

The Story of the American Healthcare Workforce, 1850-2017: A Time Series Analysis

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Abstract

Context: America experienced dramatic changes in the healthcare workforce over the past two centuries. Understanding how the workforce changed in density and skill mix over time yields lessons for predicting future workforce dynamics.

Objective: To quantify the changes in the American healthcare workforce from 1850 to 2017. The secondary objective is to quantify the changes in physicians and nurses from 1850 to 2017.

Design: Using data from the work of Kendix, the Census Bureau and the Bureau of Labor Statistics, we performed descriptive analysis on trends in the healthcare workforce from 1850 to 2017.

Setting: America from 1850 to 2017.

Participants: American healthcare workers from the Current Population Survey. Main outcome measures: The study will measure the number of healthcare workers, physicians and nurses. This number will be tracked in relation to the total American population and the total American workforce.

Results: The number of physicians per 100,000 Americans increased from 177 in 1850 to 331 in 2017; most of the gain occurred after 1950 following nearly a century of nearly flat trends. The number of nurses increased to 970 per 100,000 Americans. The healthcare workforce per 100,000 Americans as a whole increased from 198 to 392.

Conclusion: The American healthcare workforce has expanded dramatically over the past two centuries. After a period of flat supply (1850-1960), the healthcare workforce has grown faster than GDP, becoming one the largest sectors of U.S. labor. Understanding the trajectory of the health workforce may guide planning by countries undergoing similar economic transitions.

Keywords: Healthcare workforce ; Healthcare economics ; Health workers ; Gross domestic product.

Abbreviations: BLS: Bureau of Labor Statistics; CPS: Current Population Survey; GDP: Gross Domestic Product; GMENAC: Graduate Medical Education National Advisory Committee.

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Introduction

Health workers are an essential part of healthcare everywhere. The World Health Organization set human resources for health as key to achieving the sustainable development goals and universal health coverage [1]. In the coming years, the demand for health workers is expected to increase worldwide [2] with a projected deficit of 18 million workers by 2030 [3]. This is due to many factors ranging from the increasing options provided by new technologies to increased demand of services from an aging population and the burden of chronic diseases [4]. While the

shortage appears universal, countries differ in the composition, density and skillmix of their workforces.

In America, healthcare accounts for an increasingly large part of our Gross Domestic Product (GDP) and our labor workforce. The size of the physician workforce has expanded over the past century, closely following the trend in increases of the country's GDP per capita [5]. Stewart and Pennell described the health work force between 1930 and 1975, [6] yielding not only an incomplete but distorted impression of the overall trend, with a relatively flat growth during that period. Kendix and Getzen

[7] did a great econometric analysis as far back as 1850, but the analysis does not cover the last 25 years.

In the past decade, healthcare jobs were a major form of job creation after the recession in 2008, composing a third of all new American jobs [8]. The recent growth is an expansion of a health sector that has been growing for the past half century. During that time, the composition of the workforce changed, due to both introduction of new positions and the task shifting of clinical responsibilities. Even with the increasing numbers, current national projections for the physician workforce predict a large physician deficit in the coming years, as opposed to the physician surplus described during Kendix’s period of analysis [9,10].

As human resources represent a larger percentage of our healthcare costs, it is important to understand the size, density and composition of the healthcare workforce. In addition to providing insight into the future of our own workforce, it may help as other countries experience a historic economic transition to middle and upper income [11]. Our analysis of the workforce updates and expands prior studies that looked at different parts of the American story. On the other hand, using data from the Bureau of Labor Statistics and the Census Bureau, this study describes the changes in the healthcare workforce in the United States from 1850 to 2017.

Materials and Methods

Data sources

The Current Population Survey (CPS) is a monthly survey of about 60,000 U.S. households conducted by the United States Census Bureau for the Bureau of Labor Statistics (BLS). The CPS data set has historical records of healthcare workers extending back to the mid-1800s. Healthcare workers were categorized in a variety of ways, depending on the time period it was standardized in. The major standardization for the CPS began in 1973, with subsequent changes in 1983, 1999 and 2011. While physicians were listed in their own category in all the surveys, nurses, technicians and

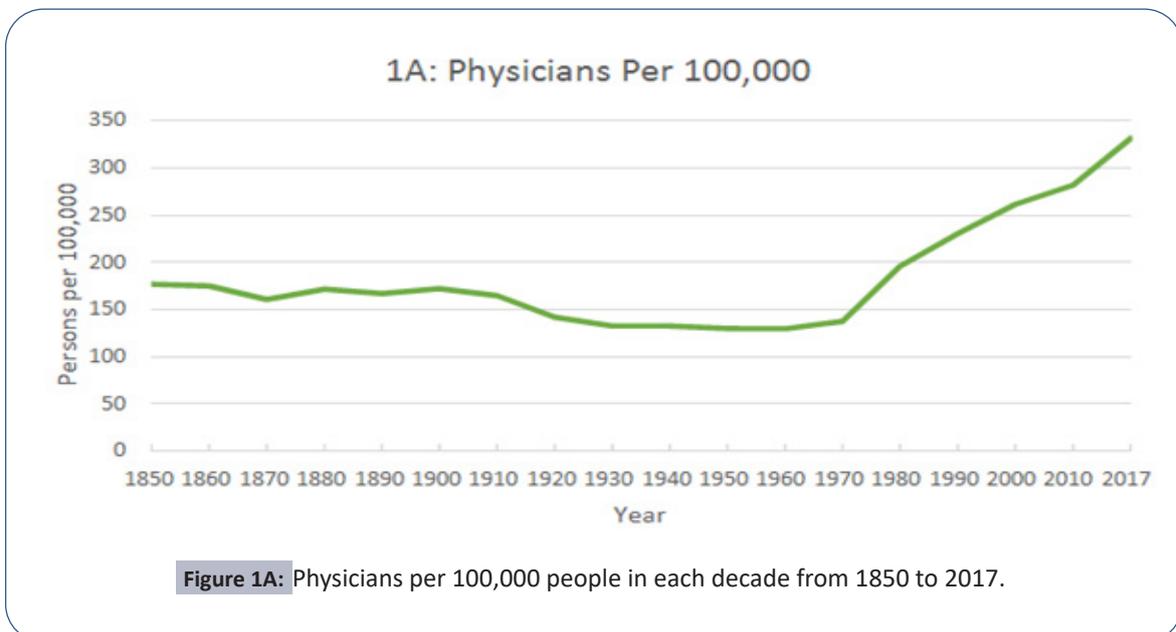
support staff belonged to different categories, depending on what year the survey was done. Unlike other government surveys like the Current Employment Survey, the CPS does not categorize professions by industry. Health workers are counted even if they do not work in the health sector, such as a physician who works as a business consultant or a school nurse. Similarly, the CPS excludes non-clinical hospital staff, such as administrators and custodians, from the healthcare workforce counts. CPS data does not delineate urban and rural physicians, nor to separate private or public employment.

Data before 1972 was obtained from the published works of Kendix [7] and the BLS. For data from 1972 onward, we used the CPS dataset looking at all healthcare workers. We first looked at the number of physicians per 100,000 citizens from 1850 to 2017. This process was repeated for registered nurses, with the first nurses being recorded in 1870. While CPS records native or foreign birth, it does not differentiate between American and foreign medical graduates. We then created a time series of the healthcare workforce sector. To estimate the total workforce in healthcare we used several categories relating to healthcare, including healthcare practitioners, health technologists and health support occupations categories.

Results

The number of physicians per capita increased over time, as shown in **Figure 1A** and **Table 1**. The recent density of 331 per 100,000 population in 2017 is nearly double the 175 per 100,000 in 1850. But the growth rate varied in significant ways: despite population growth, the number of physicians was relatively flat from 1850 to 1900 at around 170 per 100,000 and even decreased to 130 per 100,000 by 1960; since then, the number of physicians rose up by 140%.

The number of nurses per 100,000 increased from 32 in 1870 to 969 in 2017, with no nurses recorded before 1870.



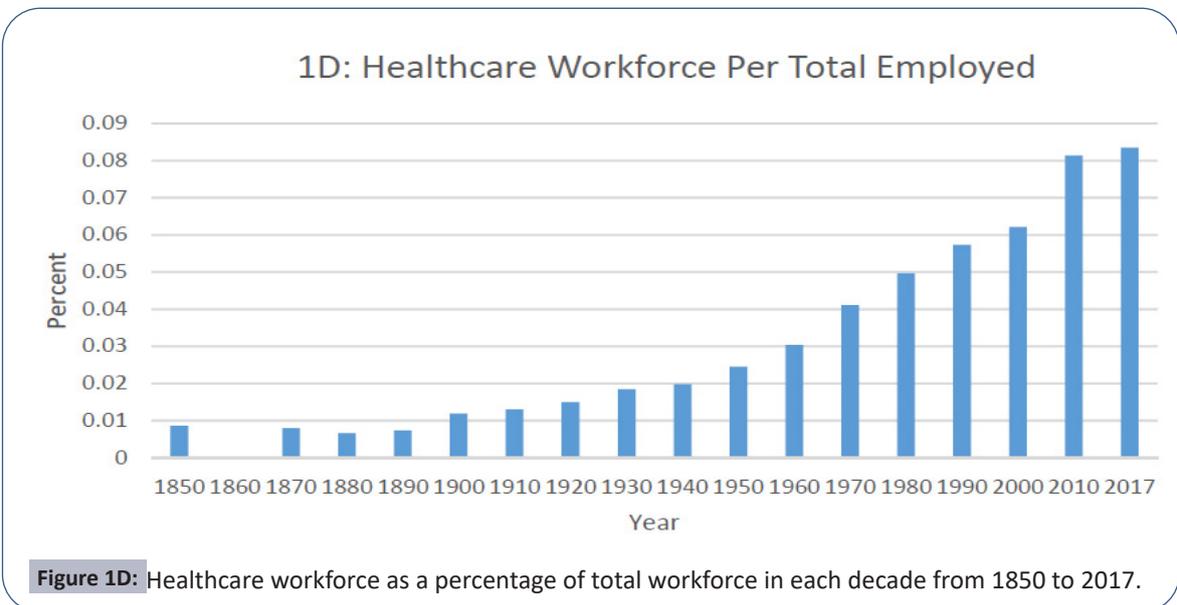
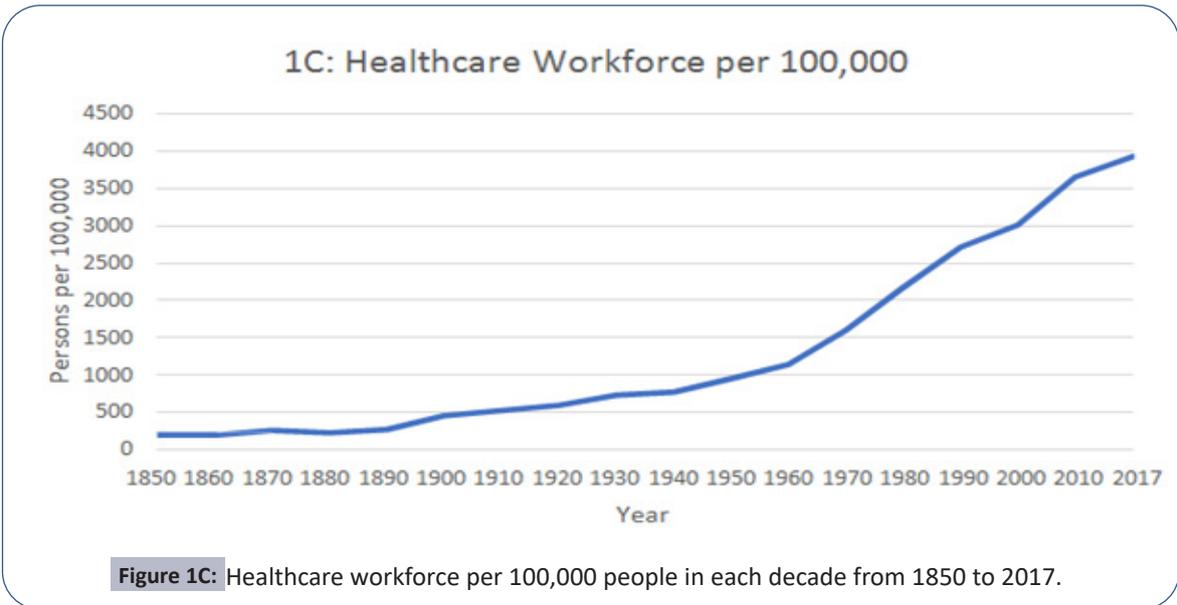
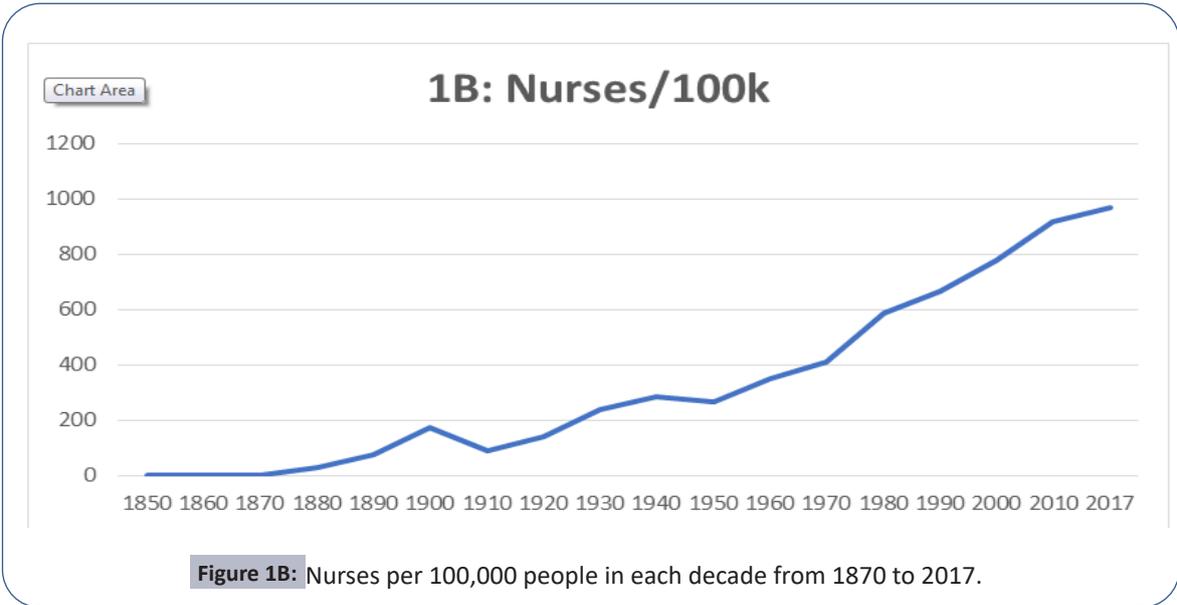


Table 1: Numbers in the healthcare workforce per decade.

Year	Physicians in thousands	Workforce in thousands	Physicians per 100,000	Healthcare workforce per 100,000
1850	41	46	177	198
1860	55	61	175	194
1870	64	103	161	259
1880	86	114	171	227
1890	105	170	167	270
1900	131	346	172	455
1910	152	486	164	526
1920	151	634	142	596
1930	163	900	132	731
1940	175	1020	132	772
1950	198	1450	130	952
1960	234	2063	130	1142
1970	282	3277	138	1598
1980	444	4927	196	2175
1990	577	6,796	231	2717
2000	738	8499	262	3012
2010	872	11313	282	3657
2017	1079	12794	331	3928

The number of healthcare workers as a whole also increased: the workforce was 46,000 in 1850 and by 2017 it numbered 12,794,000. The data is represented for every 10 years since 1850 in **Table 1**. The adjusted health worker per 100,000 Americans is shown in **Figure 1B** and **Table 1**. In 1850 the workforce was 198 per 100,000, and it was 331 per 100,000 in 2017. Health care accounted for a growing proportion of those jobs seen in **Figure 1C** (0.8% in 1850, 2.4% in 1950 and 8.3% in 2017).

Discussion

The American healthcare workforce increased dramatically over the past 160 years. After accounting for population expansion, the healthcare worker density has doubled and represents a growing proportion of all American jobs. In recent years, more than 10% of all employees worked in the healthcare industry compared with 3% in 1965. The figure is higher for cities like New York where 12.3% of all workers were in healthcare in 2016 [12]. This growth has not always been steady, but consistently rising, even during periods of economic recession.

Notably, physician density appears relatively unchanged for a century until the 1970s. There were periods of intentional contraction of the work force as early as the Flexner report in 1910, aimed at lowering physician density in order to increase the quality of physicians. With an expectation of an impending physician deficit in 1959, the Bane report began an expansionist

policy toward physician supply [13]. This predated the 1965 enactment of Medicare and Medicaid, which themselves did not immediately shift up the ongoing trend of the decade. The initial response to the increasing density was directing policy to contract the supply.

The release of the Graduate Medical Education National Advisory Committee (GMENAC) report in 1981 guided US policy on the number of medical schools and residencies in preparation for an oversupply of physicians, with expected areas of shortage in rural and inner city areas [14]. The demand for physicians continued, and the workforce was supplemented by an increasing amount of international medical graduates who become 18% of all residents by 1985 and 22% of all practicing physicians by 1986 [15,16].

Based on predictive models that demand for physicians would decrease due to gains in efficiency, a looming physician surplus was the predominant concern up until the early 2000's. [17] Yet before that date, multiple groups began predicting a physician deficit [18,19]. Newer prediction models by Cooper described the increased demand for physicians due to economic expansion, leading the Department of Health and Human Services to adopt similar predictions of physician deficits by the mid 2000's, despite the increases in supply [20].

The rest of the healthcare workforce experienced a similar growth, though with less central planning and regulation. Since 1960, we see a large increase in the supply of healthcare practitioners,

technicians and support staff. The supply is increased by larger participation of women in the workforce and foreign medical graduates. There has been exponential growth of non-physician clinicians, including the introduction of new careers and training [21].

This data is descriptive and does not explain why the workforce dramatically expanded. There are several theories to explain the drivers of this growth. Baumol's cost disease attributes it to differentials in labor productivity across sectors of the economy. As non-healthcare industries become more efficient and meet social demand, workers shift to sectors like healthcare and education for which the demand is not as easily met [22]. A key enabler of our demand for such labor-intensive services is our ability to pay higher prices for them. Higher GDP per capita is highly correlated to higher total health expenditure [23] and expansion of physician supply.

There are several notable weaknesses to this study. The retrospective and descriptive nature of this analysis is limited due to the methods of collection. As mentioned above, certain surveys changed their definitions of workers at different points making it harder to ensure the entire healthcare workforce is represented in each of the surveys. There were no recorded nurses working until 1870 and even then, the numbers were very small, probably underrepresenting the size of the workforce. This is consistent with the phenomenon of unpaid domestic labor in healthcare, where women historically have played a large role [24]. This dataset looks at healthcare workers and does not address the increases reported by others in administrative healthcare staff

[25]. In addition, this study looked exclusively at the overall number of healthcare workers. It does not comment on full time employment, productivity and expected age of retirement.

This study demonstrates a large increase in the number and density of American health worker since 1850, with a dramatic rise and continuing since 1970. Linear regulatory efforts based on simple demand models or cost concerns have proven ineffective to counter the trend, though linear growth models are still used internationally for human resource predictions [26]. If demographic and epidemiological forces are the main drivers of the uptrend, demand could very well plateau or shrink after the baby boomer peak by mid-century. If a byproduct of economic growth and insatiable appetite for care and wellbeing, the demand and supply of health workers is likely to continue this historical expansion for several decades (**Figures 1A-1D**) [27].

Conclusion

The implications of the macro trends in health workers go beyond the health system and universal coverage. These trends increasingly affect labor markets and, as they approach 20% of all jobs, they will be an additional factor in the political equation of health budgets and elections. Increases in physician density and the healthcare workforce will change the role and responsibilities of a physician as well, even if artificial intelligence proves no more disruptive than previous waves of information and communications technology. A macroeconomic perspective can help plan and develop a suitable health workforce for the 21st century.

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