# Income Inequality and Health Outcomes Among Ten Asian Countries, 1990-2016

Received: Available online:

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## Abstract

**Background**: The mixed findings on the associations between income disparities and health remains controversial and raises concerns among health policy makers and authorities, since it affects population health as well as social welfare. A crosssectional time-series study was conducted to contribute to the debate with data from 10 Asian countries during the 1990-2016 period, which was disaggregated into a sub-sample of countries with different levels of income.

**Methods**: Data were obtained from the World Bank database. Gini coefficients were used to measure the income inequality. Health outcome variables were infant mortality, under-5 mortality, and life expectancy at birth. The multivariate fixed-effect and pooled-OLS regressions were applied to examine the association between income inequality and health outcomes.

**Results**: Thailand and Malaysia had the highest level of income inequality, whereas Japan and Korea had the lowest levels. Income inequality has positive effects on mortality rates and negative effects on life expectancy at birth. The other factors also appeared to be determinants of health status. These findings were consistent with other studies, which implied that other factors, rather than income inequality, were associated with health outcomes.

**Conclusion**: Future policies should be tailored to tackle the factors affecting the income inequalities.

**Keywords:** Income inequality, Gini, infant mortality, life expectancy at birth, under-5 mortality.

JEL: C22, I14, I15

## 1. Introduction

he role of health has both significant direct and indirect impacts on the economic growth, contributing to the cycle of human capital formation of a country. Moreover. individuals having rational investment choices on health capital through their daily activities (including medical care, diet. routine exercise. and recreational activities) are assumed to slow down the depreciation rate of health.1 Although the sustainability of population health is ideally targeted in every country, there remain difficulties and barriers in reaching the target due to the existence of inequity and inequality in health. Each country has a different context

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in terms of sociology, economics, demography, politics, culture and epidemiology, which in turn result in different health outcomes. The World Health Organization (WHO) recently reaffirmed the deepening health inequities and inequalities globally, especially under the context of COVID-19 pandemic.<sup>2</sup> This phenomenon, which is caused by both avoidable and unavoidable factors. occurred in most countries. One of these factors being taken into account is income distribution.3-6 The association between income inequality and health produced mixed findings, even a large body of research was conducted decades ago. Moreover, there were few studies in this field conducted in the Asian area. In this article, we contribute to the debate by examining the associations between income inequality and health among high-income, middle-income, and low-income countries in Asia. We also test the moderating role of economic development on the effect of income inequality and health. In other words, the study also examines whether the effect of income inequality on health is different between countries depending on their economic development status.

## 2. Background

The association between income inequality and health metrics has been increasingly interesting since mixed empirical findings were reported and explained in different pathways. The most common findings from literature stated that larger disparities in income were associated with a lower standard of population health.<sup>4,7-12</sup> On the other hand, various studies reported the nonsignificant effect of income inequality on health.<sup>13-15</sup> Mixed results of this health-income inequality link also contributed to the debate.<sup>16-18</sup> A wide range of explanations and hypotheses were Income Inequality and Health Outcomes Among Ten Asian Countries, 1990-2016

indicated in a large body of research, including research methods (the appearance of control variables and the choice of regressions), the size of study settings (provincial-level, statelevel, national level, and international level), the social integration perspective (social cohesion and psychosocial experiences), and the neo-materialist perspective.4,5,19 Social integration and neo-materialist perspective are two primary intervening mechanisms mostly mentioned in previous studies. This study also adapted these names as integrationist and neo-materialist according to Curran and Mahutga's work.<sup>4</sup> Psychosocial and material pathways are mechanisms mostly mentioned in the previous work to discuss the association between income disparity and health. These pathways, however, are based on different points of view so that the link between income inequality and health outcomes has been explained in different ways.

For the social integration pathways, promote egalitarian societies equity in social capital, interpersonal trusts, sense of belonging to civic associations; in turn, improve the health outcomes.<sup>11,20</sup> Wilkinson<sup>21</sup> believed that the wider income disparities tend to have worse health outcomes. Although income is an important factor as a contributor to an individual's stock of health, it is reported somewhere that, rather than income, the income distribution has a direct effect on health metrics.<sup>22</sup> Wilkinson hypothesized that a psychosocial approach rather than material factors can bring a better understanding of this phenomenon. People tend to compare themselves with other people having near relative status position.<sup>23</sup> The comparisons arise, when income inequality exists in a society, leading to harming individuals' mental health (stress, shame, and anxiety) and attenuate the social cohesion.<sup>11,24,25</sup> In turn,

these experiences might affect risky health behaviors such as smoking, substance use, obesity, even homicide.<sup>26–29</sup> In other words, from the psychosocial perspective, income inequality has a negative influence on social capital and social cohesion which might in turn decrease the standard of population health.<sup>20,30</sup>

Beside the critical thinking of psychosocial pathways, the impact of income disparities on health is explained through neo-materialist mechanisms. It is demonstrated that societies with a high level of income disparity tend to reduce the social spending on public services (including medical and education services) due to the divergence between the rich and the typical households. This underinvestment in public services showed poorer educational outcomes (such as higher dropout rates, increase in illiteracy rates) and lower health outcomes (such as higher infant mortality rate, lower life expectancy at birth).<sup>6,9,20</sup>

Although the mechanisms above can clarify how income inequality works on health to some extent, it is just part of the story. Avendano<sup>14</sup> found that income inequality was not associated with infant mortality in OECD countries between 1960 and 2008. With the application of the fixedeffect models, Avendano<sup>14</sup> re-hypothesized whether or not income distribution is the only cause of changes in infant mortality. In other words, Avendano<sup>14</sup> supported the idea that income inequality itself may not reduce the rate of infant mortality; instead, given income inequality exists, some factors still make income inequality-health link work. For instance, the author stated that, even income inequality of a country is high, the strong social protection policies (such as universal health coverage) favouring maternity benefit packages might reduce infant mortality and premature birth rates directly.<sup>14</sup> Some other studies have also emphasized the healthincome inequality link depending on other factors rather than income inequality itself (such as social conditions and economic policies).<sup>31,32</sup> For those statements, the effect of income inequality on health should be concerned with study settings' characteristics/ put in the specific context (such as social/ economic context of the study settings). Economic development, a macroeconomic indicator, has been considered as a moderator in the income inequality – health links in some recent work.<sup>4,15,33</sup>

There was a paucity of studies on income disparities on population health outcomes with the presence of economic development Asian countries. Hence. among the comprehensive picture on this issue remains unclear in this geographical area. For this reason, this paper aimed to investigate the impact of income inequality and economic development on population health metrics among ten Asian countries during the period 1990 to 2016. Moreover, we also examined the moderator role of economic development in this income inequality - health links. These countries comprise Cambodia, China, Japan, Korea, Malaysia, Singapore, Vietnam, Laos, Thailand, and Myanmar. We initially conducted multivariate regressions for those countries, regardless their income classification, to examine the effects of income inequality and economic development on health. Then each sub-sample was analysed to test whether or not these income inequality and health links exist among high/middle/low-income countries. The high-income countries include Japan, Singapore, and Korea. The middleincome countries include Malaysia, Vietnam, China and Thailand. The remaining countries belong to low-income countries.

## 3. Data and methods

#### Data sources

Dependent variables were three population health outcomes (infant mortality, underfive mortality and life expectancy at birth) collected from the World Bank Development Indicators 2016. Measurements of income inequality (Gini coefficients or Gini) and GDP per capita (adjusted by Purchasing Power Parity - PPP) were applied as explanatory variables in this study. The data of Gini came from the Standardized World Income Inequality Database (SWIID) and data of GDP per capita PPP came from the World Bank database. This study applied the fixed-effects models to empirically examine the effects of income inequality on health outcomes and to test the moderator role of the economic development in these associations.

As the limited availability of data source, this study setting creates unbalanced panels, which includes annual different numbers of observations among ten Asian countries in the period from 1990 to 2016. The final analytic sample includes 1,145 observations listed in Table 1. Income Inequality and Health Outcomes Among Ten Asian Countries, 1990-2016

### Measures

## Dependent variables: Life expectancy at birth, infant mortality, and under-5 mortality rate

Life expectancy at birth, infant mortality rate and under-5 mortality rate were employed as health outcome measures which are highly frequent used for evaluating the population health outcomes.<sup>15,34-36</sup> Life expectancy at birth refers to the expected years lived for both genders which is determined at birth. Infant mortality rate is the number of infants (per 1,000 live births) dying before reaching the age of one. Under-5 mortality rate refers to the number of infants (per 1,000 live births) dving before reaching the age of five. These health outcome measures were gathered at the national level. We logged infant mortality, under-5 mortality, and GDP per capita (PPP) to alleviate biases that might be caused by the non-normal distribution of data.

## Independent variable: Income inequality (SWIID Gini index)

In the field of income inequality, multiple income dispersion measures have been utilized such as: the Gini coefficients, the Robin Hood

Country name	Time period	Number of observations
Cambodia	1997-2012	80
China	1990-2015	130
Japan	1990-2015	130
Korea	1990-2016	135
Malaysia	1990-2016	135
Singapore	1990-2016	135
Vietnam	1992-2016	125
Laos	1992-2013	110
Thailand	1990-2016	135
Myanmar	2010-2015	30

 Table 1. Number of observations in ten Asian countries (1990-2016)

Index, the Atkinson Index, the income shares for the top 10%, top 5%, and top 1% for various rationales.37,38 This study applied the Gini coefficients data from Standardized World Income Inequality Database (SWIID).<sup>39</sup> The SWIID is considered to be a reliable choice of database for multidisciplinary researches, especially on economics and public health issues. Moreover, it is appropriate for this cross-sectional time-series study that allows to compare the income inequality estimates across countries and address the issue of discontinuous and inconsistent data over countries and time.<sup>39</sup> Previous studies also supported the rationale of using SWIID Gini index as income inequality measures.14,33,34,40 We obtained the SWIID's estimates of disposable income inequality (also known as "SWIID Gini index" version 8.1 released in 2019) to improve the comparability among countries and time. Disposable income refers to the income (wages, salaries, social benefits...) after deducting all taxes on income.41

The Gini coefficient (known as Gini) describes the dispersion of income being earned by individuals/household guintiles in a population. The Gini index is used to examine the income distribution and the issue of income inequality. This income inequality measures were analysed widely in previous literature. The coefficient was initially developed by Corrado Gini, an Italian statistician.42 The value of Gini coefficients can range between [0; 1] or [0%; 100%] with 0 (perfect equality) and 1 (or 100%) (perfect inequality). In few cases when Gini coefficients exceed 100%, it theoretically means that the income of a population is negative. One thing to note is that the Gini coefficients have nothing to do with identifying an individual's income or describe how large the economy is. Gini coefficients only state the situation of income disparities among sub-groups of a population. The term "Gini", "income inequality", and "income disparities" will be used interchangeably through this paper.

## Independent variable: GDP per capita, PPP

The GDP per capita (PPP) is the economic indicator used in this study. GDP per capita adjusted by purchasing power parity allows to compare the economic development among countries.<sup>43–45</sup> The PPP rate conversion allows to perform the real GDP per capita by eliminating the fluctuations caused by inflation, time and foreign exchange rates. The GDP per capita PPP data (using the 2010 benchmark) is measured in USD. Due to the skewness of this data, we used a logarithmic transformation.

## Analytical strategy

Since the sample countries showed some differences in the nature of data (including unobserved difference), statistical results might be incorrect and coefficient estimates can be biased. The multivariate fixed-effects models were applied in this study to address this issue of unobserved heterogeneity. Moreover, we employ the pooled OLS models instead for those which failed the Hausman test. We estimate fixed-effects models among 10 countries and pooled-OLS regressions for subgroups, adding interaction terms between inequality and economic development.

## 4. Results

Table 2 indicates national descriptive information on economic indicators (Gini coefficients and GDP per capita PPP) and population health outcomes (infant mortality, under-5 mortality, and life expectancy at birth).

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#### Articles

			Mean						
Country	Years	Range of Gini	Gini	GDP per capita, PPP	IM	U5M	LE		
Cambodia	1997-2012	33.9-36.7	35.5313	596.502	58.51875	74.43125	62.27237		
China	1990-2015	32.2-43.2	39.2231	2788.618	25.52308	31.31923	72.23815		
Japan	1990-2015	28.4-31.9	30.4385	42757.96	3.153846	4.338461	81.41034		
Korea	1990-2016	26.7-31.2	29.1185	17702.65	6.211111	7.251852	77.17082		
Malaysia	1990-2016	39.9-44.5	42.5148	7708.163	8.862963	10.35556	73.22726		
Singapore	1990-2016	37.7-39.5	38.8667	38007.51	3.085185	3.907408	79.0841		
Vietnam	1992-2016	35.5-37.7	36.776	1017.766	22.38	28.688	73.62456		
Laos	1992-2013	33.2-35.4	34.2773	815.6476	70.38182	97.57727	60.13005		
Thailand	1990-2016	38.7-44.7	42.4815	4157.829	17.3963	20.58148	72.23792		
Myanmar	2010-2015	32.9-34	33.4166	456.213	61.13334	82.95	60.83583		

Table 2. Descriptive characteristics of variables for 10 Asian countries (1990-2016)

Source: Own calculations using the mentioned data sets

For the economic indicators, Thailand and Malaysia had the highest rate of income inequality with Gini coefficients of 42.5 whereas Japan and Korea had the lowest rates with Gini coefficients of 30.4 and 29.1, respectively. The mean GDP per capita (PPP) was the lowest in Myanmar and Cambodia (\$456.2 and \$596.5, respectively) while those in Japan and Singapore reached the highest positions (with \$42,757.9 and \$38,007, respectively).

In terms of health outcome measures, the average infant mortality rates were at the lowest level of around 3 deaths per 1,000 live births under one year of age in Japan and Singapore. These rates were observed to be significantly high in Laos (70 deaths), Myanmar (61 deaths), and Cambodia (58 deaths). The mean of under-5 mortality rates followed the similar trend with the lowest rates in Japan and Singapore and highest rates in Laos, Myanmar and Cambodia. The average years of life expectancy at birth ranked the highest at 81 and 79 in Japan and Singapore; meanwhile those in Laos, Myanmar, and Cambodia ranked the lowest level of 60, 60, and 62, respectively.

The results of multivariate regressions of health outcomes in income inequality and GDP per capita PPP among 10 countries are presented in Table 3.

The infant mortality rate and life expectancy at birth were positively associated with Gini index in basic models (1-3). These healthincome inequality links were statistically significant. The GDP per capita PPP had positive impacts on the under-5 mortality rate; meanwhile, it had negative impacts on life expectancy at birth within basic models. Those associations were also statistically significant. When considering the interaction term (i.e., Gini x log GDP per capita PPP) in Models 4-6, the results show that, as GDP per capita PPP increased, there was a small

#### Table 3. Regressions of health outcomes on income inequality and GDP per capita PPP among ten Asian countries

		Basic models			Interactive models		
Variables	(1)	(2)	(3)	(4)	(5)	(6)	
	logIM	logU5M	LE	logIM	logU5M	LE	
Gini	0.0144***	-0.1226*	0.0269***	0.0942***	0.4795***	-0.9738*	
Log GDP per capita PPP	-0.0111	6.4187***	-0.9613***	-0.4001***	1.1489***	2.4496	
Gini x log GDP per capita PPP				-0.0103***	-0.0572***	0.1076	
Constant	3.8459***	20.2315***	9.7341***	0.6289	-7.0288***	51.7603***	
Ν	229	229	229	229	229	229	

Note: \*p< .05; \*\*p< .01; \*\*\*p< .001

Source: Own calculations using the mentioned data sets

## Table 4. Regressions of health outcomes on income inequality and GDP per capita PPP among Asian high-income countries

	Basic models			Interactive models		
Variables	(7)	(8)	(9)	(10)	(11)	(12)
	lgIM	lgU5M	LE	lgIM	lgU5M	LE
Gini	-0.0024***	-0.0182***	-0.0657	-0.0093	0.0617	-0.1358
Log GDP per capita PPP	0.0789***	-0.7761***	6.3292***	0.0591	-0.5491	6.1300*
Gini x log GDP per capita PPP				0.0007	-0.0077	0.0067
Constant	3.6374***	9.8802***	13.2998***	3.8433***	7.5208	15.3703
Ν	80	80	80	80	80	80

Note: \*p< .05; \*\*p< .01; \*\*\*p< .001

Source: Own calculations using the mentioned data sets

decrease in the effect of income inequality on mortality rates.

For the sub sample of high-income had negative countries, Table 4 reports the results of the analysis using pooled-OLS for Asian high-income countries. Among basic models, a higher level of GDP per capita PPP was associated with a higher level of infant were found.

mortality, higher life expectancy at birth and lower under-5 mortality. The income inequality had negative impacts on mortality rates. With the presence of the interactive variable (i.e., Gini x log GDP per capita PPP), none of statistically significant associations between health outcomes and economic indicators were found.

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#### Articles

Table 5.	Regressions	of health	outcomes of	on income i	nequality
and GDP	per capita F	PP among	g Asian mid	dle-income	countries

		Basic models		Interactive models		
Variables	(13)	(14)	(15)	(16)	(17)	(18)
	lgIM	lgU5M	LE	lgIM	lgU5M	LE
Gini	-0.0026***	0.0448***	-0.1579***	0.0428***	0.2086	1.7981*
Log GDP per capita PPP	0.0609***	-0.8847***	4.3492***	0.2609***	0.0300	13.3635
Gini x log GDP per capita PPP				-0.0061***	-0.0189	-0.2809**
Constant	3.9103***	8.0078***	41.6913***	2.4731***	0.2428	-18.1415
Ν	105	105	105	105	105	105

Note: \*p< .05; \*\*p< .01; \*\*\*p< .001

 Table 6. Regressions of health outcomes on income inequality and GDP per capita

 PPP among Asian low-income countries

		Basic models		Interactive models		
Variables	(19)	(20)	(21)	(22)	(23)	(24)
	lgIM	lgU5M	LE	lgIM	lgU5M	LE
Gini	0.0681*	0.0116	1.5294***	1.3534***	-0.7710	11.2494
Log GDP per capita PPP	-0.0226	-0.6983***	8.4504***	6.9883***	-4.9671*	61.4652
Gini x log GDP per capita PPP				-0.2009***	0.1224	-1.5196
Constant	1.8755	8.4184***	-47.9229**	-43.0083***	35.7470*	-387.3229
Ν	44	44	44	44	44	44

Note: \*p< .05; \*\*p< .01; \*\*\*p< .001

Table 5 shows the results for middleincome countries. The basic models (Models 13 – 15) illustrate that income inequality had positive effects on under-5 mortality whereas it impacted negatively on the life expectancy at birth and infant mortality. Adversely, GDP per capita had negative effects on under-5 mortality; positive effects on life expectancy at birth and infant mortality. These effects on health outcomes were statistically significant. Interactive models (Models 16-18) report the decrease in the effects of income inequality on population health outcomes as GDP per capita PPP increases. These associations were statistically significant.

The low-income data was analysed by applying the pooled-OLS (Models 19 - 24), presented in Table 6. In basic models, income inequality and GDP per capita PPP were positively associated with life expectancy

at birth. The income inequality had positive effects on infant mortality. GDP per capita PPP was negatively associated the under-5 mortality. With the presence of the interaction term (Gini x log GDP per capita PPP), there was a small decrease in the effect of income inequality on the infant mortality rate as GDP per capita PPP increases

## 5. Discussion

inequalities impose Income social negativities, including poor health status, It was reported elsewhere, however, there were few reports of this circumstance within the Asian region. The relationship between health outcomes and income inequalities would be different from other countries because of the difference in social context, social classification, national policies. In general, income inequality harms population health when the data of ten Asian countries was regressed together. The higher level of income inequality increased the mortality rates. However, it seems to be difficult to fully explain the health-inequality links without the involvement of other economic indicators (i.e., GDP per capita PPP). It is observed that within the same level of income inequality, the GDP per capita PPP (a macro-level factor) helps reduce child mortality. In terms of life expectancy at birth, it was found no clear association with economic indicators.

When each subgroup of countries was regressed independently, the results were presented in different ways. Among three Asian countries with high GDP per capita PPP (i.e., Japan, Singapore, and Korea), inverse relationships between the income inequality and mortality rates were observed. These relationships contradicted previous literature.<sup>7,46,47</sup> Some technical reasons for the discrepancy in findings might be due to

data modelling strategies, sample size, and time conducting studies. Moreover, regarding the macro-economic indicator, the higher level of GDP per capita PPP was associated with the reduction in the mortality rate and the improvement in life expectancy at birth. Therefore, it could be seen that income inequality is only one of the main determinants for child mortality and life expectancy at birth when considering in the context of high-income countries. These health outcomes result from mutually supportive factors, including social, political and individuals factors.48-50 First, receiving adequate income may have effects on diminishing the child mortality as mothers can access basic healthcare and nutrition requirements during pregnancy periods. Hence the pre-term birth issues and infant immunization can be improved; in turn, child mortality rates might reduce. Moreover, people with sufficient sources of income can afford their basic needs for food and healthcare. Hence, their health status might be improved leading to higher life expectancy at birth. However, one thing to note is that apart from income, lifestyle risk factors (substance uses, unhealthy diet, tobacco use) contribute largely to high child mortality and low life expectancy at birth.<sup>51,52</sup> Second, ethnics, social diversity, and education attainment can create multiple health beliefs and lifestyles. Especially, in such high-income countries with relatively high level of income disparities (as Singapore, Japan, and Korea), it also creates a wider social distance and racial discrimination. Consequently, it leads to inequalities in healthcare access, and in turn, poorer population health outcomes. Third, regarding aovernment supports through national policies, citizens can benefit from government financial or non-financial supports for medical care and may enhance the population health

status. In the case of Singapore, Japan, and Korea, these high-income countries have achieved the universal healthcare ensuring the equitable health coverage for the entire population, lowering the cost of healthcare and financial reimbursement.53-55 Another standpoint was indicated that these highincome countries had developed quality health services and infrastructure. Some previous studies also hypothesised that each country has different economic contexts and different socio-economic policies with different target populations. We should reemphasize that income equality should go with socio-economic policies to enhance the population health outcomes.14,56

Regarding middle-income and low-income countries, income disparities had a statistically significant association with life expectancy and mortality rates. Remarkably, the inverse relationship between income inequalities and life expectancy implies that the elasticity of this population health outcome might be high under the context of escalating income inequality. It can be explained that although universal health coverage was addressed to facilitate the access of healthcare services, the out-of-pocket share of health expenditure among these countries was still relatively high. It probably showed that the financing health systems just cover basic health services. Hence, when income disparities appear, the poor in these countries might find it more difficult to access healthcare services (i.e. increase the unmet need for healthcare services), leading to harming health; in turn, it might reduce life expectancy in the long term. When taking the higher GDP per capita PPP into consideration, this indicator also had a strong association with the improvement of the population health outcomes. With the presence of the interactive variable (Gini x Income Inequality and Health Outcomes Among Ten Asian Countries, 1990-2016

the GDP per capita PPP), only the regression of the infant mortality brings out meaningful results. It was shown that within the same level of income inequality among middle income-countries, higher GDP per capita PPP helps reduce the infant mortality rates. This message reemphasized that income is an important determinant of infant mortality rates in the context of middle-income countries. It is believed that more correlation between income and other health outcomes (under-5 mortality and life expectancy at birth) will be determined if the future research expands to cover more socio-economic variables and longer time periods. The inverse relationships between the child mortality and income disparities were also reported in the literature.33,57-59 However, some scholars disagreed with the idea that income disparities had negative effects on population health all the time (mortality rates and life expectancy). Specifically, they claimed that this relationship is not robust over time which means that these associations appeared some time, then disappeared in another time period.<sup>33,60</sup> Consequently, we should also interpret this association with caution because we collected data only from 1990-2016 which might not be long enough to provide robust findings.

This paper has pointed out some important messages that health policymakers should consider seriously when formulating and implementing policies. First, income inequality is a crucial factor but not the key determinant affecting the health outcome status. Instead, other socio-economic and political factors, such as welfare policies, might have significant effects on health outcomes. In other words, income inequality is not sole determinant of the population's health status; rather, it should go along with various economic, social, political dimensions. Second, since income inequality

might attenuate the social cohesion, fiscal policies should be implemented to reduce the disparities in income distribution within a society. Consequently, the social cohesion can be improved, in turn, health beliefs and healthcare access can be enhanced. Further research should be conducted to quantify factors directly affecting the income inequality through decomposition analysis. Policy makers can adjust current policies or even issue new policies to address these factors. Thirdly, these ten Asian countries have targeted the universal health coverage to address the equity and equality in healthcare access within societies. Universal health care is the key global movement that many countries desire to achieve. However, the level of healthcare coverage varies among countries. Most countries cover basic healthcare services and undertake the reimbursement mechanism, so that the outof-pocket payment and catastrophic health expenditure have been an alarming issue for patients. For those countries which have high levels of income disparities, there will be a significant gap between the rich and the poor in healthcare access in terms of financial barriers. Consequently, the poor might face with the unmet need for healthcare and poor health status.

This paper has some limitations that require further investigation. Regarding the choice of economic indicator, the Human Development Index should be included in the regression as it is a more comprehensive measure for the economic development rather than GDP per capita PPP. The GDP per capita PPP only reflects the level of income of the citizens while the Human Development Index comprises multiple key dimensions of human development (long and healthy life, knowledge, a decent standard of

living).<sup>61</sup> Further in-depth research should be conducted because of the variety in the nature of population outcomes. Health inequality research should be investigated deeply on each/isolated health outcome indicator to observe accurately factors affecting the inequality circumstance. Take life expectancy at birth as an example. It is probably one of the most significant indicators reflecting a country's well-being. Life expectancy at birth is not merely an age figure, it is a comprehensive indicator reflecting the effectiveness of government policies, human behavior, and economic factors such as pension policies, human capital investment, fertility rate, economic growth, education, healthcare system.62,63 Since multiple determinants of life expectancy were found in previous literature, the income inequality is probably not the main factor affecting the inequality in life expectancy. Indeed, previous literature reported that the socio-ecological perspective, including pension, educational attainment, output per worker were those affecting this population health indicator.<sup>64</sup> Thus, future studies should gather more socioecological indicators as explanatory variables in order to investigate the inequality in life expectancy. In terms of the methodological perspective, the application of pooled-OLS models might produce biased results which can reflect incorrect relationships between income disparities and health. It should cover longer time and expand more variables into the regressions to examine and discover more factors affecting the health status. Hence, the effect of income inequality on health may change if suitable variables are considered in the analysis.

## Conclusion

This study investigated the association between income inequality health on outcomes among ten Asian countries. We revealed that income inequality and income had significant impacts on population health status. Furthermore, income inequality must accompany income and other factors in order to investigate the trend of health outcomes. Future tailored policies should be taken and adjusted to tackle the inequalities. One of those should be strengthening the benefit packages of the health insurance scheme and extending the level of healthcare coverage to facilitate the healthcare utilization, especially for the poor.

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