Research Article

Public health expenditure of BRICS countries – an empirical analysis

Jaya Veerasamy Arun, Dharumaraj Kumar

PG and Research Department of Economics, Muthurangam Government Arts College, Vellore, Tamil Nadu, India.
PG and Research Department of Economics, Jamal Mohammed College, Trichy, Tamil Nadu, India.
Correspondence to: Arun JV, E-mail: nuraeco@gmail.com

Received March 13, 2016. Accepted April 03, 2016

Abstract

Background: Health expenditure is vital as it increases labor productivity which further induces growth and development. Health-care expenses in BRICS countries are not only inadequate and access to them varies across countries which are mainly influenced by the socioeconomic conditions as well as by the health policies in place.

Objective: The purpose of this study was to analyze the per capita public health expenditure of BRICS countries in relation to exogenous explanatory variables.

Materials and Methods: The study used panel data of five countries from 1995 to 2013. Data for the per capita public health expenditure, per capita GDP, and the other six variables were obtained from the World Bank. Hausman test was in favor of fixed effect panel data regression model to determine the effects of public health expenditure on health outcomes.

Result: The results indicate per capita GDP, death rate, life expectancy at birth, and infant mortality rate under five were significantly contributing to the increase in the per capita public health expenditure. Variables such as infant mortality rate and percent of population above 65 years show negative correlation with that of per capita public health expenditure.

Conclusion: The findings imply that public health expenditure plays a crucial role in providing better health care to people in BRICS countries. The policy implication is that government of respective BRICS countries has to increase its budgetary allocation to the health sector to catch up with the standard of human capital achieved by developed countries.

KEY WORDS: BRICS, public health expenditure, per capita GDP, fixed effects model

Introduction

Health being a merit good requires a substantial contribution from the government to reach a social optimum. In a developing nation, the state's role in promoting good quality health infrastructure and healthcare services becomes imperative for the development of human capital. Health expenditure has been considered as one of the important determinants of developing human capital which in turn builds the nation's sustained economic growth. Many studies suggest that there is inequality in accessing health facilities and poor health infrastructure exist in low-income countries particularly in African and Latin American countries.[1,2] Also, several studies have been carried out to investigate the impact of public health expenditure on health outcomes, either among many countries or between the regions of a particular country.[3,4] However, most of the researchers have not adequately investigated the impact of public health expenditure on health status of BRICS countries which comprise of five developing countries Brazil, Russia, India, China, and South Africa. The background of this study was to analyze the per capita public health expenditure of BRICS in relation to per capita GDP and some other exogenous explanatory variables such as crude death rate, life expectancy at birth, infant mortality rate, mortality rate under 5 years of age, percentage of population above 65 years, and annual population growth rate through panel data. Even though the domestic landscape of BRICS countries is different, the factor that binds them is that they are all in the same stage of development and they face a lot of similar challenges with respect to providing health-care facilities. Over the years public health expenditure has been increasing in the BRICS countries like that of OECD countries.[5] Still in many ways BRICS face significant health challenges

Access this article online	
Website: http://www.ijmsph.com	Quick Response Code:
DOI: 10.5455/ijmsph.2016.13032016457	

of their own. As far as important health outcomes are concerned BRICS lag way behind the OECD countries. Table 1 concretizes the above stated fact.

The degree of relationship between health expenditure and GDP and some other endogenous explanatory variable has been tested by numerous empirical studies.[6,7] Baldacci et al.[8] constructed a panel dataset for 120 developing countries and observed that spending on health within period of time affects growth whereas lagged health expenditures appear to have no effect on growth. Aguayo-Rico and Iris[9] analyzed the impact of health on economic growth for 13 European countries, 12 African countries, 16 American countries, and 11 Asian countries over the period 1970–1980 and 1980–1990 and found that health capital has a significant effect on economic growth. In the majority of relevant studies, several researchers have identified that there exists a positive correlation between real per capita public health expenditure and real per capita GDP.[10–12]

Recently, the attention of researchers has turned toward investigating the link between public healthcare expenditure and health outcomes. In a study conducted by Gupta et al.[13] using data for 50 developing and transition countries observed that health expenditure reduces childhood mortality rates. Anand and Ravallion[14] provide evidence from 22 developing countries that public spending on health significantly matters for life expectancy at birth. In addition, Akinkugbe and Afeikhena[15] concluded that there exists a significant and positive relation between health-care expenditure as a ratio of GDP and life expectancy, under-five mortality, and infant mortality in sub-Saharan Africa, middle east, and North Africa.

Yu et al.[16] concluded that there is a positive correlation between public health expenditure and GDP and other variables such as percentage of population below 14 years, percentage of population above 65 years, number of hospital beds, number of hospital staff have no correlation. The dataset for this study consists of a panel of 31 provinces in the mainland China covering the period 1997–2008. Among such studies, series of econometric analyses of the determinants of health-care expenditure confirm that the demographic structure of the population to be a nonsignificant variable.[17,18]

Many researchers have used panel data approach to study the relationship between public health expenditure and economic growth and health indicators.[19,20] It is clear that most of the notable research on health expenditure and economic growth have largely utilized panel data analysis and employed different forms of quantitative approach for their research work.

Table 2 indicates that in 2013, India spends the least on per capita public health expenditure and its per capita GDP is the lowest among BRICS countries. Per capita public health expenditure is highest in Brazil whereas Russia achieves more on per capita GDP. Again, in relation to other BRICS countries India and South Africa's performance is the worst in terms of high prevalence rate of infant mortality and infant mortality under-5. Further, in terms of population health indicators such as life expectancy at birth, percentage of population above 65 years, and population growth rate South Africa and India have performed well below other BRICS countries.

Table 1: Health and population structure – OECD vs BRICS, 2013

Variable	OECD	BRICS
Health expenditure, public (% of total health expenditure)	61	46.4
Health expenditure, public (% of GDP)	8	3.2
Crude death rate (per 1000 people)	8	8.2
Life expectancy at birth (total years)	80	54.6
Infant mortality rate (per 1000 live births)	6	21.2
Infant mortality rate under-5 (per 1000)	8	26.8
% of population above 65 years (% of total)	16	8.2
Population growth (annual %)	1	0.8

Source: Author's Tabulation of Health Nutrition and Population Statistics, World Databank.

Materials and Methods

Data Source and Variables

The study pooled annual data for the period 1995–2013 for BRICS countries. The data used in the empirical analysis were sourced from the World Bank, World Development

Table 2: BRICS countries population health profile, 2013

Country	Brazil	Russia	India	China	S.Africa	BRICS
Per capita public health expenditure (current US$)	520.59	457.13	19.65	210.88	282.81	298.21
Per capita GDP (current US$)	11,939	14,487	1487	6992	6886	8358
Crude death rate (per 1000 people)	6	13	8	7	13	8.2
Life expectancy at birth (total years)	74	71	66	75	57	54.6
Infant mortality rate (per 1000 live births)	12	9	41	11	33	21.2
Infant mortality rate under-5 (per 1000)	14	10	53	13	44	26.8
% of population above 65 years (% of total)	8	13	5	9	6	8.2
Population growth (annual %)	6	0	1	0	2	0.8

Source: Author's Tabulation of Health Nutrition and Population Statistics, World Databank.

Indicators (WDI). To find out the variables affecting public health expenditure, variables GDP, death rate, life expectancy at birth, infant mortality rate, infant mortality rate under-5, percentage of population above 65 years, and population growth are used.

In this study public health expenditure and GDP are expressed as per capita public health expenditure and per capita GDP. The study uses death rate, life expectancy at birth, infant mortality rate, and infant mortality rate under-5 as health outcomes. Death rate was measured as crude death rate per 1000 people, life expectancy at birth was measured in years as average life expectancy of the population, infant mortality rate was measured per 1000 live births, infant mortality rate under 5 was measured per 1000, percentage of population above 65 years was measured as percentage of total population and population growth as annual growth rate.

Model Specification

The panel regression model specification is in consistent with the literature and supports to examine per capita public health expenditure in relation to per capita GDP and some other exogenous explanatory variables. Following Baltagi et al.,[21] the health model functional form can be expressed as:

$$ln\ PCPHE_{it} = \alpha_i + \beta 1\ ln GDP_{it} + \beta 2\ DR_{it} + \beta 3\ LE_{it} + \beta 4\ IMR_{it} + \beta 5\ IMR5_{it} + \beta 6\ POP65_{it} + \beta 7\ POPGR_{it} + \varepsilon_{it}$$

where $ln\ PCPHE_{it}$ is log of per capita public health expenditure in country i at time t, $lnGDP$ is log of per capita GDP, DR is death rate, LE is life expectancy at birth, IMR is infant mortality rate, IMR5 is Infant mortality rate under 5, POP65 is % of population above 65 years, POPGR is population growth, α is vector of exogenous variables, β is vector of coefficients, ε is panel error term.

To get rid of any faulty inferences about β and biased results, there are two available choices, that is, fixed effects model and random effects model. Fixed effects model was estimated by generalized least squares (GLS) in two forms with cross-section weights whereas random effects model was estimated only by GLS. A selection has to be made between fixed effects model and random effects model.

The Hausman test is statistical hypothesis test which helps to evaluate the relevance of a statistical model to that of the data. Hausman test was carried out to choose between fixed effects and random effects model. Though Hausman test favored results from fixed effects model, both the results of fixed and random effects model were reported to accede to the robustness of results. STATA (version 14) statistical software package was used in the empirical analysis.

Result

Based on panel data, per capita public health expenditure of BRICS countries was analyzed in relation to exogenous explanatory variables. Observations of the study were depicted in Tables 3-5.

Discussion

The Hausman test examines the null hypothesis (H_0: difference in coefficients not systematic) against the alternative hypothesis (H_a: significant difference). Fixed effects are consistent under both H_0 and H_a whereas random effects are efficient, and consistent under H_0 (but inconsistent under H_a). In the econometric analysis carried out as the Hausman statistic is not systematic, fixed effects is favored over the random effects model. Therefore, in order to control the effects of time invariant variables with time invariant effects a fixed effects model is used. Using a fixed effects model means the variation in α_i is captured to avoid faulty interpretations of β. The estimates of the study conform to the results found in earlier research. The econometric study suggests a direct relationship between per capita public health expenditure and per capita GDP. This result is inconsistent with the priori proposition. On health expenditure and few other exogenous explanatory variables, it was found that death rate, life expectancy at birth, and infant mortality rate under 5 were significantly contributing to the increase in the per capita public health expenditure.

On the contrary, some studies have found that the influence of public health expenditure on population growth rate are statistically insignificant.[22] The coefficients linking per capita public health expenditure and other health outcomes such as infant mortality rate, percent of population above

Table 3: Descriptive statistics

Variables	*N*	Minimum	Maximum	Mean	Standard deviation
Per capita public health expenditure	95	4.34	542.00	1.4008	141.46720
Per capita GDP	95	384.00	14,487.00	4.2032	3588.23428
Crude death rate	95	6.00	16.00	9.7368	3.57060
Life expectancy at birth	95	52.00	75.00	66.0737	6.75284
Infant mortality rate	95	9.00	78.00	33.4211	18.28415
Infant mortality rate under-5	95	10.00	109.00	43.8842	27.26383
% of population above 65 years	95	3.00	14.00	7.0526	3.26936
Population growth	95	0.00	2.00	0.9895	0.70703

Table 4: Hausman test

Co-efficient	Fixed effects (b)	Random effects (B)	Difference (b-B)
ln GDP	.9969795	1.15336	–.1563852
DR	.0845418	.0723081	.0122337
LE	.056333	–.0125556	.0688887
IMR	–.0038529	–.0049271	.0010742
IMR5	.0020519	–.0145598	.0166117
POP65	–.0089915	–.0777276	.068736
POPGR	–.0735805	.1060513	–.1796318
Test: H_0: difference in coefficients not systematic			
$\chi^2(7)$			221.07
Prob > χ^2			0.000

Table 5: Dependent variable – changes in per capita public health expenditure

Explanatory variables	Fixed effects model	Standard error
ln GDP	.9969795	.0421382
DR	.0845418	.0343143
LE	.056333	.0231002
IMR	–.0038529	.0151425
IMR5	.0020519	.0085562
POP65	–.0089915	.0356895
POPGR	–.0735805	.0491223
cons	–8.038702	1.805396
No. of observations	95	
No. of groups	5	
Observations per group	Min = 19 ; avg = 19.0 ; max = 19	
R^2	within = 0.9733; between = 0.9041; overall = 0.9117	
F-test [u_i = o]	F(4,83) = 35.24	
Prob > *F* = 0.0000		
*Significant at 5%		

65 years, and population growth rate shows negative relationship. However, number of studies have found a positive relationship between health spending and measured health outcomes.[23] Wagstaff and Cleason[24] documented that the extent to which public health-care expenditure influencing health outcomes depend on the effectiveness of health policies and institutions. According to Or[25] the absence of strong statistical relationship may be due to the fact that the returns to the increase in health spending are small.

The study is limited in the sense that country-wise analysis using the same variables for the time period to evaluate how the results differ across countries has not been carried out. Moreover, causal relation between the variables public health expenditure and GDP was not tested as it is beyond the specific objective of the study.

The empirical analysis consistent with most relevant studies and supports that the per capita public health expenditure of BRICS is not only highly significant but also positively related to per capita GDP. Similarly, death rate, life expectancy at birth, and infant mortality rate under 5 are positively related to public health expenditure and statistically significant. This signifies that during the study period there exists a strong impact of government health expenditure on GDP, death rate, life expectancy at birth, and infant mortality rate under 5 contributing to the increase in public health expenditure of BRICS countries. It was also observed that health systems of the BRICS countries are facing a daunting task of bringing down the infant mortality rate. In general, it is evident that BRICS countries lag behind in quality of life and thereby public intervention in the field of health becomes paramount importance to increase the standard of human capital. In order to take advantage of the abundant population, BRICS countries have to provide better health services and infrastructure facilities for their masses.

Conclusion

The findings imply that public health expenditure plays a crucial role in providing better health care to people in BRICS countries. The policy implication is that government of respective BRICS countries has to increase its budgetary allocation to the health sector to catch up with the standard of human capital achieved by developed countries.

References

1. Gerdtham UG, Sogaard J, Andersson F, Jonsson B. An econometric analysis of health care expenditure: a cross-section study of the OECD countries. J Health Econ 1992;11:63–84.
2. Castro-Leal F, Dayton J, Demery L, Mehra K. Public spending on health care in Africa: do the poor benefit? Bull World Health Organ 2000;78(1):66–74.
3. Kleiman E. *The Determinants of National Outlay on Health.* London: Macmillan, 1974.
4. Newhouse JP. Medical care expenditures: a cross-national survey. J Human Res 1977;12:115–25.
5. World Development Indicators, World Bank, Washington DC.
6. Badi HB Francesco M. Health care expenditure and income in the OECD reconsidered: evidence from panel data. Center for Policy Research. Maxwell School of Citizenship and Public Affairs 2010; Working Paper 46.
7. Nistor IA, Vaidean VL. Econometric modeling of Romania's Public Healthcare expenses – country panel study. Annales Universitatis Apulensis Series Oeconomica 2010;12(1).
8. Emanuele B, Benedict C, Sanjeev G, Qiang C. Social spending, human capital, and growth in developing countries: implications for achieving the MDGs. Working Paper 04/217. International Monetary Fund 2004, Washington, DC, USA.
9. Andrés Aguayo-Rico, Iris A. Guerra-Turrubiates. Empirical evidence of the impact of health on economic growth. Issues in Political Economy 2005;14: 112-114.
10. Gerdtham UG, Löthgren M. On stationary and co integration of international health expenditure and GNP. J Health Econ 2000;19:461–75.
11. Hitiris T, Posnett J. The determinants and effects of health expenditure in developed countries. J Health Econ 1992;11:173–81.
12. Hansen P, King A. The determinants of health care expenditure: a co integration approach. J Health Econ 1996;15:127–37.

13. Gupta S, Verhoeven M, Tiongson T. Does higher government spending buy better results in education and health care? Working paper 99/21. International Monetary Fund, Washington DC, 1999.
14. Anand S, Ravallion M. Human development in poor countries: on the role of private incomes and public services. J Economic Perspect 1993;7(1):133–50.
15. Akinkugbe O, Afeikhena J. Public health care spending as a determinant of health status: a panel data analysis for SSA and MENA. Applied macroeconomics and economic development, Ibadan University Press, 2006.
16. Yu Y, Zhang L, Li F, Zheng X. Strategic interaction and the determinants of public health expenditures in China: a spatial panel perspective. Annals Reg Sci 2013;50(1):203–21.
17. O'Connell JM. The relationship between health expenditure and age structure of the population in OECD countries. Health Econ 1996;5(6):573–8.
18. Gerdtham UG, Löthgren M. New panel results on co integration of international health expenditure and GDP. Appl Econ 2002;34:1679–86.
19. McCoskey SK, Selden TM. Health care expenditures and GDP: Panel data unit root test results. J Health Econ 1998;17: 369–76.
20. Homaie Rad E, Vahedi S, Teimourizad A, Esmaeilzadeh F, Hadian M, Torabi Pour A. Comparison of the effects of public and private health expenditures on the health status: a panel data analysis in east mediterranean countries. Int J Health Policy Manag 2013;1(2):163–7.
21. Baltagi Badi H, Song H, Jung BC, Koh W. Testing for serial correlation, special autocorrelation and random effects. J Econometr 2007;140:5–51.
22. Anderson GF, Hussey PS. Population aging: a comparison among industrialized countries. Health Affairs 2000;19(3):191–203.
23. Xu K, Saxena P, Holly A. The determinants of health expenditure: a country level panel data analysis, Working Paper. World Health Organization, 2011.
24. Wagstaff A, Cleason M. The millennium development goals for health: rising to the challenge. Washington, DC: The World Bank, 2004.
25. Or Z. Exploring the effects of Health care on Mortality across OECD Countries. OECD Labor Market and Social Policy. Occasional papers 46. OECD Directorate for Employment, Labor and Social Affairs, 2001.

How to cite this article: Arun JV, Kumar D. Public health expenditure of BRICS countries – an empirical analysis. Int J Med Sci Public Health 2016;5:2212-2216

Source of Support: Nil, **Conflict of Interest:** None declared.