Government Health Expenditure and Public Health Outcomes: A Comparative Study among 17 Countries and Implications for US Health Care Reform

Tae Kuen Kim, PhD
Assistant Professor
Adelphi University School of Social Work
1 South Ave. Garden City, NY 11530, USA

Shannon R. Lane, MSW, PhD
Assistant Professor
Adelphi University School of Social Work
1 South Ave. Garden City, NY 11530, USA

Abstract

This research empirically analyzed the relationship between public health expenditure and national health outcomes among developed countries. The data was collected from 17 OECD countries between 1973 and 2000. Two public health outcome indicators, infant mortality rate and life expectancy at birth, were used as dependent variables. To analyze cross-country panel data, we used a mixed-effect model. A statistically significant association was found between government health expenditure and public health outcomes. Particularly, the findings showed a negative relationship between government health expenditure and infant mortality rate, and a positive relationship between government health expenditure and life expectancy at birth. The results suggest that higher government spending on medical goods and services can be shown to provide better overall health results for individuals. Based on these results, we discussed the policy implication of recent changes in healthcare policy in the United States as well as future research direction.

Key Words: Government health expenditure, Infant mortality rate, Life expectancy, US healthcare reform

1. Introduction

The diversity of healthcare systems across countries is explicitly reflected in the degree of public health expenditure. Continuous debates result regarding the association between public health expenditures and national health outcomes, but the exact nature of the relationship remains unclear. This research empirically analyzed the relationship between public health expenditure and national health outcomes among developed countries in order to inform this debate. Based on the findings, we discuss the policy implications of current healthcare reform in the United States, and future research directions in this area.

Previous discussions regarding the impact of public health expenditure on national health outcomes do not agree whether increasing health spending is a positive, negative, or non-significant factor. Theoretical reasons that spending increases might not improve outcomes include the concern that public spending crowds out private sector provision (Rajkyman & Swaroop, 2007; Bokhari et al, 2007); that institutional inefficiencies intervene as services are being delivered (Rajkyman & Swaroop, 2007, p. 97); and that in some of the countries studied, particularly the less developed countries, the infrastructure needed to access health care may not exist, making the increased health care spending ineffective (Bokhari et al, 2007).

Health spending in general and public health spending in particular vary widely among countries. Some governments spend less than 1% of their gross domestic product (GDP) on these services (Rajkuman & Swaroop, 2007, p. 99), while in 1998, the US spent 14% of GDP on health care services (Anderson, Hurst, Hussey & Jee-Hughes, 2000). This spending includes both preventative and intervention services and is distributed through service delivery systems that vary significantly across countries (Rajkyman & Swaroop, 2007). Many factors contribute to public health outcomes of a country, including "biology, environment, lifestyles, and the health care system" (Elola, Daponte & Navarro, 1995, p. 1397), each of which is in turn affected by the country's development, egalitarianism, socioeconomic level, political system, and other factors (Elola et al, 2005).

Political factors include governance, such as a predictable, open, and transparent process, professional bureaucracy, accountable executive, and civil society that participates in public affairs, (Rajkyman & Swaroop, 2007, p. 96), as well as the ideology, political system, and resulting welfare state laws (Chung & Muntaner, 2006).

1.1. Public spending and health

Research on the results of government spending on health is mixed, but leans toward positive outcomes from increased public spending.   Bokhari, Gai & Gottret (2007) found increased government spending contributed to positive outcomes in under-five and maternal mortality (p. 257).   Elola et al (1995) found high values of both country's GDP and health care expenditures were associated with higher life expectancy for females and "inversely associated with potential years of life lost to females" in Western Europe (p. 1399).   Health care expenditure explained infant mortality better than GDP.   Or (2000/1) also found that increasing health expenditures had a statistically significant improvement in outcomes for women, but not for men (if GDP is controlled for).   This may be explained by "contrasting mortality patterns" (p. 66), where male mortality causes such as violence and accidents may be less sensitive to medical interventions, and increased public health programs (such as those for breast and cervical cancer) can be more effective in changing outcomes for women than men.   In addition, some suggest that women consume health services more regularly than men, increasing their exposure to system changes.   Or (2000/1) did find that public financing of health care lowered premature mortality for men and women.   He also found higher per-capita income, higher proportion of white-collar workers, lower amounts of air pollution (in developed countries), and lifestyle factors such as alcohol and tobacco consumption to be significant contributors to mortality.

Rajkuman and Swaroop (2007) examined data from 1990, 1997, and 2003 for effects of public health spending on the mortality of children under five, using corruption and bureaucratic quality as indicators of governance level. In countries with good governance, increasing public health spending by 1 percentage point increases the under-5 mortality rate by .32%. This effect decreases to .20% in countries with average governance and has no effect in countries with weak governance (p. 97).   Chung & Muntaner (2006) also considered a number of variables, including political environment (ideology and participation), welfare state policies (social security transfer and percentage of population under public medical coverage), health care system, income inequality, gross national product, and the Gini coefficient, and their effect on infant mortality rate, under 5 mortality rate, and low birth weight rate. The Gini coefficient was not significantly associated with infant mortality or low birth weight.   This suggests income inequality is not itself causing bad health outcomes, but is a result of something else that directly impacts population health. Provision of public health services was the only variable that showed a consistent relationship with infant mortality.

In a discordant finding, Berger & Messer (2002) considered health care inputs, health behaviors, age, education, health care expenditures, Gini coefficient, public share of health expenditures, and population covered by public sources for inpatient and outpatient services in OECD (Organisation for Economic Co-operation and Development) countries. They found that "increases in the share of health expenditures that are publicly financed are significantly associated with higher mortality rates (Berger & Messer, 2002, p. 5)." This may be because of a less productive mix of services or less efficient service provision.   Increases in insurance coverage are correlated with lower mortality rates.

1.2. US Health Care System and Spending

In 1998, the US spent $4,270 per capita (14% of GDP), compared to the next highest OECD country (Switzerland at $2,740), and a median of $2,000 among 28 OECD peers (Anderson, et al, 2000).   Only the US, Switzerland, and Germany spent more than 10% of GDP on health care. Part of this differentiation is recent: 1997 data suggested that US spending increased at the same rate as the OECD median from 1960 to 1990, but from 1990 to 1997, US spending increased 4.3% per year, compared to 3.8% for the OECD median (Anderson & Poullier, 1999). In addition, the US had the highest spending in comparison to GDP: 13.5% compared to a low of 4% in Korea and Turkey and 7.5% in the OECD median.   From 1990 to 1997, the percentage of GDP spent on health care in six countries (Canada, Denmark, Finland, Italy, Norway, and Sweden) declined, while it rose in the US from 12.6 to 13.5 (Anderson & Poullier, 1999). In 1997, 24 (of 29) OECD countries ensured health insurance to at least 99% of their citizens. Of those without universal health insurance in 1997, in two countries (Germany and the Netherlands) nearly all those not required to purchase health insurance do, for de facto universal coverage. In 1997, only Mexico, Turkey, and the US had no universal coverage.

The US also had the largest percentage of citizens without government-assured health insurance; in 1997, 43 million Americans were without any health insurance, and that number rose to 50 million by 2009 (Kaiser Family Foundation, 2010). High US spending levels can be partially explained by a higher volume of patient/physician contacts (six visits per capita, compared with OECD average of 5.9), higher number of FTE staff per hospital bed (3.9 US, 2.0 OECD median), higher capacity of technology (more MRI units, CT scanners, etc), and first-adapting of medical innovations (Anderson et al, 2000). The outcomes of these expenditures are mixed. The US does not do better on life expectancy or infant mortality than others, but is more successful in life expectancy at age 80. The US has a slightly higher 5-year relative survival rate for breast cancer than other countries (Anderson et al, 2000). In addition, US patients have the shortest wait times for coronary artery bypass graft in the eight countries that gathered that data (p. 155). One study also suggests that waiting times for nonemergency surgeries may be less in the US (Anderson et al, 2000, p. 156). In 1996, the US was below the OECD median of 80.3 years for life expectancy (79.4 years). The OECD median for infant mortality was 5.8 deaths/thousand live births. Only Hungary, Korea, Mexico, Poland, and Turkey had higher rates than the US' 7.8. That rate is also declining for the OECD faster than for the US (Anderson & Poullier, 1999).

2. Limitations of Prior Research

Some studies (Akinkugbe & Mohanoe, 2009; Gani, 2009; Kabir, 2008; Leiyu, 1997) have empirically investigated the impact of public health expenditures on national health outcomes. Previous research includes two major limitations.

First, some studies analyze the longitudinal relationship within only one country (e.g. 20 years in the US). This does not provide a comparative picture among different countries. Other studies compare different countries at two or three time points by employing a "pooled time series analyses". This does not show trajectory of a given country. To overcome the limitations of previous research, this study longitudinally analyzed 17 countries for a 27-year period. The resulting analysis shows within-country as well as between-country dynamics regarding the relationship between public health expenditure and national health outcomes. In addition, this study employed a "mixed-effect model" to adjust for cross-sectional and time specific idiosyncrasies in cross-country panel data.

3. Data and Methodology

To investigate the impact of public health expenditure on the public health outcome, data was used from 17 developed countries collected between 1973 and 2000, including Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Sweden, Switzerland, the United Kingdom, and the United States. The dataset used in this study was created through the integration of three data sources: OECD statistics, the World Health Organization (WHO) database and a Quality of Government Study dataset. The dependent variable of this study is public health outcomes. To measure public health outcomes in a given country, we used two indicators, infant mortality rate and life expectancy at birth. Infant mortality rate is the number of infants who die before reaching one year of age, per 1,000 live births in a given year. Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. We conceptualized the independent variable as the public expenditure on health as a percentage of total health expenditure in a given country. We included other socio-economic covariates that may affect public health outcome. These control variables include real GDP per capita, the Gini coefficient, unemployment rates, and the rate of the aging population (over 65). Data was analyzed using LINEAR MIXED MODEL in SPSS (Statistical Package for the Social Sciences) version 19.0.

The dataset used has multi-level structures where repeated measures (e.g., each year's infant mortality and life expectancy) are nested within a given country. As a result, individual-year cases of each country are clustered into 17 countries (country-level). Individual-year cases from the same country tend to be more similar due to their closeness in space and/or time.[1] This interdependency among individual-year cases is called intra-class correlation, or group homogeneity (Kreft & de Leeuw, 2004). The multilevel structure of cross-country panel data can be efficiently analyzed with the mixed-effect model. An analysis of panel data using the mixed effect model has several advantages compared to pooled-time estimation or other multivariate statistics. First, the time points at which measurements are obtained need not be constant for all subjects.

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[1] For example, this year's infant mortality of a given country may be more closely related to last year's infant mortality of the country rather than other countries.

Second, cases with incomplete observations can be included in the analysis without biased estimation. There are important considerations in many cross-country panel datasets, since some countries have missing variables for several years2. Finally, researchers can efficiently specify the between and within country-level effects (Norusis, 2004, p. 250).

In our dataset, each country has a maximum of 27 individual-year cases, representing 27 years of annual public health outcomes (dependent variables). The change in annual public health outcomes for a given country can be represented through a two-level structure. At level 1, annual public health outcomes of each country (independent variable) are affected by time-varied variables, annual public health expenditures of each country (independent variable), and other covariates such Gini and unemployment rate of each year, making a 27-year trajectory of a given country. At level 2, the trajectories of each country depend on the unique traditions of each country (Raudenbush & Bryk, 2002). Incorporating these two-level into one equation, mixed-effect model effectively adjusts for intra-class correlation. Thus, our study appropriately analyzed the unique nature of longitudinal cross-countries data with robust statistical methodology.

4. Results

Table 1 shows the results of mixed-effect model analysis. We analyzed two separate models because our study includes two dependent variables. The dependent variable of model 1 is infant mortality rate. The results show a negative relationship between public health expenditure and infant mortality rate. Specifically, a one percent increase in public health expenditure decreases infant mortality rate by .077, controlling for the effects of other covariates. Model 2 tests the effect of public health expenditure on life expectancy at birth. The results show a positive association between these two variables. A one percent increase in public health expenditure increases life expectancy by .026. These results indicate that a higher level of public health expenditure significantly decreases infant mortality and increases life expectancy, controlling for other socio-economic conditions of a given countries. The results also reveal that public health expenditure is a very strong predictor for public health outcomes. In both models, the p-value of public health expenditure is less than .001, showing high statistical significance. The results imply that expanding public health expenditures is an efficient strategy to improve overall health condition among citizens.

Table 1. The results of mixed-effect model

	Model 1	Model 2
Public health expenditure (% of Total health expenditure)	-.077***	.026***
Real GDP per capita	-.001**	.001***
Gini coefficient	.019	-.023**
Unemployment rate	.026	-.020
Rate of aging population (Over 65)	.122**	-.039
-2 Log Likelihood	1357.28	1031.81
(*Wald z*)	(12.35)	(12.01)
Dependent variable	Infant mortality	Life expectancy

   *p<.1, **p<.05, ***p<.01

5. Conclusions and Implications

Our empirical findings confirm the important effects of public health expenditure on public health outcomes. These results suggest that countries interested in measures to decrease infant mortality and increase life expectancy should consider expanding public health expenditures as an effective mechanism to reach these goals. Based on the results, we discuss the implications of this research for the current US debate about health care reform.   In 2010, the United States enacted PL 111-148, the Patient Protection and Affordable Care Act, and PL 111-152, the Health Care and Education Reconciliation Act, commonly referred to in total as the Affordable Care Act (ACA) (healthcare.gov, n.d.).

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2 Our dataset contains complete information for eight countries, but 87 cases from 11 countries are missing. For example, while the dataset has 27-year observations for the United States, it only has 12-year observations for Switzerland. These unbalanced observations may produce biased estimations when using conventional time-corrected methods.

The ramifications of these acts, as well as the nature of their eventual implementation, are still far from understood, but they may significantly change public spending on health care in the United States in a number of ways.

5.1.   Government health expenditures before and after health care reform

In 2010, it was estimated that the United States government spent nearly $2.6 trillion on health expenditures, including spending on Medicare, Medicaid, etc.   This increase over the figures discussed earlier averaged approximately $8,402 per American, and totaled 17.9% of the gross domestic product for that year (Kaiser Family Foundation, 2012).   The Congressional Budget Office (CBO, 2010) originally estimated that spending on the coverage components of the new law would be $938 billion over 10 years.   However, the CBO estimated that the new law will actually reduce the deficit by $124 billion over those ten years, with savings from reductions in spending and fraud through Medicare and Medicaid, and through the installations of new taxes and fees in the legislation.   This analysis is the subject of much debate (factcheck.org, 2012).

5.2.   Financial impact of health care reform

Much of the success of the bill, and its impact on our topic, the percentage of health care spending in the United States that is public rather than private, is based on the ability of the bill's implementers to achieve something closer to universal coverage (should the plan work as designed, an estimated 95% of US citizens and legal residents will have coverage within six years.).   This increased coverage would happen through important mechanisms including requiring insurers to provide insurance to anyone who purchases it (implemented in 2010) and providing subsidies to help those who do not meet the eligibility requirements for public plans, but cannot afford private coverage on their own (designed to become effective when the exchanges are created, by 2014) (Washington Post, 2010).

Recently reviewed by the US Supreme Court were two mechanisms to achieve this increased coverage.   The first, and most controversial, would require the vast majority of Americans to obtain health insurance through employers, private companies, public programs, or state exchanges beginning in 2014.   Those who do not obtain insurance would be required to make a "shared responsibility payment" in the same manner that tax penalties are assessed and collected (NFIB, 2012, p. 1).   In the June 28, 2012 ruling "Chief Justice Roberts delivered the opinion of the Court with respect to Part III–C, concluding that the individual mandate may be upheld as within Congress's power under the Taxing Clause." (NFIB, 2012, p. 4), commenting that "The Affordable Care Act's requirement that certain individuals pay a financial penalty for not obtaining health insurance may reasonably be characterized as a tax. Because the Constitution permits such a tax, it is not our role to forbid it, or to pass upon its wisdom or fairness." (p. 44).

The Supreme Court also considered the issue of expansion of Medicaid to a larger pool of individuals.   The original legislation requires that by 2014 "*all* individuals under the age of 65 with incomes below 133 percent of the federal poverty line" be covered (NFIB, 2012, p. 45).   As a result, "the Federal Government estimates that its Medicaid spending will increase by approximately $100 billion per year, nearly 40 percent above current levels." (NFIB, 2012, p. 46).   The ruling allows this expansion to continue, but states that "Congress is not free…to penalize States that choose not to participate in that new program by taking away their existing Medicaid funding" (NFIB, 2012, p. 55).   Other aspects of the bill designed to reduce costs include: increased focus on decreasing fraud, particularly in Medicare and Medicaid (implemented beginning in 2010), encouragement of integrated health systems to increase efficiencies and decrease errors (implementation starting in 2012), initiatives designed to link payments to providers with quality outcomes, rather than number of services provided, reduce avoidable hospital readmissions, and reduce paperwork and administrative costs (implementation starting in 2012), and initiatives designed to improve preventive services and limit executive compensation (implementation starting in 2013) (Washington Post, 2010).

Many variables will determine whether this law will move the percentage of US government spending as a share of total health spending in the direction that our research recommends.   The implementation of this law is complex and involves individuals from many federal agencies.   The decisions that are made through the implementation process will have a significant impact on the final results.   In addition, the 2012 presidential and congressional elections may produce a national legislature and executive that choose to repeal the ACA in its entirety or extensively change the legislation before it is enacted.

In addition, state legislatures and governors, all of whom face their own political and budgetary pressures, have much input into this process, and this variability leads to many unanswered questions. If this legislation can increase the percentage of public health expenditures in the United States, either through increasing the public spending in the system, decreasing overall health spending, or some combination of the two, our research suggests this will improve health outcomes for the American people. We look forward to watching the continuation of this process as it works toward further resolution.

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