The Cost of Alcohol in California

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Background: California is the largest alcohol market in the United States. In 2005 alone, Californians consumed almost 14 billion alcoholic drinks, which contributed to many severe and potentially fatal alcohol-related illnesses and conditions. Alcohol use also causes violent and nonviolent crimes, as well as injuries and traffic collisions. While several studies have estimated the magnitude and cost of these problems nationally and others have analyzed underage drinking costs, no overall cost estimate at the state level currently exists for California. We present the first comprehensive estimate of the cost of alcohol consumption in California.

Methods: For each category of alcohol-related problems, we estimated fatal and nonfatal cases attributable to alcohol use. We multiplied alcohol-attributable cases by estimated costs per case to obtain total costs for each problem. Our estimates are presented in 2 sections, the economic costs, estimated using a human capital approach, and quality-of-life costs estimated using a quality adjusted life year framework.

Results: Alcohol consumption in California led to an estimated 9,439 deaths and 921,929 alcohol-related problems, such as crime and injury in 2005. The economic cost of these problems is estimated at between $35.4 billion and $42.2 billion. Our main estimate is $38.5 billion, of which $5.4 billion was for medical and mental health spending, $25.3 billion in work losses, and $7.8 billion in criminal justice spending, property damage and public program costs. In addition, alcohol is responsible for severe reductions in individuals' quality of life in California. We estimate that the disability caused by injury, the personal anguish of violent crime victims, and the life years lost to fatality are the largest costs imposed by alcohol. The total value for this reduced quality of life in California is between $30.3 billion and $60.0 billion. Our main estimate for quality-of-life costs is $48.8 billion.

Conclusions: In light of the associated substantial illness, injuries, death, and high cost to society, alcohol consumption in California needs serious attention. In addition, the methods developed in this paper can be expanded to estimate the cost of alcohol in other states.

Key Words: Alcohol, Attributable, Cost, Violence, Illness, Accident.

BACKGROUND

THE NEGATIVE EFFECTS of alcohol consumption are considerable. Alcohol use contributes to illnesses as varied as liver cirrhosis, esophageal cancer, pancreatitis, and epilepsy. It also plays a role in violent crimes such as sexual assaults, domestic violence, and child abuse, while also causing serious injuries and traffic fatalities (Cherpitel et al., 1995; English et al., 1995; Greenfeld, 1998; Zador, 1991).

Often these problems are described individually instead of an overall public health challenge. Estimating the total economic cost of alcohol allows us to see problems with disparate outcomes—traumatic deaths, serious illness, broken bones, assaults, even damaged motorcycles—in a clearer, more measurable light. Cost data describe how alcohol affects society and drive analyses of the potential to reduce the harms of alcohol use cost-effectively. Cost data are valuable for problem size and risk assessment, broad priority setting, resource allocation modeling, health and safety advocacy, regulatory analysis, performance comparison, and program evaluation.

In the United States, several comprehensive studies have been conducted over the last 35 years (Berry and Boland, 1977; Harwood et al., 1998; Rice et al., 1990). These studies have typically focused on the economic cost of alcohol abuse, estimating only the negative effects of consumption. While the exact methodologies have differed, these studies generally estimated medical, criminal justice, and other direct costs as well as the lost work or productivity caused by alcohol problems.

No complete alcohol cost estimate at the state level exists for California. A 2003 study estimated the costs of addiction (alcohol combined with other drugs) in California to be $32 billion, with $11 billion coming from the state general fund (Little Hoover Commission, 2003). Another study made "preliminary" estimates of alcohol health and safety costs in California of $17.8 billion, but did not "conduct a full-scale economic study of the cost of alcohol use in California" (Max et al., 2004).

In addition to U.S. studies, detailed estimates have been carried out globally (Devlin et al., 1997; Gjelsvik, 2004; Kopp and Fenoglio, 2000; Lima and Esquerdo, 2003; Nakamura et al., 1993; Rehm et al., 2006). The economic costs of alcohol

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appear to vary significantly among countries—representing anywhere between 0.3% and 5.5% of a nation's Gross Domestic Product (Anderson and Baumberg, 2005). In contrast to the U.S. studies, some of these estimates included the health benefits of low levels of alcohol consumption (Anderson and Baumberg, 2005; Jeanrenaud et al., 2003; Rehm et al., 2006). These studies found health costs heavily outweigh the benefits.

Alongside the economic costs estimated in most studies, recent estimates have also begun to include the intangible costs, which capture pain, suffering, and quality of life. Intangible costs are important because the damage to an individual's quality of life is often the largest cost imposed by alcohol use. For example, in an alcohol-attributable assault, the pain and suffering to the victim may far outweigh the medical and judicial costs. By including these costs, studies present a fuller picture of alcohol related harm and the value people put on their quality of life. The U.S. Office of Management and Budget requires including intangible costs whenever a government agency performs a cost–benefit analysis that places a dollar value on saving human lives (Office of Management and Budget, 1989). Moreover, extensive published literature supports including intangible costs in measuring many different problems, including traffic collisions, injury, and illness (Blincoe et al., 2002; Henriksson et al., 2001; Manning et al., 1991; Miller and Levy, 2000; Zaloshnja et al., 2004). Recent alcohol cost studies have extended this literature, with intangible costs having been included in estimates of the cost of underage drinking, alcohol-involved crime, and the cost of alcohol to the European Union and the United States (Anderson and Baumberg, 2005; Miller and Hendrie, 2008; Miller et al., 2006a,b). Previous research estimates both a monetary and nonmonetary (presented in quality adjusted life years) value on these losses (Cutler and Richardson, 1998; French et al., 1996; Miller, 2000; Tolley et al., 1994). Quality adjusted life years are explained in detail under section Quality-of Life Costs.

Our research builds upon these established frameworks to provide the first comprehensive estimate of the cost of alcohol use in California. We estimate the costs of several types of problems not previously studied at the state level, most notably the work loss from morbidity, and the cost of fetal alcohol syndrome (FAS) and risky sexual behavior. We also include intangible costs for the first time in California.

METHODS

General Methods

Our study estimates only the costs of harmful drinking, which we define as any alcohol consumption that creates a harm to the drinker (e.g., liver cirrhosis) or to wider society (e.g., violent crime). We did not include any positive or negative effects that low levels of drinking (as defined by the Alcohol Related Disease Impact tool [ARDI]) may have on chronic and cumulative disease. The ARDI definitions and methodology are detailed in section Health Problems.

We examined 4 broad categories of harm for which the causal link with alcohol is well defined: illness, injury, crime, and traffic collisions. In addition, we estimated the public money spent on the prevention of alcohol problems. The exact methodology for estimating each of these problems differs and is examined in detail below. However, the general approach is consistent throughout.

For each category of harm, we calculated the total number of fatal cases in 2004 (the latest year available) and nonfatal cases in California (in 2005) and then isolated the proportion of these cases actually attributable to, or caused by, alcohol use. To do so, we relied on alcohol-attributable fractions (AAFs) (A full list of the AAFs used in this study and codes used to identify illness and injury are available online at the Marin Institute's website, under the reports section.), which measure the extent to which alcohol contributes to a health outcome. AAFs are central to our study by allowing us to estimate the unique contribution of alcohol to a wide range of problems. For example, an AAF of 0.30 for liver cirrhosis attributes 30% of liver cirrhosis cases to alcohol consumption. Table 1 summarizes the sources for incidence data and AAFs. We then took cost per case estimates from peer reviewed literature; where this was not possible, we calculated original cost per case estimates. The total costs of each alcohol-attributable problem were calculated by:

$$\text{Total number of cases} \times \text{AAF} \times \text{cost per case.}$$

Estimates are presented in 2005 dollars and were converted using the consumer price index (CPI)—medical for medical costs, the employment cost index—total compensation for work and quality-of-life costs (Council of Economic Advisers, 2006), and the CPI—all items for all other costs. In addition, as California prices tend to be above the national average, wherever necessary we converted national costs to California costs using ACCRA price indices (ACCRA, 2005), which measure relative prices in different U.S. states and per capita income data by state (U.S. Census Bureau, 2008).

Theoretical Approach of the Study

Our study takes a "societal viewpoint" and cost framework as recommended by the U.S. Panel on Cost Effectiveness in Health and Medicine (Gold et al., 1996). This viewpoint estimates the costs of alcohol problems to all members of society, including the drinker, other individuals, private industry, and public finances.

Costs are presented in 2 sections: "Economic Costs" and "Quality-Of-Life Costs." "Economic Costs" incorporate the direct (out of pocket) and indirect (lost work) costs associated with alcohol-related problems and take a human capital cost-of-illness approach. They measure the economic burden of alcohol problems, similar to that conducted in previous national studies (Harwood et al., 1998; Rice et al., 1990). "Quality-of-life Costs" estimate the intangible cost of alcohol, using a monetized and nonmonetized quality adjusted life year (QALY) approach (Gold et al., 1996; Miller et al., 2006b). QALYs are a health-outcome measure that estimates the fraction of perfect health lost during each year that a victim is recovering from a health problem or living with a residual disability. People who die lose a full QALY, while the reduction caused by nonfatal problems is determined by the duration and severity of the health problem. (For ease of comparison with previous estimates that exclude such costs, our quality-of-life estimates are presented separately from the main analysis.)

All costs were estimated using a modified prevalence approach. Typical prevalence-based costs measure all alcohol-related expenses incurred during 1 year, regardless of when the alcohol use occurred. They therefore include not only the costs of alcohol use in the base year (2005), but also the costs incurred that year due to previous alcohol use. However, following international guidelines (Single et al., 2001) and long standing practice (Rice et al., 1990), our cost estimates modify this to include future lifetime work and quality-of-life losses from premature death and permanent disability occurring in 2005

Table 1. Sources for Number of Cases and Alcohol-Attributable Fractions

	Source of numbers of cases	Source of alcohol-attributable fractions
Illness	PDD, vital statistics	ARDI
Fetal alcohol syndrome	Harwood et al., 1998;	100% Attributable
Alcohol dependence	Substance abuse and mental health services, 2005; Harwood et al., 1998	100% Attributable
High-risk sex	Biglan et al., 2004	Miller et al., 2006b;
Injury	PDD, Vital Statistics	Miller et al., 2003
Crime	California Department of Justice, 2005	Miller et al., 2006a;
Traffic collisions	California highway Patrol, 2005	Levy and Miller, 1995; Miller et al., 1999; Moskowitz and Fiorentino, 2000

but ignore permanent disability and people not alive in 2005 because of alcohol-attributable health events in earlier years.

Economic Costs. Economic costs estimate the direct and indirect costs of alcohol-related problems. The value of tangible goods and services delivered to address the consequences of the problem are referred to as direct costs. In our study, this includes medical and mental health costs, property losses, and public program costs. Medical costs for treatment of injury and the victims of traffic collisions and crime are based on published estimates and incorporate hospital fees, payments to physicians, rehabilitation, prescriptions, allied health services, medical devices, insurance-claims-processing costs, and costs associated with emergency medical transport. For the medical cost of illness, the only available data were for hospital fees and pharmaceuticals. Detailed methods for estimating medical costs are explained under each cost category. Mental health costs are estimated for the victims of crime and include payments for services by psychiatrists, psychologists, social workers, pastoral counselors, as well as associated insurance claim processing costs. Property losses arise in traffic crashes and crimes. These costs include reparation and replacement of lost or damaged property, and the cost of processing insurance claims. Public program costs involve the costs of police services (initial response and follow up), criminal adjudication and sanctioning, fire and victim services, child protective services and foster care, and special education for maltreated children. Table 2 summarizes the direct costs.

Indirect costs measure the lost work caused by alcohol problems, and are measured in terms of the monetary value of lost wages and fringe benefits, as well as the value of lost housework. We employed a human capital approach to estimate indirect costs, measuring both short-term losses during illness or acute injury recovery and lifetime losses due to death or permanent work-related disability. Short term losses were estimated differently depending on the condition and are explained separately (where applicable) under each harm category. Lifetime losses were estimated as the stream of earnings that would have occurred had an individual not died prematurely or suffered a disability.

For fatalities, work loss was estimated in a multi-stage process. First, we found the number of years lost from premature death based

Table 2. Summary of Types of Costs

Type of cost	Direct	Indirect	Intangible
Health problems	Medical: Hospitalization costs, pharmaceuticals. Specialized treatment costs for alcohol dependence syndrome. Lifetime medical costs of treating FAS and STDs	Lost work	Pain, suffering, quality of life for fatal illness and high risk sex and FAS. (Cannot calculate for other nonfatal illnesses.)
Injury (nontraffic)	Medical: Hospital fees, payments to physicians, rehabilitation, prescriptions, allied health services, medical devices, insurance-claims-processing costs and costs associated with emergency medical transport	Lost work	Pain, suffering, lost quality of life
Crime	Criminal: Costs of police services (initial response and follow up), criminal justice costs, fire and victim services, child protective services, foster care and special education for maltreated children Medical: Hospital fees, payments to physicians, rehabilitation, prescriptions, allied health services, medical devices, insurance-claims-processing costs and costs associated with emergency medical transport Mental Health for victims: psychiatrists, psychologists, social workers, pastoral counselors, as well as associated insurance claim processing costs	Lost work	Pain, suffering, lost quality of life
Traffic	Medical: Hospital fees, payments to physicians, rehabilitation, prescriptions, allied health services, medical devices, insurance-claims-processing costs, and costs associated with emergency medical transport Property damage: costs to repair and replace lost or damaged property, as well as to process auto-insurance claims	Lost work	Pain, suffering, lost quality of life
Prevention	Government spending	N/A	N/A

on life expectancy data from the U.S. Lifetables (Arias, 2004). We then estimated average wages for each of these years from the Current Population Survey years 2000 to 2006 (US Department of Commerce, 2006), then price-adjusted to California average values. We looked at a 6-year period to capture labor force participation and hours of work across the business cycle. We adjusted these wages to include fringe benefits from employment, using the ratio of "supplements to wages and salaries" to "wages and salary accruals" from the Economic Report of the President Table B-28 (Council of Economic Advisers, 2006) and added the value of household production from a published study (Krueger and Ward, 1999). This total future earning stream was discounted to present day values at a 3% rate. (Future earnings were discounted because money received today has a higher value than money received in the future.) We also assumed that wages would continue to grow at the historical average rate of 1% per year from increased productivity. The standard formula for computing lifetime production loss from these sources is from Finkelstein et al. (2006).

The lifetime-work-loss costs of injury were again estimated by following Finkelstein et al. (2006), who estimated the likelihood of suffering a disability according to the type of injury and the degree of work loss caused based on workers' compensation data.

Quality-of-Life Costs. Quality-of-life costs take into account the pain, suffering, and reduced quality of life as a result of alcohol-related problems. This study places both a monetary and nonmonetary (presented in QALYs) value on these losses. Our nonmonetary estimates are provided on a QALY scale, which measures the quantity and quality of life lived. QALY scales work by assigning a value between 1 and 0. A year in perfect health is equal to 1, down to a value of 0 for death. Injury, crime, and death cause reductions along this scale, and therefore reduce the number of QALYs for individuals and their families.

We estimate the quality-of-life losses experienced by alcohol users, their victims, and their families due to injury, traffic collisions, crime, and death. We also include estimates for fetal alcohol syndrome (FAS) and sexually related diseases. However, we were unable to develop estimates of the intangible losses caused by other nonfatal illnesses due to the absence of prior studies. Table 2 summarizes the quality-of-life costs estimated in this study.

From our total QALY estimate, we also calculated the equivalent number of fatalities (Miller et al., 2006a), found by estimating the average number of QALYs lost per death. First, we estimated the average life expectancy of individuals in California based on population data (State of California, Department of Finance, 2007) and U.S. Lifetables (Arias, 2004). Next, we discounted average life expectancy to present value using a 3% discount rate. Life expectancy was discounted because years of life in the future have less value to an individual than those closer to the present, because (among other reasons) there is more uncertainty that more distant years will be lived. We estimated that the average individual has 23.1 years of life left and therefore we equated 1 death to 23.1 QALYs.

Our monetary estimates were calculated separately for mortality, crime, and injury. For fatalities, the value of pain, suffering, and lost quality-of-life to family members was calculated based on a review of more than 65 published studies of the dollar amount people routinely spend for small reductions in their risk of death (Miller et al., 2006b). The studies examine phenomena such as the markets for smoke alarms and homes in safe neighborhoods, as well as the extra wages paid to entice workers to take risky jobs. From these studies, the estimated monetary value people place on their lives is a minimum of $4.3 million dollars per statistical life (2005 dollars) (Miller, 1990, 2000; Viscusi and Aldy, 2003). The value of pain, suffering, and lost quality-of-life for each fatality was then derived by subtracting mean lifetime after-tax earnings, fringe benefits, and household production from this value (Miller, 1990; Miller et al., 2006b).

The quality-of-life costs of nonfatal injury are based on estimates in previous studies that calculated victims' losses in 4 steps (Miller et al., 1995; Zaloshnja et al., 2004, 2005). First, they obtained physician ratings of the functional capacity typically lost by victims of every injury type. The ratings cover 6 types of functioning: cognitive, mobility, bending/grasping/lifting, sensory, cosmetic, and pain. Next, they added the probability of permanent work-related disability by diagnosis. Third, guided by surveys of the general population, they converted the functional capacity losses into estimates of the percentage loss in quality of life, measured on a QALY scale. Fourth, they valued each QALY loss at $146,201 per QALY (inflated to 2005 dollars).

Crime victims' losses due to pain, suffering, and lost quality of life are based on estimates in previous studies that analyzed jury awards to crime victims (Miller et al., 1996, 2006a). These civil lawsuits were against third parties such as a bar owner where an assault occurred, or the owner of a poorly lit garage where a sexual assault was committed. The studies analyzed almost 1,000 jury verdicts for assaults and 800 verdicts for rape. The values were calculated as general damages above wages, mental healthcare, and medical losses, but excluded punitive damages. To infer values for the actual distribution of crime victims, using regression techniques, previous research (Miller et al., 1996) adjusted the information based on typical wages and medical expenses, characteristics of the victim and severity of injury, and no contributory negligence.

Type of Costs

Health Problems. The general methodology for counting and costing most alcohol-attributable illness is detailed below. We utilized different methodologies for FAS, alcohol dependence and abuse, and alcohol's role in risky sexual behavior because the medical and work loss costs for these conditions are not often borne in a hospital.

Alcohol-Attributable Illness: To estimate the number of illnesses in California, we used 2 datasets: for fatalities, the 2004 California Death Statistical Master File (because 2005 was unavailable) and for nonfatal cases, the 2005 California Office of Statewide Health Planning and Development Patient Discharge Data (PDD). The latter includes hospitals that offer general acute care, acute psychiatric, chemical dependency recovery, and psychiatric health. PDD does not currently allow tracking numbers of patients, so instead we tracked the number of hospitalizations due to illness. For both datasets, we used International Classifications of Disease and Related Health Problems Series 9 and 10 (ICD-9 and ICD-10) codes to track the cause of death or hospitalization.

To calculate the proportion of illness hospitalizations and deaths attributable to alcohol consumption, we utilized the Alcohol Related Disease Impact (ARDI) tool developed by the U.S. Center for Disease Control and Prevention, modified with alcohol consumption data (Centers for Disease Control and Prevention, 2005a) specific to California for the appropriate year. Because the scope of this paper is to assess the costs of harmful drinking, we examined only the health effects of "medium" and "high" alcohol consumption as defined by ARDI. (ARDI utilizes different definitions of low, medium and high alcohol use depending on the condition. For most conditions, low alcohol consumption is defined as more than 0.1 drinks a day for men and women, medium alcohol consumption is defined as more than 3 drinks a day for men and 1.5 drinks a day for women and high consumption as more than 4.4 drinks a day for men and 3 drinks a day for women. For the remaining conditions—hemorrhagic stroke, ischemic stroke, and prostate cancer, for both men and women low consumption is defined as 0.1 drinks or more a day, medium consumption as more than 1.8 drinks a day and high as more than 3.6 drinks a day.)

ARDI identifies 35 illnesses for which alcohol is a cause. For those conditions where alcohol is one of several potential causes, ARDI provides an estimate of the proportion of cases that can be attributed

to alcohol consumption based (primarily) on a detailed meta-analysis of the academic literature (Corrao et al., 1999; English et al., 1995). For example, ARDI estimates that 24% of the cases of acute pancreatitis can be attributed to alcohol use. We used these AAFs to estimate both the number of hospitalizations and deaths attributable to alcohol.

The medical cost of each alcohol-related illness was estimated as the cost of hospital treatment and follow-up pharmaceuticals. Hospital treatment costs were calculated from PDD, which reports "charges" for treatment. However, most payers negotiate a contract with the hospital to make payments that are usually less than reported charges (Max et al., 2004). To adjust for this, we transformed charges into costs, using a Medicare cost-to-charge ratio for each California hospital (Office of State Health Planning and Development, 2005). To estimate the value of pharmaceuticals purchased to treat alcohol related illness, we followed previous national studies (Cruze et al., 1981; Harwood et al., 1998) in assuming that the proportion of total pharmaceutical expenditures (Bymark and Waite, 2001) attributable to alcohol treatment is equal to the percentage of inpatient hospital days attributed to alcohol use. For example, if Californians spent 1,000 days in hospital from illness, and alcohol was responsible for 100 of these, then 10% (100/1000) of hospital days were caused by alcohol. We then applied this percentage to the total pharmaceutical expenditures in the state to estimate alcohol-attributable pharmaceutical expenditures.

We estimated work loss caused by hospitalization with live discharge by assuming that each inpatient hospital day equaled $161 (converted to 2005 California wage level) (Harwood et al., 1998) in lost productive time. Work loss and quality-of-life costs caused by each fatal illness were then estimated using the methodology previously described.

Fetal Alcohol Syndrome: To estimate the number of new cases of FAS in California in 2005, we used the national average rate of 2 cases per every thousand live births (Harwood et al., 1998; Miller et al., 2006b). The cost of each FAS birth was then calculated from Harwood et al.'s (1998) per case estimate of lifetime medical and work loss costs and Miller et al.'s (2006b) estimate of quality-of-life costs. The medical costs were estimated by first analyzing the specific types of treatment for FAS, then estimating the proportion of cases requiring services and the duration of services. Work loss estimates were based on the proportion of FAS cases that suffer different severities of mental retardation and the productivity impairment of each level of disability. Quality-of-life costs were conservatively inferred from other conditions, as such figures for FAS are not currently available.

High-Risk Sex, Unwanted Pregnancy, and Sexually Transmitted Diseases: The number of high-risk sex cases was estimated from published national incidence data (Biglan et al., 2004), which defined high-risk sex as unprotected sex. The incidents are for adolescent cases (age 12 to 20). We did not examine alcohol's role in adult sexual behavior due to lack of data. The national data were scaled down to California by multiplying by the percentage of all underage drinks that are consumed in California. The published estimates treated 20% of high-risk sex as alcohol-involved and assumed that 50% of cases involving only alcohol and 25% of cases involving alcohol and other drugs were caused by the alcohol, translating to 9.15% of incidents of risky adolescent sex being alcohol-attributable. The published costs include costs of unwanted pregnancy, HIV, and other sexually transmitted diseases (Miller et al., 2006b).

Alcohol Dependence and Abuse: The number of admissions for specialized treatment of alcoholism only and alcohol with secondary drug involvement in California was estimated from the Treatment Episodes Data Set, 2005 (Substance Abuse and Mental Health Services Administration, 2005). Because these facilities are not included in PDD, we estimated the costs of this specialized treatment separately. While treatment at each facility varies, it can include both short and long term care, as well as residential, outpatient, and inpatient treatment. The cost per person treated came from a published study (Goodman et al., 1997) and averaged $24,122 (converted to 2005 California dollars).

To estimate the work loss caused by alcohol dependence, we followed Harwood et al. (1998) by examining the lower earnings of individuals who currently are or ever have been alcohol dependent. Harwood et al. estimated that for employed males over age 18, being alcohol dependent resulted in a reduction of $433 (converted to 2005 dollars) in expected monthly earnings. The study found no effect on female earnings. In addition, the study found that even men who had been alcohol dependent in previous years and had since recovered continued to experience reduced earnings. To estimate the number of employed men over age 18 in California experiencing lower wages, we used a figure from a recent study that estimated 17.1% of U.S. males over age 18 have been alcohol dependent in their lifetime (Hasin et al., 2007). We estimated the total 1-year work loss of these individuals by multiplying the monthly work loss by 12, and the "fringe to wage ratio" from the Economic Report of the President Table B-28 to account for lost fringe benefits (Council of Economic Advisers, 2006). The value of lost household production was found by multiplying this total earnings loss by the ratio of average household production (Krueger and Ward, 1998) to earnings (US Department of Commerce, 2006), for men aged 18 to 64.

Unintentional Nonmotor Vehicle and Self-Inflicted Injuries. To estimate the number of unintentional and self-inflicted injuries attributable to alcohol use in California, we first calculated the number of injury fatalities from California Vital Statistics data. The number of hospital-admitted nonfatal injuries came from data prepared by the California Department of Health Services Epidemiology & Prevention for Injury Control Branch, who used ICD-9 codes to identify injuries in PDD. ARDI provided attributable-fractions for fatal injuries. For nonfatal injury, we used the attributable-fractions from Miller et al. (2003). The fractions were estimated from risk factors found by dividing the percentage of nonfatal admissions ages 15 and over that were alcohol-positive by the percentage of hours that people ages 15 and over spent alcohol-positive. For example, if 10% of injuries occur while alcohol positive and individuals are alcohol positive for 5% of the time, then alcohol represents a relative risk of roughly 2 (10%/5%), essentially doubling the risk of injury. Alcohol involvement was estimated from a literature review (Miller et al., 2003). The study calculated the number of alcohol-positive hours based on published consumption data and assumed that 1 standard drink was metabolized per hour.

The medical and work loss costs of these injuries were estimated from recent national cost estimates (Finkelstein et al., 2006) adjusted to California prices. The quality-of-life losses were calculated based on published data (Zaloshnja et al., 2005).

Crime. Our study includes violent crimes—murder, rape, robbery, assault (including aggravated, nonaggravated, and domestic violence), and child abuse as well as property crimes—larceny, burglary, and motor vehicle theft. The number of these crimes committed in California was obtained from published crime figures (California Department of Justice, 2005) and adjusted for underreporting, using factors derived from national survey data (Miller et al., 2006a). Our estimate of the proportion of crimes attributable to alcohol was based on surveys of prison inmates (1997 Survey of Inmates in State and Federal Correctional Facilities, 1996 Survey of Inmates in Local Jails, and 1995 Survey of Adults on Probation) that indicate a large proportion of prisoners were drinking at the time of their crime. We used a weighted average of these surveys from Miller et al. (2006a), which estimates that 42% of homicides, 39% of rapes, 41% of assaults, and 33% of robberies were committed after at least 1 drink of alcohol; similar proportions were also found in other surveys (Bureau of Justice Statistics, 1993, 2001). However, not all of these crimes were caused by or are directly attributable to alcohol

use. To estimate the proportion of the alcohol-involved crimes actually attributable to alcohol, we followed previous assumptions (Harwood et al., 1998; Miller et al., 2006a) that 50% of violent crimes and 10% of property crimes committed under the influence of alcohol are attributable to drinking. For example, 42% of homicides are committed after at least 1 drink of alcohol, and we attribute half of these cases to being caused by alcohol, producing an AAF of 21% (42% × 50%) for homicide.

The cost of each alcohol-attributable crime was based on published estimates (Miller et al., 2006a), and includes the cost of adjudication and sanctioning, medical care for the victim, mental health services, property damage and loss, as well as work loss and quality of life. The adjudication and sanctioning costs include police and investigative costs, public defense, prosecution, court fees, processing and legal fees, jury and witness time, as well as incarceration costs and nonincarcerative sanctions.

Traffic Collisions. The number of alcohol-involved traffic collisions was estimated with data from the California Highway Patrol. Using formulas developed by the U.S. National Highway Traffic Safety Administration (Blincoe et al., 2002), we adjusted the figures to account for underreporting of alcohol involvement. Not all alcohol-involved crashes can be directly attributed to alcohol use. An estimated 91% of crashes involving drivers with a 0.10 blood alcohol concentration (BAC) or higher, 43.5% of crashes involving drivers with a BAC of 0.08 to 0.099, and 24% of crashes involving drivers with a BAC level of 0.01 to 0.0799 are directly attributable to drinking (Levy and Miller, 1995; Miller et al., 1999; Moskowitz and Fiorentino, 2000). We utilized these AAFs. To determine the BAC of the driver in each crash, we used estimates from national data on the proportion of alcohol involved crashes by BAC (Blincoe et al., 2002).

Estimates of crash costs, fatal and nonfatal injuries in crashes, and costs per fatal and nonfatal victim were calculated based on published methods (Blincoe et al., 2002; Zaloshnja et al., 2004). Costs per victim included medical, property damage, insurance, work loss, public services, and pain, suffering and quality of life.

Government Prevention. Each year, California spends a significant amount of state revenue on the treatment and prevention of substance use. In 2005, $594 million (2005 dollars) was allocated to the state's Department of Alcohol and Drug Programs (ADP) (California Department of Finance, 2005). Of this, we assumed 60% was used for alcohol-related problems (Harwood et al., 1998) and that 13.6% (Max et al., 2004) of these funds were used for prevention. The remaining portion of the budget was used either for treatment purposes or for the prevention of other drug problems. Because treatment costs were estimated previously, we do not include them here to avoid double counting.

In addition to state funds, California received $42,194,329 (2005 dollars) in federal grants from the U.S. Department of Education in 2005. This money was used to cover programs for the prevention of problems related to alcohol, drugs, and violence from the (Safe and Drug Free Schools and Communities State Grants, No Child Left Behind Act, 2003). Because no information exists on the proportion allocated to alcohol problems, we again followed previous assumptions of 60% (Harwood et al., 1998).

Sensitivity Analysis

We performed a sensitivity analysis on selected AAFs and other key parameters with the highest levels of uncertainty. The sensitivity analysis estimates how uncertainty impacts our results and how our figures would change under alternative assumptions.

We varied 3 sets of parameters: AAFs, the discount rate, and the value of statistical life. First, as ARDI is designed to estimate mortality from alcohol and its validity for morbidity is unknown, we estimated how variation in the attributable-fractions used for illness morbidity would affect our estimates. Similarly, because of some uncertainty related to the proportion of alcohol-involved crime and high-risk sex attributable to alcohol use, we tested alternative AAFs. We both increased and decreased each set of AAFs by 20% (i.e., an attributable fraction of 0.30 was tested at both 0.36 and 0.24). Second, we examined the effect of using a 2% and 4% discount rate throughout the indirect costs. We estimated the impact of these changes together under 2 scenarios: one scenario applied all changes that increased costs (AAFs were increased 20% and the discount rate was decreased to 2%) and the second applied all changes that decreased costs (AAFs decreased 20% and the discount rate was increased to 4%). Finally, we tested the effect of using values of statistical life of $5 million and $3 million.

RESULTS

Economic Costs

In 2005 alcohol consumption in California led to an estimated 9,439 deaths and more than 920,000 nonfatal incidents, such as crime, hospitalization, and traffic collisions. The economic cost of these problems is estimated at over $38 billion. The total cost included $5.4 billion in medical and mental health spending (14% of total), and $33.1 billion in work losses and other economic costs (86%). Of the $33.1 billion, work losses represent $25.3 billion (66%) and criminal justice and other public programs account for the remaining $7.8 billion (24%) (not in table).

Figure 1 and Table 3 break the total costs down by type of problem, with health problems causing $18.2 billion in costs (47%), crime $7.8 billion (20%), traffic collisions responsible for $8.4 billion (22%), and other injury causing $4.0 billion (11%).

Alcohol-attributable traffic collisions and unintentional and self-inflicted injuries were responsible for $12.4 billion in costs, 32% of the total, highlighting alcohol's role as a cause of acute and unintended harms (Table 3). We estimated that 3,524 people lost their lives from these problems, which can be directly linked to immediate alcohol use. These problems

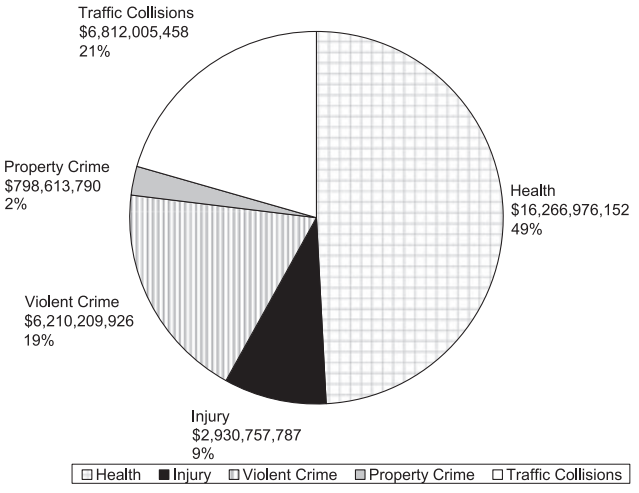

Fig. 1. Economic cost of alcohol problems in California, 2005.

Table 3. Summary of Results: Alcohol-Attributable Deaths, Incidents, and Economic Costs in California, 2005

Problem	Deaths	Incidents	Medical costs	Lost work and other economic costs	Total costs
Health	5,382	44,152	$1,913,424,807	$16,266,976,152	$18,180,400,959
Injury	2,380	41,598	$1,093,156,707	$2,930,757,787	$4,023,914,494
Violent crime	533	424,001	$814,880,612	$6,210,209,926	$7,025,090,539
Property crime	n/a	225,203	$2,708,944	$798,613,790	$801,322,734
Traffic collisions	1,144	186,975	$1,542,847,974	$6,812,005,458	$8,354,853,432
Prevention	n/a	n/a	n/a	$73,786,997	$73,786,997
Total	**9,439**	**921,929**	**$5,367,019,044**	**$33,092,350,111**	**$38,459,369,155**

Table 4. Alcohol-Attributable Deaths, Hospitalizations, and Economic Costs of Illness in California

	Deaths	Hospitalizations	Medical costs	Work loss
Malignant neoplasms				
Breast cancer (females only)	68	88	$957,754	$22,743,453
Esophageal cancer	49	47	$1,239,637	$12,606,914
Laryngeal cancer	21	42	$1,098,229	$6,024,563
Liver cancer	117	145	$3,050,855	$39,517,304
Oropharyngeal cancer	42	101	$3,024,276	$11,786,987
Prostate cancer (males only)	25	110	$1,304,263	$3,951,766
Neuro-psychiatric conditions				
Alcohol abuse	276	2,887	$23,500,916	$198,852,731
Alcohol dependence syndrome	611	7,164	$79,998,636	$388,617,027
Alcohol polyneuropathy	1	82	$1,079,254	$573,122
Alcoholic psychosis	73	6,502	$60,565,537	$41,478,272
Degeneration of nervous system due to alcohol	7	n/a	$0	$4,289,662
Epilepsy	26	725	$10,145,059	$20,437,439
Cardiovascular diseases				
Alcohol cardiomyopathy	73	136	$2,078,738	$35,159,022
Esophageal varices	4	236	$2,944,045	$1,411,970
Hypertension	214	707	$13,057,187	$59,799,706
Ischemic heart disease	104	339	$6,260,118	$22,140,431
Portal hypertension	2	162	$2,613,062	$265,727
Stroke hemorrhagic	210	861	$21,915,569	$77,864,092
Stroke ischemic	69	2,157	$26,497,590	$14,552,205
Superventricular cardiac dysrthymia	18	432	$10,943,974	$2,809,358
Digestive diseases				
Alcoholic liver disease	2,584	9,125	$162,602,801	$1,462,054,659
Acute pancreatitis	55	6,105	$64,582,852	$28,202,599
Alcoholic gastritis	6	889	$11,047,012	$3,847,568
Chronic hepatitis	-	2	$70,135	$2,191
Chronic pancreatitis	103	1,991	$20,819,578	$72,498,162
Gastroesophageal hemorrhage	2	782	$9,184,101	$1,095,412
Liver cirrhosis unspecified	607	2,009	$39,336,609	$247,502,720
Skin diseases				
Psoriasis	-	1	$45,386	$570
Conditions during pregnancy or perinatal period				
Low birth weight prematurity IUGR death	15	206	$10,783,875	$14,108,935
Spontaneous abortion (females only)	-	118	$891,319	$23,165
Total	**5,382**	**44,154**	**$591,638,367**	**$2,794,217,730**

place a significant burden on the medical system, causing more than $2.6 billion in medical costs (Table 3).

The costs and mortality caused by health problems are expanded in Tables 4 and 5. These problems are responsible for just over a third of the total medical costs and 57% of deaths. The most severe illnesses were digestive diseases, which claimed an estimated 3,357 lives, followed by neuro-psychiatric conditions at 994 lives.

The work loss costs are dominated by reduced productivity from alcohol dependence. The single largest cost result in our study, California experiences approximately $12.8 billion in reduced earnings (Table 5) annually. In addition, work losses from premature death accounted for $6.8 billion and lost work due to hospitalization and disability $5.7 billion (not in table).

Tables 6 and 7 describe the costs of fatal and nonfatal unintentional and self inflicted injury. Mortality from unintentional injury was primarily from falls and poisonings. These harms caused 83% of all unintentional injury deaths. In addition, falls were responsible for a major proportion of nonfatal unintentional injury costs, accounting for 64% of medical costs and 51% of work loss costs.

Table 8 provides detail on our crime estimates, which are dominated by the cost of violence. We estimate that alcohol is responsible for more than 350,000 assaults, 25,000 rapes, and 10,000 incidents of child abuse, costing $7.0 billion, 90% of

Table 5. Alcohol-Attributable Incidents and Economic Costs for Special Health Groups, California 2005

Special health group	Incidents	Medical costs	Work loss	Total
Fetal alcohol syndrome	1,097	$382,999,060	$581,924,339	$964,923,399
High-risk sex	49,400	$120,796,949	$126,108,727	$246,905,675
Alcohol dependence	33,611*	$817,990,431	$12,764,725,356**	$13,582,715,788
Total	**84,108**	**$1,321,786,440**	**$13,472,758,422**	**$14,794,544,862**

*33,611 individuals currently in treatment for alcoholism or alcohol abuse with a secondary substance.
**Alcohol dependence work loss costs are based on the proportion of Californian men who have ever been alcohol dependent, not only those currently in treatment.

Table 6. Alcohol-Attributable Deaths and Economic Costs for Fatal Unintended and Self-Inflicted Injury in California, 2005

Injury	Deaths	Medical costs	Work loss	Total cost
Air space transport	15	$188,473	$12,323,956	$12,512,443
Aspiration	21	$259,150	$10,747,362	$11,006,533
Drowning	108	$1,260,411	$85,659,161	$86,919,680
Falls	530	$6,243,157	$240,366,338	$246,610,025
Fire	87	$1,013,041	$44,703,105	$45,716,232
Firearm	9	$94,236	$7,575,515	$7,669,761
Hypothermia	17	$188,473	$9,549,527	$9,738,017
Occupational and machine	13	$153,134	$9,722,405	$9,875,552
Poisoning	788	$9,282,279	$641,123,150	$650,406,217
Suicide	784	$9,235,161	$614,481,106	$623,717,051
Water transport	8	$82,457	$7,324,215	$7,406,680
Total	**2,380**	**$27,999,971**	**$1,683,575,840**	**$1,711,575,811**

Table 7. Alcohol-Attributable Incidents and Economic Costs for Non-Fatal Unintended and Self-Inflicted Injury in California, 2005

Injury	Incidents	Medical costs	Work loss	Total
Cut/pierce	934	$13,103,793	$63,734,063	$76,837,856
Drowning/submersion	81	$3,024,092	$15,755,523	$18,779,615
Fall	24,039	$662,903,476	$617,556,504	$1,280,459,980
Fire/flame	180	$6,390,245	$7,228,769	$13,619,014
Hot object/substance	228	$5,409,434	$8,346,667	$13,756,101
Firearm	141	$5,213,043	$11,109,015	$16,322,058
Machinery	357	$8,441,112	$44,063,900	$52,505,012
Pedal cyclist, other	977	$27,913,767	$69,108,566	$97,022,333
Pedestrian, other	141	$5,827,934	$8,898,801	$14,726,735
Transport, other	1,099	$37,652,287	$78,071,369	$115,723,656
Other natural/env	1,243	$41,528,291	$52,973,291	$94,501,582
Overexertion	1,117	$21,966,673	$52,311,383	$74,278,056
Poisoning	2,782	$34,809,004	$8,385,062	$43,194,066
Suffocation	315	$24,493,838	$5,073,896	$29,567,734
Suicide	2,656	$29,920,998	$25,689,774	$55,610,772
Other/unspecified	5,308	$136,558,749	$178,875,364	$315,434,113
Total	**41,598**	**$1,065,156,736**	**$1,247,181,947**	**$2,312,338,683**

Table 8. Alcohol-Attributable Incidents and Economic Costs for Crime in California, 2005

Crime	Incidents	Medical and mental health costs	Adjudication, sanctioning, and other public programs costs	Property damage	Work loss	Total
Property crime						
Burglary	15,722	$164,436	$65,857,158	$29,040,433	$329,873	$95,391,900
Larceny	202,857	$2,475,226	$516,803,395	$106,190,484	$2,553,689	$628,022,794
Motor theft	6,624	$69,282	$35,726,130	$41,612,278	$500,350	$77,908,040
Violent crime						
Assault	369,416	$477,600,305	$2,974,230,671	$18,358,800	$516,197,131	$3,986,386,907
Child abuse	10,005	$41,071,154	$19,253,973	$53,565	$10,573,776	$70,952,467
Homicide	526	$20,442,070	$149,348,150	$116,679	$826,308,001	$996,214,900
Rape	26,787	$221,318,659	$1,339,409,763	$5,325,004	$92,359,741	$1,658,413,167
Robbery	17,267	$51,739,479	$209,737,963	$24,857,003	$24,079,707	$310,414,153
Total	**649,204**	**$817,589,556**	**$5,310,367,202**	**$225,554,246**	**$1,472,902,268**	**$7,823,704,328**

Table 9. Quality-of-Life Costs of Alcohol Related Problems in California, 2005

	Quality-of-life costs	Quality adjusted life years
Fatal incidents		
Fatal illness	$12,951,279,286	88,585
Fatal injury	$6,515,558,491	44,566
Fatal traffic collisions	$3,622,604,350	24,778
Homicide	$1,767,849,243	12,092
Nonfatal incidents		
Nonfatal injury	$8,181,569,725	55,961
Nonfatal traffic collisions	$5,193,473,164	35,523
Fetal alcohol syndrome	$906,476,735	6,200
High-risk sex	$484,887,986	3,317
Violent crime	$9,111,200,230	62,320
Property crime	$10,559,033	72
Total	**$48,745,458,243**	**333,414**

the total cost of alcohol-attributable crime. The criminal justice system paid for $4.7 billion of these crime costs, while $2.3 billion represents medical, mental health, and work loss costs to the victim.

Quality-of-Life Costs

Alcohol-related problems caused an estimated loss of 330,000 QALYs, valued at more than $48.7 billion annually. Fatal and nonfatal QALY losses are the equivalent of losing 14,400 lives in California a year (Table 9).

Fatalities from illness, injury, traffic collisions, and crime account for 51% of quality-of-life costs. The remaining 49% is borne by survivors of alcohol related crime, injury, traffic collisions, and health problems. Permanent disability caused by injury and traffic collisions accounts for $13.4 billion in costs, while the victims of rape and assault and their families bear $8.6 billion in quality-of-life costs.

Sensitivity Analysis

Our economic cost estimates do not appear particularly sensitive to the more uncertain variables employed in our study. With higher AAFs and a lower discount rate (both factors that raise costs), our economic cost estimate increases by $3.7 billion (10%) to $42.2 billion, while lower AAFs and a higher discount rate reduce costs by $3.1 billion (8%) to $35.4 billion.

Our quality-of-life estimates are sensitive to the value of a statistical life used. With a value of $5 million, costs would increase by $11.2 billion (23%) to $60 billion, while a value of $3 million would cause costs to fall by $18.4 billion (38%) to $30.3 billion. Importantly, recent meta-analyses favor the $5 million value over our lower base estimate (Kochi et al., 2006; Miller, 2000; Viscusi and Aldy, 2003).

DISCUSSION

Alcohol consumption leads to death, illness, injury, crime, property damage, and traffic crashes. The economic cost of these problems is approximately $38 billion or $1,040 per California resident annually. In addition, we estimate substantially reduced quality of life from alcohol-caused disability, crime, and death, totaling approximately $48.8 billion.

Our $38.5 billion estimate of the economic cost of alcohol in California is significantly larger than the $19 billion estimate (inflated to 2005 dollars) by Max et al. (2004). Several factors explain the difference. First, we include several costs not calculated in the prior study, particularly the work loss caused by morbidity, which represents more than a third of our estimate. In addition, we used more comprehensive crime and traffic collision costs, and included high-risk sex and lifetime FAS costs. Conversely, many of the AAFs we used for alcohol-related illness mortality and morbidity are markedly lower than in Max et al., who included the negative effects of low levels of alcohol consumption on chronic disease. Both studies excluded any health benefits of low levels of drinking.

Our results are comparable to previous national studies. We estimate the economic costs of alcohol in California at $38 billion, just over $1,000 per California resident. The most recent national study (Harwood et al., 1998), estimated per capita costs of about $800 (converted to 2005 dollars). However, adjusting for higher prices in California yields a cost of just over $1,000 per capita, very close to our results. In addition, similar to Harwood et al., 1998, we found work losses from alcohol dependence to equal almost one-third of total costs.

Limitations

Our estimates of the cost of alcohol problems in California have several limitations. First, the ARDI methodology tends to underestimate the number of alcohol-attributable deaths (ARDI website) and our fatality estimates and related costs may be low as a result. ARDI is also a conservative model and does not incorporate several potentially alcohol-related illnesses, such as diabetes, which have been estimated in other cost-of-alcohol studies (Max et al., 2004; Rehm et al., 2006). Additionally, ARDI is not designed for use with morbidity data, and the validity of using it for this purpose is unknown. Lacking alternatives, we used it to estimate nonfatal illness incidents attributable to alcohol.

Our hospitalization data were limited by potential underreporting of some alcohol-caused problems. Conditions such as alcohol dependence and alcohol poisonings have particular potential for underreporting (Miller et al., 2006b).

The role of alcohol in crime and risky sex requires further research. We relied on studies based on prison surveys to estimate alcohol involvement in crime. However, other surveys (Bureau of Justice Statistics, 2001) suggest that these may underestimate actual crime involvement. In addition, we followed the debatable assumptions in other studies (Harwood et al., 1998; Miller et al., 2006b) regarding the percentages of alcohol involved crimes and risky adolescent sex attributable to alcohol. Further study is needed to more accurately determine how large a causal role alcohol plays in these activities.

Our estimate of the prevention costs for alcohol in California only incorporate government funding and does not include the money spent by private and nonprofit organizations, nor for alcohol research spending. Data unavailability also prevented us from estimating costs by age and gender.

Because the methodology for monetizing QALYs is unsettled, we provide both monetized and un-monetized estimates of QALY loss. We were unable to estimate the QALY caused by nonfatal illness. Also, the published QALY loss estimates for FAS and risky sex are inexact.

Finally, our definition of harmful drinking did not include any potential effects of low levels of drinking on chronic or cumulative disease.

Policy Implications

As the largest state in the U.S., California bears a significant burden related to alcohol use. At $38 billion and $49 billion respectively, the economic and quality-of-life costs of alcohol problems in California indicate that alcohol is a serious public health and safety challenge to the state.

In addition to the overall cost, specific sectors in California suffer a particular burden from alcohol. The healthcare system bears $5.4 billion in costs, due to the large number of alcohol-related problems that require medical treatment. The array of alcohol-attributable illnesses and nontraffic injuries cost $2.2 billion in medical treatment, while medical and mental health assistance for the victims of alcohol-attributable crime cost $0.8 billion. Traffic collisions place an additional $1.5 billion burden on the medical system, while another $0.8 billion is spent on specialized treatment for alcohol dependence.

The criminal justice system also bears a significant burden, indicating that alcohol is not only a massive health problem, but also a substantial social challenge (Rehm et al., 2006). In addition, the high medical and work loss costs of FAS, unwanted pregnancy, and the transmission of STDs through high-risk sex emphasize the long-term costs these conditions impose throughout an individual's life.

Moreover, many of the costs of alcohol are imposed on people and institutions other than the drinker, including: Medi-Cal (California's public healthcare financing program for low-income residents) and other government programs, private insurance, uninsured costs to employers, uninsured medical and property losses, pain, suffering, and lost quality of life of those other than the drinker.

Moreover, California's economy as a whole bears a significant burden in the form of work loss and reduced earning capacity of those whose lives are touched by alcohol. Each year, the California economy suffers a total of $25.3 billion in work losses from premature death, hospitalization and disability, as well as reduced earnings.

Finally, a significant proportion of direct costs are likely to fall on the state's public finances. Generally, two-thirds (67%) of California hospitalization costs involve a government payer (Medicaid, Medi-Cal, County Indigent Programs and other public programs). Although this same proportion may not apply to all medical and mental health care costs reviewed in this study, a significant portion of the $5.4 billion in alcohol-related medical and mental health costs is likely paid with public tax money. In addition, all of the $5.3 billion in crime costs—adjudication, sanctioning, and other public program costs—are paid with Californians' tax dollars.

Moreover, our alcohol cost estimate is significantly higher than a recent estimate of the economic cost of tobacco use in California. Max et al. (2002) estimated economic costs of $19 billion and per capita costs of $550 (converted to 2005 dollars), roughly one-half our estimate for the cost of alcohol problems. California has been a national leader for many years in reducing smoking rates in the state, particularly through raising tobacco excise taxes and funding anti-smoking media campaigns. Our findings suggest that alcohol consumption warrants the same serious attention given to tobacco use at the state government level. While the state currently funds a "Tobacco Control Program" within the California Department of Public Health, no parallel agency currently exists to solely focus on alcohol prevention.

Current alcohol excise tax rates are inadequate to cover alcohol-related costs. In 2005, Californians consumed more than 13.9 billion alcoholic drinks (Nephew et al., 2004). We estimate the average cost to society of each of these drinks at almost $2.80 excluding quality-of-life costs or $6.25 including them. In contrast, the average excise tax per drink in California is only $0.08 (including both state and federal excise taxes).

While the enormous costs (in terms of lives lost, dollars, pain and suffering) of alcohol problems may not be completely avoidable, several policy strategies have been shown to be effective in reducing the harm caused by alcohol. Most significantly, higher prices and taxes have been showed to effectively reduce many of the types of harm caused by alcohol (Chaloupka, 2004; Cook, 2007). Other proven strategies include reducing the number of alcohol outlets, as well other restrictions on alcohol access that alter the drinker's environment (Babor et al., 2003).

This study uses publicly available data to provide estimates of the cost of alcohol use in California. Although we have not conducted a survey of other states data resources, we anticipate that similar public data sources exist for nearly all U.S. states. Thus, the general methodology and framework developed in this paper could be applied to estimate the cost of alcohol in other states, with the aim of furthering state-level policy. While there have been efforts over the years to enact policies aimed at reducing the harm from alcohol consumption, political challenges have slowed progress. Political will fostered through greater public awareness and attention must be garnered to effectively reduce alcohol-related harm.

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