

# The role of health care systems on populations' health status and longevity: A comprehensive analysis

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## Abstract

**Background:** Western populations enjoy unprecedented wealth and longevity. This increase in life expectancy is staggering, posing tremendous challenges in disease burden, especially in chronic diseases such as diabetes, hypertension, hypercholesterolemia, cancer and cardiovascular disease (CVD). Limited studies investigate the effect of health services on longevity in adult populations. In this work, findings from studies throughout the world are presented and analysed in order to evaluate the effect of health services on population's health status.

**Methods:** Published results from studies that assessed the associations of public health services (i.e., physicians supply) on longevity were retrieved (searches in Pubmed, Scopus, up to January 2010) and summarized.

**Results:** Few studies, mostly located in the US and UK, have evaluated the role of health services on the population's health status. The majority of the studies reported an association between the frequency of physicians and mortality, while some other studies reported weak or no associations between physician supply and longevity. No data are available regarding other health care services, like nursing or dietetics support.

**Conclusion:** Although very few data are available, it seems that there is a relation between quality and quantity of health care services and longevity. However, there is still a serious lack of evidence especially in other areas of health services as well as in various populations.

**Keywords:** Health systems, health services, physicians, mortality, longevity

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## Introduction

Public health, as an organized effort of the society, espouses several principles, namely: (a) emphasis on collective responsibility and role of the state; (b) focus on the whole of the population; (c) emphasis on prevention; (d) concern for the underlying socio-economic determinants of health and disease; (e) multi-disciplinary approach (both quantitatively and qualitatively); and (f) partnerships with populations served [1]. These principles form a basis for evaluating the functioning of health care systems [2]. Specifically, medical care (with its emphasis on personal clinical services) and public health (with its emphasis on collective societal efforts for population health) represent the two traditional components of a health system [3-6]. It is known that health services categorized in three different groups: primary, secondary and tertiary care. Primary health care is defined as a system providing a bundle of basic and completed services, at individual as well as at family level, and constitutes the first contact point of the citizen with the health system. Primary health care is the basis for a health system; it deals with the community health problems, provides services of promotion, prevention, treatment and restoration of health, based on scientifically substantiated, socially acceptable, practically applicable and financially accessible methodologies [6]. Secondary health care refers to those services particularly provided by hospitals, usually at local level while, tertiary health care refers to specialised, hospital-based services [4, 5]. Secondary health care is also of major importance for the population's health status, and could be prevention mean, too. For example, patients with established, non-communicable diseases, such as CVD, are at a particularly high risk of death. An effective secondary prevention at hospital setting, which includes smoking cessation, dietary and other lifestyle modifications, together with assistance in order to improve compliance to medication, can reduce CVD risk and, consequently extend survival [7].

Western populations currently enjoy unprecedented wealth and longevity [8]. According to the World Health Organization (WHO), the proportion of people over the age of 60 is growing faster than any other age groups [9]. Additionally, WHO estimates that by the year 2025, 120 countries will have reached total fertility rates below the replacement level, compared with 22 countries in the 1970s. With the increasing emphasis on health and the progressive lengthening of the average life span, both scientific community and general public have been examining ways to improve well-being and to prevent disease at every stage of life. Globally, CVD and cancer are the leading causes of mortality and loss of disability-adjusted life years [10]. It is expected that public health systems can influence many of the modifiable risk factors and increase quality of life, while avert or minimize the need for expensive medical care. Furthermore, the impact of an unhealthy lifestyle is large for the individual. In particular, an individual who smokes and is overweight and physically inactive may lose seven or more years of life expectancy, because of these reasons. Medical services, composed of preventive services and therapeutic intervention, seem to add almost five years increase in life expectancy since 1900, and almost 7 years of increase since 1950 [11]. There has been a longstanding debate within researchers as to whether longer life is associated with a compression of morbidity, an expansion of morbidity, or a combination of both, with an increased prevalence of chronic diseases counterbalanced by a decrease in the severity and consequences of the same diseases. Nonetheless, there are accumulating data that the prevalence of chronic disability is decreasing in longer-living persons [12]. Furthermore, longer life is also accompanied from a better quality of life [13]. The role of a healthy lifestyle and behaviour, such as a healthy diet (that includes moderate alcohol, low fat, and rich in fruit and vegetable consumption), daily

exercise, avoidance of smoking, and low depression and stress levels, in the prevention and control of morbidity and premature mortality due to non-communicable diseases, has been well-established by the vast population-based epidemiological research carried out over the last three decades [14].

This work focuses on studies that investigated the associations of public health care services with various health outcomes, in middle aged and elderly populations. As health care services we refer to all the services that can be offered by the health system of a country. E.g., the role of general and special physicians, the role of nutritionists and finally the role of the nursing staff is very important in health services.

## Methodology

*Table 1* summarizes the studies that will be discussed here. Original-research studies that were published in English, between 1975 and January 2010, were selected through a computer-assisted literature search (i.e., Pubmed <http://igm.nlm.nih.gov>, and Scopus [www.scopus.com](http://www.scopus.com)). Computer searches used combinations of keywords relating to diseases (cardiovascular diseases, cancer, mortality, longevity, health outcome) and health systems (health services, nutrition services, primary care, physicians supply, family doctors). In addition, the reference lists of the retrieved articles assisted in finding relevance to the present articles that did not allocate through the searching procedure. The following information was abstracted according to a fixed protocol: design of study (cross-sectional or longitudinal cohort), sample size, age (adult population) and sex of participants, assay methods, and degree of adjustment for potential confounders. Thus, 17 studies were selected and discussed; of them 12 were longitudinal and 5 was cross-sectional (Table 1).

## Results and Discussion

### Health care services and population's health

There has been a series of research reports that have described the association between the supply of physicians and health outcomes, such as CVD and cancer mortality [15-31]. This favourable association of medical resources and health has not always been well understood and appreciated. Analysis of long-term mortality trends in United States and Europe from 1900 to 1988 found that medical care could only account for a very little proportion, of the overall decline in mortality while sometimes presented even inverse associations [29-33]. Other studies found that the supply of physicians has been reported to have a "persistent, but puzzling positive correlation" with mortality rates that could not be "adjusted away" by potential confounders, such as income [22,30]. Inverse relationships (i.e., more physicians are associated with lower mortality) have been reported in the United States for overall physician supply, as well as for the supply of primary health care physicians [19,20]. Shi and colleagues presented that a higher number of physicians is associated with lower mortality from CVD and cancer [14-18]. The latter finding is in agreement with other investigators, too [23,24]. In particular, Macinko and colleagues showed that a "strong" primary health care system and practice characteristics, such as geographic regulation, longitudinality, coordination, and community orientation, is associated with improved population health [21]. Furthermore, according to Starfield and colleagues [19] there is already a considerable evidence that by increasing the supply of primary care physicians there would be a beneficial impact on the health of the population.

On the other hand, some researches refer to a paradox in primary care [34]. In particular, some studies presented only regionally focused associations between physician supply and mortality [34], while former studies presented weak or no association [29-31]. Recently, in Europe, a study reported that there is not any

significant relationship between the number of general physicians and mortality rates; however, a significant association of the composition of physicians exists. Specifically, the presence of more independent contract physicians reduces mortality rates compared with situations where more of them are employed by the municipality [26]. Also, another study reported that after adjusting for deprivation, social class and ethnicity, mortality indicators were strongly associated with the socio-demographic characteristics of registered populations, but were less consistently associated with the characteristics of primary care services (such as general practitioners) [27, 28]. Summarizing the findings of the abovementioned studies, 10 out of 17 (58.8%) reported that health care system plays a significant role in life-expectancy of the population, 4 out of 17 (23.5%) reported a moderate or weak association, 1 out of 17 (17.6%) reported no association and 2 out of 17 reported inverse association (i.e., health system is associated with worse health status of the population) (*Figure 1*). It is of interest that almost none of these studies evaluated the influence that may have other components of the health care system, like the nursing and the dieting component. Numerous long-term observational studies, have underlined that both, nursing and dietetic support are considered as important parameters in the prevention of any level, and diet together with other lifestyle recommendations and emotional support may assist people live better and longer.

Regarding the Greek reality, the available data, presented over-availability in doctors and deficits in nursing personnel, with wide discrepancies between their distributions in various regions of the country. In 2000, there were 53,200 doctors in the country or 42 doctors per 10,000 population making Greece second in Europe (after Spain) in the ratio of physicians per population [35]. Nevertheless, there is a wide variation between the distribution of doctors in different regions, since in the greater Athens area in 2000 there were 88 doctors per 10,000 people, whereas in other

regions (like Central Greece and the Aegean Islands) the corresponding ratio is less than 30 per 10,000 people [35]. A recent survey reported that better management of persistent primary care use, may address the patients' underlying problems, reduce unnecessary demand, and relieve some of the pressure on the capacity of primary care providers to deliver care to all patients [36]. The majority of studies in Greece underlined the necessity for re-organization of the national health care system and the appearance of a strong primary care [37]. However, it should be noted that there are very limited reports that have assessed associations between health services (supply of physicians and other health care scientists) and health outcomes in Greece.

## Conclusion

Conclusively, the majority of the published studies have investigated the role of physicians supply in the population's longevity. Globally, few studies, based mainly in the US, have evaluated the role of health care services in the population's overall health status. In Greece, there have been some efforts to describe the role of primary health care in prevention and longevity, but much work is needed in order to have the whole picture of the situation. Furthermore, there is serious lack of evidence that presented associations between physicians and longevity in all age groups, and especially in the elderly, while there are not many studies that evaluate the associations between health services and prevalence of other co-morbidities, like hypertension, diabetes, obesity and hypercholesterolemia. In addition, the role of nurses and dieticians in the health care system, in relation to population health has not been adequately studied. Thus, well-conducted and adequately-powered studies are needed in order to evaluate the various aspects of the health care system (physicians, dieticians and nursing staff) on longevity and well-being status of the general population.

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## Appendix

**Table 1. A summary of studies that evaluated the role of Health Services on population's health.(1/2)**

Studies	Design	Sample	Main finding(s)
Shi et al [15], [16], [17],[18]	Pooled, cross-sectional, time series analysis (longitudinal study)	Adult U.S population	Enhancing primary care, particularly family medicine, even in states with high levels of income inequality, could lead to lower all-cause mortality in those states.
Starfield et al [19], [20],	Pooled cross-sectional analyses (longitudinal study)	Adult U.S population	Populations do not necessarily benefit from an overabundance of specialists in a geographic area. The increasing of supply in primary care physicians would have a beneficial impact on the health of the population.
Masincio et al [21]	Pooled, cross-sectional, time series analysis (longitudinal study)	Adult population from 18 OCED countries	Strong primary care system and practice characteristics were associated with improved population health.
Young [22]	Cross-sectional	Adult population from the Japanese, USA prefectures, and European countries	The availability of medical specialists had little impact on mortality rates in competition with the social and economic variables that were used as controls.
Or [23], Or et al [24]	Pooled cross-sectional analyses (longitudinal study)	Adult population from 21 OCED countries	Physician numbers are an important determinant of mortality, and cross-country heterogeneity in the effect of physician availability on health is significant.
Gulliford et al [27], [28]	Cross-sectional	English population	Mortality is weakly associated with the degree of organisation of practices as represented by the partnership size but not with the supply of GPs.
Aakvik and. Holmas [26]	Pooled, cross-sectional, time series analysis (longitudinal study)	Adult Norwegian population	Reject the significant relationship between mortality and the number of GPs per capita found in most previous studies. There is a significant effect of the composition of GPs.

**Table 1. A summary of studies that evaluated the role of Health Services on population's health (2/2)**

Studies	Design	Sample	Main finding(s)
Robst and Graham [25]	Cross-sectional	Adult U.S population	The number of physicians in a county has a positive influence on the health status of individuals in rural areas. Older people benefit more from the presence of physicians than younger people.
Mackenbach et al [30]	Cross-sectional, time series analysis (longitudinal study)	Dutch population	There are negative associations between mortality and the presence of university hospitals, but also found a few unexpected positive associations with general practitioner density.
McKeown and Brown [29]	Longitudinal study	English population	The rise of population was due primarily to the decline of mortality and the most important reason for the decline was an improvement in economic and social conditions.
Cochrane et al [31]	Cross-sectional	Population from 18 developed countries	The indices of health care are not negatively associated with mortality, and there is a marked positive association between the prevalence of doctors and mortality in the younger age groups.

*OECD: Organisation for Economic Co-operation and Development*

*Figure 1: Results from 17 studies that evaluated the the association between Health Care Services (i.e., number of physicians) and population's health (i.e., longevity, quality of life).*

