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The Contribution of Public Health and Improved Social Conditions to Increased Life Expectancy: An Analysis of Public Awareness

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Abstract

Background: Historical analysis of health data suggests the majority of the life expectancy increase that occurred during recent centuries was caused by improvements in public health and social determinants of health. The purpose of this study was to assess lay public perceptions regarding why life expectancy has increased.

Methods: A nationally representative sample of 705 adults were surveyed to determine which factors people credit for the 40 plus year increase in life expectancy that occurred since the mid-1800s. Survey items included open-ended questions, rank ordering of possible explanations, and numeric estimates of attribution.

Results: Participants in the study rarely attributed increased life expectancy to public health measures or improvements in social health determinants. In contrast, subjects believed that medical care, by far, played the predominant role and attributed medical care for causing 80% of the life expectancy increase.

Conclusion: The public grossly overestimates how much of our increased life expectancy should be attributed to medical care and is largely unaware of the critical role played by public health and improved social conditions determinants. These misperceptions may hinder adequate public health funding and efforts to address important health-related social issues. Misattribution of credit may also contribute to overfunding the medical sector of the economy and impede efforts to contain health care costs.

Keywords: Life expectancy; Public health; Social determinants of health; Medicine

Introduction

Public health historians and epidemiologists calculate that the majority of the life expectancy increase during the last 200 years resulted from control of infectious diseases, more abundant and safer foods, better sanitary conditions, and other nonmedical social improvements [1-5]. The greatest increase in life expectancy, referred to as the "First Public Health Revolution," occurred between 1880 and 1920, before the advent of antibiotics and advanced surgical techniques [6-8]. It has been over 90 years since this era and the important contribution of nonmedical health determinants may be largely unknown and unappreciated by the lay public. We were unable to locate any studies that specifically addressed the lay public's explanations for the historical increase in life expectancy, which represents an important gap in the professional literature.

The purpose of this study was to measure how people explain the historical increase in life expectancy. It was hypothesized that people would attribute most of the progress in life expectancy to medical care, based on a preliminary assessment conducted among college aged public health students. The research hypothesis was also supported by a class assignment in which we required over 30 students to each survey 10 individuals as to what they thought were the primary reasons explaining the increase in life expectancy over the past century. It may be that people can more easily relate to the direct effects medical care can have on health versus the prevention conditions and behaviors of the distant past. Failure to accurately attribute credit for health improvements may predispose a society to overfund the healthcare sector of the economy, which focuses on treating rather than preventing health problems. Conversely, such misperceptions may reduce public support of contemporary public health programs and efforts to address social determinants of health.

Background

While several indicators are commonly used to monitor the public's health, life expectancy is perhaps the most widely used and best recognized. Life expectancy is the average number of years lived by all members of a population [9]. It is extremely useful when comparing the relative health of populations from different locations and time periods. The indicator is by no means a new concept; life tables have been used to evaluate life expectancy since the days of John Graunt (1662) in England [10].

Numerous conceptual models have been used to account for the factors that determine health and life expectancy. In the 1970s, the LaLonde report proposed that life expectancy was the result of lifestyle, the physical environment, medical care, and biological factors [11]. Critics suggest this model only views proximate health determinants and ignores the more distal, but nevertheless powerful broader social influences on health [12]. Contemporary health determination models include these broader contributing factors such as poverty, education, housing, food insecurity, unemployment, and income distribution

[13,14]. These more holistic models emphasize the ecological nature of multiple health determinants, which interact to form a "web of causation" explanation of health and life expectancy.

Not all health determinants are equally important. The Health Impact Pyramid developed by Frieden postulates [15] that both addressing socioeconomic factors and changing the social/environmental context of health-related decisions have the greatest ability to increase life expectancy. Despite these recommendations, the United States spends almost 18% of its gross domestic product (GDP) on technologically-oriented healthcare, and underfunds cost effective public health programs that have been proven to improve population health [16].

The predilection to improve health through medical interventions may partially result from not knowing that major life expectancy gains in the last 200 years were primarily the result of improvements in nonmedical determinants of health [1-5]. Historical analysis indicates that improved sanitation in the form of public water treatment, sewage management, food inspection and municipal garbage collection nearly eliminated the diseases of cholera, dysentery and typhoid [17]. Revolutionary methods of agricultural production, food transportation, and preservation greatly improved the average diet eradicating many nutritional deficiency-caused diseases and improving immune function against infectious diseases [18]. In 1900, tuberculosis was the number two cause of death in America [1]. Better housing, less crowded living conditions, and improved nutrition tremendously reduced this disease long before the first effective TB drug was developed in 1946 [19]. Approximately half of the reduction of the coronary death rate in the last 50 years is attributed to lifestyle improvements, which primarily reduced tobacco use [20,21]. Unintentional injury and occupational deaths rates were significantly reduced through regulations, education and engineering changes [22]. Air quality has improved with the elimination of coal burning furnaces, leaded gasoline and better industrial emissions regulation [23]. More education, higher literacy rates, child labor laws, and increased economic prosperity also greatly improved life expectancy and health [5,24-26].

As a result of these improvements in nonmedical determinants of health, and in combination with advancements in healthcare, life expectancy increased from approximately 39 years in the mid-1800s to nearly 79 years by 2014. [27,28]

The Center for Disease Control and Prevention estimated in 1999 that 25 of the 30 years of increased life expectancy in the United States in the Twentieth Century were attributed to advances in public health [1]. McKinlay and McKinlay calculated that only 3.5 of the total mortality decline between 1900 and 1970 could be "ascribed to medical matters" [25]. Bunker calculated that clinical prevention and therapeutic interventions could be credited with five and a half of the thirty-year increase that occurred in the United Kingdom from 1900 to 2000 [29]. Hence, public health interventions and improved social conditions can take most of the credit for the increase in life expectancy experienced since the mid-1800s.

Methods

Population

Analyses are based on a representative cross sectional survey of the U.S. adult population. The distribution of selected demographic variables was similar between survey participants and the U.S. population.

Sample

Survey data were gathered from an online sample of actively managed panels of high quality respondents who have been recruited by a large professional public opinion/marketing research company called Survey Sampling International [30]. The online sample involved respondents from the United States who were willing to provide their honest opinions. The company's reward system engaged and motivated participation and encouraged better representation. Participants who have an interest in contributing to research were incentivized to be members of the company's response panels. The strict quality control procedures used by the company's recruiting practices ensures that samples of opt-in respondents are of high quality. The demographics of potential respondents were known to the research company before an invitation to participate was extended. The opportunity to complete the survey was progressively closed to some potential respondents after select demographic variables were sufficiently represented in the sample. This procedure ensured that the generated sample was representative of the United States national demographic profile 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. Twenty such responses were eliminated from the analysis, resulting in a final sample size of 705.

Instrument

A questionnaire was developed to assess what factors the public believes contributed to the increased life expectancy and health improvements over the past two centuries in the United States. Three public health faculty, separate from those on the current study, evaluated the instrument for content and face validity. This resulted in a revised version of the questionnaire that was then tested on a convenience sample of twenty individuals who were thought to be representative of the U.S. adult population. This resulted in a few additional minor revisions, following which the instrument was administered to a group of 357 public health students. Based on the hypothesis that the majority of people would attribute the increase in life expectancy to medical care instead of public health prevention, an effect size and standard deviation was obtained from the pilot study group to calculate the required sample size. Human subject approval to conduct the survey was obtained from the research team's academic institution.

The survey utilized questions that provided three alternative measurements of how people explain the historical increase in life expectancy. The survey begins with a statement that "This survey deals with health, disease and life expectancy. Life expectancy is defined as the average number of years people will live from birth. Future life expectancy is the number of years the average person will yet live after reaching a certain age." They were then asked in an open-ended question, as follows: "In the United States, average life expectancy was 35 years in 1850 and 79 years in 2011. What is the single biggest reason for this improvement in life expectancy?" Responses were independently coded by two researchers into the categories of "modern medicine," "better nutrition," "healthier lifestyle," "sanitation," "education, awareness, knowledge," and "other/don't know." The responses were numerically coded and the few

discrepancies (n=7) that occurred were recoded after discussion and mutual agreement.

Second, participants were given a list of six factors that public health historians suggest were major causes for life expectancy increase since the mid-1800s. This second measure of attribution provided plausible explanations which participants may not have recalled and, therefore, considered when answering the open-ended questions. The question asked was: "Several factors have contributed to the rise in life expectancy seen in the U.S. from 1850 to the present day. Below, rank each factor by its level of contribution to the rise in life expectancy. 1= the most important factor, 2= the second most important factor, and so forth until you reach 6= the least important factor." The factors to be ranked were improved sanitation, improved food production, vaccinations, modern medicine (surgeries, medications, diagnostic techniques, etc.), reduction in poverty, and public education. These first two questions only allowed for a ranking of explanations to be calculated.

Third, the proportion of improved life expectancy people attributed to healthcare/modern medicine was assessed. Participants were informed that the nation spent 17% of its Gross Domestic Product in 2011 on healthcare/modern medicine (e.g., physicians, hospitals, clinics, diagnostic technology surgery, and antibiotics). They were then asked "What would life expectancy be if we spent nothing on healthcare/modern medicine."

Demographic data were collected to ensure that a representative sample had been drawn and to analyze potential differences in responses between groups. Demographic variables included age, sex, race, ethnicity, income, and education attainment.

Statistical Techniques

Frequency distributions were used to summarize and describe the data. Bivariate analyses were used to evaluate the relationship between selected variables, with the chi-square test used to evaluate significance. The Mantel-Haenszel (MH) chi-square was also used to evaluate differences in trend. Two-sided tests of hypotheses were evaluated using the 0.05 level of significance. Analyses were performed using the Statistical Analysis System (SAS) software, version 9.3 (SAS Institute Inc., Cary, NC, USA, 2010).

Results

Participants are characterized according to selected demographics in Table 1. Sixty-four percent of participants were younger than age 50. There was a slightly higher percentage of females than males, and most were white, non-Hispanic. Fifty-five percent had an income of less than $50,000 per year and 63% had less than a college degree.

Age (years)	No.	%
18-29	159	23
30-39	146	21
40-49	140	20
50-59	138	20
60-69	90	13
70+	32	5

Sex		
Male	344	49
Female	361	51
Race		
White	599	85
Black/African American	59	8
Other	47	7
Ethnicity		
Latino/Hispanic	57	8
Not Latino/Hispanic	645	91
Don't Know/Not Sure	3	0
Annual Household Income		0
Less than $25K	171	24
$25K-$49,999	218	31
$50K-$74,999	140	20
$75K or more	176	25
Education		
Some High School	15	2
High School Graduate or GED	151	21
Some College or Technical School	282	40
College Graduate	177	25
Master's Degree	64	9
Doctoral or Professional Degree	16	2
Source: Survey Sampling International, 2012.		

Table 1: Summary of participant characteristics.

Responses to the open-end question, which asked participants to identify the single most important reason for increased life expectancy, were most commonly classified as "modern medicine" (Table 2). Far fewer responses were classified as "improved lifestyle," or "improved nutrition," and fewer still were classified as "education, awareness, or knowledge" or "improved sanitation."

Participants were asked to rank from high to low the relative importance of six factors that have been cited in the literature as playing key roles in increasing life expectancy (Table 3). The reason most commonly selected as most important for increased life expectancy was modern medicine. Other factors, such as vaccination and sanitation were much less likely to be ranked first. Education, poverty, and food production combined only received 20% of the first place votes. Bivariate analyses assessed whether selecting modern medicine as the most important reason was associated with age, sex, race, ethnicity, education, or annual household income. Only race was statistically significant, with 45% of whites selecting this item as most important compared with 32% of non-whites (p=0.0151).

Life Expectancy	No.	%
Modern Medicine	462	66
Improved Lifestyle	67	9
Improved Nutrition	62	9
Education, Knowledge	15	2
Improved Sanitation	14	2
Other, Don't Know	85	12
Source: Survey Sampling International, 2012		

Table 2: Open-ended Responses for Explaining Increased Life Expectancy.

Life expectancy	No.	%
Modern Medicine	302	43
Vaccination	141	20
Sanitation	120	17
Education	72	10
Poverty	43	6
Food Production	27	4
Source: Survey Sampling International, 2012.		

Table 3: Primary reasons given for the improvement in life expectancy

When asked to project what life expectancy would be if society had all the modern conveniences (e.g. sanitation, education, sufficient income and food production), with the exception of "healthcare/modern medicine," the average response was approximately 47 years. This would be a decline of 32 years from our current life expectancy of 79 years. These data indicate that of the 40-year life expectancy increase since the mid-1800s, the public attributes 80% of the improvement to modern medicine and only 20% to all other factors.

Discussion

The results of this study show that adults in the U.S. attribute 80% of the improvement in life expectancy since the mid-1800s to modern medicine. The combined impact of improved sanitation, literacy, housing, health behaviors, food production, safer environments, and other public health factors received relatively little credit. These misperceptions were consistently observed across the levels of age, sex, race, education or income.

This study has important implications for a nation that far outspends all others on healthcare, despite a life expectancy ranking in 34nd place [30]. Prudent national health policy that seeks to increase life expectancy and lower healthcare costs should better appreciate the importance of multiple determinants of health. An incorrect understanding of the contribution of public health measures may have resulted in poor policy decisions and distorted funding priorities.

The 2011 World Health Organization Rio Conference report challenged nations to improve health by addressing social health determinants [31]. Unfortunately, when people believe increased life expectancy is primarily the result of technology intensive medicine, they may be more willing to expend a large portion of the national budget on the healthcare sector of the economy. Consequently, fewer resources are available to conduct population-based public health interventions and address social health determinants that improve health, with primary emphasis on prevention.

Many factors might explain the public's failure to accurately attribute the reasons for improved life expectancy in the United States and elsewhere. Most importantly, society may have simply forgotten. It has been over ninety years since the end of the first public health revolution (1880-1920). Many people today have no personal knowledge of it and, consequently, no fear of many of the diseases that were prevalent at the time, such as cholera, tuberculosis, dysentery, typhoid, rickets, or scurvy. Further, they have little appreciation for how these health problems were solved.

The media may play a role in causing the misperceptions identified in this study. Television programs dramatize and glamorize the world of modern medicine and portray healthcare as having amazing powers to restore health [32]. Television dramas seldom communicate to viewers that environmental factors, poverty, housing, food insecurity, education or social welfare, are powerful predictors of health. In addition to the entertainment function of television, new drugs and medical procedures are also consistently given great attention in broadcast news. By contrast, public health interventions are successful when things do not happen. By definition, the news media does not report on things "not happening." As a result, the public inflates the relative importance of modern medicine in relation to other health determinants.

Another reason for imbalance of credit for increased life expectancy is that the benefits of medicine are individualized rather than population-based. Medicine treats individual patients who can see the causal connection between treatment and outcomes. Results are also often seen in a short time frame. Patients know they have been helped and are grateful. In contrast, the cause-and-effect link between a public health program and improved health often occurs in the distant future and, therefore, difficult to see. The beneficiaries of public health programs are often unaware that they have been helped [33]. As a result, there is little or no sense of gratitude and relatively little support for funding public health programs.

It is not known whether the under-attribution of credit to the nonmedical health determinants is a belief that can be readily changed. Future research should determine if educational interventions can correct the misperceptions and blind spots identified in this study. There are two limitations that may have influenced the survey results. The survey was conducted online and, therefore, excluded individuals who had no access to computers. People with less education and lower income may be underrepresented in this study. The study was also conducted only in English and excluded a portion of some minority groups.

Conclusion

People are largely ignorant of the factors that have been responsible for increasing life expectancy. The misperceptions identified in this study have implications for national health policy. The society that fails to understand that improvements in nonmedical determinants of health were primarily responsible for past increases in life expectancy may be less likely to support contemporary interventions and policies which seek to address these important but less visible health

determinants. Public health workers have the formidable and important challenge of helping the medically-mesmerized public understand that many factors, outside the walls of hospitals, have a profound influence on life expectancy. Health education's role in public health needs to expand from the focus on individual decision-making. The most fundamental objective of health education is to help society [34] understand what factors contribute most to increased life expectancy and [35] that by addressing those factors, society has the greatest potential to improve the nation's health.

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