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The Cost of Substance Abuse to America’s Health Care System; Report 2: Medicare Hospital Costs

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The Cost of Substance Abuse to America's Health Care System

Report 2: Medicare Hospital Costs

May 1994
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This study was conducted by Jeffrey Merrill, Vice President for Policy and Research at CASA; Kimberley Fox, Senior Program Manager; Han-hua Chang, Research Assistant; Gerald Pulver, Data Manager; and Dr. Andrew Schiff, Medical Associate. The study was funded by a grant from the Henry J. Kaiser Family Foundation.

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FOREWORD

Substance abuse and addiction is an equal opportunity problem. Old and young, rich and poor are equally vulnerable to its effects on their health. In order to improve the health and well-being of our nation’s citizens, we need to recognize the universality of the effects of substance abuse and mount an all-fronts attack on all abuse of legal and illegal drugs, alcohol, and tobacco.

The central missions of CASA--the Center on Addiction and Substance Abuse at Columbia University--are to identify the cost of substance abuse throughout American society and inform the American people of those costs and the impact of substance abuse on their lives: to find out what works in prevention and treatment; and to encourage all individuals and institutions to take responsibility to deal with substance abuse.

For almost two years, funded by the Henry J. Kaiser Family Foundation, CASA has been engaged in the first analysis ever undertaken of the cost of substance abuse to the nation’s health care system. The initial phase of this project, completed in July of 1993, examined the effect of substance abuse on inpatient Medicaid hospital costs. In that study, CASA found that one in five hospital days and $7.4 billion of Medicaid inpatient hospital costs in 1994, will be linked with the use or abuse of alcohol, tobacco or drugs.

This second report documents the impact on the Medicare hospital program. Nearly one out of every four dollars Medicare spends on inpatient hospital care, and one out of every five Medicare hospital admissions, are attributable to substance abuse. From cancer to stroke and heart disease, from respiratory infections to injuries and accidents, the use and abuse of cigarettes, alcohol, pills and drugs is a major cause of many diseases that eventually result in
hospitalizations for which Medicare pays. In 1994 dollars, substance abuse will cost Medicare $20 billion in inpatient hospital costs alone.

These numbers are low. Research documenting the health effects of alcohol and drugs on the elderly has not been a high priority and studies of the effects of abuse of prescription drugs are nearly non-existent. Even for cigarettes, where there is a substantial body of research on health effects, much of it ignores the elderly and the accumulated consequences of smoking for decades, which affects the elderly disproportionately. Physicians underreport the incidence of alcohol and drug abuse in the elderly population more so than in the younger population. Concern about patient confidentiality and embarrassment leads many doctors to fail to record alcohol and drug problems. Physicians often misperceive disorientation or incoherence caused by alcohol or drugs as a symptom of the natural aging process or dementia.

For Medicare, the biggest culprit in causing poor health is tobacco, accounting for nearly 80% of substance abuse-related Medicare hospitalizations. Again, this may be because we do not know enough about the health effects of alcohol and drugs. But it also reflects the high prevalence of long-term smoking among the elderly. More than 36% of Medicare recipients are former smokers and nearly 20% currently smoke. Three out of five current smokers and one third of the quitters smoked more than 10 cigarettes a day for more than 35 years.

Perhaps the most disturbing finding of this study is that substance abuse will cost the Medicare program one trillion dollars over the next 20 years. On April 21, the trustees of the Medicare Trust Fund released a report predicting that the Fund would run out of money in seven years. Inevitably, the politicians responded with proposals to raise taxes, increase
premiums, and/or cut benefits. In all the discussions about rising Medicare costs, little attention focused on how to prevent hospitalizations altogether. A ten percent reduction in the amount of substance abuse would save the Trust Fund $100 billion over the next 20 years.

This study was conducted by CASA under the direction of Jeffrey Merrill, Vice President for Policy and Research and a professor at Columbia University School of Public Health, and Kimberley Fox, senior program manager, with the assistance of Han hua Chang, Gerald Pulver and Dr. Andrew Schiff. Their research could not have been accomplished without the valuable advice of a number of distinguished physicians, epidemiologists, and economists. For their continued assistance and consultation on this entire project to identify the cost of substance abuse to the health care system, I would especially like to thank Jeffrey Kelman, M.D. and Dorothy Rice, ScD.

By the end of the year, CASA will complete its assessment of the impact of substance abuse on the entire health care system and will release a report covering the entire system -- private sector hospitalizations as well as outpatient and long term care.

Joseph A. Califano, Jr.

Chairman and President
THE IMPACT OF SUBSTANCE ABUSE ON MEDICARE INPATIENT HOSPITAL COSTS

INTRODUCTION

The Annual Report of the Trustees of the Federal Hospital Insurance Trust Fund released in April 1994 projected that the Medicare program will run out of money in seven years. This projection of future insolvency for the Fund—which pays the vast majority of hospital costs for the elderly and disabled—is due in large part to the fact that Medicare payments for hospital costs continue to grow at an alarming rate, outstripping the revenues paid into the Fund.

In responding to this crisis, invariably, the proposed solutions involve raising taxes or cutting benefits. In all these discussions, however, little time is spent in thinking about how we can keep elderly people healthy and avert hospitalizations. The worst example of this is our failure to move aggressively on the pervasive impact of substance abuse, including tobacco, alcohol and drugs, on both Medicare and overall health costs. Based on our findings, $20 billion 1994 inpatient Medicare hospital payments will be due to substance abuse and addiction. If the problems of substance abuse did not exist, we would not now be concerned about the solvency of the Hospital Trust Fund. Over the next seven years, substance abuse will cost the Trust Fund almost $170 billion. For future generations worried about the continued survival of this program, over the next 20 years, Medicare will pay out more than $1 trillion for hospital care related to substance abuse.

Past studies have provided evidence of the impact of substance abuse on health care. Further, these studies have tended to underestimate the full magnitude of the problem because they either focus on only one substance or have not taken full advantage of the epidemiologic research that relates substance abuse to virtually every major disease category.
Despite such limitations, these studies still provide a powerful argument for the inclusion of substance abuse in the cost containment debate. In addition, they demonstrate the need to understand more fully just how critical this issue is if we are to address seriously not only the concerns over the solvency of the Medicare Trust Fund, but health care reform in general.

**The CASA Study**

In 1992, CASA--The Center on Addiction and Substance Abuse at Columbia University--initiated a comprehensive study documenting the full extent to which all substance abuse, including alcohol, drugs and tobacco, contributes to the costs of the health care system. Combining a critical review of the medical and epidemiologic literature linking substance abuse as a risk factor for a wide variety of medical conditions, with extensive consultation with physicians and researchers knowledgeable in this area, CASA is in the process of estimating the magnitude of this problem and its associated costs.

The first phase of this project, which examined the extent to which Medicaid hospital costs might be attributed directly or indirectly to substance abuse, was completed in July of 1993.4 This study found that at least one in five hospital days under Medicaid, or $7.4 billion of Medicaid hospital costs in 1994, could be linked with the use or abuse of alcohol, tobacco or drugs. For diseases and health conditions as disparate as cancer, stroke, heart disease, AIDS, trauma, and birth complications, substance abuse has been documented to be a major risk factor. When these health effects are considered, substance abuse takes a major toll on the Medicaid program. And these estimates are undoubtedly still low because of both the underreporting of the problem and the fact that the available research, particularly for alcohol and drugs, is incomplete in documenting the full impact of substance abuse on morbidity.
In addition, while many had argued that the effects of these substances on disease were long-term, and the results of efforts to control abuse and addiction would not be seen for many years, the CASA study found the opposite to be the case. In fact, two-thirds of the costs of substance abuse to Medicaid were related to short-term health problems including those associated with trauma, AIDS and birth complications, where the impact on health can be seen almost immediately. Efforts to control the use of these substances can lead to immediate savings to the health care system.

The current phase of CASA’s work deals with the impact of substance abuse on the use of inpatient hospital services under Medicare. As suggested in a recent study reported in the Journal of the American Medical Association, which examined alcohol-related hospitalizations in the elderly, the costs of alcohol abuse to Medicare can be significant. But, when all substances—as well as all the health problems related to them—are considered, the costs to Medicare are astronomically higher: more than 50 times as much as was estimated in that earlier study. Using the methodology from the previous CASA study of Medicaid (described in Appendix I), but accounting for the differential impact of these substances on the elderly, as with Medicaid, substance abuse proved to be a major contributor both to morbidity and to the costs of health care for the elderly and disabled.
RESULTS

The High Cost of Substance Abuse

In 1991\textsuperscript{a}, there were 2.2 million tobacco, alcohol, or drug-related Medicare admissions which accounted for 20\% of all Medicare hospitalizations. Because these substance abuse-related cases tend to be more expensive to treat than the average hospital case, the amount actually paid out by Medicare for substance abuse-related care was even higher, accounting for 23\% or nearly one-fourth of the total Medicare payments for hospital care.\textsuperscript{b} Substance abuse-related cases cost more to treat because they required almost 26\% more hospital staff and other resources than Medicare discharges that are unrelated to substance abuse. We estimated that Medicare discharges for conditions where substance abuse was a major risk factor had a Case Mix Index (CMI = a measure of resource use) of about 1.51, compared to a CMI of 1.21 for diagnoses not related to substance abuse.

As displayed in Graph 1, in dollars, Medicare spent over $13 billion of its $57 billion inpatient short-stay hospital expenditures on substance abuse-related care. These amounts exceed the 1 out of 5 dollars spent in the Medicaid program for substance-abuse related conditions.

Based upon these results, it is estimated that, for 1994, substance abuse-related Medicare hospital costs will rise to $20 billion. These costs include substance abuse-related care for both elderly and disabled Medicare recipients, with the disabled comprising 12\% of these costs.

\textsuperscript{a} 1991 is the most recent year that National Hospital Discharge Survey data is available.

\textsuperscript{b} See Methods section for discussion of how payments were calculated.
Graph 1: Nearly 1 Out of 4 Medicare Dollars for Hospital Care Associated with Substance Abuse

Medicare Payments

- Substance-related: 23%
- Non-substance related: 77%
As can be seen in Table 1, the largest share of Medicare inpatient substance abuse costs—$12.5 billion or 97% of the total—was for medical treatment of illnesses and conditions attributable to the abuse of alcohol, drugs and tobacco. These are conditions that do not mention substance abuse in the diagnosis, but are ones that have been repeatedly shown in epidemiologic research to be associated with the use of at least one of these substances.

In contrast, treatment for conditions that explicitly mention alcohol or drug abuse account for only 4% of all substance abuse-related discharges, consuming 3% of those costs. This low percentage of alcohol and drug diagnoses is misleading, and is probably more reflective of a reluctance by physicians to classify the elderly population as alcohol or drug dependent, than an indication of a low prevalence of alcohol or drug use among the elderly and disabled. Underreporting of substance abuse as either a primary or secondary condition for this population is clearly a problem as depicted in Graph 2. While 5% of all Medicare beneficiaries are considered heavy drinkers and 3% report using drugs (see Table 2), only 3% of Medicare patients in the hospital had a diagnosis that mentioned either alcohol or drug use or both. Since alcohol and drug users tend to be at greater risk for medical care, we would expect them to make up a larger, not smaller, proportion of the hospitalized population. In fact, separate studies measuring alcoholism alone among the hospitalized elderly indicate that 9-20% actually have a drinking problem. This wide range in estimates of alcohol problems suggest that identification of alcoholism varies considerably across physicians. Thus, relying solely on diagnoses that explicitly mention alcohol or drugs on the medical record in order to measure the prevalence and cost of drugs and/or alcohol problems in hospitals grossly underestimates the full impact of substance abuse on Medicare costs.
### TABLE 1: Substance Abuse Costs to Medicare

*Total Hospital Care, 1991*

<table>
<thead>
<tr>
<th>Category</th>
<th>Discharges</th>
<th>Expenditures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Direct Treatment for Alcohol and Drug Primary Diagnoses</td>
<td>90,659</td>
<td>$319 million</td>
</tr>
<tr>
<td>2. Treatment for Diseases Where Substance Abuse Is a Major Risk Factor</td>
<td>2,076,840</td>
<td>$12.487 billion</td>
</tr>
<tr>
<td>3. Additional Days Required for Patients with a Secondary Diagnosis of Substance Abuse</td>
<td>N/A</td>
<td>$112 million</td>
</tr>
<tr>
<td><strong>Substance Abuse Total</strong></td>
<td><strong>2,167,499</strong></td>
<td><strong>$12.9 billion</strong></td>
</tr>
<tr>
<td><strong>Total Medicare</strong></td>
<td><strong>11.1 million</strong></td>
<td><strong>$57 billion</strong></td>
</tr>
<tr>
<td>Substance Abuse as Percent of Total</td>
<td>20%</td>
<td>23%</td>
</tr>
</tbody>
</table>

**Sources:**
Graph 2: Underreporting of Substance Abuse on Hospital Records

Alcohol and Drugs Recorded on Medicare Records Compared to Actual Prevalence of Alcohol Alone as Reported in Studies of Heavy Drinking in Hospitalized Elderly Populations

Alcohol and Drugs Reported on Record

- Identified Substance Abuse
- No Identified Substance Abuse

Estimates of Actual Heavy Alcohol Use

- 21%
- 9%
- 79%
- 3%
Table 2: Consumption Rates for Medicare and General Population

<table>
<thead>
<tr>
<th>Substance</th>
<th>User category</th>
<th>Consumption Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cigarettes</td>
<td>Current Smokers</td>
<td>18.4%</td>
</tr>
<tr>
<td></td>
<td>Former Smokers</td>
<td>36.1%</td>
</tr>
<tr>
<td>Alcohol</td>
<td>Heavy Drinkers</td>
<td>4.8%</td>
</tr>
<tr>
<td>Illicit Drugs</td>
<td>Drug Users</td>
<td>3.2%</td>
</tr>
</tbody>
</table>

|                 | Medicare            | General          |
|                 | 29.6%               | 23.3%            |
|                 | 8%                  | 5%               |

Drug use among the elderly also accounted for a very small percentage of the total discharges, even though more than 3% of this population admit to using drugs in the last year. This low number is, in part, indicative of a lack of research connecting illicit drugs with disease, and does not imply that drugs present no problem for the elderly. Further, since we were also unable to find sufficient data from the epidemiologic literature to quantify the health effects of the abuse of prescription drugs, we could not estimate the extent of that problem either. Thus, our estimate of the impact of drugs—both legal and illicit—on Medicare is undoubtedly low. There is clearly a need for more research to understand and quantify the impact of all drugs on morbidity and cost. Since the elderly are such large users of prescription drugs, this research is even more critical with respect to that population.

In total, we found more than 60 conditions that are associated with substance abuse covering virtually every major disease category (Appendix II)\textsuperscript{6}. In the Medicare population, more than half of the substance abuse-related hospital admissions were for cardiovascular diseases, 15% for respiratory diseases, 12% for neoplasms, and 7% for burns and trauma (Table 3). These results differ somewhat from the earlier Medicaid study where the adverse impact on birth outcomes represented the major contributor to the costs attributable to the substance abuse. Further, in comparing substance abuse problems in the Medicaid and Medicare populations, the impact on Medicare was much more a result of the long-term effects of smoking. More than 80% of substance abuse-related Medicare hospital costs was for treating smoking-related medical conditions — from lung cancer to chronic pulmonary

\textsuperscript{6}This number is lower than the 72 substance-abuse related conditions identified in the Medicaid because further analysis led us to combine some specific diagnoses into broader diagnostic categories. Appendix II provides an even more detailed breakdown of the substance abuse-related discharges in all the conditions identified.
Table 3: Medicare Discharges for Diseases Attributable to Substance Abuse as a Major Risk Factor  
U.S. General Hospitals, 1991

<table>
<thead>
<tr>
<th>Disease/Condition</th>
<th>Attributable Discharges</th>
<th>% of Total Attributable Discharges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular Diseases</td>
<td>1,156,057</td>
<td>53.3</td>
</tr>
<tr>
<td>Respiratory Diseases</td>
<td>328,453</td>
<td>15.2</td>
</tr>
<tr>
<td>Neoplasms</td>
<td>249,683</td>
<td>11.5</td>
</tr>
<tr>
<td>Trauma/Burns</td>
<td>149,649</td>
<td>6.9</td>
</tr>
<tr>
<td>Cerebrovascular Diseases</td>
<td>112,799</td>
<td>5.2</td>
</tr>
<tr>
<td>Digestive Diseases</td>
<td>49,798</td>
<td>2.3</td>
</tr>
<tr>
<td>Other</td>
<td>30,402</td>
<td>1.4</td>
</tr>
<tr>
<td>Direct Alcohol and Drug Diagnoses</td>
<td>90,659</td>
<td>4.2</td>
</tr>
</tbody>
</table>

TOTAL 1991 ATTRIBUTABLE MEDICARE DISCHARGES 2,167,500
1991 ASSOCIATED MEDICARE COSTS ATTRIBUTABLE TO SUBSTANCE ABUSE AS A RISK FACTOR $12.8 billion

**Sources:** National Hospital Discharge Survey, 1991; CASA Substance Abuse Epidemiologic Database, 1993.
obstruction disease (COPD) to coronary artery disease, as opposed to only 40% for the predominantly younger, Medicaid population.

The Medicare population is at a much higher risk for getting smoking-related diseases because people over 65 who have smoked tend to have done so more heavily and for longer time periods. Nearly 3 out of 5 of current Medicare smokers (58%) and almost one third of former smokers (32.7%) smoked an average of more than 10 cigarettes per day for over 35 years (Graph 3).

Substance Abuse as a Complicating Factor in the Treatment of other Diseases

When substance abuse is recorded as a secondary diagnosis to an otherwise unrelated condition, it tends to complicate and prolong the treatment for the underlying problem. On average, a secondary diagnosis of alcohol and/or drug abuse increased the length of time patients stay in the hospital. Compared to Medicare patients with the same primary diagnoses, those with a secondary diagnosis of substance abuse stayed an average of more than a half a day longer, 9.3 days compared with 8.6 days. While this is not insignificant, the marginal effect of substance abuse as a secondary diagnosis in the Medicare population is much smaller than what was found for Medicaid, where substance abusers stayed twice as long as non-substance abusers.

This small differential between length of stay for Medicare patients with and without substance abuse problems is most likely a significant underestimate of the full effect of alcohol and drugs as a complication. Many cases that actually involved alcohol or drug problems were not recorded as having this secondary diagnosis. Since, in our analysis, these cases would be counted in the non-substance abuse group, they may be artificially inflating the length of stay for that group. If the secondary diagnosis of substance abuse had been correctly noted, the
Graph 3: Portion of Medicare Smokers Who Have Smoked Heavily
(Those Who Have Smoked More Than 10 Cigarettes per Day for Over 35 Years)

Current

- Heavy: 58%
- Other: 42%

Former

- Heavy: 32.7%
- Other: 67.3%
difference between the two groups would have been greater. Nevertheless, despite this problem, complications resulting from a secondary diagnosis of substance abuse accounted for $108 million in added cost to Medicare.

These figures represent average lengths of stay in Medicare but, for some diseases, the difference in length of stay was much higher. For example, for patients with pancreatitis, those requiring major joint and limb reattachments, and those with pathological fractures with a secondary diagnosis of substance abuse, patients stayed approximately twice as long as their non-substance abusing counterparts (pancreatitis 17 days vs. 8 days; major joint 24 vs. 10; pathological fractures 17 vs. 10) (Graph 4).

However, for other diseases, the ALOS was, in fact, shorter for some Medicare patients with a secondary diagnosis of substance abuse. For example, patients with respiratory infections and inflammations, cellulitis, and GI obstruction, who also had a secondary diagnosis of substance abuse, stayed less time in the hospital than non-substance abusers (e.g., respiratory infections 8.4 days vs. 11.7 days, cellulitis 7.4 vs. 8.6, and GI obstruction 3.7 vs. 7.4) This does not mean that patients with substance abuse needed less care. There are several possible explanations for why these substance abusers had shorter lengths of stay. It may result from an aberration in the data due to the small sample size of patients within these diagnoses, or because of the premature departure caused by some patients signing out against medical advice. However, it may also reflect the financial or social undesirability to hospitals of many of these patients which, in turn, may lead to their early discharge or transfer to another facility. In this context, it is worth noting that, if this hypothesis is true, as the forces of competition in health care intensify, these results suggest that such “undesirable” patients may be increasingly pushed out prematurely from some institutions. Further, the nature of the
Graph 4: Conditions Where Medicare Patients w/ and w/o Substance Abuse Stay Longer

Average Length of Stay for Medicare Patients w/ and w/o Substance Abuse

- Fractures
- Major Joint Procedures
- Pneumonitis

Source: National Hospital Discharge Survey, 1991
DRG payment itself-- with an implicit limit on the days of covered care--also may work against patients with substance abuse as a complicating factor to another health problem. Far more research is needed in this area.

While this study focused on substance abuse in short stay general hospitals, Medicare also pays a significant amount in psychiatric hospital costs. According to a survey of psychiatric hospitals, 15.6 percent of total admissions were for alcohol and drug abuse-related disorders. This does not include cases where another diagnosis may have been recorded or the substance abuse was secondary to a mental health problem. But, applying this percentage to Medicare psychiatric costs, in 1991 Medicare spent an additional $160 million on care for substance abuse in psychiatric hospitals.

CONCLUSION

Substance abuse is a pervasive problem that is not limited to one segment of our society. Rather, old and young and rich and poor are all equally vulnerable to its effects on their health. Further, substance abuse cannot be viewed only as a single disease entity, but must be considered as a problem that permeates every aspect of our health system and is a risk factor for all major disease categories. Not only must physicians concerned with addiction medicine address this issue, but all physicians, regardless of specialty, must be aware of the fact that alcohol, tobacco and drugs are a major factor in both causing and complicating the medical problems of their patients. Thus, physicians--as well as other health care professionals--must be both capable of, and willing to identify substance abuse and take the steps necessary to address it. This may range from discussions with their patients about their substance abuse problems to referral to appropriate treatment.
But, the problem does not rest solely upon the shoulders of health care providers. What has been sorely needed in the discussions of how to contain health care costs is a discussion of how we can improve our health and reduce the morbidity that leads to those costs. To do so, we need to acknowledge the importance of substance abuse as a major factor in causing and complicating the health problems of our citizens. As a nation, we have not yet made the commitment to address the problem of substance abuse. For example, the U.S. is the only industrialized nation among a group surveyed which had a tobacco tax that amounted to less than 50% of the cost of a pack of cigarettes. U.S. total taxes amounted to only an average of 30%. In addition, most other countries have considerably greater regulation on all forms of tobacco advertising than does the U.S. Among 19 countries rated in terms of their control of advertising, the U.S. ranked 18th.

Nor have we invested sufficiently in the research necessary to identify and target effective interventions, or even to understand fully the relationship between various substances and illness. As we found in our own work, while there has been extensive epidemiologic research linking cigarette smoking and a variety of diseases, fewer studies relate alcohol to disease, and even less is known about the full impact of illegal drugs.

#ether, in the end, we discover that substance abuse is responsible for 20 or 30 percent (or more) of health care costs may be less the issue than the fact that we already know that literally **hundreds of billions** of dollars are spent each year on health care as a result of substance abuse. As a result, the future solvency of the Medicare Trust Fund is inextricably intertwined with what we do *today* to reduce substance abuse in all its forms—among our citizens. Preventing diseases that result from substance abuse and prolonging a healthy life for the elderly can be a much more potent weapon against rising Medicare expenditures than the
multitude of other, more frequently discussed cost-containment measures or benefit reductions. If there were no substance abuse, the Trust Fund’s solvency would not be in doubt for almost twice the period than the Trustees are now projecting.

But this issue extends beyond the Medicare program. Debating the broader issues surrounding health care reform without either acknowledging the impact of substance abuse, or including the prevention and treatment of this problem an integral part of that reform, will be a costly mistake, making it impossible to provide universal access at all; or at a cost that, as a nation, we can afford.
APPENDIX I: METHODS

The methodology for this study relied primarily on the existing epidemiologic literature, as well as on consultations with physicians knowledgeable about substance abuse and related disorders.

Epidemiologic Literature Search

We conducted a Medline search of epidemiologic or etiologic studies that identified substance abuse (tobacco, alcohol, or drugs) as a major risk factor for acquiring a given disease/condition. In this search, we selected individual studies, reviews, or meta-analyses, that quantified either a relative risk or an attributable risk, and that generally met the criterion established by the Surgeon General for establishing causality. Specifically, we favored studies that 1) reported stratified relative risks by levels of consumption or by age and sex, 2) demonstrated a dose-response relationship, 3) found diminishment of risk upon cessation of use, and 4) had findings that were generally consistent with other studies. In addition, with a very few exceptions, we used studies that measured the abusers’ increased risk of acquiring a disease relative to a non-substance abuser (morbidity studies), as opposed to their increased risk of dying of the disease (mortality studies).

Studies that were reviews or meta-analyses of other studies took priority since they combined the results of multiple studies and often reported a composite attributable or relative risk. If these were not available, we selected large prospective or case-control studies and calculated an average relative risk from these studies. When possible, we selected studies that
were targeted at the elderly population. However, we found that the elderly population is not often the focus of medical or epidemiologic research. In lieu of elderly-specific relative risks, we used relative risks for the general adult population.

**Population Attributable Risk**

Relative risks in epidemiologic studies are calculated by dividing the incidence of disease in the exposed group by the incidence in the non-exposed group. Some researchers go one step further and calculate the risk, not just for the individual, but to the larger community, by measuring the Population Attributable Risk (PAR). The PAR is the proportion of cases for a given disease that may be attributable to an etiologic factor (e.g. cigarette smoking) and is calculated using the following formula:

\[
    PAR = \frac{b(r-1)}{b(r-1)+1} \times 100
\]

where \( b \) = prevalence of substance use in the population

\( r \) = relative risk for a given disease

For each disease or medical condition where a substance abuser’s relative risk was reported in the epidemiologic literature, we calculated a Medicare-specific population attributable risk (PAR) using relative risks reported in the studies and the specific prevalence estimates for tobacco, alcohol, and drugs in the Medicare population. Appendix II provides a listing of those conditions, the related substances and their PARs. The PAR was computed using the above formula or, where different relative risks were reported by current and former users or by level of consumption, the PAR formula was revised to reflect this specificity.
Where diseases had joint multiple PARs for different substances (smoking and alcohol), the alcohol PAR was weighted by a factor of 0.5.

For the Medicare population, we used a prevalence of 9% for heavy drinking based on studies of drinking in the hospitalized elderly population. The prevalence of drug use was obtained from the 1991 National Household Drug Survey, and smoking from the 1987 National Medical Expenditures Survey. For most smoking-related diseases, we calculated PARs using prevalences for current and former smokers with their respective relative risks (see TABLE 4 in Results). However, for malignant neoplastic disease, some scientific evidence suggests that once smokers have reached a certain threshold of smoking (more than 10 cigarettes per day for more than 35 years), their relative risk is not diminished by cessation. Smoking over a long period of time may have an irreversible oncogenic effect which is not altered by quitting. For the Medicare population over 65 we found that 32.7% of former smokers meet the criterion of having smoked more than 10 cigarettes per day for more than 35 years. For this reason, we considered this subset of former smokers to be equivalent to current smokers in the PAR calculations for cancer.

Once PARs were computed for all diseases and conditions, ICD-9-CM codes were matched to the general diagnostic categories used in much of the epidemiologic literature. For example, the lung cancer category included ICD-9 codes 162.2-.9 (malignant neoplasms of the bronchus and lung). However, if the ICD-9 codes were not specifically identified in the original study, with the assistance of a medical coder and several physician consultants, we selected ICD codes that fell into the general disease classification and then matched the PARs for that disease category with the associated ICD-9 codes (see Appendix II).
## TABLE 5--ICD-9-CM Diagnoses with Mention of Alcohol or Drugs

<table>
<thead>
<tr>
<th>ALCOHOL</th>
<th>DRUG</th>
</tr>
</thead>
<tbody>
<tr>
<td>291 Psychosis, alcoholic</td>
<td>292 Psychosis, drug</td>
</tr>
<tr>
<td>303 Alcohol Dependence Syndrome</td>
<td>304 Dependence, drug</td>
</tr>
<tr>
<td>357.5 Polyneuropathy, alcoholic</td>
<td>305 Nondependent Abuse of Drugs</td>
</tr>
<tr>
<td>425.5 Cardiomyopathy, alcoholic</td>
<td>357.6 Polyneuropathy, due to drugs</td>
</tr>
<tr>
<td>535.3 Gastritis, alcoholic, w/o hemorrhage</td>
<td>535.3 Gastritis, alcoholic, w/o hemorrhage</td>
</tr>
<tr>
<td>571.0 Cirrhosis, fatty, alcoholic</td>
<td>648.3 Pregnancy, complicated by drug dependence</td>
</tr>
<tr>
<td>571.1 Hepatitis, acute, alcoholic</td>
<td>655.5 Pregnancy, management affected by suspected damage to fetus from damage</td>
</tr>
<tr>
<td>571.2 Cirrhosis, liver, alcoholic</td>
<td>760.7 Noxious influences affecting fetus via placenta or breast milk</td>
</tr>
<tr>
<td>571.3 Damage, liver, alcoholic, unspecified</td>
<td>779.4 Reaction and intoxication, drugs, specific to newborn</td>
</tr>
<tr>
<td>760.71 Fetal alcohol syndrome - Alcohol affecting fetus via placenta or breast milk</td>
<td>779.5 Syndrome, drug withdrawal in newborn</td>
</tr>
<tr>
<td>790.3 Abnormal findings, alcohol in blood level</td>
<td>962 Poisoning by hormones and other synthetic substitutes</td>
</tr>
<tr>
<td>980 Poisoning by alcohol</td>
<td>965 Poisoning by Opiates and related narcotics</td>
</tr>
<tr>
<td>V79.4 Personal history of alcoholism</td>
<td>967 Poisoning by sedatives and hypnotics</td>
</tr>
<tr>
<td>V79.4 Personal history of alcoholism</td>
<td>968 Poisoning by other central nervous system depressants and anesthetics</td>
</tr>
<tr>
<td>V79.4 Personal history of alcoholism</td>
<td>969 Poisoning by psychotropic agents</td>
</tr>
<tr>
<td>V79.4 Personal history of alcoholism</td>
<td>970 Poisoning by central nervous system stimulants</td>
</tr>
<tr>
<td>V79.4 Personal history of alcoholism</td>
<td>971 Poisoning by drugs primarily affecting the autonomic nervous system</td>
</tr>
<tr>
<td>V79.4 Personal history of alcoholism</td>
<td>977 Poisoning by other and unspecified drugs</td>
</tr>
<tr>
<td>V79.4 Personal history of alcoholism</td>
<td>E850 Accidental poisoning by analgesics, antipyretics, and antirheumatics</td>
</tr>
<tr>
<td>V79.4 Personal history of alcoholism</td>
<td>E851 Accidental poisoning by barbiturates</td>
</tr>
<tr>
<td>V79.4 Personal history of alcoholism</td>
<td>E852 Accidental poisoning by other sedatives and hypnotics</td>
</tr>
<tr>
<td>V79.4 Personal history of alcoholism</td>
<td>E853 Accidental poisoning by tranquilizers</td>
</tr>
<tr>
<td>V79.4 Personal history of alcoholism</td>
<td>E854 Accidental poisoning by other psychotropic agents</td>
</tr>
<tr>
<td>V79.4 Personal history of alcoholism</td>
<td>E858.0 Accidental poisoning by hormones and synthetic substitutes</td>
</tr>
<tr>
<td>V79.4 Personal history of alcoholism</td>
<td>E858.8 Accidental poisoning by other specified drugs - central appetite depressants</td>
</tr>
<tr>
<td>V79.4 Personal history of alcoholism</td>
<td>E858.9 Accidental poisoning by unspecified drug</td>
</tr>
</tbody>
</table>
For those ICD-9 codes which explicitly mention alcohol or drug abuse in their titles, we assigned a PAR of 100%, since all of these hospital days are attributable to substance abuse. In addition, the NIAAA has identified a list of diagnoses that are completely alcohol-related (e.g. cirrhosis). These diagnoses were also assigned a PAR of 100% (Table 5).

The costs to Medicare of substance abuse treatment in psychiatric hospitals was also included in the study. This was derived from data collected by the National Association of Psychiatric Health Systems on both the use of drug and alcohol services and the prevalence of Medicare discharges.”

**Database**

To determine the Medicare hospital costs for treating substance abuse-related illnesses, we used Medicare data reported on the 1991 National Hospital Discharge Survey (NHDS). The NHDS is a nationwide sample survey of short-stay hospitals. Each NHDS record includes the patient’s primary payer, demographic information, principal diagnosis and up to four secondary diagnoses (reported by ICD-9 codes), DRG category, procedures, and length of stay.

Extracting all Medicare discharges that had a primary diagnosis that fell within a given ICD-9 code for which we had a PAR, we then applied each PAR (by age or sex, if applicable) to the discharges with corresponding diagnoses. For example, approximately 111,000 Medicare hospital discharges had lung cancer as their primary diagnosis. Of these, 87% (the PAR) or 96,600 hospitalizations were attributed to smoking.

Since Medicare pays on the basis of DRGs (not diagnoses), it was necessary to analyze the data by DRGs to estimate the costs of these substance abuse-related admissions to
Medicare. For example, Medicare discharges that had a primary diagnosis of lung cancer fell into any one of 8 DRGs (depending on the procedure required or other complications) and, therefore, were paid a different amount depending on the DRG. By placing the discharges calculated above for each ICD-9 code into their appropriate DRG, we were able to adjust for the case mix index (CMI), or the relative payment level for that discharge. In this way, we were able to obtain a case-mix adjusted total for substance abuse-attributable discharges. We then multiplied these weighted discharges by the standardized national average DRG payment for 1991 ($3,974) to determine total Medicare substance abuse costs.

While adjusting for CMI allows us to capture the higher cost per discharge for certain diagnoses, it does not measure the differential impact on length of stay when substance abuse is recorded as a secondary diagnosis. To capture the incremental costs of substance abuse as a complicating factor in treating conditions unrelated to substance abuse, we also analyzed the marginal impact of substance abuse as a secondary diagnosis on hospital length of stay. For this analysis, we defined substance abuse as only those diagnoses that explicitly mention drug or alcohol use (e.g. alcohol poisoning) or that are the immediate reaction to substance use (e.g. delirium tremens).

We calculated the difference in length of stay for patients with and without these substance abuse secondary diagnoses that had the same primary diagnoses (by gender and for the under 65 and over 65 age groups) to determine the marginal days of care that were substance-abuse related. Estimating an average cost of $604 per day for these extra days, we then added these incremental costs to our total.
# APPENDIX II
## MEDICARE ICD9 CODE/PAR LIST

<table>
<thead>
<tr>
<th>Disease Category</th>
<th>Abused Substance</th>
<th>ICD-9 Codes</th>
<th>PAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIDS</td>
<td>IV D</td>
<td>042.0-044.9</td>
<td>32% &gt;13</td>
</tr>
<tr>
<td></td>
<td>IV D</td>
<td></td>
<td>55% &lt;13</td>
</tr>
</tbody>
</table>

### Neoplasms

- **Bladder Cancer**
  - S
  - ICD-9 Codes: 188.0-188.9, 233.7
  - PAR: 49% M, 39% F

- **Breast Cancer**
  - A
  - ICD-9 Codes: 174.0-174.9, 233.0
  - PAR: 15% M, 39% F

- **Cervical Cancer**
  - S
  - ICD-9 Codes: 180.0-180.9, 233.1
  - PAR: 15% M, 28% F

- **Cheek and Gum Cancer**
  - SLT
  - ICD-9 Codes: 143.0-143.9, 145.0-234.8
  - PAR: 86% M, 49% F

- **Colorectal Cancer**
  - A, S
  - ICD-9 Codes: 153.0-153.9, 154.0-154.1
  - PAR: 33% M, 18% F

- **Esophageal Cancer**
  - A
  - ICD-9 Codes: 150.1-150.9, 230.1
  - PAR: 100% M, 97% F

- **Laryngeal Cancer**
  - A, S
  - ICD-9 Codes: 161.0-161.9, 231.0
  - PAR: 100% M, 83% F

- **Leukemia**
  - S
  - ICD-9 Codes: 204.0-208.9
  - PAR: 20% M, 37% F

- **Liver Cancer**
  - A
  - ICD-9 Codes: 155.0-155.2, 230.8
  - PAR: 18% M, 31% F

- **Lung cancer**
  - S, PS
  - ICD-9 Codes: 162.2-162.9, 231.2
  - PAR: 93% M, 35% F

- **Oral/Pharyngeal Cancer**
  - A, S, SLT
  - ICD-9 Codes: 140.0-141.9, 143.0-149.9, 150.1-150.9, 230.0
  - PAR: 100% M, 82% F

- **Pancreatic Cancer**
  - S
  - ICD-9 Codes: 157, 230.9
  - PAR: 37% M, 31% F

- **Prostate Cancer**
  - S
  - ICD-9 Codes: 185, 233.4
  - PAR: 7% M, 43% F

- **Renal Cancer**
  - S
  - ICD-9 Codes: 189.0, 233.9
  - PAR: 17% M, 62% F

- **Renal Pelvis Cancer**
  - S
  - ICD-9 Codes: 189.1
  - PAR: 62% M, 71% F

- **Salivary Gland Cancer**
  - SLT
  - ICD-9 Codes: 142.0-142.9
  - PAR: 10% M, 28% F

- **Stomach Cancer**
  - S
  - ICD-9 Codes: 151.0-151.9, 230.2
  - PAR: 35% M, 97% F

- **Ureter Cancer**
  - S
  - ICD-9 Codes: 189.2
  - PAR: 71% M, 24% F

- **Vulvar Cancer**
  - S
  - ICD-9 Codes: 184.0, 84.9
  - PAR: 24% M, 54% F

- **Cancer, General**
  - S
  - ICD-9 Codes: V073, V66.2, 198.89, 199, V58.1
  - PAR: 54% M, 22% F
Respiratory Disease

<table>
<thead>
<tr>
<th>Condition</th>
<th>Code</th>
<th>Males (%)</th>
<th>Females (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COPD</td>
<td>491.0-492.9, 493.2, 494, 496</td>
<td>86%</td>
<td>74%</td>
</tr>
<tr>
<td>Influenza</td>
<td>487.0-487.1</td>
<td>30%</td>
<td></td>
</tr>
<tr>
<td>Other respiratory dis.</td>
<td>510.9, 511.0-511.9, 512.0-512.8, 513.0, 518.0, 518.3, 518.81, 518.82</td>
<td>37%</td>
<td>35%</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>480.1-480.8, 481.0, 482.1-482.9, 483, 485, 486</td>
<td>29%</td>
<td></td>
</tr>
</tbody>
</table>

Cardiovascular Disease

<table>
<thead>
<tr>
<th>Condition</th>
<th>Code</th>
<th>Males (%)</th>
<th>Females (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiomyopathy</td>
<td>425.1, 425.4, 425.9</td>
<td>37%</td>
<td></td>
</tr>
<tr>
<td>Cerebrovascular Disease</td>
<td>431.0-435.9</td>
<td>70%</td>
<td>73% &lt;65</td>
</tr>
<tr>
<td></td>
<td></td>
<td>73%</td>
<td></td>
</tr>
<tr>
<td>Coronary Artery Disease</td>
<td>410.0-410.9, 411.1-411.9, 413.0-413.09, 413.2-414.09, 414.2-414.9, 427.41, 429.2-429.29, 427.41, 429.71, 429.79</td>
<td>64%</td>
<td></td>
</tr>
<tr>
<td>Coronary Heart Disease</td>
<td>413.1, 414.1, 427.1, 427.41, 427.5-427.69, 427.71, 429.79, 428.0-428.19, 428.9, 429.3</td>
<td>18%</td>
<td>31%</td>
</tr>
<tr>
<td>Endocarditis</td>
<td>421.0, 421.9</td>
<td>75%</td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>401.0-401.9, 402.0-402.9, 403.0-403.9, 404.0-404.9</td>
<td>18%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>642.0, 642.2, 642.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peripheral Vascular Dis.</td>
<td>415.1, 416.9, 440.0-448.9, 451.0-451.9, 453.1-453.9, 454.0-454.9</td>
<td>75%</td>
<td></td>
</tr>
</tbody>
</table>

Pregnancy Complications

<table>
<thead>
<tr>
<th>Condition</th>
<th>Code</th>
<th>Males (%)</th>
<th>Females (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placenta Previa</td>
<td>641.0-641.1, 642.0</td>
<td>26%</td>
<td></td>
</tr>
<tr>
<td>Premature Rupture</td>
<td>658.11, 658.13, 658.2, 761.1</td>
<td>32%</td>
<td></td>
</tr>
<tr>
<td>Spontaneous Abortion</td>
<td>634</td>
<td>37%</td>
<td></td>
</tr>
<tr>
<td>Preterm Delivery</td>
<td>644.0-644.9, 656.3-656.6</td>
<td>18%</td>
<td></td>
</tr>
<tr>
<td>Newborns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Congenital Anomalies</td>
<td>740.0-759.9</td>
<td>20%</td>
<td></td>
</tr>
</tbody>
</table>

IV D = Intravenous Drug Use; S = Smoking; A = Alcohol; SLT = Smokeless Tobacco; PS = Passive Smoke.
<table>
<thead>
<tr>
<th>Condition</th>
<th>Code</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Birth Weight</td>
<td>S 764.0-765.9</td>
<td>36%</td>
</tr>
<tr>
<td>Congenital Syphilis</td>
<td>S 090.0-090.9</td>
<td>18%</td>
</tr>
</tbody>
</table>

**Digestive System**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Code</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cirrhosis</td>
<td>A 571.5</td>
<td>72%</td>
</tr>
<tr>
<td>Crohn’s Disease</td>
<td>S 555.0-555.9</td>
<td>32%</td>
</tr>
<tr>
<td>Duodenal Ulcers</td>
<td>A, s 532.00-532.90</td>
<td>46% M</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>3% F</td>
</tr>
<tr>
<td>Pancreatitis, Acute A</td>
<td>577.0</td>
<td>44%</td>
</tr>
<tr>
<td>Pancreatitis, Chronic</td>
<td>A</td>
<td>577.1</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>33% F</td>
</tr>
<tr>
<td>Peptic Ulcers</td>
<td>S 533</td>
<td>25% M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14% F</td>
</tr>
<tr>
<td>Stomach Ulcers</td>
<td>A</td>
<td>531</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>8% F</td>
</tr>
</tbody>
</table>

**Endocrine and Metabolic**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Code</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>S 250.0</td>
<td>4% F</td>
</tr>
</tbody>
</table>

**Other**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Code</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burns</td>
<td>A, S!</td>
<td>940.0-949.9</td>
</tr>
<tr>
<td>Cataract</td>
<td>S 366.1,366.3,366.45,366.9</td>
<td>3% M</td>
</tr>
<tr>
<td>Dementia</td>
<td>A, D 290.1,290.2,290.3,290.4, 294.1, 294.9</td>
<td>11%</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>A 345.1,345.3,345.9</td>
<td>27%</td>
</tr>
<tr>
<td>Hepatitis A</td>
<td>IV D 70.1</td>
<td>6%</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>IV D 70.2, 70.3</td>
<td>12%</td>
</tr>
<tr>
<td>Hepatitis C</td>
<td>IV D 70.51, 70.59, 70.9</td>
<td>36%</td>
</tr>
<tr>
<td>Low Back Pain</td>
<td>S 724.2,724.5,724.8,724.9</td>
<td>5%</td>
</tr>
<tr>
<td>Pelvic Inflammatory Dis.</td>
<td>S 614-616</td>
<td>38% F</td>
</tr>
<tr>
<td>Peridontitis</td>
<td>S 522.4, 523.4</td>
<td>40%</td>
</tr>
<tr>
<td>Seizures</td>
<td>A 780.3</td>
<td>22%</td>
</tr>
<tr>
<td>Trauma</td>
<td>A, D 800.0-909.9</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>921 .O-939.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>950.0-959.9</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>A 011-013, 017, 018</td>
<td>25%</td>
</tr>
</tbody>
</table>

**Diseases Entirely Related to Substance Abuse**

**IV D = Intravenous Drug Use; S = Smoking; A = Alcohol; SLT = SmokeLess Tobacco; PS = Passive Smoke.**
<table>
<thead>
<tr>
<th>Related</th>
<th>Category</th>
<th>Codes</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>A</td>
<td>291, 303, 980, 950, 357.5, 425.5, 535.3, 571.0-571.3, 655.4, 760.71, 790.3, 11.3, 61.41, 70.4, 79.1, 860.1, 860.2, 860.8, 860.9</td>
<td>100%</td>
</tr>
<tr>
<td>Drug</td>
<td>D</td>
<td>292, 304, 962, 965, 967, 968, 969, 970, 971, 977, 850-854, 357.6, 648.3, 655.5, 760.7, 779.4-779.5, 858.0, 858.8, 858.9</td>
<td>100%</td>
</tr>
</tbody>
</table>

**IVD** = **Intravenous Drug Use**; **S** = **Smoking**; **A** = **Alcohol**; **SLT** = **Smokeless Tobacco**; **PS** = **Passive Smoke**.
References


BIBLIOGRAPHY


