The Correlation of Government Health Expenditure and Infant Mortality Rate (IMR) : Panel Data Analysis in ASEAN Countries

By

Thu Thu Theint

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

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Committee in charge:

Professor Liu, Cheol, Supervisor

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Table of Content

List of Tables

List of Figures

Abstract

This study investigated the correlation between domestic government health expenditure (DGHE) and the rate of infant deaths among ten ASEAN member countries within 6 years period (2010-2016). The required data was collected from World Development Indicators (WDI) and random effects and fixed effects model were used to run regression analysis. Infant mortality rate was considered as outcome variable and domestic government health expenditure as predictor variable. In fact, private health expenditure, external health expenditure, urban population, immunization, GDP per capita and access to basic sanitation facilities were assumed as control variables in the model. The regression results revealed that domestic government health expenditure was negatively correlated with infant mortality rate at 5% significance level. Although private health expenditure and external health expenditure were negatively correlated with the rate of infant mortality, their relationship was not significant. Moreover, other control variables were also negatively associated with infant mortality rate in ASEAN countries. The findings suggest that, in the developing countries like Myanmar, the government should increase government health expenditure to promote better health outcomes such as reducing infant mortality rate through performing the correct allocation and good management of public health funds and it is worthy to consider on investing and providing more for the improvement of immunization programme and sanitation facilities to reduce infant mortality rates.

Key words: Infant Mortality Rate, Domestic Government Health Expenditure, ASEAN countries

Chapter I: Introduction

1.1 Issues and Objectives

Recently, the concept of "health" has become the center of sustainable development and many countries consider the improvement and expansion of good healthcare as priority. In a recent report of World Health Organization (2017) found that USD 7.3 trillion was spent on health around the world in 2015, which is nearly 10% of GDP globally. The share of GDP on health sector in the countries of high-income is greatest at nearly twelve percent on average; however, it takes for seven percent of GDP on average in the countries of low-income and six percent of GDP in middle-income countries. The United Nations (n.d.) claims that the significant progress can be seen in saving millions of lives by providing efficient funds to health system, creating better hygiene and sanitation, increasing access to physicians. More precisely, it emphasizes on the child mortality rate reduction globally and increasing health financing substantially. Moreover, WHO (2010) agrees that one of the core factors to maintain health system's ability and human welfare improvement is health financing.

In the advanced macroeconomics literature, the improvement of human capital is described as one of the essential factors for promoting a country's development and economic growth (Romer, 2005). In a similar way, the human capital model of Grossman states that more working time and improved utility can be dominated by good health of human capital. Empirical studies have also revealed that a healthy person is able to work efficiently and devote more time for improving productivity which could impact on economic development positively (e.g. Bloom & Sevilla, 2004). According to WHO (2017), a large number of advantages, such as providing healthier lives, enhancing social and political stability, can be emerged by investing in the healthcare and that investment can also contribute to economic development and productivity. Therefore, it can be implied that

government should spend a fair amount of expenditure on healthcare in order to promote the country's economic growth.

Thus, a large body of literature has conducted to investigate the linkage between the expenditure on healthcare and health outcomes for more than 2 decades after realizing the importance of population health and its influence to the economy of a nation (Edeme et al., 2017; see also Rahman et al., 2018; Novignon et al., 2012). Edeme et al. (2017) states that, in developing countries, there are significant challenges and problems for the improvement of health status such as high rate of maternal and infant deaths and low life expectancy because of limited health resources and infrastructure. If the improved healthcare services could be accessed by all citizens from each part of a nation, the mortality rate as well as financial risk among the population will be reduced to some degree. Therefore, the efficient and adequate share of government spending on health sector plays a crucial part to improve a country's health outcomes. They showed that a long run equilibrium relationship exists between public expenditure on healthcare and health outcomes in Nigeria.

Similarly, Novignon et al. (2012) also claimed that healthcare expenditure plays a vital role in performing to improve the status of health in sub-Saharan African region. According to their empirical findings, although both of private and public expenditure on healthcare have positively associated with health outcomes (the rate of infant mortality and life expectancy), public health spending shows stronger impact relatively. In contrast, Rahman et al. (2018) argues that private expenditure has greater effect than public expenditure on health in reducing the rate of infant and crude deaths although both of them have significant positive relations with health outcomes. Such kind of different outcomes from the previous literature make the researcher interests to conduct an empirical study exploring the association between public expenditure on health and health outcome improvements in the ASEAN member countries.

1.2. Significance of study

There are ten member countries in ASEAN, however, no existing literature which conducted the association between public healthcare spending and health status results for all ten member countries was found. Although some scholars investigated the relationships between the two variables, it is not included all member countries. Moreover, the previous scholars used different indicators such as crude death rate, the rate of maternal and infant deaths and life expectancy in order to measure health outcomes and they categorized health expenditure's source as public and private only (Kiross et al., 2020; Edeme et al., 2017; Shetty et al., 2014). However, the new classification for healthcare expenditure's source by WHO report is described as public, private and external. Unlike the previous literature, this study will measure the health outcomes in terms of infant mortality rate (IMR) and discuss the correlation status of IMR and health expenditure in terms of public, external and private distinctly. In addition, other social determinants of health such as GDP per capita, immunization, basic sanitation, urban population will also be considered as control variables and discussed their influence on IMR by conducting a panel data analysis among 10 ASEAN member countries in this study.

1.3. Contribution of the study

Furthermore, Shetty et al. (2014) has found that Myanmar has one of the highest IMR rates (41 per 1,000 live births) and its level of public expenditure on health as a percentage of GDP is very low (only 2% of GDP) among the Southeast Asian countries. In 2015, the IMR of Myanmar is 40 per 1,000 live births and is ranked 43 among 191 countries around the world represented in descending order of IMR (Actualitix, 2015). This is a very poor ranking and says a lot about the level of human development in Myanmar. So, this study will also

seek the update status public health spending and the death rate of infants in Myanmar and try to formulate some policy recommendations for the improvement of the health sector in Myanmar. This research will be interest to Myanmar government's policy makers, the executive level of health sectors, international organizations and non-governmental organizations to design and implement more effective policy to improve health outcomes, especially, for the reduction of the IMR.

1.4. Research Questions

The research questions as follow will guide this paper:

(i) Is there any significant correlation between infant mortality rate (IMR) and domestic government health expenditure in ASEAN member countries?

(ii) Which are the other major factors that may influence the infant mortality rate?

(iii) How should Myanmar's government do to achieve better health outcomes in the future?

1.5. Hypothesis

Ho: Higher government health expenditure has no significant association with reducing the death rate of infants.

H1: Higher government expenditure on health has significant positive association with reducing the death rate of infants.

1.6. Overview of structure

This paper is composed of five chapters. First, Chapter 1 describes issues and objectives of this research, research questions and hypothesis. Secondly, the findings from the existing literature are reviewed in Chapter 2. Then, Chapter 3 states the methodology

including data analysis method and explanation about variables. Next, the findings of data analysis for this paper including summary statistics, trends of each variables and regression results are discussed in Chapter 4. Finally, Chapter 5 concludes with some policy recommendations.

Chapter II: Literature Review

The objective of this section is to review the findings of previous literature concerned with the linkage between the death rate of infants (IMR) and government spending on healthcare and to investigate the factors which may influence IMR.

Does the government expenditure on healthcare play a vital role in promoting health outcomes of a nation? A large body of empirical studies has examined the status of the correlation between health outcomes and government expenditure on healthcare in both developed and developing countries for decades. Some scholars conducted a cross-sectional panel data analysis between the different countries (Kiross et al., 2020; see also Novignon et al., 2012; Rad et al., 2013; Kim et al., 2013; Shetty et al., 2014; Novignon et al., 2017; Rahman et al., 2018) while some scholars have done country-specific data analysis (Edeme et al., 2017; see also Rajagopal, 2016; David, 2018).

Different studies have used different variables to measure a country's health status such as the rate of maternal death, IMR, life expectancy, the rate of crude deaths, neonatal mortality rate and showed different results. Most of the studies have indicated the existence of substantial positive linkage between health outcomes and government expenditure on health (but see Kiross et al., 2020, Novignon et al., 2012); however, other studies have shown that their relationship is not statistically significant (Filmer, 1999; Filmer et al., 1999). Moreover, some of the previous literature has argued that the impact of private spending on healthcare on improving the status of the country's health is more substantial than the public expenditure on health does (e.g., Rahman et al., 2018) and vice versa.

For instance, Novignon et al. (2012) explored the association between private and public healthcare expenditure and the health status in 44 countries in Sub-Saharan Africa for 16 years period (from 1995 to 2010). They collected the required figures from World

Development Indicators (WDI) and analyzed those figures by using panel data regression models namely random effects and fixed effects. After controlling per capita income and urban population, they found that healthcare expenditure has significant effect in improving health status by means of reducing infant death and crude death rates and increasing life expectancy. According to the results, although both of public and private expenditure on health is strongly related with health status, public spending on health shows relatively higher impact in improving health status than private spending.

Similarly, Kiross et al. (2020) inspected the influence of healthcare expenditure on the IMR and neonatal mortality rate in forty-six countries in Sub-Saharan Africa for 16 years period (from 2000 to 2015). The study used panel data from WDI and random effects model to analyze the data. Access to improved sanitation and water, school enrolment rate, measles vaccination coverage, the HIV prevalence rate, the rate of fertility and maternal mortality are used as control variables and immunization rate is assumed as proxy variable in the model. The obtained findings of this research also revealed that a negative relationship occurs between both public and external healthcare expenditure and the rate of infant and neonatal mortality significantly; but, the association between dependent variables and private healthcare expenditure was not significant. Based on these findings, they deduced that it is necessary to increase the allocation of aid to health purposes, decrease out of pocket expenditure and create PPP (public-private partnerships) in order to reduce the death rate of neonates and infants. Moreover, they claimed that the greater the degree of out-of-pocket expenditure on health, the more difficulties the middle and low income countries would face in implementing public health policy.

In the same vein, the descriptive-analytical study in 20 eastern Mediterranean countries for 16 years period (from 1995-2010) also revealed that IMR and public expenditure on healthcare are negatively associated and their relationship is significant.

However, surprisingly, the linkage between private health expenditure and IMR is positive but not significant. In this research, the scholars used Pesaran's CADF unit root test, Westerlund panel co-integration test and random effects model and they controlled the variables like GDP per capita, fertility rate, proportion of population (under 15 years), female labor participation rate, means year school (people who are above 25 years old), proportion of population (between 15 and 64), and urban population. Based on the results of the analysis, scholars concluded that the Eastern Mediterranean countries' health status can be developed and the IMR can be reduced by increasing public health expenditures (Rad et al., 2013).

In fact, a study in 17 OECD countries between 1973 and 2000 also described the same results as government spending on healthcare was negatively correlated with IMR and positively related to life expectancy at birth in developed countries. In the study, the rate of infant deaths and life expectancy were assumed as dependent variables to measure public health outcomes, public health expenditure as independent variable and the variables like the rate of the aging population (over 65), unemployment rates, the Gini coefficient, and real GDP per capita were controlled. According to the empirical results, the scholars suggested that government expenditure should increase in providing medical services and goods to deliver the better health conditions for the citizens (Kim et al., 2013).

On the contrary to the above literature, in the study of the association of 3 kinds of spending on health (total, private and public) and 3 key variables which can measure health status – the rate of crude death and infant death and also life expectancy at birth in the SAARC-ASEAN region, Rahman et al. (2018) presented that all types of expenditure on health could reduce IMR significantly; though the effect of public expenditure on healthcare was relatively less than private healthcare spending in the regression results. The control variables like improved sanitation facilities and per capita income were also influenced population health improvement significantly in that region. They also deduced that

insufficient public health funds resulting from corruption and inappropriate governance can make private spending on health play a crucial part in the lessening of the infant and crude death rates in those countries. Moreover, it shows that per capita income growth and improved sanitation facilities are also important factors which have influence on improving the health of population in that area.

In addition to the cross-country study, a growing body of previous literature has analyzed at the country specific level with the purpose of assessing the correlation status between health expenditure and health outcomes (but see David, 2018; Edeme et al., 2017). Edeme et al. (2017) studied the association between IMR and life expectancy and public healthcare expenditure in Nigeria by collecting the required data from WDI for 34-year period between 1981 and 2014. The findings of that study revealed that a long-run equilibrium relationship occurred between health outcomes and public expenditure on healthcare in Nigeria and the researcher assumes that public spending on health plays a crucial component in performing the development of health status in Nigeria. Likewise, David (2018) also agreed that significant co-integrating (long-run) relationship exists between IMR and government healthcare spending in Nigeria. He claimed that private health expenditure, external health resources, government health expenditure and immunization have substantial impact on the IMR negatively for short-run as well as long-run.

Not only the health spending but also various factors could determine infant mortality rate. Factors such as literacy status, adequate sanitation facilities, access to safe drinking water, GDP per capita annually are inversely related with infant mortality rate in the study done in 16 Arab countries (Shawky, 2001). In another study, Filmer et al. (1999) also added that the level of female education and ethnic fragmentation, income distribution inequality and per capita income can explain cross-national variation in mortality about 95%.

Recently, Shetty et al. (2014) has drawn the assumption that the most significant determinant of the rate of infant deaths is per capita state spending and the countries with higher per capita spending can achieve lower levels of IMR through the results of empirical study in 34 Asian nations. This paper has also pointed out that Laos and Myanmar have the highest IMR among Southeast Asian countries, and particularly, the proportion of government expenditure on health as a percentage of GDP in Myanmar is lowest (only 2%) and the amount of private health expenditure is the highest (nearly 88%) in that region. This indicates that citizens have to rely on unaffordable private healthcare frequently if the public healthcare system and infrastructure are not arranged well by the government and, this may lead to poorer health outcomes consequently.

Moreover, in the paper about studying on the factors of infant and child morbidity and mortality in Myanmar (2005), it is also claimed that the degree of infant and child deaths is pretty large in Myanmar and the pattern of death is similar with other developing countries in that the population death was seriously gathered in the early childhood age; and in particular within one year of life. Nearly 50% of all deaths in the developing countries occur among the children (under 5 years) whereas the equal amount of deaths in developed countries occurs among old people (over 70). If deaths at this point of life could be reduced, it would contribute significantly to improving overall levels of child survival. So, as a developing country like Myanmar, it is necessary to think about the best possible ways to reduce IMR, especially focusing on infant and child mortality. Given this background, the current study will also assess the updated status of Myanmar's government healthcare spending and health status and give some recommendations for improving health policy in the future.

After reviewing the findings of previous literature, the following section will explain about the methodology including the selection of variables, collection of data and the model specification of this paper.

Chapter III: Methodology

3.1. Data Collection and Selection of Variables

This paper used pooled panel data for seven-year period (2010- 2016) for ten member countries in ASEAN, namely Cambodia, Brunei, Laos, Indonesia, Myanmar, Malaysia, Singapore, Philippines, Vietnam and Thailand. Initially, the required secondary data was gathered from WDI (World Development Indicators) which is the database of the World Bank. As discussed in Chapter 2, the previous scholars used different variables such as IMR, the death rate of neonates, life expectancy to measure the health outcomes of a country. In this study, however, the rate of infant mortality (IMR) was used as outcome variable (dependent variable) because many scholars often used it as an indicator to assess the health and well-being of a country. According to WDI (n.d.), IMR refers to the number of infants who died before one year old per 1,000 live births in a given year.

As the predictor variable (independent variable), domestic general government health expenditure was used in the model because it is essential for the decision makers to recognize government-funding amount on healthcare, healthcare programs' effectiveness and the public health expenditure's efficiency level on achieving developments in health status. This study expected that higher government health expenditure will be related with lower IMR.

According to the existing literature, apart from government spending on health, other factors like private health expenditure, external health expenditure, per capita income, immunization, access to basic sanitation facilities, urban population are also the critical factors which can influence infant mortality rate. So, these variables were considered as control variables in the model. Moreover, these variables were selected based on existing literature and data obtainability for the studied country in all the study period.

Government expenditure on health is measured as a proportion of current health expenditure and it is a share of current expenditure on health financed from domestically public health sources consisting domestic revenue as transfers, internal transfers and grants, compulsory prepayment, subsidies to voluntary health insurance beneficiaries, social health insurance contributions as well as non-profit organizations (NGOs) serving households or enterprise financing schemes (WDI, n.d.). Private health expenditure is referred to the proportion of current expenditures on health supported from domestic private sources which consists of funds from NGOs, corporations and households (WDI, n.d.). In addition, the external health expenditure is also measured as the share of current expenditure on healthcare funded from external sources composing of foreign transfers distributed by government including all financial inflows into the national health system from outside of the country as well as direct foreign transfers (WDI, n.d.).

And individual income was described by GDP per capita (current US$) and it is used as a mean of evaluating the quality of life and living conditions measured by people in different areas. Economic theory suggests that a person's spending capacity on better quality healthcare services and healthy food will be increased along with the income level of that person (as purchasing power increases). The higher the income, the larger amount of money on health he or she could spend.

Then, the number of people who can access to basic sanitation facilities is measured as the proportion of population and it is also predicted that the health outcomes of a country will be better if the larger proportion of population can access the basic sanitation facilities. Urban population is calculated as proportion of total population and it can help to measure the degree of changes of health outcomes in terms of the changes in the portion of population living in urban areas. Immunization BCG is used to measure preventive health care services usage on health.

3.2. Model Specification

The model specification of this study followed the previous literature (e.g. Kiross et al., 2020). Assuming health outcome as endogenous variable and government expenditure as exogenous variable, this study used a simple model of health outcomes as follows:

$$Y_{it} = \beta_o + \beta_1 X_{it} + \varepsilon_{it} \quad \ldots\ldots (1)$$

Where "Y" represents the health outcomes, "X" represents the exogenous variable which influences health outcomes and β_1 is the coefficient of exogenous variables, while β_0 is the intercept term. "ε" denotes as the error term that is assumed to be normally distributed with zero mean and constant variance, "i" denotes as each country and "t" defines each year of the study period. Given the specific variables, the current study analyzed the correlation between IMR and government spending on health by using the following equation:

$$IMR_{it} = \beta_o + \beta_1 DGHE_{it} + \beta_2 DPHE_{it} + \beta_3 EHE_{it} + \beta_4 GPC_{it} + \beta_5 IMU_{it} + \beta_6 SAN_{it} + \beta_7 UPOP_{it} + \varepsilon_t \quad \ldots\ldots (2)$$

Where:

IMR = the rate of infant mortality (calculated infant deaths per 1,000 live births)

EHE = External health expenditure (as a % of current health expenditure)

DPHE = Domestic private expenditure on health (as a % of current health expenditure)

DGHE = Domestic government expenditure on health (as a % of current health expenditure)

GPC = GDP per capita (measured by current US$)

IMU = immunization BCG (measured by percentage of one year old children)

SAN = access to basic sanitation services (as a % of population)

UPOP = urban population (as a % of population)

ε = error term

In order to estimate the equation above, the collected data were analyzed by using random effects and fixed effects model in STATA software. According to Baltagi et al. (2007), random effects model is more preferable to use if the error term is not assumed continuously linked with the remainder error and spatial series dependence of error usages are not existed. In fact, Cameron et al. (2005) claimed that fixed effects model is more suitable to control the situation of independent variable is associated with the error term, which is called endogeneity, in panel data where that situation appears owing to time-invariant omitted variables.

In the current research, Hausman test was applied in order to select the more preferable method between fixed effects and random effects model. Statistical Theory describes that if the p-value is less than 0.05, fixed effects model is more preferable. Otherwise, if the p-value is greater than 0.05, we have to choose random effects model. According to the Hausman test results as shown in Fig 1 below, random effects method showed more robustness than fixed effects method so the discussion of this study will be made based on the results of random effects method.

```
. hausman fe re
```

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
dghe	-.2132946	-.2155367	.0022421	.0229758
dphe	-.0427143	-.0509242	.0082098	.0295383
ehe	-.0700652	-.0615693	-.0084958	.031
imu	-.071586	-.0800302	.0084442	.0158834
upop	-.1000684	-.0674849	-.0325835	.1889382
log_GPC	-2.874819	-2.513214	-.3616053	.641988
san	-.3029588	-.3213814	.0184227	.0520927

```
                b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        1.15
                Prob>chi2 =      0.9921
```

Table 1: Hausman test result

Chapter IV: Findings and Discussions

4.1. Descriptive Statistics

Having explained about the data collection, selection of variables in the model and specification of the model, this chapter will now discuss the findings of summary statistics and regression analysis. Table 2 below provides minimum and maximum values, standard deviation and mean values of infant mortality rate (IMR), domestic private health expenditure (DPHE), domestic government health expenditure (DGHE), external health expenditure (EHE), immunization BCG (IMU), GDP per capita (GPC), urban population (UPOP) and access to basic sanitation (SAN) in ASEAN countries during the studied period.

Variable	Obs	Mean	Std. Dev.	Min	Max
IMR	70	21.56	14.74	2.20	51.70
DGHE	70	44.31	23.88	9.02	95.03
DPHE	70	51.65	20.32	4.97	80.74
EHE	70	5.20	7.70	0.00	27.60
IMU	70	93.03	7.43	72.00	99.00
UPOP	70	50.82	23.86	20.29	100.00
GPC	70	12205.54	18272.34	785.50	57562.53
SAN	70	78.41	18.07	37.82	100.00

Table 2: Descriptive Statistics

Table 2 shows that, in ASEAN countries, the mean value of IMR was 21.56 per 1000 live births between 2010 and 2016 with the range of 2.2 to 51.7. The lowest value of this range is for Singapore and the highest one is for Laos in 2010. And the average of domestic government health expenditure is around 44.31% of current health expenditure while the mean value of private health expenditure and external health expenditure is 51.65% and 5.20% respectively. Here, one interesting point is that the minimum and maximum values of DGHE, DPHE and EXE show large gap in the study region: 9.02 to 95.03, 4.97 to 80.74 and 0 to

27.60 respectively. According to Shetty et al. (2014), poorer nations had a higher share of private expenditure on health so that it doesn't need to surprise these results because not only high income countries but also lower middle income and low income countries are included in ASEAN region.

The mean value of immunization BCG is 93.03% and the gap between minimum and maximum value is not quite high (72% to 99%) in the region. In fact, the average rate of urban population is 50.82% of total population where Cambodia has the minimum value of 20.29% in 2010 and Singapore has the maximum value of 100% as Singapore is an island city-state in Southeast Asia. Next, the mean value of the proportion of people using basic sanitation facilities is 78.41% of total population, and also, Cambodia has the lowest rate of 37.82% in 2010 and Singapore has the highest rate of 100%. Another interesting point is that the average amount of GDP per capita is US$ 12205.54; however, range of minimum-maximum rate is pretty much large (785.50 for Cambodia in 2010 and 57562.53 for Singapore in 2016). This result reveals that wealth is distributed unevenly among the studied countries.

4.2. Trend of Variables among ASEAN countries between 2010 and 2016

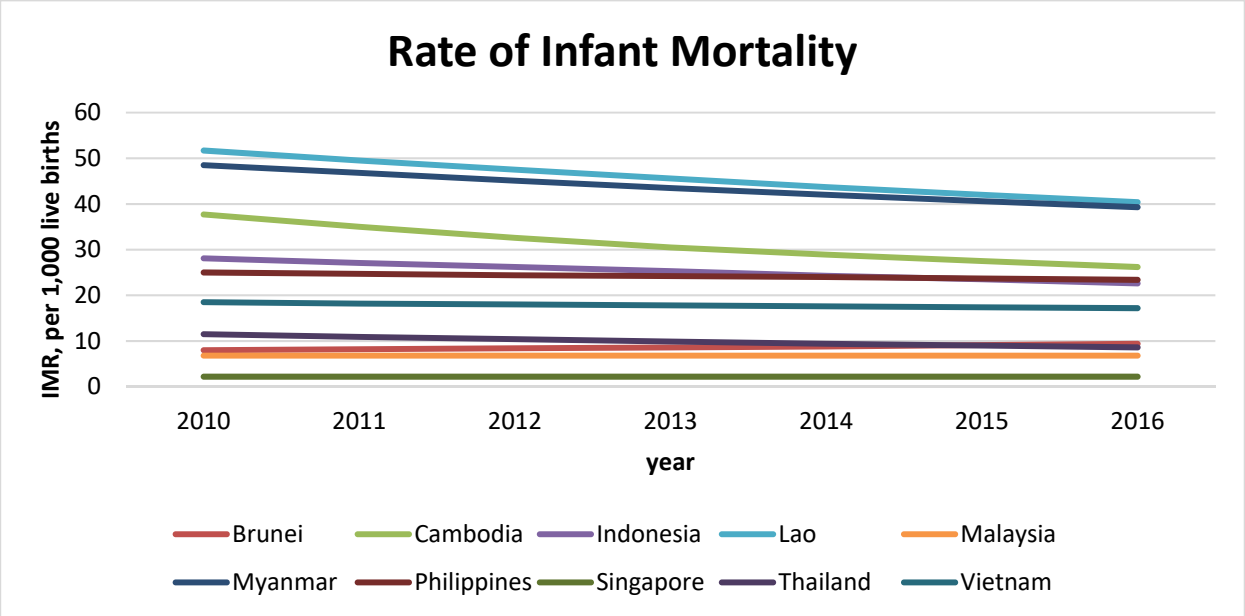

Fig 1: Infant mortality rate's trend among ten ASEAN member countries

Fig 1 shows infant mortality rate's trend among ASEAN member countries during the study period. It can be seen that the rate of infant deaths is gradually decreased in most of the countries like Laos, Myanmar, Cambodia, Indonesia, Philippines, Thailand and Vietnam and it seems to be quite steady in Singapore and Malaysia (2.2 and 6.8 respectively). However, IMR in Brunei is gradually increased within 2010 and 2016 (from 8 to 9.4 per 1000 live births). According to the data, Singapore has the lowest IMR rate in the region and, Laos and Myanmar have the highest IMR rate although their IMR trends are declining dramatically.

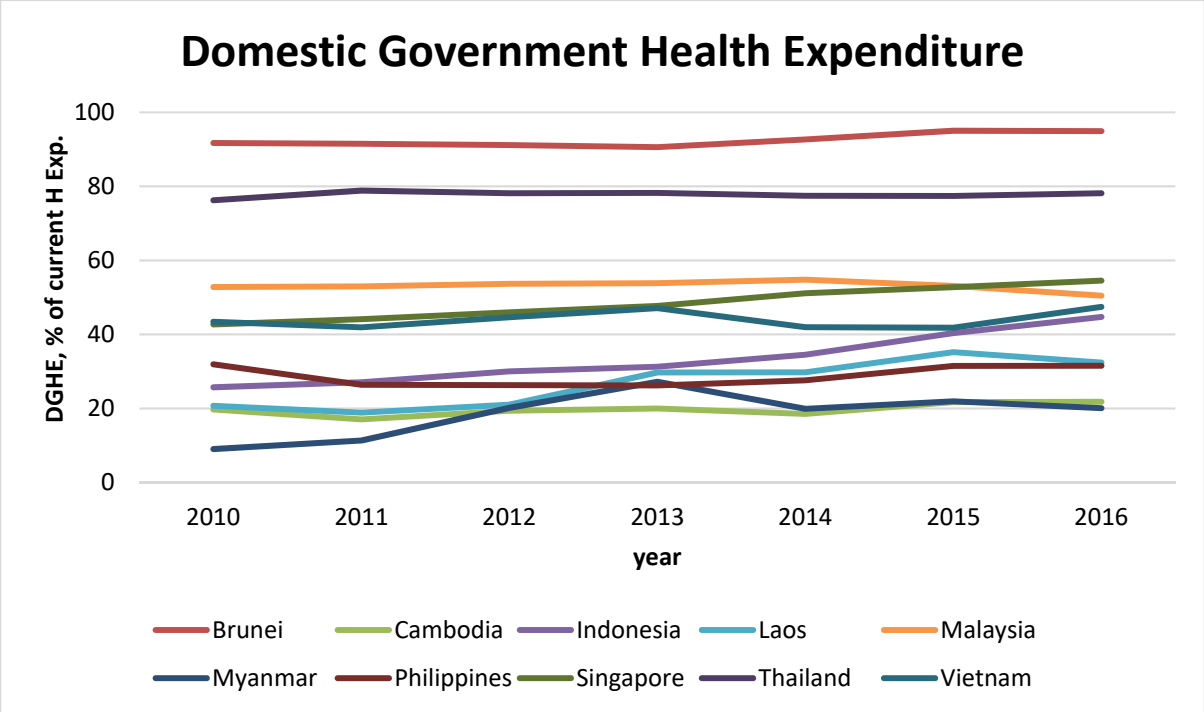

Fig 2: Domestic Government Health Expenditure's trend among ASEAN countries

The trend of domestic government health expenditure is displayed in Figure 2 above. In 2010, Myanmar had the lowest government health expenditure; however, it has dramatically increased starting from 2011 because Myanmar started its democracy transition after 2010 general election and the government has implemented a large range of reforms in social sectors especially in education and health. But it decreased again in 2014 and still now Myanmar's DGHE rate is the lowest among ASEAN countries. Brunei and Thailand have the

highest government health expenditure among the ASEAN countries between 2010 and 2016. The trend of DGHE in Indonesia keeps growing up continually during the study period. One interesting point is that Singapore spends around 50% of government expenditure on health although its GDP per capita is the highest in the region.

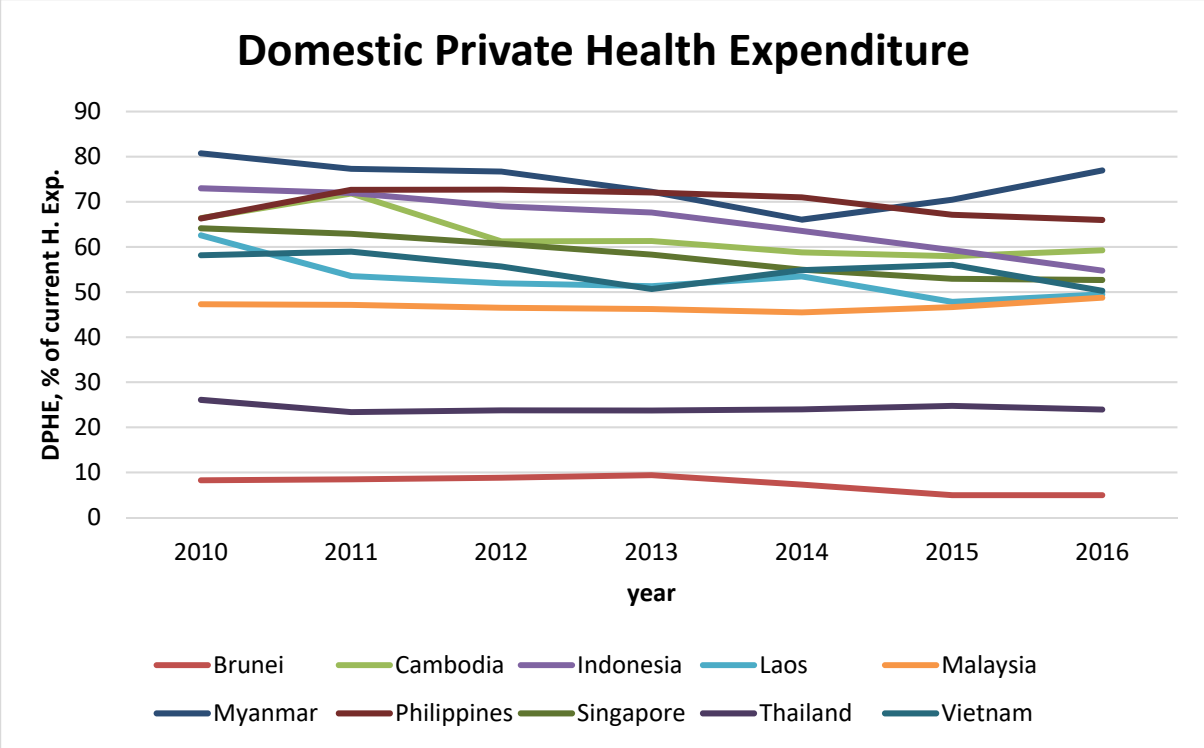

Fig 3: Domestic private health expenditure's trend among ASEAN countries

The trend of domestic private health expenditure in the studied region is demonstrated in figure 3. Among the studied countries, Brunei has the lowest rate of private spending on health and Thailand follows the second position during 2010 and 2016. Not surprisingly, the proportion of Myanmar's DPHE is the highest among ASEAN countries and it is interested that private health expenditure of Indonesia is continually fallen during the 6 year period.

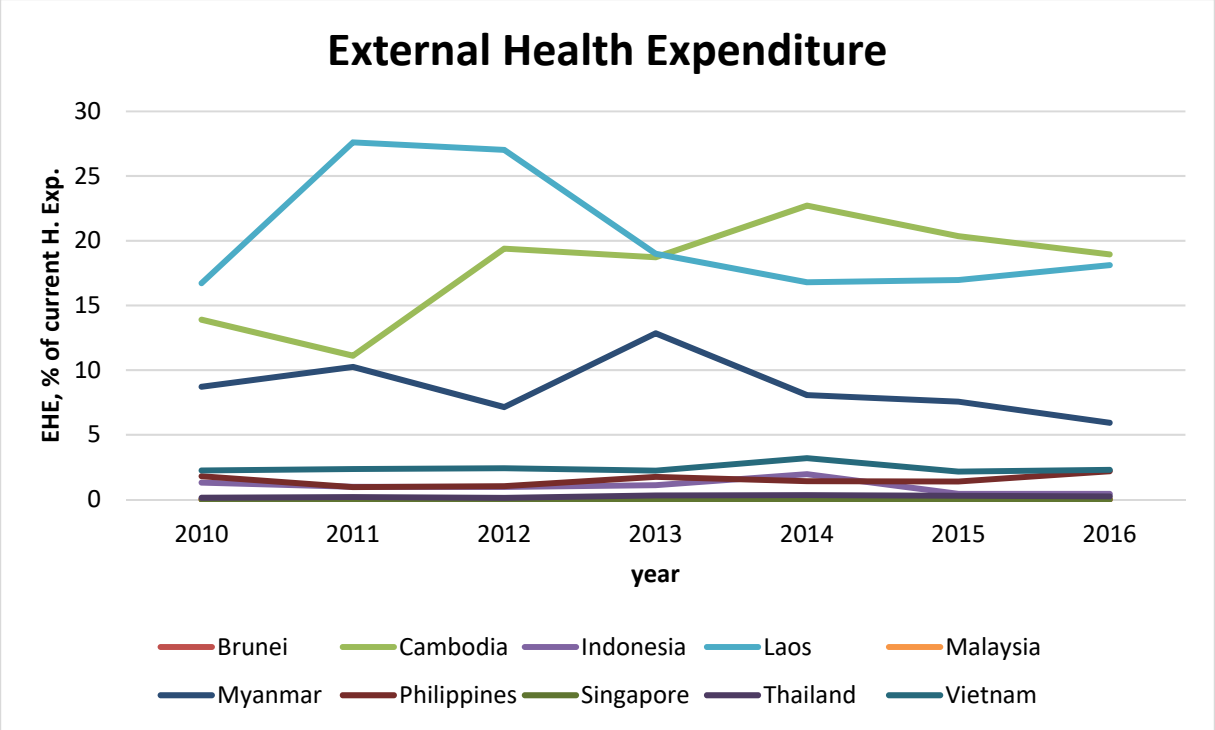

Fig 4: External health expenditure's trend in ASEAN countries

Figure 4 illustrates the situation of external health expenditure in ten countries within 2010 and 2016. It can be clearly seen that Laos had the highest external health expenditure from 2010 to 2013; however, this position has changed to Cambodia in 2014 onwards. And the external health expenditure of Myanmar is quite fluctuated within 2010 and 2014 but its trend goes down in the following years. Moreover, the proportion of external health expenditure of other countries is not too much different and the trend seems to be steady. Singapore and Brunei has no external heath expenditure between 2010 and 2016.

The trend of GDP per capita in ASEAN countries is displayed in the below figure 5. Among 10 ASEAN countries, Singapore stands the highest position in terms of GDP per capita and then Brunei follows the second place. Although most of nations in ASEAN region are developing nations, Brunei and Singapore are regarded as the developed ones in the world. Thus, there is a large gap between Singapore and Brunei comparing with the rest of the ASEAN member countries in terms of GDP per capita.

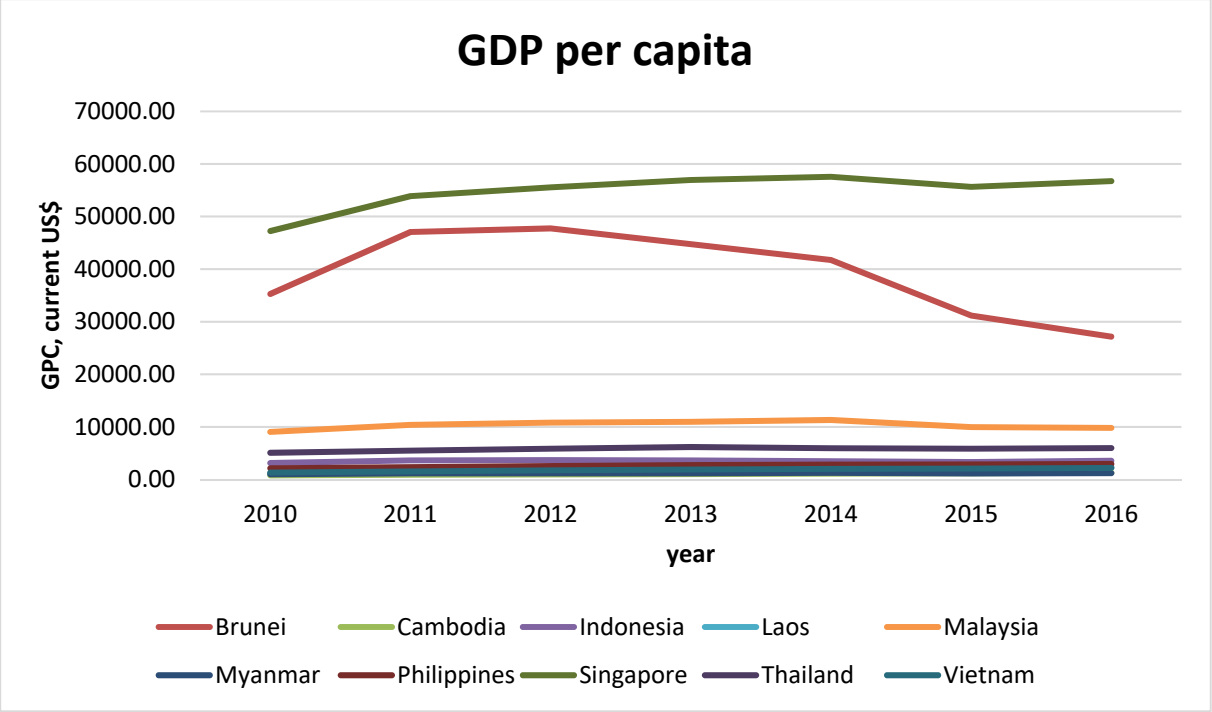

Fig 5: The trend of GDP per capita in ASEAN countries

According to the figure 5, Myanmar's GDP per capita is the lowest and Cambodia has the second lowest ones in the region.

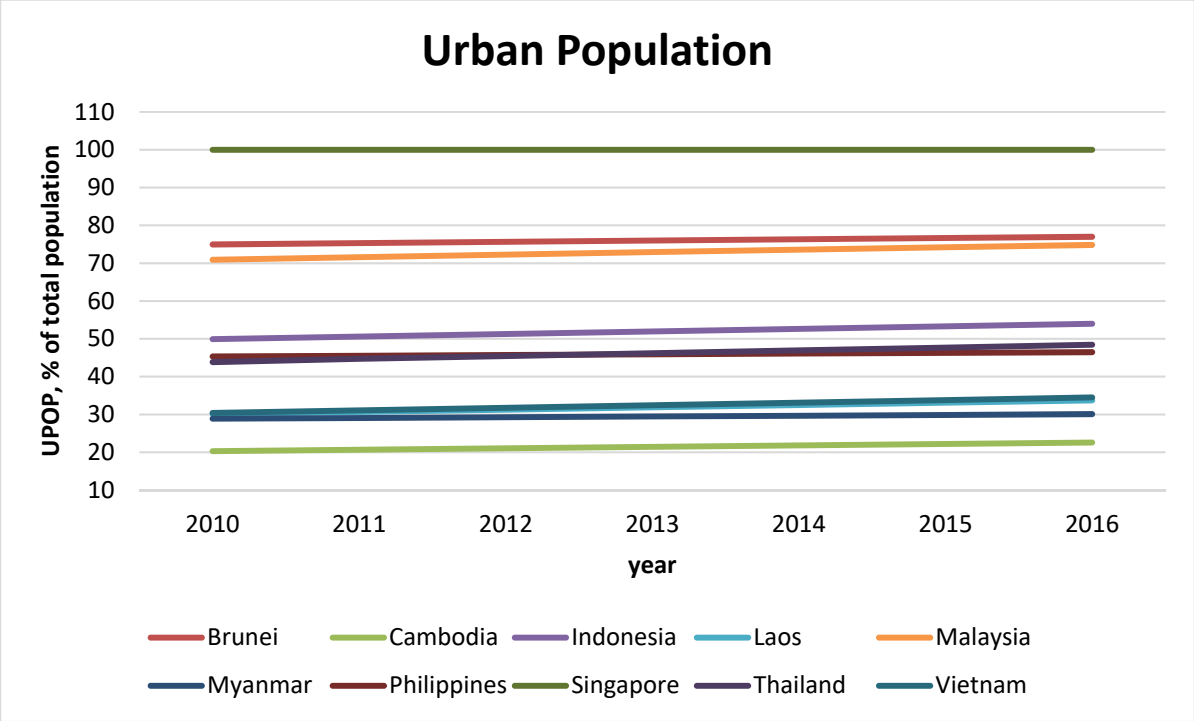

Fig 6: The trend of urban population in ASEAN countries

Figure 6 describes the urban population's movement in the studied countries during six years period. From 2010 to 2016, Cambodia has the lowest urban population ratio and Singapore has the highest urban population ratio (100%) in the region. Except Singapore, it can be seen that the trend of urban population ratio in other countries is gradually increased. According to Kiross et al. (2020), increasing the urban population would lead to reduction of infant mortality rate. As the infant mortality rate's trend gradually decreases and urban population's trend steadily increases in most of the ASEAN countries, the findings of this study support the argument of Kiross et al. (2020).

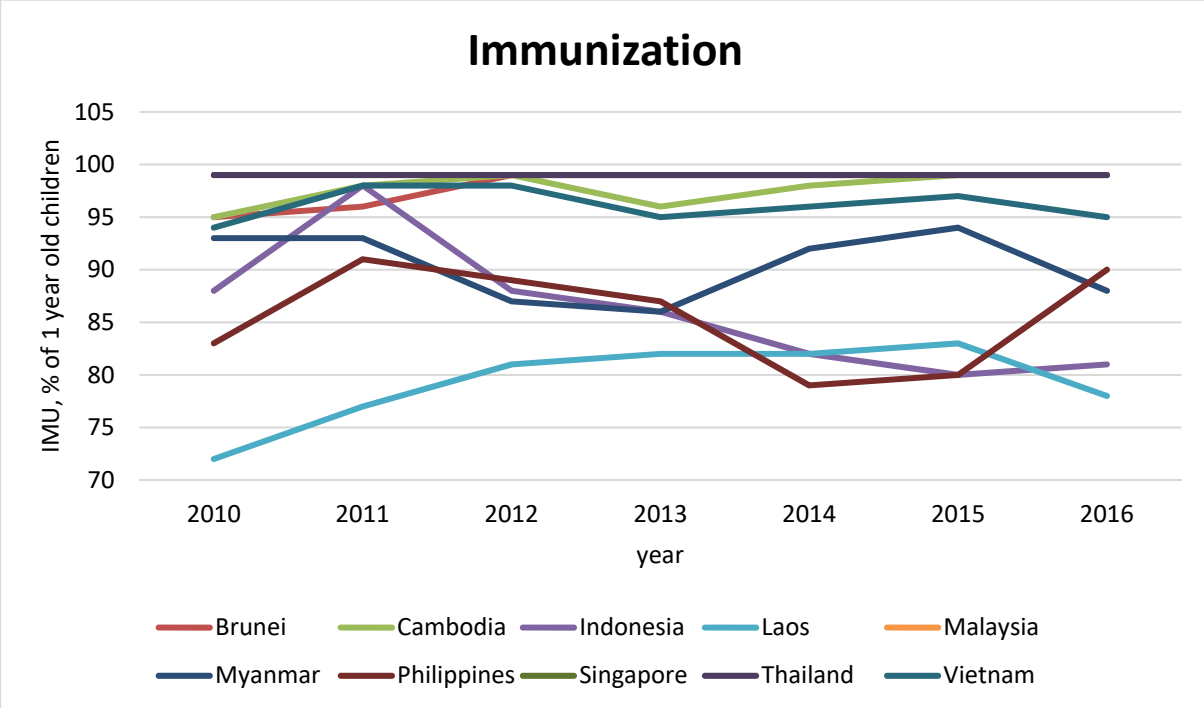

Fig 7: The trend of immunization in ASEAN countries

Figure 7 shows the situation of immunization within the ten ASEAN countries. In the figure, the trend of immunization in most of the countries is quite fluctuated. Laos has the lowest immunization rate and Brunei, Cambodia, Malaysia, Singapore and Thailand have the highest immunization rate (99% in 2016). It is interested that the trend of immunization is steeply declined in Indonesia starting from 2011 to 2016. Considering the fact that Laos has

the highest infant mortality rate and the lowest immunization rate within the 6 years period, it can deduce that immunization could be one of the key factors to reduce the infant mortality rate.

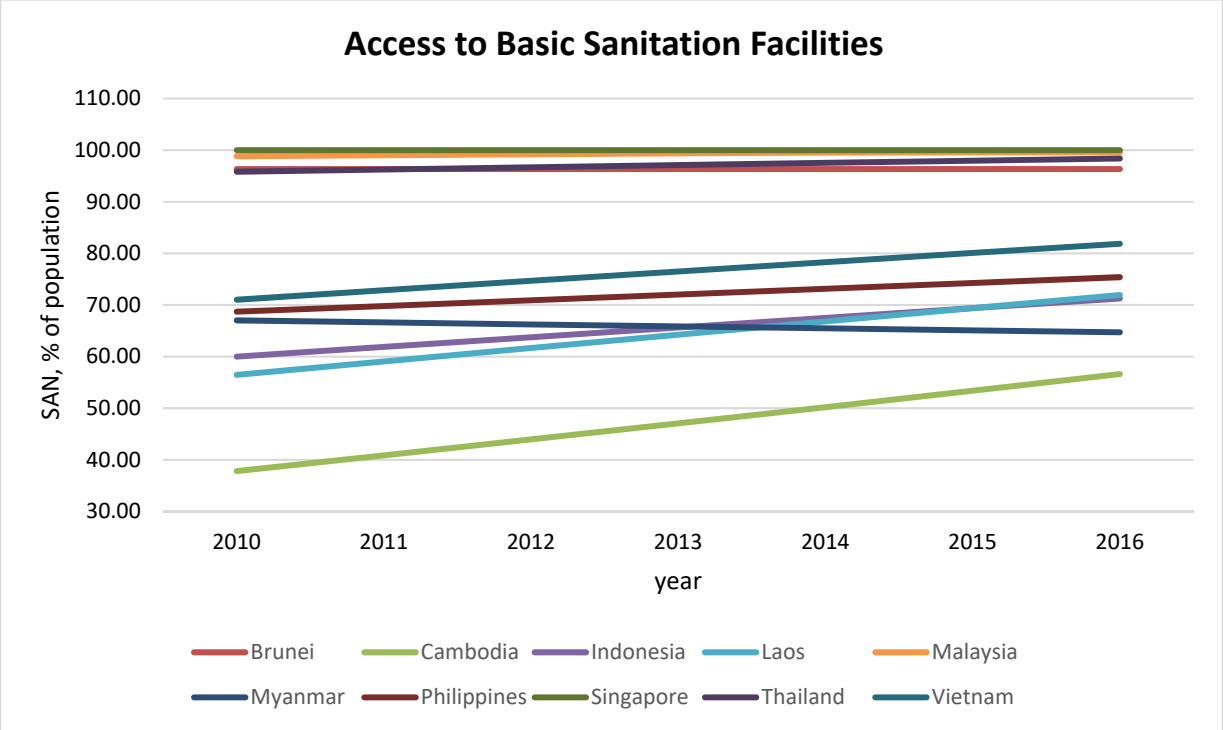

Fig 8: The trend of access to basic sanitation facilities in ASEAN countries

Figure 8 illustrates basic sanitation facilities' trend in ten ASEAN member countries from 2010 to 2016. The rate of Cambodia's basic sanitation facilities is increasing gradually within the studied period; however, it remains the lowest among the ASEAN countries. Singapore keeps the best sanitation facilities which have 100%. For Myanmar, the rate of accessing basic sanitation facilities has slowly declined within 2010 and 2016.

4.3. Regression Results

Having discussed about the trend of IMR, DGHE, DPHE and EHE, the current researcher will analyze the collected data by using random effects and fixed effects model in the STATA software and the results of regression analysis were shown in Table 3 below.

VARIABLES	(1) Fixed Effects	(2) Random Effects
DGHE	-0.213** (0.0783)	-0.216** (0.0848)
DPHE	-0.0427 (0.147)	-0.0509 (0.159)
EHE	-0.0701 (0.165)	-0.0616 (0.180)
IMU	-0.0716** (0.0313)	-0.0800** (0.0378)
UPOP	-0.100 (0.320)	-0.0675 (0.129)
log_GPC	-2.875 (2.340)	-2.513 (1.835)
SAN	-0.303 (0.231)	-0.321* (0.188)
Constant	93.31*** (12.96)	91.32*** (10.37)
Observations	70	70
R-squared	0.704	
Number of country2	10	10
Country FE	YES	
Country RE		YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's computation

Table 3: The effect of government health expenditure on IMR in ASEAN countries

Based on the Hausman test results, although it was favored to choose random effects model, both of the results of fixed and random effects model were reported for the purpose of comparison of the regression analysis results. According to Table 3, domestic government expenditure on health was an important factor in reducing the death rate of infants in ASEAN region. Domestic government health expenditure was negatively correlated with infant mortality rate as expected at 5% significant level statistically. The estimated elasticity for this relationship showed that IMR will be decreased by 0.22 units approximately when government health expenditure rises by 1 unit in random effects model while IMR will be reduced by 0.21 units by increasing DGHE by 1 unit in fixed effects model.

Although private health expenditure and external health expenditure also had negative relationship with infant mortality rate but their relationship was not significant. Concerned with private health expenditure, it was suggested that increasing domestic private health expenditure by one percent could reduce the infant mortality rate by 0.04% in the fixed effects model, whereas, IMR will be reduced by 0.05% when domestic private health expenditure increases by 1% in the random effects model. Similarly, for the external health expenditure, it was revealed that infant mortality rate will be reduced by 0.07 percent in the fixed effects model and 0.06 percent in the random effects model when external health expenditure increases by 1%.

Moreover, a general observation described that a negative relationship occured between other control variables like immunization, GDP per capita, access to basic sanitation facilities and urban population and IMR in both of random and fixed effects models. Based on the regression results of random effects model, the coefficient of immunization of -0.08 implies that on the average, 1% increase in immunization could reduce IMR by 0.08% and this result was significant at 5% level.

And the coefficient of basic sanitation facilities of -0.32 means that IMR will decrease 0.32% when the proportion of people who access the basic sanitation facilities increases by one percent and this association was significant at 10% level. Also, the negative correlation between IMR and urban population expressed that 1% increase in the proportion of urban population can decrease infant deaths by 0.08%, but their relationship was not significant. GDP per capita was also negatively related with IMR though their relationship was not significant. According to the regression results, IMR will be reduced 2.52 units whenever GDP per capita is increased by 1 unit. The results and significance of the association of control variables and IMR in the random effects method were quite similar as the results of the fixed effects method.

4.4. Discussion

The purpose of this research was to investigate the relationship between government expenditure on healthcare and the rate of infant deaths among 10 ASEAN member countries. A large body of previous literature has argued that health financing is really important factor to create better health outcomes for the society. Without financing enough in healthcare sector, the qualified health inputs such as health promotion or prevention of diseases, required medical equipment and medicine, appropriate skillful health workers cannot be provided for producing better health outcomes.

The results of regression analysis from this study indicated that all of the domestic government health expenditure, external health expenditure and private health expenditure were negatively related with IMR. Among the three types of healthcare expenditure, the domestic government health expenditure was significantly associated with IMR at 5% significant level. According to the findings, one percent increase in public healthcare spending could significantly reduce infant death rate by 0.22% approximately in the random

effects method. This result was similar to some existing studies conducted in SAARC-ASEAN region, sub-Saharan Africa, eastern Mediterranean countries (Novignon et al., 2017; Kiross et al., 2020; Rahman et al., 2018). This implies that further investment in the healthcare system of ASEAN region is required to provide better population health, especially among children.

However the association between private and external health expenditure and infant death rate were insignificant statistically in both of the random and fixed effects methods in this study. Other previous studies found such kind of results in their studies (e.g., Novignon et al., 2017). The empirical results in the current study suggested that increasing healthcare expenditure, especially government health expenditure, remains an essential step in reducing the rate of infant deaths in ASEAN region. Kiross et al. (2020) has argued that increasing government health spending is used to develop the accessibility and quality of healthcare services by means of upgrading health system operations and providing the healthcare facilities. Moreover, public expenditure on important health services such as food safety, immunization, preventive health services and communicable diseases is necessary for the reduction of disease and furthermore it declines the rate of infant deaths. Findings from other previous literature also described that healthcare expenditure is an important factor for improving health status and it was negatively associated with IMR substantially (Novignon et al., 2012).

Gupta et al. (2003) claimed that poor people are more strongly benefited by public healthcare spending in comparison with the rich ones. In contrast, in a study in African region, Castro-Leal et al. (2000) argued that public spending on healthcare does not arrange the accessibility of primary care or service facilities systematically for poor residents. They found that the poor people benefit less rather than the rich from public health funds. Given these findings, the scholars have pointed out that better results for population health and

infant mortality rate cannot be emerged by misallocation and poor management of public spending although the government increases public healthcare expenditure. Therefore, this study would like to suggest that developing countries in ASEAN region need to prioritize their public funding and arrange them systematically rather than only increasing the government expenditure in order to reduce the infant mortality rate.

Poorer nations took a greater share of private healthcare expenditure due to unavailability of quality public healthcare services properly (Shetty et al., 2014). In the present research, Myanmar still had the highest share of private health expenditure and the lowest rate of GDP per capita among the ASEAN nations. Moreover, the proportion of government spending on health as a percentage of current health expenditure in Myanmar was the lowest in ASEAN region and it can be assumed that these factors made Myanmar become a country which had the second highest infant mortality rate in ASEAN region. This points out that citizens have to depend on expensive private healthcare and spend more private health expenditure if a reliable public healthcare system and infrastructure is unavailable and this could lead to poorer health outcomes consequently.

There are different impacts from private and public expenditure on health status. For instance, improving out-of-pocket expenditure, which is a kind of private healthcare spending, on health could decrease the spending ability of a person on other services and goods and consequently this may increase poor health outcomes due to the inadequate amount of money to use on further services and goods for better health (Yardim et al., 2010). Also, WHO (2017) claimed that around eight hundred million people in the world have to apply more than ten percent of their income on healthcare annually, and 100 million people are faced with extreme poverty each year because of out-of-pocket health payments.

On the other side, government budget deficit may be enlarged by increasing public health expenditure although this could decrease the burden of private health expenditure of

the citizen. However, the extent of societal health would be more improved by increasing public health expenditure and, finally, it would lead to greater economic growth of a country (Yardim et al., 2010). Therefore, this paper would like to recommend that it is a good option to increase government health expenditure to promote better health outcomes such as reducing infant mortality rate by managing the correct allocation and good management of public health funds in the developing countries like Myanmar.

Besides the effect of healthcare expenditure, the proportion of urban population was also negatively related with infant mortality in this study but their relationship was not significant. Urbanization was accounted as an indicator to access the health services, especially in the urban areas. Generally, most of the healthcare services are concentrated around the cities in the developing countries. Therefore, increasing urban population ratio could reduce infant mortality rate due to the increasing accessibility and better quality maternal and child health services. Edeme et al. (2017) also discovered the same result as there was significant relationship between IMR and urban population in the study of Nigeria and they claimed that residents in urban parts tend to receive more health improvement techniques, as compared to their counterparts in the rural areas. However, the findings in a previous study conducted in sub-Saharan Africa by Arthur et al. (2017) were different from the current study. Their results showed that the growing urban population rate led to enhancing the infant mortality rate because of the pressure on health facilities in urban areas such as high migration rates in urban areas which could result rising in death rates.

Moreover, this study showed that access to basic sanitation facilities and immunization were significantly associated with infant mortality rate at 10% significant level and 5% significant level respectively in random effect model. Kiross et al. (2020) also observed the same result in a study of panel data analysis in sub-Saharan, and also, David

(2018) showed the presence of significant co-integrating association between the death rate of infants and immunization in the study of Nigeria.

Similarly, a negative relationship between IMR and GDP per capita was also found in this study. According to the regression results, a unit increase in per capita income could reduce the infant death rate by 2.51%. According to Edeme et al. (2017), the regular improvement of per capita income would reflect in the disposable income of the individuals and improve their access to healthcare services which will also increase health status and reduce mortality rate.

V. Conclusion and Policy Recommendation

This research investigated the correlation between government expenditure on healthcare and the death rate of infants in ASEAN member countries for 6 year period (2010-2016). The results of the regression analysis provided that government expenditure on healthcare had a negative linkage with infant death rate at 5% significant level. External and private healthcare spending were also negatively related with IMR, however, their relationship were not significant. Not only health expenditure, other socio-economic and demographic variables like GDP per capita, urban population, access to basic sanitation facilities (at 10% significance level) and immunization (at 5% significance level) were also negatively associated with infant mortality rate.

Among the ASEAN member countries, Myanmar had the lowest government health expenditure and highest private health expenditure. In fact, Myanmar had the second highest infant death rate in the region within 2010 and 2016 although Myanmar's IMR is declining gradually during this period. As GDP per income of Myanmar is the lowest among ASEAN countries, it is impossible to produce better health outcomes, particularly reduction of infant mortality rate, only if the government depends too much on private health expenditure continually.

Based on these findings, it could be deduced that, as a developing country like Myanmar, the government should increase government health expenditure to promote better health outcomes such as reducing infant mortality rate through performing the correct allocation and good management of public health funds. On the other hand, increasing public expenditure on healthcare may worsen the country's budget deficit. Therefore, the government of Myanmar should also try to find out the ways to get foreign aids and grants

and establish public-private partnership in developing health sector in order to develop public health outcomes in the long-run.

Concerned with immunization rate, it was significantly related with infant mortality rate at 5% significance level but Myanmar's IMU rate showed downward direction within 2015 and 2016. Furthermore, access to basic sanitation facilities and infant mortality rate were negatively associated at 10% significance level in the regression analysis results, but the trend of accessing basic sanitation facilities in Myanmar was gradually decreasing slowly within the studied period. Based on these findings, this paper would like to recommend that it is worthy to consider on investing and providing more to improve the immunization programme and sanitation facilities to reduce infant mortality rates.

There are some limitations in this study. Although there are many exploratory variables which influence infant mortality rate, only a few of them were considered in the model because of the time constraint and availability of the data in the studied countries. In fact, concerned with the health expenditure, only disaggregated expenditure (public, private, external separately) was considered in the model. For future research, the limitations of this study could consider as the channel for improvement.

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APPENDIX A

STATA Output for Table 3: The effect of government health expenditure on IMR in ASEAN countries (Fixed effects method)

```
. xtreg imr dghe dphe ehe imu upop log_GPC san,fe

Fixed-effects (within) regression               Number of obs      =        70
Group variable: country2                        Number of groups   =        10

R-sq:                                           Obs per group:
     within  = 0.7045                                         min =         7
     between = 0.7702                                         avg =       7.0
     overall = 0.7687                                         max =         7

                                                F(7,53)            =     18.05
corr(u_i, Xb)  = -0.2491                        Prob > F           =    0.0000

------------------------------------------------------------------------------
         imr |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        dghe |  -.2132946   .0942854    -2.26   0.028    -.4024071   -.0241821
        dphe |  -.0427143   .1007892    -0.42   0.673    -.2448718    .1594431
         ehe |  -.0700652   .1134265    -0.62   0.539      -.29757    .1574396
         imu |   -.071586   .0601189    -1.19   0.239    -.1921692    .0489971
        upop |  -.1000684   .2276291    -0.44   0.662    -.5566346    .3564978
     log_GPC |  -2.874819   1.719805    -1.67   0.100    -6.324311    .5746721
         san |  -.3029588   .0943198    -3.21   0.002    -.4921403   -.1137773
       _cons |   93.31449   18.30464     5.10   0.000     56.60004    130.0289
-------------+----------------------------------------------------------------
     sigma_u |  7.5599584
     sigma_e |  1.3011291
         rho |  .97123102   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(9, 53) = 106.77                     Prob > F = 0.0000
```

APPENDIX B

STATA Output for Table 3: The effect of government health expenditure on IMR in ASEAN countries (Random effects method)

```
. xtreg imr dghe dphe ehe imu upop log_GPC san,re

Random-effects GLS regression                   Number of obs     =         70
Group variable: country2                        Number of groups  =         10

R-sq:                                           Obs per group:
     within  = 0.7039                                         min =          7
     between = 0.7732                                         avg =        7.0
     overall = 0.7717                                         max =          7

                                                Wald chi2(7)      =     153.42
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0000
```

imr	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
dghe	-.2155367	.0914431	-2.36	0.018	-.3947619	-.0363115
dphe	-.0509242	.0963636	-0.53	0.597	-.2397934	.1379451
ehe	-.0615693	.1091081	-0.56	0.573	-.2754173	.1522786
imu	-.0800302	.0579827	-1.38	0.168	-.1936743	.0336138
upop	-.0674849	.1269542	-0.53	0.595	-.3163106	.1813408
log_GPC	-2.513214	1.595487	-1.58	0.115	-5.640312	.6138836
san	-.3213814	.0786293	-4.09	0.000	-.4754921	-.1672708
_cons	91.31943	14.55076	6.28	0.000	62.80047	119.8384
sigma_u	8.8459405					
sigma_e	1.3011291					
rho	.97882336	(fraction of variance due to u_i)				