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Determinants of healthcare quality in single-payer healthcare system countries

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ABSTRACT

Background: The quality of healthcare system in any country is essential for the wellbeing of its population. Improving the quality of the healthcare sector would lead to a healthier population and thus more productive nation and stronger economy. The level of healthcare quality depends on both economic and non-economic factors. Addressing the level of effect these factors on healthcare quality would facilitate policy makers' tasks in achieving that goal.

Method: This study is based on the 2019 data of 29 countries that adapt single-payer healthcare system. Pearson correlation matrix is used to examine the relation of a number of variables with healthcare quality, measured by life expectancy, in these countries.

Results: The results from this research showed that literacy rate, digital adaptation, pollution level, corruption level, healthcare expenditure (HE) per capita, GDP per capita, healthcare expenditure as a percentage of GDP all showed a strong relation at the 99% confidence level while the number of physicians per 1000 showed statistically significant relation with healthcare quality at the 95% confidence level. While all factors showed direct relation, pollution and corruption showed an inverse relation.

Conclusions: Improving the quality of the healthcare sector is the goal of any government since it would lead to better and stronger economy. While economic factors play a role in achieving that goal, other non-economic factors can also have the same effect in achieving that goal.

Keywords: Single-payer healthcare system, Healthcare quality, Life expectancy, HE, Pollution, Corruption

INTRODUCTION

The quality of the healthcare system in any country is considered to be a major factor on the growth and prosperity of its economy. Governments in all countries pay huge amount of attention to its healthcare system. Even though all countries aim at the same target and that is providing the best healthcare system to their population, they adapt different systems in doing so. These systems or models, are;

The Beveridge model (Single-payer healthcare model):

Where the majority of the hospitals and doctors work for the government and are funded by the government through taxes. Private physicians and insurance do exist in this model but it is optional to those who are willing to pay for it.

The Bismarck model: where most of the hospitals are private but the population are insured by either single insurer, like in France, or multiple insurers, like in Germany, but their prices are controlled by the

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government. In this model the healthcare system is funded jointly by employers and employees through payroll deduction.

The national health insurance model: In this model the government acts as the single-payer for medical procedures through its insurance program that every citizen pays into. But the medical services itself is provided by the private sector.

The private insurance model: Usually poor and less developed countries follow that model where their citizens are only covered by private insurance system. In this system, individuals are either covered by their employers, covered by a private policy the policyholder purchases themselves or they go without the coverage at all

Out of these four models, both the Beveridge model and national health insurance model can be labeled as singlepayer healthcare systems since governments are the only payers.

In determining the quality of the healthcare system, many researchers looked at it from an economical point of view. They saw the quality level of the healthcare sector, measured by life expectancy, as an outcome of economic inputs such as the share of the health sector as a percentage of the country GDP, HE per capita, and GDP per capita. Even though percentage of GDP allocated to the healthcare sector does not give a clear picture of the amount of funds since the amount of funds allocated in a country with high GDP and low percentage might be much more than the amount allocated by a different country with low GDP and high percentage allocated to its healthcare sector. Another note is the population size, even if two countries allocated the same amount of funds to their healthcare sector the amount allocated per patient would be lower in the country with higher population. The percentage of GDP allocated to the healthcare sector would give an indication of the amount of attention the government pays to its healthcare sector and the health of its people. Even though HE per capital is more relevant, researchers' results were conflicted. Gulis using the data of 156 countries, did not find any statistically significant relation between HE per capita and life expectancy.¹ Also, Kaufmann et al also, did not find any statistical validations that considerably increase in investments on healthcare have any significant influence on the indicators of population health.² While Deshpande et al. did not find any significant correlation between HE and life expectancy in developing countries, but that relation did exist in developed countries when he studied the relation using the data of 181 countries.³ On the other hand, Jaba et al found positive association between life expectancy and HE when examining the data of 175 countries over the period 1995 to 2010.4

High income people can afford better health services and thus would be expected to live longer than lower income people. Conducting a study using U.S. data over the period 2001-2014, Chetty et al. found that income was positively correlated with greater life expectancy.⁵ Deshpande et al. also found statistically significant direct relation between GDP per capita and life expectancy.³ Building, running, and providing hospitals with medical staff and equipment's are the main expenses in the healthcare budget. According to Grubaugh and Santerre, the number of medical staff that includes doctors, nurses, and medical technicians' have a positive impact on life expectancy.⁶

Other researchers went beyond the economic and financial inputs in determining life expectancy. Many researchers linked literacy rate to life expectancy, the assumption there is that as a person gets higher education his chances increase in finding better job and thus would get a higher income than less educated person. Higher income would increase his/her ability to get better medical care and for that would expect higher life expectancy. Researchers used literacy rate as a proxy. Adult literacy rate is defined as the percentage of people ages 15 and above who can both read and write with understanding a short simple statement about their everyday life. Boachie and Ramu concluded that the effect of education on health was greater than that of public health spending whereas the effect of real per capita income on health was found to be weak.7 Gulis using the data of 156 countries, found statistically significant direct relation between literacy rate and life expectancy.1 Also, Messias shows that the income inequality and the illiteracy rates are negative correlated with the life expectancy of the population.⁸ On the other hand, Deshpande et al studied the effect of literacy rate on life expectancy, using the data of 181 countries, they found a positive relation but it was statistically insignificant.³ Now a days, education is closely related to technology, using digital adaptation index as a proxy for technology implementation in countries, Lleras-Muney and Sherry showed that education, technological change, income and cultural differences have been identified as major drivers of health outcomes rather than healthcare spending.9

While there is evidence of direct relation between education and technological advancement, the relation between education and corruption is an inverse one. MO found that average years of schooling are significantly lower in countries with more corruption. 10 Corruption is measured by the corruption perceptions index (CPI), this index is widely recognized as the most comprehensive and robust index of corruption. 11 Corruption does not only affects education but it also affects the healthcare quality in the country, Mauro stated that corruption level has direct effect on expenditures on health and education, reducing them significantly.12 Gupta et al showed that increased investment in healthcare and population health indicators really exists, and these investments effectively decrease the child mortality and increase the life expectancy, but that improvement is much higher in

countries with low corruption and a high level of administration quality, compared to the countries with high corruption rating.¹³

Countries with high level of corruption tend to have high level of pollution, according to the world health organization data, air pollution is responsible of killing around seven million people worldwide every year of which 9 out of 10 people breath air containing high levels of pollutants. ¹⁴ Ebenstein et al examined the relationship between air pollution and life expectancy in China from 1991 to 2012 and found significant direct relation between them. ¹⁵ Correia et al using the data of 545 U.S. counties over the period 1980 to 2007, found that the reduction in air pollution resulted in an increase in mean life expectancy by 0.35 years. ¹⁶

The objectives of this research were to evaluate the effect of both economic and non-economic factors on the quality of healthcare sector, measured by the life expectancy, in countries that adopt single-payer healthcare system.

METHODS

Pearson correlation matrix is used in this study to determine the relation between the variable under study. The correlation coefficients are used to measure the strength and the direction of that relation. The correlation coefficients would have a value ranging from -1 to +1, where -1 indicates perfect inverse relation and +1 means perfect direct relation while 0 indicates no relation between the variables. The correlation coefficients (r) are calculated using equation 1;

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

Where r is Pearson correlation coefficient between the two variables,

In calculating t Stat equation 2 was used;

$$t = \frac{r}{\sqrt{(1-r^2)(n-2)}}$$

The t table was then used to determine the significance of the relation.

RESULTS

This study based on 2019 data of 29 countries that follows single-payer healthcare system. Study attempts to examine the relation between healthcare quality, measured by life expectancy, and a number of factors as seen in Table 1.

Table 1: Variables under study.

Variable	Symbol	Data source
Life expectancy	Y	World bank
Literacy rate	X1	World bank
Digital adoption index	X2	World bank
Pollution index	X3	https://www.numbeo.com/poll ution/rankings_by_country.jsp
Corruption perceptions index	X4	Transparency International
HE per capita	X5	World bank
GDP per capita	X6	World bank
Health sector % of GDP	X7	World bank
Physicians per 1000	X8	World bank

Countries under study are shown in Table 2.

Table 2: Countries under study.

Australia	Denmark	Kuwait	Saudi Arabia	
Bahrain	Finland	Malaysia	South Africa	
Bhutan	Georgia	Georgia Malta		
Botswana	Greece	New Zealand	Sri Lanka	
Brazil	Iceland	Norway	Sweden	
Brunei	Ireland	Oman	Trinidad and Tobago	
Canada	Italy	Portugal	United Kingdom	
Cuba				

By looking at the matrix in Table 3, it can be seen that life expectancy does not only depend on the amount of money government spend on their healthcare systems, but other factors do affect it. Factors such as education and technology adoption, having a significant direct relation between them, both showed statistically significant direct effect on life expectancy at the 99% confidence level which supports Lleras-Muney and Sherry and Boachie and Ramu findings. 9.7 Corruption and pollution also showed strong direct relation between them but each of them showed a statistically significant inverse relation with life expectancy at the 99% confidence level.

When it comes to spending, results shows that HE per capita and percentage of country GDP allocated to the healthcare system showed a statistically significant direct

relation with life expectancy which contradicts Kaufmann et al findings.² A person with a high income can afford to go to private healthcare centers where he/she can get better quality healthcare services (Herrera et al), this

assumption is confirmed in this research since results shows statistically significant direct relation between GDP per capita and life expectancy at the 99% confidence level.¹⁷

Table 3: Pearson correlation matrix.

	Y1	X1	X2	X3	X4	X5	X6	X7	X8	
Y1	1									
X1	0.517***	1								
	(3.138)	1								
X2	0.517***	0.346*	1							
	(3.138)	(1.919)	1							
Х3	-0.507***	-0.271	-0.418**	1						
	(-3.056)	(-1.463)	(-2.389)	1						
X4	-0.535***	-0.209	-0.420**	0.847***	1					
	(-3.290)	(-1.109)	(-2.402)	(8.269)	1					
X5	0.735***	0.542***	0.384**	-0.568***	-0.661***	1				
	(5.632)	(3.355)	(2.159)	(-3.582)	(-4.573)					
X 6	0.691***	0.460**	0.574***	-0.722***	-0.756***	0.831***	1			
	(4.967)	(2.693)	(3.643)	(-5.427)	(-5.993)	(7.773)				
X7	0.509***	0.457**	0.318*	-0.397**	-0.455**	0.733***	0.443**	1		
	(3.073)	(2.671)	(1.742)	(-2.248)	(-2.653)	(5.592)	(2.568)			
X8	0.409**	0.491***	-0.104	-0.034	-0.110	0.448**	0.138	0.559***	1	
	(2.329)	(2.932)	(-0.544)	(-0.178)	(-0.576)	(2.606)	(0.721)	(3.503)		
*,**,	*,**,*** indicates confidence level at 90%,95%, and 99% respectively									

DISCUSSION

This study is set to evaluate the factors affecting the quality of the healthcare sector, measured by life expectancy, in countries that follows single-payer healthcare system. Using the data of 29 countries for the year 2019, results showed that economic factors such as HE per capita, GDP per capita, percentage of GDP allocated to the healthcare sector, and number of physicians per 1000 all showed significant direct relation with life expectancy. Results also revealed that non-economic factors do affect life expectancy. Non-economic factors such as population literacy rate and technology adaptation both had a statistically significant direct relation with life expectancy, while corruption and pollution showed significant inverse relation with healthcare quality.

CONCLUSION

The results from this research shows that not only economic factors affect the quality of the healthcare sector but also non-economic factors like fighting corruption and education improvement can have the same effect on the improvement of the quality of the healthcare sector.

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Institutional Ethics Committee

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