

# The Human and Economic Cost of Alcohol Use in Minnesota



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State Epidemiological Outcomes Work Group

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## Executive Summary

Estimating the economic costs of alcohol is important for policymakers, public health leaders and other government agencies. Cost estimates can be used to facilitate alcohol interventions and/or policies that focus on reducing the associated harm of alcohol abuse. In addition, they can be used to attract public awareness of the overall impact of drinking upon society and stimulate action for local communities. For the purposes of this report, the economic cost of alcohol refers to the amount spent on the consequences of alcohol use and abuse—not the amount paid by consumers to purchase alcohol.

In order to measure changes in alcohol-related costs over time and to monitor the outcomes of alcohol-related policies, programs and interventions, cost estimates must be transparent and replicable. In order to compare the effectiveness of strategies, such as raising the cost of alcohol sales tax, it is important to establish a standardized method for estimating costs across different geographic areas. A review of the research literature reveals inconsistencies in methodologies, data sources and cost variables.

The Minnesota Department of Health and the Minnesota Department of Human Services State Epidemiological Outcomes Workgroup contracted with the Minnesota Institute of Public Health (MIPH) to estimate the alcohol-related costs of health care services, productivity effects/lost earnings and social effects incurred by the state of Minnesota. An Alcohol Cost Estimation Worksheet developed by the New Mexico Department of Health was utilized. The model starts with the best available estimates of United States costs by component (category of cost, such as health care or criminal justice). These costs are then converted to per capita costs to facilitate application at the state level. The national per capita cost estimates are then multiplied by the appropriate incidence adjustment factors, average wages and consumer price indices in order to adjust for differences in burden of alcohol-related problems and costs from one location to another.

Overall, the economic costs associated with alcohol use in Minnesota in 2007 amounted to an estimated \$5.06 billion. This amounts to \$975 for every person in the state. These costs are 17 times greater than the \$296 million in tax revenues collected from alcohol sales. Alcohol-related health care services cost Minnesota \$938 million, including \$266 million in alcohol and drug abuse services costs and \$672 million in medical consequence costs. Lost earnings due to alcohol-related productivity effects cost the state \$3.71 billion. This includes \$729 million in lost productivity due to premature deaths, \$2.78 billion due to impaired productivity and \$196 million in lost productivity for victims of crime and incarcerated persons. Social effects of

alcohol cost Minnesota \$415 million, including \$117 million in alcohol-related criminal justice costs, \$15 million in alcohol-related social welfare program administration costs, \$278 million for alcohol-related motor vehicle crashes and \$8 million in alcohol-related fire destruction costs.

It is important to note that this is a stand-alone study. Though previous studies in Minnesota have estimated the economic impact of alcohol, no two have utilized the same methodologies, data sources, variables and assumptions. Therefore, it is not possible to determine changes in the economic impact of alcohol over time. Comparisons should not be made between cost estimates from different years. Methodologies have changed over time as lessons have been learned from previous studies, cost components have been identified and more accurate adjustment factors have been utilized.

Also of note, the 2007 alcohol-cost estimate is based on incidence rates from a single year. Minnesota's alcohol abuse and dependence rates were higher in 2006-2007 than in 2005-2006 and 2004-2005. Also, the state alcohol-related motor vehicle crash fatality rate was higher in 2007 than in 2006 or 2008. However, the Minnesota alcohol-related death rate (for causes of death other than motor vehicle fatalities) was lower in 2007 than in 2006 or 2008, and the cost of alcohol-related fires was at a ten-year low in 2007. Finally, though crimes (and related costs) have continued to decline over the years in Minnesota, mean hourly wages (which influence alcohol-related productivity losses) have been gradually increasing. Future estimates should be calculated using a three-year average in order to smooth out year-to-year fluctuations.

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## Introduction

Current alcohol use is reported by over half of all adults in the United States<sup>1-2</sup> and is the most widely used drug in Minnesota<sup>3</sup>—even more widely used than tobacco. In 2009, 62 percent of Minnesota adults reported any use of alcohol in the past 30 days and 20 percent reported binge drinking (five or more drinks in a row for men and four or more drinks in a row for women, on one occasion) in the past 30 days<sup>3</sup>. In 2010, 41 percent of Minnesota’s twelfth-graders reported any use of alcohol in the past 30 days and 24 percent reported binge drinking (five or more drinks in a row on at least one occasion) in the past two weeks<sup>3</sup>.

Per capita ethanol consumption in the United States totaled 1.21 gallons from beer, 0.38 gallons from wine and 0.73 gallons from spirits in 2007; in Minnesota per capita ethanol consumption totaled 1.16 gallons from beer, 0.32 gallons from wine and 0.97 gallons from spirits<sup>4</sup>. The retail sales of alcoholic beverages in the United States totaled approximately \$167 billion in 2009<sup>5</sup>. In Minnesota, liquor gross receipt taxes, sales taxes on alcohol and excise taxes generated about \$296 million in 2007<sup>6</sup> (this does not include local tax revenue generated from liquor sales).

Many Minnesota residents use alcohol in a variety of contexts and for a variety of purposes. Alcohol consumption has been a part of America’s culture throughout its history for social, religious and self-medication purposes, and many people who consume alcohol perceive that there are benefits to their actions<sup>7</sup>. Recent studies have documented an association between moderate alcohol consumption and reduced risk for coronary heart disease<sup>8</sup>. In addition, sales of alcoholic beverages provide jobs in the alcohol manufacturing, wholesaling, retail and service industries.

Alcohol consumption has also resulted in serious problems for individuals, families and communities throughout the country. Alcohol use has been associated with unintentional injuries including falls, burns, drowning and motor vehicle crashes; violent acts including homicide, suicide and assault; chronic diseases including cancer, digestive disease and cardiovascular disorders; unintended pregnancies, sexually transmitted diseases and alcohol-related birth defects<sup>9-10</sup>. The costs associated with these problems have been documented in multiple reports and studies<sup>11-12</sup> and have public health and public policy implications. The data collection and analysis methods employed in these studies, and implications of these studies, is described in more detail in the literature review below.

## Scope of Project

The purpose of this report is to estimate the total costs of alcohol abuse in Minnesota using quantitative data available from state and national sources. Cost estimates can be used to help prioritize needs for alcohol abuse prevention policies and practices in Minnesota. These identified needs can be a key factor in selecting, implementing and evaluating prevention strategies that are most likely to be effective in reducing the associated harm of alcohol abuse in Minnesota communities. Additional data documenting alcohol use patterns and consequences in communities throughout Minnesota is already available through the website Substance Use in Minnesota (SUMN) at [www.sumn.org](http://www.sumn.org). This report will summarize current data documenting the costs of alcohol abuse and will complement existing data available to policymakers.

This report does not attempt to quantify benefits of alcohol sales or consumption, nor does it attempt to quantify the costs of pain and suffering resulting from alcohol-related problems. The focus of this report is the presentation of verifiable quantitative data describing the financial costs of alcohol abuse in Minnesota.

This project was funded by the Minnesota Department of Health (MDH) with the ultimate goal of creating a fact sheet on the current human and economic cost of alcohol use in Minnesota. To this end, the Minnesota Institute of Public Health (MIPH):

- Conducted a literature review of national and state estimates of alcohol costs and consequences of alcohol use
- Collected the most up-to-date Minnesota statistics on drinking patterns in Minnesota
- Evaluated a list of cost components based on importance to the study, data quality, availability and feasibility of methodology
- Consulted with state and national experts on the best methodology to use when estimating state-level costs using national data

## Review of the Literature

Estimating the economic costs of alcohol is notably important for policymakers, public health leaders and other government agencies. Cost estimates can be used to facilitate alcohol interventions and/or policies that focus on reducing the associated harm of alcohol abuse. It not only can drive policy and prevention but also be used to attract public awareness of the overall impact of drinking upon society and stimulate action for local communities.

Numerous analyses of the economic impact of alcohol use have been conducted and published throughout the world; however, there is a less concrete understanding or “best practice” applicable to the researcher on how the economic burden is calculated. These studies have involved various methods utilized to come up with the overall economic impact upon society. Literature reviews prior to 2004 have already been published and most cost analyses publications have used the Lewin Group<sup>11</sup> methodology, as well as the Center on Addiction and Substance Abuse (CASA) *Shoveling Up: The Impact of Substance Abuse on State Budgets*<sup>13</sup> report, as a foundation to compute the economic impact associated with alcohol abuse.

Harwood et al produced *The Economic Costs of Alcohol and Drug Abuse in the United States 1992* for the National Institute on Drug Abuse (NIDA) and the National Institute on Alcohol Abuse and Alcoholism (NIAAA). Harwood, with the Lewin Group, published an updated version of the alcohol cost study in 2002. Using adjusted inflation to compare costs from 1992 and 1998, the Lewin Group accounted for the total population change, consumer price index, wage levels and health care expenditures. The Lewin Group assessed the economic costs to society and cost-benefit analyses, cost-effectiveness of treatments and a general public understanding of societal costs of continued addiction. They found a 25 percent increase in the economic burden of alcohol abuse from 1992 to 1998, an increase of 4 percent annually. In 1998, the United States spent an estimated \$185 billion on alcohol-related costs. Cost components included: alcohol abuse treatment, prevention, research and training, medical consequences of alcohol consumption (including fetal alcohol syndrome), lost future earnings due to premature death, lost productivity due to alcohol-related illness (including fetal alcohol syndrome) and crime (victims and prisoners), crime/criminal justice, social welfare administration, motor vehicle crashes and property damage and fire destruction.

The National Center on Addiction and Substance Abuse (CASA) at Columbia University published *Shoveling Up: The Impact of Substance Abuse on State Budgets* in 2001 and followed-up with *Shoveling Up II*<sup>14</sup> in 2009. The latter report found that in 2005, federal, state and local government spent \$468 billion (11 percent of their allotted budgets) on substance abuse and



addictions. Cost components included: burden spending (health, justice, child/family assistance, education, mental health/developmental disabilities, public safety and federal and state workforce), prevention/treatment/research, interdiction and regulation/compliance. For every dollar spent by federal and state government on substance abuse and addiction, 95.6 cents paid for the burden on public programs. It should be noted that *Shoveling Up* did not separate alcohol-related costs from drug-related costs.

This literature review outlines the most current body of research from 2004 to 2010. The literature was obtained using Google, Google Scholar, Medline, Medline Plus, PubMed and the Education Resources Information Center Collection (ERIC). While the search was extensive, it did not include all the possible electronic databases that might include literature on economics and health. The keywords used in the search combined terms for substance use and abuse (alcohol, alcoholism, alcohol abuse, dependence, addiction or treatment), with terms related to costs (costs, cost-benefit, cost-effectiveness, or economics). The search was limited to English language articles. This review focused on four major cost components: health care, criminal justice and law enforcement, property damage and lost productivity.

Moller and Matic<sup>15</sup> from the World Health Organization (WHO) published an article in 2010 that provided a conceptual model for other studies estimating alcohol-attributable costs to replicate. The article defined cost components such as health and crime expenditures, labor and productivity costs and non-financial costs, which all go into the full economic welfare cost. However, the article did not include a best practice formula to use when conducting a cost analysis of alcohol abuse on society.

Thavorncharoensap, Teerawattananon, Yothasamut, Lerpitakpong and Chaikledkaew<sup>16</sup> summarized knowledge related to cost components included in the estimations and the methodologies utilized in studies published from 1990-2007. Thavorncharoensap et al used the Medline database and identified 318 total studies, with only nine fulfilling the eligibility requirement. Those requirements included: studies that considered the costs of alcohol or social costs of alcohol, English language and published between 1990 and 2007. Costs were presented in 2007 dollar amounts by using Gross Domestic Product (GDP) inflation. Health care, research and prevention, crime and law enforcement, property damage, administration, welfare assistance costs, alcohol costs and other costs were identified as variables to consider when estimating the economic impact of alcohol abuse upon society. As the cost variables differed in each article reviewed, no set of methodological guidelines outlining the economic cost formula could be provided. The authors of the literature review concluded that the economic cost of alcohol can be useful for policymaking; however, more research is needed to establish a best practice formula.

Whelan, Josephson and Holcombe<sup>17</sup> estimated the economic costs of alcohol and drug abuse in Oregon, using the Lewin Group<sup>11</sup> method. Data from Oregon Vital Statistics, the Behavioral Risk Factor Surveillance System (BRFSS), Centers for Disease Control and Prevention (CDC), EcoNorthwest and the U.S. Department of Health and Human Services (US DHHS), were used to assess medical consequences, forgone productivity, costs incurred by victims of crime committed by alcohol and drug abusers, criminal justice, property damage related to motor vehicle crashes and social welfare program costs. Based on age-adjusted rates, Oregon ranked fourth in the nation for alcohol-induced deaths (7/100,000 for U.S. vs. 13.5/100,000 for Oregon). Substance abuse cost Oregon \$5.9 billion, which amounts to \$1,600 for each taxpaying Oregonian<sup>17</sup>.

Roeber<sup>18</sup> produced a fact sheet estimating the cost of alcohol use and consequences in New Mexico using the Lewin Group methodology, along with Vital Statistics, the CDC Alcohol-related Disease Impact (ARDI) software, New Mexico Bureau of Business and Economic Research and New Mexico Taxation and Revenue Department figures. In 2006, the 1,000 deaths in New Mexico related to alcohol represented 27,000 years of potential life lost. The overall economic cost of alcohol was \$2.5 billion, or \$1,250 per person in New Mexico.

Wright, Grenne, Li and Judson-Patrick<sup>19</sup>, from the Indiana Center for Health Policy, conducted a study assessing the economic impact of substance misuse and abuse in Indiana. Wright, epidemiologist for the Indiana State Epidemiology and Outcomes Workgroup (SEOW), followed the same methodology as the National Center on Addiction and Substance Abuse (CASA). Using fiscal year 2008 state data, they determined that Indiana spent \$7.3 billion on substance abuse. That totals \$1,688 per person in Indiana. The authors combined both alcohol and drug use in calculating the overall economic burden, which limited the utility of this resource for Minnesota's alcohol cost study.

Barkey<sup>20</sup> published a study quantifying the cost to Montana's economy that could be attributed to alcohol abuse. They utilized a Substance Abuse and Mental Health Services Administration (SAMHSA) cost formula. Data were obtained from the Montana Vital Statistics, Montana Department of Justice, Montana Department of Public Safety, Montana Department of Health, Montana Department of Transportation, Montana Veterans Association, Montana Department of Human Services, the Lewin Group study<sup>11</sup> and the American Hospital Association. In 2005, Montanans spent \$511 million (\$546 per person) dealing with the consequences of alcohol consumption.

Bamberger, Nelson, Sporer, Sturm and Weintraub<sup>21</sup> from the Lewin Group estimated the health-related economic costs of the measureable, direct effects of alcohol consumption in San Francisco. Costs were calculated using the inflated fiscal year 2008-2009 Consumer Price Index.

Bamberger et al found that there was \$17.7 million in unreimbursed alcohol-attributable costs in San Francisco for 2008. The San Francisco Department of Public Health spent \$13,692,287, while the San Francisco Fire Department spent \$3,371,665. The article did not provide any of the cost components that went into figuring out the overall economic burden of alcohol abuse on the city.

The articles reviewed varied in terms of overall usefulness for the purposes of the cost estimation being conducted for Minnesota. Differences in estimation methods and cost components limited direct comparison across studies. The current availability of peer-reviewed journal articles related to alcohol cost burden is limited. Most authors stated a need for a more transparent formula to establish the economic impact of alcohol upon society.

Calculation of Minnesota's 2007 alcohol cost estimate was a collaborative effort involving national experts and partners from other states, with the hope of continuing a discussion on the benefits of standardization of cost estimate methodology. This cost estimation is intended to be easily replicable; all efforts at providing transparency have been made.

## Methods

Attempts were made to replicate the methodology used in 2003 for the first alcohol use study, *The Human and Economic Cost of Alcohol Use in Minnesota*, using the most current state and national cost estimates and the most recent prevalence and incidence rates. The literature and cost component spreadsheets were reviewed. Each cost component and cost variable were researched, as were the cited data sources for each. Consultations were held with the author of the 2003 study to obtain clarification on formulas and figures utilized. Due to the amount of time that had passed since the first study, the number of reference links that were no longer viable and the lack of clarification on the formulas used, the same methodology could not be utilized.

Cost studies conducted nationally were reviewed to determine a best practice. Calls and emails were sent to experts in the field, including Henrick Harwood, Dorothy Rice, Bob Brewer, Mandy Stahre, Eric Wright and Jim Roeber. At the 2010 Council of State and Territorial Epidemiologists National Conference, Jim Roeber from the New Mexico Department of Health (NMDOH) presented a model for estimating the economic impact of alcohol use at the state level which he agreed to share.

In 2009, the New Mexico state legislature mandated that the NMDOH produce and annually update a state alcohol cost estimate. They first published a cost estimate for the year 2006 and recently updated this estimate for the year 2007. Roeber/NMDOH used an approach developed by ECONorthwest of Oregon.

Roeber's model starts with the best available estimates of U.S. costs by component. These costs are then converted to per capita costs to facilitate application to other geographies, such as states. The national per capita cost estimates are multiplied by the appropriate incidence adjustment factors in order to adjust for differences in burden of alcohol-related problems and costs from one location to another. Incidence adjustment factors are rate ratios comparing incidence in a given location to that of the nation. For example, the national cost per capita of premature alcohol-related death would be multiplied by the rate ratio comparing the Minnesota alcohol-related death rate to the nation's in order to determine the Minnesota cost per capita of premature alcohol-related death. The major modification Roeber and NMDOH made to the ECONorthwest approach was to implement, in place of a single "incidence adjustment factor" applied to all cost categories in the report, several different "incidence adjustment factors" specific to the various cost categories in the report<sup>22</sup>.

The New Mexico method of estimating alcohol-related costs in the state is relatively simple to update, which facilitates tracking trends over time. While this method does not produce as detailed an estimate as the previous method used in Minnesota, applying the national estimate proportionately to Minnesota's population allows for comparisons with other states. Various policy options can then be compared to determine effective methods of reducing the social costs. For example, the impact of different strategies for reducing drinking and driving, or effective substance abuse treatment after involvement with criminal justice or human services, could then be expanded or replicated in other states/communities.

Using the toolkit provided by Roeber, estimates were calculated for the economic costs of health care services (including alcohol and drug abuse services and medical consequences), productivity effects/lost earnings (premature deaths, impaired productivity, crime and victims of crime), criminal justice, social welfare program administration, motor vehicle crashes and fires. Lost productivity costs were adjusted for differences between Minnesota and U.S. productivity. Minnesota per capita cost estimates were adjusted for inflation using the appropriate consumer price index (CPI).

### ***Alcohol Cost Calculation***

The Alcohol Cost Calculation Table (Appendix B) was pre-populated by Roeber with 1992 NIDA cost estimate data (Appendix C) and 1998 NIAAA cost estimate data (Appendix D). These provide the basis of estimates for Minnesota's 2007 alcohol-related costs. Once the CDC releases the updated national cost estimates, the Minnesota Alcohol Cost Estimation Worksheet will need to be updated as well. The following cost components described below can be found in the Alcohol Cost Calculation.

Alcohol and drug abuse services costs include alcohol abuse treatment costs, insurance administration costs and costs related to alcohol abuse prevention, research and training. The 1998 national cost of such services was converted to a per capita cost. This per capita national cost was adjusted to account for Minnesota's alcohol abuse or dependence rate. This state cost per capita for alcohol and drug abuse services was then inflated to 2007 dollars. Finally, this amount was adjusted for state-level change in the medical Consumer Price Index.

Medical consequence costs include insurance administration costs as well as costs associated with the medical consequences of alcohol consumption and of fetal alcohol syndrome. The per capita national cost was adjusted to account for Minnesota's alcohol abuse or dependence rate. As with alcohol and drug abuse services costs, this per capita cost was adjusted for state-level

change in the medical Consumer Price Index. This differs from New Mexico’s methodology—Roeber adjusted medical consequence costs by the state-to-nation alcohol-related death rate ratio. Oregon’s methodology, which served as the basis for the New Mexico model, adjusted all cost components by the state-to-nation alcohol abuse or dependence rate.

Lost earnings due to premature deaths was adjusted to account for Minnesota’s alcohol-related death rate. Lost earnings due to impaired productivity was adjusted to account for Minnesota’s alcohol abuse or dependence rate. This again differs from New Mexico’s method, as they adjusted lost earnings due to impaired productivity by the death rate. The per capita Minnesota costs were next adjusted for differences in the average wages in the state versus the nation. These figures were then inflated to 2007 dollars. Finally, per capita costs related to lost earnings were adjusted for change in the National Consumer Price Index. Lost earnings of victims of crime and of incarcerated persons, were adjusted to account for Minnesota’s alcohol-related crime rate. This figure was also adjusted for differences in the average wages in the state versus the nation for change in the National Consumer Price Index.

Criminal justice costs include costs associated with violent crime, property crime and alcohol-defined offenses. This cost was adjusted for Minnesota’s alcohol-related crime rate. Social welfare administration costs, including supplemental security income and other social insurance, were adjusted to account for Minnesota’s alcohol abuse or dependence rate. This again differs from New Mexico’s method, as they adjusted social welfare administration costs by the death rate. Motor vehicle crash costs, both fatal and non-fatal, were adjusted for the Minnesota to U.S. ratio of alcohol-related motor vehicle fatalities. The national estimate for costs per capita of alcohol-related fire destruction/property damage was adjusted for the Minnesota to U.S. ratio of alcohol-related fire deaths. These state social costs were then inflated to 2007 dollars, then adjusted for change in the National Consumer Price Index.

### ***Population Inputs***

The Population Inputs table (Appendix E) was pre-populated by Roeber with the 1998 U.S. non-institutionalized civilian population aged 12 and older. These data were used to calculate the U.S. costs per adult for each indicator. The 1998 population was used to match the 1998 economic cost estimates from the Lewin Group.

The 2007 total Minnesota population (all ages) was obtained from the U.S. Census Population Estimates by State and by Age, Sex, Race and Hispanic Origin. After adjusting national per capita costs by incidence adjustment factors, local wages and inflation, costs were then multiplied by the state population to estimate the total cost for Minnesota. The total population (all ages)

was used to calculate per capita costs for Minnesota, since children ages 0 to 11 are impacted by alcohol via motor vehicle crashes and fatalities, abuse, neglect and other crimes.

### ***Alcohol Dependence or Abuse Rates***

The Alcohol Dependence and Abuse Rates table (Appendix F) was pre-populated by Roeber with 2006/2007 National Survey on Drug Use and Health (NSDUH) alcohol dependence or abuse rates. These data can be obtained from the U.S. Department of Health and Human Services, Office of Applied Studies, "State Estimates of Substance Use from the 2006–2007 National Surveys on Drug Use and Health;" Appendix B: Tables of Model-Based Estimates (50 States and the District of Columbia). Minnesota rates from this same data source were added. The resulting rate ratio for Minnesota compared to the United States was used as the incidence adjustment factor for alcohol and drug abuse services costs.

The Minnesota Department of Human Services (DHS) Alcohol and Drug Abuse Division (ADAD) is not able to tease out the costs of alcohol-related treatment, prevention, research and training from the overall costs of substance abuse (alcohol and other drugs) treatment, prevention, research and training. Otherwise, state-specific costs would have been utilized rather than adjusted national estimates.

### ***Alcohol-Related Death Rates***

Alcohol-Related Disease Impact (ARDI) software was used to estimate the number of alcohol-attributable deaths (AADs) and the years of potential life lost (YPLL). "ARDI estimates AADs by multiplying the number of deaths from a particular alcohol-related condition by its alcohol-attributable fraction (AAF). Certain conditions (e.g., alcoholic cirrhosis of the liver) are, by definition, 100 percent alcohol-attributable. For the majority of the chronic conditions profiled in ARDI, the system calculates AAFs by using relative risk estimates from meta-analyses and prevalence data on alcohol use from the Behavioral Risk Factor Surveillance System. For some conditions, especially those with an acute onset (e.g., injuries), ARDI includes direct estimates of AAFs. Direct estimates of AAFs are based on studies assessing the proportion of deaths from a particular condition that occurred at or above a specified blood alcohol concentration (BAC). For acute conditions, a death is alcohol-attributable if the decedent (or, as in the case of motor vehicle traffic, a driver or non-occupant) had a BAC of  $\geq 0.10$  g/dL. YPLLs, a commonly-used measure of premature death, are then calculated by multiplying age- and sex-specific AAD estimates by the corresponding estimate of life expectancy. For chronic conditions, AADs and YPLLs were calculated for decedents aged  $\geq 20$  years; for the majority of acute conditions, they were calculated for decedents aged  $\geq 15$  years. However, ARDI also provides estimates of AADs

and YPLLs for persons aged <15 years who died from motor vehicle crashes, child maltreatment, or low birthweight.”<sup>9</sup>

Minnesota alcohol-related deaths from 2005 to 2010 were provided by the Minnesota Department of Health’s Center for Health Statistics. Primary cause of death, from death certificates, was examined for 54 selected ICD 10 codes (see Appendix G). Annual datasets were analyzed using the Custom Tables function of the CDC’s Alcohol-Related Disease Impact (ARDI) software. While only 2007 death data were ultimately used in the cost estimate (Appendix H), additional years of data were requested to make sure the number of 2007 deaths was not unusually high or low. These data can also be used for future studies, to update the estimate again or to calculate an estimate for an average of three years.

The ARDI software is an online tool developed by the CDC’s Alcohol Program to estimate alcohol-related harms including alcohol-attributable deaths (AAD), years of potential life lost (YPLL) and alcohol-attributable fractions (AAF). Estimates of alcohol-related harms are available for the United States overall and individually for all 50 states and the District of Columbia. The computer application uses alcohol-related death statistics, Minnesota rates of excessive drinking (from BRFSS) and standardized relative risk ratios. After applying the indexing method separately for males and females, average daily alcohol consumption is compared to cut-points specified by the meta-analyses used to obtain risk estimates for a given cause of death. The cut-points are used to calculate the proportion of the population that consumes alcohol at low, medium, or high levels. Excessive consumption, used for this report, is based on the AAFs from medium and high average daily consumption. In establishing relative risk for indirect estimates of AAFs, the “low” average daily consumption group was used as the reference population rather than abstainers. <https://apps.nccd.cdc.gov/ardi/AboutARDIMethods.htm>

### ***Alcohol-Related Crime Rates***

Criminal justice costs include costs associated with violent crime, property crime and alcohol-defined offenses. Alcohol-defined crimes include driving under the influence, public drunkenness and liquor law violations. Crime rates for Minnesota and the United States were obtained from Uniform Crime Reports (UCR). National or state offense totals are based on data from all reporting agencies and estimates for unreported areas. Rates are the number of reported offenses per 100,000 population. Crime rates were then multiplied by crime-related alcohol-attributable fractions from Harwood et al<sup>11</sup> (Appendix I).



### ***Alcohol-Involved Motor Vehicle Crash Fatality Rates***

The Alcohol-Related Motor Vehicle Fatality Rates table (Appendix J) was populated by Roeber with data on alcohol-involved motor vehicle crash fatality rates (driver BAC 0.01+) in Minnesota and in the United States, per 100,000 population. It was decided instead to use data only on drivers with a BAC of 0.08+, as this reflects Minnesota impaired driving laws. These data were obtained from the National Highway Traffic Safety Administration (NHTSA) Fatality Analysis Reporting System (FARS) Encyclopedia at <http://www-fars.nhtsa.dot.gov/Main/index.aspx>. The 2007 Minnesota and U.S. alcohol-involved motor vehicle crash fatality rates were used to calculate the rate ratio used for the incidence adjustment factor. Use of driver BAC 0.08+ vs 0.01+ did not change the overall Minnesota to U.S. rate ratio.

### ***Alcohol-Related Fire Death Rates***

National alcohol-related fire cost estimates were obtained from the U.S. Fire Administration <http://www.usfa.dhs.gov/statistics/index.shtm>. While reports on the involvement of alcohol in fires are available from 2003, no data are available to measure any trend of alcohol involvement in fires.

The rate ratio comparing the Minnesota alcohol-related fire death rate to that of the nation (Appendix K) is included as a proxy incidence adjustment factor, since no incidence data are available for comparing fire damage and fire-related use of emergency services in Minnesota to that of the nation. The alcohol-related fire death rate was calculated using the ARDI alcohol-attributable fraction and mortality data from the Minnesota Center for Health Statistics.

### ***Wages***

The United States mean hourly wage for all occupations in 2007 was pre-populated in the Mean Hourly Wage for All Occupations table (Appendix L). These data were obtained from the U.S. Department of Labor, Bureau of Labor Statistics (BLS). Minnesota data were also obtained from BLS in order to calculate the rate ratio used for the incidence adjustment factor. Occupational employment and wage estimates are calculated by BLS with data collected from employers in all industry sectors in metropolitan and non-metropolitan areas in Minnesota.

### ***Medical and National CPI***

The national consumer price index (CPI) and annual rate of change was used to adjust the alcohol-related costs of productivity and social effects. The medical CPI annual rate of change for Minnesota was calculated using the Midwest region, urban, size class B/C as proxy for Minnesota—state-level CPIs are not available (Appendix M). Data were obtained from the BLS CPI webpage. The medical CPI was then used to adjust the estimated costs of alcohol-related health care services in Minnesota.

## **Findings**

For the most recent year data is available, the overall economic costs associated with alcohol use in Minnesota amounted to an estimated \$5.06 billion. This amounts to \$975 for every person in the state. These costs are 17 times greater than the \$296 million in tax revenues collected from alcohol sales.

### ***Alcohol Cost Calculation***

The Alcohol Cost Calculation Table (Appendix B) provides a summary of the major cost components. The economic costs of health care services cost the state of Minnesota \$938 million, including \$266 million in alcohol and drug abuse services costs and \$672 million in medical consequence costs. Lost earnings due to alcohol-related productivity effects cost the state \$3.71 billion. This includes \$729 million in lost productivity due to premature deaths, \$2.78 billion due to impaired productivity and \$196 million in lost productivity for victims of crime and incarcerated persons. Social effects of alcohol cost Minnesota \$415 million, including \$117 million in alcohol-related criminal justice costs, \$15 million in alcohol-related social welfare program administration costs, \$278 million for alcohol-related motor vehicle crashes and \$8 million in alcohol-related fire destruction costs.

### ***Population Inputs***

The 2007 estimated total non-institutionalized, civilian population for Minnesota was 5,191,206. The state population aged 12 and older was 4,304,972 (Appendix E). The population aged 12 and older was used to calculate per capita costs utilizing 1998 national estimates from the Lewin Group. The total Minnesota population was used to adjust all costs for 2007.

### ***Alcohol Dependence or Abuse Rates***

According to the National Survey on Drug Use and Health (NSDUH), 9.44 percent of Minnesotans met the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria for alcohol dependence or abuse in 2006-2007 (Appendix F). This was higher than the national rate of 7.58 percent (rate ratio: 1.25). This incidence adjustment factor was also used to estimate the state costs of alcohol and drug abuse services (\$266 million), alcohol-related medical consequences (\$672 million), alcohol-related impaired productivity (\$2,783 million) and alcohol-related social welfare administration (\$15 million).

Minnesota’s 2006-2007 alcohol dependence or abuse rate was slightly higher than previous years:

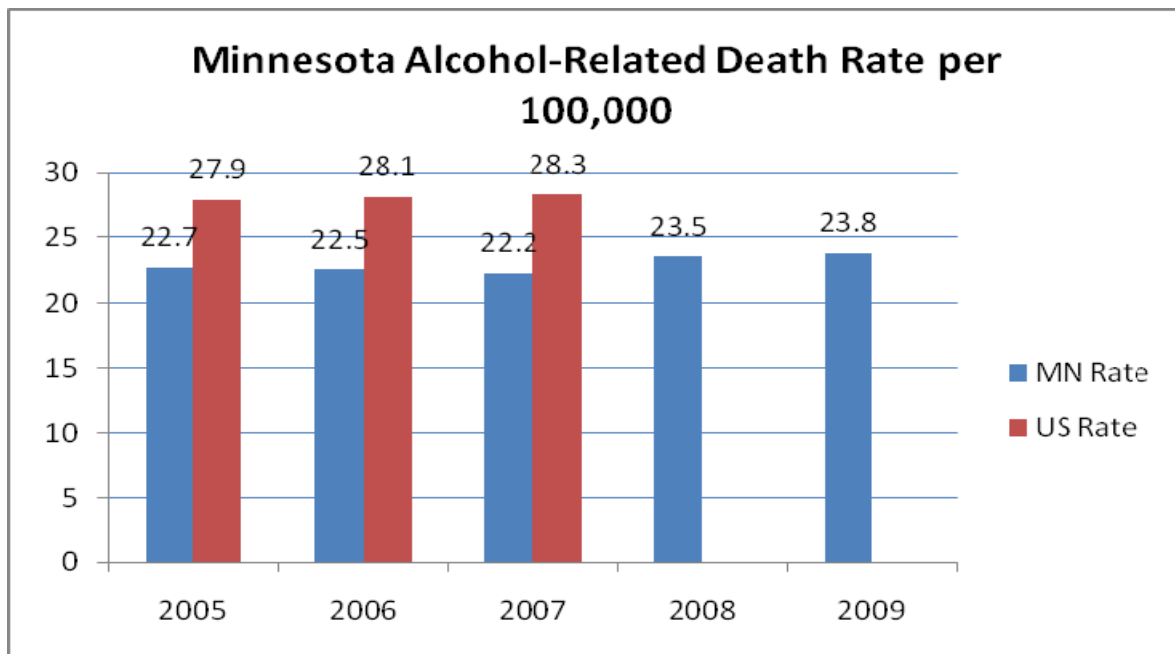
	2003-2004	2004-2005	2005-2006	2006-2007
Minnesota’s alcohol abuse or dependence rate	8.76%	8.17%	9.24%	9.44%

Source: Substance Abuse and Mental Health Services Administration, National Survey on Drug Use and Health

### ***Alcohol-Related Death Rates***

According to the MIPH analysis of Minnesota Center for Health Statistics data, the total state alcohol-related death rate for 2007 was 22.2 per 100,000 population (1,150 deaths). This was lower than the national rate of 28.3 (rate ratio 0.78) as per the National Center for Health Statistics mortality files (Appendix H). Using the 2007 alcohol-related death rate ratio as the incidence adjustment factor in conjunction with the national estimate for lost earnings due to alcohol-related premature deaths brings the total state estimate to \$729 million.

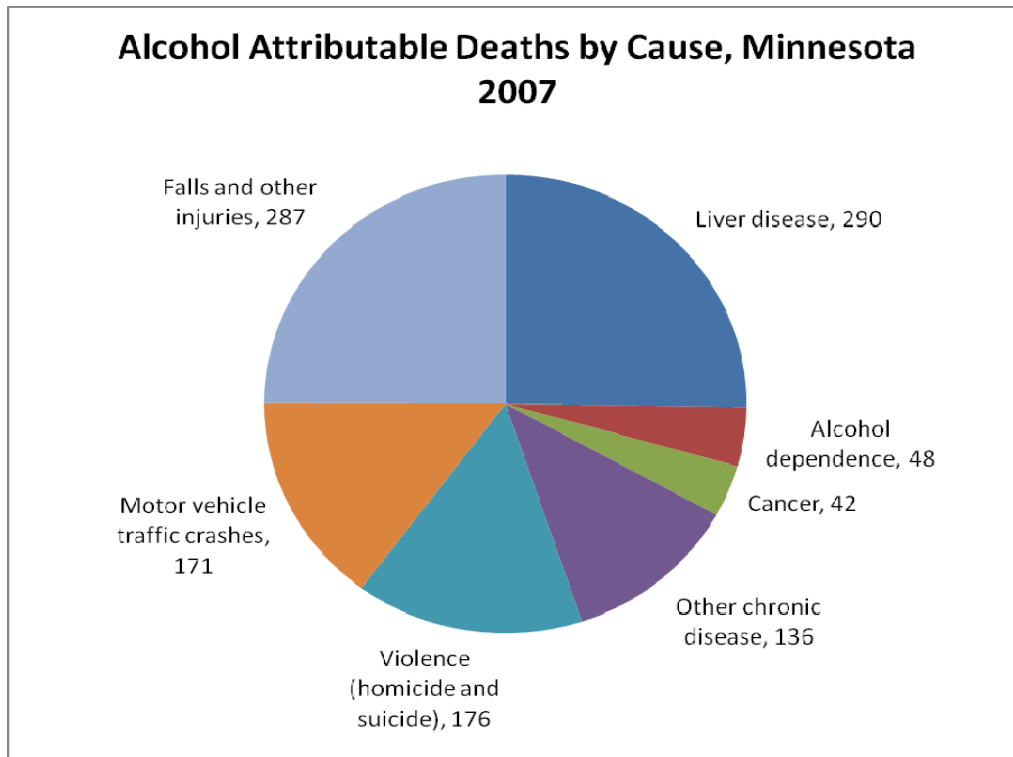
Minnesota’s alcohol-related death rate decreased slightly from 2005 to 2007 and then increased in 2008 and again in 2009:



Sources: Minnesota Center for Health Statistics and the Centers for Disease Control and Prevention, Alcohol-Related Disease Impact software

In 2007, liver disease made up 25 percent of Minnesota’s alcohol-related deaths. Falls and other injuries made up another 25 percent of the alcohol-related deaths. It should be noted

that the alcohol-attributable fraction calculated for deaths from falls is the same for all age groups. However, deaths resulting from falls of people in their seventies may be more or less likely to have resulted from alcohol than deaths resulting from falls of people in their twenties. There is little information in the research literature on the role of alcohol in acute causes of death of people over age 65.



Sources: Minnesota Center for Health Statistics and the Centers for Disease Control and Prevention, Alcohol-Related Disease Impact software

### ***Alcohol-Related Crime Rates***

Uniform Crime Reporting Statistics put the total 2007 Minnesota crime rate at 3,325.2 per 100,000 population (violent crime rate = 288.7; property crime rate = 3,036.6.) Harwood et al estimated that 21 percent of violent crime is alcohol-related and that 3 percent of property crime is alcohol-related<sup>11</sup>. This puts the total 2007 alcohol-related crime rate for Minnesota at 150.8 per 100,000 (Appendix I). The national 2007 crime rate was 3,730.4 per 100,000 (violent crime rate = 466.9; property crime rate = 3,263.5). The national alcohol-related crime rate was 198.3 per 100,000, producing a Minnesota to U.S. rate ratio of 0.76. This incidence adjustment factor was used to estimate the state alcohol-related costs of lost earnings of victims of crime and incarcerated persons (\$196 million) and the alcohol-related costs of criminal justice (\$117 million).

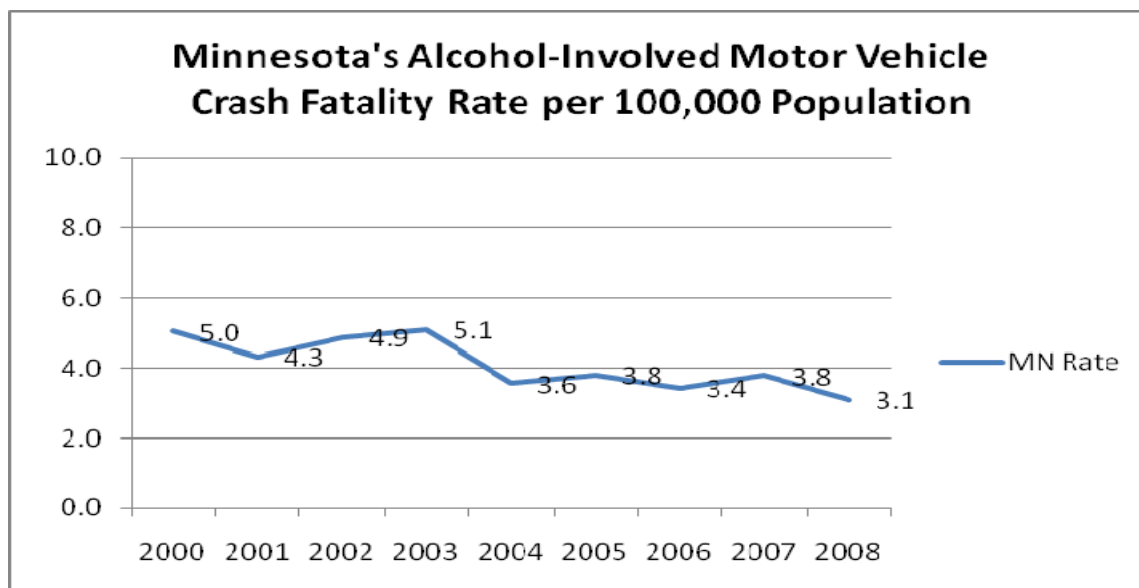
Minnesota's total crime rate has been on the decline over the past five years:

	2005	2006	2007	2008	2009
Minnesota's total crime rate per 100,000 population	3,381.1	3,391.5	3,325.2	3,113.4	2,884.9

Source: Federal Bureau of Investigation, Uniform Crime Information

### ***Alcohol-Involved Motor Vehicle Crash Fatality Rates***

Minnesota's 2007 alcohol-involved motor vehicle (ARMV) crash fatality rate (driver BAC 0.08+) was 3.8 per 100,000 population, according to the FARS encyclopedia (Appendix J). This was lower than the national rate of 5.2 per 100,000 (rate ratio 0.73). Using this incidence adjustment factor in conjunction with the national estimate brings the total cost of these crashes to \$278 million in Minnesota. Minnesota's ARMV crash fatality rate (driver BAC 0.08+) has dipped over the past eight years, though the 2007 rate was slightly higher than both the 2006 rate and the 2008 rate:



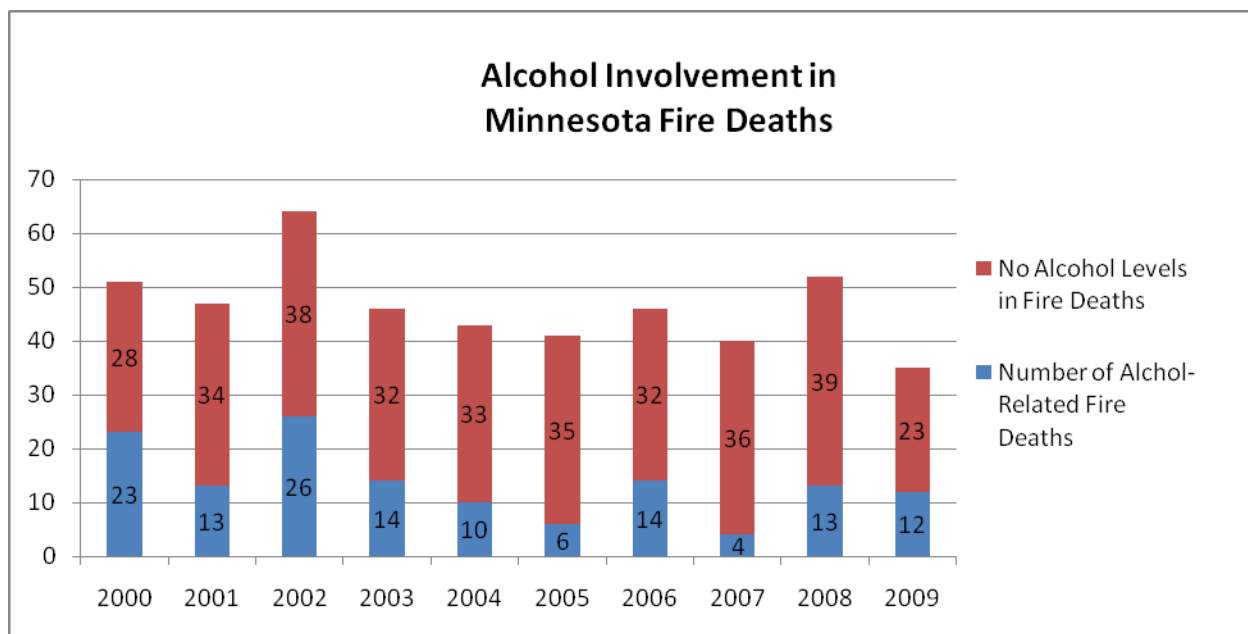
Source: National Highway Traffic Safety Administration, Fatality Analysis Reporting System

### ***Alcohol-Related Fire Death Rates***

Four Minnesota lives were lost to alcohol-related fire injury deaths in 2007. This produced a death rate of 0.077 per 100,000 population. The national alcohol-related fire injury death rate was higher at 0.38 per 100,000 population (Appendix K). The resulting rate ratio of 0.20 was used as the incidence adjustment factor to approximate the alcohol-related costs of fire damage and emergency services utilized. In this respect, alcohol-related fires cost Minnesota an

estimated \$8 million in 2007. This cost estimate is conservative, considering the number of alcohol-related fire deaths in 2007 was unusually low compared to the average for the state.

In July of 2003, the U.S. Department of Homeland Security, the Federal Emergency Management Agency (FEMA), the U.S. Fire Administration and the National Fire Data Center produced a case study on the contribution of alcohol to fire fatalities in Minnesota. Key findings from this case study include the fact that 36 percent of the state’s fire fatalities from 1996 to 2002 had blood alcohol levels of 0.1 or higher<sup>24</sup>. According to *Fire in Minnesota Annual Reports* from the Minnesota Department of Safety, approximately 28 percent of fire deaths had a positive blood alcohol level from 2000 to 2009. The highest percentage was 45 percent of fire deaths having a positive BAC in 2000; the lowest was 10 percent in 2007 (the year of this cost estimate). Total fire deaths are the sum of alcohol positive and non-alcohol readings at the time of death. Some of the fire deaths described as non-alcohol-related did have positive drug results. Alcohol and drug involvement is based on medical examiner reports of people who died in fires.

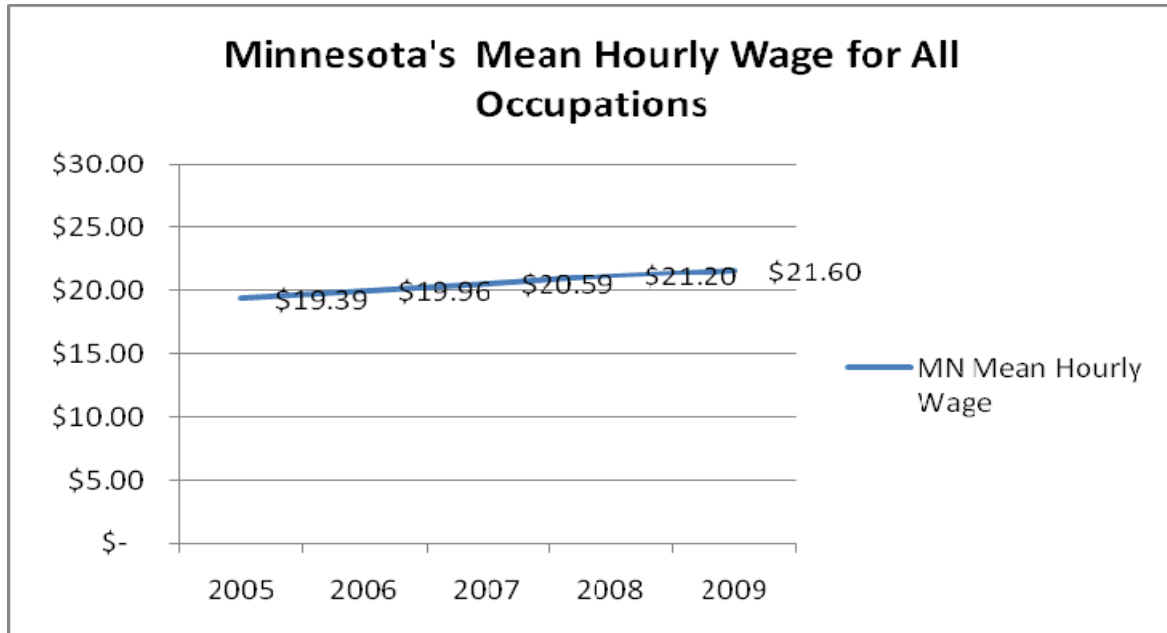


Source: Minnesota Department of Public Safety, Fire In Minnesota Annual Reports

## Wages

In 2007, the mean hourly wage for all occupations in Minnesota was \$20.59. This is higher than the national mean hourly wage of \$19.56 (Appendix L). The Minnesota to U.S. rate ratio of 1.05 was used to adjust to costs of lost productivity due to alcohol. The total state alcohol-related

productivity effects for 2007 were estimated to be \$3.71 billion. Minnesota's mean hourly wage for all occupations has slowly increased over time:



Source: U.S. Bureau of Labor Statistics

### ***Medical and National CPI***

The overall national consumer price index (CPI) was 207.3 in the year 2007. Since the 1998 NIAAA cost estimate was used as the basis of all calculations, the national CPI rate of change from 1998 to 2007 was calculated (2.71 percent). This was used to adjust the state cost estimates for productivity and social effects (Appendix M). Alcohol-related productivity effects cost Minnesota an estimated \$3.71 billion, while alcohol-related social effects cost the state approximately \$417 million.

Minnesota's 2007 medical CPI was estimated to be 152.8, using Midwest region, urban and size class B/C as a proxy. Again, the rate of change from 1998 to 2007 had to be calculated and then applied to the 1998 national cost estimates for the alcohol-related economic costs of health care services. An annual rate of change of 4.61 percent was used as the adjustment factor, bringing the state estimate to \$938 million.

### ***Minnesota Alcohol Tax Revenue***

Though not included as part of the Alcohol Cost Estimation Toolkit, MIPH calculated Minnesota alcohol tax revenue for the purpose of measuring the disparity between state-level costs incurred and revenue generated. Total alcohol taxes include liquor gross receipt taxes, excise



taxes and sales taxes on alcohol. Sales taxes on alcohol are based on the gross liquor sales total. In 2007, total alcohol taxes equaled \$296 million. This came to approximately 1.7 percent of all state tax revenue.

	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
Gross Liquor Sale Total (calculated based on 2.5% Liquor Gross Receipts Tax)	\$2,479,080,000	\$2,583,520,000	\$2,656,080,000	\$2,704,360,000
Sales taxes on alcohol	\$161,140,200	\$167,928,800	\$172,645,200	\$175,783,400
	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
Liquor Gross Receipts Tax	\$61,977,000	\$64,588,000	\$66,402,000	\$67,609,000
Excise Tax	\$72,809,000	\$73,093,000	\$76,068,000	\$75,570,000
Sales taxes on alcohol	\$161,140,200	\$167,928,800	\$172,645,200	\$175,783,400
Total Alcohol Taxes	\$295,926,200	\$305,609,800	\$315,115,200	\$318,962,400
	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
Alcohol tax as percent of total state tax revenue	1.71%	1.72%	1.91%	1.97%

Source: Minnesota Department of Revenue

## **Discussion**

Estimates of the alcohol-related costs incurred by local, state and federal government, and by society as a whole, can be useful for policymakers, planners, prevention and treatment specialists, and researchers. In order to measure changes in alcohol-related costs over time, and to monitor the outcomes of alcohol-related policies, programs and interventions, cost estimates must be transparent and replicable. In order to compare the effectiveness of prevention strategies, such as raising the cost of alcohol sales tax or increasing enforcement of DWI laws, across different geographic areas it is important to establish a standardized method for estimating costs.

The purpose of this study was not to quantify the revenue generated, or costs incurred, by businesses and individuals from the production, sale, use and consequences of alcohol but rather to estimate the costs and revenue realized by the government and Minnesota taxpayers. Unfortunately, these government cost estimates cannot be broken down to proportion paid by local, state and federal government. It is worth stating again that this cost estimate does not include an estimate of the financial cost of pain and suffering.

## ***Limitations***

This study has a number of limitations. For one, the availability of the latest national cost estimate (due out in 2011) will provide a more accurate estimate of state-level costs. This upcoming report from the Centers for Disease Control and Prevention will provide national 2006 alcohol cost estimates. The Minnesota estimate should be updated as soon as the national report is made public—the New Mexico Worksheet utilized will make this an easy process. More specifically, the alcohol-related crime AAFs used by Harwood et al<sup>11</sup> in 1998 are substantially lower than those used in the forthcoming U.S. cost estimate update<sup>22</sup>.

There is considerable lag time when it comes to data availability, especially for federal data sources. State level data for a number of indicators are available for 2009. However, since many of the cost components are based on adjusted national estimates, the report is limited to 2007. Further, 2007 was the most current year available for most national data used to calculate the rate ratios which served as incidence adjustment factors.

State-level costs of substance abuse prevention, treatment, research and training cannot be sorted out by alcohol and by other drugs. Looking at the primary cause of death in vital

statistics, or primary diagnosis in hospital discharge datasets, can miss the cases where alcohol was a contributing factor rather than the primary cause.

Cost components for which specific incidence adjustment factors could not be determined had to be adjusted by proxy factors. For example, estimates of the alcohol-related costs of medical consequences, impaired productivity and social welfare administration were adjusted by the Minnesota to U.S. abuse and dependency rate ratio. Similarly, costs associated with alcohol-related fire damage and resulting emergency services were adjusted by the rate ratio for alcohol-related fire injury deaths.

Another limitation of this study is that CPI adjustors are not available at the state level; they must be chosen from regional and/or metropolitan area options. Finally, estimating the cost of lost productivity for persons suffering alcohol-related deaths, victims of alcohol-related crime and persons incarcerated for alcohol-related crimes assumes that these individuals would have collectively earned close to the average state hourly wage.

### ***Recommendations***

A standardized, transparent, user-friendly method for estimating the costs of alcohol should be developed and utilized in Minnesota and nationally. This would facilitate replication of estimates, allow for comparison from one geographic location to the next and allow for the tracking of trends over time. National and state-level estimates of annual alcohol-attributable deaths, years of potential life lost, alcohol-attributable health care expenditures and productivity losses, similar to those available for tobacco through the CDC's Smoking-Attributable Mortality, Morbidity and Economic Costs (SAMMEC)<sup>25</sup> would be beneficial.

Future work analyzing hospitalization data for alcohol-related incidents (injuries, poisonings, diagnoses, etc.) would improve the accuracy of the estimate. However, major limitations related to diagnosing and coding identified above must also be addressed. Electronic health records may improve our ability to search for and analyze these data.

The Alcohol Cost Estimation Worksheet could be used to estimate alcohol-related costs at the state level on an annual basis. This would allow that state to monitor trends over time and measure outcomes related to prevention strategies implemented. The Worksheet could potentially be used to estimate alcohol-related costs at the local level. Calculating sub-state estimates would require sub-state incidence adjustment factors. Currently, alcohol dependence and abuse rates from NSDUH are only available regionally. Death rates are available by county, but these data would need to be requested from the Minnesota Center for Health Statistics, and considerable staff time would be needed to run the numbers and load them into the ARDI

software. Crime rates and motor vehicle fatalities are available at the local level. Hourly wage estimates are available for metropolitan areas in Minnesota and available regionally for non-metropolitan areas.

Future estimates should be calculated using a three-year average in order to smooth out year-to-year fluctuations. Future studies and reports should be as explicit as possible about what information was utilized and how, who the information was obtained from and how, what skills, software and resources are required and which caveats and limitations must be noted.

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## Appendix A: Glossary

Acute Causes of Death—conditions (i.e., illness or injury) with a very short latency period from the time of onset to the time of death

Alcohol Consumption Levels—levels of daily alcohol consumption based on set cut-points (low, medium, and high) drawn from studies examining the impact of alcohol consumption on health.

Alcohol-Attributable Deaths (AADs)—number of deaths from various causes that are directly attributable to alcohol.

Alcohol-Attributable Fraction (AAF)—percentage of deaths from a given cause that are directly attributable to alcohol

ARDI—Alcohol-Related Disease Impact

BAC/BAL –blood alcohol concentration/blood alcohol level

Behavioral Risk Factor Surveillance System (BRFSS)—a state-based system of health surveys of U.S. adults age 18 years or older that is coordinated by the CDC. The system collects information on alcohol use and other health-related topics

Burden—the burden of alcohol abuse/dependence can be defined as the gap between the current substance-related health status of the population and an ideal situation in which all persons are free from negative substance-related consequences. The economic burden of alcohol relates to the gap between what is spent by the state on alcohol-related consequences and what is received by the state from alcohol-related tax revenues.

CASA—Center on Addiction and Substance Abuse

CDC—Centers for Disease Control and Prevention

Chronic Causes of Death—conditions with a long latency period from the time of onset to the time of death

Consumer Price Index (CPI)—the ratio of the value of a basket of goods in the current year to the value of that same basket of goods in an earlier year, measuring the change over time in the average level of prices of the goods and services typically consumed by an urban American household

Cost Analysis—an economic evaluation technique that involves the systematic collection, categorization, and analysis of program costs



Costs—the value of resources (persons, buildings, equipment, and supplies) used to produce a good or a service

Direct AAFs—Alcohol-Attributable Fractions that are based on direct observations of the relationship between alcohol and a given health outcome. These estimates are generally based on the proportion of persons dying from a particular condition at or above a specified BAC or from follow-up studies that specifically assess prior alcohol use among persons dying of specific conditions (e.g., liver cirrhosis)

Fatality Analysis Reporting System (FARS)—an annual survey of all motor vehicle traffic crashes on United States roadways that is administered by the National Highway Traffic Safety Administration

FAS—fetal alcohol syndrome

International Classification of Diseases (ICD) Codes—the alpha-numeric classification of morbidity and mortality developed by the World Health Organization (WHO). The death data included in ARDI are coded using the 10th revision of the ICD codes, also known as ICD-10.

Indirect AAFs—Alcohol-Attributable Fractions calculated in ARDI using pooled risk estimates for alcohol-related conditions at specific consumption levels

MCHS—Minnesota Center for Health Statistics

MDH—Minnesota Department of Health

MIPH—Minnesota Institute of Public Health

Model—a simplified yet accurate representation of a policy, program, or intervention based on a set of assumptions

NIAAA—National Institute on Alcohol Abuse and Alcoholism

NIDA—National Institute on Drug Abuse

Productivity Loss—costs associated with the decrease in production and income attributable to a disease or disability

Years of Potential Life Lost (YPLL)—measure of the impact of premature mortality. YPLL is calculated by subtracting the age at death from life expectancy. For ARDI, deaths and life expectancies are compiled using standard 5-year age groupings.

## Appendix B: Alcohol Cost Calculation Table

Cost Component	National Institute on Alcohol Abuse and Alcoholism (NIAAA)			Real Adjustment Factors			Price/Wage Adjustments		
	US Total Costs 1992 <sup>1</sup> (\$ in millions)	US Total Costs 1998 <sup>2</sup> (\$ in millions)	US Costs Per Adult 1998 <sup>3</sup>	Minnesota Costs Per Adult After Incidence Adjustment 1998	Minnesota Costs Per Adult After Productivity Adjustment 1998 <sup>9</sup>	Minnesota Total Costs After Population Adjustment 2007 <sup>3</sup> (1998 dollars)	Minnesota Total Costs After Adjustments Based on Health Care Costs <sup>10</sup>	Minnesota Total Costs After CPI Adjustment <sup>10</sup>	Minnesota Total Costs (2007 dollars) (\$ in millions)
<b>Economic Costs of Health Care Services</b>									
Alcohol and drug abuse services <sup>4</sup>	\$5,573	\$7,466	\$33.04	\$41.14	\$41.14	\$177	\$266		\$266
Medical consequences <sup>4</sup>	\$13,247	\$18,872	\$83.51	\$104.00	\$104.00	\$448	\$672		\$672
	\$18,820	\$26,338	\$116.54	\$145.14	\$145.14	\$625	\$938		\$938
<b>Productivity Effects (Lost Earnings)</b>									
Premature deaths <sup>5</sup>	\$31,327	\$36,499	\$161.51	\$126.38	\$133.03	\$573		\$729	\$729
Impaired productivity <sup>4</sup>	\$69,209	\$87,621	\$387.72	\$482.86	\$508.28	\$2,188		\$2,783	\$2,783
Crime and victims of crime <sup>6</sup>	\$6,461	\$10,085	\$44.63	\$33.93	\$35.72	\$154		\$196	\$196
	\$106,997	\$134,205	\$593.85	\$643.17	\$677.03	\$2,915		\$3,707	\$3,707
<b>Other Social Effects</b>									
Criminal justice <sup>6</sup>	\$6,312	\$6,328	\$28.00	\$21.29	\$21.29	\$92		\$117	\$117
Social welfare program admin. <sup>4</sup>	\$683	\$484	\$2.14	\$2.67	\$2.67	\$11		\$15	\$15
Motor vehicle crashes <sup>7</sup>	\$13,619	\$15,744	\$69.67	\$50.73	\$50.73	\$218		\$278	\$278
Fires <sup>8</sup>	\$1,590	\$1,537	\$6.80	\$1.37	\$1.37	\$6		\$8	\$8
	\$22,204	\$24,093	\$106.61	\$76.06	\$76.06	\$327		\$417	\$417
<b>Total All</b>	<b>\$148,021</b>	<b>\$184,636</b>	<b>\$817.00</b>	<b>\$864.37</b>	<b>\$898.24</b>	<b>\$3,867</b>			<b>\$5,062</b>

1. Appendix C: 1992 NIDA Cost Estimate
2. Appendix D: 1998 NIAAA Cost Estimate
3. Appendix E: Population Inputs
4. Appendix F: Alcohol Dependence and Abuse Rates
5. Appendix H: Alcohol-Related Death Rates
6. Appendix I: Alcohol-Related Crime Rates
7. Appendix J: Alcohol-Related Motor Vehicle Fatality Rates
8. Appendix K: Alcohol-Related Fire Losses
9. Appendix L: Mean Hourly Wage for All Occupations
10. Appendix M: Consumer Price Index—National and Medical

## Appendix C: 1992 NIDA Cost Estimate

The Economic Costs of Alcohol and Drug Abuse in the United States, 1992. Table 1.1 from Harwood H, Fountain D, Livermore G. The Economic Costs of Alcohol and Drug Abuse in the United States, 1992. Report prepared for the National Institute on Drug Abuse and the National Institute on Alcohol Abuse and Alcoholism, National Institutes of Health, U.S. Department of Health and Human Services. NIH Pub. No. 98-4327. Rockville, MD: National Institute on Drug Abuse, 1998. Source: [http://archives.drugabuse.gov/economiccosts/Table1\\_1.html](http://archives.drugabuse.gov/economiccosts/Table1_1.html), accessed 10/13/2010

<b>Economic Costs of Alcohol and Drug Abuse in the United States, 1992 (millions of dollars)</b>			
<b>Economic Costs</b>	<b>Total</b>	<b>Alcohol</b>	<b>Drugs</b>
<b>Health Care Expenditures</b>			
Alcohol and drug abuse services	\$9,973	\$5,573	\$4,400
Medical consequences	\$18,778	\$13,247	\$5,531
	\$28,751	\$18,820	\$9,931
<b>Productivity Effects (Lost Earnings)</b>			
Premature death	\$45,902	\$31,327	\$14,575
Impaired productivity	\$82,201	\$67,696	\$14,205
Institutionalized populations	\$2,990	\$1,513	\$1,477
Incarceration	\$23,356	\$5,449	\$17,907
Crime careers	\$19,198	-	\$19,198
Victims of crime	\$3,071	\$1,012	\$2,059
	\$176,418	\$106,997	\$69,421
<b>Other Effects on Society</b>			
Crime	\$24,282	\$6,312	\$17,970
Social welfare administration	\$1,020	\$683	\$337
Motor vehicle crashes	\$13,619	\$13,619	-
Fire destruction	\$1,590	\$1,590	-
	\$40,511	\$22,204	\$18,307
<b>Total</b>	<b>\$245,680</b>	<b>\$148,021</b>	<b>\$97,659</b>

Note: Components may not sum to totals because of rounding

## Appendix D: 1998 NIAAA Cost Estimate

Updating Estimates of the Economic Costs of Alcohol Abuse in the United States. Table 3 from Harwood, H. Updating Estimates of the Economic Costs of Alcohol Abuse in the United States: Estimates, Update Methods, and Data. Report prepared by The Lewin Group for the National Institute on Alcohol Abuse and Alcoholism, 2000. Source:

<http://pubs.niaaa.nih.gov/publications/economic-2000/index.htm>

Economic Costs of Alcohol Abuse: 1992 Estimates and Updates for 1998 (Millions of current-year dollars)				
Cost Component	Cost Estimate (\$ in millions)		Average Annual Percent Change	Total Percent Change
	1992 (original estimate)	1998 (updated estimate)		
<b>Total</b>	<b>148,021</b>	<b>184,636</b>	<b>3.8</b>	<b>24.7</b>
<b>Specialty Alcohol Services</b>	<b>5,573</b>	<b>7,466</b>	<b>5</b>	<b>34</b>
Alcohol Abuse Treatment	4,046	5,506	5.3	36.1
Insurance Administration	182	248	5.3	36.1
Alcohol Abuse Prevention	1,088	1,397	4.3	28.4
Alcohol Abuse Research	184	226	3.5	22.8
Alcohol Abuse Training	73	90	3.6	23.3
<b>Medical Consequences</b>	<b>13,247</b>	<b>18,872</b>	<b>6.1</b>	<b>42.5</b>
Medical Consequences of Alcohol Consumption	10,667	15,196	6.1	42.5
Medical Consequences of Fetal Alcohol Syndrome	1,944	2,769	6.1	42.5
Insurance Administration	636	906	6.1	42.5
<b>Lost Future Earnings Due to Premature Deaths</b>	<b>31,327</b>	<b>36,499</b>	<b>2.6</b>	<b>16.5</b>
Motor Vehicle Crashes	8,023	8,592	1.1	7.1
Other Alcohol-Related	23,304	27,906	3	19.7
<b>Lost Productivity Due to Morbidity</b>	<b>69,209</b>	<b>87,621</b>	<b>4</b>	<b>26.6</b>
Lost Productivity Due to Alcohol-Related Illness	68,219	86,368	4	26.6
Lost Productivity Due to Fetal Alcohol Syndrome	990	1,253	4	26.6
<b>Lost Earnings Due to Crime/Victims</b>	<b>6,461</b>	<b>10,085</b>	<b>7.7</b>	<b>56.1</b>
Lost Productivity Due to Alcohol-Related Crime	1,012	988	-0.4	-2.4
Lost Productivity of Incarcerated Persons	5,449	9,097	8.9	67
<b>Crime-Criminal Justice, Property Damage, etc.</b>	<b>6,311</b>	<b>6,328</b>	<b>0</b>	<b>0.3</b>
Violent Crime	3,386	3,208	-0.9	-5.3
Property Crime	393	325	-3.1	-17.3
Alcohol-Defined Offenses	2,532	2,795	1.7	10.4
<b>Social Welfare Administration</b>	<b>683</b>	<b>484</b>	<b>-5.6</b>	<b>-29.1</b>
Supplemental Security Income <sup>1</sup>	84	0	-100	-100
Other Social Insurance	599	484	-3.5	-19.1
<b>Motor Vehicle Crashes-Property Damage</b>	<b>13,619</b>	<b>15,744</b>	<b>2.4</b>	<b>15.6</b>
Fatal Crashes	2,416	2,511	0.6	3.9
Nonfatal Crashes	11,203	13,233	2.8	18.1
<b>Fire Destruction-Property Damage</b>	<b>1,590</b>	<b>1,537</b>	<b>-0.6</b>	<b>-3.3</b>

1. Social Welfare Administration: This category was divided into two separate components for updating: Supplemental Security Income (SSI) payments and all other social welfare payments. Beginning in 1997, alcohol disorders no longer constituted an acceptable basis for SSI eligibility. Therefore, this value was set to zero and no SSI costs were attributed to alcohol abuse after 1996. Other major changes in social welfare becoming effective in 1997 have significantly reduced payments to beneficiaries. This trend has been estimated/represented by the change in Food Stamp benefits (U.S. Department of Agriculture, 2000). While the Social Security Administration (SSA) compiles national (Federal plus State) estimates of social welfare outlays (and particularly public aid), publication of these data lags about 4 to 5 years - 1994 data are the most recent available.

## Appendix E: Population Inputs

### U.S. Census Estimates

Population Source: U.S. Census State by Age, Sex, Race and Hispanic Origin,

<http://www.census.gov/popest/datasets.html>

Percent of Civilian Population Non-Institutionalized Source: U.S. Census Bureau, American Fact Finder, QT-P11. Household Relationship and Group Quarters Population: 2000,

[http://factfinder.census.gov/servlet/QTTable?\\_bm=y&-state=qt&-context=qt&-qr name=DEC 2000 SF1 U QTP11&-ds name=DEC 2000 SF1 U&-tree id=4001&-all geo types=N&- caller=geoselect&-geo id=04000US01&-geo id=04000US02&-geo id=04000US04&-geo id=04000US05&-geo i](http://factfinder.census.gov/servlet/QTTable?_bm=y&-state=qt&-context=qt&-qr name=DEC 2000 SF1 U QTP11&-ds name=DEC 2000 SF1 U&-tree id=4001&-all geo types=N&- caller=geoselect&-geo id=04000US01&-geo id=04000US02&-geo id=04000US04&-geo id=04000US05&-geo i)

1998 U.S. U.S. Population Aged 12 and Older	2000 Census Percent of U.S. U.S. Civilian Population Not Institutionalized	1998 U.S. U.S. Civilian Population Aged 12 and Older Not Institutionalized
229,200,853	x 98.60%	= 225,992,041

US Costs Per Adult (see Appendix B) were calculated using the 1998 NIAAA Cost Estimate (see Appendix D) and the 1998 U.S. U.S. Civilian Population Aged 12 and Older Not Institutionalized.

2007 MN Population Aged 12 and Older	2000 Census Percent of MN Civilian Population Not Institutionalized	2007 MN Civilian Population Aged 12 and Older Not Institutionalized
4,404,263	x 98.70%	= 4,304,972

Minnesota Total Costs After Population Adjustment 2007 (see Appendix B) were calculated using the U.S. Costs Per Adult and the 2007 MN Civilian Population Aged 12 and Older Not Institutionalized. Adjustments were made to the U.S. costs to account for Minnesota's incidence (see Appendices F through K) and productivity (Appendix L).

## Appendix F: Alcohol Dependence and Abuse Rates

Minnesota and United States alcohol and dependence abuse rates, 2006-2007, for persons age 12 and older were obtained from the Substance Abuse and Mental Health Services Administration (SAMHSA), Office of Applied Studies (OAS) National Survey on Drug Use and Health (NSDUH). Appendix B, Table B.16 Alcohol Dependence or Abuse in Past Year, by Age Group and State: Percentages, Annual Averages Based on 2006 and 2007 NSDUHs from <http://www.oas.samhsa.gov/2k7State/AppB.htm>

Alcohol Dependence or Abuse in Past Year, 2006-2007	Percent of Persons Age 12 and Older
Minnesota	7.58%
United States	9.44%
Minnesota to U.S. Rate Ratio	1.25

NOTE: Dependence or abuse is based on definitions found in the 4th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV). Estimates are based on a survey-weighted hierarchical Bayes estimation approach, and the 95 percent prediction (credible) intervals are generated by Markov Chain Monte Carlo techniques.

National estimates of alcohol and drug abuse services costs, medical consequences of alcohol costs and alcohol-related impaired productivity costs (see Appendix B) were adjusted by the Minnesota to U.S. alcohol dependence or abuse rate ratio.

## Appendix G: ICD 10 Codes for Alcohol-Related Deaths

CHRONIC CONDITIONS	
Condition	ICD-10 Code
<i>100% Attributable</i>	
Alcoholic psychosis	F10.3-F10.9
Alcohol abuse	F10.0, F10.1
Alcohol dependence syndrome	F10.2
Alcohol polyneuropathy	G62.1
Degeneration of nervous system due to alcohol	G31.2
Alcoholic myopathy	G72.1
Alcohol cardiomyopathy	I42.6
Alcoholic gastritis	K29.2
Alcoholic liver disease	K70-K70.4, K70.9
Fetal alcohol syndrome	Q86.0
Fetus and newborn affected by maternal use of alcohol	P04.3, O35.4
Alcohol-induced chronic pancreatitis	K86.0
<i>High Causation</i>	
Liver cirrhosis, unspecified	K74.3-K74.6, K76.0, K76.9
Acute pancreatitis	K85
Chronic pancreatitis	K86.1
Portal hypertension	K76.6
Gastroesophageal hemorrhage	K22.6
<i>Medium Causation</i>	
Oropharyngeal cancer	C01-C06, C09-C10, C12-C14
Esophageal cancer	C15
Liver cancer	C22
Laryngeal cancer	C32
Supraventricular cardiac dysrhythmia	I47.1, I47.9, I48
Esophageal varices	I85, I98.20, I98.21
<i>Medium/Low Causation</i>	
Stroke, ischemic	G45, I63, I65-I67, I69.3
Stroke, hemorrhagic	I60-I62, I69.0-I69.2
Ischemic heart disease	I20-I25
Epilepsy	G40, G41
Breast cancer, females	C50
Hypertension	I10-I15
Psoriasis	L40.0-L40.4, L40.8, L40.9
Spontaneous abortion	O03
Cholelithiasis	K80



Low birth weight, prematurity, intrauterine growth retardation or death	O36.5, O36.4, P05, P07
Chronic hepatitis	K73
Prostate cancer	C61
<b>ACUTE CONDITIONS</b>	
<b>Condition</b>	<b>ICD-10 Code</b>
<i>100% Attributable</i>	
Alcohol poisoning	X45, Y15, T51.0, T51.1, T51.9
Suicide by and exposure to alcohol	X65
Excessive blood level of alcohol	R78.0
<i>Direct AAF Estimate</i>	
Air-space transport	V95-V97
Aspiration	W78-W79
Child maltreatment	X85-Y09, Y87.1
Drowning injuries	W65-W74
Fall injuries	W00-W19
Fire injuries	X00-X09
Firearms	W32-W34
Homicide	X85-Y09, Y87.1
Motor vehicle non-traffic crashes	V02.0, V03.0, V04.0, V09.0, V12-V14(.0-.2), V19.0-V19.3, V20-V28(.0-.2), V29.0-V29.3, V30-V39(.0-.3), V40-V49(.0-.3), V50-V59(.0-.3), V60-V69(.0-.3), V70-V79(.0-.3), V81.0, V82.0, V83-V86(.4-.9), V88.0-V88.8, V89.0
Motor vehicle traffic crashes	V02(.1, .9), V03(.1, .9), V04(.1, .9), V09.2, V12-V14(.3-.9), V19.4-V19.6, V20-V28(.3-.9), V29.4-V29.9, V30-V39(.4-.9), V40-V49(.4-.9), V50-V59(.4-.9), V60-V69(.4-.9), V70-V79(.4-.9), V80.3-V80.5, V81.1, V82.1, V83-V86(.0-.3), V87.0-V87.8, V89.2
Occupational and machine injuries	W24-W31, W45
Other road vehicle crashes	V01, V05-V06, V09.1, V09.3, V09.9, V10-V11, V15-V18, V19.3, V19.8-V19.9, V80.0-V80.2, V80.6-V80.9, V81.2-V81.9, V82.2-V82.9, V87.9, V88.9, V89.1, V89.3, V89.9
Poisoning (not alcohol)	X40-X49 (except X45)
Suicide	X60-X84, (except X65) Y87.0
Water transport	V90-V94

Source: ARDI (<https://apps.nccd.cdc.gov/ardi/AboutARDICrosswalk.htm>)

## Appendix H: Alcohol-Related Death Rates

Minnesota death statistics were obtained from the Minnesota Center for Health Statistics (CHS): <http://www.health.state.mn.us/divs/chs/>. National death statistics are from the National Center for Health Statistics: [http://www.cdc.gov/nchs/nvss/mortality\\_methods.htm](http://www.cdc.gov/nchs/nvss/mortality_methods.htm). The alcohol-related death rate is based on alcohol-attributable fractions (AAFs) from the Centers for Disease Control and Prevention (CDC) Alcohol-Related Disease Impact (ARDI) software: <https://apps.nccd.cdc.gov/ardi/Homepage.aspx>.

Alcohol-Related Death Rates per 100,000 Population			
	2005	2006	2007
Minnesota	22.7	22.5	22.2
United States	27.9	28.1	28.3
Minnesota to U.S. Rate Ratio	0.82	0.80	0.78

Source: CDC ARDI AAFs; MN CHS death files; Census population files; rates calculated by the Minnesota Institute of Public Health. Note: MN rates are calculated using state vital statistics mortality files (instead of NCHS mortality files) because since 2005 NCHS has not been providing state indicator on national mortality files.

National estimates of lost earnings due to alcohol-related premature death (Appendix B) were adjusted by the Minnesota to U.S. alcohol-related death rate ratio.

## Appendix I: Alcohol-Related Crime Rates

Crime statistics on violent and property crimes were obtained from the U.S. Department of Justice, Federal Bureau of Investigation, Criminal Justice Information Services Division, Uniform Crime Reports: <http://www.ucrdatatool.gov/Search/Crime/State/OneYearofData.cfm>. Alcohol-attributable fractions for crimes (21 percent for violent crime; 3 percent for property crime; 5 percent for total crime) are from Harwood, H. Updating Estimates of the Economic Costs of Alcohol Abuse in the United States: Estimates, Update Methods and Data. Report prepared by The Lewin Group for the National Institute on Alcohol Abuse and Alcoholism, 2000. Based on estimates, analyses and data reported in Harwood, H.; Fountain, D.; and Livermore, G. The Economic Costs of Alcohol and Drug Abuse in the United States 1992. Report prepared for the National Institute on Drug Abuse and the National Institute on Alcohol Abuse and Alcoholism, National Institutes of Health, Department of Health and Human Services. NIH Publication No. 98-4327. Rockville, MD: National Institutes of Health, 1998.

<b>Crimes, 2007: Number and Rate per 100,000 Population</b>		
	Minnesota	United States
Number of Violent Crimes	15,003	1,408,337
Number of Property Crimes	157,829	9,843,481
Total Number of Crimes	172,832	11,251,818
Rate of Violent Crimes	288.7	466.9
Rate of Property Crimes	3,036.6	3,263.5
Total Crime Rate	3,325.2	3,730.4
Number of Alcohol-Related Violent Crimes	3,092	297,316
Number of Alcohol-Related Property Crimes	4,744	300,721
Total Number of Alcohol-Related Crimes	7,836	598,037
Rate of Alcohol-Related Violent Crimes	59.5	98.6
Rate of Alcohol-Related Property Crimes	91.3	99.7
Total Alcohol-Related Crime Rate	150.8	198.3
<b>Total Minnesota to U.S. Total Alcohol-Related Crime Rate Ratio</b>	<b>0.76</b>	

Note: National or state offense totals are based on data from all reporting agencies and estimates for unreported areas.

National estimates of alcohol-related criminal justice costs and lost earnings of victims of alcohol-related crimes and incarcerated persons (Appendix B) were adjusted by the Minnesota to United States alcohol-related crime rate.

## Appendix J: Alcohol-Related Motor Vehicle Fatality Rates

Minnesota and United States motor vehicle fatality rates were obtained from the National Highway and Traffic Safety Association (NHTSA) Fatality Analysis Reporting System (FARS) Encyclopedia: <http://www-fars.nhtsa.dot.gov/States/StatesAlcohol.aspx>

<b>Alcohol-Involved Motor Vehicle Crash Fatality Rates (Driver BAC 0.08+) per 100,000 Population, 2007</b>	
Minnesota	3.8
United States	5.2
Minnesota to U.S. Rate Ratio	0.73

Note: Based on highest driver blood alcohol concentration (BAC) of 0.08 or higher.

National estimates of the cost of alcohol-related motor vehicle crashes (Appendix B) were adjusted by the Minnesota to U.S. alcohol-involved motor vehicle crash fatality rate.

## Appendix K: Alcohol-Related Fire Losses

Minnesota alcohol-related fire injury death statistics were obtained from the Minnesota Center for Health Statistics (CHS): <http://www.health.state.mn.us/divs/chs/>. National alcohol-related fire injury death statistics are from the National Center for Health Statistics: [http://www.cdc.gov/nchs/nvss/mortality\\_methods.htm](http://www.cdc.gov/nchs/nvss/mortality_methods.htm). The alcohol-related fire injury death rate is based on alcohol-attributable fractions (AAFs) from the Centers for Disease Control and Prevention (CDC) Alcohol-Related Disease Impact (ARDI) software: <https://apps.nccd.cdc.gov/ardi/Homepage.aspx>.

<b>Alcohol-Related Fire Injury Death Rates per 100,000 Population, 2007</b>	
Minnesota	0.077
United States	0.381
Minnesota to U.S. Rate Ratio	0.20

Source: CDC ARDI AAFs; MN CHS death files; Census population files; rates calculated by the Minnesota Institute of Public Health. Note: MN rates are calculated using state vital statistics mortality files (instead of NCHS mortality files) because since 2005 NCHS has not been providing state indicator on national mortality files.

National cost estimates of alcohol-related fire damage and use of emergency services from the U.S. Fire Administration (Appendix B) was adjusted by the Minnesota to U.S. alcohol-related fire injury death rate ratio. This ratio is used as a proxy incidence adjustment factor, since no incidence data are available for comparing fire damage and fire-related use of emergency services in Minnesota to that of the nation.

## Appendix L: Mean Hourly Wage for All Occupations

Minnesota mean hourly wage, for all occupations (occupation code 00-0000), statistics were obtained from the Bureau of Labor Statistics, May 2007 State Occupational Employment and Wage Estimates: [http://www.bls.gov/oes/2007/may/oes\\_mn.htm](http://www.bls.gov/oes/2007/may/oes_mn.htm). National statistics were pulled from the May 2007 National Occupational Employment and Wage Estimates: [http://www.bls.gov/oes/2007/may/oes\\_nat.htm](http://www.bls.gov/oes/2007/may/oes_nat.htm).

Mean Hourly Wage for All Occupations, May 2007	
Minnesota	\$20.59
United States	\$19.56
Minnesota to U.S. Rate Ratio	1.05

Minnesota Costs per Adult after Productivity Adjustment of lost earnings due to alcohol (Appendix B) were calculated using the U.S. Costs per Adult 1998 and the Minnesota to U.S. mean hourly wage rate ratio, after adjusting for the Minnesota 1998 population (Appendix E).

## Appendix M: Consumer Price Index—National and Medical

The National Consumer Price Index (CPI) and Annual Rate of Change were obtained from the U.S. Department of Labor, Bureau of Labor Statistics: [http://www.bls.gov/cpi/cpi\\_dr.htm](http://www.bls.gov/cpi/cpi_dr.htm).

<b>Total CPI and Annual Rate of Change, United States<sup>1</sup>, 1998-2007</b>			
Year	Overall CPI	Year	Overall CPI
1998	163.0	2003	184.0
1999	166.6	2004	188.9
2000	172.2	2005	195.3
2001	177.1	2006	201.6
2002	179.9	2007	207.3
<b>Annual Rate of Change<sup>2</sup>: 1998-2007</b>		<b>2.71%</b>	

1. US City Average, not seasonally adjusted, 1982-84 base year
2. Annual rate of increase representing an average calculated over the period of time being examined

Minnesota Total Costs after Population Adjustment 2007 for productivity effects and other social effects (Appendix B) were adjusted by the CPI Annual Rate of Change.

The medical Consumer Price Index (CPI) and Annual Rate of Change were obtained from the U.S. Department of Labor, Bureau of Labor Statistics (BLS): [http://www.bls.gov/cpi/cpi\\_dr.htm](http://www.bls.gov/cpi/cpi_dr.htm). Midwest region, urban, size class B/C was used as proxy for Minnesota since state-level CPIs are not available. From the BLS CPI home page, select CPI databases; All Urban Consumers (current series); Multi-screen data search; non-seasonally; location; current base; all items or medical care; and monthly.

<b>Medical CPI and Annual Rate of Change, Minnesota<sup>1</sup>, 1998-2007</b>			
Year	Medical CPI	Year	Medical CPI
1998	101.8	2003	126.4
1999	104.9	2004	134.5
2000	109.7	2005	140.7
2001	115.2	2006	146.4
2002	121.0	2007	152.8
<b>Annual Rate of Change<sup>2</sup>: 1998-2007</b>		<b>4.61%</b>	

1. Midwest region, urban, size class B/C used as proxy for "Minnesota", 1996 base year [overall], 1997 base year [medical care]
2. Annual rate of increase representing an average calculated over the period of time being examined

