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Healthcare Spending on the Quality of the Nation's Health: An Analysis of Public Perceptions

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Abstract: This study evaluated the public's perception of how increasing levels of GDP spending on healthcare impact average life expectancy, according to a representative sample of adults in the United States. Statistical analyses correlated the responses with selected demographic variables. The results show that the sample placed greater importance on advances in healthcare than on public health efforts for explaining improved life expectancy over the past century. The sample perceived that increased spending on healthcare through 100% of GDP would continue to promote higher life expectancy. As to why life expectancy has improved, 72% of men and 68% of women (p = 0.0004) attributed it to healthcare. The second most common reason given was lifestyle (10%), followed by diet (9%), education (2%), sanitation (2%), and other (6%). A positive linear relationship was observed between percent of GDP spent on healthcare and perceived life expectancy for all education groups, but the estimated slope showing the relationship decreased with increasing education. In addition, estimated life expectancy when 0% of the GDP was spent on healthcare increased from 30.4 for those with some high school to 40.4 for those with some college, to 45.8 for those with a college degree, to 48.8 for those with a doctoral or professional degree. With greater importance placed on healthcare than public health, over spending on healthcare as opposed to public health will likely result in declining health outcomes and life expectancy in the future.

Keywords: GDP, Healthcare Spending, Life Expectancy, Public Health

1. Introduction

Life expectancy at birth is a marker of health status that reflects the average number of years a newborn is expected to live, assuming current mortality rates across the age span continue to apply. On the world level, life expectancy has improved from 52.6 in 1960 to 72.0 in 2016 [1]. This improvement reflects increased life expectancy in almost every country [1]. Higher life expectancy can be explained by both achievements in public health and healthcare [2-4]. Since 1900, life expectancy in the United States has improved by more than 30 years, from 47.3 years in 1900 to 78.6 years in 2016 [5, 6]. It has been estimated that 23-25 (77%-83%) of the 30 year improvement in life expectancy has been attributed to achievements in public health, with the remainder due to advances in healthcare [2, 3].

Among the 35 countries that comprise the Organisation for Economic Co-operation and Development (OECD), in 2016 the United States had the highest health spending as a percentage of Gross Domestic Product (GDP) [7]. International comparisons show that the relationship between percent of GDP spent on healthcare and life expectancy from birth is unique for the United States (Figure 1) [7]. That is, despite its relatively high healthcare spending, the United States ranked 33rd in infant mortality and 28th in average life expectancy [7]. This result may be because of inadequate attention to the social, behavioral, and environmental determinants of health [8, 9]. Specifically, the United States has disproportionately low spending on public health preventive efforts compared with the other countries in the OECD [9]. In general, countries with lower spending on social services compared with healthcare have worse health outcomes [9]. It may be that limited focus on specifically the social determinants of health are driving much of the comparatively high healthcare costs and low life expectancy.

The purpose of the current study was to measure the public's perception of how increasing levels of GDP spending on healthcare would impact the nation's life

expectancy. It was hypothesized that public perceptions could take one of three forms: (1) increased spending on healthcare through 100% of GDP would promote increasingly higher life expectancy, (2) increased spending on healthcare would eventually lead to a peak and leveling off in life expectancy, and (3) increased spending on healthcare would lead to a peak but subsequent decrease in life expectancy. This final hypothesis would involve an understanding that a tipping point exists where spending on healthcare takes funding from public health prevention efforts, resulting in a decline in life expectancy.
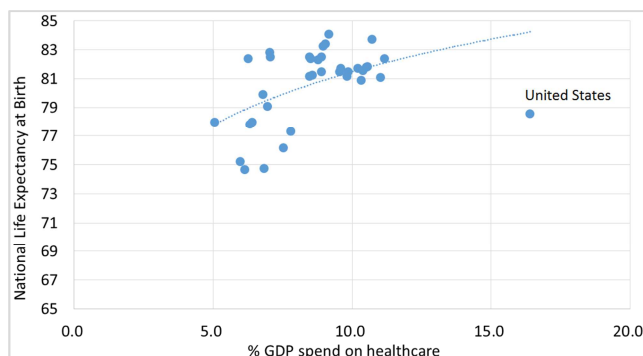

Figure 1. *Organisation for Economic Co-operation and Development (OECD) country healthcare expenditure by life expectancy, 2016. Data source: Reference 8.*

2. Methods

Population

The target population is the adult population, aged 18 years and older, in the United States. A sample was drawn from this population and assessed using a cross-sectional survey. Survey participants had a comparable distribution of selected demographic variables to that of the general US adult population.

Sample

Survey Sampling International, a professional public opinion/marketing research company, was used to actively manage panels of respondents in an online survey [10]. Participants were made up of individuals from the United States who were willing to provide their opinions and were incentivized to be members of the company's response panels. The company encouraged participation, engagement, and good representation through a reward system within these panels, while also utilizing strict quality control measures to secure high quality responses. The demographics of these participants were known to the research company when the invitations for participation were extended. As participants responded to the survey, it was progressively closed to those whose demographic variables were already sufficiently represented in the sample. This procedure ensured that the survey sample remained demographically representative of the United States population with respect to age, sex, race, income, and education. A total of 725 individuals completed the survey.

Quality assurance methods were used to identify nonsensical survey responses. These responses were eliminated from the analysis (20 in all), resulting in a final sample size of 705.

Instrument

A questionnaire was developed to assess the level at which the public associates increased life expectancy with an increased percentage of GDP spent on healthcare. The instrument was evaluated for content and face validity by three public health faculty who were not associated with the current study. The revised version of the questionnaire that resulted from this evaluation was then tested on a convenience sample of 20 individuals who were thought to be representative of the US adult population. A few minor revisions resulted from this administration, after which the questionnaire was delivered to a group of 357 public health students. The hypothesis of this study indicated that people would associate increased life expectancy with a greater percentage of the GDP dedicated to healthcare. Accordingly, the pilot study group was used to calculate an effect size, standard deviation, and the resulting required sample size. Human subject approval for conducting the survey was given by the research team's academic institution.

The survey respondents were presented with the following statement: "This survey deals with health, disease and life expectancy. Life expectancy is defined as the average number of years people will live from birth." Participants were informed that life expectancy in the United States was approximately 35 years in 1850 and approximately 79 years in 2011. Next, participants were informed that in 2011 the United States spent 17% of the GDP on healthcare (e.g., physicians, hospitals, clinics, diagnostic technology, surgery, and antibiotics). Participants were asked in an open-ended response format to report what life expectancy would be in the United States if the amount of the GDP spent on healthcare services were 0%, 10%, 25%, 50%, 75% and 100%. The survey requested that life expectancy be reported in integer form (rounded to the nearest whole number) for each of the percentages presented.

The survey collected demographic data in order to analyze potential differences in responses by person characteristics and to ensure appropriate representation of the sample to the US adult population. Demographic variables collected included age, sex, race, ethnicity, income, and education.

Statistical Techniques

Frequency distributions were used to summarize and describe the data. Bivariate analyses were used to assess the relationship between selected variables, with the chi-square test used to evaluate statistical significance. Repeated measures analysis of variance was used to determine whether a linear trend existed in life expectancy by % GDP spent on healthcare, with significance based on Wilks' Lambda. Linear regression models were computed for assessing the relationship between perceived life expectancy and % GDP spent on healthcare. Two-sided tests of hypotheses were evaluated using the 0.05 level of significance. Statistical analyses were performed using the Statistical Analysis System (SAS) software, version 9.3 (SAS Institute Inc., Cary, NC, USA, 2010).
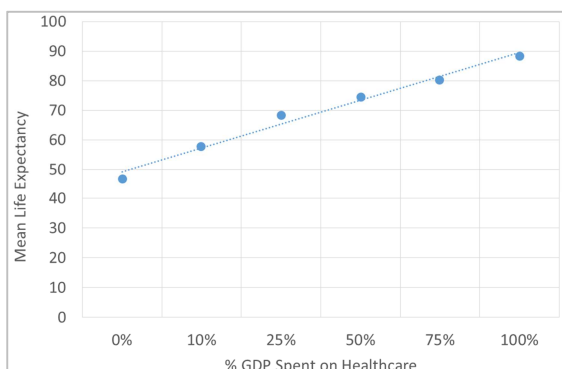
3. Results

Selected demographic variables are presented in Table 1. Open-ended responses were collected to explain the increase in life expectancy from 1850 through 2011 and were categorized as follows (a total of 662 of the final sample population provided these responses): healthcare (462, 70%), lifestyle (67, 10%), diet (62, 9%), education (15, 2%), sanitation (14, 2%), and other (42, 6%). Bivariate analyses assessed the significance of the association between the selected demographic variables and reasons (healthcare, lifestyle, and diet) provided for the increase in life expectancy. A greater percentage of men chose healthcare as the primary reason for the increase in life expectancy (72% vs. 68%). In addition, a higher percentage of women identified lifestyle (14% vs 6%) as a primary reason for the improvement in life expectancy.

Table 1. *Participant Demographics.*

	No.	%	Healthcare %	Lifestyle %	Diet %	Chi-square p value
Age (years)						
18-29	159	23	74	10	5	0.3055
30-39	146	21	65	10	8	
40-49	140	20	65	12	11	
50-59	138	20	71	11	9	
60-69	90	13	72	6	16	
70+	32	5	75	9	12	
Sex						
Men	344	49	72	6	9	0.0004
Women	361	51	68	14	10	
Race						
White	589	84	73	9	8	0.1049
Black/African American	62	9	52	20	15	
Asian	29	4	59	7	15	
Hawaiian/American Indian	22	3	48	14	19	
Other	3					
Ethnicity						
Latino/Hispanic	57	8	63	12	13	0.8825
Not Latino/Hispanic	645	91	71	10	9	
Don't Know/Not Sure	3					
Annual Household Income						
Less than $25K	171	24	62	15	14	0.0591
$25K-$49,999	218	31	73	9	7	
$50K-$74,999	140	20	66	13	10	
$75K or more	176	25	77	5	7	
Education						
Some High School	15	2	69	23	0	0.1680
High School Graduate or GED	151	21	62	15	8	
Some College or Technical School	282	40	70	11	11	
College Graduate	177	25	74	8	9	
Master's Degree	64	9	70	3	8	
Doctoral or Professional Degree	16	2	81	0	19	

Data source: Survey Sampling International, 2012.

Data source: Survey Sampling International, 2012.

Figure 2. *Perceived relationship between Life Expectancy and spending of GDP on healthcare*

Participants were asked to project what life expectancy would be with specific associated-levels of GDP-spending on healthcare, of which 665 responded. Repeated measures analysis of variance showed an increase in average life expectancy with GDP spending on healthcare (Wilks' Lambda p = 0.0008). Average life expectancy according to percent GDP spent on healthcare is shown in Figure 2. This result is consistent with the hypothesis of public perception that a positive association between healthcare spending and life expectancy would continue through 100% GDP spending on healthcare. Repeated measures analysis also found that among the selected demographic variables considered in this study, perceptions of the association between healthcare spending and life expectancy significantly differed according to education level (Wilks' Lambda p = 0.0019). The average

of the responses collected indicated an increase in life expectancy of 11 years for an increase in GDP spending on healthcare from 0 to 10%, 21 years for 0 to 25%, 28 years for 0 to 50%, 34 years for 0 to 75%, and 41 years for 0 to 100%.

A linear relationship between average life expectancy and percent GDP spent on healthcare appears, for each level of education (Table 2). A linear model explained most of the relationship between perceived life expectancy and percent GDP spent on healthcare for each level of education. In general, the slope showing the average change in life expectancy per unit increase in percent of GDP spending on healthcare decreased with education. On the other hand, the average level of life expectancy at 0% GDP expenditure on healthcare increased with education.

Table 2. Linear relationship between perceived life expectancy and percent of GDP spent on healthcare according to education.

	Intercept	Linear Slope	R^2
Some High School	30.4	10.4	0.98
High School Graduate or GED	34.8	9.2	0.99
Some College or Technical School	40.4	8.3	0.99
College Graduate	45.8	6.9	0.92
Master's Degree	46.0	7.8	0.93
Doctoral or Professional Degree	48.8	6.0	0.98

Data source: Authors' analysis of data from Survey Sampling International, 2012.

4. Discussion

This study evaluated the public's perception of how increasing levels of GDP spending on healthcare impact average life expectancy. The results showed that the public perceived that increasing spending on healthcare through 100% of GDP would promote increasingly higher life expectancy, in a linear fashion. The public is largely unaware of this growing gap and recent analysis suggests that most of the United States population mistakenly attributes the majority of increased life expectancy in the past century to advances in healthcare, not public health efforts [11]. Advances in healthcare is only one of the many influences on life expectancy [4, 12].

Researchers have posited that healthcare spending is a poor indicator of health outcomes within a nation [13]. Typically, the most cost-effective nations will focus first on vaccinations and maternal/infant interventions; this initial spending on prevention results in significant improvements in life expectancy [14, 15]. As nations expend further resources on healthcare, the benefit of each dollar spent becomes less significant [13]. Finally, in well-developed countries, increasing expenditures on healthcare require more frequent use of high cost medical technology; this technology benefits fewer patients and the cost-benefit curve begins to level off. The principle of diminishing returns posits that increased spending on healthcare will improve health outcomes, but to a lesser degree for each additional dollar spent, eventually resulting in a flat cost-benefit line. This phenomenon has also been referred to as "flat-of-the-curve medicine" [16].

While the principle of diminishing returns provide valuable insight into the relationship between spending on healthcare and health outcomes, the assumption that the cost-benefit line will remain flat is incomplete. Because there are public health efforts that require financing, it can be deduced that when a certain level of spending on healthcare is reached, the population's health status and life expectancy will start to decline. For example, a society that spends every dollar on healthcare will eventually starve its population. Declining health status could thereby be associated with less funding for many other important health determinants.

Consider the importance of individual and societal level spending on public health prevention efforts. Health outcomes are improved throughout society when adequate funding is available for housing [17], early childhood development programs [18], family planning services [19], public transportation and city planning [20, 21], safe highway engineering [22], chemical dependency treatment [23], and pollution control [24]. Individually-based health outcomes are affected by available funding for retirement [25], vacations [26, 27], personal fitness equipment [28, 29], mental health treatment [30], and fresh fruits and vegetables [31]. Education is an important indicator of health outcomes and improves those outcomes by improving health behaviors and by providing income for spending on social services [3, 32]. Improving financial security decreases stress levels, improves psychological status, and improves long-term health outcomes [33]. At some point, spending too much money on healthcare in place of public health prevention will result in poorer health outcomes and decreased life expectancy.

Although our results showed an inaccurate perception of the relationship between the percent of GDP spent on healthcare and life expectancy, defining an ideal percent of GDP to spend on healthcare is not universally plausible. When considering healthcare service expenditures in a nation a number of factors must be considered. These factors include the desired level of health status of its citizens, the cost effectiveness of available medical interventions, and the demands of GDP revenue for non-healthcare services.

Although all education levels of participants in the current study perceived a positive linear association between life expectancy and % GDP spent on healthcare through 100%, the slope showing the relationship decreased with increasing education. In addition, perceived life expectancy when 0% of the GDP was spent on healthcare increased with education level. This may be because people with higher education better appreciate the important contribution public health plays in increasing life expectancy.

5. Conclusion

The projected increases in spending on healthcare in the United States in the coming years will likely continue to have a negative effect on spending on public health prevention efforts, resulting in diminishing returns on expenditures and eventually a decline in health outcomes and life expectancy. Public perceptions are skewed regarding the relationship between spending on healthcare services and life expectancy. The perception that life expectancy will continue to increase with increasing levels of spending on healthcare, in a linear fashion, even to the point of spending the entire GDP on healthcare, is a concern. Public health prevention efforts in the United States will continue to have the primary influence on the health status of the nation for years to come. This perception is positively associated with higher education.

It may be difficult for society to find the optimal balance between spending on healthcare services and public health prevention. Funding for social services, public health interventions, and other non-healthcare health determinants is important; failure to allocate the appropriate funding in public health may cause the United States to continue to fall behind other countries in measures of life expectancy and other health indicators. Efforts should focus on correcting the public's misperception that increasing spending on healthcare services, in lieu of other public health spending, will always result in better health outcomes.

Author's Contribution

RMM: Designed, conceptualized, analyzed, and prepared the manuscript.

GBL: Designed, conceptualized, acquired the data, and prepared the manuscript.

CCA: Prepared the manuscript.

Conflict of Interest

The authors declare that they have no competing interests.

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