ESSENTIAL HEALTHCARE SERVICES AND ECONOMIC PROSPERITY: EVIDENCE FROM CROSS-SECTIONAL AND TIME-SERIES DATA

RADHAMES A. LIZARDO
AdventHealth University

BENITA DAVID
AdventHealth University

ABSTRACT

This paper examines the relationship between investments in healthcare services and economic development across the world. The motivation comes from the assertion of the 2015 Lancet Commission that "investment in surgical and anesthesia services is affordable, saves lives, and promotes economic growth" and the 2016 World Health Organization Bulletin 94:201-209F who indicates a strong explanatory power of per capita expenditure on health as a determinant of surgical volume, an essential healthcare service. Using several methodologies, we find support for the hypothesis that investment in surgical, anesthesia, and other essential healthcare services and beyond, promotes economic growth. Our finding suggests that, other things equal, an increase of 1% in healthcare expenditure per capita leads to an increase in economic prosperity varying from 0.22% to 0.88%.

Keywords: surgical care, instrumental variables, case fatality, efficiency, rule of law.

INTRODUCTION

Economists and other social scientists have tried to determine the causes of economic prosperity dispersion across the world. Figure 1 shows the 2015 per capital gross domestic product (GDP) for the 21 regions of the world, the regional grouping system used by the Institute for Health Metrics and Evaluation (IHME), an independent global health research center at the University of Washington, USA. The High-Income North American region boasts a per capita GDP of $48,771 which is $46,812 higher than that of the Eastern Sub-Saharan African region. The regional per capita GDP's mean (μ) and standard deviation (σ) are $15,901 and $13,281 respectively. Dispersion is even greater when we look at the desegregated sample of 199

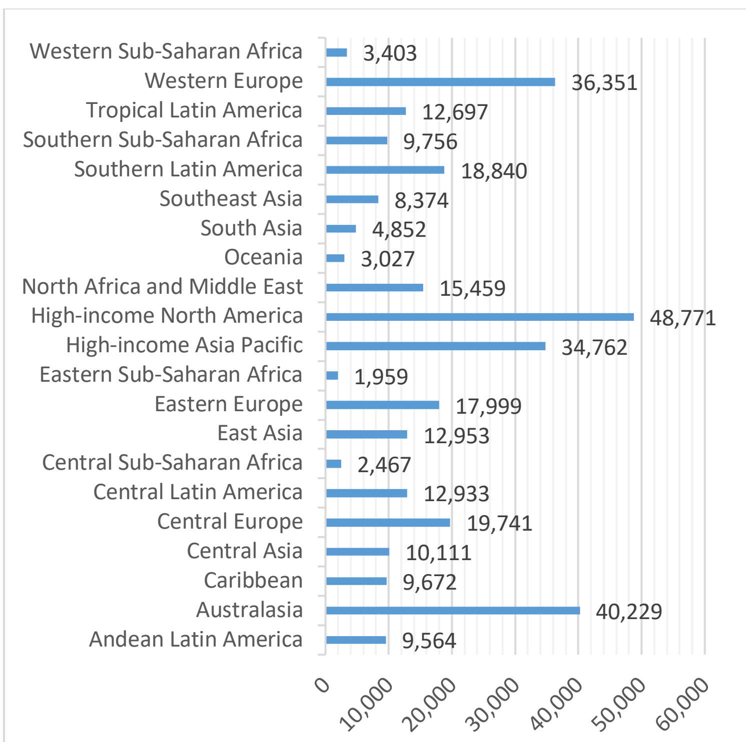

Figure 1. Per capita GDP. Constructed by the authors using data from World Bank (http://web.worldbank.org).

nations included in the analysis (σ= \$18,936). According to Shuh (2013), almost half the world — over three billion people — live on less than \$2.50 a day. The identification of economic prosperity explanatory variables has been the object of many theoretical and empirical research projects and is an important focus of developmental economics. The stock of literature concerning developmental economics is vast. It will be futile to address even a fraction of the published studies who seek to explain variation in economic prosperity. Barro (1989, 1990, 1991, 1996, 2013) and others (Schumpeter, 1934; Solow, 1956; Cass, 1965; Leff, 1964; Nelson and Phelps, 1966; Sheshinski, 1967; Becker et al., 1990; Bradford & Summers, 1991; Torstensson, 1994; Mauro, 1995; Hall and Charles, 1999; Farr and Wolfenbarger, 1998; Henisz, 2000; La Porta et. al., 1999; Glaeser, et.al.,2004) have enhanced the theoretical foundation and empirically tested several explanatory variables of economic prosperity. Stock of human capital (e.g. knowledge, talents, skills, abilities, experience, intelligence, training, judgment, wisdom); endowment of physical capital (e.g. infrastructure, production capabilities, equipment, machinery); natural resources (e.g. oil reserves, mineral resources, land); and government policies (e.g. economic freedom, property rights, rule of law, corruption, openness), are typically included in empirical studies. Since natural resources are generally fixed, human capital, physical capital, and government policies measurements are the objects of manipulations to elicit changes in economic prosperity.

Human capital plays a prominent role in a number of models of endogenous economic growth. Romer (1987; 1990) proposes that an economy with a larger stock of human capital will experience faster economic growth. Therefore, subsidizing the accumulation of human capital is superior to a subsidy to physical capital accumulation. An argument can be made that natural resources can dwindle over time and commodity prices are subject to exogenous shocks. Physical capital is subject to depreciation and obsolescence. Creativity is an output of human capital. Given an initial stock of human capital, strategic investment (development and improvement of human capital) facilitates a steady flow of new knowledge or ideas that underlie technological progress. Thus, countries with greater stock of human capital experience a more rapid rate of introduction of new goods and thereby tend to grow faster (Barro, 1991). A loop is naturally created, as increases in economic prosperity facilitates ever-increasing investment in human capital.

The World Intellectual Property Organization reports statistics on worldwide patent activity. Figure 2 shows the patent grants per million population and per capita GDP for the 21 regions of the world. The degree of positive covariance between these two variables is quite remarkable and shows the potential returns associated with investments in human capital. Investments in education and health care are essentials inputs in the creation and development of human capital. However, Barro

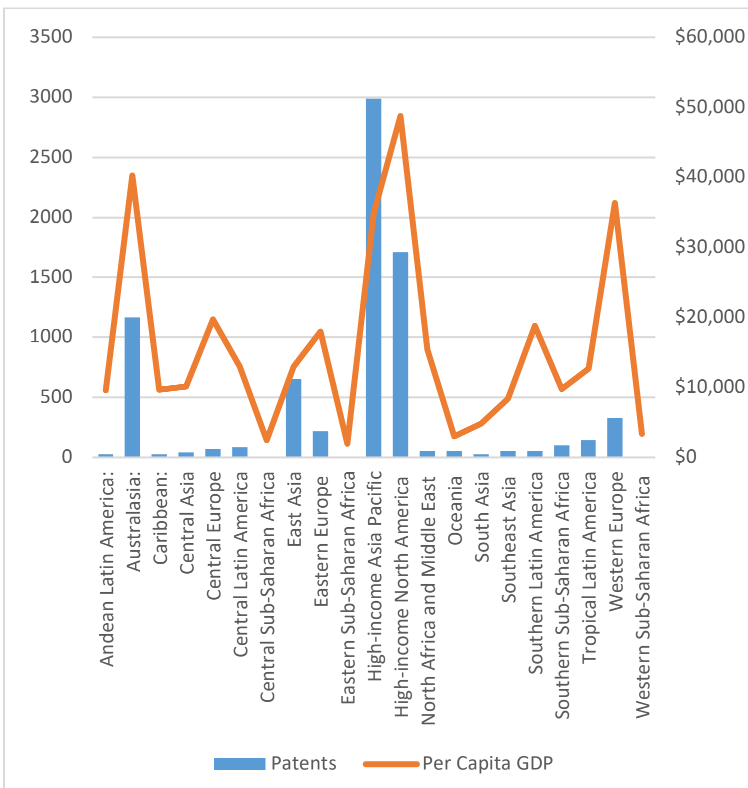

Figure 2. Regional Per Capita GDP and Patent Applications per Million Population. Constructed by the authors using data from World Bank (http://web.worldbank.org) and he World Intellectual Property Organization http://www.wipo.int/portal/en/index.html

(2013) properly points out that previous work on growth has often stressed the role of education as a contributor to human capital but has tended to neglect the role of health.

The 2015 Lancet Commission's "Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development", posits that investment in surgical, anesthesia, and other essential services promotes economic prosperity. The suggestion is that scaling up crucial medical care is a necessary step in the improvement of health, a significant determinant of human capital. The Commission argues that, in absence of surgical care, and by extension, other necessary services, case fatality rates are high for common, easily treatable conditions including appendicitis, hernia, fractures, obstructed labor, congenital anomalies, and breast and cervical cancer. In fact, the Commission states that "investment in surgical and anesthesia services is affordable, saves lives, and promotes economic growth" (Meara et al., 2015, p. 577). Weiser et al. (2008) who gathered yearly data for 194 WHO Member States, found that per-head total expenditure on health was strongly correlated with rates of surgery in these countries (r^2=0.996). It is a well stablished fact in the literature that per-head total expenditure on health correlate with the magnitude of healthcare services (volume of surgical, anesthesia, other essential services and beyond). The purpose of our study is to test the hypothesis that "investment in healthcare services promotes economic growth."

The relationship between economic growth and health has been the object of some empirical studies, usually focusing on a country or region (Ama, 2016; Halder, 2009; Tolulope & Taiwo, 2014; Kurt, 2015; Granados & Ionides, 2008) and other dimensions of health inputs, or, in some cases, health status itself (which is the output of the health production function as presented later). See for example Barro, 2013; Pradhan, 2011; and Aisa & Pueyo, 2013. This research is unique in that it focusses on the Commission's assertion concerning the relationship between healthcare services and economic growth. Figure 3 depicts the trends between gross domestic product per capita and the surgical rate per 100,000 population. A direct and significant relationship is observed (r^2=0.80, ρ<0.00). We posit that a similar relationship exists between gross domestic product and per capita healthcare expenditure. This paper exclusively considers this empirical relationship. In addition, the geographical scope is the world, not just a country or a region. Furthermore, the approach of the investigation is from different perspectives: cross-section analysis with and without IVs, and time-series cross-section analysis for the 21 regions of the world. The multifaceted approach is designed to address the endogeneity (simultaneous causality) difficulties common in developmental economic studies. Adding time series increases the number of observations and facilitates the modeling of time and space, which increases the ability to show causation. The remainder of the paper is organized as follows: Section Two describes the theoretical framework and methodology, Section Three describes the dataset, and Section Four presents the empirical analysis followed by the conclusion.

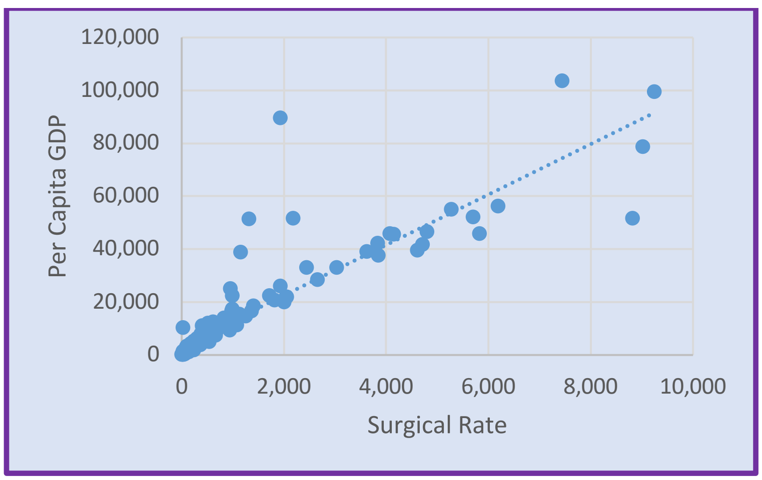

Figure 3. Per Capita GDP and Surgical Rate per 100,000 population. Constructed by the authors using data from World Bank (http://web.worldbank.org) and estimates based on Weiser et al., 2008.

THEORETICAL FRAMEWORK AND METHODOLOGY

The neoclassical Ramsey–Cass–Koopmans and Solow–Swan economic growth models constitute the main theoretical underpinning of developmental economics. Both models start with an aggregate Cobb–Douglas production function of the type

F(K,AL) where *K* is physical capital, *L* is amount of labor, and *A* represents labor-augmenting technology. In essence, these models postulate that economic growth is determined by changes in the stock of physical capital, population, and technology. Recent extensions of these models suggest that government policies with respect to level of consumption spending, protection of property rights, and distortion of domestic and international markets are additional sources of cross-country variation in economic prosperity (Barro 2013). The concept of capital in the neoclassical model has been expanded to include human capital in the form of education and health (Lucas, 1988; Rebelo, 1991; Caballe & Santos, 1993; and Milligan & Sala-i-Martin, 1993). Incorporating these recent theoretical developments, the basic neoclassical model expands as follows,

$$Y = A.K^{\alpha}S^{\beta}L^{\gamma}G^{\delta}H^{1-\alpha-\beta-\gamma-\delta} \tag{1}$$

Whereas $\alpha>0$, $\beta>0$, $\gamma>0$, $\delta>0$ and $0<\alpha+\beta+\gamma+\delta>1$. The output of goods and services, *Y* depends on inputs of physical capital, *K*; worker schooling, *S*; labor, *L*; government policies, *G*; and worker health capital, *H*. The formulation assumes constant returns to scale in the five inputs and diminishing returns with respect to each input individually. *K, S, L, G*, and *H* can be single variables or vectors of variables. For example, *K* can take the form of foreign direct investment (FDI), private domestic investment (PDI), public domestic investment (PDI), total domestic investment (DI), etc., or it can be a bucket of different types of investments. The same can be said about schooling, labor, government policies, and health capital. To minimize the possibility of multicollinearity, individual variables or indexes are employed that, based on empirical evidence, can be validated. The preliminary empirical version of (1) becomes:

$$\log(Y_t) = \beta_0 + \beta_1 \log(K_t) + \beta_2 \log(S_t) + \beta_3 \log(L_t) + \beta_4 \log(G_t) + \beta_5 \log(H_t) + \varepsilon_t \tag{2}$$

Since H_t is the focus of our study, the order of (2) is rearranged and H_t is placed as the first predictor. This is necessary to detect whether or not the estimated parameter associated with this input is consistent across specifications (in term of magnitude, direction, and statistical significance) as other predictors are added one at a time. We proxy *Y* with gross domestic product per capita (*GDPPC*), *K* with investment per capita (*IPC*), *S* with a human capital index with an emphasis on education and training (*HCD*), *L* with population (*POP65 and URP*), *G* with rule of law (*ROL*) and *H* with total health expenditure per capita (*HCEPC*). Additional information about these proxies are provided under Section 3. The applied empirical workhorse becomes:

$$log(GDPPC_i)=\beta_0 + \beta_1 log(HCEPC_i)+\beta_2 log(HCD_i)+ \beta_3 log(IPC_i)+\beta_4\ log(PO65_i)+\beta_5\ og(URP_i)+\beta_6\ log(ROL_i)+\varepsilon_i \quad (3)$$

The composite model represented in (3) is estimated by OLS and TSLS. Since estimations using OLS may suffer from spuriousness due to heteroscedasticity and autocorrelation, the Newey and West (1987) variance-covariance estimator, consistent with the presence of both heteroscedasticity and autocorrelation, is utilized.

Equation (3) is based on cross-sectional aggregated data. When cross-sectional data are aggregated, statistical power may be negatively affected due to the loss of variance. In order to minimize the effect of aggregating cross-sectional data, the analysis is expanded by combining cross-sectional data with time series in a panel data context. The relationship between economic prosperity and total health expenditure per capita is assessed using equation (4). To take into account the characteristics of each country, the intercept varies for each one while still assuming that the slope coefficients are constant across countries. See Gujarati (2003) for details. The fixed effects model in the panel data analysis is in the following format:

$$log(GDPPC_{it})=\beta_0 + \beta_1 log(HCEPC_{it})+\beta_2 log(HCD_{it})+ \beta_3 log(IPC_{it})+\beta_4 log(POP_{it})+\beta_5 log(ROL_{it})+\varepsilon_i \quad (4)$$

Due to time series data availability constraints, total population (POP) is used in equation (4). Total population should capture the combine net effect of both, population over 65 (POP65), and, urban population (URP). The number of countries was also reduced (from 133 to 122) since many countries lack data for many of the periods within the selected time frame (1995 – 2014). The time frame was also dictated by data availability.

In section 3, the sources of data and descriptive statistics are presented. However, we felt that it was important to include in this section the justification for the selected variables. The main focus of this paper is to assess the magnitude and direction of the influence of health inputs on economic output. Health status (H) is an endogenous variable, a function of several predictors (Folland et al., 2014),

$$H = f(HC, \textit{Other inputs}, C_0) \qquad (5)$$

Where *H*=health status. On the aggregate, *H* can be measured by life expectancy, mortality rate, morbidity rate, etc. *HC*= health care. *HC* has a lot of different dimensions: visits to the general practitioner, visits to the specialist, blood tests, screening and diagnosis, medications, surgeries and anesthesia services, etc. *Other inputs* include life style habits (tobacco and alcohol consumption, exercise, nutrition, etc.), and environmental factors (pollution, climate, geography, genetics, occupation, etc.). C_0= initial health condition. Since the focus is to empirically test the relationship between healthcare services and economic growth, the attention is not on health status but instead on investment in health care, which is a determinant of health status. We use the log of healthcare expenditure per capita as a proxy for healthcare services. The justification for this approach is Weiser et al. (2008) who gathered yearly data for volume of surgery from countries with available data and found that per-head total expenditure on health was strongly correlated with rates of surgery in these countries (r^2=0.996) and was thus the only variable that was included in their linear model for estimation of surgical rates for countries with no hard data.

The inflow of foreign capital, in the form of foreign direct investment (FDI), has significantly augmented in developing countries during the last few decades. FDI inflow enhances economic growth and enables economy stability. Choong and Lim (2007) argue that FDI affects economic development of the recipient country at the macro and micro level. On a macro level, it is beneficial for real sectors of the economy whereas, on a micro level, it creates technological spillover and training of manpower and enhances management skill and so forth. However, Adams (2009) found that domestic investment was positive and significantly correlated with economic growth in both the OLS and fixed effects estimation, but foreign direct investment was positive and significant only in the OLS estimation. It seems that domestic investment is a stronger predictor of economic prosperity. For that reason, domestic investment as a proxy for *K* is used. As in the case of health, education is an investment in human capital. The relationship between education and economic prosperity is well documented (Barro, 1991; Meulemeester & Rochat, 1995; Klasen, 2002; Hanushek & Woessmann, 2012). Given the different possible proxies for education and closely related inputs (e.g. training, retraining, capacitation, etc.) an index is used to capture this important explanatory force. Population is used as a proxy for labor. There is evidence (See for example, Van Der Gaad & Beer, 2015) that economic growth is positively impacted by a relatively younger, urban workforce and that countries with a relatively high elderly-dependency ratio and rural population tend to exhibit low economic growth. As the elderly-dependency ratio increases, economic growth tends to decline. Two variables are included to capture the effects of these forces: urban population and population ages 65 and above, as a percentage of the total population. It seems that segregating both segments of the population (younger or older), provides a better approach in analyzing this important relationship. As the OECD (2018) states, demographic trends have a number of implications for government and private spending on pensions, health care, and education, and, more generally, for economic growth and welfare. This research looks at this dichotomy and expects the elderly population to be associated negatively with economic growth, while the younger, urban population to be a positive driver of economic prosperity.

In regard to government policies (*G*), we concentrate on the rule of law because it is a multidimensional concept, encompassing a variety of discrete components from security of person and property rights, to checks on government and control of corruption (Haggard & Tiede, 2011).

DATA AND DESCRIPTIVE STATISTICS

Due to data constraints, the analysis considers 133 of the countries of the world for 2015. The excluded countries are, in most cases, small islands and/or failing states for which data are unavailable. The observations of Gross Domestic Product per Capita (GDPPC), Investment per Capita (IPC) and Healthcare Expenditure per Capita (HCEPC) come from the World Bank's Data & Statistics (http://web.worldbank.org). Human Capital Development (HCD) is a composite index that measures the average achievements in several dimensions of human development with an emphasis on knowledge, as measured by the adult literacy rate and the combined gross enrolment ratio for primary, secondary and tertiary schools. Population Over 65 (PO65) represents % of total Population ages 65 and above as a percentage of the total population. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship, except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of the country of origin. Urban Population (URP) refers to people living in urban areas as defined by national statistical offices. URP is calculated using World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects. Rule of Law (ROL) measures the independence of the judiciary; the extent to which rule of law prevails in civil and criminal matters; the existence of direct civil control over the police; the protection from political terror, unjustified imprisonment, exile and torture; absence of war and insurgencies; and the extent to which laws, policies and practices guarantee equal treatment of various segments of the population. Countries are graded between 0 (worst) and 16 (best). The observations and descriptions of the Human Capital Development Index (HCD), Population Over 65 (PO65), Urban Population (URP), and the Rule of Law (ROL) come from The Quality of Government Basic Dataset (http://www.qog.pol.gu.se).

Table 1 presents key descriptive statistics of the series used in this analysis. Tests of the shape of the distributions indicate that all series are leptokurtic, which implies that these distributions are higher or more peaked than the normal distribution. The majority of the series are also moderately skewed to the right. As a result, the Jarque-Bera tests reject the null ($p<0.01$) of underlying normal distribution for all the series. Due to the sample size (133 nations) and the implications of the central limit theorem, nonnormality was considered not to be an impediment for our analysis (Sarno & Thornton, 2003). However, the series were corrected by transforming the observations with the base 10 logarithm to account for their skewed distributions (Weiser et al., 2008).

Table 1
Descriptive Statistics: Cross-Sectional Variables

	GDPPC	HCEPC	HCD	IPC	PO65	URP	ROL
Mean	14,461	6,905	0.69	3,332	8.35	58.82	9.19
Median	5,746	6,442	0.71	1,322	6.04	60.69	7.0
Maximum	103,828	17,048	0.94	34,282	24.29	99.00	16.0
Minimum	251	1,918	0.33	24	0.85	8.80	0.00
Std. Dev.	20,329	2.6	0.16	5,182	5.81	22.90	4.63
Skewness	2.25	2.5	-0.46	3.08	0.79	-0.27	0.14
Kurtosis	8.39	9.1	2.19	15.30	2.32	2.15	1.84
Jarque-Bera	273.5	347.3	8.32	148.3	16.5	5.64	7.95
P-value	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.06)	(0.02)
Observations	133	133	133	133	133	133	133

Notes: GDPPC, HCEPC, HCD, IPC, PO65, URP, and ROL refer to gross domestic product per capita, healthcare expenditure per capita, human capital development, investment per capita, population over 65, urban population, and rule of law. See part 3.1 for additional information about these variables. P-values for the Jarque-Bera tests are reported below the statistics.

EMPIRICAL ANALYSIS

Cross-sectional Analysis

The relationship between economic prosperity and healthcare expenditure per capita is assessed using equation (3). Table 2 shows the estimation of the equation using OLS. Newey-West-robust heteroscedasticity consistent standard errors are given in parenthesis. Healthcare expenditure per capita ($\beta 1$) is positive and significant at the 1% level throughout. Its magnitude and direction are consistent across specifications. As control variables are added, $\beta 1$ remains stable. The result suggests that, other things equal, an increase of 1% in healthcare expenditure per capita leads to an increase in economic prosperity varying from 0.22% to 0.88% depending on the specification. This remarkable finding tends to support the Lancet Commission's hypothesis that investment in healthcare services saves lives and as a result, promotes economic growth. The larger message is that effective and efficient investment in essential health care is a key policy tool that promotes the development and maintenance of human capital, a critical determinant of prosperity.

Beside health, investment in education seems to positively impact the formation of human capital and as a result is a reliable predictor of economic prosperity. The Human Capital Development Index (β2), which reflects different aspects of education, also contributes to explain the variance of the dependent variable. As can be seen, there is a positive relationship between the two, in line with economic theory and the evidence in Barro (1991) and others. The coefficient is very stable, with both magnitude and direction consistent throughout model specifications and statistically significant at the 1% level. The implication is that besides keeping an adequate and accessible health care system where surgical, anesthesia, and other essential services are readily available, policy makers should strive to increase quality and access of education at all levels in order to encourage economic prosperity.

As expected, Human Capital Development and Rule of Law (β3 and β6) are positive and statistically significant throughout. In general, Population Over 65 (β4) negatively impact economic prosperity while Urban Population (β5) seems to be a positive predictor of it. Column 7 of Table 2 includes two regional dummies (no displayed). The dummy variable AFRICA equals one for countries in sub-Saharan Africa, and the dummy variable LATIN AMERICA equals one for countries in South and Central America, including Mexico. The estimated coefficients are negative, as expected (Barro, 1991).

A potential problem with the above analysis is that the estimates presented in Table 2 may be biased by endogeneity (simultaneous causality). Economic prosperity can be a determinant of healthcare expenditure per capita, and, as a result, health status. The implication is that richer countries can afford better health care systems. To mitigate such conundrum, we

Table 2
OLS Estimates: Cross-sectional Data
$\log(GDPPC_t)=\beta_0 + \beta_1\log(HCEPC_t)+\beta_2\log(HCD_t)+ \beta_3\log(IPC_t)+\beta_4 \log(PO65_t)+\beta_5\ og(URP_t)+\beta_6 \log(ROL_t)+\varepsilon_t$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Regional Dummies	No	No	No	No	No	No	Yes
β₁	0.880[c]	0.587[c]	0.290[c]	0.327[c]	0.313[c]	0.338[c]	0.346[c]
	(0.021)	(0.076)	(0.073)	(0.083)	(0.080)	(0.084)	(0.081)
β₂		2.152[c]	0.742[c]	0.944[c]	0.889[c]	0.754[c]	0.840[c]
		(0.521)	(0.284)	(0.293)	(0.273)	(0.282)	(0.380)
β₃			0.544[c]	0.500[c]	0.482[c]	0.491[c]	0.455[c]
			(0.064)	(0.070)	(0.066)	(0.064)	(0.065)
β₄				-0.086[c]	-0.073[b]	-0.321	-0.044
				(0.038)	(0.038)	(0.040)	(0.040)
β₅					0.003[c]	0.003[b]	0.004[c]
					(0.112)	(0.002)	(0.002)
β₆						0.0124[c]	0.0012[b]
						(0.005)	(0.007)
R^2	0.90	0.91	0.93	0.94	0.96	0.97	0.97
F p-value	0	0	0	0	0	0	0
N	133	133	133	133	133	133	133

Notes: [a]Newey-West heteroscedasticity and autocorrelation consistent (HAC) standards errors are reported in parenthesis. The dependent variable is economic prosperity captured by gross domestic per capita. The constant term was included in the estimations but is not reported. The symbols [a], [b], and [c] attached to the figure indicates significance at the 10%, 5%, and 1% levels, respectively. GDPPC, HCEPC, HCD, IPC, PO65, URP, and ROL refer to gross domestic product per capita, healthcare expenditure per capita, human capital development, investment per capita, population over 65, urban population, and rule of law.

estimate equation (3) using TSLS. The justification is that health care inputs is not necessarily determined solely by how rich a country is but how resources are administered and allocated (priorities, efficiency, ethics, corruption, waste), how responsive is the political system to people's needs, and overall collective preferences in term of national welfare. As a point of reference, the United States, a high-income country and with the highest healthcare expenditure per capita in the world (medical spending= 17.8% of national income in 2015), ranks 42th in life expectancy at birth. In fact, the overall life expectancy for someone born in

2015 in the USA, fell from 78.9 years to 78.8 years (Xu, J., Murphy, S., Kochanek, K., & Arias, E., 2016).

Table 3
TSLS Estimates: Cross-sectional Data
$\log(GDPPC_t)=\beta_0 + \beta_1\log(HCEPC_t)+\beta_2\log(HCD_t)+ \beta_3\log(IPC_t)+\beta_4 \log(PO65_t)+\beta_5$ og$(URP_t)+\beta_6 \log(ROL_t)+\varepsilon_t$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Regional Dummies	No	No	No	No	No	No	Yes
β₁	0.873[c]	0.583[c]	0.205[c]	0.283[c]	0.257[c]	0.416[c]	0.352[c]
	(0.023)	(0.076)	(0.069)	(0.099)	(0.060)	(0.145)	(0.137)
β₂		2.116[c]	0.850[c]	0.928[c]	0.866[c]	0.735[c]	0.838[c]
		(0.522)	(0.284)	(0.295)	(0.278)	(0.286)	(0.374)
β₃			0.610[c]	0.540[c]	0.527[c]	0.438[c]	0.451[c]
			(0.063)	(0.092)	(0.091)	(0.109)	(0.112)
β₄				-0.061[a]	-0.0414	-0.056	-0.046
				(0.040)	(0.055)	(0.052)	(0.052)
β₅					0.003[c]	0.002[a]	0.004[c]
					(0.112)	(0.001)	(0.002)
R^2	0.90	0.91	0.93	0.94	0.96	0.97	0.97
F p-value	0	0	0	0	0	0	0
N	133	133	133	133	133	133	133

Notes: [a]Newey-West heteroscedasticity and autocorrelation consistent (HAC) standards errors are reported in parenthesis. The dependent variable is economic prosperity captured by gross domestic per capita. The constant term was included in the estimations but is not reported. The symbols [a], [b], and [c] attached to the figure indicates significance at the 10%, 5%, and 1% levels, respectively. GDPPC, HCEPC, HCD, IPC, PO65, URP, and ROL refer to gross domestic product per capita, healthcare expenditure per capita, human capital development, investment per capita, population over 65, urban population, and rule of law.

Table 3 shows the estimation of equation (3) using Two-Stage Least Squares (TSLS). TSLS-Newey-West-robust heteroscedasticity consistent standard errors are given in parenthesis. No significant changes are observed. As before, healthcare expenditure per capita (β1) is positive and significant at the 1% level throughout. The estimate of the other parameters are also similar to the previous findings which add support to our previous conclusions. The nonmonetary variables Corruption, Transparency, and Wellbeing seems to capture societal qualities that correlate with the existence or absence of effective, efficient, and accessible health care systems and therefore, are appropriate instruments. In other words, countries with less corruption, more transparency, and who emphasize collective wellbeing, tend to have more effective and efficient health care systems (Browne et al., 2015) and as a result, access to general health care services, including surgical and anesthesia services, are more reachable.

Table 4

OLS Estimates: Time-Series Cross-sectional Data

$\log(GDPPC_{it})=\beta_0 + \beta_1\log(HCEPC_{it})+\beta_2\log(HCD_{it})+$
$\beta_3\log(IPC_{it})++\beta_4\log(POP_{it})+\beta_5 \log(ROL_{it})+\varepsilon_{it}$

	(1)	(2)	(3)	(4)	(5)
β_1	0.658[c]	0.559[c]	0.221[c]	0.279[c]	0.2655[c]
	(0.0051)	(0.009)	(0.0006)	(0.0074)	(0.0078)
β_2		0.730[c]	0.143[c]	0.3778[c]	0.361[c]
		(0.0555)	(0.0324)	(0.0339)	(0.0338)
β_3			0.598[c]	0.546[c]	0.548[c]
			(0.0083)	(0.085)	(0.008)
β_4				-0.201[c]	-0.205[c]
				(0.0122)	(0.0121)
β_5					0.002[c]
					(0.001)
R^2	0.87	0.88	0.95	0.96	0.97
F p-value	0	0	0	0	0
N	122	122	122	122	122
T	20	20	20	20	20
N.T	2440	2440	2440	2440	2440

Notes: The dependent variable is economic prosperity captured by gross domestic per capita. The constant term was included in the estimations but is not reported. The symbols [a], [b], and [c] attached to the figure indicates significance at the 10%, 5%, and 1% levels, respectively. GDPPC, HCEPC, HCD, IPC, POP, and ROL refer to gross domestic product per capita, healthcare expenditure per capita, human capital development, investment per capita, population, and rule of law.

Panel Data Analysis

Table 4 shows the estimation of equation (4) using OLS. Panel Data Analysis confirms the previously reported findings: healthcare expenditure per capita has a direct and significant relationship with economic prosperity over time. The findings add additional support to the assertion of the Lancet Commission that investment in essential healthcare services promotes economic prosperity. Note that (β1) is again positive and significant at the 1% level throughout. The magnitude and direction of this relationship are consistent across specifications and methodologies. Other things equal, an increase of 1% in healthcare expenditure, leads to an increase in economic prosperity varying from 0.22% to 0.88%. Human capital is probably the most important input in the aggregate production function. Health care is a key tool used to sustain such an important determinant of prosperity. In the absence of adequate health services, including surgical and anesthesia services, the depreciation of human capital accelerates, a loss of production power.

As expected, Panel Data Analysis confirms the positive effects of education, investment, and the rule of law. Population is a complex predictor: some elements positively impact prosperity, other elements have a negative effect. Overpopulation can drain national resources and can limit the ability to provide adequate health care and education. A relative share of elder population is also associated with increased demand for health care services.

CONCLUSION

The result of this analysis has important implications for policy makers. The evidence supports the notion that maintaining a healthy stock of human capital is good for the nations. Access to necessary medical care appears to be a considerable predictor of prosperity: other things equal, an increase of 1% in healthcare expenditure per capita leads to an increase in economic prosperity varying from 0.22% to 0.88%. Quality and opportune healthcare services lower mortality and disability, reduce deaths resulting from birth defects, and prevent other adverse health outcomes arising from the burden of injuries and noncommunicable diseases. The absence of such services creates a drag in economic prosperity due to the negative effect on human capital development and preservation. In addition, the promotion of effective and efficient health care policies works best when it is accompanied by improvements in education, private investment, and the rule of law.

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