

**THE EFFECTS OF PREVENTION AND PUBLIC HEALTH
EXPENDITURE ON MEASLES IMMUNIZATION RATES IN
ORGANISATION FOR ECONOMIC CO-OPERATION AND
DEVELOPMENT (OECD) COUNTRIES**

A Thesis

by

CHRISTINA MELONIE CHEN

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

August 2007

Major Subject: Health Education

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ABSTRACT

The Effects of Prevention and Public Health Expenditure on Measles Immunization Rates in Organisation for Economic Co-operation and Development (OECD) Countries.

(August 2007)

Christina Melonie Chen, B.A., Rice University

Chair of Advisory Committee: Dr. James Eddy

Globalization has brought health concerns to the forefront. Moreover, governments, policymakers, and health officials are paying more attention to these health concerns. With the increased cross-national interaction, diseases have more pathways to spread than ever. As countries attempt to ensure access to care and control health expenditure, monitoring and improving the quality of health care is a pressing issue. This paper uses linear regressions to analyze the relationship between prevention and public health expenditure and the rate of measles immunizations in member countries of the Organisation of Economic Co-operation and Development (OECD).

There is a weak negative relationship between the expenditure and rates of measles immunizations for both private and public expenditure data, suggesting that the higher the expenditure the lower the rates of measles immunizations. Several possible reasons for this phenomenon is discussed in conjunction with the role of health educators as it relates to the use of theory based interventions to improve rates of measles immunizations.

To my family who have supported and encouraged me through all my endeavors.

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Especially, I would like to give my special thanks to my family and friends, whom I love very much.

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CHAPTER I

INTRODUCTION: MEASLES AS A GLOBAL HEALTH THREAT

Globalization has brought about the interconnectedness of diverse countries through economic, social and political forces (Doyal, 2002). Unrestricted population movement is likely as millions migrate for multiple reasons (Daulaire, 2003). There is a growing understanding that health now transcends national borders, and as the world becomes better connected, the nature of diseases will also become more globalized (Daulaire; Taylor, 2004). As diseases do not respect national boundaries, the increase of cross-national interaction implies that infectious diseases are no longer a concern solely for the developing countries (Waters, 2001). According to Taylor, the number and scale of transboundary public health concerns, including infectious diseases, are indeed increasing.

The spread of AIDS and reappearance of tuberculosis in many developed countries have taught policymakers and governments the importance of remaining vigilant in public health and health promotion efforts to control and prevent infectious diseases (Waters, 2001). More recently, the concern for measles has been gaining attention because as one of the most contagious human diseases, the threat of using measles as a bioterrorist weapon exists (Strebel et al., 2003; Meissner, Strebel, & Orenstein, 2004).

This thesis follows the style of *The Health Educator*.

In addition, importation, cases classified as persons infected with the measles virus while outside their home country during the 21 days before rash onset, has become more common in the past two decades. It now is responsible for nearly half of all reported measles cases in the United States (Centers for Disease Control and Prevention [CDC], 1999; Oster, Harpaz, Redd, & Papania, 2004). Worldwide, measles is a heavy public health burden, with 30-40 million cases and 745,000 deaths in 2001 representing 50%-60% of all vaccine preventable deaths in children worldwide (World Health Organization [WHO], 2002). While developed countries are not endemic to measles, importation and circulation of measles will continue as long as measles is prevalent in developing countries (Meissner et al., 2004; CDC, 2004).

Efforts to combat measles are common. For example, the Centers for Disease Control and Prevention and the Agency for Toxic Substances and Disease Registry lists both “vaccine preventable diseases,” and “improved immunization coverage and introduction of new childhood vaccines in many countries” as priority programs in their *Global Health Strategy* (Walker, Evans, & Mouton, 2006); the United Nations Special Session on Children endorsed the goal of reducing measles death (Strebel et al., 2003); and the World Health Organization adopted aggressive measles control or elimination strategies (Strebel et al.). These efforts emphasize the global nature of the disease and the need for cross-national joint efforts.

With the increase of transnational agenda setting in efforts to target measles, global tracking of measles immunization rates and analyses are important for comparison of health status. In addition, governments can learn from one another in the

prevention and containment of diseases and make sense of the challenges in their own countries (Murphy, 2007).

The Organisation for Economic Co-operation and Development (OECD) is one organization that has realized and acted on the need for cross-national data collection and management. The OECD (2007) is a group of 30 like-minded countries, and represents the world's most developed and wealthy nations, producing about 60% of the world's goods and services. As such, high levels of trade and cross-national business are characteristics of member countries, increasing the necessity for health status monitoring.

As a basic health status indicator, the measles immunization agenda has been termed unfinished (Strebel et al., 2003) and factors associated with improved measles immunization rates in developed countries have not been determined. This paper poses a basic research question: Is expenditure towards prevention and public health in OECD countries related to measles immunization rates? Using OECD Health Data 2006, this paper analyzes the relationship between prevention and public health expenditure on measles immunization rates OECD countries.

CHAPTER II

**ARTICLE: THE EFFECTS OF PREVENTION AND
PUBLIC HEALTH SPENDING ON MEASLES
IMMUNIZATION RATES IN ORGANISATION FOR ECONOMIC
CO-OPERATION AND DEVELOPMENT (OECD) COUNTRIES**

Introduction

Due to globalization, population health is now a cross-national interest for multiple parties. Despite the difference in funding and delivery of health care, common challenges across nations exist (Murphy, 2007; Haux, Ammenwerth, Herzog, & Knaup, 2003; Hall & Walton, 2004). Economists, policy analysts, and health officials are all working towards understanding international health (Doyal, 2002; Cornia, 2001; Dollar, 2001; Drager & Beaglehole, 2001; Feachem, 2001; Weisbrot et al., 2001). Because of the significant potential to learn from countries that may be ahead in planning and development of health care, shared information and research across nations is crucial (Murphy).

Particularly, cross-national tracking of health expenditure have been scrutinized by policy analysts, economists, and researchers. Since the 1980s, researchers have been able to track diminishing returns in life expectancy gains from increased health expenditures (Newhouse, 1987). This raises the important question of what is being purchased with the increase in health finances (Berman, 1997).

The Organisation for Economic Co-operation and Development (OECD) has gathered and published information on the availability on various health measures, including health expenditure and health status measures. Specifically, because there has been limited research in the area of prevention and public health expenditure, and as a basic health status indicator, the measles immunization agenda has been termed unfinished (Strebel et al., 2003), this paper poses a basic research question: Is expenditure towards prevention and public health in OECD countries related to measles immunization rates? This relationship is examined using OECD Health Data 2006. Additionally implications for the Health Education profession are made.

Method

Data Source

Data from the OECD Health Data 2006 were analyzed. OECD Health Data 2006 is an electronic database, containing aggregate data on the health care systems of the 30 OECD countries from 1960 to 2005. Data are collected and reported by the member countries directly to the OECD for publication. All OECD Health 2006 data are available at www.sourceoecd.org to subscribers.

This study included two measures in the data set: 1) Prevention and Public Health Expenditure per capita, using purchasing power parity (PPP) rates to convert from national currency to U.S. dollars (Table 1); and 2) Rates of measles immunization by the age of one in percentages (Table 2). PPP rates, which relate the prices of a market basket of goods in one country to the comparative group of countries, have been accepted for use when analyzing health expenditures and health outcomes (Schieber &

Poullier, 1991). Data were taken from select years between 1999-2005 using the most recent reported measles immunization percentage and prevention and public health expenditure for the given countries.

Table 1

Prevention and Public Health Expenditure (USDPPP)

Country	Total	Public	Private
Australia	46	44	2
Austria	63	42	21
Belgium*	40	40	0
Canada	185	184	1
Czech Republic	27	23	4
Denmark	15	13	2
Finland	87	41	47
France	90	68	22
Germany	100	86	15
Greece	65	35	30
Hungary**	54	29	24
Iceland	40	40	0
Ireland	78	59	19
Italy	15	15	0
Japan*	50	30	20
Korea	21	20	1
Luxembourg	63	61	2
Mexico	18	18	0
Netherlands	148	76	71
New Zealand	62	48	14
Norway	75	65	11
Poland	14	12	2
Portugal	36	24	12
Slovak Republic*	13	13	0
Spain	29	21	8
Sweden	85	76	9
Switzerland	89	57	32
Turkey***	10	10	0
United Kingdom****	30	30	0
United States	224	206	18

All data from 2004, unless otherwise noted.

* Data from 2003

** Data from 2002

*** Data from 2000

****Data from 1999

Table 2

Percent Children Immunized Against Measles

Country	% Children Immunized
Australia*	93.4
Austria	74.0
Belgium	82.0
Canada**	94.5
Czech Republic	96.9
Denmark	96.0
Finland	97.0
France	87.1
Germany	93.3
Greece	88.0
Hungary	99.9
Iceland*	99.0
Ireland	81.0
Italy	85.5
Japan***	100.0
Korea****	90.2
Luxembourg	91.0
Mexico	96.4
Netherlands	96.0
New Zealand	85.0
Norway	88.0
Poland	97.0
Portugal	94.8
Slovak Republic	99.6
Spain	97.3
Sweden	94.0
Switzerland	82.0
Turkey*	90.0
United Kingdom*	81.7
United States	93.0

All data from 2004 unless otherwise noted.

* Data from 2005

** Data from 2002

***Data from 2000

****Data from 1999

Definitions

OECD Measures of Expenditure on Prevention and Public Health

The OECD defines expenditure on prevention and public health to include “services designed to enhance the health status of the population as distinct from the curative services which repair health dysfunction (OECD, 2007).” Typical services in the classification include vaccination campaigns and programs (OECD, 2007). Data are taken from 1999-2004, using the most recent reported expenditure. Data on prevention and public health expenditure are categorized into three sets: 1) total expenditure, 2) public expenditure, and 3) private expenditure (Table 1). Public expenditure accounts for government funded projects and private expenditure accounts for occupational health care, charities, non-governmental organizations, and voluntary organizations funded projects.

OECD Measures of Immunization

OECD defines measles immunization rates as “the percentage of children reaching their first birthday who have been fully immunized against measles” (OECD, 2007). Data are used from years 1999-2005, taking the most recent data for the countries. Table 2 indicates which years data were drawn from for each country.

Missing Data

As reported by OECD (2005), OECD countries on average spend 3% of total health care expenditure on prevention and public health. Data on Prevention and public health expenditure was unavailable for four countries, Greece, Ireland, New Zealand,

and Sweden. For these countries, figures were estimated using 3% of total health care expenditure (also reported in OECD Health Data 2006).

Statistical Procedures

Secondary data analysis was carried out using Statistical Package for the Social Sciences version 14.0 (SPSS). Descriptive statistics were obtained and linear regression models were estimated. Pearson's correlations are reported as well as the p-value of findings. The models are estimated with prevention and public health expenditure as the independent variable and measles immunization rates as the dependent variable. The equations are estimated with the following general form of $Y_i = \beta X_i + U_i$ where X represents the prevention and public health expenditure and $i = 1, 2, \dots, 30$ OECD countries. The error is assumed to be independent and identical across the i countries. Due to lack of previous research related to this study, only the effect of prevention and public health expenditure is considered. Confounding variables are not considered, however will be addressed in the discussion.

Data were analyzed in three sets: 1) total prevention and public health expenditure on measles immunization rates; 2) public funding of prevention and public health expenditure on measles immunization rates; and 3) private funding of prevention and public health expenditure on measles immunization rates.

Table 3

Statistical Results

Dependent Variable	Independent Variable – Expenditure on Prevention and Public Health	Coefficient	Constant	p-value	R²
Measles Immunization Rate	Total	-0.0046	91.742	.856	.001
	Public	-0.0056	91.729	.001	.846
	Private	-0.003	91.497	.846	.0008

Results

Descriptive Statistics

Prevention and Public Health Expenditure

Total expenditure ranged from 10 million to 224 million, Turkey and the United States, respectively. The mean total expenditure was 64.4 million with standard deviation of 50.58. Public expenditure towards prevention and public health ranged from 10 million to 206 million, Turkey and the United States, respectively. The mean public expenditure was 49.96 million with standard deviation of 44.88. Private expenditure towards prevention and public health ranged from 0 million to 71 million. Belgium, Iceland, Italy, Mexico, Slovak Republic, Turkey, and United Kingdom were at 0 million for private expenditure, and the Netherlands at 71 million. The mean private expenditure was 12.93 million with standard deviation of 16.25.

For few countries, 100% of all prevention and public health expenditure is funded through public sources; however for the majority of OECD countries, total expenditure is a combination of both public and private funds. For Finland, Hungary, Germany, Netherlands, and Norway, there was a discrepancy in the data of 1 million dollars when public and private expenditure were added and compared to the total expenditure. This is possibly attributed to rounding and approximation in the data. A second source of data was unable to be located, and the data were analyzed using the reported values.

Measles Immunization

Percent of children immunized ranged from 74% to 100%, Austria and Japan, respectively. The mean immunization rate is 91.5% with standard deviation of 6.7. Data were available for all countries.

Regression and Correlation

Total Prevention and Public Health Expenditure

There is no significant relationship between total prevention and public health expenditure and measles immunization rates (Figure 1). However, the direction of effect indicates that the higher the expenditure on prevention and public health, the lower the rates of measles immunization. Pearson correlation = $-.035$, with a linear regression equation of $y = -0.0046x + 91.742$ and $R^2 = 0.001$ ($p = .856$) (Table 3). The three outliers belong to the United States, Canada, and the Netherlands. After accounting for the outliers, $R^2 = .083$ and Pearson's correlation = $-.289$ ($p = .144$), making the relationship stronger, but still not significant at $p < .10$.

Public Expenditure on Prevention and Public Health

Public funding on prevention and public health expenditure has no significant relationship with measles immunization rates (Figure 2). Pearson's correlation = $-.037$, with a linear regression equation $y = -0.0056x + 91.729$ and $R^2 = .001$ ($p = .846$). The two outliers belong to Canada and the United States. After accounting for the outliers, $R^2 = .061$ and Pearson's correlation = $-.248$ ($p = .203$), making the relationship stronger, but still not significant at $p < .10$.

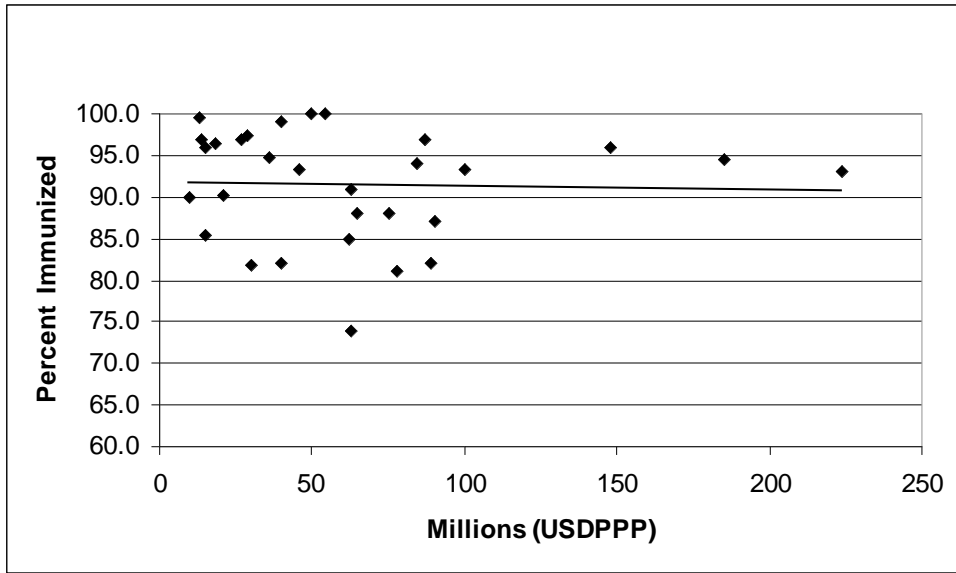


Figure 1

Total Prevention and Public Health Expenditure on Measles Immunization Rates

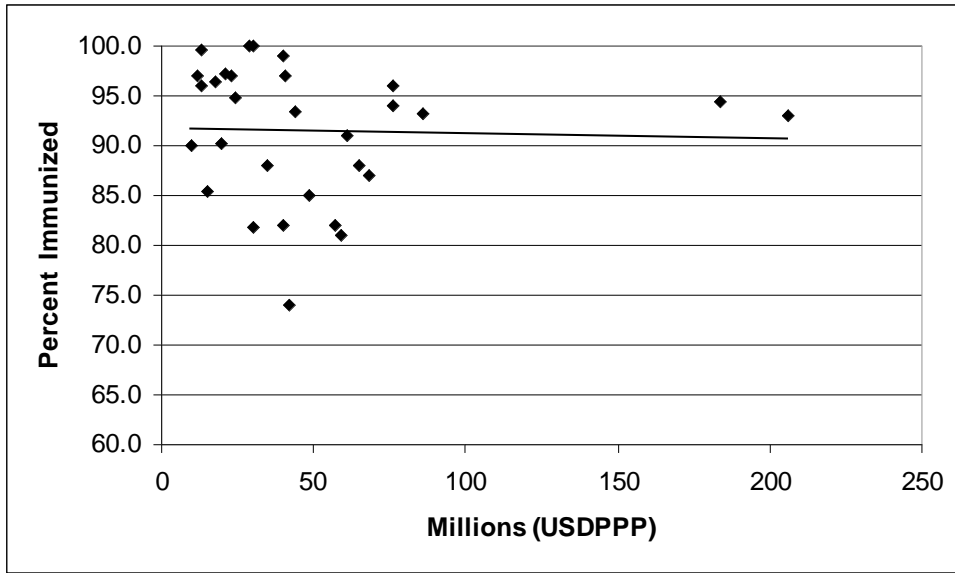


Figure 2

Public Expenditure on Prevention and Public Health on Measles Immunization Rates

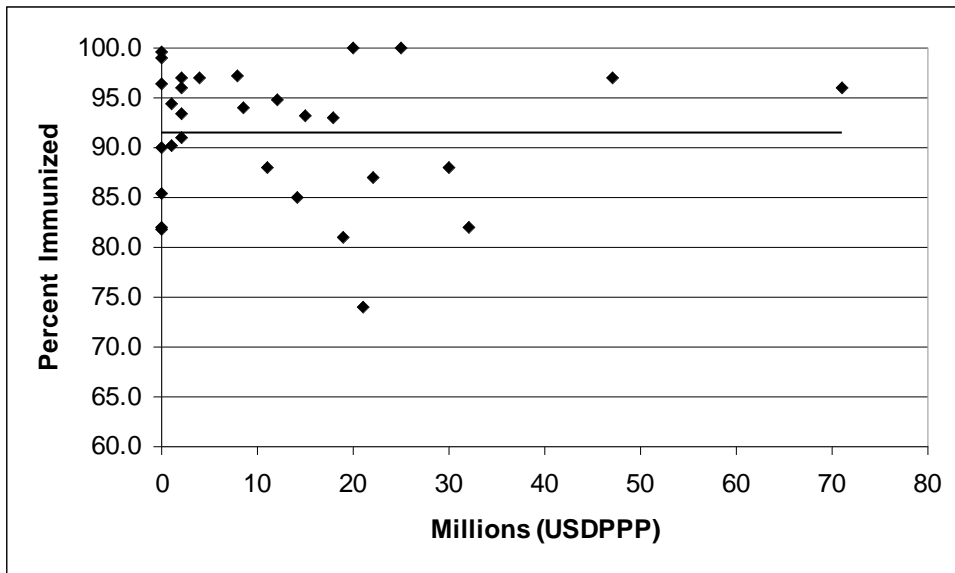


Figure 3

Private Expenditure on Prevention and Public Health on Measles Immunization Rates

Private Expenditure on Prevention and Public Health

Private funding on prevention and public health expenditure has no significant relationship with measles immunization rates (Figure 3). Pearson's correlation = $-.008$, with a linear regression equation $y = -0.003x + 91.497$ and $R^2 = .008$ ($p = .846$). The two outliers belong to Finland and the Netherlands. After accounting for the outliers, $R^2 = .075$ and Pearson's correlation = $-.274$ ($p = .158$), making the relationship stronger, but still not significant at $p < .10$.

Discussion

This study contributes to the limited body of knowledge on prevention and public health expenditure as it relates to measles immunization rates. Particularly, this study is unique because it analyzes data from member countries of the OECD, the most developed nations in the world. The results demonstrated that for OECD countries, prevention and public health expenditure (total, public, and private) are not strongly related to measles immunization rates. This finding is significant because although the OECD mentions immunization campaigns as part of prevention and public health expenditure, there was no correlation with measles immunization. This raises several research questions including which immunization campaigns receive the funds and how effective are immunization campaigns. In addition, since expenditure towards immunization is only a fraction of the total prevention and public health expenditure, this leads to research of prevention and public health expenditures and the methods of data tracking.

Limitations

Because this paper only used data from the OECD, the findings may not be generalizable to countries outside the OECD. While the OECD represents of the most developed countries of the world, membership in the organization may provide for external pressure faced by these countries. The OECD also claims that they are a group of “like-minded countries,” reemphasizing the inability to generalize these findings.

The assumptions associated with this secondary data set are that the data captures similar measurements between the countries. However, when comparing cross-national data, three limitations often apply. First the data are collected for operational rather than research purposes and therefore may carry with them country-specific definitions (Reinhardt, 2002). Second, the boundary between health and social services is often unclear and the reported figures may not capture all the related spending (Schieber & Poullier, 1991). Third, there is a lack of internationally accepted definitions of many health related terms and unintended confusion even with the operational definitions (Schieber & Poullier), and therefore national reporting of prevention and public health expenditure could potentially capture different measures. These assumptions and limitations among the data set cannot be addressed until further research is initiated in these countries and more comparable data is collected.

However, it should also be emphasized that these data measurement problems have not deterred health policy analyst, researchers, or the popular press from drawing substantive conclusions of the performance (Grubaugh & Santerre, 1994). In addition, it is advantageous that these data are based on an internationally accepted functional

classification and are monitored by statistical offices of the countries (Schieber & Poullier, 1991).

Implications

Several explanations pertaining to the weak correlation between increased public and prevention health expenditure and measles immunization rates are discussed below. Future studies are also suggested which may help explain this phenomenon.

Fewer Measles Cases

According to the Health Belief Model, people fail to take action if they have a low perceived risk of contracting the disease, or they perceive the risks associated with the disease as low. As higher prevention and public health expenditure may result in lower measles prevalence, people may not be aware of the disease or believe themselves to be less susceptible to the disease and forgo proper immunization. However, even in countries where measles are not endemic, children not immunized may experience more than a 60-fold increase in risk of disease due to importation (Meissner et al., 2004). Future research should explore if countries with higher expenditure on prevention and public health have fewer cases of measles, and if such is the case, develop methods to raise awareness among individuals of the need for proper immunization.

Funding of Campaigns Unrelated to Measles

There is currently no tracking system to identify and record the allocation of prevention and public health expenditure. Without a tracking system, it is difficult to analyze the overall effects of prevention and public health expenditure in a nation because of the numerous programs which receive funding. The lack of information can

be addressed by governmental and health agencies by recording the allocation of prevention and public health expenditures. With this information, governments, policy-makers and health educators can better analyze the relationship between prevention and public health expenditure and health status, including measles immunization rates.

Governance

Taylor (2004) concluded that globalization is creating a heightened need for new global health governance structures to promote coordinated intergovernmental action. However, few studies have attempted to determine the relationship between governance and health status. A relatively new line of research has given attention to broader measures of health, such as mortality (Novarro et al., 2003), yet immunization rates may not share the same characteristics as broad measures such as mortality. Immunizations are often state mandated; therefore the form of governance and health care structure may play an important role.

The Private Sector

The private sector currently is not a large contributor towards prevention and public health (ranging from only \$0 - \$71 USPPP per capita, compared to \$10 – \$206 USPPP per capita contributed by the public sector). However, it has been the case through history that the private sector was first to capitalize on the current wave of globalization (Daulaire, 2003). In addition, forward-thinking entities in the private sector have already begun to realize the health threats associated with transnational movement and are beginning to use global health promotion to ensure optimal market access (Daulaire). These agencies should capitalize on the fact that they are not bound by

geography, and can simultaneously work in multiple nations. Transnational health organizations also can help mobilize public opinion in these countries, guiding diplomatic institutions (Daulaire). These private organizations also may have more freedom in the expenditure of funds, and can have more freedom in designing and delivering public health programs. Future studies should attempt to capture how these entities can be involved in measles immunization campaigns.

Health Education in Practice

Health educators need to adopt an international scope towards health education and promotion. As globalization increases the global health influence, health educators will be forced into taking on additional responsibilities.

The measles immunization agenda is unfinished and discerning factors contributing to increased immunization is important. In addition, the potential for substantial cost savings makes reduction in disease prevalence valuable and policymakers at all levels will benefit to recognize the impact of increased prevention and public health expenditure (Carabin & Edmunds, 2003).

Furthermore, as health educators, it is important to realize that increased health expenditure may not always correlate to improved health status measures. With training in the conducting needs assessment, developing, implementing, and evaluating programs, health educators must play a crucial role in improving the efficacy and efficiency in the measles immunization agenda.

CHAPTER III

CONCLUSION

Globalization has brought health issues to the forefront grabbing policy makers, health officials and government organizations' attention. As diseases are not bound by national borders, the frequent cross-national contact through people and product flows continues to heighten the need for a cross-national research and interventions in health issues.

Immunizations against preventable diseases are particularly important worldwide. Moreover, nations that have access to and can afford the immunizations need to ensure that the national population is receiving the proper dosages of protection. Measles is one of the top five killers of children under five (Strebel et al., 2003), and the WHO has initiated a call for the eradication of this disease. Therefore, this paper specifically examines the relationship between measles immunization rates and prevention and public health expenditure.

The countries included in this study are all members of the Organisation for Economic Co-operation and Development (OECD), which represent the most developed nations worldwide. Decision to use this set of countries was based on the assumption that available funding and provision are available to provide the population with measles immunizations, and development, economic and living standards are comparable between the countries.

Data for this paper were collected from the OECD Health Status 2006 report. This information is public domain and can be accessed from www.sourceoecd.org. Much research has been conducted with OECD data; however, this paper fills the void in the analyses of prevention and public health expenditure, which accounts for an OECD average of 3% of total health expenditure (OECD, 2005)

Analyses were conducted in order to determine the relationship between prevention and public health expenditure and measles immunization rates. Data were a compilation of the most recent statistics provided for countries, ranging from year 1990-2005. Missing data were estimated based on findings from the literature.

Regression models were estimated for: 1) total prevention and public health expenditure on measles immunization rates; 2) public expenditure towards prevention and public health on measles immunization rates; and 3) private expenditure towards prevention and public health on measles immunization rates.

The relationship between prevention and public health expenditure and measles immunization rates are not statistically significant in OECD countries. Results strongly suggest that prevention and public health expenditure is not related to measles immunization rates in the OECD countries. However, there is a slight negative correlation, hinting that higher expenditure on prevention and public health, results in a lower percentage of children under the age of one immunized against measles.

Studies have not been conducted to determine factors that influence measles immunization rates in developed countries and this paper opens discussion in this area laying the groundwork for future studies. Findings here suggest that a broader

consideration beyond monetary spending may have to be considered to fully understand the relationship between expenditure and health. Suggestions presented included the need for more data tracking, isolating for various factors of expenditure, and determining if there is a relationship between governance and immunization rates.

Lastly, this study indicated how health educators can contribute to raising measles immunization rates in developed countries. Health educators must be responsible for conducting research projects related to measles immunizations. With the skills set to conduct needs assessments, develop, implement and evaluate programs, health educators are responsible for researching reasons why individuals do not receive the immunization. Furthermore, health educators need to determine which population subset is at risk for not receiving the immunization and develop targeted interventions to increase immunization rates among these subpopulations. Aiding in the increase of measles immunization rates is particularly important to promote global health, and health educators must take responsibility in this area.

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