IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 19, Issue 5 Ser.10 (May. 2020), PP 51-54
www.iosrjournals.org

Discounted monetary value of human lives lost due to COVID-19 in the USA as of 3 May 2020

Joses M. Kirigia[1*], Rose Nabi Deborah Karimi Muthuri[2]
[1]*African Sustainable Development Research Consortium (ASDRC), Nairobi, Kenya*
[2]*Faculty of Health Sciences, University of Pretoria, Hatfield, Pretoria 0002, South Africa*
**Corresponding author: Professor Joses M. Kirigia*

Abstract
Objective: *To estimate the total discounted monetary value of human lives lost (TDMVHL) due to Coronavirus disease (COVID-19) in the USA as of 3 May 2020.*
Methods: *The study estimates the present value of the 67,535 lives lost from COVID-19 in the USA, using the national average life expectancy of 78.6 years and a 3% discount rate. The robustness of the DMVHL was tested, first using 5% and 10% discount rates, and second, assuming the average global life expectancy of 72 years and then the world's highest life expectancy of 87.1 years.*
Results: *The COVID-19 deaths had a TDMVHL of Int$ 19,780,290,991, and an average of Int$ 292,889per human life lost.About 66.7% of the DMVHL was borne by those aged between 25 and 64 years.Re-analysis of the economic model with a 5% and 10% discount rate instead of 3% resulted in a declines in TDMVHL of Int$ 3,137,875,342 (15.9%) and Int$ 8,029,231,329 (41%), respectively.Application of the average global life expectancy of 72 years, shrank TDMVHL by Int$ 6,642,600,193 (33.6%). Interchangeably, the use of the world's highest life expectancy - which is the Japanese female life expectancy of 87.1 years - lead to an increase in TDMVHL of Int$ 17,672,957,517 (89%).*
Conclusion: *Even though our study is of limited scope, it has revealed that every human life lost in the USA from COVID-19 is worth 4.3 times the national per capita GDP.*
Keywords: *COVID-19, gross domestic product, monetary value of human life, USA*

Date of Submission: 07-05-2020 Date of Acceptance: 21-05-2020

I. Introduction

The United States of America (USA) has an estimated gross domestic product (GDP) of International Dollars (Int$) 22,321.8 billion, and a GDP per capita of Int$ 67,426.8 [1]. The country has a population of 331.052 million persons [1].

As of 3rd May 2020, worldwide there were 3,507,785 coronavirus disease (COVID-19) cases, including 1,130,122 recovered cases, and 245,254 deaths [2]. Out of212 countries and territories around the world with COVID, the United States of America was leading with a cumulative total of 1,162,383 cases, which included 173,910 recovered cases, and 67,535 deaths [2].

Why have the COVID-19 cases and deaths exploded in the USA? The universal health coverage (UHC) index in 2018 was 80%, implying a gap in coverage of essential health services of about 20% [3]. Approximately, 4.8% of the population had household expenditures on health greater than 10% of total household expenditure or income; and almost 0.8% of the population had household expenditures on health greater than 25% of total household expenditure or income [3].

The proportions of the population using safely managed drinking water and sanitation services were 99% and 89%, respectively [3]. This sub-optimal coverage implies that approximately 3,310,520 (1%)and 36,415,720 (11%) persons did not have access to safely managed drinking water and sanitation facilities. Persons with those kinds of deprivations might have a significant challenge in maintaining personal hygiene and practising regular handwashing to minimize the probability of COVID-19 infection.

The USA has significant income inequalities. For example, 20.2% of the national income accrues to the wealthiest 1%, while only 15.2% accrues to the 40% of the poorest population [4].In 2014,46.7 (14.8%) million people were living in poverty [5].People living in poverty would have many challenges affording any protective measures against COVID-19.

The purpose of this study was to estimate the discounted monetary value of human lives lost (DMVHL) due to COVID-19 in the USA as of 3 May 2020.

II. Methods

Analytical framework

Weisbrod [6] explained that"The present value of a man at any given age may be defined operationally as his discounted expected future earnings stream (net of his consumption if the net concept is used)" (p.427). In this study, we used GDP per capita as a proxy for annual earnings. However, following Weisbrod's advice, we subtracted the per capita current health expenditure for the USA from the GDP per capita to obtain net GDP per capita.

The COVID-19 human lives lost were broken down by ten age groups, i.e. (1) 0-4 years, (2) 5-14 years, (3) 15-24 years, (4) 25-34 years, (5) 35-44 years, (6) 45-54 years, (7) 55-64 years, (8) 65-74 years, (9) 75-84 years, and (10) 85 years and above. Thus, the total discounted monetary value of human lives lost ($TDMVHL_{USA}$) from COVID-19 as of 3 May 2020 in the USA is the sum of the discounted monetary values of human lives lost across the ten age groups. The TDMVHL was obtained using the following formula:

$$TDMVHL_{USA} = \sum_{J=1}^{J=10} DMVHL_{j=1,..,10} \dots\dots\dots\dots\dots (1)$$

$$DMVHL_j = \sum_{t=1}^{t=n} (X_1 \times X_2 \times X_3) \dots\dots\dots\dots\dots\dots (2)$$

Where:$DMVHL_j$ is the discounted monetary value of human lives lost in j^{th}age group;X_1 is the net GDP per capita, which equals per capita GDP minus current health expenditure per capita; X_2 is the number of deaths from COVID-19 in j^{th} age group, which equals total number of COVID-19 deaths in USA multiplied by the proportion of deaths in j^{th} age group; X_3 is the discount factor in year t, which was equals $1/(1+r)^n$; r is the discount rate of 3%; t=1 first year of life lost and t=n is the last year of life lost in j^{th}age group; and year of life lost in j^{th} age group equals the average life expectancy in USA minus the average age at death for age group j.

III. Data and Data Sources

The data analysed was obtained from the following sources:

a) Per capita current health expenditure for USA of Int$ 10,246 was extracted from the WHO Global Health Expenditure Database [7].

b) GDP per capita of Int$ 67,426.8 was mined from the IMF World Economic Outlook Database [1].

c) Average life expectancies at birth of the USA of 78.6 years; the world of 72 years; and the Japanese females of 87.1 years (which is the highest in the world) were obtained from the WHO World Health Statistics Report 2019 [3].

d) Total number of COVID-19 deaths in the USA as of 3 May 2020 was gotten from the Worldometer [2],

e) Data on the distribution of COVID-19 deaths by age group and state were obtained from the US Centers for Disease Control and Prevention [8].

IV. Results

Table 1 shows the age group distribution of TDMVHL from COVID-19 by 3rd May 2020 in the USA. The 67,535 COVID-19 deaths had aTDMVHL of Int$ 19,780,290,991. The lives lost among 0-4-year-olds accounted for 0.09%; 5-14-year-olds for 0.05%; 15-24-year-olds for 0.60%; 25-34-year-olds for 3.71%; 35-44-year-olds for 8.44%; 45-54-year-olds for 19.37%; 55-64-year-olds for 35.14%; and 65-74-year-olds for 32.6%. About 66.7% of the TDMVHL was borne by those aged between 25 and 64 years. The average discounted monetary value per human life lost was Int$ 292,889.

Table 1: Discounted monetary value of human lives lost from COVID-19 in the USA (in 2020 Int$): calculated assuming three discount rates

Age group in years	Discounted monetary value of human lives lost at 3% discount rate (Int$)	Discounted monetary value of human lives lost at 5% discount rate (Int$)	Discounted monetary value of human lives lost at 10% discount rate (Int$)
0-4	18,575,864	12,130,930	6,206,491
5-14	9004370.233	5,996,204	3,100,938
15-24	119,577,981	82,059,858	43,316,628
25-34	733,821,375	522,812,945	285,058,015

35-44	1,669,121,217	1,245,318,999	714,020,884
45-54	3,831,328,495	3,023,194,305	1,870,814,450
55-64	6,950,611,068	5,864,391,444	4,059,070,205
65-74	6,448,250,620	5,886,510,963	4,769,472,051
75-84	-	-	-
85 and above	-	-	-
Total	19,780,290,991	16,642,415,649	11,751,059,662
Average discounted monetary value per human life lost	292,889	246,426.53	174,000

Re-analysis of the economic model with a 5% and 10% discount rate instead of 3% resulted in a declines in TDMVHL of Int$ 3,137,875,342 (15.9%) and Int$ 8,029,231,329 (41%), respectively.

Table 2 provides a comparison of the discounted monetary values of human lives lost from COVID-19 in the USA, which were estimated holding discount rate constant at 3%, assuming the USA's, global and world's highest life expectancies. This was done to determine the effect of changes in life expectancy on the TDMVHL of USA. Application of the average global life expectancy of 72 years, which is 7 years lower than that of the USA, shrank TDMVHL by Int$ 6,642,600,193 (33.6%). Interchangeably, the use of the world's highest life expectancy - which is the Japanese female life expectancy of 87.1 years - leads to an increase in TDMVHL of Int$ 17,672,957,517 (89%).

Table 2: Discounted monetary value of human lives lost from COVID-19 in the USA: estimated assuming USA's, global and world's highest life expectancies (in 2020 Int$ or PPP)

Age group in years	**Discounted monetary value of human lives lost at 3% discount rate and assuming the USA's average life expectancy of 83 years (Int$)**	**Discounted monetary value of human lives lost at 3% discount rate and assuming the global average life expectancy of 72 years (Int$)**	**Discounted monetary value of human lives lost at 3% discount rate and assuming world's highest life expectancy of 87.1 years (Int$)**
0-4	18,575,864	18,087,178	18,575,864
5-14	9,004,370	8,743,077	9,287,932
15-24	119,577,981	114,661,802	125,495,650
25-34	733,821,375	690,089,764	786,461,684
35-44	1,669,121,217	1,519,655,240	1,849,035,354
45-54	3,831,328,495	3,283,269,378	4,491,034,366
55-64	6,950,611,068	5,160,602,833	9,105,267,211
65-74	6,448,250,620	2,342,581,526	11,390,297,789
75-84	-	-	7,408,410,848
85 and above	-	-	2,269,381,811
Total	19,780,290,991	13,137,690,799	35,183,866,698
Average discounted monetary value per human life lost	292,889	194,531.59	554,575

V. Discussion

The 67535 COVID-19 deaths had a TDMVHL of Int$ 19,780,290,991; which is 0.09% of the total GDP of the USA. The USA average discounted monetary value per human life of Int$ 292,889, was lower than the average fiscal value per COVID death in China of Int$ 356,203 [9]. The former is because 39,198 (58%) human lives lost in the USA occurred above the age of 79 years, and were valued at zero. On the other hand, no human life lossesoccurred above the Chinese average life expectancy of 76.4 years.

VI. Limitations

This study had some limitations. First, it omits the costs of health systems inputs used in prevention, diagnosis, tracking of contacts, quarantine of suspected cases, isolation of the infected, and management of cases that test positive for COVID-19. Second, it used the per capita GDP estimates for 2020 projections made by the IMF in January 2020, i.e. before the explosion in the spread of COVID-19 in the USA in March 2020. The actual GDP might have shrunk following the economic slowdown during the ongoing pandemic. Third, due to the weaknesses inherent in the human capital approach for valuing human lives [10], the lives of persons who

died above the average life expectancy in the USA of 78.7 years were valued at zero. Fourth, during pandemics, dead bodies are buried almost immediately, often without post-mortem to confirm the cause of deaths. Therefore, COVID-19 may not have been recorded as the cause of in some instances.

VII. Conclusion

Even though our study is of limited scope, it has revealed that every human life lost in the USA from COVID-19 is worth 4.3 times the national per capita GDP. We concur with Card and Mooney [10] that because the national resources are scarce "..the valuation of human life should be made more rational and explicit" (p.1629). The evidence presented in this paper is mainly useful for advocating for increased and equitable investments into the creation of resilient federal and state health systems and other systems that tackle social determinants of health to combat not only COVID-19 effectively but also future pandemics in the USA. Full economic evaluations that assess both the costs and consequences of preventive and curative interventions into COVID-19 are needed to guide health-related decision-making.

Competing interests

The authors declared no conflict of interest.

Authors contributions

JMK contributed in study design, development of economic model on Microsoft Excel, data analysis, and writing of the manuscript. RNDKM contributed in literature review, extraction of data from various databases, data analysis, and writing of the manuscript.

Acknowledgements

We are indebted to Jehovah Shalom for granting us peace during the entire process of the study reported in this paper. Lenity Honesty KainyuNkanata provided invaluable moral support and encouragement.

References

[1]. International Monetary Fund (IMF). IMF World Economic Outlook Database. Washington, DC: IMF; 2020. https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx. Accessed 3 May 2020.
[2]. Worldometer. COVID-19 Coronavirus Pandemic. Reported Cases and Deaths by Country, Territory, or Conveyance. Last updated: May 03, 2020, 13:59 GMT https://www.worldometers.info/coronavirus/country/us/ Accessed 17:11 PM 3 May 2020.
[3]. World health statistics overview 2019: monitoring health for the SDGs, sustainable development goals. Geneva: World Health Organization; 2019.
[4]. UNDP. Human Development Report 2019. Beyond income, beyond averages, beyond today: Inequalities in human development in the 21st century. New York: UNDP; 2019.
[5]. DeNavas-Walt C, Proctor BD. Income and Poverty in the United States: 2014, U.S. Census Bureau, Current Population Reports, P60-252. WashingtonDC: U.S. Government Printing Office; 2015.
[6]. Weisbrod BA. The Valuation of Human Capital. J Political Econ. 1961; 69(5):425-436.
[7]. WHO. WHO Global Health Expenditure Database. Geneva: WHO; 2020. https://apps.who.int/nha/database/ViewData/Indicators/en. Accessed 4 May 2020.
[8]. Centers for Disease Control and Prevention (CDC). Provisional Death Counts for Coronavirus Disease (COVID-19): Weekly Updates by Select Demographic and Geographic characteristics. National Center for Health Statistics. Atlanta, USA: CDC; 2020. https://www.cdc.gov/nchs/nvss/vsrr/covid_weekly/index.htm#AgeAndSex]. Accessed 3 May 2020.
[9]. Kirigia JM, Muthuri RNDK. The fiscal value of human lives lost from coronavirus disease (COVID-19) in China. BMC Res Notes. 2020; 13:198. https://doi.org/10.1186/s13104-020-05044-y.
[10]. Card WI, Mooney GH. What is the monetary value of a human life? BMJ. 1977; 2: 1627-1629.

Professor Joses M. Kirigia, et. al. "Discounted monetary value of human lives lost due to COVID-19 in the USA as of 3 May 2020." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 19(5), 2020, pp. 51-54.