International Comparison of Health Care Systems

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Abstract

The issue concerning efficiency evaluation of health care systems has become increasingly important in the context of ever growing health care expenditure in the U.S. vis-a-vis the other industrialized nations. International comparison of health care systems is commonly practiced using subjective methods available in the literature, which lead to non-standard rankings. Each individual investigator uses different subjective judgment and assigns varying weights to measurements in each class. Hence, a mathematical evaluation method, based on the concept of Pareto-optimal organization, is proposed in this paper. This method is easy to apply and uses a linear programming model. The weights for various measurements are determined by an objective method and are standardised. The United States is ranked lowest under most of the categories of health care system. Japan with highest life expectancy, lowest child mortality rate and health care expenditures is ranked number one under most of the categories.

Keywords: Pareto-optimal Organization, Linear Programming, Life Expectancy, Infant Mortality Rate

1 Introduction

Health care spending in U.S. continues to grow every year, and commands a large proportion of nation's output. In 1960, national spending for health care accounted for 5.3 percent of GDP. The share was less than 7.5 in 1970; by 1976, it had increased to 8.5 percent. The nation's health care burden grew to 10.2 percent of GDP in 1982. Each year since 1982, the year to year difference in the health care portion of the GDP had grown, reaching 13 percent in 1991. Figure 1 illustrates the health-to-GDP ratios for the United States over 40 years period. Under the regression forecast, the ratio of health spending to GDP is projected to increase from the current level of 14.5 percent to almost 50 percent in 2065. The projection for the year 2003 is 15.0 percent [2]. The climb through 2010 is due mainly to the continued fast pace of health care price inflation, while the climb after 2010 is attributed to the aging population [22].

Total health care expenditure also includes the medical technology expenditure. More than 50 percent of the rise in health care costs over the past three decades has been attributable to advances in medical technology [19]. Technological change has also been identified as the most important component of health spending growth in the United States. Although scientific and technical progress often is portrayed as the

primary driving force behind improved productivity and economic growth, the technological change in health care is considered responsible for rising costs [5]. In the past, progress in health care has been viewed as scientific and technical advances that could save lives. Some of the medical technologies did not cure or prevent disability, they did keep people alive, although at great cost. Many life-sustaining technologies such as organ transplantation, cardiac revascularization, cancer surgery, combination chemotherapy, and radiation therapy have shown successes in extending life, nevertheless, all are very costly. The average cost of a pharmaceutical drug innovation has also increased forty-fold during the last three decades.

Medical technology innovation in U.S. includes a wide variety of activities such as basic and applied research efforts in areas including bioinstrumentation, artificial organs, cellular bioprocessing, and developmental efforts that yield products such as diagnostic imaging equipment and implantable devices. The innovation process engages many participants, including the National Institutes of Health and other federal agencies, universities, and research laboratories. In 2001, the medical technology industry invested 18.5 percent of its sales and exports in research and development (R&D), representing an increase of more than 9 percent over the previous year [1]. The level of venture capital funding for the medical technology industry also increased by 51 percent between 1997 and 2001 [15]. Rapid advances in biotechnology and other areas of medical research have resulted into the increased flow of potentially expenditure-enhancing technologies.

International comparison of health care spending to GDP ratios reveals a different situation. In 1998, the health to GDP ratios ranged from 6.7 percent in United Kingdom to 13.6 percent in the United States, with an average of 8.4 percent (excluding the Eastern Europe and developing countries). Japan and Canada had GDP shares of 7.6 percent and 9.2 percent, respectively. Figure 1 illustrates the health-to-GDP ratios for seven major industrialized nations. The widening of the gap between the United States and the other countries, especially since 1985 is a very striking factor [13, 14].

Analysis of year-to-year changes in health care spending indicates that the United Kingdom had the highest rate of growth in nominal per capita health expenditures, with 1998 per capita spending 23 times the level in the 1970 base year for a compound annual rate of growth of 13.8 percent. Germany had the lowest rate of growth by far, while Canada had a higher rate of growth than Germany and the United States [14, 17]. In terms of the absolute levels of health spending denominated in a single currency, spending in 1970 ranged from $82 per person in Spain to $346 in the United States with an average of $175. In 1998, health spending ranged from $1,218 per person in Spain to $4,178 in the United States, with an average of $2,028. U.S. spending was over double the industrialized countries average; 50 percent higher than Switzerland, the second highest country; and 72 percent higher than Germany, the third-ranked country. The United States spends more than double per person on health care compared to Canada, yet several scholars claim that Canadians, on average, enjoy better health [2].

The 1998 data on inpatient medical care beds per thousand population indicate that beds per capita range from 3.7 in the United States to 18.1 in Switzerland, with an average of 8.3. Japan, at 16.5 beds per thousand, has the second-highest ratio. Average length of inpatient stay days, ranges from 6.9 in Denmark to 40.8 in Japan with an average of 2.9. The United States, at 7.1 days is again the third-lowest country. The number of physicians per thousand population ranges from 1.7 in United

Kingdom to 5.9 in Italy, with U.S. ratio of 2.7. The U.S. ratio is well above Canada, Japan and Switzerland, but below France, Germany, and nine other west European nations.

A review of life expectancy, infant mortality, as well as general population measures for various industrialized countries shows a very disappointing figure for the United States. Infant mortality is widely used as a measure of health outcomes. The 1998 infant mortality rates range from 3.5 deaths per thousand live births in Sweden to 7.2 in the United States, with an average of 5.02. The United States ranked the lowest and has the highest infant mortality rate in the industrialized world. Similarly, life expectancy at various ages is used as a measure of health system outcomes. Life expectancy at birth (average of males and females) ranged from 75.9 years in Ireland to 80.6 in Japan, with an average of 78.01. The United States, with a life expectancy of 76.6 years, ranked eighteenth, one of the lowest [13]. Canadians live about three years longer on average than Americans [2].

Despite the differences between different countries in medical culture, in health care institutions, and in medical practices themselves, most countries seem to share similar health policy objectives. A survey of the health care systems of different industrialized countries manifests that they have some major features in common as well as some important differences [7, 8, 9, 18]. The financing and delivery systems vary from country to country, and countries vary in the way that their governments regulate their health care systems. Regulations range from centralized command and control systems to decentralized arrangements. The nations also exhibit diversity in per- capita economic wealth and level of resources contributed to health. Nursing home and home care services appear in Social Security accounts in some countries and in health accounts in others. There are also national differences in physicians' prescribing behaviour, especially in the treatment of minor illnesses. The common features of health care systems are that almost all the industrialized nations insure virtually all of their citizens and they allow patients to select their own physicians. They constrain medical expenditures at some level, and operate in a state of continuous change. Countries have a mix of central regulation with some reliance on local self-regulation of their health care systems. Nations strive to adjust to the economic, political, and social demands of the moment. International comparisons of health care systems can offer an opportunity for countries to learn from one other's experiences in managing and running health care systems.

There are many problems in national and international comparisons of health care systems. First, regarding obtaining accurate and better data, standard agreed-upon definitions and periodic reporting practices need to be developed. A second problem in evaluating the performance of health systems is the lack of a standard objective model to assign weights to each measurement to calculate a weighted sum for ranking. Many investigators have simply collected the data relevant to different measurements, and discussed the past issues and trends. Many papers have described the subjective or judgmental technique only [2, 7, 14, 17, 20], and the performance of health systems has not been evaluated by using a quantitative method in the literature. In this paper, a quantitative method is proposed, based on the concept of Pareto-optimal organization which is much easier to conduct. Pareto-optimality is a concept of relative comparison, not absolute comparison [10]. Health care systems data from different industrialized nations are collected to illustrate how this method is applied to real world evaluation. The results from this quantitative evaluation are used to rank the different health care systems. The objective

technique of health care systems comparison can offer an opportunity for low ranked countries to learn from high ranked nation's experiences in operating health care.

2 Model Development

Cross-national health care systems data has been presented in Table 1 from the OECD database on expenditures, hospital services, physician services, pharmaceutical services, and output measures such as life expectancy, infant mortality rate, population measure, etc. [13, 16, 18]. An international comparison of the health systems is conducted under five classes: health care expenditures, hospital care, physician services, pharmaceutical services, and life expectancy and infant mortality. Based on the items of each category together with the available data from above source, different measurements are selected for each category for evaluation.

The first category is health care expenditure, and the measurements selected for evaluating this are percent of GDP, percent public spending, and per capita health spending. It is assumed that the technology expenditure is built into the total health care expenditure [11, 19]. For hospital care, the measurements chosen are beds per one thousand population, percentage occupancy, expenditures per day, and expenditures per admission. The measurements selected for evaluating physician services are physicians per one thousand population, physician contacts per capita, and physician expenditures per physician. For pharmaceutical services, the following measurements are chosen: pharmacists per one thousand population, pharmaceuticals as percentage of total health expenditures, and pharmaceutical expenditures per capita. In selecting measurements for life expectancy and infant mortality, one major difficulty is that life expectancy at various ages varies. Some have argued that life expectancy in the older age ranges may provide a better indication of the availability and use of high-technology health interventions and hence may be more influenced by health spending than is life expectancy at birth. To overcome this difficulty, two separate measurements for life expectancy are considered, one at birth and the other one at age 65 years. The other measurements selected under this last grouping are infant mortality (deaths in the first year per thousand live births), and percentage of population over age 64 years.

The objective method introduced in this paper only uses data contained in Table 1. In most of the previous studies, the ranks were determined by assigning subjective weights to each measurement and then calculating a weighted sum for a given category [4, 21]. However, this method has many difficulties. First, the weights for different measurements in a grouping are difficult to determine. Second; the subjectively determined weights are not convincing to many people. The concept of Pareto-optimal organization is a very efficient tool for objectively assigning weights to different measurements [10].

Pareto-optimal organization:

In order to illustrate the score calculation method, let us consider anyone measurement, for instance life expectancy at birth as the measurement of performance. Based on the concept of relative comparison, we assign score 100 to the country or health care system with the highest life expectancy at birth. For other countries, the scores are calculated as: [(life expectancy of the country being evaluated)/(the highest life expectancy)]* 100.

If two or more measurements are to be considered, the evaluation becomes a little complicated and we use the concept of Pareto-optimal organization [10]. In a Pareto-optimal organization, any change which makes some people better off makes

some others worse off [6, 10]. An organization is Pareto-nonoptimal if some people can be made better off without harming anyone else.

Each health care system can be considered as an organization and the measurements as indicators of well being of persons. When several health care systems are compared with each other, the systems with measurements dominated by other health systems are not Pareto-optimal, The comparison is relative not absolute, hence the score of a system depends on other health care systems being evaluated. When new health systems are added or old systems deleted, the evaluated score of each system will perhaps be changed. Nevertheless, a non-optimal system will never become optimal when new health care systems are added for comparison [10].

A linear programming model is formulated using this concept of calculating scores. Let,

g is the number of categories considered for international comparison,

M_{ijr} is the j-th measurement of the i-th health care system under category r ,

Z_{kr} is score of the k-th health care system under category r,

w_{jr} is the weight to be assigned to measurement j under category r,

m_r is the number of measurements under category r ,

n is the number of health care systems,

Z_k: is the overall score of the k-th health care system.

The score of the k-th health care system under category r is calculated via the following linear program:

$$Z_{kr} = Max \sum_{j=1}^{mr} w_{jr} M_{i\,jr} \qquad (1)$$

Subject to,

$$\sum_{j=1}^{mr} w_{jr} M_{i\,jr} \le 100 \quad \text{i=1,2,---,n} \qquad (2)$$

$$w_{jr} \ge 0, \quad \text{j=1,2,----,}m_r \qquad (3)$$

Again, after repeating the above linear program r times for r different categories,

$$Z_k = \sum_{r=1}^{g} Z_{kr} \qquad (4)$$

In solving the linear program, each health care system is assigned weights which will result in the highest possible score for that health care system. The only constraint imposed on the weights is that in assigning the selected weights to every health care system under a given category, the resulted score should not exceed 100. To evaluate different health care systems under a given category r, only the objective function is changed, the constraint set is untouched. The important property of this evaluation method is that a health care system is not required to accomplish a certain level of achievement for every measurement to be optimal. Concentrating on its most suitable groupings might be more advantageous to its evaluated score.

3 Mathematical Evaluation

A subjective method is employed to determine a scale for calculating the measurement values under each class. As discussed above, the first category is health care expenditure, and one of the measurements for evaluating this is percent of GDP. An ordinal number is assigned to each 1% increment of GDP range: 1 to 14%, 2 to 13%, 3 to 12%, 4 to 11%, 5 to 10%, 6 to 9%, 7 to 8%, 8 to 7%, and 9 to 6%.. Measurement value for percent public spending is calculated similarly: 10 point assigned to 100%, 9 to 90%, 8 to 80%, 2 to 20%, and 1 to 10%. In calculating the per capita health spending, a highest point is given to lowest spending data, and lowest point to maximum health spending using a

scale of 0 to 10. Appendix shows the scales for different measurements. These three measurements for every country under study are collected to calculate the score of this category by applying the linear programming model introduced above.

The measurements selected for hospital care, and other categories are presented in the Appendix. Table 2 shows the measurements of the five classes of each country under study. The linear programming model discussed above has some restrictions regarding w_{jr}'s. The w_{jr}'s must be strictly positive and this way we can avoid assigning zero weight to unfavorable measurements [3, 10]. That is $w_{jr} \geq \varepsilon > 0$ where ε is an infinitesably small quantity .Now, mathematical model is applied to calculate the scores of each grouping, with lower bound $w_{jr} \geq 0.005$. The scores are summarized in Table 3. Subsequently, the total scores, Z_k's are calculated using equation (4). If uniform weights are not acceptable, one can come up with differential weights for each category and equation (4) can be changed to

$$Z_k = \sum_{r=1}^{g} W_r Z_{kr} \qquad (5)$$

where W_r is the weight for category number r.

It is important to differentiate between the two types of weights here. The w_{jr}'s in the linear programming model are objectively determined from solving the mathematical model. The W_r's are subjectively determined by humans.

4 Discussion and Conclusion

International comparison of health care systems is commonly practiced using subjective methods available in the literature. The subjective methods lead to non-standard rankings. Each individual investigator uses different subjective judgment and assigns varying weights to measurements in each class. The compiled results differ with large variations. A mathematical evaluation method based on the concept of Pareto-optimal organization is proposed in this paper. This method is easy to apply and uses linear programming model. The weights for various measurements are determined by objective method and are standard. The method is illustrated with real data from industrialized countries.

The United States is ranked lowest under most of the categories of health care system. It has the highest health care expenditure, high child mortality rate and shorter life expectancy compared to other industrialised countries. America has the highest levels of income inequality among all wealthy nations and the poverty affects one's health much more than the limited ministration of a formal health care system. Japan with highest life expectancy, lowest child mortality rate and health care expenditures is ranked number one under most of the categories. Of course, averages are deceptive. There is no doubt that Americans have the best health care system in the world—for those who can afford it. Perhaps, Americans are not getting full value for their investment [2]. The people working in the health care system are generally dedicated to providing the best possible service. The problem is, the work force and, more importantly, management, do not have the training or knowledge to make the best use of available resources. No private industry would survive with the level of inefficiency seen in the U.S. health care. Politicians complain that government cannot afford the annual increase in tax dollars that go to health care. Insurance companies complain that costs are out of control. The newspapers complain that the U.S. health care is not sustainable.

The United States, for all of the leadership it provides in so many other spheres, is perhaps the most resistant to

changing policies and ideas regarding its health system problems. By examining other countries' experiences the U.S. can extend its range of perceptions of what is possible. The important lessons can be drawn from Europe and other industrialized nations to enable the United States to achieve greater efficiency and equity in providing health care, without damaging the innovative capacity of its medical technology industry. Among nations, the United States has the best-financed and arguably the most capable health services research community. The health care systems of Europe, Australia. Canada, and Japan may lack America's rich biomedical research capacity, its open-ended financing, and its vast databases, but their systems are undergoing processes of structural reform and changing systems of financial management. In most countries the chief motivation for change is rising costs. The United States can observe the unfolding process of health care reform in Europe, in designing health care reforms.

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Appendix: Health Care Expenditure (HCE):

The following scores are designated to the various items associated with HCE.

1.

Percent of GDP	Score
6%	8
7%	7
8%	6
↓	↓
13%	1
14%	0

2.

Percent Public Spending	Score
100%	10
90%	9
↓	↓
50%	5
40%	4

3.

Per Capita Health Spending	Score
$1000- $1500	7
$1501 -$2000	6
$2001- $2500	5
↓	↓
$3501-$4000	2
$4001- $4500	1

4. Hospital Care:

Beds per thousand population: Score same as the values given in Table 1.

Occupancy Percentage	Score
100%	10
90%	9
80%	8
70%	7
60%	6

5.

Expenditures per Day	Score
$0 -$100	12
$101- $200	11
$201 -$300	10
↓	↓
$1101 -$1200	1

6.

Expenditures per Admission	Score
$1000 -$1500	15
$1501 -$2000	14
$2001 -$2500	13
↓	↓
$8001 -$8500	1

7. Physician Services:

Physicians per one thousand population: Score same as values given in Table 1. Physicians Contacts per Capita: Score = Values given in Table 1 / 2.

8.

Physician Expenditure/Physician	Score
$30,000 -$35,000	5.1
$35,001 -$40,000	5.0
$40,001 -$45,000	4.9
↓	↓
$280.001- $285.000	0.1

9. Pharmaceutical Services:

Pharmacists per one thousand population: Score = values given in Table 1 * 10. Pharmaceutical as percentage of total expenditures: Values given in Table 1 /10.

10. Pharmaceutical Expenditures

per Capita	Score
$125 -$150	9
$151-$175	8
↓	↓
$326-$350	1

11. Life Expectancy:

a) Infant Mortality Rate

(per 1000 child births)	Score
7.5	1
7.0	2
↓	↓
2.5	11

b) Life Expectancy at Birth

(in years)	Score
75.5	1
76.0	2
76.5	3
↓	↓
81	12

TABLE 1 (Year: 1998)

	Australia	Austria	Belgium	Canada	Denmark	Finland	France	Germany	Iceland	Ireland
HEALTH CARE EXPENDITURES										
Percent of GDP (%)	8.5	8.2	8.8	9.2	8.3	6.9	9.5	10.6	8.3	6.4
Percent of Public Spending (%)	69.4	70.3	89.7	71.7	81.9	76.8	75.7	74.5	84.3	75
Per Capital Health Spending ($)	2036	1968	2081	1828	2133	1502	2055	2424	2103	1436
HOSPITAL CARE										
Beds per 1,000 population	8.5	8.9	7.2	4.7	4.5	7.8	8.5	9.3	15.9	3.7
Occupancy (%)	81.2	82.8	86.7	82.7	81.3	83.7	81.2	86.5	93	80.1
Expenditures per capita ($)	880	787	901	813	1158	617	937	848	1158	604
Expenditures per day ($)	242	202	240	489	286	302	284	228	280	306
Expenditures per admission ($)	2527	1354	1767	5615	2367	1830	3045	2186	4353	--
PHYSICIAN SERVICES										
Physicians per 1,000 population	2.5	3	3.4	2.1	3.3	3	3	3.5	3.3	2.2
Physicians contacts per capita	6.6	6.8	7.2	6.5	7	6.2	6.5	6.5	6.8	6
Physicians expend. per capita ($)	385	--	--	265	--	--	242	398	--	--
Physicians expend. per physician ($)	104,350	--	--	141,560	32,220	--	68,070	88,010	--	39,530
PHARMACEUTICAL SERVICES										
Pharmacists per 1,000 population	0.66	0.25	1.18	0.8	0.29	0.86	0.91	0.56	0.74	0.31
Pharma. % of total health expend.	11.6	14	17.9	13.6	8.5	14.4	16.8	12.3	16.5	10.6
Pharma. expend. Per capita ($)	202	247	306	258	165	209	337	289	312	126
LIFE EXPECTANCY										
Infant mortality live birth per 1,000	5	4.9	6	5.5	4.7	4.2	4.7	4.7	2.6	6.2
Perinatal mortality deaths per 1,000	10.7	7.4	10.4	7.6	8.7	6.5	9.2	6.5	7.5	10.4
Life expectancy at birth	78.7	77.8	77.9	78.6	76.1	77.1	78.4	77.5	79.2	75.8
Life expectancy at age 65 years	18.4	17.6	17.4	18.4	16.5	17.1	18.7	17.3	18.1	15.9
% of population over age 65	12.2	15.4	16.5	12.3	14.9	14.6	15.8	16.6	11.6	11.3

Source: OECD Health Data 2002

TABLE 1 (CONTINUED, Year: 1998)

	Italy	Japan	Luxemb.	Netherla.	Spain	Sweden	Switerla.	UK	US
HEALTH CARE EXPENDITURES									
Percent of GDP (%)	8.4	7.6	5.9	8.6	7.1	8.4	10.4	6.7	13.6
Percent of Public Spending (%)	66.6	78.9	91.5	69.7	76	83.3	74	83.5	44.8
Per Capital Health Spending ($)	1,783	1,822	2,215	2,070	1,218	1,746	2,794	1,461	4,178
HOSPITAL CARE									
Beds per 1,000 population	5.9	16.5	8	11.3	3.9	3.8	18.1	4.2	3.7
Occupancy (%)	70.2	84.1	81	89	76.4	85.1	83.9	80.6	69.2
Expenditures per capita ($)	738	685	680	1,093	510	698	1,405	616	1,763
Expenditures per day ($)	268	83	185	251	243	218	212	320	1,128
Expenditures per admission ($)	2,553	4,022	1,639	3,896	3,505	--	3,792	--	8,346
PHYSICIAN SERVICES									
Physicians per 1,000 population	5.9	1.9	3	2.4	4.4	3.1	1.9	1.7	2.7
Physicians contacts per capita	13.6	16	7	7.2	6.4	4.6	8.1	5.9	6
Physicians expend. Per capita ($)	--	350	--	137	--	--	324	222	815
Physicians expend. Per physician ($)	120,010	210,700	157,680	56,480	--	--	112,610	54,000	282,500
PHARMACEUTICAL SERVICES									
Pharmacists per 1,000 population	--	0.69	0.77	0.15	0.87	0.51	--	--	0.66
Pharma. % of total health expend.	17.9	21.2	11.7	10.8	20	13	7.6	16.1	9.4
Pharma. expend. per capita ($)	284	349	250	193	223	218	190	218	344
LIFE EXPECTANCY									
Infant mortality live birth per 1,000	6.2	3.6	5	5.2	5	3.5	4.8	5.7	7.2
Perinatal mortality deaths per 1,000	12.3	6.2	7.1	9.2	10.6	6.8	7.6	9.1	9.7
Life expectancy at birth	78.45	80.6	76.5	77.95	78.5	79.4	79.5	77.15	76.6
Life expectancy at age 65 years	18	19.45	17.4	16.75	18.45	18.2	18.7	16.9	17.6
% of population over age 65	17.72	16.21	14.28	13.5	16.26	17.4	15.09	15.68	12.35

Source: OECD Health Data 2002

Table 1 shows the five classes chosen to compare the health care standards among industrialised countries. These classes are chosen because they best reflect the health care systems of most countries. In class 1, United States spends more per person on health care than any country. A review of the life expectancy class shows that United States has the highest infant mortality rate and one of the lowest life expectancy. Sweden and Japan have the lowest infant mortality rate and longest life expectancy.

TABLE 2 (Year: 1998)

	Australia	Austria	Belgium	Canada	Denmark	Finland	France	Germany	Iceland	Ireland
HEALTH CARE EXPENDITURES										
Percent of GDP (%)	5.5	5.8	5.2	4.8	5.7	7.1	4.5	3.4	5.7	7.6
Percent of Public Spending (%)	7	7	9	7.1	8.2	7.6	7.5	7.4	8.4	7.5
Per Capital Health Spending ($)	4.9	5.1	4.8	5.3	4.7	6	4.9	4.1	4.8	6.9
HOSPITAL CARE										
Beds per 1,000 population	4.25	4.45	3.6	2.35	2.25	3.9	4.25	4.65	7.95	1.85
Occupancy (%)	8.1	8.3	8.6	8.3	8.1	8.4	8.1	8.6	9.3	8
Expenditures per capita ($)	9.2	10.1	9	9.9	6.4	11.8	8.6	9.5	6.4	12
Expenditures per day ($)	9.6	10	9.6	7.1	9.1	9	9.2	9.7	9.2	8.9
Expenditures per admission ($)	11.9	14.3	13.4	5.8	12.2	13.3	10.9	12.6	8.3	--
PHYSICIAN SERVICES										
Physicians per 1,000 population	2.5	3	3.4	2.1	3.3	3	3	3.5	3.3	2.2
Physicians contacts per capita	3.3	3.4	3.6	3.3	3.5	3.1	3.3	3.3	3.4	3
Physicians expend. per capita ($)	4.6	--	--	5.8	--	--	6.1	4.5	--	--
Physicians expend. per physician ($)	3.6	--	--	2.9	5.1	--	4.4	4	--	4.9
PHARMACEUTICAL SERVICES										
Pharmacists per 1,000 population	6.6	2.5	11.8	8	2.9	8.6	9.1	5.6	7.4	3.1
Pharma. % of total health expend.	1.2	1.4	1.8	1.4	0.8	1.4	1.7	1.2	1.6	1.1
Pharma. expend. per capita ($)	5.9	4.1	1.8	3.7	7.4	5.6	0.5	2.4	1.5	9
LIFE EXPECTANCY										
Infant mortality live birth per 1,000	6	6.2	4	5	6.6	7.6	6.6	6.6	10.8	3.6
Perinatal mortality deaths per 1,000	2.3	5.6	2.6	5.4	4.3	6.5	3.8	6.5	5.5	2.6
Life expectancy at birth	7.4	5.6	5.8	7.2	2.3	4.3	6.8	5	8.5	1.7
Life expectancy at age 65 years	5.8	4.2	3.8	5.8	2	3.3	6.5	3.7	5.2	0.9
% of population over age 65	2.4	8.9	11.1	2.7	7.8	7.3	9.6	11.2	1.3	0.7

Source: OECD Health Data 2002

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TABLE 2 (CONTINUED, Year: 1998)

	Italy	Japan	Luxemb.	Netherla.	Spain	Sweden	Switerla.	UK	US
HEALTH CARE EXPENDITURES									
Percent of GDP (%)	5.6	6.4	8.1	5.4	6.9	5.6	3.6	7.3	0.4
Percent of Public Spending (%)	6.6	7.9	9.1	7	7.6	8.3	7.4	8.3	4.4
Per Capital Health Spending ($)	5.4	5.3	4.6	4.8	6.6	5.5	3.4	6.1	0.6
HOSPITAL CARE									
Beds per 1,000 population	2.95	8.25	4	5.65	1.95	1.9	9.05	2.1	1.85
Occupancy (%)	7	8.4	8.1	8.9	7.6	8.5	8.4	8	6.9
Expenditures per capita ($)	10.6	11.1	11.2	7.1	12.9	11	3.9	11.8	0.4
Expenditures per day ($)	9.3	11.2	10.1	9.5	9.6	9.8	9.9	8.8	0.7
Expenditures per admission ($)	12.5	8.9	14.7	9.2	10	--	9.4	--	0.3
PHYSICIAN SERVICES									
Physicians per 1,000 population	5.9	1.9	3	2.4	4.4	3.1	1.9	1.7	2.7
Physicians contacts per capita	6.8	8	3.5	3.6	3.2	2.3	4	3	3
Physicians expend. per capita ($)	--	5	--	7.1	--	--	5.3	6.3	0.4
Physicians expend. per physician ($)	3.3	1.5	2.6	4.6	--	--	3.5	4.7	0.1
PHARMACEUTICAL SERVICES									
Pharmacists per 1,000 population	--	6.9	7.7	1.5	8.7	5.1	--	--	6.6
Pharma. % of total health expend.	1.8	2.1	1.2	1.1	2	1.3	0.8	1.6	0.9
Pharma. expend. per capita ($)	2.6	0.1	4	6.3	5.1	5.3	6.4	5.3	0.3
LIFE EXPECTANCY									
Infant mortality live birth per 1,000	3.6	8.8	6	5.6	6	9	6.4	4.6	1.6
Perinatal mortality deaths per 1,000	0.7	6.8	5.9	3.8	2.4	6.2	5.4	3.9	3.3
Life expectancy at birth	6.9	11.2	3	5.9	7	8.8	9	4.3	3.3
Life expectancy at age 65 years	5	7.9	3.8	2.5	5.9	5.4	6.4	2.8	4.2
% of population over age 65	13.4	10.4	6.6	5	10.5	12.8	8.2	9.4	2.7

Source: OECD Health Data 2002

Table 2 is mapped from Table 1. It shows the measurements of the five classes of each country under study. A subjective method is used to calculate the measurement values under each class.

TABLE 3

Country	Life span & Infant Mortality	Pharmaceutical Services	Physician Services	Hospital Services	Health Care Expenditure
Australia	80.61	93.56	80.84	91.65	81.76
Austria	70.26	72.87		100	80.02
Belgium	58.13	100		100	100
Canada	80.83	67.79	75.85	88.84	81.51
Denmark	68.3	95.36		91.84	96.43
Finland	79.02	100		100	92.21
France	100	90.97	92.85	88.57	84.01
Germany	72.56	100	100	98.19	81.92
Iceland	92.32	71.17		100	95.64
Ireland	45.33	100			100
Italy	72.17			90.04	90.33
Japan	100	93.35	100	100	88.38
Luxemborg	56.65	82.79		100	100
Netherlands	86.53	77.12	88.56	95.66	84.04
Spain	80.32	100		85.44	100
Sweden	92.98	92.4			97.81
Switzerland	100		99.99	90.19	76.94
U.K.	63.6		96.86		100
USA	73.57	55.93	79.29	74.3	45.63

Table 3 shows the scores of each grouping. The maximum value of score is 100 under each category. The United States is ranked lowest under most of the categories. Japan is ranked number one (score = 100) under most of the categories.

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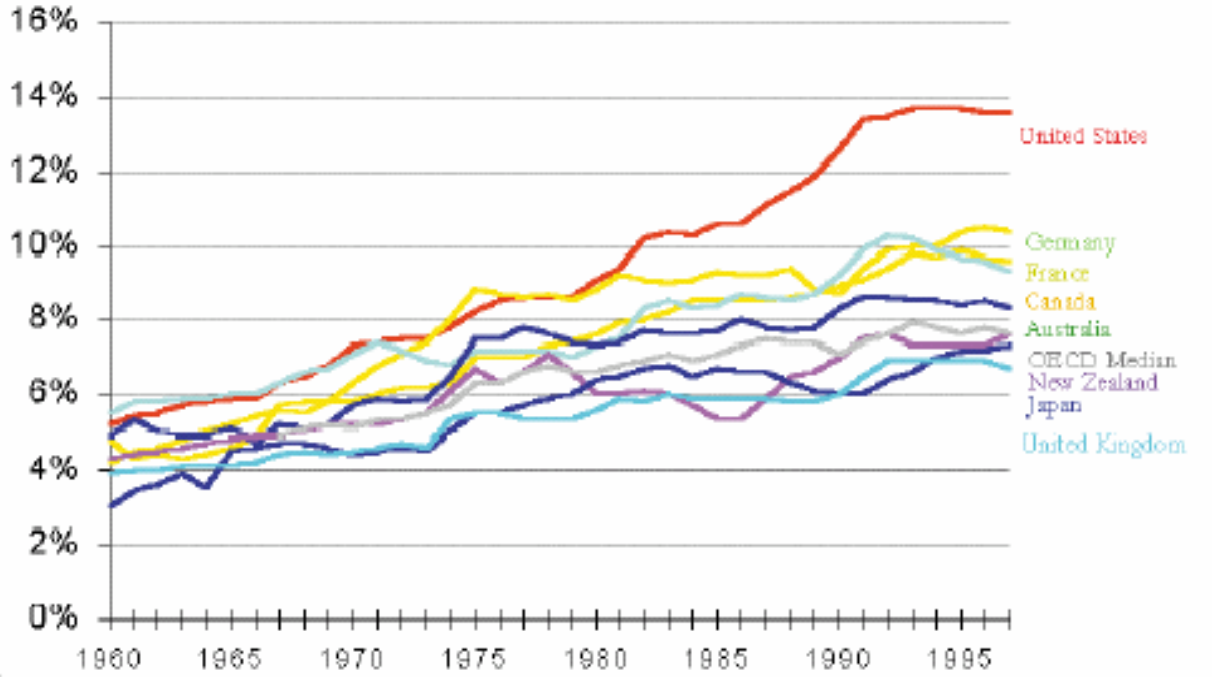

Figure 1: Percentage of GDP Spent on Health Care

Source: OECD Health Data 2002