Comparative Analysis of Health Expenditure Using Data Science

Emily Hey

Skidmore College

Abstract

The healthcare system across countries has drastically different impacts and costs. This paper provides an overview of research comparing the Netherlands, Singapore, and the United States' overall costs for each country's healthcare system. I have broken down the costs, showing where the budgetary income is spread between individual and government allocations. The research specifically focuses on healthcare pricing around the 2009 to 2020 range, considering significant changes in United States policies such as the Affordable Care Act. The goal of this research is to highlight ways in which the healthcare system can improve by learning from successful scenarios.

Introduction

The United States spends significantly more of its gross domestic product on healthcare. However, when examining the health system, it is evident that the cost is not proportional to the results. The OECD (standing for Organization for Economic Cooperation and Development) is an organization of 37 different democracies collaborating to improve the global economy and find solutions to common problems. Based on data the OECD has found, the U.S. has the highest mortality, suicide, obesity, hospitalization, and chronic disease burden rates of all countries involved (OECD, 2023). These higher prices per capita can be traced to higher hospital administration costs, higher salaries for doctors and nurses, and higher drug prices. Nearly twice as much is spent per person for healthcare in the United States. There are shorter hospital stays and fewer physicians. However, the leading cause of this higher pricing is the cost of inpatient and outpatient care (defined as including "payments to hospitals, clinics, and physicians for services and fees such as primary care or specialist visits, surgical care, and facility and professional fees") (Kurani and Cox, 2020). Despite this expense, the results still show less care and worse health outcomes than peer nations.

Improving the affordability of this care would meaningfully improve its accessibility, helping to increase the amount of care in the United States. While the Affordable Care Act has helped insure many people, much more work still needs to be done. The United States is the only high-income country without universal healthcare. Aspects like high out-of-pocket spending provide barriers to reducing gaps in the health system, leading to why those with low incomes in the U.S. are the most at risk.

Literature Review

The United States has some of the highest out-of-pocket medical expenses, with the total potential out-of-pocket medical costs for employees in 2021 being $8,338 on average. These costs lead to a significant number of people in medical debt: 12.6% of adults. However, according to the Commonwealth Fund, 12.1% of adults were uninsured, and between 2019 and 2020, about 60% of adults with mental illness did not receive treatment (Tikkanen and Abrams, 2020). In the context of healthcare across countries, people in the United States tend to spend a lot more while getting fewer beneficial results.

The United States also tends to spend more money on a governmental level in attempts to provide healthcare support. According to the OECD, the United States has significantly higher private and public health spending than other developed countries. In a survey that tested health expenditure as a percentage of gross domestic product (GDP) in selected countries in 2022, the United States was the highest at 16.6% (OECD, 2023). However, higher spending does not mean the U.S. health system is more effective than other developed countries. Mostly, it is due to higher prices rather than more efficient use of money. Given the status of other countries and where they choose to allocate their money, it becomes evident that there are more strategic ways to need fewer financial resources and get a better result.

By analyzing the specific cost breakdown, we can compare the United States to other countries and determine the differences in where governments allocate money and how effective these decisions are. The Commonwealth Fund states that despite this expense of twice as much as the average OECD country, the U.S. has the lowest life expectancy, highest suicide rates, obesity rates, and chronic disease burden. Due to fewer physicians, Americans tend to have fewer physician visits. The technology used is more expensive (Tikkanen and Abrams, 2020).

Methods

This research aims to highlight aspects of the United States healthcare system that can be improved. It started with research into the Affordable Care Act, comparing data from before 2014 (when it was enacted) to data afterward. It quickly became apparent through the data that the Affordable Care Act had improved our healthcare system. The main area the United States seems to be lacking in healthcare accessibility is affordability, leading to many uninsured members of the public.

After the ACA, these numbers were significantly reduced. Table 1 shows that the percentage of uninsured people started decreasing in 2014, and the number of people without insurance continues to be significantly reduced. Public opinion in states initially opposed to the ACA shifted after it began helping them and lowering the number of uninsured people.

Percentage of people in the U.S. without health insurance 1997-2022		
1997	15.40	in %
2005	14.20	in %
2010	16	in %
2011	15.10	in %
2012	14.70	in %
2013	14.40	in %
2014	11.50	in %
2015	9.10	in %
2016	9	in %
2017	9.10	in %
2018	9.40	in %
2019	10.30	in %
2020	9.70	in %
2021	9.20	in %
2022	8.40	in %

Table 1: Percentage of people in the U.S. without health insurance 1997-2022 (CDC, 2023)

Despite the successes of this policy, it was still clear that the United States is far from where many other countries are in terms of expense, inequality of access to healthcare, and misdirected government expenditure. The data suggests that a large majority of where the United States goes wrong is related to expense, both on a governmental level and for the general affordability of the public. The next step in this research was to compare data from other countries with this expense data. This approach helped to discover more about the exact causes of unnecessary expenses in the United States. It can be easily compared by breaking down how the U.S. government distributes its healthcare spending in percentages.

Using data on the total government expense for healthcare, these percentages were converted to USD to determine the exact amount spent. Data from the other countries used were also converted to USD using the average exchange rate for each year of the data. Starting with

Singapore, the first dataset was "Per capita government health expenditure in Singapore from 2011 to 2020" (Singapore Department of Statistics, 2023). After calculating the average conversion each year from Singapore dollars to U.S. dollars, each year of the per capita dataset was multiplied by this average to get as close as possible to the USD conversion (Investing, 2024). The same was done to the Netherlands dataset "Total healthcare expenditure per capita in the Netherlands from 1998 to 2022" (Centraal Bureau voor de Statistiek, 2023), only comparing the same years from 2011 to 2020. Using the same site, the average conversion rate per year from Euros to USD was calculated and multiplied for each year.

The U.S. dataset had a slightly different process since it was already in USD. However, the data, "U.S. national health expenditure from 1960 to 2022" (CMS, 2023), was converted from billions of dollars to per dollar so that each country could be compared under the same scale. Then, it was divided by "Population of the United States from 1610 to 2020" (Gapminder, UN DESA, and Macmillan Publishers, 2019) data to get the value of each year per capita. Otherwise, the U.S. would be disproportionately large to the Netherlands and Singapore.

From this converted data, a bar plot was made comparing the three countries using RStudio to show the total government expense on healthcare from 2011-2020 per capita. This process was repeated with different datasets to compare the personal expense of healthcare. After it became clear that the U.S. exceeded the other countries' spending by a large majority (in both categories), the next step was to figure out why by breaking down the U.S. healthcare spending to see what most of the money is spent on. Using a dataset called "Health spending distribution in the United States by category 2013-2021" (CHCF, 2023) and converting it to a more readable graph allows visualization of the exact situation for healthcare spending in the United States. This data was further converted to per capita to be more transparent about how much is spent on

the average individual rather than dealing with data in the billions of dollars that seems unmanageable to conceptualize.

The data from the Netherlands' healthcare spending per person was placed above it on this graph for each year to show how extreme the United States spending is.

To examine this cost breakdown more closely, the pharmaceutical costs were examined to see how they compare between countries.

Results

Figure 1 depicts the total Government expenses in each country from 2011 to 2020. There is an apparent increase in U.S. spending that remains above the other countries while the others have less consistent indications of trends up or down. This data is in USD per capita, showing that the U.S. spent around $12,000 per person in 2020 on healthcare.

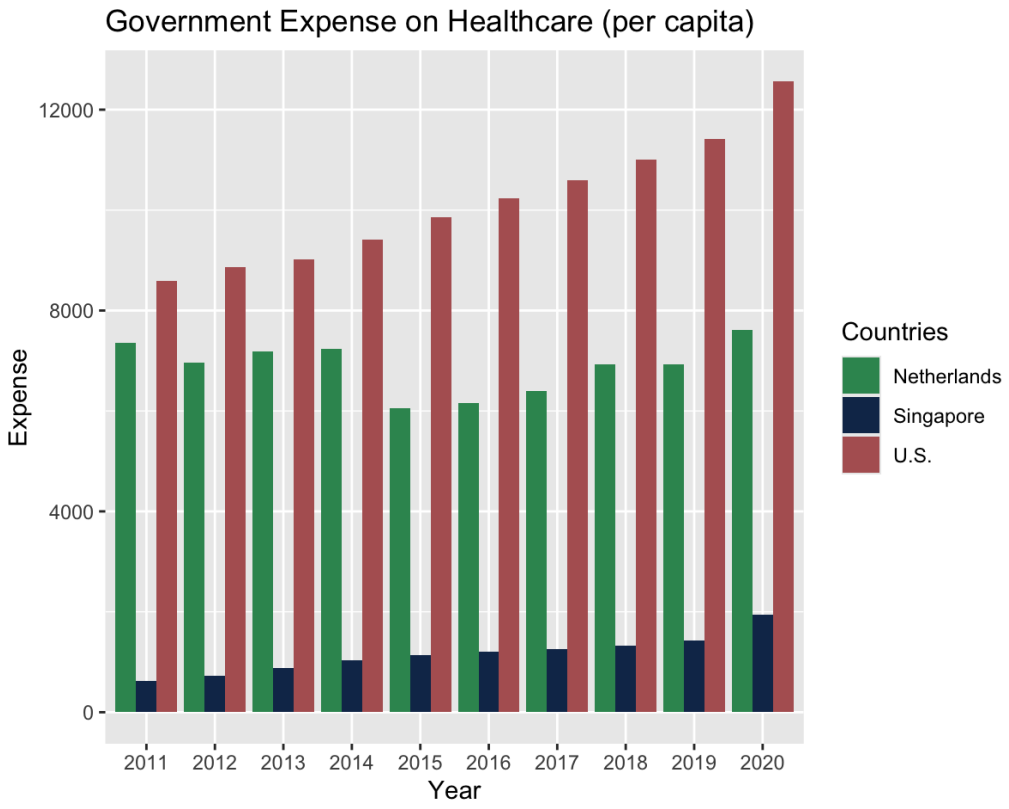

Figure 1: Bar plot of per capita government expenses on healthcare

Figure 2 highlights the expense that an individual spends on personal healthcare per capita. There is a similar trend in the United States, with the average person's 2020 healthcare spending around $10,000. However, this graph makes it more evident that the average personal expense in other countries tends to have a more considerable disparity than the government expense. Here, the Netherlands and Singapore spend much less each year.

Figure 2 also uses a stacked bar graph to depict each year's healthcare cost breakdown. Each expense category is colored differently to show the general trend from 2013 to 2020. While the overall trend shows an increase in the total cost, individually, no category seemed to grow disproportionately to any other.

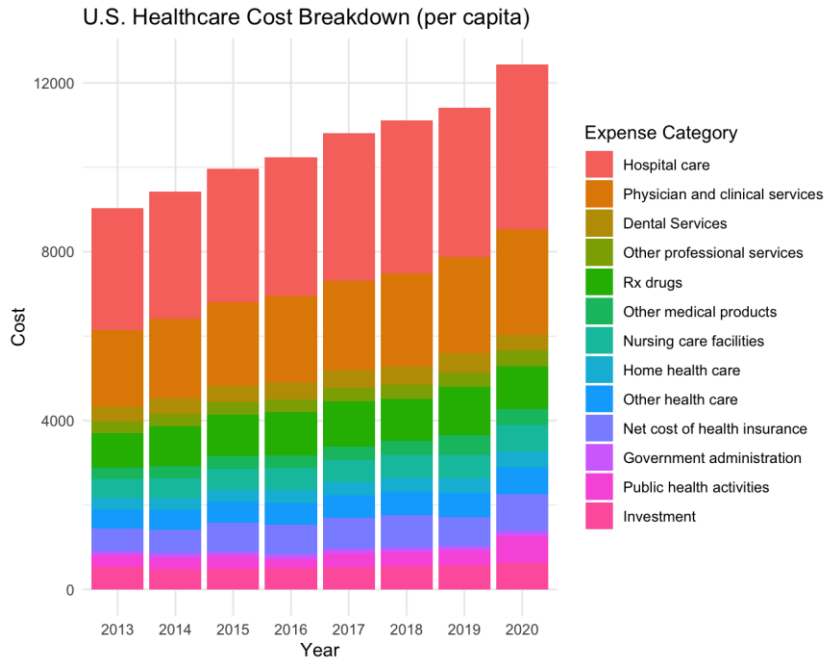

Figure 2: U.S. per capita healthcare cost breakdown

To compare these more clearly, Figure 3 shows the total U.S. government spending in light blue with the total Netherlands spending outlined in darker blue over it.

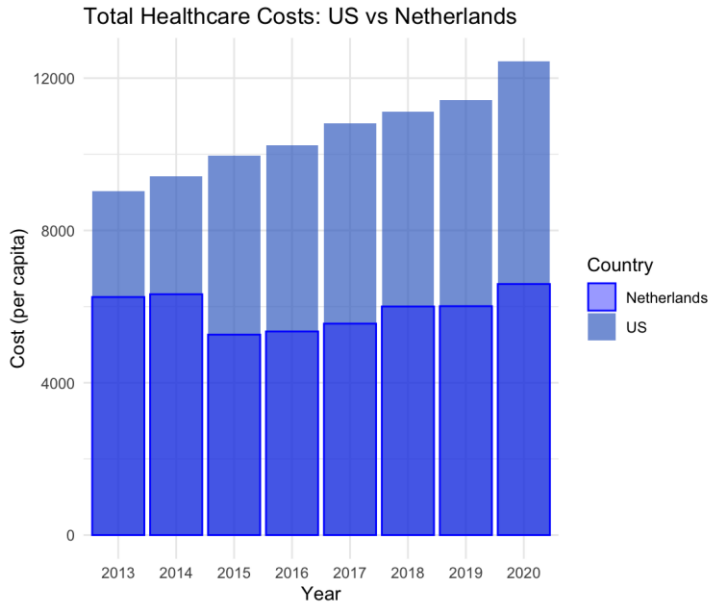

Figure 3: Total U.S. healthcare costs with the Netherlands healthcare costs overlaid

A common cause of excess expense on the client in the U.S. healthcare system is the price of prescription drugs. Figure 4 depicts pharmaceutical costs between the U.S. and The Netherlands, indicating that this sector is a significant cause of spending disparities. Compared to other countries, the U.S. has a higher pharmaceutical expense. The U.S. government healthcare expense breakdown consistently rises annually, while it is stagnant in the Netherlands. This trend parallels a similar one in the data from the total cost breakdown.

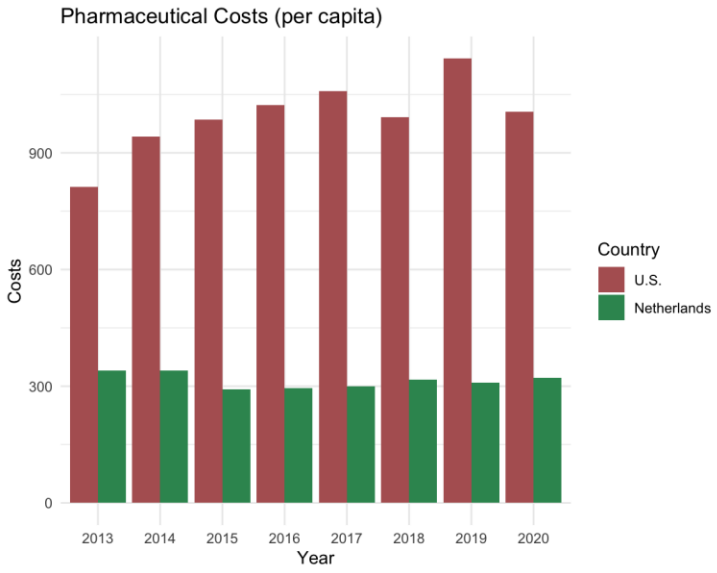

Figure 4: Pharmaceutical costs in the U.S. and the Netherlands from 2013-2020

Discussion

The United States spends much more on healthcare at the governmental and personal levels while getting worse outcomes. After considering the cost breakdown and analyzing specific categories to determine more about these significant disparities between countries, it is crucial to understand what causes these extremes. The pharmaceutical costs, for example, have a few known reasons why their pricing is significantly higher in the United States than in other nations. A noteworthy reason is that the U.S. government does not negotiate costs with

pharmaceutical manufacturers. A noninterference clause was added in 2003 when Medicare's Part D outpatient prescription drug program was being created (Alonso-Zaldivar, 2021).

In countries where the government pays for most healthcare, negotiating with drug companies is given much more priority. In the United States, smaller government programs and private insurance companies negotiate individually, giving them less power to bargain.

Figure 5 shows the amount of private spending on healthcare in the United States compared to other countries. To give more context to this chart, "[a]t $4,092 per capita, U.S. private spending is more than five times higher than Canada, the second-highest spender. In Sweden and Norway, private spending made up less than $100 per capita" (Tikkanen and Abrams, 2020).

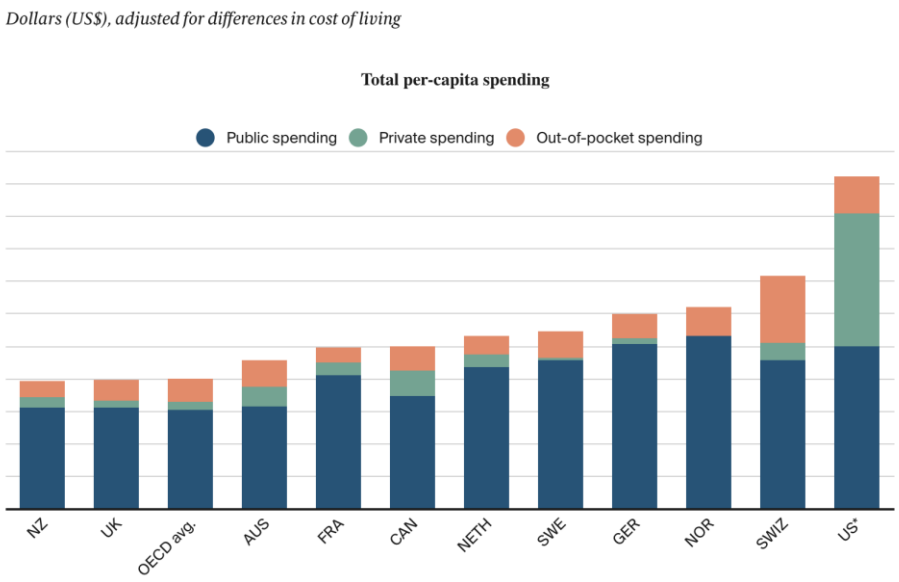

Figure 5: Total per capita spending on healthcare between various countries (Tikkanen and Abrams, 2020)

The U.S. government also does not regulate medication prices, allowing pharmaceutical companies to decide their costs. This freedom allows them to raise prices faster than inflation, which they often take advantage of (Smith, 2022).

Similarly, the United States government does not negotiate prices for medical technology such as CAT scans or MRIs. Figure 6 shows the average cost of an MRI in 2017 across several countries.

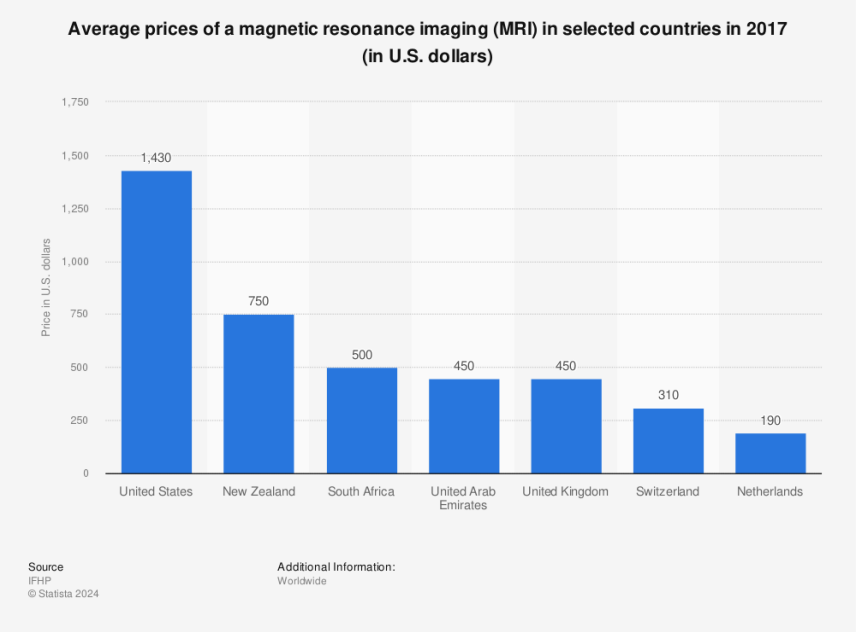

Figure 6: Average price of MRI in 2017 among selected countries (IFHP, 2019)

There are a few reasons along with this that help explain the hefty price disparity shown in the graph below with medical technology. One is that in the United States, there is a demand for the most expensive advanced technology; however, this does not equate to a much better distinction in results from the machine. Especially not enough to account for the tenfold difference in cost. However, other countries seem to have their system set up to allow for less expensive machines, "In Japan, we can buy a less fancy MRI machine and then you can make up the cost fast because MRIs are incredibly popular. Now, it is unclear if MRIs are popular because they are cheap or if they are cheap in part because they are popular" (Joffe-Walt, 2009). Another major reason the U.S. cannot make up for this cost as efficiently as other countries is that they pay radiologists a lot more.

References

Alonso-Zaldivar, R. (2021, October 6). Ban on negotiating Medicare drug prices under pressure. A.P. News. https://apnews.com/article/lifestyle-business-congress-health-care-reform-medicare-756e3255a1cb4ab8c813151aec19b60c

CDC (Centers for Disease Control). (May 16, 2023). Percentage of people without health insurance in the United States from 1997 to 2022 Graph]. In Statista. Retrieved April 25, 2024, from https://www.statista.com/statistics/200957/percentage-of-americans-without-health-insurance/

Centraal Bureau voor de Statistiek. (July 7, 2023). Total healthcare expenditure per capita in the Netherlands from 1998 to 2022 (in euros) graph]. In Statista. Retrieved April 25, 2024, from https://www.statista.com/statistics/575988/total-health-expenditure-per-capita-in-the-netherlands/

CHCF. (February 23, 2023). Health spending distribution in the United States from 2013 to 2021, by category* Graph]. In Statista. Retrieved April 25, 2024, from https://www.statista.com/statistics/246932/health-spending-distribution-in-the-us-by-category/

IFHP. (December 17, 2019). Average prices of a magnetic resonance imaging (MRI) in selected countries in 2017 (in U.S. dollars) graph]. In Statista. Retrieved April 25, 2024, from https://www.statista.com/statistics/312020/price-of-mri-diagnostics-by-country/

Joffe-Walt, C. (2009, November 18). In Japan, MRIs Cost Less. NPR. https://www.npr.org/templates/story/story.php?storyId=120545569

Kurani, N., & Cox, C. (2020, September 25). What drives health spending in the U.S. compared to other countries. Peterson-KFF Health System Tracker. https://www.healthsystemtracker.org/brief/what-drives-health-spending-in-the-u-s-compared-to-other-countries/#Distribution%20of%20difference%20in%20per%20capita%20health%20spending%20between%20the%20U.S.%20and%20comparable%20countries,%20by%20spending%20category,%202018

OECD. (August 14, 2023). Health expenditure as a percentage of gross domestic product (GDP) in selected countries in 2022 Graph]. In Statista. Retrieved April 25, 2024, from https://www.statista.com/statistics/268826/health-expenditure-as-gdp-percentage-in-oecd-countries/

SGD/USD historical data. Investing.com. (n.d.). https://www.investing.com/currencies/sgd-usd-historical-data

Singapore Department of Statistics. (August 22, 2023). Per capita government health expenditure in Singapore from 2011 to 2020 (in Singapore dollars) graph]. In Statista. Retrieved April 25, 2024, from https://www.statista.com/statistics/891506/singapore-government-health-expenditure-per-capita/

Smith, C. H. (2022, October 19). Why are prescription drugs more expensive in the U.S. than in other countries?. GoodRx. https://www.goodrx.com/drugs/savings/why-are-prescription-drugs-more-expensive-in-the-us-than-in-other-countries

Tikkanen, R., & Abrams, M. K. (2020, January 30). U.S. health care from a global perspective, 2019: Higher spending, worse outcomes?. U.S. Health Care from a Global Perspective, 2019 | Commonwealth Fund.

https://www.commonwealthfund.org/publications/issue-briefs/2020/jan/us-health-care-global-perspective-2019