia**			**South East Asia**			**OECD group**			**World**		
	1995	2005	2014	1995	2005	2014	1995	2005	2014	1995	2005	2014
Total life expectancy at birth (years)	60.68	60.80	68.12	66.57	69.88	72.36	75.70	78.25	80.13	66.28	69.01	71.45
Infant mortality rate per	80.10	58.30	43.30	42.44	28.94	20.26	13.50	8.57	6.09	60.00	44.30	32.60

1000 live birth												
Crude death rate per 1000 people	9.49	7.93	7.16	7.29	6.35	6.27	8.51	8.07	8.10	8.95	8.25	7.75

Source: Word Development Indicators, World Bank (2016).

4.0 Methodology, Model and Data

In the literature different estimation methods (e.g. cross sectional analysis, panel, autoregressive distributed lag model, etc.) have been used to analyse the relationship between healthcare expenditures and health status outcomes. For a study that covers a number of countries, a panel estimation is the best approach to follow. Panel data analysis has always an advantage over the cross sectional analysis. Therefore, our chosen method for this research is a panel data analysis.

Following Novignon et al. (2012), we adopt a health outcome model as follow:

$y_{it} = H_{it}\beta + \varepsilon_t, t = 1 \ldots . . T$……..……..……(1)

$\varepsilon_t = \mu Z + v$ ……...……(2)

Where y_{it} is a vector of dependent variables in country i at time t, H is a vector of exogenous variables, including the constant, and β is a vector of coefficients. ε_t is a vector of random error terms. Baltagi et al.

(2007) propose two components of the error process such as time variant and reminder error process. The error term is spatial weights matrix, Z, and contains spatial autocorrelation parameter μ.

We have also considered the effects of two controlled variables: real per capita income and improved sanitation facilities. These two variables are chosen following the earlier literature and based on the availability of data in the countries of study. Therefore, to investigate the effects of health care expenditure, real per capita income and sanitation on health outcomes in this study, we specify the following equation:

$$HS_{it} = \alpha + \beta_1 THE_{it} + \beta_2 GDP_{it} + \beta_3 SAN_{it} + \varepsilon_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

Where, HS denotes three health outcomes variables, namely total life expectancy at birth (years), infant mortality rate (per 1,000 live births) and crude death rate (per 1,000 people). THE is total health expenditure (% of GDP), and GDP represents for per capita gross domestic product (constant 2005 US$) and SAN is the improved sanitation facilities.

Total health expenditure is the summation of two types of health expenditure: Public and private health expenditures. Public health expenditure includes social security contributions, taxation to private and public sectors and foreign resources like loans and grants. On the other hand, private health expenditure includes private health insurance premium, direct payments or out- of – pocket health expenditure, etc. (Novignon 2012; Lu et al 2010). Both private and public health expenditures have different effects on the health status. For example, an increase of out-of- pocket health expenditure, one of the private health expenditures, reduces the people’s spending ability on other goods and services, which may lead to more poverty. On the other hand, an increase of public health expenditure may lead to increase of the government budget deficit, but it will decrease the burden of people’s private health expenditure. Increased public health expenditure

contributes to improve society's health, implying improved human capital that eventually leads to higher economic growth in an economy (Yardim, et al 2010). Thus we analyse the individual impact of these two components on health outcomes using the following equation:

$$HS_{it} = \alpha + \beta_1 PUB_{it} + \beta_2 PRI_{it} + \beta_3 GDP_{it} + \beta_4 SAN_{it} + \varepsilon_{it} \quad \ldots\ldots (4)$$

Where, PUB and PRI represent public health care expenditure and private health care expenditure, respectively. All variables are in natural logarithm. The subscripts i and t represent country and time, respectively.

Firstly, we run fixed effect model GLS and random effect model GLS (with cross-section weights). Baltagi et al. (2007) argue that the random effect model will be more suitable when error term is considered not serially correlated with the reminder error and there is no spatial serial dependence of error terms. Cameron and Trivedi (2005) argue that fixed effect may be used to control endogeneity in panel data where endogeneity arises owing to a time-invariant omitted variables. We conduct the Hausman Test to find out whether the fixed effect or random effects model is the most appropriate model. In addition, we address the potential endogeneity issue by adopting the Panel Generalized Method of Moments (GMM). Arellano and Bond (1991) propose that the use of instrumental variable GMM mitigates the endogeneity problem with explanatory variables. Also GMM is very useful to estimate extensions of the basic unobserved effects model (Wooldridge 2002).

Initially, we collect annual data from 1960 to 2014 (55 years) from the World Development Indicators (WDI), World Bank database for 17 countries of two regions of South Asia (SAARC) and South East Asia (ASEAN), namely Bangladesh, Bhutan, Brunei Darussalam, Cambodia, India, Indonesia, Lao PDR,

Malaysia, Maldives, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Thailand and Vietnam. The chosen variables for collected data are total life expectancy at birth (years), infant mortality rate (per 1,000 live births), crude death rate (per 1,000 people), per capita real GDP, improved sanitation facilities (% of population with access), total health expenditure (% of GDP), public health expenditure (% of government expenditure) and private health expenditure, i.e. out-of-pocket health expenditure (% of private expenditure on health). Due to lack of data for all countries and for all years, we have to limit the study to 15 countries excluding Myanmar and Brunei Darussalam for the period of 1995 - 2014 (20 years).

5. Empirical results and analysis

Table 3 provides the mean and standard deviation of life expectancy at birth (LIF), mortality rate (MOR) and death rate (DEA), per capita real GDP (GDP), total health expenditure (THE), public health expenditure (PUP), private health expenditure (PRI) and improved sanitation facilities (SAN). The highest and the lowest mean of LIF of 79.54 and 61.32 are reported in Singapore and Lao PDR, respectively. The highest and lowest mean death rates are 8.77 and 4.33 for Lao PDR and Maldives, respectively. The lowest mean value of mortality (2.73) and the highest mean values of GDP and SAN (1319.45 and 99.84, respectively) are reported in Singapore. While, the lowest mean of total health expenditure is reported for Indonesia (2.50), it is the highest for Maldives. The highest and the lowest means of public health expenditure are for Thailand (16.72) and India (4.39). The highest mean of private health expenditure is for Bhutan (98.07), and the lowest mean of it for Maldives (65.26). For Cambodia, the sanitation facilities are minimum among the sample countries.

Table 3: Descriptive statistics of variables

		LIF	DEA	MOR	GDP	THE	PRI	PUB	SAN
Bangladesh	Mean	67.37	6.43	53.57	509.00	2.73	94.83	7.87	50.06
	Std. Dev.	2.98	0.89	15.29	121.80	0.30	2.25	0.96	6.13
Bhutan	Mean	63.85	7.79	48.37	1343.95	5.59	98.07	12.26	37.89
	Std. Dev.	4.26	1.55	14.93	420.86	1.30	2.25	3.26	8.86
Cambodia	Mean	62.06	8.14	58.36	468.01	5.83	94.30	9.73	24.13
	Std. Dev.	4.44	1.75	22.47	161.03	0.83	8.62	3.82	10.27
India	Mean	64.33	8.25	57.46	768.06	4.29	89.99	4.39	30.10
	Std. Dev.	2.33	0.68	11.99	244.75	0.18	1.69	0.30	5.85
Indonesia	Mean	67.06	7.24	35.30	1336.29	2.50	74.82	5.00	51.38
	Std. Dev.	1.17	0.06	8.47	259.47	0.39	1.56	0.75	6.03
Lao PDR	Mean	61.32	8.77	72.63	504.03	3.63	78.71	6.11	42.55
	Std. Dev.	3.18	1.53	14.30	158.28	1.03	10.62	2.15	16.96
Malaysia	Mean	73.43	4.58	7.95	5587.07	3.51	76.59	5.60	92.96
	Std. Dev.	0.85	0.17	1.69	929.23	0.45	1.98	0.58	2.40
Maldives	Mean	72.74	4.31	25.03	4223.96	7.86	65.26	15.49	86.86
	Std. Dev.	3.78	0.88	15.09	703.87	2.05	15.06	4.04	9.74
Nepal	Mean	64.76	7.80	49.76	325.83	5.85	84.81	11.19	28.93
	Std. Dev.	3.47	1.25	14.50	52.21	0.44	7.35	2.52	9.66
Pakistan	Mean	63.82	8.34	81.43	693.06	2.83	87.07	4.13	44.90
	Std. Dev.	1.44	0.67	8.96	78.54	0.27	5.65	0.51	10.59
Philippines	Mean	67.18	6.28	27.77	1230.63	3.76	81.75	8.12	66.80
	Std. Dev.	0.67	0.20	3.17	206.24	0.58	2.78	0.88	3.94

Singapore	Mean	79.54	4.48	2.73	29060.14	3.49	94.70	9.04	99.84
	Std. Dev.	2.03	0.24	0.67	5641.49	0.69	1.17	2.13	0.21
Sri Lanka	Mean	72.73	6.69	12.39	1319.45	3.66	84.04	7.30	85.87
	Std. Dev.	2.02	0.46	2.88	374.54	0.29	4.59	1.62	6.14
Thailand	Mean	72.10	7.09	16.24	2883.15	4.93	68.76	16.72	92.18
	Std. Dev.	1.53	0.42	4.05	534.58	0.89	9.77	4.85	1.45
Vietnam	Mean	73.94	5.65	23.44	705.23	5.60	89.97	8.48	60.49
	Std. Dev.	1.15	0.11	4.01	209.81	0.80	6.26	2.47	9.92

5.1 The effects of health care expenditures on life expectancy

Table 4: Effects of health care expenditure on life expectancy at birth (LIF)

Model	**Fixed Effect**		**Random Effect**	
C	3.3306 (142.61)***	3.3777 (59.17)***	3.3807 (144.15)***	3.4243 (60.30)***
LNTHE	0.0011 (0.23)		0.0055 (1.23)	
LNPUB		-0.0015 (-0.45)		0.0001 (0.04)
LNPRI		-0.0093 (-0.88)		-0.0088 (-0.85)
LNGDP	0.0740 (13.67)***	0.0750 (14.21)***	0.0608 (12.56)***	0.0631 (13.19)***
LNSAN	0.0911	0.0890	0.1004	0.0972

	(16.32)***	(15.72)***	(19.03)***	(17.97)***
R-squared	0.9805	0.9805	0.8888	0.8891
Durbin-Watson	0.0857	0.0896	0.0665	0.0703
F-Statistic	885.05	885.51	772.96	579.11
Observations	294	294	294	294
Cross-section included	15	15	15	15

Notes: ***, **, and * denote significance level at 1%, 5% and 10% respectively. Figures in the parentheses are t-statistics.

The effect of health care expenditures on life expectancy is investigated using the fixed and random effect models, and the results are reported in Table 4. An increase of total health expenditures has no impact on life expectancy at birth (LIF) supporting the view of Filmer and Pritchett (1999) and Barlow and Vissandjee (1999) but contradicting with the findings of Novignon, Olakojo & Nonvignon (2012). In addition, public health care expenditures (PUB) and private health care expenditures (PRI) also have no impact on life expectancy at birth. This could be possible as life expectancy might be affected by other factors such as diet, life-style and environment that are not directly related to the health care system (Nixon and Ulmann 2006). Per capita income (GDP) and sanitation (SAT) improve life expectancy at birth. The corrected random effect Hausman specification test confirms that fixed effect estimate is more appropriate (Chi-Sq. Statistic is 31.87) in this estimate. The fixed effect model is significant with an R-square of 98%, and F-statistic 885.

5.2 The effects of health care expenditures on death rate

Table 5: Effects of health care expenditures on death rate (DEA)

Model	Fixed Effect		Random Effect	
C	3.4010 (35.49)***	3.8843 (16.78)***	3.4273 (35.77)***	3.9320 (17.01)***
LNTHE	0.0910 (4.82)***		0.0861 (4.66)***	
LNPUB		0.0645 (4.69)***		0.0632 (4.65)***
LNPRI		-0.1065 (-2.51)**		-0.1100 (-2.60)***
LNGDP	0.0016 (0.07)	0.0111 (0.52)	-0.0063 (-0.32)	0.0017 (0.09)
LNSAN	-0.4173 (-18.20)***	-0.4385 (-19.11)***	-0.4098 (-18.96)***	-0.4307 (-19.56)***
R-squared	0.9637	0.9647	0.7866	0.7946
Durbin-Watson	0.2637	0.2952	0.2403	0.2762
F-Statistics	430.76	417.07	356.22	279.50
Observations	294	294	294	294
Cross-section included	15	15	15	15

Notes: ***, **, and * denote significance level at 1%, 5% and 10% respectively. Figures in the parentheses are t-statistics.

Table 5 reveals that total health expenditure (THE) has a positive impact on death rate and show that increase in THE is more likely to increase infant mortality rate with 1% level of significance. When we split the total health expenditures into public and private, public health expenditure (PUB) increases death rate, whereas, private health care expenditure (PRI) reduces death rate. While public health care expenditure increases the death rate by about 0.06 in both fixed and random effects models, private health care expenditure reduces death rate by 0.11 per 1000 people in fixed and random effect models at 1% significance level, respectively, supporting partially the findings of Novignon, et al (2012) from sub-Saharan Africa. However, the studies of Berger and Messer (2002) and Hitiris and Possnett (1992) on OECD countries revealed that health expenditure reduced mortality rate in developed countries. The reason for unexpected sign of public health care expenditure in our study may be that good governance for utilising public health expenditure in these countries is not maintained. If resources in public sector are inefficiently used, and corruption prevails, likely outcome on health status will not be achieved (Hilaire, 2016). Furthermore, the public health care expenditure compared to the private health care expenditure in developing countries like ours are manifold; since the sign of public health expenditure is positive, the effect of total health expenditure is also found positive (see Akinci et al 2014 for example). Additionally, while per capita GDP has no effect on death rate (DEA), improved sanitation facilities reduce the death rate. The corrected random effects of Hausman specification test confirm that random effect estimate is more appropriate (Chi-Sq. Statistic is 5.45) in this case. The random effect model is significant with an R-square of 79%, and F-statistic 356.

5.3 The effect of health care expenditure on infant mortality rate

Table 6: Effects of health care expenditure on infant mortality rate (MOR)

Model	Fixed Effect		Random Effect	
C	10.1249 (52.39)***	11.3396 (22.58)***	10.0440 (47.78)***	11.2206 (22.15)***
LNTHE	-0.2683 (-7.05)***		-0.2749 (-7.32)***	
LNPUB		-0.0833 (-2.79)***		-0.0888 (-3.00)***
LNPRI		-0.2383 (-2.59)***		-0.2405 (-2.62)***
LNGDP	-0.7840 (-17.51)***	-0.8579 (-18.48)***	-0.7581 (-18.12)***	-0.8209 (-18.89)***
LNSAN	-0.2124 (-4.59)***	-0.1709 (-3.43)***	-0.2332 (-5.23)***	-0.1996 (-4.14)***
R-squared	0.9893	0.9879	0.8467	0.8267
Durbin-Watson	0.2062	0.1751	0.1976	0.1644
F-Statistics	1495.82	1247.25	533.76	344.70
Observations	294	294	294	294
Cross-section included	15	15	15	15

Notes: ***, **, and * denote significance level at 1%, 5% and 10% respectively. Figures in the parentheses are t-statistics.

Total health care expenditures are more likely to reduce the infant mortality rate and show that a 1% increase in total health care expenditure (as% of GDP) leads to reduce the infant mortality rate by around 0.27 per 1000 live births in the fixed and random effect models at 1% of significance level (Table 6). When we split the total healthcare expenditures into public and private, both expenditures decrease the infant mortality rate as expected. Both real per capita GDP and sanitation facilities reduce the infant mortality rate as well. These results are along the line of findings of Crémieux et al (2005), Elola and Vicente (1995), Novignon, et al (2012), Issa and Ouattara (2012), Paxson and Scady (2005) and many others. The extent of effect of private health expenditure (0.24) is higher than that of public health expenditure (0.09) on the infant mortality rate. The corrected random effect Hausman specification test confirms that random effect estimate is more appropriate (Chi-Sq. Statistic is 3.07) in this case. The random effect model is significant with an R-square of 85%, and F-statistic 534.

5.4 Addressing the potential endogeneity issue

We have estimated the panel GMM results to address the potential endogeneity problem. The obtained results are noted in Table 7 below. We find similar results of the fixed and random effect models reported in Table 4 – 6 above.

Table 7: The results of panel Generalized Method of Moments (GMM)

Dependent variable	**LIF**		**DEA**		**MOR**	
C	3.3306 (149.24)***	3.3777 (84.62)***	3.4273 (35.88)***	3.8843 (19.85)***	10.1249 (68.28)***	11.3396 (25.50)***
LNTHE	0.0011 (0.27)		0.0861 (4.32)***		-0.2683 (-6.69)***	
LNPUB		-0.0015 (-0.43)		0.0645 (3.86)***		-0.0833 (-2.88)***
LNPRI		-0.0093 (-1.45)		-0.1065 (-3.66)***		-0.2383 (-2.85)***
LNGDP	0.0740 (13.54)***	0.0750 (14.41)***	-0.0063 (-0.31)	0.0111 (0.51)	-0.7840 (-19.65)***	-0.8579 (-19.35)***
LNSAN	0.0911 (23.36)***	0.0890 22.05	-0.4098 (-27.80)***	-0.4385 (-27.61)***	-0.2124 (-4.86)***	-0.1709 (-4.11)***
R-squared	0.9804	0.9805	0.7866	0.9646	0.9893	0.9879
Durbin-Watson	0.0857	0.0896	0.2403	0.2952	0.2062	0.1751
Observations	294	294	294	294	294	294
Cross-section included	15	15	15	15	15	15

Notes: ***, **, and * denote significance level at 1%, 5% and 10% respectively. Figures in the parentheses are t-statistics.

Overall, our main results indicate that total health care expenditures significantly reduce the number of infant mortality per 1000 live births. The separate effects of public and private health expenditure on infant

mortality rate is also negative in the sample of selected countries. While health care expenditures have no effect on the life expectancy at birth, the private health expenditure has negative effect on the death rate in the selected sample countries. Here public and private health care expenditures provide conflicting effects on the death rate.

5. Conclusion and policy implications

This study has explored the role of healthcare expenditures on three important health status outcomes namely life expectancy at birth, crude death rate and infant mortality rate in the SAARC-ASEAN region. A panel data set of 15 countries for 20 years (1995-2014) is used. The separate effects of private and public healthcare expenditures on health outcomes are also examined. Furthermore, two controlled variables, GDP per capita and improved sanitation facilities, are also added in the selected models as explanatory variables.

Our findings reveal that total health expenditures have significant effect in reducing infant mortality rate in the region. The separate effects of private and public health expenditures on this health status indicator are also negative as expected and statistically significant implying that both types of healthcare expenditures are essential for improving the population health. However, unlike some earlier studies, Novignon et al (2012) for example, the extent of effect of private health expenditure is higher than that of public health expenditure. This may be due to the fact that the use of public health fund in these countries is, in general, inefficient, and corruption is dominant.

The private healthcare expenditure also significantly decreases the crude death rate in the region though the public health expenditure is showing opposite sign. Again lack of proper utilisation of public sector fund may be the reason. The study has not found any significant effect of healthcare expenditures on the life expectancy. This may be due to the reason that life expectancy depends on some other important factors such as life style, environment, individual education level, etc. for which we have no available data.

Furthermore, the per capita income growth rate has significant positive effects in increasing the life expectancy and reducing the infant mortality rate in the region. Improved sanitation facilities have also played significant positive role in increasing the life expectancy and decreasing the crude death rate and the infant mortality rate.

Based on the findings the following policy implications may be drawn: (i) increased share of health expenditures is to be supported for increasing the health status of the population in the region. This share is to be more or less close to that of the developed countries; (ii) proper care must be taken for appropriate and efficient use of public sector health funds, and accountability and transparency must be ensured in this regard; (iii) efforts are to be made and adequate policies must be adopted and executed for raising the income level of the people to enable them to spend more on health; and (iv) further improved sanitation facilities are to be supported by the government and private initiatives.

The current study faces some limitations, mainly with the data for many countries, many variables and for longer period. For example, we had to reduce the data set from 55 years to 20 years and from 17 countries to 15 countries. Also we had no data on some important variables like people's diet, life-style, education level and environment which could have incorporated as explanatory variables in the models. Future research should address these limitations though they no way invalidate the findings of this current study.

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