Current Journal of Applied Science and Technology

Volume 43, Issue 7, Page 80-92, 2024; Article no.CJAST.118883
ISSN: 2457-1024
(Past name: British Journal of Applied Science & Technology, Past ISSN: 2231-0843, NLM ID: 101664541)

Risk Factors Affecting Life Expectancy Resulting in Premature Mortalities and the Accompanying Economic Losses

Gavin J. Putzer [a*], Alan Cooper [b] and Juan R. Jaramillo [c]

[a] University of Central Florida College of Medicine, 4363 Scorpius Street, HSII Room 335, Orlando, FL 32816, USA.
[b] Adelphi University, Garden City, NY, USA.
[c] Long Island University, School of Entrepreneurship and Innovation, 720 Northern Blvd, Brookville, NY 11201, USA.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/cjast/2024/v43i74408

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/118883

Original Research Article

Received: 13/04/2024
Accepted: 17/06/2024
Published: 24/06/2024

ABSTRACT

Chronic diseases such as heart disease, stroke and diabetes often lead to increased rates of morbidity and premature mortality thereby diminishing professional productivity. Many chronic diseases are a result of combination of genetic, behavioral, lifestyle, socioeconomic, and environmental risk factors. We examined modifiable risk factors stratified by sociodemographic factors to ascertain economic losses resulting in premature mortality. Mortalities were calculated using a methodology employed by Dr. Ralph Keeney which estimates mortalities from a single underlying cause of death. The results show 2.8M deaths, of which greater than 1.1 million were attributable to risk factors with a productivity loss of $402.5 billion. Our paper showed that the leading causes of preventable deaths across gender and race during this time period had unique

**Corresponding author: E-mail: gputzer@ucf.edu, Gavin.Putzer@ucf.edu;*

Cite as: *Putzer, Gavin J., Alan Cooper, and Juan R. Jaramillo. 2024. "Risk Factors Affecting Life Expectancy Resulting in Premature Mortalities and the Accompanying Economic Losses". Current Journal of Applied Science and Technology 43 (7):80-92. https://doi.org/10.9734/cjast/2024/v43i74408.*

patterns with lifestyle factors such as smoking, accidents, and sexually transmitted infections declining, while behaviors such as alcohol, drug use and suicide increased. These findings may not be revolutionary; however, they do strongly reinforce, from an economic point of view, the need for the initiation and/or expansion of several targeted public health campaigns.

Keywords: Life expectancy; premature mortality; modifiable risk factors; economic losses; sociodemographic.

1. INTRODUCTION

Life expectancy predicts how long an individual of a certain age, gender, and health status is anticipated to live on average. Life expectancy at birth refers to how long a hypothetical newborn would live if current age-specific death rates prevailed through one's entire life. Naturally, it changes with increasing age. Thus, for older individuals, one may calculate how long someone of a certain age may expect to live, or their longevity, (i.e., how long you might live), with the aid of an educational tool known as an Actuaries Longevity Illustrator (ALI) [1]. There is a possibility that you will live many years beyond the average. Information is input regarding your health, lifestyle factors such as smoking and demographic characteristics into an ALI and it produces results reflecting the probability of your lifespan, including assessing probability to the number of future years you might expect to live [2-5].

Several of the leading causes of death in the United States (US) today are the very same leading causes of mortality from previous decades despite a concerted focus on disease pathogenesis and disease prevention concomitant with the implementation of associated medical and public health measures [6-14]. Chronic diseases such as heart disease, stroke, cancer, and diabetes often lead to increased rates of morbidity and premature mortality thereby diminishing professional productivity and personal health [10,15-18].

Many chronic diseases are a result of a combination of genetic, behavioral, socioeconomic, and environmental risk factors. Many of these risk factors may be classified as modifiable or at least partially modifiable while some factors are non-modifiable. For purposes of this study and to augment the previous research of Dr. Ralph Keeney [16], modifiable risk factors (MRF) may be defined as factors in which there are alternative courses which may be selected More specifically, an MRF is a factor that may be altered at some point; although, not necessarily by the individual alone, leading to a different outcome [16]. Previous research studies [19-23] corroborate that modifiable risk factors such as smoking, excessive alcohol consumption, illicit drug use, engaging in risky sexual behaviors, poor dietary habits and physical inactivity are tangibly associated with approximately 40% of US mortalities [9,10,16].

Recent research also has shown that there is a widening mortality gap between American adults with a college degree and without a college degree [24]. More alarming is the US appears to be the only Western country in which life expectancies are trending in different directions based on education according to this study [24]. Their research paper builds upon the dramatic increase in suicide, drug overdoses and alcoholism from a 2020 published book [25]. A recent study [26] that we conducted shows the increase in these outcomes stratified by sociodemographic characteristics (i.e., age, gender and race).

In our study, the MRF's we examine include smoking, excessive alcohol consumption, illicit drug misuse, sexually transmitted infections, obesity (i.e., poor dietary habits and physical inactivity, accidents, homicide, and suicide. For purposes of this study as in previous research [16,26], suicide is classified as a risk factor while it is also an established health outcome. It may be postulated that these factors appear to be partially attributable to behaviorally modifiable risk factors. Furthermore, these risk factors diminish life expectancies and therefore result in premature mortalities along with personal and economic losses. In this study, we examine these MRF stratified by gender and race to ascertain economic losses resulting from premature mortality of life expectancy.

2. METHODS

For the purpose of this study, the authors apply the race categorization used by the United States Census Bureau [27].

- "White – a person having origins in any of the original peoples of Europe, the Middle East, or North Africa."
- "Black or African American – a person having origins in any of the Black racial groups of Africa."
- "American Indian or Alaskan Native – a person having origins in any of the original peoples of North and South America (including Central America) and who maintains tribal affiliation or community attachment."
- "Asian – a person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam."

The United States Census Bureau defines Hispanics as: "Hispanic or Latino as a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race."

The CDC Wonder database [23] that tracks mortality causes including demographics classifies Hispanic information, in addition, to the traditional ethnicity/race groups mentioned above. In fact, the CDC Wonder database separates each of the four race groups and the Hispanic group in its report to avoid double counting (i.e., an Asian person with Latin American roots). Consequently, this manuscript includes five racial/ethnic groups in the analysis.

This study collects a single underlying cause of death (UCD-ICD-10 Codes) at the US level, including age, gender, and racial/ethnicity for the year 2019. The source of the data is the CDC Wonder database [27] and the information collected includes all deaths in the US. The CDC database provides mortality that is directly associated to MRF such as suicide (codes X60-X84), illicit drug misuse (Codes F11-F16, X42 and Y12), and alcohol cirrhosis (code K70), However there are other cases in which the single cause of death is not as specific. That is the case of malignant neoplasms of the stomach (code C16), which have multiple underlying origins. Another such case being alcohol misuse. Therefore, this work adjusts MRF deaths by using the methodology proposed in Keeney [16]. Continuing with the example and applying the methodology, 20% of malignant neoplasms of the stomach are associated with alcohol misuse in ages of 35 and older. MRF mortality data is partitioned by racial/ethnic groups, leading to ten separate groups as follows: White females and males (WF and WM), African American females and males (AF and AM), Asian or Pacific Islander females and males (PF, PM), American Indian and Alaskan Native females and males (NF, NM), and Hispanic or Latino females and males (HF, HM). For each of these groups MRF mortality is expressed as deaths per 100,000 persons. Finally, deaths with incomplete information are discarded. Incomplete mortality data is rare (i.e., less than 0.01% of the total). Therefore, discarded data is not expected to have a measurable nor meaningful impact on our work.

This study uses the definition of MRF defined by Keeney's [16] work. Keeney defines eight MRF: Accidents, Alcohol misuse, Illicit Drug misuse, Homicide, Suicide, Obesity, Smoking, and STIs. Moreover, the MRF is broad and defines the word 'Modifiable' as something that could have been altered by either the victim or by society. For example, a death in a car accident caused by a lack of wearing a seat belt is considered modifiable. In the same fashion, a death caused by smoking habits could have been avoid if cigarettes would have been avoided in one way or another. In Keeney's definition, modifiable differs from intentionality. It is not the purpose of this work to review a definition that has been used in the literature in the last 15 years.

3. RESULTS

Our study estimates single year MRF mortality economic loss cost using single year economic loss curves that are derived from 2016 economic loss curves for the year 2016 with respect to males and females presented in Scott [28]. These curves have been created based on the combination of annual growth in employment compensation and net present value discount rates. Moreover, we used two levels for annual growth in employment compensation (0.5% and 1.0%) combined with net present value discount rates from 0 to 10%. Unofficial guidelines recommend the use of discount rates of 3% [29]. Moreover, the US office of Management and Budget recommends the use of 3% and 7% discount rates [30].

This work selected the curves with annual growth in employment compensation of 0.5% and net present value discount rates of 7% to be in the conservative spectrum and follow the

recommendations mentioned above. Given that these curves have been built for the year 2016 and the focus of this study is the year 2019, these curves are applied to year 2019 dollars by applying a factor of 1.065 [31]. Fig. 1 shows the mortality economic loss cost single age-year curves for females and males used in this study. The higher loss for males occurs at the age of 34 with a loss of $1,406.085, while regarding females the peak value is at the age of 30 with a loss of $1,147,007.

Fig. 2 shows US total mortality partitioned by gender. In addition to total mortality, the figure charts include deaths caused by MRF's. There is a peak that appears in total mortality around 70 years old. The peak is more pronounced in males versus females. The peak origin is in the CDC data and its interpretation is beyond the scope is this study. More importantly, MRF mortality's largest impact is due to early age mortality, meaning that this peak has a minimal (if any) effect in the results of this work.

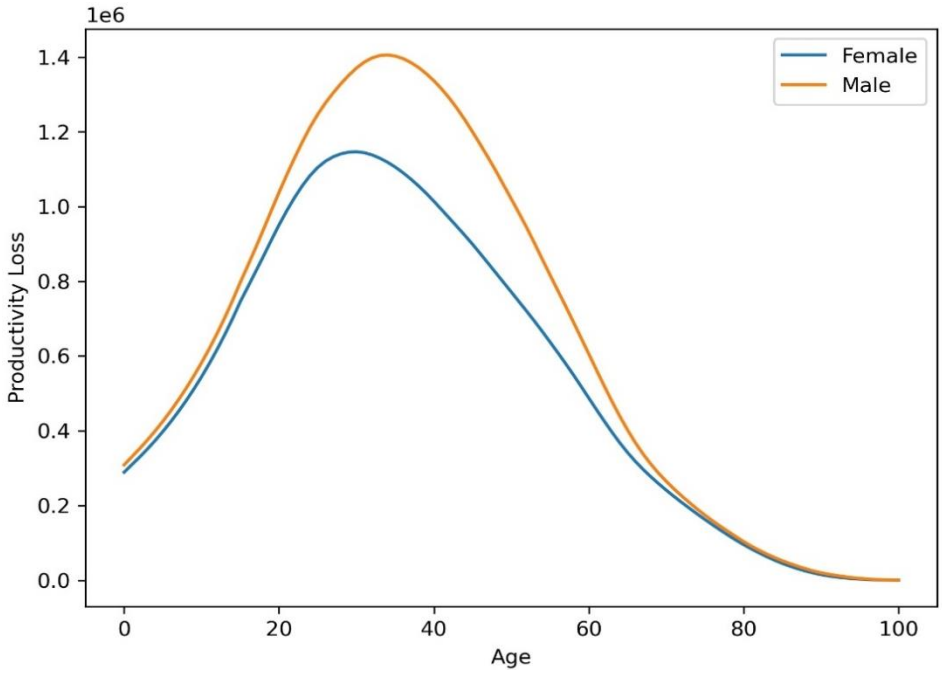

Fig. 1. Mortality economic loss cost single age-year curves

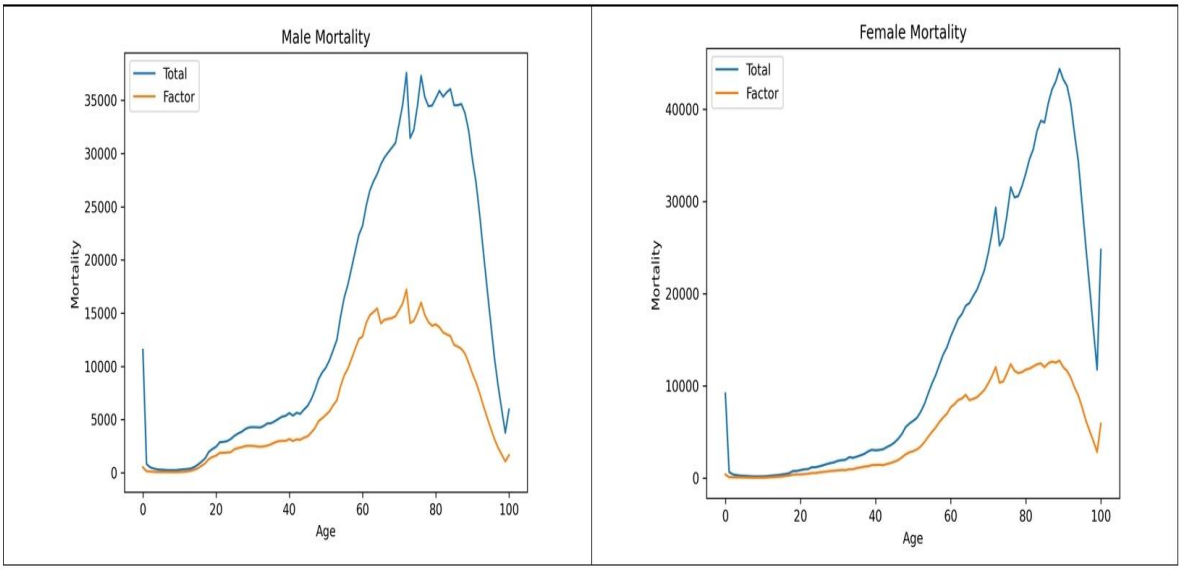

Fig. 2. Total and MRF mortality among males and females

Table 1 shows the economic loss due to Total and MRF mortality stratified by gender. These values are obtained by multiplying yearly mortality into mortality economic loss cost single age-year values plotted in Fig. 1. In 2019, there were greater than 2.8M deaths with a productivity loss in the US of $402.5 billion dollars. Among these mortalities, greater than 1.1M were caused by modifiable behavioral risk factors with an economic loss of $402.5 billion. MRF deaths amount to 39.9% of total mortality, but represent 49.6% of the economic loss. When mortality is partitioned by gender, male mortality is higher in numbers and more importantly, deaths caused by modifiable behavioral risk factors represent a higher percentage of total deaths. Similarly, the economic loss generated by MRF is higher in males than females (52.9% vs 43.2%).

A classification of mortality by gender and racial/ethnicity grouping shows differences in economic loss among the groups. Table 2 is female mortality stratified by race/ethnicity. Native American women show the highest proportion of MRF mortality followed by White and Asian Pacific women. In contrast Native American, White and Asian Pacific show the highest proportional costs. African American women show the lowest proportional valued among all racial groups.

As previously mentioned, MRF male mortality shows higher proportions in comparison to females. When examining by race, the highest MRF mortality proportions are associated with Native American, Black, and Hispanic groups; whereas, White and Asian Pacific individuals show the lowest percentages. In addition, economic loss associated with MRF is consistently above 50% for all males. Among males, Native American and Black have the highest impact of MRF's, while Asian Pacific have the lowest impact.

The above results suggest that MRF mortality follows different patterns among gender and race, leading to different economic loss structures. Table 4 is a detailed economic loss in US dollars ($ billions) classifying MRF factor by gender and race. Group denominations are abbreviated as follows: The first letter defines the racial group: W is white; A is African American and Black; P is Asian and Pacific Origin; N is Native American and Alaskan; and H is Hispanic. Also, the second letter corresponds to gender: F for females and M for males. As an example: PF stands for Asian and Pacific Females.

Table 5 presents the results as a percentage of the total economic loss with respect to the total economic loss classified by gender and racial cohort. The most abundant MRF are shown in red, while the ones with the less abundance are represented in green. For example, alcohol is most abundant among Native American and Alaskan Females while obesity is most abundant among Hispanic Males.

Table 6 shares the abundance of each modifiable risk factor stratified by gender and racial cohort. For example, the economic loss due to accidents among white females is $4.25B (see Table 4) and the 2019 population of white females in the US is 100.0M according to the Census Bureau1. Therefore, productivity loss is $4.25/100.0M = $42.51 per white female. These results show major differences among males and females for each racial group. Also, there are crucial differences among the groups. The last two rows summarize USA population totals. Red color highlights the most abundant; whereas, green shows less abundant ones. Notice that the group with the highest economic loss in 2019 is the Native American and Alaskan with a loss of $2,259, followed by African American males with a loss of 2021.3.

Fig. 3 summarizes the main results obtained in Table 4. The size of the square represents the economic loss for each group represented as economic loss per person in the group.

4. DISCUSSION

Premature mortality due to modifiable risk factors is not only a personal and family tragedy, but an economic one as well. Table 1 poignantly shows that in 2019 alone, almost 40% of deaths were due to modifiable risk factors, with a subsequent economic loss of over $400 billion. Moreover, almost 50% of the economic loss due to total overall mortality. Even more telling is the fact that deaths due to modifiable risk factors account for 39.9% of total mortality, yet they are responsible for 49.9% of total economic loss (across genders). When broken down by gender, the gap widens further, with male deaths due to modifiable risk factors accounting for 44.1% of total mortality, yet responsible for 52.9% of total economic loss (peaking at age 34). Females show a similar trend with 35.4% of mortality due to modifiable risk factors responsible for 44.1% of the economic loss (peaking at age 30). These facts are alarming on many levels, not the least being the staggering amount of money lost, both personally and to the national economy. Add to

this the portion of the unyielding rise in healthcare spending, overall, $3.8 trillion in 2019, spent on treating modifiable risk factors, and the total costs of these deaths are almost beyond comprehension [32].

To better understand these numbers, we can stratify them even further by age and race. As previously stated, when combined across race, the peak value for economic loss due to death caused by modifiable risk factors for males occurs at age 34, while the peak value for women occurs at age 30. However, the total economic losses are higher for males ($1.4 million) compared to females ($1.1 million). This fact may not only be due to the discrepancies between male and female salaries (not accounted for in this paper), but also because there is a higher total number of male deaths due to modifiable risk factors. Another possible explanation is that women may leave the workforce or reduce their workload (both voluntarily and involuntarily), during child rearing years resulting in lower income over that time period, sometimes referred to as “the mommy penalty [33,34].” This gap, however, may have diminished over recent years due to the introduction of paternity leave benefits [35].

When the data is broken down by gender and race, some interesting trends emerge; we see that, as previously stated, the proportion of economic loss due to premature death caused by modifiable risk factors being higher than the proportion of deaths due to modifiable risk factors as compared to total mortality, holds true across racial groups for both men and women. For women, Native American and Alaskan Natives have the highest proportion of deaths due to modifiable risk factors and the highest proportion of economic loss (albeit the lowest total numbers of both deaths and economic loss). While African American women and Hispanic Women have the lowest proportion of deaths due to modifiable risk factors and subsequently the lowest proportion of economic loss. The overall correlation between proportion of deaths due to modifiable risk factors and proportion of economic loss due to these deaths in women is r^2=0.97, showing that economic loss due to death caused by modifiable risk factors is homogenous across races.

Fig. 3. Total MRF economic loss in proportional impact

Table 1. Total and factor mortality cost by gender

	Total mortality	Risk factor mortality	Percentage	Total cost	Risk factor cost	Percentage
Female	1,378,516	488,305	**35.4%**	$280.7**B**	121.5**B**	**43.2%**
Male	1,469,296	648,209	**44.1%**	$530.8**B**	281.0**B**	**52.9%**
Total	2,847,812	1,136,514	**39.9%**	$811.5**B**	402.5**B**	**49.6%**

Table 2. Female mortality by racial classification

	Total mortality	MRF	Percentage	Total loss	MRF loss	Percentage
White	1,070,895	383,950	**35.9%**	194.1**B**	87.6**B**	**45.1%**
Black or African American	166,412	55,127	**33.1%**	49.5**B**	20.5**B**	**36.7%**
Asian and Pacific	37,642	13,390	**35.6%**	7.7**B**	3.4**B**	**43.9%**
Native American and Alaskan	8,854	3,704	**41.8%**	3.4**B**	1.7**B**	**49.6%**
Hispanic	94,713	32,135	**33.9%**	26.0**B**	10.6**B**	**40.9%**
Total	1,378,516	488,305	**35.4%**	$280.7**B**	121.5**B**	**43.2%**

Table 3. Male mortality by racial classification

	Total mortality	Risk factor mortality	Percentage	Total cost	Risk factor cost	Percentage
White	1,118,620	490,035	**43.8%**	$357.5**B**	$188.9**B**	**52.8%**
Black or African American	182,330	83,676	**45.9%**	$92.1**B**	$49.5**B**	**53.7%**
Asian and Pacific	39,830	16,926	**42.5%**	$14.3**B**	$7.3**B**	**51.0%**
Native American and Alaskan	10,842	5,225	**48.2%**	$6.3**B**	$3.5**B**	**55.0%**
Hispanic	117,674	52,347	**44.5%**	$60.5**B**	$31.9**B**	**52.8%**
Total	1,469,296	648,209	**44.1%**	$530.8**B**	$281.0**B**	**52.9%**

Table 4. MRF economic losses in US $ billions among gender and racial classification

	WF	WM	AF	AM	PF	PM	NF	NM	HF	HM
Accidents	4.25	10.32	1.10	2.95	0.18	0.40	0.16	0.29	0.93	3.08
Alcohol	8.40	18.21	1.42	2.69	0.26	0.60	0.50	0.72	1.27	4.02
Illicit Drugs	5.73	14.68	1.49	4.09	0.05	0.24	0.09	0.19	0.61	3.16
Homicide	1.23	2.86	1.19	8.37	0.09	0.20	0.07	0.21	0.50	2.39
Obesity	28.81	40.23	7.69	9.50	1.44	1.85	0.35	0.48	3.85	5.30
Smoking	31.82	47.28	6.13	9.36	0.92	1.66	0.35	0.49	2.20	4.42
STIs	1.55	1.19	0.96	1.20	0.10	0.07	0.04	0.03	0.46	0.52
Suicide	5.83	20.51	0.58	2.32	0.34	0.93	0.15	0.42	0.79	3.08

Table 5. MRF economic loss expressed as percentages by gender and race

	Female					Male				
	WF	**AF**	**PF**	**NF**	**HF**	**WM**	**AM**	**PM**	**NM**	**HM**
Accidents	**4.9%**	**5.3%**	**5.3%**	**9.4%**	**8.8%**	**6.6%**	**7.3%**	**6.7%**	**10.2%**	**11.8%**
Alcohol	**9.6%**	**6.9%**	**7.6%**	**29.3%**	**11.9%**	**11.7%**	**6.7%**	**10.1%**	**25.5%**	**15.5%**
Illicit Drugs	**6.5%**	**7.3%**	**1.4%**	**5.3%**	**5.8%**	**9.5%**	**10.1%**	**4.0%**	**6.7%**	**12.2%**
Homicide	**1.4%**	**5.8%**	**2.7%**	**4.2%**	**4.7%**	**1.8%**	**20.7%**	**3.4%**	**7.6%**	**9.2%**
Obesity	**32.9%**	**37.4%**	**42.7%**	**20.6%**	**36.2%**	**25.9%**	**23.5%**	**31.1%**	**16.9%**	**20.4%**
Smoking	**36.3%**	**29.8%**	**27.4%**	**20.5%**	**20.7%**	**30.4%**	**23.1%**	**27.9%**	**17.4%**	**17.0%**
STIs	**1.8%**	**4.7%**	**2.9%**	**2.1%**	**4.4%**	**0.8%**	**3.0%**	**1.2%**	**0.9%**	**2.0%**
Suicide	**6.7%**	**2.8%**	**10.0%**	**8.6%**	**7.4%**	**13.2%**	**5.7%**	**15.5%**	**14.9%**	**11.8%**

Table 6. MRF economic loss per individual

Race	Gender	Accidents	Alcohol	Illicit Drugs	Homicide	Obesity	Smoking	STIs	Suicide	Total
White	Female	42.5	84	57.3	12.3	288.1	318.3	15.5	58.3	876.3
	Male	106	134.9	150.8	29.4	413.4	485.9	12.2	210.8	1,543.50
African American	Female	51.1	66.3	69.4	55.2	357.9	285.3	44.5	26.9	956.5
	Male	150.1	100	208.1	425.7	482.8	475.7	61.2	117.8	2,021.30
Pacific and Asian	Female	17.7	25.2	4.6	9.1	141.6	90.7	9.5	33.1	331.5
	Male	43.2	44.1	25.7	22	199.1	178.5	7.9	99.5	620.2
Native American	Female	129.3	400.8	72.8	57.3	282.5	281.1	28.3	117.5	1,369.60
	Male	240.6	499.3	158.8	179.2	399.3	410.1	21.3	350.7	2,259.30
Hispanic	Female	31.1	42.3	20.4	16.8	128.3	73.5	15.4	26.3	354.1
	Male	100.6	87.4	103.4	78.2	173.4	144.5	17.1	100.6	805.3
USA Population	Female	40.6	72.7	48.9	18.9	258.7	254.3	19	47.1	760.3
	Male	107.8	118.7	141.5	88.9	362.9	399.9	19.1	172.4	1,411.20

As formerly stated, male mortality and economic loss show higher proportions than women, but we see some similar trends when broken down by race. The highest proportion of deaths due to modifiable risk factors are seen in Native American and Alaskan Natives, as well as the highest proportion of economic loss, while the lowest proportion of deaths caused by modifiable risk factors and subsequent economic loss are seen in Asian and Pacific Islanders, with Whites being close behind. The latter differs from that which we observed in the female population in which we found the lowest proportion of deaths due to modifiable risk factors in Black/African American and Hispanic women. There are most likely several reasons for the cause of this difference, some may be revealed when we investigate further into the specific modifiability risk factors involved. The overall correlation between proportion of deaths due to modifiable risk factors and proportion of economic loss due to these deaths in men is also $r^2 = 0.97$, showing that economic loss due to death caused by modifiable risk factors in men is also homogenous across racial groups. One interesting finding among the male population, however, is the age at which mortality occurs due to modifiable risk factors. We found that Black and African American, and Native American men die younger due to modifiable risk factors than Whites and Asians. This would parallel the overall U.S. life expectancy by race which shows the average life expectancy for White Americans is higher than that for African or Black Americans [36]. Studies have shown several reasons for this, including the fact that African Americans have a higher death rate than White Americans due to homicide, 41.6% vs 53.7% respectively, which tends to happen at earlier ages [37]. This is also in line with our findings showing that homicide as a cause of early mortality was responsible for the third highest economic loss due to modifiable risk factors in African American men. We can explore this phenomenon further by breaking down our findings by specific risk factor.

Viewing specific risk factors, we see that the highest productivity loss due to risk factor mortality in Whites and Asians is smoking and obesity. These losses are significantly higher than any other modifiable risk factors for these racial groups. This holds true for both men and women. Although the same result is found for all the other races, except for Native Americans, the magnitude of the difference is not nearly as strong. Therefore, we can conclude that collapsed across gender and race, obesity and smoking are the largest modifiable causes of economic loss due to early mortality. For Native Americans, the highest contributor to economic loss due to preventable risk factors is alcohol, followed by obesity and smoking. This is correlated with the high overall alcohol abuse rate by Native Americans which can be linked to heart and liver disease and subsequent death [38,39]. We also see that in African American men, the next largest contributor to economic loss is homicide, while in White, Asian, and Hispanic men, it is alcohol.

Examining these numbers from a percentage perspective, combining two factors -obesity and smoking- represents over 50% of the economic loss due to early mortality in White females, African American females, Asian females, and Hispanic females. The only exception to this trend is Native American females, with a combined percentage is 41.1%. For White and Asian males, these two factors are responsible for over 50% of the economic loss as well. With African American males showing these factors being responsible for 46.6% of economic loss. For Native Americans, alcohol alone was responsible for 29.3% of the economic loss for females, and 25.5% of the economic loss for males.

While examining the economic loss by individual (Table 6), some remarkably interesting facts arise. We see that when we collapse across risk factor, the economic loss per Hispanic male is $805.30, while the economic loss per African American Male is $2,021.30. One would assume that mostly the same limitations and challenges would affect the two groups, yet the dollar loss is significantly larger per African American male. The largest areas of economic loss for both African American and Hispanic Males is due to obesity and smoking; however, the economic loss for early mortality due to obesity and smoking for African American males is almost three times higher than that of Hispanic males. The study's assumption that earnings are equal across racial groups may not hold true across all races in the study, however, it essentially holds true when you compare the weekly median salary of African American and Hispanic males, $769 vs. $747, respectively.[31] Therefore, other social and behavioral factors must be playing a role.

The relative economic loss comparison per ethnic group population tells a powerful story:

smoking and obesity far outweigh the other modifiable risk factors with respect to economic loss due to early mortality. Across genders, smoking and obesity combined are the largest causes of economic loss due to early mortality across all races. Separately, these elements are the number one and number two leading risk factor causes of economic loss due to early mortality across all races, apart from Native American and Alaskan natives, in which they are a close second and third. There should be no surprise, then, that the data shows that diabetes and heart disease, both of which are closely correlated to smoking and obesity, are responsible for early mortality in double the amount of African American men than White or Asian men, and over 30% more Hispanic men than White or Asian Men.

Our study has a few limitations. One example is the presence of mistakes in death reports provided to the CDC. Another limitation is that this work assumes that the coefficients used in Keeney [16] are the same across gender and racial/ethnicity cohorts. There may be minor differences that are beyond the scope of this work. This is another reason for selecting conservative economic loss curves.

5. CONCLUSION

The implications of the findings may not be revolutionary, but they do strongly reinforce, from an economic point of view, the need for the initiation or expansion of several ethnically targeted public health campaigns. The data presented here are for 2016, in our previous study, modifiable causes of early mortality was tracked over the time period 2006 – 2019 and showed that the leading causes of preventable deaths across gender and ethnicity during this period had unique patterns with factors such as smoking, accidents, and STI's declining, while alcohol, drug use and suicide increased. The paper also broke down the data based on age [26]. Although our previous study did find a downward trend in smoking and obesity, the current study shows that these are by far the largest contributors to economic loss due to early mortality caused by modifiable risk factors. Using the data from our previous paper, combined with the data presented here, public health officials can target at risk populations not only by race/ethnicity, but also by gender, and age, thereby making the campaigns more efficient and therefore more effective.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/118883