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Personal Decisions Are the Leading Cause of Death

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This paper analyzes the relationships between personal decisions and premature deaths in the United States. The analysis indicates that over one million of the 2.4 million deaths in 2000 can be attributed to personal decisions and could have been avoided if readily available alternative choices were made. Separate analyses indicate 46% of deaths due to heart disease and 66% of cancer deaths are attributable to personal decisions, about 55% of all deaths for ages 15–64 are attributable to personal decisions, and over 94% of the deaths attributable to personal decisions result in the death of the individual making the decisions. Relative to the current 45%, retrospective appraisal suggests that roughly 5% of deaths in 1900 and 20%–25% of deaths in 1950 could be attributed to personal decisions. These results suggest that more effort directed toward improving personal choices regarding life risks may be an effective and economical way to save lives.

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1. Introduction

This paper investigates a different framing of the major causes of death in America. With this frame, the major cause of death is not heart disease or cancer, nor is it smoking or being overweight. The leading cause of death is personal decision making, which leads to over one million deaths annually. Framing the situation this way suggests different types of potentially effective alternatives to improve this circumstance. Making better personal decisions could potentially prevent millions of premature deaths per decade.

The logic is straightforward. A review of the medical literature indicates that heart disease and cancer are the leading medical causes of death in the United States (Centers for Disease Control and Prevention 2002a). This raises the question of what causes heart disease and cancer. Certainly, a multitude of factors do. Two major causes are smoking (Centers for Disease Control and Prevention 2002b) and being overweight (Allison et al. 1999), each resulting in over 400,000 deaths annually (Mokdad et al. 2004). Hence, many people conclude that the leading causes of premature death are smoking and being overweight. We extend this logic by asking what causes smoking and being overweight? One answer is personal decision making, because smoking and being overweight result from several choices that were made by each individual. With different personal choices, such circumstances could have been avoided. Other personal decisions that lead to significant premature deaths include drinking too much alcohol, vehicle deaths,

and homicide and suicide. Collectively, personal decisions lead to more than one million premature deaths annually.

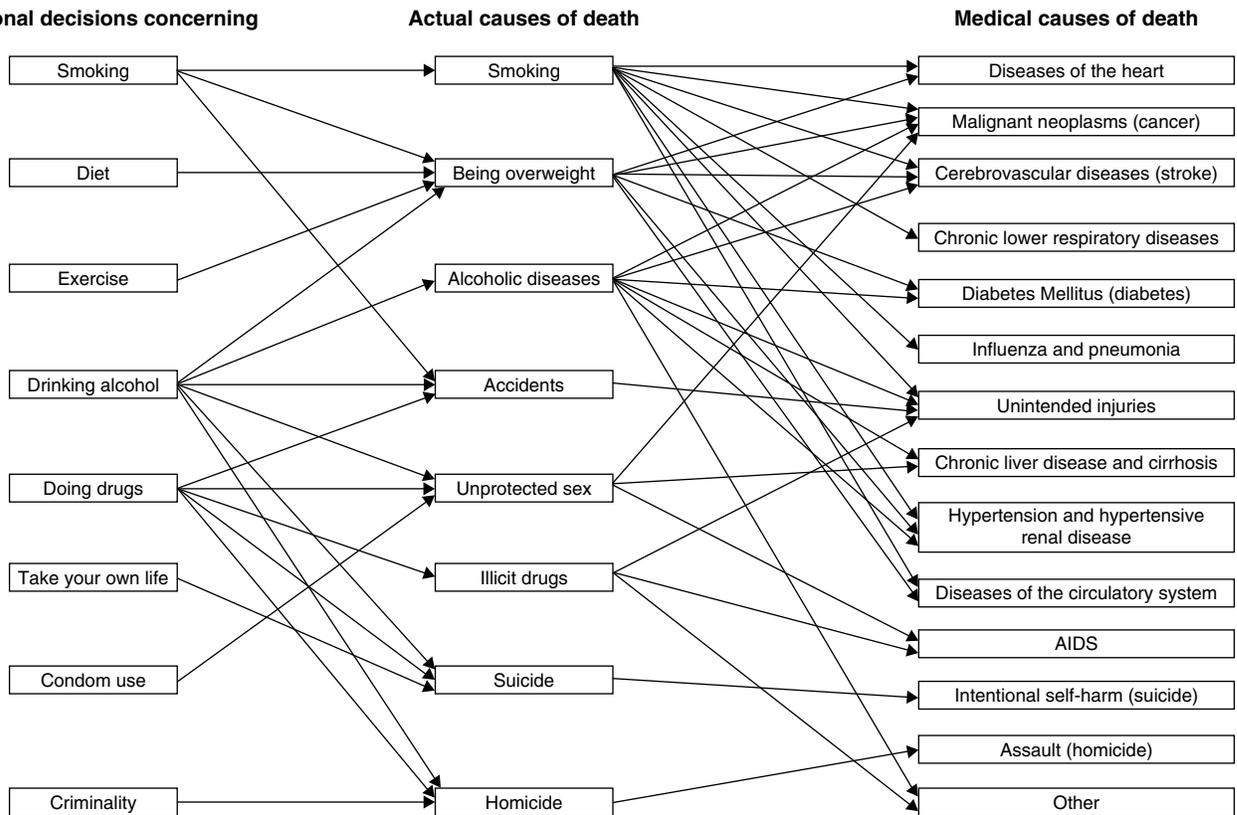
This is both bad news and good news. It is certainly a terrible circumstance where so many people die because of personal decisions. The good news is two-fold. First, individuals can take much more control of their personal fate regarding death. Second, improving decision making is less expensive and, at least in some cases, may be more effective in reducing premature death than are technological, medical, or public policy remedies.

This paper is organized as follows. Section 2 outlines the relationships between personal decisions and subsequent fatalities. Section 3 presents the information used to calculate the number of fatalities attributable to personal decisions, both by classes of decisions and age groups. Section 4 presents additional analyses and insights about the medical causes of deaths attributable to personal decisions, the proportion of deaths in different age groups attributable to personal decisions, and a perspective on the changes in the proportion of deaths attributable to personal decisions over the last century. Section 5 summarizes the implications of this study and suggests research using the ideas here to avoid substantial numbers of premature deaths.

2. Structuring the Problem

The main claims in this paper are that personal decisions result in large numbers of premature deaths and that readily available alternative choices could have avoided many of

Figure 1. Influences of personal decisions on causes of death.



Note. An arrow means “influences.”

these premature deaths. Thus, we need to carefully define our meanings for the terms personal decisions, readily available alternatives, and premature deaths. Figure 1 indicates the main influences of personal decisions on subsequent fatalities. The figure illustrates, for example, that an individual’s decisions about diet and exercise influence being overweight, which influences, among others, the likelihoods of diseases of the heart and cancer (i.e., malignant neoplasms), which can each lead to death.

A *personal decision* is a situation where an individual can make a choice among two or more alternatives. This assumes that the individual recognizes that he or she has a choice and has control of this choice. *Readily available alternatives* are alternatives that the decision maker would have known about and could have chosen without investing much time or money. For the premature deaths examined in this paper, there are typically many decisions leading up to that death for which readily available alternatives could have been available. For some of these decisions, the individual may not have had control over the choices. Our analysis assumes that for at least one of these many decisions, the individual does control the choice of a readily available alternative that, if chosen, could have avoided the specific premature death. A readily available alternative does not mean that it would be easy to choose because habits, social pressure, or genetic predisposition can render some alternatives very hard to select.

Some elaboration may clarify the notion of a “death due to a personal decision” as used in this paper. Essentially, it is defined by the categories of deaths analyzed and the decisions that lead to them. It intentionally excludes any situations requiring heroic decisions, extraordinary foresight, or more knowledge than common sense. One can die from a fall while walking or from choking from eating. One certainly could have made a decision to avoid that walk or to eat something else, but common sense excludes such decisions from our analysis. The same is true for deaths to commercial flyers and to military personnel, although other choices could have been made in each situation. A kid who joins a gang makes a personal decision, perhaps in his own self-interest, to do so. If he later is killed by a rival gang, his killer made a decision that led to his death. Hence, my calculations include this as a death due to a personal decision. Subsequently, I estimate the total of such deaths that result in the decision maker’s own death.

A *premature death* resulting from a personal decision is defined to be one where an individual dies sooner than would have been the case if a different choice had been made. Deaths attributable to obesity or automobile wrecks due to drunk driving or not wearing a seat belt are examples of premature fatalities. The key notion here is attributable. Suppose, for example, that data indicate that smoking triples one’s risk of dying from a particular cancer at age 60. Hence, if 300 smokers die from this cancer at age 60, the

triple-the-risk data indicates on average that only one-third of them (namely, 100) would have died if none of them had been smokers. Thus, we consider the other 200 to be premature deaths resulting from the decision to smoke.

The logic for these calculations can be clearly indicated with a little formality. Let S be a smoker and S' a non-smoker, C be a particular cause of death, and N the number of smokers. Furthermore, define $p(C | S)$ and $p(C | S')$ as the respective probabilities that a smoker and a nonsmoker die due to cause C . Now we want to calculate $D_S \equiv$ the number of smoker deaths from C , $D_{S'} \equiv$ the number of deaths to those smokers if they had not smoked from C , and $D_A \equiv$ the number of premature deaths due to C attributable to smoking. Suppose that data indicates that the risk of death from C to smokers is a proportion $\pi > 1$ relative the risk for nonsmokers. Thus,

$$p(C | S) = \pi p(C | S'). \quad (1)$$

Now,

$$D_S = Np(C | S) \quad (2)$$

and

$$D_{S'} = Np(C | S'). \quad (3)$$

Substituting (1) and (2) into (3) yields

$$D_{S'} = N(1/\pi)p(C | S) = (1/\pi)D_S. \quad (4)$$

The number of premature deaths due to C attributable to smoking is

$$D_A = D_S - D_{S'} = D_S - (1/\pi)D_S = (1 - (1/\pi))D_S. \quad (5)$$

From (5), you can calculate the premature fatalities attributable to C due to smoking given a knowledge of the number of smokers who died from C and the relative risk π .

Before proceeding, it is worthwhile to introduce the concept of poor personal decisions. Decisions typically have a myriad of potential consequences. For decisions considered in this paper, a premature death is one of these potential consequences. Whether a particular decision is poor or good can be made from the perspective of the decision maker who made the choice or from the perspective of society, meaning the collective thoughts and feelings of the public.

The decisions of focus in this paper concern activities such as smoking, overeating, exercise, and driving. An individual can coherently decide that he would rather continue to smoke because the enjoyment he gains from smoking outweighs his concern for the risks to his health and longevity. Such a decision would not be a poor decision from that individual's perspective. The same individual may have started smoking just to do something and may state that he knew it was stupid at the time. This would have been a poor decision from that individual's perspective. Because we cannot

know what an individual thought in these situations, it is not possible to definitively say that poor personal decisions were made from the individual's perspective.

From the public perspective, I believe a large majority of the premature deaths that could have been avoided by different personal decisions are considered poor personal decisions. Smoking and being overweight collectively contribute over 80% of the premature deaths in this paper. Most people, including many smokers, believe smoking is stupid. Most people have family members, perhaps themselves, or friends who wish they could make some very different decisions about eating and exercise. Very few people think drunk driving and speeding is a good decision.

Obviously habits, and especially addictive habits such as smoking and excess alcohol use, are very difficult to break. However, prior to having these habits, the individuals made personal decisions that led to these habits and these are the personal decisions of concern in this paper.

Two major studies in the recent past have tabulated what is referred to as the actual causes of death in the United States. McGinnis and Foege's (1993) original paper calculated the main external contributors to death using 1990 data. The top five causes were tobacco, diet/activity patterns, alcohol, microbial agents, and toxic agents. Mokdad et al. (2004) updated these results using 2000 data and found the same top five causes; the main difference was the significant increase of 100,000 deaths annually attributed to poor diet and physical inactivity.

Our work differs from and extends these studies in several ways. First, our focus is to relate the actual causes of death to individual decisions that could have avoided them. Many deaths caused by microbial or toxic agents may not have easily been under the control of the individual decision maker, so we do not count these as deaths attributable to personal decisions. Second, we calculate the deaths attributable to personal decisions, and the percentage of such deaths, as a function of age. Third, we calculate the medical causes of death due to each class of personal decisions (e.g., choosing to smoke, inactivity and poor diet, and lack of safety habits in automobiles) and collectively for all classes. Fourth, we examine the increase in the percentage of deaths attributable to personal decisions over the past century.

Previous studies of premature deaths in the United States suggest the implications for what the government, the health care system, or schools might do to lessen the consequences. The excellent papers cited above are examples. McGinnis and Foege (1993) summarize the implications of their results with "the public health burden they impose is considerable and offers guidance for shaping health policy priorities" (p. 2207). Mokdad et al. (2004) conclude that their findings "argue persuasively that the need to establish a more preventative orientation in the U.S. health care and public health systems has become more urgent" (p. 1238). I agree with these conclusions. The analysis here suggests complementary efforts that may be fruitful.

Table 1. Medical causes of all deaths in the United States in 2000.

Rank	Cause of death	International classification	Number	Percent of total deaths
...	All causes	...	2,403,351	100.00
1	Diseases of the heart	I00–I09, I11, I13, I20–I51	710,760	29.6
2	Malignant neoplasms	C00–C97	553,091	23.0
3	Cerebrovascular diseases	I60–I69	167,661	7.0
4	Chronic lower respiratory diseases	J40–J47	122,009	5.1
5	Accidents (unintentional injuries)	V01–X59, Y85–Y86	97,900	4.1
6	Diabetes Mellitus	E10–E14	69,301	2.9
7	Influenza and pneumonia	J10–J18	65,313	2.7
8	Alzheimer's disease	G30	49,558	2.1
9	Nephritis, nephrotic syndrome, and nephrosis	N00–N07, N17–N19, N25–N27	37,251	1.5
10	Septicemia	A40–A41	31,224	1.3
11	Intentional self-harm (suicide)	X60–X84, Y87.0	29,350	1.2
12	Chronic liver disease and cirrhosis	K70, K73–K74	26,552	1.1
13	Essential (primary) hypertension and hypertensive renal disease	I10, I12	18,073	0.8
14	Assault (homicide)	X85–Y09, Y87.1	16,765	0.7
15	Pneumonitis due to solids and liquids	J69	16,636	0.7
...	All other causes	Residual	391,904	16.3

In today's world, individuals have significant control over potential causes of premature death. Circumstances have essentially empowered individuals by giving them information and opportunities to reduce their own life-threatening risks perhaps to a greater degree than the government or the health care system.

3. Deaths Attributable to Personal Decisions

There were just over 2.4 million deaths in the United States in the year 2000 as summarized in Table 1 (Centers for Disease Control and Prevention 2002a). Of these, the calculations summarized in Table 2 and described in this section indicate 1.069 million deaths, which are 44.5% of all deaths, are premature and can be attributed to personal decisions with readily available alternatives.

Table 2. Premature deaths attributable to personal decisions.

Personal decisions influencing (example decisions about)	Number of premature fatalities caused
Smoking (starting, not quitting)	453,377
Weight (diet, exercise)	434,395
Alcoholic diseases (overdrinking alcohol)	67,779
Accidents (driving while drinking, speeding, not using seat belts, other activities under the influence of alcohol and drugs)	38,246
Suicide (trying to commit suicide)	29,350
Unprotected sex (not using protection)	19,837
Homicide (criminality, joining gangs, carrying weapons)	16,765
Illicit drugs (using of illicit drugs)	9,411
Total	1,069,160

An online appendix presents a spreadsheet with the details of our calculations. (An electronic companion to this paper is available as part of the online version that can be found at <http://or.journal.informs.org/>.) The information is organized separately for the personal decisions influencing each actual cause of death listed in Table 2. For each of these actual causes, the medical causes of subsequent premature deaths are identified in various sources described below. Table 3 illustrates the information used in the spreadsheet with an example. The first column of the spreadsheet, and of Table 3, indicates a medical cause of death (ischemic heart disease) associated with a corresponding actual cause of death (smoking) that can be influenced by personal decisions (all decisions concerning smoking behavior). The second column gives the ICD-10 code for the medical cause of death. The next two columns list the fractions of all medical deaths for each age group attributable to decisions related to the actual cause of concern. The next several columns in the online appendix specify the number of deaths during 2000 in each age group due to the medical cause. Multiplying these times the aforementioned fractions yields the number of deaths from that medical cause attributable to decisions about the associated actual cause.

An example will be helpful. Consider ischemic heart disease attributable to decisions to smoke. The Centers for Disease Control and Prevention (2002b) has statistics showing that 29,128 smokers from age 35–64 died annually during 1995–1999 from ischemic heart disease attributable to smoking. Also, there were 72,358 total annual deaths for that age group due to this cause during this time period. Thus, we calculate that 40.3% of deaths to individuals aged 35–64 from ischemic heart disease are due to smoking. The Centers for Disease Control and Prevention (2002a) report that there were 47,737 deaths to individuals aged from 55–64 due to ischemic heart disease in 2000. Because 40.3%

Table 3. Illustration of calculations for deaths attributable to personal decisions.

ACTUAL (CAPS) and medical (lower case) causes of death	ICD-10 code	Fraction due to medical cause	Age group	Medical deaths in 2000 for ages 55–64	Medical deaths in 2000 for ages 55–64 due to actual cause
SMOKING Ischemic heart disease	I20–I25	0.403	35–64	47,737	19,217

are attributed to smoking, we multiply $(0.403)(47,737)$ to determine 19,217 such deaths caused by decisions to smoke.

Before summarizing our calculations of premature fatalities due to various categories of personal decisions, it is useful to comment on two important topics: possible double counting of premature deaths and the precision of the premature fatality estimates.

Double counting in this paper would occur if specific premature fatalities were attributed to more than one cause (i.e., categories of personal decisions). Examples could concern premature deaths of obese smokers and of drunk drivers in automobile crashes. To minimize such cases, four things were done: much of the external data that we chose to use in our calculations had accounted for double counting possibilities, separate analyses in this paper accounted for obvious potential overlaps (e.g., smoking and obesity), models to incorporate dependencies among causes were constructed, and categories of premature fatalities were defined to reduce double counting. Examples of each will be useful.

The premature fatalities calculated for personal decisions concerning smoking and drinking alcohol used attributable fractions of total deaths due to these causes. The sources were the Centers for Disease Control and Prevention for smoking and The National Institute of Alcohol Abuse and Alcoholism for drinking alcohol. These sources tried to eliminate double counting in estimating their attributable fractions.

A major potential source of double counting could involve smoking and being overweight. To minimize this possibility, our estimates of premature fatalities due to being overweight are based on studies that used separate data and analyses for overweight smokers and overweight nonsmokers (Allison et al. 1999).

There are potential overlaps of vehicle fatalities due to driving after drinking alcohol, speeding, and not wearing a seat belt. A simple model described later in this section was developed to incorporate these dependencies in estimating premature fatalities.

Our categories of death due to personal decisions were chosen to eliminate some obvious possibilities of double counting. For example, our categories of death due to alcohol use included only those due to chronic use. Premature fatalities caused by short-term use of alcohol (e.g., being drunk) such as vehicle deaths and other accidents are separately included under the accidents category. Suicides and homicides involving alcohol or drug use are only counted under suicides and homicides.

In providing estimates of premature fatalities for each cause for each age group, I have chosen to show the calculation to the number of fatalities. Hence, as indicated above, the calculation for premature fatalities due to ischemic heart disease due to smoking for individuals 55–64 years old was 19,217. Obviously, such estimates are not precise and should not be interpreted as such. I chose to present them this way for three reasons: (1) it is then easier to understand how the calculations were done and to check them, (2) the possible imprecision on some large causes of premature fatalities (e.g., smoking) would mask smaller causes even if they are extremely precise (e.g., suicides and homicides), and (3) the reader can then interpret the precision of any of the calculations using their own judgment unconfounded by my judgment.

The sources and logic used to relate personal decisions to actual causes of death and subsequently to medical causes of death are discussed below. These sources often provide the fraction of medical deaths in each category attributed to the actual cause for the different age groups. In a few situations, such as motor vehicle accidents, we calculated these and our assumptions and reasoning are presented.

Decisions About Smoking

Individuals have a choice about whether they begin to smoke. This does not mean that they do not feel peer pressure to begin smoking, but that they did have a choice. They also can choose to try to quit at any time. Many do quit and many fail. Since the first surgeon general’s report (U.S. Department of Health, Education, and Welfare 1964) is over 40 years old, essentially everyone now knows that smoking is bad for one’s health. Hence, individuals reflect on their decisions to smoke or not, so we consider all premature smoking deaths to be due to personal decisions.

Premature deaths attributable to smoking were calculated using the Centers for Disease Control and Prevention methodology (2006). The specific calculations were done as follows. Using the 1995–1999 smoking-attributable deaths for specific diseases caused by smoking and the average total number of deaths due to those causes in those five years, we determined the percentages of deaths for each disease due to smoking. Then, we multiplied these percentages times the reported number of deaths in 2000 from each of the diseases for each age group (Centers for Disease Control and Prevention 2002a). For smoking fatalities to the smoker and to others due to second-hand smoke, only ages over 35 were included in the calculations. For burn deaths due

to smoking, all ages were used. Perinatal fatalities refer to deaths of newborn children.

The Centers for Disease Control and Prevention (2002b) calculated 442,398 annual deaths for the years 1995–1999. Our calculations for 2000 indicated that the fatalities caused by decisions to smoke included 411,000 due to smoking diseases, 40,000 due to second-hand smoke, and about 1,000 burn deaths and 1,000 perinatal deaths. The slightly higher estimate for 2000 is due to the increase in population from the average population of 1995–1999 to 2000.

Decisions Influencing Weight

It is well known that being overweight is detrimental to one's health and mortality (Office of the Surgeon General 2001). Hundreds of thousands of people die prematurely each year in the United States due to decisions that they make, or choose not to make, concerning their weight. Specifically, many people eat too much food, have poor diets, and do not exercise enough or at all. In addition, the percentage of overweight people is increasing rapidly in the United States (Flegal et al. 2002).

Allison et al. (1999) in a seminal paper estimated the annual number of premature deaths in the United States using 1991 data on the prevalence of overweight and obese people and each of six major studies that related weight to death rates. They provide separate calculations for non-smoking or never-smoking individuals in the studies. For all people, the range of estimated annual premature deaths attributable to being overweight was 236,111 to 341,153 with an average of 280,184. Using data for nonsmokers only, the range was 262,541 to 383,410 with an average of 324,940. As described in Allison et al. (1999), the calculations that include smokers may lead to conservative (i.e., low) estimates of premature deaths. Smokers have higher death rates than nonsmokers, so the measured hazard of being overweight (which is measured by the death rate of people of a given level of being overweight to the base level death rate of people who are not overweight) is lower because the base level death rate including smokers is higher. Allison et al. (1999) did analyses that control for these effects that result in an estimate of 374,239 annual premature deaths due to being overweight.

The estimates in our analysis rely on the two largest studies analyzed by Allison et al. (1999), which were based on much larger data sets than the other four. These are the American Cancer Society (ACS) Cancer Prevention Study, which had 830,000 subjects, and the Nurse's Health Study, which had 115,000 subjects. The largest of the other four studies had 14,000 subjects. In Allison et al. (1999), the ACS study resulted in the lowest of the six study fatality estimates and the Nurse's Study had the third-highest estimate using all data and the second-highest estimate using nonsmoker data only.

To calculate deaths for the year 2000, I first calculated the premature fatalities for overweight people (defined as a body mass index (BMI) of 25.0 to just under 30.0) and

obese people (defined as a BMI greater than 30.0) by averaging results of the two studies and averaging results using all subject data and nonsmoker data only. This yielded 64,833 annual fatalities for the overweight and 227,600 annual fatalities for the obese.

To account for the increase in the percentages of overweight and obese people from 1991–2000 and the increase in population, I needed to adjust these results. From Table 3 in Allison et al. (1999), 32.1% of the U.S. population in 1991 was overweight and 21.9% was obese. In 1999–2000, these percentages had increased to 33.8% and 30.3%, respectively (Centers for Disease Control and Prevention 2002c). Thus, the ratio of overweight people in 2000 relative to 1991 was $33.8/32.1$ or 1.053 and the ratio for obese people was $30.3/21.9$ or 1.384. The population in the United States over 18 in 1991 and 2000, respectively, was 185.105 million and 209.128 million, so the ratio of population in 2000 relative to 1991 was 1.130.

Adjusting the fatalities from Allison et al. (1999) to year 2000 yields $64,833(1.053)(1.130) = 77,144$ premature fatalities due to being overweight and $227,600(1.384)(1.130) = 355,948$ from being obese. Hence, the total estimated number of premature fatalities due to being overweight or obese is 433,092. Alternatively, McGinnis and Foege (1993) cite sources that estimate 35% of cancer deaths, 30% of diabetes deaths, and 22% to 30% of cardiovascular deaths are attributable to dietary factors and lack of exercise. Using the 35% and 30% for cancer and diabetes deaths, respectively, and the average 26% for cardiovascular deaths, we calculate 455,378 fatalities using 2000 vital statistics. To bring this estimate closer to the data-based estimate, we reduced these percentages to 33%, 28%, and 25%, respectively, which results in a total of 434,395 annual deaths due to being overweight and obesity.

Decisions Causing Alcoholic Diseases

These are two main pathways that lead from personal decisions about alcohol use to subsequent fatalities. One concerns the long-term effects of excessive alcohol use that leads to medical problems causing death. These are considered here. The other pathway concerns short-term effects that lead to accidents (e.g., automobile accidents) causing death. They are separately considered later.

Over the past quarter century, the National Institute of Alcohol Abuse and Alcoholism (Stinson and Proudfit 1994) has developed an alcohol attributable fraction (AAF) indicating the proportion of deaths for each medical cause attributable to alcohol consumption (Schultz et al. 1990). For some diseases, such as alcoholic cirrhosis of the liver, the $AAF = 1.0$ meaning that all such deaths are caused by alcohol consumption. For other diseases, such as malignant neoplasm (i.e., cancer) of the esophagus, the AAF is 0.75, meaning that 75% of such deaths to individuals 35 years or older are attributable to alcohol consumption. Multiplying the AAF for each disease times the number of deaths due to the disease in year 2000 yields the number of

deaths due to the disease attributable to alcohol consumption. We add all of these results to obtain 67,779 annual fatalities caused by diseases due to personal decisions about alcohol consumption.

Decisions Causing Death by Accident

We tabulated six categories of accidents caused by decisions. Except for motor vehicle accidents, all of the decision-caused fatalities were due to short-term alcohol use. The method used to calculate these fatalities was the same as described for alcoholic diseases above. For accidents due to falls, fires, drowning, and other adverse effects, the AAFs are directly provided in Schultz et al. (1990). From this same source, the AAF for water transport accidents is 0.20 and for air and space transport accidents is 0.16. The summary information on deaths in 2000 aggregates water, air, and space, and other transport accidents, for which we used an AAF of 0.18 aggregating the two component AAFs.

There are three classes of personal decisions that we considered that cause motor vehicle accidents leading to death. These are driving under the influence of alcohol, speeding, and not using a seat belt. Because of the interdependence among these causes, we calculated the fraction of motor vehicle deaths attributable to one or more of the causes as follows.

We first considered the percentage of motor vehicle deaths due to the four combinations of sober or drinking and speeding or not speeding. The National Highway Traffic Safety Administration (2001) provides the basic data necessary for these calculations: 40% of fatalities are alcoholic related and 29% are due to speeding. Also, we used 37.5 as the percentage of drinking drivers involved in fatal crashes who were speeding, because 40% of intoxicated drivers were speeding, and 30% of drinking, but less than intoxicated drivers were speeding. Multiplying the percentage of drinking drivers times the percentage of those speeding yields 15% of drivers in fatal crashes are both drinking and speeding. Therefore, 25% are drinking and not speeding, 14% are speeding and not drinking, so 46% are neither drinking nor speeding. Thus, we assume that 54% of motor vehicle deaths are attributable to either drinking and/or speeding.

For the other 46%, the National Highway Traffic Safety Administration (2001) provides information that allows us to conclude that approximately 43% of the deaths involving sober, nonspeeding drivers were not wearing seat belts. Cummings (2002) calculated that 64% of those who died without a seat belt could have been saved if a seat belt were used. Hence, $(0.46)(0.43)(0.64) = 0.129$ or about 13% is the additional percentage of motor vehicle deaths that could be saved by using a seat belt. Adding this to the 54% of deaths due to drinking and/or speeding, we assume that 67% of motor vehicle deaths are due to personal decisions about these three causes.

It should be noted that there are many other classes of personal decisions not included in our estimation that lead to motor vehicle deaths. These include not maintaining a safe automobile, driving unnecessarily in terrible weather, driving under the influence of drugs, and driving when deprived of sleep. Hence, the 67% attributable to personal decisions is likely an underestimate. Using the AAFs above results in 38,246 accident deaths due to personal decisions in 2000.

Decisions Leading to Suicide and Homicide

In our compilation of deaths that could have been avoided by making different personal decisions, we include all suicide and homicide fatalities. In 2000, there were 29,350 suicides and 16,765 homicides (Centers for Disease Control and Prevention 2002a). Many of the decisions in the chain of decisions leading to each of these deaths may not have been made with clear thought. The same can be said about drinking and driving, smoking, or choosing not to exercise. It is not our claim that rational personal decisions lead to premature deaths, but that personal decisions do.

For most cases of suicide or homicide, there were several personal decisions made along the path leading up to a fatality. For suicide, such decisions likely include at least some of the following categories: decisions that result in isolation from family, friends, and the community, an increased chance of the loss of employment, poor health, and no psychiatric care. For homicide, decisions about remaining in school and in activities, membership in gangs, selling illicit drugs, and pursuing criminal activity are often precursors leading to a homicide. Decisions about the use of alcohol and drugs also contribute to many cases of suicide and homicide.

If we could do a very thorough analysis of suicides and homicides on a case-by-case basis, some of the cases may not involve any personal decisions with readily available alternatives that eventually resulted in the corresponding fatalities. An example is a person who has a terminal disease, is in terrible pain, and elects to take his or her own life. However, it seems that such cases would be a small percentage of the totals, so we have assumed here that all cases are attributable to personal decisions.

Decisions Leading to Sexually Transmitted Diseases

Unprotected sex was a precursor of approximately 20,000 fatalities in the United States in 2000 (Mokdad et al. 2004). In our analysis, we assumed that all AIDS deaths to individuals over 25 years old were attributable to sexual contact, although a portion of these were likely caused by other means such as sharing needles when using illegal drugs. Deaths due to sharing needles are not tabulated elsewhere in our results because the information to distinguish how the HIV virus was obtained is not readily available. Thus, because the personal decision to share needles obviously

does not result in a sexually transmitted disease, our inability to distinguish slightly overestimates fatalities due to sexually transmitted diseases. Deaths due to congenital HIV infections are not included in our calculations because these would likely occur before age 25.

Ebrahim et al. (1997) make the case that all cervical cancers are caused by sexually transmitted viral agents, but they also acknowledge other cofactors. In our analyses, we attribute 13.3% of cervical cancers to women over 35 to smoking, so to avoid double counting, only the remaining 86.7% are attributed to sexually transmitted diseases. No cervical cancer deaths for women under 35 are attributed to smoking so all of the cancer cases for women under 35 are attributed to sexual transmission.

The other three causes of premature death due to sexually transmitted diseases accounted for in our analysis are viral hepatitis, chronic liver disease, and hepatoma. These are caused by sexually attributed infections due to either hepatitis B or hepatitis C. Ebrahim et al. (1997) estimate that 26% of hepatitis B and 9% of hepatitis C cases for adults were due to sexual transmission. They also support estimates that hepatitis B led to 11% of the chronic liver disease cases and hepatitis C lead to an additional 26%. Thus, our estimate of the percentage of chronic liver disease fatalities due to sexually transmitted disease is $(0.26)(0.11) + (0.09)(0.26) = 0.052$, which we define as 5%. Similar calculations were done for viral hepatitis and hepatoma. Using the attributable fractions above resulted in 19,837 fatalities in 2000.

Other sexually transmitted diseases that lead to death that were not included in our tabulations included syphilis, gonococcal infections, other venereal diseases, and pelvic inflammatory disease. The results of Ebrahim et al. (1997) through 1992 suggest that the total number of fatalities caused by these collectively is of the order of 300 per year.

Decisions About Illicit Drug Use

The use of illicit drugs can lead to premature death due to many causes. Among these are situations where illicit drug use leads to suicide and where shared needles or unprotected sex lead to AIDS. These premature fatalities have been accounted for under other categories due to personal decisions.

Use of illicit drugs also directly results in premature deaths because of subsequent mental and behavioral disorders, accidental poisoning, or other exposure to narcotics and/or hallucinogens. We consider all of these deaths attributable to personal decisions due to illicit drug use. Using the detailed data supporting the national death statistics (Centers for Disease Control and Prevention 2002a), we found that there were 9,411 such deaths in 2000 as shown in the online appendix.

4. Additional Analyses and Perspectives

The analysis in the online spreadsheet provides a basis for several additional analyses that offer further perspectives

on fatalities induced by personal decisions. These are the following:

- Proportions of medical causes of death attributable to personal decisions.
- Proportions of deaths attributable to personal decisions for different age groups.
- Sensitivity analyses of deaths attributable to personal decisions based on different judgments about which premature fatalities are counted as attributable to personal decisions.
- Proportions of self-caused deaths attributable to personal decisions.
- Historical perspective over time on proportion of deaths attributable to personal decisions.

Medical Causes of Death Due to Personal Decisions

Using the ICD-10 codes in Table 1, we can tabulate the number of fatalities of each major medical cause of death attributable to each decision category. By summing over decision categories, we obtain the number of deaths shown in Table 4 for each major medical cause attributable to personal decisions.

For the two major medical causes of death, 46% of deaths due to diseases of the heart and 66% of the deaths due to cancers can be attributed to personal decisions. Approximately 55% of the deaths due to the five main medical causes of death are attributable to personal decisions. In Table 4, many of the avoidable accidents have use of excess alcohol or illicit drugs as a compounding factor. Hence, of the seven medical causes of death that result in over 50,000 annual fatalities, only chronic lower respiratory diseases is caused by only one category of personal decisions.

Deaths Attributable to Personal Decisions for Different Age Groups

The number of deaths attributable to decisions for each age group is determined by summing the medical deaths by age due to decisions related to all of the actual causes. The results are listed in the first row of Table 5. The second row lists the total number of deaths of the corresponding age group based on the national vital statistics. Dividing the number of deaths due to personal decisions by the total number of deaths, we obtain the proportions of deaths attributable to personal decisions shown in Table 5.

For the three youngest age groups, the causes are mainly due to accidents and homicides. Prenatal deaths to babies less one year of age and suicides for children in the 5–14 age group also are relevant. For the age group 15–24, alcohol induced deaths begin to take a toll. For ages over 25, deaths due to being overweight or obese are added. All of the causes of deaths due to decisions affect those over 35 years of age.

The proportion of deaths attributed to personal decisions is 5.2% of those 0–1 years old and rises to 25.2% for those

Table 4. Medical causes of death due to personal decisions.

Medical cause of death	Decisions influencing							Number of deaths in 2000 due to personal decisions	Total number of deaths in 2000	Percent of deaths in 2000 due to decisions		
	Smoking	Being overweight	Excess alcohol	Accidents	Suicide	Unprotected sex	Homicide					
Diseases of the heart	147,779	177,196						324,975	710,760	45.7		
Malignant neoplasms	161,587	181,451	18,748			4,211		365,997	553,091	66.2		
Cerebrovascular diseases	18,340	41,804	11,736					71,880	167,661	42.8		
Chronic lower respiratory diseases	92,767							92,767	122,009	76.0		
Accidents (unintentional)				36,896				6,137	43,033	97,900	43.9	
Diabetes Mellitus		19,348	3,465						22,813	69,301	32.9	
Influenza and pneumonia	11,681		3,266						14,947	65,313	22.9	
Alzheimer's disease									0	49,558	0.0	
Nephritis and nephrosis									0	37,251	0.0	
Septicemia									0	31,224	0.0	
Intentional self-harm (suicide)					29,350				29,350	29,350	100.0	
Chronic liver disease and cirrhosis			19,331			701				20,032	26,552	75.4
Hypertension and renal disease	6,269	4,513	1,446						12,228	18,073	67.6	
Assault (homicide)							16,765		16,765	16,765	100.0	
Pneumonitis due to solids and liquids									0	16,636	0.0	
All other causes	14,954	10,083	9,796	1,351		14,924		3,274	54,372	391,904	13.9	
Totals	453,377	434,395	67,779	38,246	29,350	19,837	16,765	9,411	1,069,160	2,403,351	44.5	

1–4 and 30.0% for children 5–14. For ages 15–64, the proportion is fairly constant between 54% and 59%. Then, it drops about 7% for each age group older than 64 because a higher proportion of fatalities are due to “old age.”

Sensitivity Analysis of Deaths Attributable to Personal Decisions

The calculations resulting in Table 5 yield a base-case estimate of the annual number of deaths attributable to personal decisions. A key assumption in these calculations is the proportion of various medical causes of death due to various actual causes of death influenced by personal decisions. For the three major actual causes (smoking, obesity, and alcohol misuse), there is substantial research by national institutes concerned with health and medical research on which these estimates are based. For motor vehicle accidents, there is substantial national data on which the proportion attributed to personal decisions is calculated in this

paper. Other judgments were based more on logic and personal judgments of the author and explained as such. Obviously, other individuals with more knowledge may wish to make different judgments. It is easy to examine the effects of the changes of such judgments with sensitivity analyses such as those illustrated below.

The first sensitivity analysis assumes the base-case estimates for smoking, obesity, alcohol misuse, and suicide. For accidents, only the base-case for motor vehicle accidents is included and no other accidental deaths are attributed to personal decisions. Similarly, for illicit drug deaths, the only fatalities attributable to personal decisions are those resulting from accidental poisoning due to narcotics and hallucinogens. For sexually transmitted diseases, this illustration assumes that only AIDS deaths are attributed to personal decisions. For homicides, to illustrate what could be done, suppose that an analysis indicated that 30% of homicides involved individuals in the act of criminal activity,

Table 5. Deaths attributable to personal decisions for different age groups.

	Age groups											Age not stated	All ages
	0–1	1–4	5–14	15–24	24–34	35–44	45–54	55–64	65–74	75–84	Over 85		
Deaths attributable to personal decisions	1,458	1,255	2,301	17,629	22,192	50,898	90,539	141,807	219,696	295,067	226,208	111	1,069,160
Total deaths	28,035	4,979	7,413	31,307	40,451	89,798	160,341	240,846	441,209	700,445	658,171	356	2,403,351
Percentage of deaths attributable to personal decisions	5.2	25.2	30.0	56.3	54.9	56.7	56.5	58.9	49.8	42.1	34.4	31.2	44.5

individuals involved with illicit drug distribution, or gang members fighting other gangs. If these were the only homicides attributable to personal decisions, the proportion of homicides attributable to personal decisions would obviously be 0.3 rather than the 1.0 in the base case. When all of these changes are made, the total number of fatalities attributable to personal decisions is 1,039,343, rather than the 1,069,160 for the base case.

In another sensitivity analysis, one can only include the base-case estimates for smoking, obesity, alcohol misuse, suicide, and the motor vehicle accidents as attributed to personal decisions. All deaths due to homicides, illicit drugs, and sexually transmitted diseases are assumed not to be attributed to personal decisions. Now the total number of deaths attributable to personal decisions is 1,013,948. Sensitivity analyses such as these can be used to establish bounds on the number of deaths attributable to personal decisions.

Self-Caused Deaths Attributable to Personal Decisions

A large majority of the premature deaths attributed here to personal decisions are deaths of the individuals who made those decisions. However, some of the attributed deaths are deaths of other individuals. To reasonably estimate the self-caused deaths and the deaths of others, we needed to make assumptions about the proportions of deaths of each medical cause in each decision category that resulted in self-caused deaths. Table 6 presents the situations that we assumed resulted in deaths of others using the logic below. As indicated, 57,169 of the total deaths due to personal decisions were deaths of others, so over one million (calculated as 1,011,991) were self-caused deaths.

Table 6. Percentage of deaths induced by decisions that result in self-caused deaths.

Death category in Table 3	Percentage of self-caused deaths	Number of self-caused deaths	Number of deaths to others
14 years of age and younger (all)	0	0	5,014
15 years of age and older			
Second-hand smoking deaths	0	0	40,470
Burn deaths due to smoking	50	409	410
Motor vehicle accidents	79	21,576	5,735
Water, air, and space transport accidents	79	261	70
Accidents caused by fire and flames	70	876	376
Accidents due to other adverse effects	70	902	387
Homicides	70	10,982	4,707
All other categories	100	976,985	0
Total deaths		1,011,991	57,169

We first assumed that all 5,014 deaths to individuals under 14 years of age were due to others' personal decisions. For smoking, we assumed all fatalities were self-caused except prenatal deaths (which naturally affect people under 14), burn deaths, and those due to second-hand smoke. Second-hand smoke accounted for 40,470 deaths to others. For burn deaths due to smoking, without data we assumed half of such fatalities were self-caused deaths.

All other deaths attributed to personal decisions were self-caused deaths except for some accidents. For motor vehicle accidents, 43.4% of total deaths occurred in two-vehicle accidents (National Highway Traffic Safety Administration 2001), so 56.6% were in single-vehicle accidents. Because some deaths in two-vehicle accidents involving a drunk or speeding driver are in that driver's vehicle, we assumed that two-thirds of the fatalities involving a drunk or speeding driver are the driver or passengers making a choice to ride with them. Because 54% of the vehicle fatalities are due to driving drunk and/or speeding, 36% of vehicle fatalities are self-caused deaths due to these personal decisions. Thus, 18% of vehicle deaths are in a car hit by a drunk or speeding driver, and 46% are in other accidents. Of these 64%, data indicates that 43% wear no seat belt and 64% of these deaths could have been avoided with a seat belt. Multiplying $(0.64)(0.43)(0.64) = 0.17$ indicates that an additional 17% of vehicle fatalities are self-caused deaths due the personal decision not to use a seat belt. Hence, 53% of vehicle fatalities are self-caused deaths due to personal choices and, from §3, 67% of vehicle deaths result from personal decisions. By dividing 53/67, we find that 79% of vehicle deaths due to personal decisions are self-caused deaths. Without additional information, we used the same 79% for other vehicle accidents. For accidents caused by fire and flames and other adverse effects, we chose 70% to represent self-caused deaths without having data. Any death due to rape would not logically be considered as self-caused. However, because the number of rapes is presumably orders of magnitude less than the number of consensual sexual encounters, and the data did not distinguish such cases, all deaths caused by sexually transmitted disease were counted as self-caused in the analysis.

Deaths Over Time Attributable to Personal Decisions

In Table 5, we estimate that 44.5% (1.069/2.403) of the deaths in 2000 are attributable to personal decisions. It is interesting to consider how this percentage may have changed over the last century. For this, Table 7 lists the leading causes of death in 1900 and 1950 according to the Centers for Disease Control and Prevention (1998).

In 1900 the knowledge about and ability to avoid many of the causes of death would seem to be much lower than in 2000. There was not much to be done to avoid infectious diseases. Also, smoking and being overweight were much less prevalent in 1900 than in 2000. The main deaths in

Table 7. Leading causes of death in 1900 and 1950 (from Centers for Disease Control and Prevention 1998).

Rank	1900		1950	
	Cause	Number	Cause	Number
1	Pneumonia (all forms) and influenza	40,362	Diseases of the heart	536,705
2	Tuberculosis (all forms)	38,820	Malignant neoplasms, including neoplasms of lymphatic and hematopoietic tissues	210,733
3	Diarrhea, enteritis, and ulceration of the intestines	28,491	Vascular lesions affecting central nervous system	156,751
4	Diseases of the heart	27,427	Accidents	91,249
5	Intracranial lesions of vascular origin	21,353	Certain diseases of early infancy	60,989
6	Nephritis (all forms)	17,699	Influenza and pneumonia, except pneumonia of newborns	47,120
7	All accidents	14,429	Tuberculosis, all forms	33,959
8	Cancer and other malignant tumors	12,769	General arteriosclerosis	30,734
9	Senility	10,015	Chronic and unspecified nephritis and other renal sclerosis	24,677
10	Diphtheria	8,056	Diabetes Mellitus	24,419
All causes		343,217		1,452,454

1900 that may have been averted by making readily available alternative choices are those due to accidents. Because 4.2% of the deaths in 1900 were due to accidents, it seems reasonable that perhaps 5% of deaths in 1900 could be attributed to personal choices.

By 1950, diseases of the heart and cancer deaths had increased to 51% of total deaths from just under 12% in 1900. This was likely in part due to the citizenry living much longer, the much lower death rates due to infectious diseases, and the effect of smoking beginning to have a significant major impact.

Presumably, the number of overweight ($25 \leq \text{BMI} < 30$) and obese ($\text{BMI} \geq 30$) adults in the United States in 1950 was not more than in 1960 when national data became available. The percentage of overweight and obese adults was relatively stable from 1960–1980 at about 32% and 14.5%, respectively (National Center for Health Statistics 2005). The same source reported in 2000 that 34.1% of adults were overweight and 31.1% were now obese. An analysis of the deaths attributed to obesity in Allison et al. (1999) indicated that the relative likelihood of dying from obesity is five times higher than dying from being overweight. Together, this suggests that the percentage of deaths that would have been attributable to being overweight or obese in 1950 were less than half the percentage of those attributable today.

Much of the evidence relating smoking and being overweight to premature death appeared after 1950 in the Surgeon General's reports on smoking (U.S. Department of Health, Education, and Welfare 1964) and on being overweight or obese (Office of the Surgeon General 2001). Hence, in 1950 many individuals may not have been aware of the risks to life imposed by smoking or being overweight. The effects of most of the other causes (e.g., alcoholic diseases, accidents, suicide, and homicide) are much smaller and information was available in 1950 indicating that they contributed to fatalities.

Over 80% of the deaths attributable to personal decisions in 2000 were due to smoking and being overweight. Because the prevalence of these causes would probably have been less than half as great in 1950 and fewer would be attributable to personal decisions because of the lack of information, the percentage of fatalities attributable to personal decisions in 1950 may be about half, say 22%, of the 2000 percentage.

Clearly, one should not put much credibility in this 22% or the corresponding 5% for 1900. The purpose of this exercise was to demonstrate the reasoning that supports the idea that the percentage of deaths attributable to personal decisions has risen greatly in the past century from a level well under 10% in 1900 to about 45% in 2000.

5. Summary and Conclusions

The main results of this research are clear. Over one million people prematurely die each year in the United States due to causes that can be attributed to personal decisions. This is 44.5% of all deaths. For ages from 15 to 64, about 55% of all deaths are attributable to personal decisions. Well over 90% of these premature deaths can be attributed to decisions of the person who died.

The inescapable conclusion of these results is that individuals have a great deal of control over their own mortality. This circumstance is much different from the recent past. Likely less than 10% of all deaths a century ago were avoidable by readily available personal choices, and in 1950, maybe half today's percentage (i.e., 22%) were avoidable by available personal choices.

These results should be viewed mainly as good news. We seem to worry greatly about our safety and mortality. As a consequence, many advocate that the government, businesses, and the medical community should do more to save lives. This research indicates that we do not now need to rely mainly on others to make our lives safer because we can take effective action ourselves. The decisions that individuals can make to greatly enhance their safety and avoid

Table 8. Common sense “life-saving decisions” to avoid premature death.

Make personal decisions that

- Avoid smoking (don’t start, quit if you do smoke)
 - Avoid being overweight (exercise regularly, eat and drink responsibly)
 - Avoid becoming alcoholic (drink alcohol in moderation)
 - Reduce vehicle accidents (don’t drink and drive, don’t speed, use a seat belt)
 - Do not use illicit drugs (don’t use narcotics or hallucinogens)
 - Do not commit suicide
 - Do not commit homicide
 - Avoid unprotected sex (use a condom, abstain)
-

premature death do not require effort beyond the abilities or knowledge of “regular people.” These “life-saving decisions,” which are based on common sense and lead to our results, are listed in Table 8. Today, almost all individuals understand the logic implicit in Table 8 and can take the control to make these choices.

It is reasonable to ask what would happen if individuals, who until now have made some of the personal choices that may result in their premature death, change their decisions. Our analyses did not explicitly examine this, but the general implication is clear. The first three decision categories considered in Table 2 refer to deaths as a result of chronic conditions. A Surgeon General’s report (U.S. Department of Health and Human Services 1990) clearly indicates that smokers who quit significantly lower their risk of death due to their smoking. If overweight individuals start exercising regularly and eating and drinking responsibly, they should be able to significantly lower their weight and their risk of death in five years. The same is true for alcoholics and heavy drinkers. The other causes in Table 2 typically concern fatalities caused by single events (e.g., vehicle accidents). Hence, if one starts making less life-threatening decisions regarding these today, the effects would be immediate in most cases. In summary, if an individual who currently makes the decisions that can lead to premature death changes to readily available life-promoting alternatives today, this should have a significant impact on lowering their risk of premature death.

The results presented here surely overestimate the number of deaths attributable to personal decisions in some cases and do not include deaths attributable to personal decisions in some other cases. For example, a more careful analysis may identify a small proportion of overweight and obese people who are in that situation due to medical circumstances that are beyond their control. On the other hand, we did not attempt to calculate deaths attributable to decisions such as not getting a flu shot (for recommended groups), eating a poor diet (other than the influence on being overweight), not getting routine physical exams that would detect correctable subsequent causes of death, avoiding too much direct sun (that causes skin cancer), and not having an operable home fire alarm. We do not suspect a more careful study addressing overcounting and

undercounting would change the main result that a substantial proportion of deaths in the United States today are attributable to personal decisions with readily available alternatives.

In doing the analysis for this paper, I had a choice of what measure to use to indicate the mortality consequences of personal decisions. I could have used either the number of premature fatalities or the years of life lost (see Cohen and Lee 1979) due to premature fatalities or both. I chose the number of premature fatalities because it better captures the relationship between personal decisions and subsequent fatalities and it is a more easily understood measure. My motivation was to make as apparent as possible the influence that individuals can have on their own mortality. Doing a similar analysis using years of life lost would not much enhance this concept.

If one wishes to prioritize decisions that individuals should take to reduce their chances of premature death and lengthen their lives, an analysis using years of life lost would be very useful and I would recommend it. The analysis incorporating years of life lost that I would most like to see is prospective. It would examine situations looking forward from today for individuals currently making decisions that lead to the premature fatalities discussed in this paper. It would investigate their expected years of life remaining and their years of life lost from each cause for each age group if they do not make choices such as the readily available alternatives (e.g., stop smoking, use seat belts) listed in Table 8. It would also calculate the years of life gained for individuals who do change some of their current choices.

Because a major cause of premature deaths in the United States is personal decisions, a key question is whether education and training in decision-making skills can modify personal decisions to avoid premature fatalities. Our results will hopefully stimulate research and experimental programs to learn how to get individuals to make decisions that would avoid millions of future premature deaths. Some current experience suggests the potential for such an approach. For example, since 1980, Mothers Against Drunk Driving (MADD 2006) has educated the country and legislators about the obvious problems of drunk drivers. Their action has led to thousands of lives saved, many of them young, in this time period. The American Cancer Association on a recent annual fund mailing states: “Take control of your own health. Studies show that at least two-thirds of cancer deaths can be prevented by not using tobacco products, maintaining a healthy weight, getting plenty of physical activity, eating healthy foods, and avoiding the midday sun and protecting skin with a hat, shirt, and sunscreen.”

Results here indicate for individuals from 15 to 64 years old, over 50% of the deaths are premature and are avoidable by choosing readily available alternative choices. This information on age-dependent premature fatalities may provide a basis for programs aimed at age groups such as teenagers. In a somewhat analogous situation, Abbas et al.

(2007) discusses initial successes in a program to transfer decision-making skills to youth who have been arrested and are spending time in a correctional facility. Different programs should be designed and implemented to achieve specific purposes regarding premature death. They could focus on particular decisions to avoid premature deaths, on general principles of good decision making, on specific groups of individuals, or on individuals who already have chosen decisions that may significantly shorten their lives. Subsequently, the effectiveness of the different programs should be measured and evaluated to identify the better ways to prevent premature death.

6. Electronic Companion

An electronic companion to this paper is available as part of the online version that can be found at <http://or.journal.informs.org>.

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