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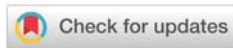***Corresponding author:** Colin Pritchard, Professor, Faculty of Health & Social Sciences, Royal London House, Christchurch Rd, Bournemouth BH13LT, UK, Tel: 078825248004;
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Research Article

USA Child (0-4) and Adult (55-74) Mortality and % GDP-Health Expenditure and the Other Western Countries 1989-2015. America needs an "National Neighbourhood Health Service"

Abstract

Purpose: To analyse how effective was the USA, compared to Other Western Countries (OWC) in reducing premature deaths 1989-2015.

Design: This population-based study is a cost-effective model of fiscal input into health related to clinical outputs, recognising socio-economic factors influence health outcomes. Using World Bank data for total % GDP-Expenditure-on-Health, and, WHO data for Child (0-4), Adult (55-74) and Age-Standardised-Death-Rates rates per million America is compared with OWC. Cost-Effective Ratios (CEF) are calculated and Confidence Intervals (95%) tests USA against each OWC. `Excess' deaths are calculated between the *most* and *least* expensive health systems.

Setting: Twenty Other Western countries.

Patients: National populations.

Outcomes: USA highest current total %GDPEH 16.8% and highest average of 12.7% and UK *lowes*t 7.1% over period.

USA *Child (0-4)* highest at 1249pm, OWC averaged 803pm. Fourteen countries had significantly bigger reductions than America.

USA Adult (55-74) mortality was highest at 12,554pm, OWC averaged 9,835pm. Fourteen countries had significantly bigger reductions than USA.

Excess Deaths: America failed to match UK total mortality rates yielding 488,273 excess deaths, of which 12,613 were children.

Cost-Effectiveness-Ratio*:* America had smallest CER 1:113, OWC averaged 1:270, an USA to OWC ratio of 1:239. UK CER was 1:323 producing a USA: UK ratio of 1:2.86.

Conclusion: America's health system more expensive as Britain's and *significantly less effective* than most OWC. The USA needs to change its socio-economic political mind set' if it is to match the `half price' NHS and move towards an American style `Neighbourhood National Health Service'.

Keymessages: Implications for Policy makers: 1. policy makers in the USA need to re-think their present configuration and funding of their health services.

2. should confront the question, can any nation continue spend 17.1% GDP on health bearing in mind the challenges posed by longevity, yet still have the poorest clinical outcomes of the 21 Western nations. Whilst at the same time the richest nation on earth has the widest relative poverty in the West.

3. examine the findings of the USA `excess deaths', compared to the lowest- health funded country, the UK and challenge politicians to be less doctrinaire and react to the evidence.

4. recognising that the USA is a continent with incredible social variation, they need to think outside the box and reject isolationist stereotypical thinking, otherwise the inconsistencies in the USA will worsen and possibly destabilise.

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Implication for General Public: 1. Democracy works best when citizens are well informed. This research shows the American public that compared to the rest of the Western world, despite USA health expenditure being the most costliest in the world they have the highest rate of child (0-4) and adult (55-74) mortality amongst Western countries - thus the American health care system is both relatively inefficient and ineffective and such results points the need for change.

2. A system based upon the American tradition of `neighbourliness' could develop a reciprocal health care system which would ensure that the monies reach the patient at the point of need, and not be lost in the uneconomic profit-making insurance health model.

3. These evidenced-based recommendations could benefit the people of America significantly by reducing health costs, get a better return on money invested in health care, be more equitable, inclusive and contribute to a more cohesive society.

Introduction

The recent debate about repealing the Affordable Health Care Act (Obama Care) was based upon the argument that it was inefficient and that there were rising complaints about rising costs [1]. This might be seen as a reasonable economic question because it has long been known that the USA spends more of its %GDP on health than any other country [2,3]. So the question can be translated into asking, does the USA get a good return on its financial investment into health care? This raises the further question, what would be the criteria on which to make such judgements. It is argued that in the last analysis health care's clinical outcome measure is to reduce premature deaths, in particular Child Mortality Rates (CMR: 0-4years) and mortality Rates of people aged 55-74. If a country can reduce deaths in these age bands, it would make a substantial contribution to reducing premature death and improving life expectancy [4]. Thus we juxtapose CMR (0-4) and what we categorise as Adult Mortality Rates (AMR) of people in the age–band 55-74. In addition, any changes in total deaths rates are examined of all age-bands, which are based upon the WHO category of Age-Standardised-Deaths-Rates (ASDR) [4]. Thus we can compare the USA, with the twenty Other Western Countries (OWC) in regard to economic input into health care– the total %Gross-Domestic-Product-of-Expenditure-on-Health (%GDPEH) based on World Bank data ², and health outputs in changes in Child (0-4), Adult (55-74) and all deaths (ASDR) based upon WHO data [4].

However, it is recognised that there are confounding influences from pre-existing social determinates that impact upon health outcomes, which needs to be considered within the context of underlying health issues in the various population and comorbidities [5]. There are of course a range of public health and socio-economic issues, which impacts upon health outcomes, especially in regard to children, linked to relative poverty [6-9]. It is however, recognised that relative poverty is a very broad category and the actual mechanism of how it affects children's health is not fully understood. From a number of clinical studies more specific factors related to poorer child health outcomes have been established. These include low birth weight [10,11], parental smoking [12], drug and alcohol misuse [13], living in deprived polluted areas [14], social inequalities associated with poorer education, anti and post-natal care [6-9,15] and belonging to an ethnic minority [16]. Though the above factors are themselves linked to relative poverty in the West [2,6-16]. Moreover, the UN Millennium goals recognised that the aim of reducing child mortality by 2% pa also required the need to reduce relative poverty [2]. There is a debate surrounding measures of poverty, between relative, as in the West and absolute poverty more often found in the developing countries [17,18]. We use the World Bank Income Inequality, the difference between the top and bottom 10% of incomes, as a surrogate measure of relative poverty, not least because it is country -specific [19].

However, the central focus of this study is to answer the question of whether the USA %GDPEH achieves as much as the OWC, in relation to health expenditure and crucially in reducing mortality outcomes over the period 1989-91 v 2013-15, which is the latest available international mortality data [2].

A simple economic model is postulated of contrasting fiscal input %GDPEH [2], against the clinical outputs of reducing the three mortality categories based upon the latest WHO data [4].

Earlier work has shown an unexpected finding that although the USA has long had the highest %GDPEH of all Western countries it has poorer health outcomes than many OWC [3,6], which have been described as "the US health care paradox" [20,21], of a health system that is predominately funded from `Private' (employment or personal insurance related) than `Public' sources coming from State or Federal avenues [22]. This appears related to the problems of a predominantly private insurance model, as even within the Affordable Care Act, the insurance company needs to make a profit. Therefore, because of market uncertainty, it has been shown that costs will need to be higher to account for previous illnesses and medical unknowns and under-lying conditions [5,23-26], than in a predominately direct-taxation based service as such a service as the British National Health Service (NHS) which provides a free health care at the point of delivery, irrespective of any pre-existing conditions. Indeed, as will be seen although the configuration of health services varies across the twenty countries reviewed, with the partial exception of Greece and Switzerland, every other country's health funding comes predominately from direct taxation [22].

The study has two working null-hypotheses

There will be no statistically significant differences between the USA and the Other Western Countries (OWC):- in reducing child (0-4), adult (55-74) mortality and ASDR, that is total all-age mortality, and, countries' cost-effectiveness in reducing mortality 1989-91 v 2013-15.

Methodology

Socio-Economic Factors Input: The *%GDPEH* data is drawn from the World Bank (2018), updated July 2018, which differentiates sources of funding. `Private' source, which is mainly insurance-related (personal or employment linked)

and `Public' (state and federal) funding [22], and, the combined Private and Public sources which is the nation's total %GDPEH (including health and social care) [2,22]. It is the total %GDPEH that will be used for cross national comparisons. This was reported for 27 separate years during the period between 1980 and 2015 [2]. Some countries did not report %GDPEH every year but the number of any missing years are indicated in table (1).

To illustrate changes in %GDPEH over time, the tables shows the baseline year 1980 and the years 2000, 2010 and then 2015 the latest available year. As will be seen, every countries' %GDPHE rose substantially since 1980 [2]. The Private and Public percentage of GDPEH is given for the index year 2015, which combined is the total %GDPEH, which is used in the international comparisons. Furthermore, the percentage of GDPEH is taken as a broad practical indication of the fiscal priority each nation gives to its health care. Moreover, a country acts as its own control over the comparative period for both fiscal and clinical outputs.

The OWC are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland and the UK. Latin America, Africa, the Middle-East and the former communist countries are not included in the view of their different historical and socio-economic political situations.

Table 1: Total % Gross-Domestic-Product Expenditure on Health 1980 −2000-2015 & Percentage DPEH from Private Source (Based upon 26 years reported data unless noted in brackets).

Country & Rank	Total GDP 1980	Total GDP 2000	Total GDP 2010	% GDPEH Private	Total %GDP 2015	Total Average 1980-15
1. USA	9.0	13.4	17.1	9.15	16.8	12.7
2. Germany	8.4	10.1	11.6	2.62	11.2	9.7
3= France	7.0	10.3	11.6	2.47	11.1	9.6
3= Switzerland	7.3	10.2	10.9	4.80	12.1	9.6
5. Canada	7.0	8.8	11.1	3.10	10.4	9.3
6= Netherlands	7.4	8.0	12.1	4.02	10.7	8.8
6=. Sweden	8.9	8.2	9.5	2.15	11.0	8.8
8. Austria [23]	7.4	9.0	11.1	2.59	10.3	8.5
9. Belgium [23]	6.3	9.0	10.6	n/a	10.5	8.4
10. Norway	7.0	8.4	9.4	1.53	10.0	8.2
11.Australia [23]	6.1	8.0	8.9	3.71	9.4	8.1
12=. Italy	7.0	8.1	9.4	2.10	9.0	8.0
12=. Denmark [23]	8.9	8.3	11.1	1.33	10.3	8.0
14= New Zealand	5.9	7.7	10.0	2.16	9.3	7.9
14= Finland	6.3	7.2	9.0	2.50	9.4	7.9
16. Portugal [23]	5.3	8.8	10.9	2.68	9.0	7.6
17. Japan [22]	6.5	7.7	9.6	1.76	10.9	7.5
18. Ireland	8.2	6.1	9.2	1.80	7.8	7.3
19=. Greece [21]	5.9	7.9	9.5	3.23	8.4	7.2
19=. Spain	5.3	7.2	9.6	1.63	9.2	7.2
21. U.K	5.6	7.0	9.4	1.58	9.8	7.1
Other Countries average	6.9	8.3	10.1	2.09	9.5	8.2

Health Outcomes:- Child (0-4), Adult (55-74) & Age-Standardised-Death-Rates (ASDR). All three types of mortality data is drawn from WHO (2018) updated June 2018. This takes us to the latest available index year 2015 [4]. The results will be placed within the context of economic inputs into health which is each country's total national %GDPEH.

Comparative baseline years are the 3year average of 1989-91 and the index years of 2013-15, which is the latest available data [4]. A few countries have slightly earlier index years than 2013-15 which are noted in the tables.

Child-Mortality-Rates (0-4). CMR are calculated from the numbers of deaths in 1year olds (<1) and the 1-4years olds, from which a CMR 0-4 is calculated per million (pm) per population [4]. This is an appropriate measure as all 21 Western countries were signatories to the UN Millennium Goals objective of reducing CMR (0-4) by 2% per annum [27], reflecting the UNICEF (2001) view "*that in the last analysis child mortality rates are an indication of how well a nation meets the needs of its children*" [28]. Moreover, the UN Millennium objective was also linked to reducing poverty, which was recognised as a feature associated with child mortality, even in the richer countries [6-9,28].

In regard to *Adult Mortality Rates* (AMR 55-74) the analysis focuses upon reducing mortality of people aged 55-74years rates per million of population, which would make an especially major contribution to further improving life expectancy and reducing premature deaths in the countries reviewed [4].

Total mortality rates are analysed via the `*Age Standardised Deaths Rates'* (ASDR), which includes all the age bands from <1year to 75+years, based upon all-age death rates standardised on the World Standard Population [4]. The WHO reports in rates of per 100,000 however we adopt the increasing use of rates per million (pm) of which avoids the use of the decimal point reported in rates per hundred thousand [4].

It is recognised that there may also be different prevailing disease patterns in the various countries influencing mortality results but this is minimised as in effect each nation is its own control over the period. Thus, partially controlling for any prevailing socio-economic features related to health outcomes [6-9]. Moreover, based upon WHO 10th edition of International Classification of Diseases, resolves any issues about cause of death as the study is concerned with total mortality rates within the age-bands, not their diagnostic category [4].

To determine any statistical significant difference in the mortality rates over the period Confidence Intervals (95%) are used to test outcomes between each of the OWC and the USA whose results are shown in the final column of the mortality tables.

Cost-Effective Ratios (CEF): CER are based upon the level of *reduced* Age-Standardised-Death-Rates (total all-age mortality) rates over the period, divided by the average %GDPHE of that nation over the period. However, caution is required in interpreting the results as CER can be influenced by the laws of diminishing returns as it is easier for countries with initially higher rates to make greater gains than countries

whose baseline years are relatively low [29-31]. Moreover, this simple model of CEF cannot account for the underlying health conditions within a nation's population. Furthermore, as there are approximately 17% of the US general population are of an African-American background, it has long been known that Black American mortality rates are higher than the White aged contemporises. However, the OWC also have ethnic minorities and whose mortality rates also tend to be higher than the majority ethnic group but not such high proportions of their general population [16,32].

'Excess Deaths': Analysing mortality rates per million population enable us to make comparison between countries of markedly different population sizes. However, rates and percentages can appear to be somewhat detached and the practical reality can be masked. Consequently, to highlight any differences between the countries with the highest and lowest %GDPEH, we transpose the rates back into numbers. This enables us to calculate what if any `excess' deaths would there be if highest and lowest %GDPEH countries had not substantially matched each other's current child (0-4), adult (55-74), and ASDR (total) mortality rates.

A major limitation of the study is we cannot explain the differences between countries, which would require country-specific research, other than to place them within the context of economic input into health care, its %GDPHE. Nor can it account for the under-lying and often prevailing socio-economic circumstance [6-9] but in part this is resolved as each nation acts as its own control over time in both economic input and health output data.

The study is a broad-brush analysis hypothesis stimulating study and the results can only be indicative rather than definitive but can serve as a base-mark for later research. However it asks the basic question of how effective and efficient is the US health care system compared to the twenty Other Western Countries (OWC) and does it receive a good return on its financial investment into health?

Results

Economic Input into Health. In every year the USA had the highest total *%GDPHE.* In 1980 it was 9.0%, by 2000 it rose to 13.4%, by 2010 it had risen to 17.0% and went to 16.8% by 2015. The next highest *current* %GDPEH was Switzerland at 12.1%, Germany 11.2% France 11.1% down to lows in Ireland 7.8%, Greece 8.4%, Spain 9.2% and the UK at 9.8%.

The highest *average* %GDPEH over the period 1989-2015 was America at 12.7% followed by Germany 9.7% and France and Switzerland at 9.6%. The *lowest average* over the period was *the UK* at 7.1% followed by Greece and Spain 7.2 % and Ireland at 7.3%. The average %GDPEH of the OWC was 8.2% yielding an OWC to USA ratio of 1:1.55.

Over the four periods the OWC average %GDPEH was 7.1%, 8.6%, 10.2% and 10.4%. This yields OWC to USA ratios of 1:1.27, 1:1.56, 1:1.67 and 1:1.95, indicating that over the period American %GDPEH became more expensive in comparison to the other nations, with an odds ratio of 1:1.55 over the whole period.

Private: Public Source %GDP: Currently the USA has considerably higher %GDPEH from Private sources, at 9.15%, the next highest Private %GDPEH was Switzerland at 4.8%, the Netherlands 4.02% and Australia 3.71%. The lowest %GDPEH from Private sources was Denmark at 1.33%, Norway 1.53% and the UK at 1.58%. The average percentage of %GDPEH coming from `Private' sources in the OWC was 2.51%, yielding an OWC to USA ratio of 1:3.79.

Somewhat counter intuitively the percentage of USA GDP coming from `Public' sources at 7.95% was higher than *eleven* OWC Public %GDPEH, including the UK at 7.52%. The average OWC Public %GDP was 7.71%, giving an OWC to USA ratio of 1:1.03., indicating the seldom recognised fact that some funding for health in America comes from both Federal and State sources (Table 1).

Comparative Health Outputs: *Child-Mortality-Rates (0-4):* Every country substantially reduced its CMR over the period, the average reduction for the OWC was a 58% decline.

The highest current (2013-15) rates were in America at 1249pm, followed by New Zealand 1160pm, Canada 1094pm, Belgium 1091pm and the UK 885pm. These rates were equivalent to falls of 48%, 51%, 37%, 46% and 51%respectively. However, despite these improvements, this means that the USA, Canada and Belgium failed to meet the UN Millennium target of reducing CMR by 2%p.a.

The lowest CMR was Finland 451pm, Norway 552pm and Sweden 577pm, all having half the rate of the USA.

The OWC current average of 788pm yielded an OWC to USA ratio of 1:1.59, indicating that America had substantially higher child mortality than most of the OWC and by a substantial margin.

In the final column of table 2 a perusal of the Confidence Intervals shows that fourteen of the OWC had significantly bigger reductions than the USA, including the UK although America had a better outcome than Canada.

Adult Mortality Rates (AMR 55-74): Every country reduced its AMR substantially. The current highest AMR (55-74) was in the USA at 12544pm, Denmark at 11920pm, Germany 11701pm and Austria 11024pm down to the lowest in Australia 8121pm, Switzerland 8311pm, Japan 8556pm and Spain 8835pm. The average OWC was 98530pm, giving an OWC to USA ratio of 1.27.

Confidence Intervals showed that the USA had greater reductions in AMR (55-74) than Greece and Japan but *fourteen* OWC had significantly bigger falls than America, including the UK, the lowest funded %GDPEH (Table 3).

Age-Standardised-Death-Rates **(ASDR):** Every country reduced its total deaths (ASDR) substantially, the OWC averaging 34% reduction compared to the USA fall of 23% over the period.

The highest ASDR was in the USA at 4772pm, followed by Portugal 4136pm, Denmark 4124pm and Germany 4173pm, equivalent falls of 24%, 42%, 37% and 35% respectively. The lowest ASDR were Japan at 3084pm, Switzerland 3326pm, Australia at 3420pm and Spain at 34426pm, representing reductions of 34%, 33, 39% and 40% respectively.

The OWC average was 3784pm, produced an OWC to USA ratio of 1:1.26.

It is notable that *every* OWC had a significantly bigger reduction in all-age mortality (ASDR) over the period than America (Table 4).

Cost-Effective-Ratios (CER): Table 5 lists the CER for the ASDR outcomes between 1989-91 and 2013-15. The table was led by Ireland 1:419, followed by Portugal 1:388, Finland 1:333 and the UK 1:323. The lowest CER were in the USA 1:113, Switzerland at 1:1.67, France 1:1.859 and Sweden 1:1.197.

The OWC average CER was 1:270, yielding an OWC: USA ratio of 1:2.39. Fifteen countries had *double* the cost-effective ratio than the USA over the period. Whilst comparing CER between the most and least expensive countries %GDPEH, highlights just how more cost-effective was Britain, as the USA to UK ratio was 1:2.86 indicating the UK was more than twice cost-effective over the period.

Excess Deaths: Most v Least Expensive Countries. When

Table 3: Adult Mortality Rates (55-74) per million [pm] 1989-91 v 2013-15 Comparing Other Developed Countries (ODC) with USA by Confidence Intervals.

Country, Ranks 2014 v 1989	AMR 1989-91	AMR 2013-15	% Change	Confidence Intervals		
				Lower	OR	Upper
1- 4. USA	19168	12544	-35%	1:0.97	1:1	1:1.03
2- 6. Denmark	21104	11920	-44%	1:1.12	1:1.16	1:1.2
3- 6. Germany 1990-2015	18230	11701	-36%	1:0.99	1:1.02	1:1.05
4-10. Austria	17693	11024	-38%	1:1.02	1:1.05	1:1.09
5-12. Belgium	16874	10902	-35%	1:0.98	1:1.01	1:1.05
6-10. Finland	17845	10587	-41%	1:1.07	1:1.1	1:1.14
7-3. UK	20554	10568	-49%	1:1.23	1:1.27	1:1.31
8-8. Portugal 2012-14	17902	10391	-42%	1:1.09	1:1.13	1:1.17
9-19. Greece	14093	10371	-36%	1:0.86	1:0.89	1:0.92
10-12. Netherlands	16938	10114	-40%	1:1.06	1:1.1	1:1.13
11-1. Ireland 2012-14	22003	9821	-55%	1:1.42	1:1.47	1:1.51
12-15. Sweden	16297	9573	-41%	1:1.08	1:1.11	1:1.15
13-18. France 2012-14	14299	9443	-34%	1:0.96	1:0.99	1:1.03
14-14. Canada 2011-13	16392	9348	-43%	1:1.11	1:1.15	1:1.19
15-5. N. Zealand 2011-13	18843	9304	-50%	1:1.28	1:1.33	1:1.37
16-7. Norway	18042	9194	-49%	1:1.24	1:1.28	1:1.33
17-16. Italy	15661	8970	-43%	1:1.1	1:1.14	1:1.18
18-17. Spain	14625	8835	-40%	1:1.05	1:1.08	1:1.12
19-24. Japan	11818	8556	-38%	1:0.87	1:0.9	1:0.94
20- Switzerland	13589	8311	-39%	1:1.03	1:1.07	1:1.11
21-21. Australia	12394	8121	-34%	1:0.96	1:1	1:1.04
Average(-USA) Countries	**16319**	**9853**	**-40%**			

Table 2: Child Mortality Rates (CMR) per million 1989-91 v 2013-15, percentage of change; Comparing Other Developed Countries (ODC) with USA by Confidence Intervals.

Country, Current Rank v 1989-91 v 2013-15	0-4 CMR 1989 - 2015	% of Change	Confidence Intervals		
			Lower	OR	Upper
1-2. USA	*2420 - 1249*	**-48% #**	**1:0.91**	**1:1**	**1:1.1**
2-3. New Zealand 2011-13	*2361 - 1160*	*-51%*	1:0.95	1:1.05	1:1.16
3-14. Canada. 2011-13	*1740 - 1094*	*-37% #*	1:0.74	1:0.82	1:0.91
4-5. Belgium	2013 - 1091	-46% #	1:0.86	1:0.95	1:1.05
5-9.U. K	1929 - 885	-51%	1:1.01	1:1.12	1:1.25
6-13. Switzerland	1783 - 871	-51%	1:0.95	1:1.06	1:1.17
7-4. Greece	2039 - 843	-59%	1:1.12	1:1.25	1:1.39
8. 7. Denmark	1993 - 815	-60%	1:1.13	1:1.26	1:1.4
9-14=. France 2012-14	1740 - 810	-53%	1:1	1:1.11	1:1.23
10-11. Australia	1886 - 806	-57%	1:1.09	1:1.21	1:1.34
11-18. Germany 1990-92	1611 - 796	-51%	1:0.94	1:1.04	1:1.16
12-16. Netherlands	1729 - 789	-53%	1:1.01	1:1.13	1:1.26
13-17. Ireland 2012-14	1659 - 767	-54%	1:1	1:1.12	1:1.25
14-1. Portugal 2012-14	2993 - 752	-75%	1:1.85	1:2.05	1:2.28
15-8. Austria	1944 - 737	-62%	1:1.22	1:1.36	1:1.52
16-10. Italy	1895 - 684	-64%	1:1.28	1:1.43	1:1.6
17-22. Japan	1218 - 655	-46% #	1:0.85	1:0.96	1:1.08
18-12. Spain	1790 - 627	-65%	1:1.32	1:1.47	1:1.65
19-19. Sweden	*1520 - 577*	*-62%*	1:1.21	1:1.36	1:1.53
20-6. Norway	2005 - 552	-72%	1:1.67	1:1.87	1:2.11
21 -20. Finland	*1463 - 451*	*-69%*	1:1.48	1:1.67	1:1.9
Average West Countries (-USA)	***1866 - 788***	***-58%***			

# Indicates failed UN millennium goals.

Table 4: Total Age-Standardised-Deaths (ASD) per million 1989-91 v 2013-15: % Comparing Other Developed Countries (ODC) with USA by Confidence Intervals.

Country, 1989-91 v Final Year 2013-15	ASDR 1989-91	ASDR 2013-15	% change	Confidence Intervals		
				Lower	OR	Upper
1. USA	6203	4772	-23%	1:0.95	1:1	1:1.05
2. Portugal 2012-14	7086	4136	-42%	1:1.25	1:1.32	1:1.39
3. Denmark	6512	4124	-37%	1:1.15	1:1.21	1:1.28
4. Germany	6456	4173	-35%	1:1.13	1:1.19	1:1.26
5. Belgium	6151	4081	-34%	1:1.1	1:1.16	1:1.22
6. Ireland 2012-14	7127	4065	-43%	1:1.28	1:1.35	1:1.42
7. UK	6340	4044	-36%	1:1.14	1:1.21	1:1.27
8. Greece	5694	3995	-30%	1:1.04	1:1.1	1:1.16
9. Finland	6613	3985	-40%	1:1.21	1:1.28	1:1.35
10. Austria	6334	3945	-38%	1:1.17	1:1.24	1:1.3
11. Netherlands	5739	3898	-32%	1:1.07	1:1.13	1:1.2
12. New Zealand 2011-13	6278	3879	-38%	1:1.18	1:1.25	1:1.32
13. Norway	5862	3697	-37%	1:1.15	1:1.22	1:1.29
14. Sweden	5420	3688	-32%	1:1.07	1:1.13	1:1.2
15. Canada 2011-13	5504	3663	-33%	1:1.09	1:1.16	1:1.22
16. France 2012-14	5377	3604	-33%	1:1.08	1:1.15	1:1.21
17. Italy	5675	3455	-39%	1:1.19	1:1.26	1:1.34
18. Spain	5670	3422	-40%	1:1.2	1:1.27	1:1.35
19. Australia	5641	3420	-39%	1:1.2	1:1.27	1:1.34
20. Switzerland	4930	3326	-33%	1:1.08	1:1.14	1:1.21
21. Japan	4675	3084	-34%	1:1.1	1:1.17	1:1.24
Average (-USA)	**5735**	**3784**	**-34%**			

Income Inequality v ASDR Rho=+0.1974 n.sig.

019

Table 5: Cost-Effectiveness-Ratios | (CER) Reduced ASDR 1989-2015 Divided by Average %GDPEH 1980-2015. Ranked by Widest CER.

Country	Reduced ASDR	CER
1.Ireland	3062	1:419
2. Portugal	2950	1:388
3.Finland	2628	1:333
4. UK	2296	1:323
5. Spain	2248	1:312
6. New Zealand	2399	1:304
7.Denmark	2388	1:299
8. Austria	2389	1:281
9. Italy	2220	1:277
10. Australia	2221	1:274
11.Norway	2165	1:264
12. Japan	1591	1:252
13.Belgium	2070	1:246
14=. Germany	2283	1:236
14=. Greece	1699	1:236
16. Netherlands	1841	1:209
17. Canada	1841	1:198
18. Sweden	1732	1:197
19. France	1777	1:185
20. Switzerland	1604	1:167
21. USA	1431	1:113
OWC Average	2051	1:270

examining nation's mortality by rates of change can appear somewhat desiccated. When transposed into the actual numbers of deaths the practical reality emerges of what these difference means between the highest and lowest %GDPEH, in this case the USA, and the UK.

In 2015 there were a total of 2,726,630 deaths in the USA. American ASDR rates were 18%higher than the UK, the USA failing to match British rates means there was an excess of 488,273 deaths across all the ages. This included an excess of 12,613 American children's (0-4) deaths, as the USA failed to match British child mortality rates.

Discussion

It is reiterated that the major limitation to the study is that we cannot explain why the highest health-spender, the USA, has the highest mortality in all categories. Nor can we cross-reference the results in terms of the socio-economic influences on health outcomes other than to place them in the wider context of relative poverty, as measured by Income Inequality[19]. Nonetheless, we can reject the null hypotheses that there will be no significant differences between the USA and twenty other Western countries in regard to reduced mortality and cost-effectiveness over the period.

Over the years, the USA increased its %GDPEH and on average the USA spent 55% more of its GDPEH than the OWC. On average its child mortality was 59% higher, its adult death 27% higher and its total ASDR rates were 26% higher than the

other Western nations. Whilst over the period fourteen other countries had significantly bigger reductions in child and adult mortality respectively than the USA and even worse America has a significantly poorer ASDR outcomes than all the other countries. This it must be reiterated is despite the USA having far higher and increasing percentage GDP expenditure going to health over the period. On these criteria the American health care system is the most expensive and ineffective and inefficient in the Western world.

It may be that this disproportionate high %GDPEH is undermined by the simple fact that the USA has considerably wider income inequality than the other Western countries [3,19]. This points towards the impact of relative poverty upon health outcomes, which can be evidenced from a close perusal of Table 3 of the US National Vital Statistics [32]. The Table reports deaths rates by age, sex and `race', where it can be shown that for every White child's deaths there are 2.1 Black children dying. Whilst such a wide ratio falls through the age-bands, so that young adults (20-24) ratio of White to Black is 1:1.42 and continues up to the 65-69 age-band but falls to 1:1.8 by 75+ age-band [32]. This seem to be a clear reflection of the persistent influence of socio-economic disadvantage upon health outcomes.

This raises the question, should the USA increase even further its %GDPHE or primarily address the poverty issues related to people from poorer backgrounds, a feature found in every Western country but more marked in the USA [6,8,9,33,34].

One unexpected finding merits comment, namely that GDPEH from USA `Public' sources was higher than eleven other counties `Public' %GDEPH, including the UK. Is this a further indication that the under-lying insurance model of the USA system is problematic?

Possible Explanations for USA system weakness

In addition to the underlying social conditions impacting upon US mortality rates is the problem that the US health system suffers both from a lower level of productive efficiency and the significant market failure of asymmetric information [20-26]. This is because the USA has high administrative costs due to higher spending on more nonclinical staff, and duplicates often unnecessary investigations, indeed it has been estimated that then US system spends an excess of $150 billion on these additional administrative insurance-linked costs [35]. In addition is the relative over-use of the latest technology which further reduces productive efficiency [36,37], though whether this is due to American patients being more ill than in the other countries cannot be determined here. Moreover, many US physicians have the perverse incentive of earning additional income by ordering imaging studies such as MRI scans and CT scans which has resulted in diagnostic tests increasing at an annual rate of roughly 10 per cent per year [37,38]. A prestigious McKinsey Global Institute Study estimated that US health care providers earned as much as $25 million from profits on self - owned facilities providing laboratory, imaging and other services [39]. Consequently, the production

function for US healthcare is empirically demonstrated, to be significantly below that of the mainly universal direct taxation system, whilst Garber goes as far to describe the US system as "uniquely inefficient" [39]. Furthermore, insurance costs are high because of the market failure of asymmetric information. This results in higher insurance premiums as the insured have more information about their health than the insurer, who to mitigate potentially unlimited costs, need to increase their premiums significantly because of possible pre-existing conditions [20,23-26,35-41]. Equally, many people were unable to obtain full insurance due to known chronic medical conditions and who are on relatively low incomes, rather than pooling the risk collectively as with tax-based systems [2,38,40,41]. Such America citizens fall outside the system, possibly contributing to higher national mortality than other Western countries. Consequently in fiscal and clinical terms, the USA achieves less with more, whilst the UK, with its National Health Service (NHS) achieves proportionately more with relatively less. Indeed the NHS, compared to the USA, could almost be described as a half-price system, with the UK to USA %GDPEH odds ratio of 1:1.79.

The Affordable Health Care Act was surely right in principle but the insurance model still diverts too many resources from clinical care to the for-profit medicare agencies who compound the problem [42]. Despite the greater inclusiveness of Obama Care, the systematic problems inherent in an insurance model remain, with recent complaints from insurance companies supporting AHCA, they have difficulty in making a profit [41]. Hence it is still more expensive than a direct taxation system and has not produced the improvement that was hoped for [38-41]. Indeed, a JAMA study found continued criticism of the cost of AHCA from 21% of Democratic and 63% of Republican respondents who support the repeal of the AHCA [1], but whether given more time, this might change under Obama Care is too soon to determine. So, does the USA get a good return on its investment in health care - the answer must be a resounding no.

The Case for Change: It is acknowledged that in terms of *clinical excellence*, at its best American medicine is amongst the leaders of the world but these results show that despite vast sums expended on health the money clearly does not *reach the citizen effectively* or how else could the supporters of the present system explain the `excess' of US deaths compared to almost `half-price' NHS? Moreover, President Trump claims to be the first businessman to occupy the White House and as a businessman the need for a good return on a major financial investment would be almost formulaic. Yet clearly, in terms of health outcomes, the USA has actually fallen behind other Western countries over the period, which is a poor return on the vast amounts of money going to health care. Quite apart from the impact of prevailing inequality has upon health and social outcomes - surely there is a need for a major radical rethink?

In terms of health care systems, it appears to outsiders the two major US political parties have trapped themselves in ideological silos but perhaps there are vested interested in maintaining the present system as a progressive direct taxation

system clearly would be cheaper for the nation. However whether the evidenced-based argument could overcome the USA political misunderstandings about `Government' intervention into health care might be incompatible to the USA tradition, is uncertain? But it is suggested the comparative mortality argument has not been made.

When listening to some USA media presentation during the first election of President Obama and his hopes for Òbama Care, his opponents accused him of wanting to bring in something like Britain's NHS, which was characterised as `socialised medicine' and by inference, un-American. British people hearing this would not recognise this distorted description of the NHS and such rhetoric stops balanced public health analysis and creates prejudiced stereotyping. Yet paradoxically, the NHS can claim to be similar to the great American tradition of *neighbourliness and community*, eulogised in many Hollywood epics, where people rally round in hard times to support other citizens in trouble. This in effect is the underlying principle of the NHS. So the USA might well adopt its own style of a Neighbour Helping Health Service system – an American NHHS, as all neighbours / citizens contribute through progressive taxation, to help each other at the point of need, which is of course a reciprocal support system and is far more cost-effective and community cohesive. That the NHS is such a reciprocal and cost-effective system often goes unrecognised by the proponents of an insurance based model. In summary, in terms of reducing deaths, a neighbour / community orientated National Health Service is a model superior in cost and outcome than the current American insurance model, which profits from the ill-health of American people. Indeed, based simply upon mortality rates, every one of the other twenty Western nations is superior to the United States health care system, compounded by having the worst Income Inequality in the Western world [3,19].

The USA failure to meet the UN Millennium goals for reducing under-five mortality, with its association with relative poverty [5], should be the greatest spur for change in the richest country in the world and these results support the clarion call that "abolishing inequality is a necessity to realise child mortality targets" [45].

These general findings, along with excess four-hundred thousand plus `excess' deaths, compared to British rates, are likely to be very unwelcome information as they challenge entrenched stereotypes and ideologies but evidence must speak truth to power. We leave the last word to that great American founder, William Penn who was a forerunner of public health, who said "*It is a reproach to Government and Religion to suffer such poverty and excess*", almost prophetic when considering the excess of American deaths compared to Britain and of course most of the other Western countries.

Acknowledgements

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