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ABSTRACT

This report provides evidence concerning the projected demand for substance abuse treatment services for older Americans over the next 20 to 30 years and suggests approaches for refining these projections. A work group of Federal agency representatives and university researchers was established by the Substance Abuse and Mental Health Services Administration, Office of Applied Studies, to examine and assess the ability of available data to provide sufficient information to guide planning to address the possible doubling of the number of those older adults requiring substance abuse treatment services. The work group identified and reviewed available information, gaps in data, assumptions concerning data collection and analysis, important variables, and estimation methods and models. This report includes original analyses of a wide variety of data sources undertaken by an invited panel of experts. The chapters in this report review the issues in anticipation of the substance abuse treatment needs of the future elderly. The report highlights uses of available data and provides examples of analyses and methodological issues required to refine forecasts of the demand for substance abuse treatment services emerging over the next several decades. The final chapter discusses the implications and suggests approaches to extending our knowledge in the area. (Contains 209 references and 29 tables.) (GCP)

Analytic Series: A-21

# Substance Use by Older Adults: Estimates of Future Impact on the Treatment System




**DEPARTMENT OF HEALTH AND HUMAN SERVICES**
Substance Abuse and Mental Health Services Administration
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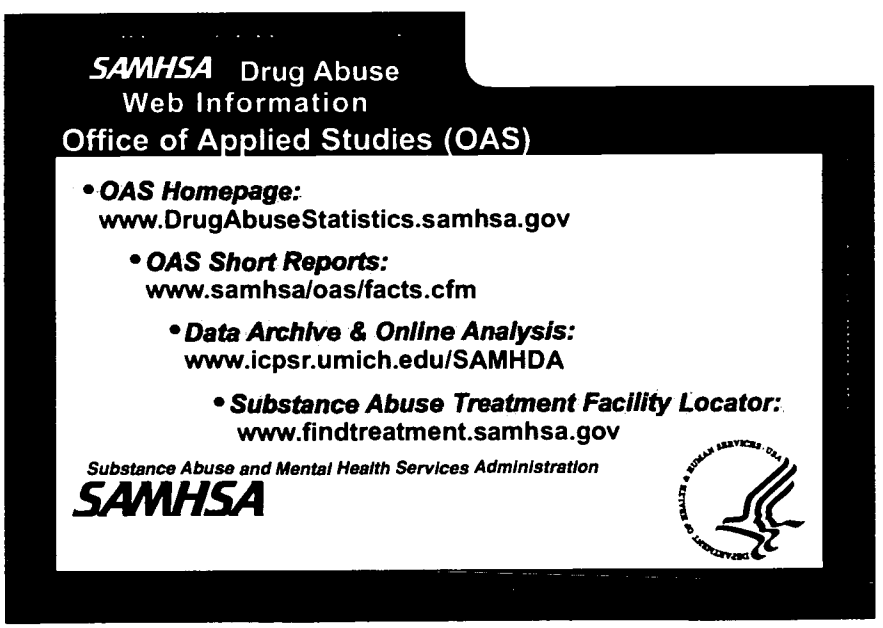

# Substance Use by Older Adults: Estimates of Future Impact on the Treatment System

Samuel P. Korper
Carol L. Council

Editors

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Substance Abuse and Mental Health Services Administration
Office of Applied Studies

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December 2002

# Table of Contents

## Table of Contents (continued)

## Table of Contents (continued)

## Table of Contents (continued)

# List of Figures

# List of Tables

## List of Tables (continued)

## List of Tables (continued)

# Overview

This report provides evidence concerning the projected demand for substance abuse treatment services for older Americans over the next 20 to 30 years and suggests approaches for refining these projections. It was developed in response to two trends in the United States—the aging of the population and the higher consumption of alcohol and illicit substances by people born between 1946 and 1964 (the baby boom generation) than was true in earlier cohorts. A work group of Federal agency representatives and university researchers was established by the Substance Abuse and Mental Health Services Administration (SAMHSA), Office of Applied Studies (OAS), to examine and assess the ability of available data to provide sufficient information to guide planning to address the possible doubling of the number of those older adults requiring substance abuse treatment services. The work group identified and reviewed available information, gaps in data, assumptions concerning data collection and analysis, important variables, and estimation methods and models. This report includes original analyses of a wide variety of data sources undertaken by an invited panel of experts. It was prepared to demonstrate approaches to the issues raised and the suggestions of the Federal work group.

The chapters in this report review the issues in anticipation of the substance abuse treatment needs of the future elderly. To make reliable forecasts of the demand for substance abuse treatment services, more updated and expanded information is needed concerning the life course of persons who abuse substances and are in recovery, those who continue to abuse substances throughout their lives and may or may not be in treatment, and those who begin abusing substances later in life. Patterns of relapse and recovery must be better understood. The report highlights uses of available data and provides examples of analyses and methodological issues required to refine forecasts of the demand for substance abuse treatment services emerging over the next several decades. The final chapter discusses the implications and suggests approaches to extending our knowledge in the area.

Key highlights include the following:

- Demographic projections suggest that the proportion of the population 65 years or older in the United States will rise from the current 12 percent to 20 percent by the year 2030. Moreover, the population will become more ethnically and racially diverse, live longer, and face higher health care service and prescription drug costs than ever before (Chapter 1).

- Abuse of alcohol and drugs, licit and illicit, is currently a serious health problem among older Americans, affecting up to 17 percent of adults aged 60 or older (approximately 8 million adults) (Chapter 8).

- Estimates using data from the 1999 National Household Survey on Drug Abuse (NHSDA) suggest that the number of adults with substance abuse problems will double to 5 million during the time period from 1999 to 2020 (Chapter 5).

- Many data resources exist for measuring substance misuse and abuse across the life cycle. However, most fail to provide direct measures of age-specific recovery, relapse, and mortality of substance abusers (Chapter 2).

- Analysis of existing data on high-risk substance abusers indicates that age-related drug use progression and recovery appear to differ depending on the type of drug abused (Chapter 3).

- An analysis of the 1992 National Longitudinal Alcohol Epidemiologic Survey (NLAES) data indicates that substantial changes in the patterns of substance use/abuse over different age cohorts will dramatically affect future treatment and prevention for senior adults (Chapter 7).

- An analysis of the National Health and Nutrition Examination Survey (NHANES) Longitudinal Analysis of Drinking Over the Life Span indicates that the baby boom generation is likely to maintain a higher level of alcohol consumption than previous generations' cohorts (Chapter 8).

- An analysis of the Department of Veterans Affairs (VA) inpatient utilization data indicates that the baby boom generation uses the largest proportion of substance abuse treatment services provided by the VA. Furthermore, there is little evidence of declining need for treatment or "aging out" among this group of substance-using veterans (Chapter 9).

- Treatment Episode Data Set (TEDS) data for 1997 indicate that alcohol abuse was the primary problem of those aged 50 or older who were admitted to publicly funded substance abuse treatment. Abuse of tranquilizers and sedatives increased with age and was consistent with problem prescription drug use among older adults, especially when combined with alcohol (Chapter 4).

- The NHSDA in its current form is capable of producing limited estimates for projecting substance abuse in an older population, but changes to the survey could facilitate the use of a follow-up life table to track a cohort of substance-abusing baby boomers as they move into old age by 2020 or 2030 (Chapter 6).

- The health care system in the United States does not yet appear to have recognized or to be effectively dealing with the increased and increasing

use and abuse of licit and illicit psychoactive substances by older populations (Chapter 10).

- The organization and financing of health care and related services also are factors in the underdiagnosis and undertreatment of elderly substance abusers (Chapter 1).

- The development of innovative and effective screening and treatment methods for substance misuse among older adults is an important focus of future research (Chapter 7).

- Analyses of existing data underscore the need to develop and include improved measurement of substance abuse/dependence in the elderly, as well as the need to improve sampling methods to ensure the representativeness of the older population in datasets. There is also a need for longitudinal data to better understand the "life course" of substance use and recovery (Chapter 10).

In summary, this report underscores the expected change in the magnitude of the requirement for substance abuse treatment in future generations of older Americans. Complementing the accelerated aging and changing demographic profile of the U.S. population will be a new constellation of factors, including longer life span, increased per capita use of multiple prescription drugs, increased pressure to retain older people in the workforce, and the enhanced propensity of those entering their senior years to abuse both licit and illicit drugs. These factors will have an impact on both the Nation's substance abuse treatment and the greater health care system. Therefore, it is suggested that more informed policy will require new approaches, including the following:

- data-related collection strategies, methods, and analyses designed specifically with an emphasis appropriate to documenting substance abuse in the elderly, including the identification of polydrug use in the elderly;

- an ongoing, expanded, and better targeted review of the literature to identify new conceptual and methodological insights in the specific older populations at risk;

- prevention, treatment, and management strategies specifically tailored for the elderly from different ethnic, gender, and racial groups, including immigrant populations, monitoring the demographic shifts in heterogeneous elderly populations; and

- long-term projections of the demand for expanded clinical and public health services for substance abusers.

# Chapter 1. The Impact of Substance Use and Abuse by the Elderly: The Next 20 to 30 Years

Samuel P. Korper,* Ph.D., M.P.H.
Ira E. Raskin, Ph.D.

## Introduction and Background

Imagine a world where the problems of youthful drug abusers share a common stage with images of senior citizens' health and behavior modified by adverse reactions to multiple prescription drugs, alcohol abuse, and illicit substances. Imagine a world where active efforts to recruit retired workers (some with undiagnosed substance abuse) into a younger, smaller, and more diverse labor force are confounded by historical requirements for a drug-free work environment. Imagine a world where the achievement of balanced resource allocation and intergenerational equity is strained by unanticipated demands for health care resources, including substance use and abuse-related services, for a growing elderly population that was expected to live longer but with a reduced burden of illness (Fries, 1980). Imagine, as Reinhardt (1999) observed in the case of Europe, economic efficiency and long-term capital development sacrificed explicitly for purposes of social equity and increased consumption by a growing elderly population—a phenomenon likely to become more explicit and powerful in the United States as well.

The dynamic arithmetic of aging and the limitations of current substance abuse policy and treatment strategies for the elderly have begun to crystallize these images. However, limited understanding of the extent of licit and illicit substance abuse problems among the elderly makes uncertain the full measure and impact of this reality. Forecasts and figures for the coming years are cautionary and sobering, but their precision is uncertain. Such efforts are made inexact by ever-moving targets, evolutionary treatment approaches accompanied by novel terminology, and redefined target populations. Estimates and forecasts drawn from recent sources (Epstein, 2002; Gfroerer, Penne, Pemberton, & Folsom, in press; Office of National Drug Control Policy, 2001; The Robert Wood Johnson Foundation, 2001) suggest an escalation of the approximately 1.7 million current substance dependent and abusing adults over age 50 to 4.4 million by 2020. But do such estimates matter? Will resources be available to respond? Are caregivers, treatment and service providers, and Federal, State, and local service and funding agencies aware of such projections, and are they preparing for the consequences?

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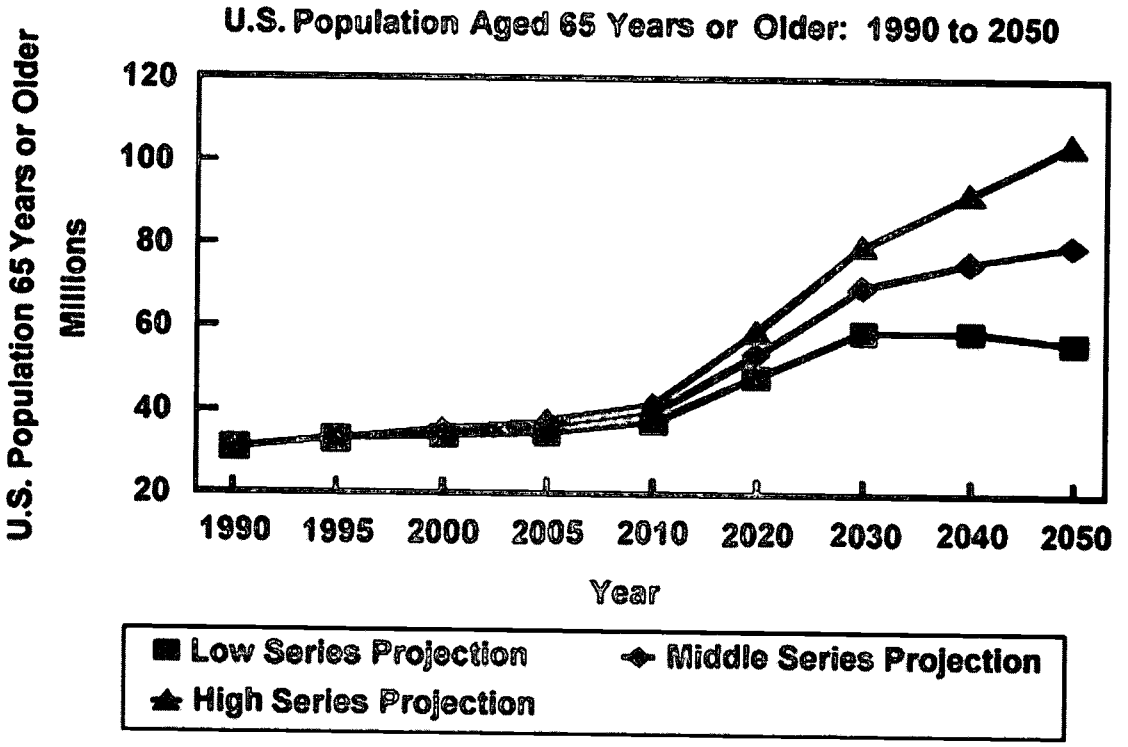
Several chapters in this report address both this uncertainty and the need for more informed discussion about how health policy can creatively balance the competing needs of young and elderly constituencies. This chapter serves as a brief introduction to eight other chapters that explore the data and methods available for estimating the number of elderly substance abusers over the next 30 years.

Approximately 35 million people in the United States are 65 or older, accounting for about 12.4 percent of the total population. As Figure 1 shows, the anticipated impact of the aging of baby boomers—people born between 1946 and 1964—will increase this proportion to 20 percent by 2030, or approximately 70 million people (Federal Interagency Forum on Aging-Related Statistics, 2000).

**Figure 1 The Growing U.S. Population Aged 65 Years or Older**




Source: Federal Interagency Forum on Aging-Related Statistics (2000).

As Reinhardt (2000, p. 71) stated, "...the impending retirement of the Baby Boom generation sometime after the year 2010 is viewed with the apprehension normally reserved for an impending hurricane." This expected increase in the elderly population has major ramifications for most facets of American life. The older population will be more ethnically and racially diverse—by 2050, 64 percent of those aged 65 or older will be non-Hispanic whites, down from the present 84 percent. Further, the next several decades will demonstrate sizable

increases in the proportion of older men and women without family support and with generally less income (Federal Interagency Forum on Aging-Related Statistics, 2000).

The changes described above are likely to place increased pressure on health care services and on the demand for social services and pensions. As Reinhardt (2000) observed, there is substantial policy and social risk in failing to be responsive to the accelerated growth in the numbers of the elderly and their proportionately greater and more expensive needs for health care services. A more racially diverse and younger worker population will have to support those on Social Security, leading to greater competitive pressure for health resources between the two generations (Waite, 1996). An increased transfer of intergenerational resources will be required to support the health care costs of an older population over the next three decades. This may strain the ability and willingness of a smaller, relatively economically disadvantaged group of taxpayers and workers to share their income with retirees.

A major shift of an experienced labor force into retirement will affect the productivity and income required to support the needs of the elderly. Despite the extension of the age of retirement eligibility, efforts to keep retirees in the workforce may be hampered by various factors. For example, the rise in chronic illness associated with living longer will take its toll on labor force participation and productivity. Another factor is the accumulating evidence of psychoactive substance use by the elderly. The future extent of this use is not certain. However, the experience of the baby boomer generation with drugs and expanded polypharmacy and its associated adverse effects (Center for Substance Abuse Treatment [CSAT], 1998; Williams, Stinson, Parker, Harford, & Noble, 1987) will likely shape this future. Some report that baby boomers have 3 to 4 times the rate of emotional disorders (depression, suicide, anxiety, alcohol and drug abuse) than is found in today's elderly population (Koenig, George, & Schneider, 1994).

Age-related changes in biological sensitivity and physiological reaction of elderly retirees and workers to licit and illicit substances (Atkinson, Ganzini, & Bernstein, 1992) may reduce the potential for rehiring or retaining elderly workers in the labor force. The anticipated growth in the use of substances will affect the readiness and ability of the elderly to continue working in a drug-free environment and will mean major new challenges for the delivery of geriatric health services. Alcohol and substance abuse constitute an estimated 10 percent of all cases treated by geriatric mental health facilities, and alcohol, mental health, and drug abuse problems typically are concomitant and interactive (King, Van Hasselt, Segal, & Hersen,1994). Abuse of alcohol and legal drugs, prescribed and over the counter, is currently a serious health problem among older Americans, affecting up to 17 percent of adults aged 60 or older (approximately 8 million adults) (CSAT, 1998). Prescription drug misuse and abuse are prevalent among older adults, not solely because more drugs are prescribed, but because aging affects vulnerability to drugs. Loss

of body mass leads to a decrease in body water and higher concentration of alcohol in the blood of an older person; a decline in a stomach enzyme that breaks down alcohol before it reaches the bloodstream (alcohol dehydrogenase) combines with reduced liver and kidney function to eliminate alcohol more slowly from the blood of an older person (Brody, 2002).

Use of drugs in combination with alcohol carries risk, and multiple drug use increases that risk (CSAT, 1998). Because about 50 percent of the elderly are light or moderate drinkers, interaction between alcohol and other drugs is likely to become an even more significant problem with the aging of the population (Adams, 1997). Substance abuse-related problems may spiral higher as baby boomers age and experience chronic physical disability, shrinking social networks, and lower standards of living (Koenig et al., 1994).

The combination of the negative consequences of polypharmacy described above and the comparatively low rate of illicit drug use (1 to 2 percent) by the elderly represent a relatively small element in the overall picture. However, "we face an aging population that will be accepting of drug use...with considerable impact...on social services" (Rosenberg, 1997, p. 207). Substance abuse among the elderly undoubtedly will enhance the pressure on society's ability to sustain the prevailing balance in the social compact with the elderly and the young. Estimates of treatment needs that consider the long-term health consequences of substance abuse on the baby boomer cohort are required.

## How Prepared Are Substance Abuse Services to Meet Anticipated Future Requirements?

No one really knows the answer to this question. However, even if the incidence rate of substance abuse among the elderly in 1995 is assumed to drop by half in 2030, there will be increased demand for treatment. The increase in need for marijuana treatment, for example, has been estimated to be 1½ times greater in 2030 if the 1995 incidence rate is assumed constant (Gfroerer & Epstein, 1999). These anticipated increases in treatment stem only partially from demographic changes—substance abuse also interacts with, and complicates, all features of aging, illness, and dysfunction (Atkinson et al., 1992; CSAT, 1998; King et al., 1994). Today's health care system fails to deal with this reality. Some of this deficiency is the result of limited information concerning the most efficacious approaches to preventing, treating, and managing substance abuse among the elderly. Diagnostic and treatment strategies are neither age-specific nor sensitive to what is most clinically effective in accommodating the unique biological and social condition of the elderly. Few studies have explicitly assessed the efficacy of drugs used for treatment of alcohol withdrawal in elderly patients (Kraemer, Conigliaro, & Saitz, 1999). The relative absence of clinical guidelines in treating substance abuse problems among the elderly is

largely attributable to a lack of empirical studies targeting these problems and this population, including the diverse ethnic and racial groups that comprise the elderly population.

Substantial work has been done on alcohol abuse, including recent evidence that instruments used to screen for alcohol abuse (MAST-G and CAGE) have adequate validation for older persons (Blow et al., 1992; CSAT, 1998; Jones, Lindsey, Yount, Soltys, & Farani-Enayat, 1993; Joseph, Ganzini, & Atkinson, 1995; Morton, Jones, & Manganaro, 1996). Blow, Walton, Chermack, Mudd, and Brower (2000b) demonstrated that older adults with alcohol problems who received treatment specific to their needs could achieve positive health outcomes. However, this treatment may take longer because alcohol withdrawal may be more severe in elderly than in younger patients (Brower, Mudd, Blow, Young, & Hill, 1994). In general, however, a shortage of trained geriatricians and other relevant professionals limits awareness and understanding of specific clinical patterns and responses in the elderly.

Because many of the definitions, models, and classifications of alcohol consumption levels are static and do not account for age-related physiological and social changes, they do not apply to older adults (e.g., older adults cannot continue to drink the equivalent amount of alcohol consumed safely in earlier years) (CSAT, 1998). It also may be more difficult for health care providers to diagnose alcoholism in older patients because a third of those with problems did not abuse alcohol in their earlier years. Older adults at risk for alcohol abuse may not evidence poor physical health functioning in primary care settings, although they may have significantly poorer mental health functioning than low-risk drinkers (Blow et al., 2000b). These older patients often do not have alcohol-related health problems, difficulties with family relationships associated with problem drinking, or problems with legal and correctional institutions. Older problem drinkers typically begin abusing alcohol and medications following a major life change, such as the death of a spouse, a divorce, or retirement (CSAT, 1998). Difficulty in the clinical detection of substance abuse is further compounded by a wider fluctuation in symptoms over time for elderly alcoholics and a greater level of associated medical, psychiatric, and social dysfunction (in contrast with younger substance abusers) (King et al., 1994). Moreover, many more subtle interactions with prescription medications may not be identified by physicians because they are unaware of the large number of prescriptions the patient possesses or of the compounds actually ingested.

The organization and financing of health care and related services also are factors in the underdiagnosis and undertreatment of elderly substance abusers. Managed care plans are increasingly limiting the provision of services to Medicare patients. Medicare requires a 50 percent copayment from patients for the treatment of substance abuse and mental health problems. Health care practitioners limit the number of Medicare patents in their practices (older

adults with complex and consuming psychosocial and medical disorders, including stressed and overburdened families), especially when younger patients can be seen at higher fees than are allowed under Medicare (Koenig et al., 1994). Reduced time for doctor-patient interactions makes it difficult to identify patient problems with substances and drug interactions. The health care system has experienced reduced hospital lengths of stay, increased reliance on primary care physicians, dwindling outpatient resources, and reduced nursing home beds. Older adults with chronic mental illness (and other medical and social covariates of alcohol and drug abuse) subsequently have fewer options as to where they can live and receive care (Koenig et al., 1994). Few Medicare substance abuse patients receive prompt outpatient mental health care after hospital discharge (Brennan, Kagay, Geppert, & Moos, 2001).

Atkinson et al. (1992) reviewed the special risk factors facing the elderly and developed a conceptual framework and synthesis of research in this area. In addition, the reader is referred to the more recent Treatment Improvement Protocol (TIP) Series No. 26 titled *Substance Abuse Among Older Adults* (CSAT, 1998), which outlines what is known about substance abuse in older adults and establishes a framework for accumulating future, evidence-based data on preventing, screening, assessing, treating, and managing substance abuse in the elderly. The document sets out standards for testing and treating substance abuse in the elderly derived from research-based information and the clinical experience of expert panelists. Of its 65 recommendations, however, only 35 (53.8 percent) are drawn from research- or evidence-based knowledge. Thirty (46.2 percent) of the remaining recommendations are drawn from the experience of the 15 clinicians on the TIP consensus panel. Moreover, approximately 50 percent of the evidence-based data referred to in the TIP recommendations pertains only to alcohol abuse, not to the abuse of other substances (e.g., prescription drugs) or the interactions among various substances and mental health problems.

Current emphasis on the scientific exploration of treatment effectiveness and patient outcomes merits greater investment in substance abuse research and practice standards based on empirical evidence. Although much is known about substance abuse and the elderly, more systematic fact gathering and resource planning are required in preparing for the problems of the 21st century.

## Initial Federal Response

The legislative authority establishing and authorizing the Substance Abuse and Mental Health Services Administration (SAMHSA) within the U.S. Department of Health and Human Services (DHHS) provides the legal basis and responsibility to "promote and evaluate substance abuse services for older Americans" (Public Health Service Act, Sec. 501(d)(17)) and to that end

requires consultation with other Federal agencies. Earlier analytical work supported by SAMHSA summarized what is known about substance abuse among older adults (CSAT, 1998). In addition, recognizing that available studies of substance abuse among elderly citizens have not been used to estimate future service requirements, SAMHSA's Office of Applied Studies (OAS) has coordinated interagency collaboration and discussion on these issues through the establishment of a Federal work group. The following agencies are involved in this effort:

- National Institute on Aging,
- National Institute on Drug Abuse,
- National Institute on Alcohol Abuse and Alcoholism,
- National Institute of Mental Health,
- Centers for Disease Control and Prevention,
- Health Care Financing Administration (now the Centers for Medicare & Medicaid Services),
- Agency for Healthcare Research and Quality,
- Health Resources and Services Administration,
- Food and Drug Administration, and
- SAMHSA.

In a series of interagency meetings, the group identified and reviewed available information, gaps in data, assumptions, important variables, estimation methods, and models. Approaches, key Federal agencies, topics for papers, and outside experts were considered. Future efforts in this collaboration, both in the Federal sector and with non-Federal partners, are expected to encourage novel analysis of existing data, stimulate new research, and accelerate the development of action plans for informing future substance abuse policy.

Subsequent to this interagency activity, OAS/SAMHSA developed this special report. The chapters in this report provide a detailed review of the demographic and clinical perspectives of the elderly and substance abuse, examine various risk factors associated with the use of licit and illicit substances, describe the examination of several data sources that can contribute to an understanding of substance abuse and aging, discuss modeling efforts and the analysis of extant data, array preliminary projections of the number of elderly needing substance abuse services

during the 2020-2030 time period, and describe the implications of these projections for needed substance abuse services.

## Overview of Report

Chapter 2. A Conceptual Model for Measuring Substance Misuse and Abuse Through the Life Cycle: The Importance of Recovery and Death Rates *(Barbara A. Ray)*

This chapter sets out the overall perspective of substance abuse through the aging process. The model lays the conceptual groundwork for reviewing the potential of various data sources for forecasting substance abuse. It also presents a discussion about the consideration of recovery rates in forecasting.

Chapter 3. Drug Use Careers: Recovery and Mortality *(Yih-Ing Hser)*

This chapter contains detailed information on two longitudinal studies of male opiate users and other high-risk drug users identified at emergency rooms, sexually transmitted disease clinics, and jails in California. Preliminary estimates of age-specific recovery, relapse, and mortality rates are provided as the basis for projecting future health care needs of an aging population. Dr. Hser documents that heroin use appears to be persistent with age—the mortality rate rises from about 33 percent for heroin users aged 45 to 49 to 76 percent or higher for users older than 65. Rates of abstinence for 5 years or more increased to about 50 percent beyond ages 45 to 49, but no continuing increase of recovery after age 50 was observed. Age-related drug use progression and recovery appeared to differ depending on the type of drug used. However, the baby boomer generation reported greater levels of illicit drug use. Dr. Hser calls for future studies to include women and to improve sampling of the elderly.

Chapter 4. Age Differences in Multiple Drug Use: National Admissions to Publicly Funded Substance Abuse Treatment *(Leigh A. Henderson)*

This chapter examines polydrug use among various age groups using the Treatment Episode Data Set (TEDS). Emphasis is placed on baby boomers and current older users of the substance abuse treatment system. The analysis is intended to provide a benchmark to measure future change in polydrug use among the substance-abusing or dependent population treated in publicly supported programs. TEDS data for 1997 indicate that alcohol abuse was the primary problem of those aged 50 or older who were admitted to publicly funded substance abuse treatment. At age 55 or older, an increasing percentage of persons entering treatment for the first time was due to late-onset alcoholism. However, the use of multiple substances was reported by

7 to 20 percent of those aged 55 to 79, increasing among those aged 75 or older to levels comparable with those for persons younger than 40. Abuse of tranquilizers and sedatives increased with age and was consistent with problem prescription drug use among older adults, especially when combined or with alcohol. Referral to treatment by health care providers also increased with age.

Chapter 5. The Aging Baby Boom Cohort and Future Prevalence of Substance Abuse *(Joseph C. Gfroerer, Michael A. Penne, Michael R. Pemberton, and Ralph E. Folsom, Jr.)*

This chapter uses data from the 1999 National Household Survey on Drug Abuse (NHSDA) in a series of regression models to estimate the number of adults with substance abuse problems in the year 2020. It is estimated that the number of adults over the age of 50 with substance abuse problems will double to 5 million during the time period from 1999 to 2020. In 2020, approximately 50 percent of persons aged 50 to 70 will be in a high-risk group (use of alcohol and marijuana before age 30) compared with just less than 9 percent in 1999. The authors call for alternative measures of substance abuse in the older population (e.g., persons in recovery or abusing prescription drugs) and for the analysis of different categories of substance abuse.

Chapter 6. Substance Abuse Among Older Adults in 2020: Projections Using the Life Table Approach and the National Household Survey on Drug Abuse *(Albert Woodward)*

This chapter offers a conceptual approach to project substance abuse in an older population. The focus in on a life table methodology using data drawn from the National Household Survey on Drug Abuse (NHSDA). Dr. Woodward discusses the limitations of the NHSDA and possible changes to the survey that could facilitate the use of a follow-up life table to track a cohort of substance-abusing baby boomers as they move into old age by 2020 or 2030. A hypothetical example of this type of projection analysis is discussed, as are limitations and strengths of the NHSDA for future study of substance abuse in the older population.

Chapter 7. National Longitudinal Alcohol Epidemiologic Survey (NLAES): Alcohol and Drug Use Across Age Groups *(Frederic C. Blow, Kristen L. Barry, Deborah Welsh, and Brenda M. Booth)*

This chapter uses 1992 NLAES data to compute rates of substance abuse by age cohort and gender. Abuse and dependence were shown to be highest among young adults, with the rate of marijuana use higher than any other drug among male and female baby boomers. The analysis indicates that substantial changes in the patterns of substance use/abuse over different age cohorts will have a dramatic effect on future treatment and prevention for senior adults.

Chapter 8. Analysis of the National Health and Nutrition Examination Survey (NHANES): Longitudinal Analysis of Drinking Over the Life Span *(Frederic C. Blow, Kristen L. Barry, Bret E. Fuller, and Brenda M. Booth)*

This chapter examines changes in drinking among adults aged 18 or older during the years from 1972 to 1992. Data are drawn from the initial NHANES study (1972-74) and the 1982-84, 1987, and 1992 follow-up surveys. Weekly drinking levels were collected from these four waves of data and were calculated based on 5-year and 10-year age categories over the 20-year period. Cross-tabulations were run to indicate differences by gender and age. Alcohol consumption appeared to decrease with increasing age. However, the baby boomer cohort is likely to maintain a higher level of alcohol consumption than previous cohorts. The chapter addresses the need for prevention and treatment strategies targeted at baby boomers.

Chapter 9. Utilization of Veterans' Health Services for Substance Abuse: A Study of Aging Baby Boomer Veterans *(Brenda M. Booth and Frederic C. Blow)*

This chapter examines whether veterans' use of substance abuse services as they became older has changed over time. Cross-sectional data over 11 years of VA utilization are analyzed. Five-year age groups are defined with a base year of 1992. Because baby boomers were born between 1946 and 1964, they were aged 28 to 46 in 1992. Drs. Booth and Blow show that the use of inpatient and outpatient substance abuse treatment by veterans aged 35 to 49 in 1992 did not decline between fiscal years 1988 and 1998. Veterans may not be decreasing their dependence on alcohol and drugs with increasing age. The ramifications for the allocation of VA treatment resources for older veterans are discussed.

Chapter 10. Conclusions and Policy Implications *(Samuel P. Korper and Ira E. Raskin)*

This final chapter summarizes the issues raised in this volume, highlights several findings, and amplifies concern about the projected demand for substance abuse services in the next 20 to 30 years. It also recommends steps that may be taken to strengthen the empirical grounding for more informed policy in addressing this demand.

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# Chapter 2. A Conceptual Model for Measuring Substance Misuse and Abuse Through the Life Cycle: The Importance of Recovery and Death Rates

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*Abstract*: Clinical reports of substance-related health problems among older adults speak to the dangers of overdose, dangerous combinations of therapeutic drugs, and misdiagnosis of drug-induced mental confusion as early dementia. Misdiagnosis of drug-induced health problems may trigger prescribing of still more drugs. To date, there are no population-based estimates of the size of this problem, but there are increasing indications that drug-related health problems will be at unprecedented levels in the baby boom generation (born from 1946 to 1964) as it begins to reach Medicare eligibility in the year 2012. Recent population estimates for Medicare beneficiaries show that in 1998, nearly 42 percent of drug expenditures were by seniors, who were only 13 percent of the population. Six years earlier, in 1992, the average number of prescriptions per elderly person (including refills) was over 19 and was projected to increase to over 38 by 2010. That would mean nearly 40 prescriptions per person, likely to include antidepressants and other psychoactive drugs. Considering the rising cost of prescription drugs, expected to triple by 2010 from current levels, a potential financial crisis lies ahead as increasing numbers of seniors require health care that they cannot afford. Methods are needed for estimating this future impact that account for drug abuse/misuse (a) incidence, (b) prevalence, (c) recovery, and (d) death throughout the life cycle.

## Introduction

The U.S. and global populations are aging. As a result, this age shift has focused attention on the coming need for health care services for older adults, particularly the generation of baby boomers born between 1946 and 1964 who are now entering their fifth decade of life. It is well known that this generation was exposed to an unprecedented array of psychoactive substances, both during the youth drug culture of the 1960s and 1970s, and subsequently to an unprecedented array of psychoactive medications available by prescription and over the counter. This trend continues in subsequent generations; psychoactive drugs are now prescribed to preschoolers at a rapidly increasing rate (Zito et al., 2000).

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There is growing evidence that this generation will have an unprecedented level of substance-related health problems in their older years (Edgell, Kunik, Molinari, Hale, & Orengo, 2000; Hanlon, Fillenbaum, Schmader, Kuchibhatla, & Horner, 2000; Rice & Duncan, 1995; Steinberg et al., 2000; U.S. Department of Health and Human Services [DHHS], 1999). Inappropriate use of medications is reported among community-dwelling older adults, nonalcohol-related use disorders are found among geropsychiatric patients, and national admissions to substance abuse treatment repeatedly show that an alcohol-plus-drug problem is the leading problem at admission. The separation between alcohol use and drug use is becoming blurred. If the expected increase in drug problems among elderly people materializes, it will mean a shift in health care services and costs because prescription drug expenditures have grown at double-digit rates every year since 1980 (Employee Benefits Research Institute [EBRI], 1999). Misuse of psychoactive medications, for example, can contribute to physical problems, including liver and heart disease. New kinds of treatment may be required to deal with complications from the many psychoactive substances now available that can compromise the health of older adults through mental confusion leading to a misdiagnosis of severe memory loss or dementia. The risk of inappropriate medication is currently quite high, according to a recent report from the National Academy of Sciences (Kohn, Corrigan, & Donaldson, 2000). The report estimates that medication error accounts for 7,000 deaths annually in the United States. These deaths are among the conservatively estimated 44,000 deaths attributable to medical errors of all kinds, ahead of auto accidents (43,458), breast cancer (42,297), and AIDS (16,516), according to data from the 1999 National Vital Statistics System (National Center for Health Statistics [NCHS], 2001). Among elderly homebound individuals, 40 percent have been found to have at least one inappropriate prescription medication (Golden et al., 1999). Among elderly outpatients in 1995, prescriptions for psychoactive medications were greatest in those over age 84 (Aparasu, Mort, & Sitzman, 1998).

By the time a baby boomer has survived to an older age, a complex history of drug use combined with new life stresses, such as the loss of a loved one and retirement, can trigger late-onset abuse of alcohol and other drugs. Distinguishing appropriate and health-enhancing drug use from debilitating overuse is difficult but essential to measure if the quality of later life is to be preserved in the baby boom and future generations.

To provide a rational basis for future health care needs and costs, some estimate of the past and future use of psychoactive drugs is necessary in order to also estimate the associated residual health disorders, both physical and mental. The key variables for predicting future problems are as follows:

- *first use of psychoactives by age,*

- *permanent recovery to appropriate use or abstinence by age* because this is one way to exit the population of current psychoactive substance users, and

- *death rate for users by age* because this is the other way to exit the population of current users.

These three variables are the basic elements in the conceptual model for estimating the future impact of psychoactive substance use on the health of older adults between now and 2030.

Because older persons have not been a consistently high national priority, and because locating and interviewing infirm or frail older adults is both expensive and intrusive, national health statistics are disproportionately based on young and middle-aged persons. It is recognized, therefore, that national statistics may carry a large estimation error for older adults. The data used here suffer from these same sampling problems but are used to begin the estimation process and to highlight the need for more accurate measures of the incidence and prevalence of substance use among older adults.

The model is designed to estimate level of use of psychoactive substances by age to the year 2030. Whether any given level of substance use constitutes "abuse" depends on operative clinical standards.

## Definitions

For the purposes of this chapter, the following definitions apply.

"Use" is operationally defined by the quantity of substance consumed, which can then be categorized as "low," "medium," or "high" according to current clinical standards.

"Permanent" recovery is ideally defined as lifetime abstinence from problematic substances. Due to the limitations of available data, retrospective reports of any prior treatment by age are used here to model lifetime recovery. Because recovery is a complex concept and subject to measurement error, to define it as abstinence from all psychoactive substances for the rest of one's life is not realistic when psychoactives are the recommended treatment for an array of medical diagnoses. Moreover, to define it as abstinence from illegal substances is not always useful because legal substances (such as alcohol, tobacco, and some medications) are the largest contributors to the Nation's substance-related problems.

"Recovery," as used here, refers to abstinence or near abstinence from substances that have previously created problems. National survey data are available describing the number of prior treatment episodes by age, and these data have been used to estimate national recovery rates. Defining recovery must take into account these four possibilities: (a) recovery is permanent, meaning lifetime, for all problematic psychoactive substances (this is the ideal); (b) recovery is short term and relapse quickly ensues; (c) recovery from one substance is replaced by use or abuse of another; and (d) recovery is counterfeit with continued drug use successfully concealed.

"Death rate" is defined as the national poisoning rate attributable to psychoactive substances (Fingerhut & Cox, 1998). This is a conservative estimate based on medical examiner, coroner, and physician opinions on the cause of death. To date, it is the only comprehensive analysis of deaths for psychoactives. It must be noted that all substances with abuse liability are psychoactive, but not all psychoactives have abuse liability. For example, it is difficult to maintain persons on antipsychotic medications due to their unpleasant side effects.

## Developing the Model

Because psychoactive substances can induce aberrant cognitive and emotional behavior, the question of which came first, the drug or the mental disorder, is important for both diagnosis and treatment. The model, however, requires no assumption about which came first because it addresses only the level of psychoactive substance use.

When psychoactive substances are used to excess, mental problems are inevitable (Figure 1). Mental confusion, perceptual distortion, even hallucination can follow directly from psychoactive substance misuse. With prolonged lifelong use and abuse, physical problems also begin, involving almost every organ of the body. The consequences of drug use, therefore, can masquerade as almost anything. Unless the drug problem is recognized and successfully treated (recovery), life will be shortened by probable accidents and accumulated health problems (early death).

When a preexisting mental disorder leads to the use of psychoactive substances, either by self-medication or medically monitored prescription, the risk of excessive use is present (Figure 2). The quality of dosage monitoring determines whether psychoactive medication has a normalizing influence (recovery) or adds substance use problems to the mental ones (early death). Anxiety is the most prevalent mental diagnosis in persons aged 55 or older, according to the 1999 Surgeon General's report on mental health (DHHS, 1999). Anxiety and depression symptoms coexist to the extent that this comorbidity is the rule and not the exception. The

potential for medication complications in persons older than 55 is raised by the many coexisting mental and physical complaints that can lead to psychoactive medication.

**Figure 1 Substance Abuse Lifeline**

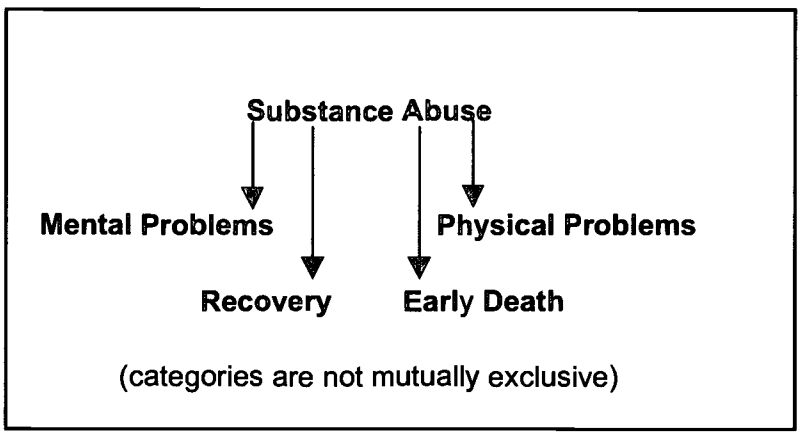
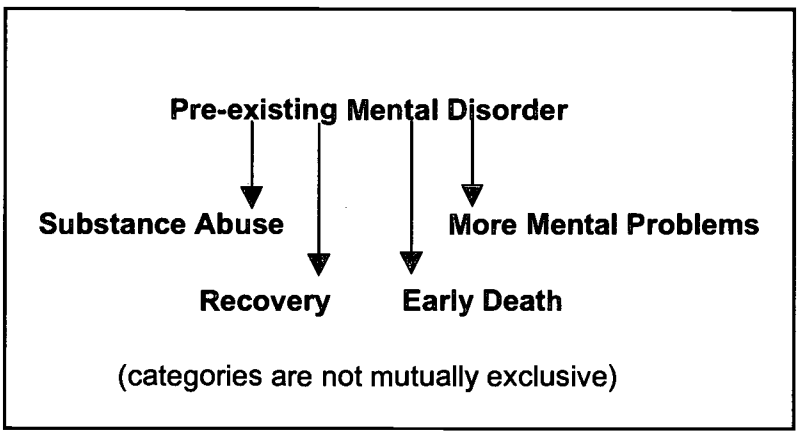
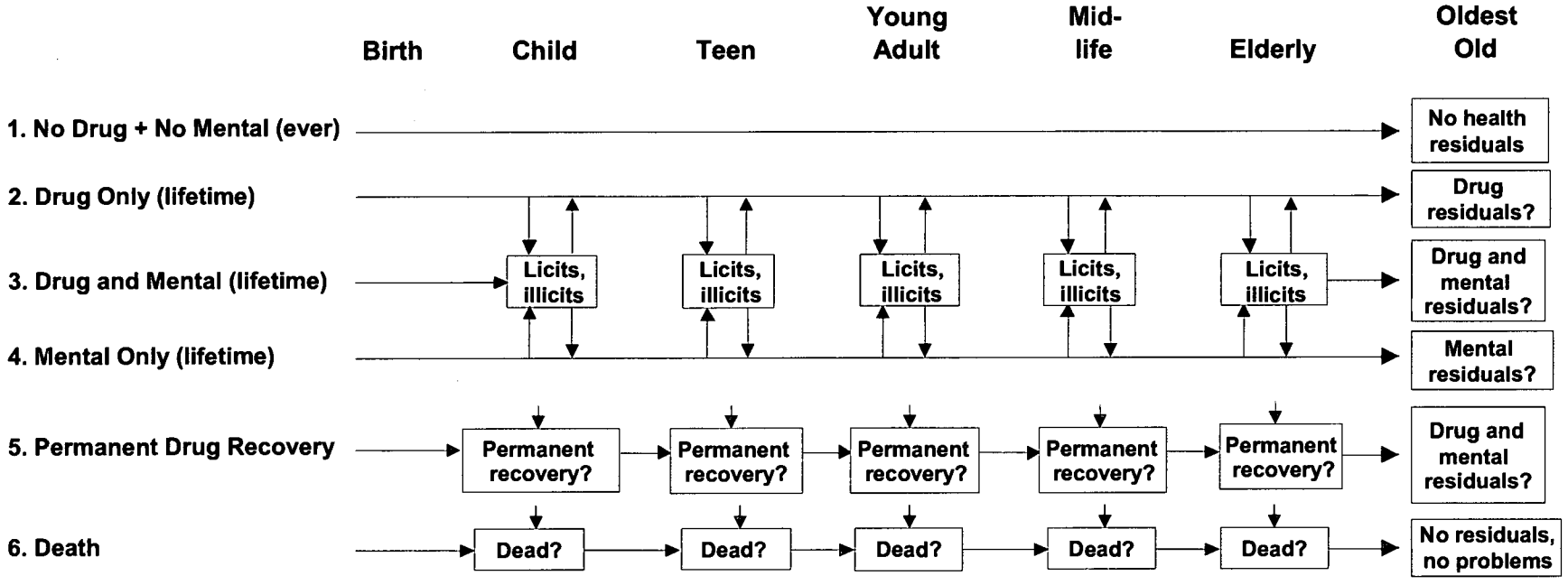



**Figure 2 Preexisting Mental Disorder Lifeline**




In order to estimate future health requirements stemming from current or past substance abuse, the model includes a measure of the residual physical problems stemming from prior use or abuse even among recovered individuals. Studies of comorbidity between substances used and chronic physical disorders are the sources for this information. A summary measure of lifelong residuals stemming from typical patterns of substance abuse is beyond the scope of this chapter, but it will be necessary as estimates are revised and refined. A cradle-to-grave picture of all possible lifelines involving drug or mental problems is shown in Figure 3.

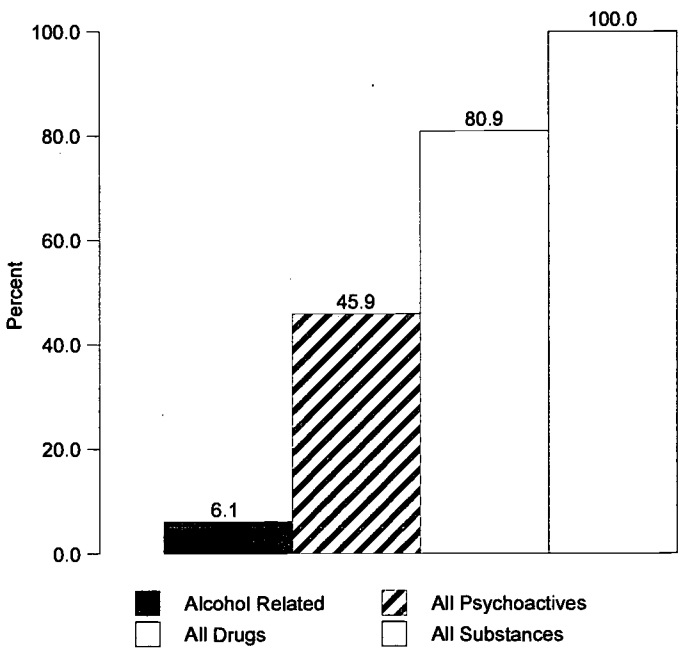
**Figure 3 Possible Lifelines Involving Drug and Mental Problems**




Note: "Abuse" is a threshold measure on one or more continuua. It is a clinical judgment.

The model accounts for those individuals who exit from the population of psychoactive drug users by recovery or death. Deaths attributed to psychoactive drugs (Figure 4) accounted for 46 percent of poisoning deaths in 1995, considerably more than half of all poisonings in the year. This makes psychoactives a significant predictor of the death rate. Considering that national surveys of older adults must rely on living survivors, the impact of substance use in prior years may be greatly underestimated by retrospective data.

**Figure 4 Percentage of All Reported Poisoning Deaths Using Death Certificate ICD-9 E-Codes**




Source: Fingerhut and Cox (1998).

To separate psychoactive substances from other poisoning agents, all death certificate International Classification of Disease codes - 9th revision (Central Office on ICD-9-CM, 1997) pertaining to psychoactives were identified and grouped from those listed in a report on 1995 poisoning deaths (Fingerhut & Cox, 1998). These ICD-9 codes are shown in Table 1.

Recovery rates are another predictor of future health status and substance use. A pattern of repetitive recovery and relapse is not considered a significant predictor of health in the older years, but permanent lifelong recovery should have a strong positive influence on later health. Unpublished data from the Alcohol and Drug Services Study (ADSS) show that 50 percent or more of those treated for substance abuse reported no prior treatment. Of those with no prior treatment, about half required repeated treatment within the following 5 years. The age-specific percentages from the ADSS can be used in the model as a first approximation of recovery rate

across ages from 10 years to 84 years. The number of persons in treatment drops starting about age 40 to 45, and estimates of recovery rate are more accurate below this age.

**Table 1 ICD-9 Codes, by Category**

| | ICD-9 codes | | | |
|---|---|---|---|---|
| Category | Alcohol Related | All Psychoactives | All Drugs | All Substances |
| Unintentional | E860 | E850.0, E851-E855, | E850-E858 | E850-E858, E860-E866, E867-E869 |
| Nondependent Abuse | 305 | 305.0, 305.1-305.9 | 305.0, 305.1-305.9 | 305.0-305.9 |
| Suicide | - | E950.0-E950.3 | E950.0-E950.5 | E950.0-E950.9, E951-E952 |
| Homicide | - | - | E962.0 | E962.0-E962.2 |
| Undetermined | - | E890.0, E890.3 | E980.0-E980.5 | E980.0-E980.9 |

Source: Fingerhut and Cox (1998).

The model assumes that the first significant use of a drug at any age continues until recovery or death. Temporary periods of abstinence followed by relapse are considered continued use by the model. Incidence rates for major substances of abuse are available from the National Household Survey on Drug Abuse (NHSDA), but that sample is not adequate to cover incidence at older ages (Office of Applied Studies [OAS], 2000). Nevertheless, the incidence rates at younger ages can be used in the model, which assumes that use continues until recovery or death. Because one person will use more than one drug, a measure of overlap among drugs is needed in the model.

A complication of measuring substance use prevalence is the problem of multiple use, what in the model is called "overlap." One person may use four or five psychoactive substances, such as alcohol, marijuana, cigarettes, over-the-counter diet pills, and prescribed antianxiety drugs. A national estimate of the average overlap among drugs by age is needed for the model. The Treatment Episode Data Set (TEDS), which tracks national admissions to treatment by substance, provides enough information about multiple substance use to begin to measure overlap. The overlap between alcohol and drugs is reported annually in this dataset, and further analysis may provide an estimate of overlap among alcohol, sedatives, stimulants, tranquilizers, and hallucinogens. TEDS captures illicit and licit substance use once it has become a problem requiring treatment. Knowing the extent of "use" of each substance by individuals at every age would improve the accuracy of the model in estimating future health requirements.

## Conceptual Model

The conceptual model is as follows:

*Users* = (*Cumulative incidence* ÷ *Overlap*) - *Deaths* - *Permanent recoveries*,

where

*Users* are users of any psychoactive category at a given age,

*Cumulative incidence* is the cumulative incidence for each psychoactive category to the age,

*Overlap* is the estimated number of categories used per person at the age,

*Deaths* are the cumulative number of deaths among psychoactive users at the age, and

*Permanent recoveries* are the cumulative number of total or near abstainers among former users at the age.

The definition of misuse and abuse is not constant but changes with time, depending on current clinical judgment, the law, and national data standards. At any given time, the current standard is applied to the national population at a given age as follows:

*Misusers* = *Users* × *Age-specific rate of problem use.*

For older adults, the term "misuse" is preferred to the term "abuse" because problems with recommended and legal medications predominate among older adults.

If the necessary population-based longitudinal data were available, the following formula could be applied:

$$Y_i = \beta_0 + \frac{\beta_1 X'_{1i}}{\beta_2 X'_{2i}} - \beta_3 X'_{3i} - \beta_4 X'_{4i} + e_i,$$

where

$Y_i$ = users of any (psychoactives) at age $i$,

$X'_{1i}$ = cumulative incidence of use (each psychoactive category),

$X'_{2i}$ = average number of categories per person,

$X'_{3i}$ = cumulative deaths for users of any psychoactive,

$X'_{4i}$ = cumulative living recoverers by age $i$, and

$e_i$ = error term.

Because the lifelong rate of change (slope) for incidence may be significantly different from the lifelong rate of change in number of categories per person, the formula does not conceptually reduce to a linear regression.

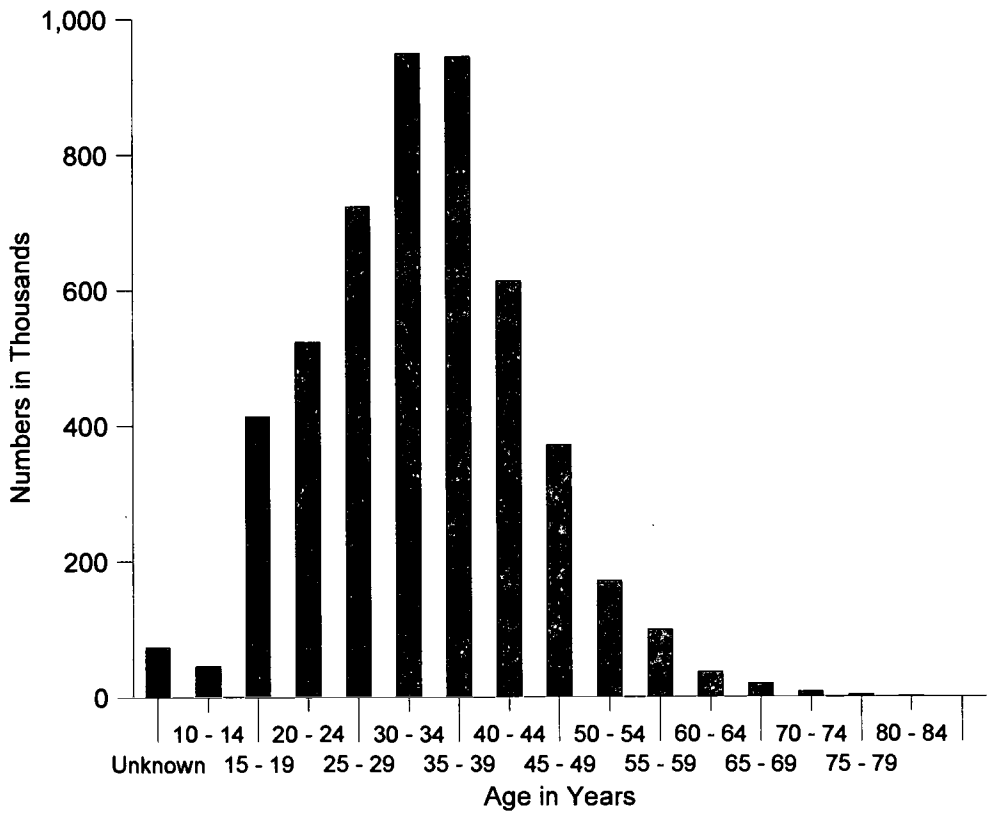
This is the conceptual model in search of numbers. As a first attempt, national datasets have been selected that offer crude estimates of the concepts involved. The critical review of this first attempt, it is hoped, will be the stimulus for improvements in both data selection and data collection.

## Data Quality for Older Adults

### Recovery Rate Estimating

Persons in substance abuse treatment have, by definition, encountered problems due to substance use, and their history of prior treatment can give a picture of recovery status by age. Error is introduced to the estimate of recovery rate to the degree that persons referred to treatment are unable to obtain it, also known as the "treatment gap." The data used to estimate recovery in this chapter came from the ADSS, which is not yet published and is based on a nationally representative sample of treatment programs. The age distribution of the ADSS sample shows the treatment rate increasing until about 40 years old and then declining rapidly (Figure 5). In contrast, the distribution of any prior treatment by age is flatter, with the rate rising slightly to age 40 and then holding steady until age 60. The rates of prior treatment in age groups above 60 cannot be considered reliable as they are based on too small a sample (e.g., the 100 percent rate in the 80 to 84 age group is based on one person).

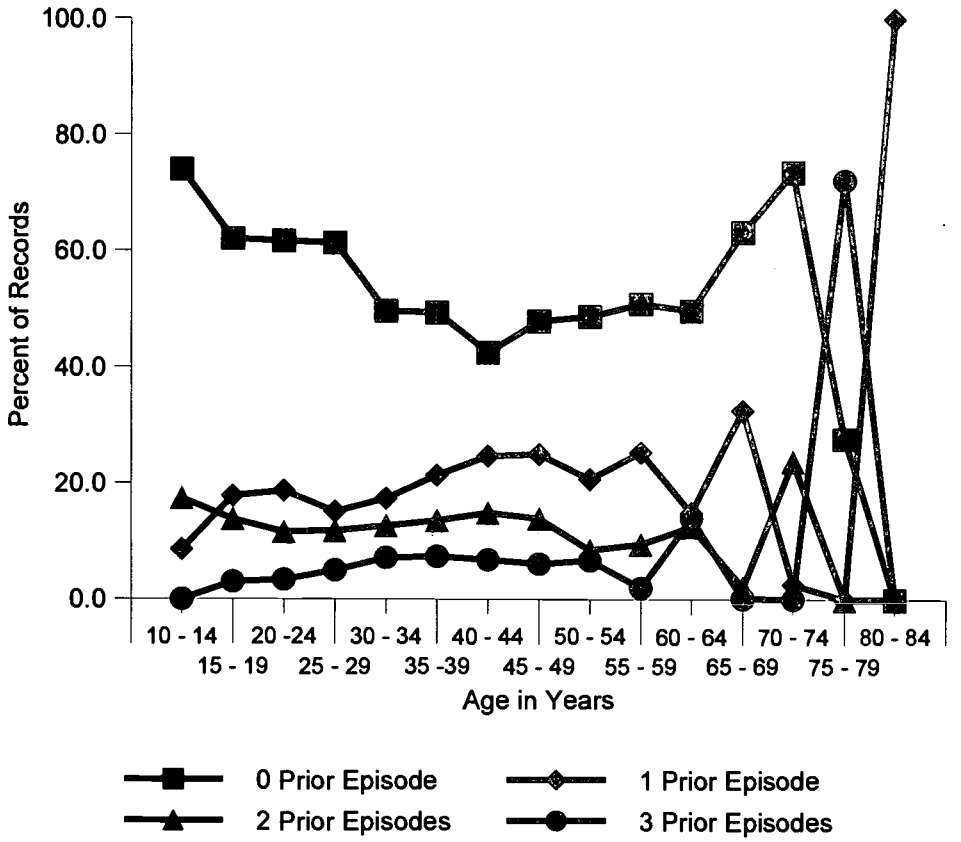
**Figure 5 ADSS Sample Distribution, by Age (Unweighted Data)**




Source: OAS, unpublished data from ADSS.

For persons up to age 65 (above this age the samples are too small to give meaningful results), the rates of prior treatment are remarkably stable by age (Figure 6). Between 40 and 60 percent are entering treatment for the first time (i.e., zero prior treatment episodes) over the entire age range up to age 65. About 20 percent have had one prior treatment episode. About 10 percent have had two prior episodes, and 5 percent have had three prior episodes. This means that of the approximately 50 percent in treatment for the first time, half do not return. Of those in treatment for the second time, half again do not return. And so on, until a small number of individuals remain who are treated more than three times. Are all those who do not return to treatment permanently recovered? If so, the permanent recovery rate is about 87 percent for the treated population over the life span. More likely, those who do not return are recovered, or dead, or maintaining a drug problem without treatment. Until more detailed research is done on the lifetime use of psychoactive substances, it is impossible to know whether substance abuse problems are maintained, reappear, or appear for the first time at these older ages. The literature suggests that all of these occur.

**Figure 6 Prior Treatment, by Age (ADSS Weighted Data)**



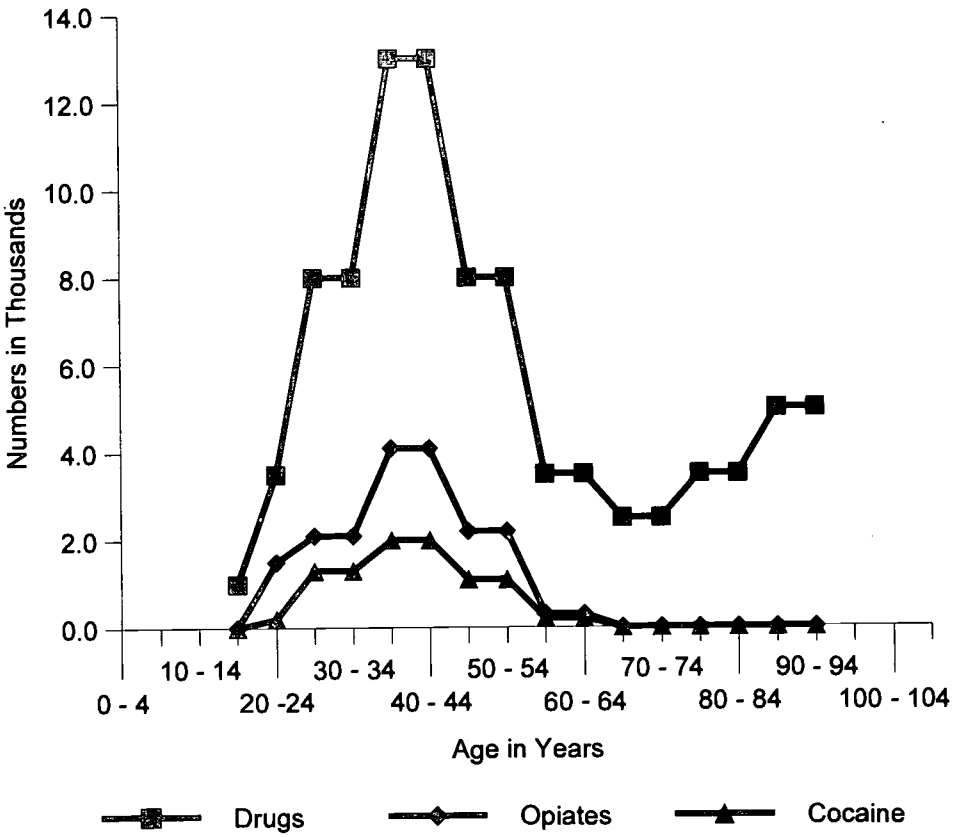

Source: OAS, unpublished data from ADSS.

## Death Rate Estimation

The sample for the death rate information is the U.S. population, excluding territories and protectorates. Death certificates (completed by physicians, medical examiners, or coroners) are the source of national information on cause of death. The information is forwarded to the NCHS by the 50 States and the District of Columbia. Since 1979, the cause of death has been coded according to ICD-9 codes, which show that in 1995 poisoning was the third leading cause of death (18,549 persons) after motor vehicle-traffic and firearm causes (Fingerhut & Cox, 1998). Of these deaths by poisoning, 81 percent were due to drugs and 46 percent to psychoactive substances.

Fingerhut and Cox (1998) separated out the codes for death by opiates and cocaine from the overall death-by-drug codes. As shown in Figure 7, the distribution of deaths by drugs across age shows a similar pattern whether for all drugs, opiates, or cocaine. The highest death rates occurred between the ages of 35 and 45. Because these distributions are similar in shape, the

**Figure 7 Deaths per 100,000 by Poisoning, 1995**




Source: Fingerhut and Cox (1998).

model will calculate deaths due to psychoactives as 56.7 percent of the deaths due to all drugs (45.9 to 80.9 percent; Figure 4).

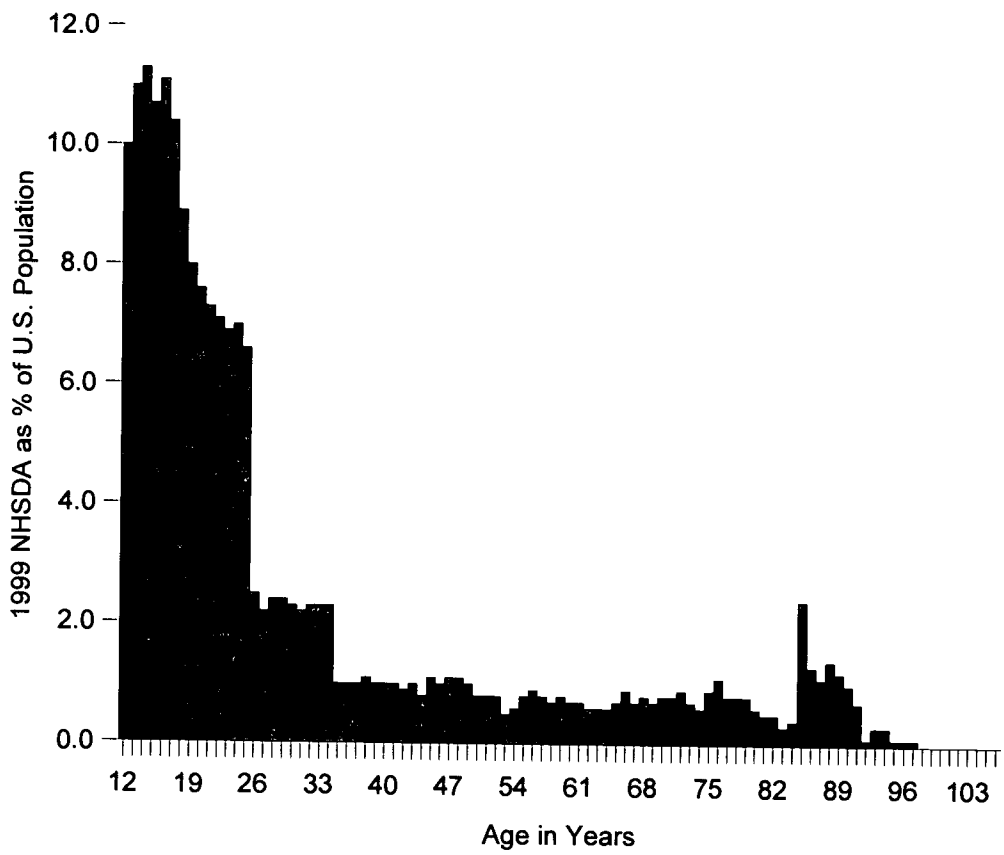
## Overlap Estimation

The incidence of drug use by age is reported by the NHSDA as "year of first use" for marijuana, cocaine/crack, inhalants, hallucinogens, heroin, other illicit, alcohol, cigarettes, and any "nonmedical" use of psychotherapeutics, including pain relievers, tranquilizers, stimulants, and sedatives. Medical use and substance combinations are not reported, although overlap might be estimated by a special analysis of the data. The category of "psychotherapeutics" omits substances that are psychoactive but medically used for other purposes (e.g., beta-blockers prescribed for cardiovascular problems). The overall medical use of psychoactive drugs among elderly people does not appear to be measured by any Federal national dataset. Medicare's source of information about prescription drugs derives from the Medicare Current Beneficiary Survey begun in 1992 that asks about prescription drugs. The NHSDA sample, as with many other

national datasets, is biased toward younger persons (Figure 8), which is consistent with its focus on incidence and prevalence of illicit drug use. When distributed across the age range of interest, 0 to 105 years, the NHSDA has a high proportion of 12 to 26 year olds but drops dramatically for those in the age range older than 35. The NHSDA would be an ideal source of numbers to fill in the model if it covered all psychoactive substances, measured lifetime recovery rates, were adjusted for death rates by users and better represented older adults. This is a tall order for a survey focused on illicit drugs.

TEDS reports on psychoactives used by those admitted to publicly funded treatment. The strengths and weaknesses of TEDS, as well as its significant findings, are described elsewhere in this report (see Henderson's chapter). TEDS omits antidepressants and antipsychotic categories from its catalogue of substances, but does report on stimulants (includes crack, cocaine), opiates, sedatives, tranquilizers, hallucinogens, inhalants, alcohol, and over-the-counter drugs. TEDS measures national admissions to publicly funded substance abuse treatment as reported by States,

**Figure 8 1999 NHSDA as a Percentage of the U.S. Population**

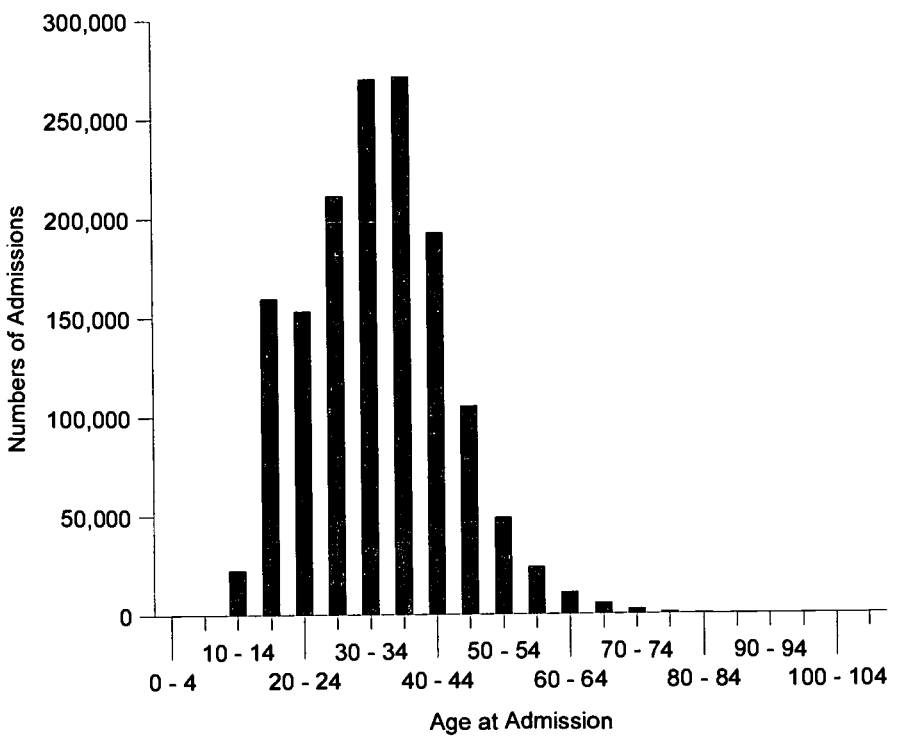



Sources: U.S. Bureau of the Census' 1999 U.S. population middle estimate and 1999 NHSDA special analysis runs.

territories, and the District of Columbia. Because a person can enter treatment more than once in a given year, TEDS provides a count of admissions, not people.

There were 1,479,203 admissions to treatment in 1997. The age distribution ranged from age 10 to persons older than 90, and the rate of admissions declined after age 40 (Figure 9). Whether this decline represents an actual decrease in the need for treatment or failure to recognize the need for treatment in older adults is not known. Elsewhere in this report, Henderson points out that referrals by health care professionals proportionately increase with age and that admissions for more than one substance problem increase between ages 70 and 75. The numbers are small at these older ages, and Henderson cautions against overinterpretation of these data. Studies are needed that give accurate and detailed estimates of the number of persons with psychoactive substance use problems alone and in combination at these older ages. Whether older persons will appear in publicly funded treatment depends on a variety of factors discussed in the Henderson chapter.

**Figure 9 Total Number of TEDS Admissions, 1997**

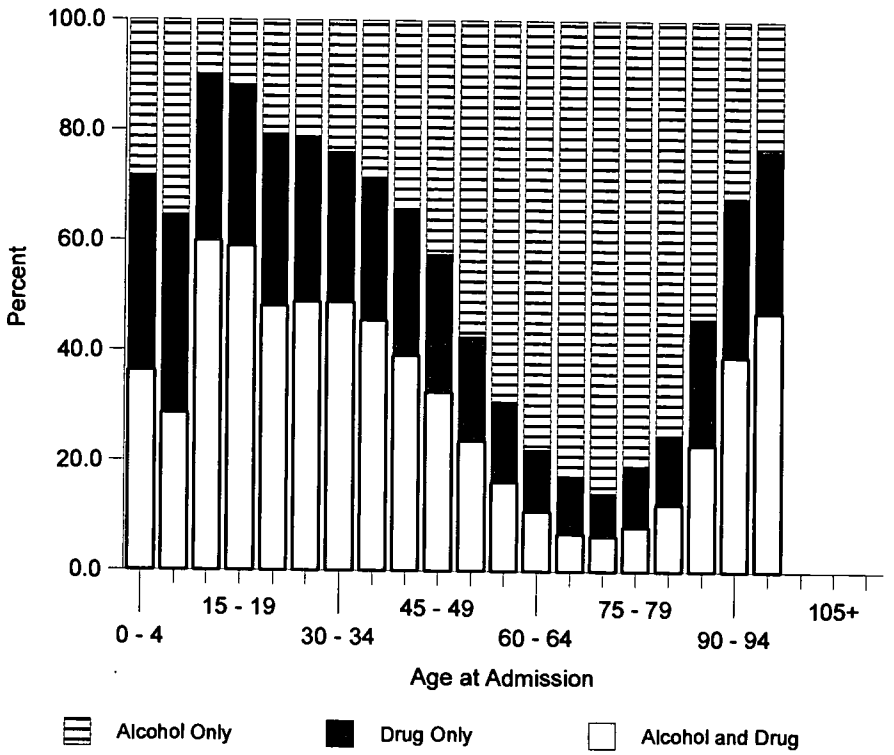



Note: There were 1,479,203 admissions to treatment in 1997.

Source: OAS (1999).

TEDS routinely reports the degree of overlap between nonalcoholic psychoactive drugs (excluding antidepressants and antipsychotics) and alcohol. Figure 10 shows the increase in use of only alcohol up to age 70, followed by a rapid increase in the use of alcohol and another drug. Whether this pattern reflects increased reliance on prescription medication is not now known. Overall, the overlap factor appears to change significantly over the life span.

**Figure 10 TEDS Alcohol and Drug Overlap, 1997**




Note: There were 1,479,203 admissions to treatment in 1997.

Source: OAS (1999).

## Conclusions

The conceptual model described here can project the number of users and abusers into future years, provided the numbers can be found to fill the formula. Unless death rates and permanent recovery rates are estimated at several points in the life span, projections will continue to misrepresent the size of the problem.

Rough approximations are available for all the elements in the model with the exception of "drug overlap" (the combined use of the full range of psychoactive substances). The weakness

is primarily due to missing information about the use of prescription (licit) psychoactive drugs that are increasing in number and popularity. Elsewhere in this report, Henderson begins to document the degree of drug overlap seen in admissions to substance abuse treatment.

The accuracy of estimates of recovery rate depends on accurate identification of substance abuse problems. In this model, admission to substance abuse treatment is used as a proxy for drug use having reached the level of a problem. This proxy is useful only to the extent that persons needing treatment are admitted to treatment. To the extent that persons waiting for treatment are unable to obtain it, their potential recoveries will be missing from the denominator and the rate estimates will be flawed.

The model describes the elements necessary to attempt an estimate of the number of older adults with substance misuse problems in the out years. Data to fill in the model are not yet completely available, but interest in the risks of prescription drugs is growing along with a demand for relevant data. This conceptual model highlights the specific missing data necessary to accurately estimate the substance-related health problems of the Nation's future elderly population.

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# Chapter 3. Drug Use Careers: Recovery and Mortality

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*Abstract*: Although long-term follow-up studies of substance-using individuals provide direct measurement of recovery and mortality, few in the literature report age-specific recovery and mortality rates. This chapter examines these parameters based on data from two studies. The California 33-year Follow-up Study of 581 heroin addicts showed a 49 percent overall mortality rate, with rates increasing with age from about 33 percent for those in the 45- to 49-year age category to 76 percent or higher among those older than 65. Rates of permanent recovery (i.e., abstinent for 5 years or more) also appeared to increase from 36 percent for those in the 45- to 49-year age category to about 50 percent for older ages, but there was no continuing increase of recovery after age 50. The Study of High-risk Samples (i.e., patients from emergency rooms and sexually transmitted disease clinics, recent arrestees) showed that baby boomers generally reported greater levels of illicit drug use but comparable levels of use of medications. The relationship between age and the drug use progression or recovery process appears to differ depending on the type of drug used. Future studies need to include women and to improve sampling of the elderly.

## Introduction

The purpose of this chapter is to provide direct measurement of recovery and mortality in the drug use careers of two special populations: (a) male opiate users and (b) drug users identified at high-risk sites (emergency rooms [ERs], sexually transmitted disease [STD] clinics, and jails). The male opiate users have been followed longitudinally in a California 33-year Follow-up Study (Hser, Hoffman, Grella, & Anglin, 2001). The samples in the newer Study of High-risk Samples include users of various types of drugs, but have been followed for only 3 years so far (Hser, Boyle, & Anglin, 1998). These data provide the basis for an understanding of the longitudinal changes in drug use as drug users age, with a particular focus on mortality and recovery rates and the baby boom generation (i.e., those born between 1946 and 1964).

Direct population-based measures of drug use recovery rates and mortality rates are unavailable. This chapter summarizes estimates from the two previously mentioned studies and from those published based on long-term follow-up studies of drug users from both treated and nontreated samples. Each of these studies was designed to address specific issues, and their samples are often considered special populations that may be limited in sample size and

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representation (demographics, geographical location, etc.). Nevertheless, the studies provide longitudinal estimates of recovery and mortality rates associated with drug use, which are critically needed for projecting future health care needs among populations in need as they age.

This chapter first reviews existing longitudinal studies that provide estimates of recovery and mortality rates among substance abusers. Then recovery and mortality rates are reported based on a 33-year follow-up of heroin users, as well as rates of drug use and changes (e.g., relapse and quitting) over three annual assessment points among a high-risk sample of drug users recruited from nontreatment sources.

## Background: Mortality and Recovery Rates

Several long-term follow-up studies of substance abusers have been conducted in the United States. For the specific purpose of this chapter, the most representative studies published in the past 5 to 6 years are reviewed (i.e., those with relatively large sample sizes and follow-up periods of 3 years or longer). Studies that are follow-ups of treatment samples are differentiated from those that are not because recovery and mortality rates may be influenced by the treatment intervention. Sample characteristics and findings on recovery and mortality rates of these studies are summarized in Table 1.

### Treatment Sample

*SROS 5-year follow-up of a national treatment sample.* The Services Research Outcomes Study (Office of Applied Studies [OAS], 1998) reported a mortality rate of 9.1 percent (277 deaths among a targeted sample of 3,047) over 5 years posttreatment. The study was based on a national probability sample of 99 treatment programs and 3,047 patients discharged from these programs in 1989 and 1990. Treatment program modalities were hospital inpatient, residential, outpatient methadone (including detoxification and maintenance), and outpatient nonmethadone programs. The study conducted record abstraction of these patients during 1994 and follow-up interviews during 1995-96. The ages of the patients ranged from 15 to 60 years at treatment discharge in 1991. Based on a fairly small number of deaths, 277, when compared with the number of deaths in the total population over 5 years, these substance abusers had estimated mortality rates that were 7.3 times the general population of similar age, gender, and race; the death rate was 8 times for white males, 18 times of that for white females, 5 times for black males, and 7 times for black females.

**Table 1 Sample Characteristics and Mortality and Recovery Rates of Studies of Alcohol- and Drug-Abusing Populations**

| Study Name | Geographic Coverage | Sample Size (Total/Follow-Up)[1] | Age Range[2] | Gender (Male/ Female) | Ethnicity (White/Black/Other) | Years of Follow-Up | Recovery[3] | Mortality |
|---|---|---|---|---|---|---|---|---|
| **Treatment Sample** | | | | | | | | |
| SROS | National | 3,047 / 1,799 | 15 - 60 | 71 / 29 | 60 / 28 / 12 | 5 | 21% | 9% |
| DATOS | National | 2,147 / 1,042 | 21 - 74 | 63 / 37 | 42 / 46 / 12 | 5 | 18% | 6% |
| Moos' VA Study | National | 21,139 / N/A | 55 - 75+ | 99 / 1 | 83 / 13 / 4 | 4 | N/A | 24% |
| **Nontreatment Sample** | | | | | | | | |
| Vaillant's Study | Local | 55 / 52 | 47 | 100 / 0 | 100 / 0 / 0 | 13 | 11% | 18% |
| | | 150 / 129 | 47 | 100 / 0 | 100 / 0 / 0 | 13 | 30% | 28% |
| California 33-year Follow-up Study[4] | California | 581 / 242 | 18 - 45 | 100 / 0 | 37 / 7 / 56 | 33 | 47% | 49% |

N/A: Not applicable; DATOS: Drug Abuse Treatment Outcome Studies; SROS: Service Research Outcome Study.

[1] Total sample size was the denominator for the mortality rate, and the follow-up sample size was the denominator for calculating the recovery rate.

[2] Ages refer to those at the baseline of the follow-up study.

[3] "Recovery" is defined as abstinent for 5 years or more at the time of final assessment and was based on the follow-up sample; one exception is Vaillant's study, which reported 3-year abstinence rates for those aged 60 or older.

[4] Although the original sample was recruited from a compulsory treatment program for criminal offenders, we consider this a nontreatment sample because data reported in this chapter are mostly based on the long-term follow-up that was conducted more than 33 years post the original program admission.

Self-reported data on drug use from 1,799 patients who completed the follow-up interview indicated that those using any illicit drug decreased from 75 percent before treatment to 59 percent 5 years after treatment, which was a statistically significant difference of minus 16 points, or a 21 percent recovery rate.

*DATOS 5-year follow-up of a community treatment sample.* The Drug Abuse Treatment Outcome Studies (DATOS) reported a 6.0 percent mortality rate (based on 128 deaths among the 2,147 targeted sample) over 5 years posttreatment (Hubbard, Craddock, & Anderson, 2001). The original sample was recruited from 1991 to 1993 at DATOS treatment admission to 96 programs, which involved short-term inpatient, long-term residential, methadone maintenance, and outpatient drug-free programs. The mean age at treatment admission was 32.6 years (standard deviation [*SD*] = 7.6); at the 5-year follow-up interview, the mean age was 40.0 (*SD* = 7.7).

Patterns of abstinence and relapse ($N = 1,042$) at the 5-year follow-up were as follows: Approximately 18 percent had been abstinent without relapse, 14 percent relapsed once and then stopped use, 27 percent relapsed and never stopped using, and 41 percent relapsed, stopped use, and relapsed again. About 32 percent reentered treatment after DATOS discharge (Hser, Grella, Shen, & Anglin, 2000). Additionally, at the 5-year follow-up interview, 66.4 percent were not using marijuana, 64.5 percent were not using cocaine, and 77.6 percent were not using heroin (compared with the respective rates of 47.5, 30.6, and 59.2 percent during the year before treatment).

*Moos et al.'s VA study.* A mortality rate of 24 percent (2.64 times higher than expected) was reported among late-middle-aged and older (55+) substance abuse inpatients ($N = 21,139$) in Department of Veterans Affairs (VA) Medical Centers who were followed for 4 years after receiving inpatient care (Moos, Brennan, & Mertens, 1994). The study was based on VA records of patients who were diagnosed with substance abuse disorder and were discharged from VA inpatient programs during a 1-year period (October 1, 1986, to September 30, 1987). Age-specific mortality rates were as follows: 21.3 percent for those aged 55 to 64 years, 29.4 percent for those aged 65 to 74 years, and 45.4 percent for those aged 75 or older.

**Nontreatment Sample**

*Vaillant's follow-up study of alcohol abusers.* A prospective study of the alcohol use of two samples of men (268 college students, 456 city adolescents) has been conducted since 1940 and followed up for 50 years (Vaillant, 1996). By age 70 years, 52 (21 percent) of the 249 college men who remained in the study at age 47 years had met the DSM-III criteria for alcohol abuse (as had 3 of the 13 who dropped out of the study); at some point, 21 of the 55 men (38 percent) also

met the criteria for dependence.[1] By age 60 years, 150 of the 433 city men (35 percent) who remained in the study at age 47 years and whose alcohol abuse status was known had met the DSM-III criteria for alcohol abuse. At some point, 77 (51 percent) of the city alcohol abusers also met the criteria for alcohol dependence. The average age at onset of alcohol abuse for the 51 college men was 40.2 (*SD*=9.9) years; for the city men, it was 29.2 (SD=9.5) years.

By 60 years of age, 18 percent of the college alcohol abusers had died, 11 percent were abstinent, 11 percent were controlled drinkers, and 59 percent were known to be still abusing alcohol. By 60 years of age, 28 percent of the city alcohol abusers had died, 30 percent were abstinent, 11 percent were controlled drinkers, and only 28 percent were known to be still abusing alcohol. Vaillant (1996) concluded that after abstinence had been maintained for 5 years, relapse was rare. In contrast, return to controlled drinking without eventual relapse was unlikely.

*California 33-year Follow-up Study.* The sample of Californian heroin users who were followed for 33 years consisted of 581 male narcotics/opiate addicts admitted to the California Civil Addict Program (CAP) from 1962 through 1964. Although the original sample was recruited from CAP, the sample is considered a nontreatment sample because data reported in this chapter are mostly based on the long-term follow-up conducted more than 33 years after the original program admission. Mean age at admission was 25.4 years. Three face-to-face interviews were conducted with the sample every 10 years over 33 years (Hser et al., 2001).

At the first follow-up study in 1974-75, 13.8 percent of the original 581 sample had died. The average age of the 439 living addicts interviewed at that time was 36.8 years. Urine tests revealed that 37.8 percent of the interviewed sample showed no opiate use, although they could have been using other drugs. At the second follow-up study in 1985-86, 27.7 percent of the original 581 sample had died, and the average age of the 354 interviewed was 47.6. Urinalysis revealed that 41.0 percent of those interviewed tested negative for opiates. At the latest, or third follow-up study in 1996-97, close to half (48.9 percent) of the original sample had died. The average age of the 242 who were interviewed was 57.4, and 55.8 percent of them tested negative for opiates.

Among the 284 confirmed deaths, the most common cause of death (21.6 percent) was accidental poisoning (ICD-9 code 850.0)[2] or drug overdose. A total of 45 subjects' death certificates specified overdose due to heroin, and 16 were due to use of other drugs. The next

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[1]Criteria for alcohol abuse and dependence are defined in the 3rd edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-III) published by the American Psychiatric Association (APA, 1987).

[2]Based on the *International Classification of Diseases, Ninth Revision* (ICD-9) (National Center for Health Statistics [NCHS], 2001).

most common causes of death were chronic liver disease (15.2 percent), cancer (11.7 percent), and cardiovascular diseases (11.7 percent). Other deaths included homicide (8.2 percent), accidents (8.5 percent), or suicide (2.8 percent).

Among the 242 subjects interviewed in 1996-97, 46.7 percent reported continuous abstinence from heroin use in the past 5 or more years. Their long-term heroin abstinence was associated with less criminality, morbidity, psychological distress, and higher employment.

Although the literature is limited, the brief review presented here provides a broad picture of mortality and recovery rates among alcohol abusers or illicit drug users. However, few of these studies provide these parameters by specific age categories, which will be needed if projection into the future is desired. The following sections examine age-specific mortality and recovery rates in two studies—the California 33-year Follow-up Study of a sample of heroin users and the Study of High-risk Samples.

## California 33-year Follow-up Study

### Study Design

As noted earlier, the California 33-year Follow-up Study was a prospective longitudinal study of 581 male narcotics addicts admitted to CAP from 1962 through 1964. Established in 1961 by California legislation, CAP was a compulsory drug treatment program for narcotics-dependent criminal offenders committed under court order. The program consisted of an inpatient period followed by supervised community aftercare. Patients could be returned for further inpatient stays if there was evidence of relapse to addiction or other behaviors that violated conditions of aftercare. This program offered the only major publicly funded treatment to California addicts during the 1960s; during the 1970s, methadone maintenance became commonly available. The sample, selected from the 1962 through 1964 admission records, was first interviewed in 1974-75 as part of an evaluation of CAP (McGlothlin, Anglin, & Wilson, 1977). A second follow-up of this sample was conducted in 1985-86 (Hser, Anglin, & Powers, 1993), and a third in 1996-97 (Hser et al., 2001).

### Sample

The sample of 581 heroin users was limited to male subjects because of the small number of female commitments to CAP. The sample consisted of white (36.5 percent), Hispanic (55.6 percent), and African-American (7.9 percent) addicts. Before age 18, more than 80 percent of the sample had been arrested, and 80 percent had tried marijuana. More than 60 percent of the

sample started using narcotics before age 20. Mean age at admission in 1962-64 was 25.4 years (*SD*=3.9). The mean age of the 242 subjects interviewed in 1996-97 was 57.4 years (*SD*=4.0). The 1996-97 study had a 96 percent location rate (242 interviewed, 31 refused or were too mentally dysfunctional to be interviewed, and 284 were confirmed to be dead), with 24 subjects lost to follow-up.

**Interview Procedure**

The three face-to-face interviews conducted at 10-year intervals collected information on patterns of drug use and related activities. The interview protocol was adapted from Nurco, Bonito, Lerner, and Balter (1975) and was designed to obtain information on subjects' demographic characteristics, family history, drug use history, employment, and criminal behavior, as well as information on their legal status history (incarcerated, under legal supervision but not incarcerated, and unsupervised). Subjects were aware that the interviewer already knew their official history of criminal activity and legal status from information obtained independently from California criminal justice system records and could therefore verify the subjects' self-reports of criminal activity and legal status. Subjects gave informed consent for study participation and were given written assurances of confidentiality prior to the interview. Multiple measures were retrospectively recalled in a chronological sequence that covered, across three interviews, from 1 year prior to their first narcotics use to the time of the 1996-97 interview. The average interview at each follow-up point required between 2 and 3 hours to administer. At the end of each interview, a urine specimen was collected from those subjects who were not incarcerated. All participation, including the furnishing of urine samples, was voluntary.

The rates of congruence between self-reported current opiate use and urinalysis among those who provided a urine specimen was 73.7 percent at the first interview, 85.8 percent at the second interview, and 90.2 percent at the third interview. The reliability of the instrument has been examined and reported elsewhere (Anglin, Hser, & Chou, 1993; Hser, Anglin, & Chou, 1992).

**Results**

Rates of mortality and recovery (i.e., abstinent from heroin for 5 years or more) were calculated by 5-year age categories constructed from the age of the subjects (alive or dead) in 1992 (see Figure 1). This year was selected so as to enable comparisons across the chapters included in this monograph. As expected, rates of death increased steadily as a function of the ages of the respondents (see Table 2). Permanent recovery also appeared to increase from 36.5

**Figure 1 California 33-year Follow-up Study Sample Distribution, by Age, in 1992**

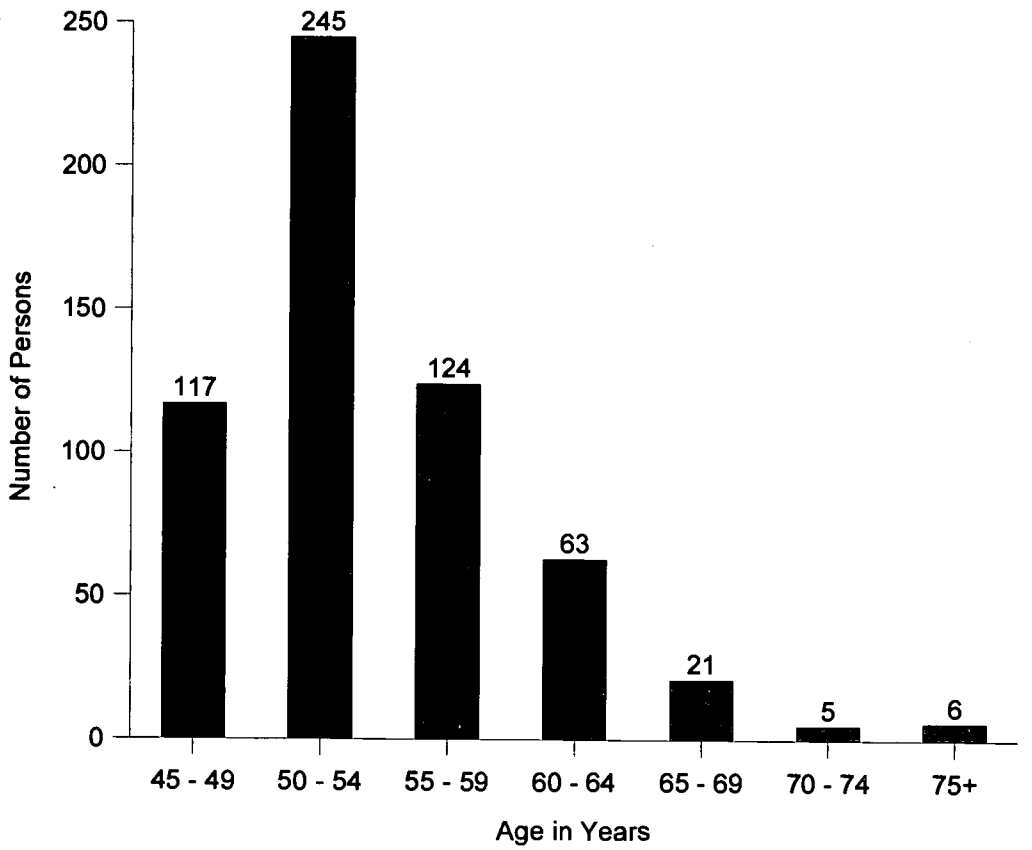



**Table 2 Mortality and Recovery Rates, by Age Group, in the California 33-year Follow-up Study Sample**

| Age Category in 1992 | Number of Subjects ($N = 581$) | Deaths by 1997 (%) | Number of Subjects Interviewed in 1997 ($N = 242$) | Abstinent for 5 Years or More (%) |
|---|---|---|---|---|
| 45 to 49 | 117 | 33.3 | 63 | 36.5 |
| 50 to 54 | 245 | 41.2 | 117 | 49.6 |
| 55 to 59 | 124 | 50.0 | 47 | 53.2 |
| 60 to 64 | 63 | 74.6 | 12 | 41.7 |
| 65 to 69 | 21 | 76.2 | 2 | 50.0 |
| 70 to 74 | 5 | 80.0 | 1 | 100.0 |
| 75 or Older | 6 | 100.0 | 0 | -- |

percent at the age category of 45 to 49 years to about 50 percent at older ages, but there did not appear to be a continuing increase of recovery after age 50. (Unfortunately, partly because of the high mortality rates, the numbers of subjects at the age categories of 60 years or older were too small to support reliable estimates of recovery.)

## Study of High-risk Samples

### Study Design

The Study of High-risk Samples was also a prospective longitudinal study, similar to the California 33-year Follow-up Study, but it examined other drug use as well as opiate use among an expanded range of high-risk populations (Hser et al., 1998; Hser, Maglione, & Boyle, 1999). In 1992-94, more than 5,000 individuals were interviewed and screened in ERs, STD clinics, and jails in Los Angeles County (Hser et al., 1998). Annual follow-up interviews were conducted with successively smaller (randomly selected) subsets of the original sample (i.e., approximately 900 drug users at Follow-up 1, 500 at Follow-up 2, and 300 at Follow-up 3). The criterion for inclusion of young adults aged 18 to 25 years in the follow-up was use of any illegal drug in the past year or a history of ever being dependent on an illegal drug. For subjects 26 years or older, the criterion was past year use of an illegal drug other than marijuana or a history of ever being dependent on an illegal drug. These selection criteria allowed oversampling of young adults, many of whom were still in an early stage of a drug use career.

### Subjects

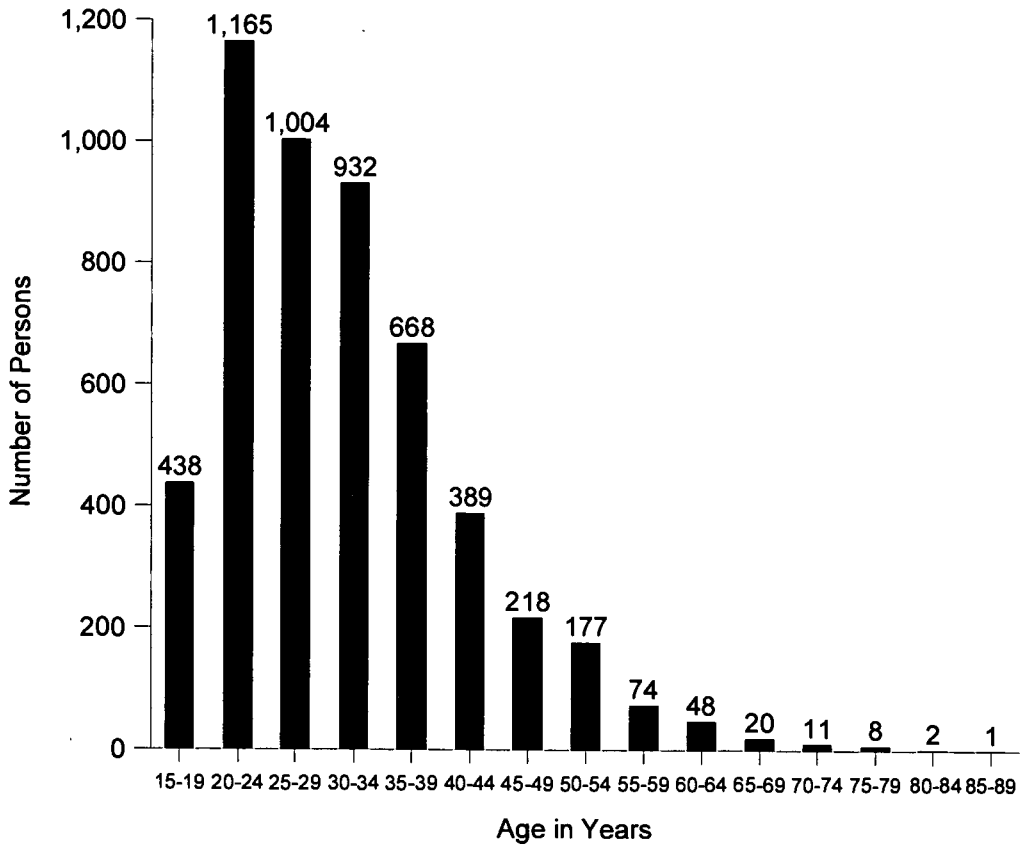
The study examined 5,168 individuals at baseline (1,571 patients in ERs, 1,563 patients in STD clinics, and 2,034 arrestees in jails). Subjects were screened and assessed through several stages. The intake sites included three ERs, three STD clinics, and four county jails, all located in Los Angeles County. Study sites were purposefully selected, as opposed to randomly selected, to provide a sufficient subject pool and to include gender and ethnic diversity.

Interviewers visited ERs approximately 2 days a week on various days and at different times of day and night in an effort to capture the full range of patients. Subjects were randomly selected from the sign-in list. The refusal rate was 14.6 percent of all subjects approached. A total of 1,571 patients from ERs were interviewed (39.2 percent female, 14.3 percent white, 40.4 percent Hispanic, 40.4 percent African American, and 5.0 percent other races/ethnicities, with a mean age of 37.0 years).

In STD clinics, research interviewers used the sign-in list as a base and attempted to interview every person on the list. Overall, about 23 percent of those approached refused to participate in the study. A total of 1,563 patients were interviewed (40.6 percent female, 7.1 percent white, 40.1 percent Hispanic, 50.5 percent African American, and 2.3 percent other races/ethnicities, with a mean age of 29.7 years).

The four jails were sites included in the National Institute of Justice (NIJ) Drug Use Forecasting (DUF) study. Interviewers collected data for 1 week at each jail on a quarterly cycle. The subject selection was in accordance with the DUF protocol, which had the following prioritization for subject selection: those arrested for nondrug felonies, followed by nondrug misdemeanors, then drug felonies, and finally drug misdemeanors. About 6 percent of those approached refused to participate. A total of 2,034 adult arrestees were interviewed (34.1 percent female, 19.6 percent white, 41.7 percent Hispanic, 35.7 percent African American, and 2.7 percent other races/ethnicities, with a mean age of 30.1 years). Age distribution in 1992 for the total sample is displayed in Figure 2.

**Figure 2 Study of High-risk Samples Distribution, by Age, in 1992**



## Data Collection Procedures

Face-to-face interview procedures and questionnaires were similar across sites. At STD and ER sites, study participants were paid $5 for their participation. Interviews with arrestees in jail went uncompensated, but snacks were offered as an inducement. The baseline interview lasted approximately 25 minutes, at the end of which a urine specimen was collected (including those in jails). Each subsequent face-to-face interview lasted 2 to 2½ hours, and respondents were paid $40 to $50 for each completed interview. A urine specimen was obtained from those not incarcerated at the end of these interviews. Respondents were queried about demographics, personality measures, drug use history, and other measures. Respondents were assured that all information provided to the researchers would be held in the strictest confidence.

## Results

*Prevalence rates among the high-risk samples*. Prevalence rates of self-reported lifetime alcohol, tobacco, and other drug use are provided by 5-year age categories constructed from the age of the participants in 1992 (Table 3). Not surprisingly, almost all respondents reported alcohol use, and to a lesser extent, tobacco use sometime in their lifetime. In terms of illicit drugs, marijuana and crack/cocaine were the most prevalent drugs used by all age groups. In general, compared with other age categories, the baby boomers (approximately 28 to 46 years of age) reported a higher level use of all drugs: marijuana and cocaine use at rates between 45 and 75 percent, followed by heroin, PCP, amphetamines, Valium, and downers at about 20 to 30 percent. Older adults aged 65 or older reported virtually no illicit drug use.

Self-reported use in the past 30 days (Table 4) followed similar patterns, although at much lower rates. Table 4 shows that in this high-risk population, use of such drugs as speed, PCP, amphetamines, barbiturates, tranquilizers, and LSD stopped by age 55. Marijuana, heroin, and crack and cocaine use stopped before age 65. Urinalysis results for recent use confirmed that crack/cocaine was the most frequently used illicit drug by this sample, with the highest rates among baby boomers (33 to 42 percent) (Table 5).

A subgroup of the sample (1,313 patients from ER sites, 767 from STD sites, and 142 from jail sites) also responded to a questionnaire on their use of 11 types of medications (Table 6). Rates of self-reported use in the past 30 days were generally low, except for pain pills (nonopiate), a use of which was reported by at least 25 percent of the respondents across all age groups. The use patterns among baby boomers appeared to be comparable with other age groups, including the elderly.

**Table 3 Self-Reported Lifetime Use (Percent) at Baseline (1993-94) in the Study of High-risk Samples ($N$ = 5,155)**

| Age Category (in 1992) | *N* | Alcohol | Tobacco | Mari-juana | Heroin | Crack | Cocaine | PCP | Speed | Amphet-amines | Barbi-turates | Tran-quilizers | LSD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15-19 | 438 | 94.75 | 71.00 | 68.04 | 1.60 | 18.72 | 24.20 | 14.61 | 12.56 | 4.79 | 2.51 | 3.88 | 15.75 |
| 20-24 | 1,165 | 95.36 | 71.07 | 65.32 | 4.29 | 21.63 | 28.33 | 12.79 | 12.02 | 7.98 | 5.24 | 8.93 | 13.30 |
| 25-29 | 1,004 | 95.82 | 79.78 | 74.20 | 11.95 | 40.04 | 46.81 | 23.21 | 18.43 | 15.84 | 11.35 | 17.83 | 18.73 |
| 30-34 | 932 | 95.28 | 86.37 | 75.75 | 14.91 | 49.25 | 53.86 | 31.97 | 18.13 | 17.17 | 15.34 | 26.61 | 19.53 |
| 35-39 | 668 | 97.75 | 85.03 | 74.25 | 22.46 | 49.85 | 55.24 | 32.78 | 18.26 | 28.44 | 28.29 | 35.48 | 25.15 |
| 40-44 | 389 | 95.12 | 84.58 | 67.10 | 23.65 | 46.27 | 45.76 | 24.42 | 14.65 | 25.71 | 28.02 | 32.90 | 26.48 |
| 45-49 | 218 | 95.41 | 84.40 | 61.47 | 25.69 | 33.49 | 41.74 | 19.72 | 14.22 | 26.15 | 26.61 | 31.65 | 22.48 |
| 50-54 | 177 | 93.79 | 79.66 | 49.15 | 15.82 | 22.03 | 25.99 | 7.91 | 10.17 | 14.69 | 15.25 | 20.90 | 9.60 |
| 55-59 | 74 | 89.19 | 79.73 | 25.68 | 5.41 | 8.11 | 13.51 | 2.70 | 2.70 | 10.81 | 6.76 | 13.51 | 4.05 |
| 60-64 | 48 | 75.00 | 70.83 | 20.83 | 6.25 | 8.33 | 6.25 | 4.17 | 2.08 | 4.17 | 8.33 | 8.33 | 4.17 |
| 65-69 | 20 | 90.00 | 80.00 | 25.00 | 5.00 | 10.00 | 5.00 | 0.00 | 0.00 | 5.00 | 5.00 | 10.00 | 0.00 |
| 70-74 | 11 | 90.91 | 72.73 | 18.18 | 0.00 | 0.00 | 9.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 75-79 | 8 | 62.50 | 62.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 12.50 | 0.00 |
| 80-84 | 2 | 50.00 | 50.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 85-89 | 1 | 100.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**Table 4 Self-Reported Drug Use in the Past 30 Days (Percent) at Baseline (1993-94) in the Study of High-risk Samples (N = 5,155)**

| Age Category (in 1992) | *N* | Alcohol | Tobacco | Mari-juana | Heroin | Crack | Cocaine | PCP | Speed | Amphet-amines | Barbi-turates | Tran-quilizers | LSD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15-19 | 438 | 63.93 | 45.89 | 38.58 | 0.46 | 8.45 | 6.62 | 3.88 | 4.57 | 0.46 | 1.82 | 0.68 | 1.83 |
| 20-24 | 1,165 | 69.36 | 46.87 | 34.76 | 1.37 | 10.30 | 6.09 | 2.75 | 4.29 | 1.29 | 1.12 | 1.03 | 1.12 |
| 25-29 | 1,004 | 69.02 | 57.27 | 32.17 | 3.29 | 20.62 | 10.46 | 1.79 | 5.38 | 2.09 | 1.29 | 2.29 | 0.40 |
| 30-34 | 932 | 64.27 | 64.48 | 25.21 | 4.29 | 25.64 | 10.19 | 2.15 | 4.29 | 1.29 | 0.75 | 2.04 | 0.43 |
| 35-39 | 668 | 62.72 | 62.28 | 21.26 | 4.04 | 26.50 | 9.58 | 2.54 | 3.74 | 1.50 | 2.10 | 4.64 | 0.00 |
| 40-44 | 389 | 62.21 | 63.24 | 20.82 | 5.14 | 28.53 | 10.03 | 2.57 | 1.03 | 1.03 | 1.03 | 3.34 | 0.00 |
| 45-49 | 218 | 55.05 | 54.59 | 13.76 | 5.05 | 16.06 | 5.96 | 0.00 | 1.83 | 1.38 | 0.92 | 3.21 | 0.00 |
| 50-54 | 177 | 48.02 | 48.02 | 9.04 | 3.39 | 8.47 | 3.95 | 0.00 | 2.26 | 0.56 | 0.56 | 2.26 | 0.00 |
| 55-59 | 74 | 45.95 | 33.78 | 2.70 | 0.00 | 2.70 | 2.70 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 60-64 | 48 | 22.92 | 31.25 | 6.25 | 2.08 | 4.17 | 2.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 65-69 | 20 | 35.00 | 5.00 | 0.00 | 0.00 | 5.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 |
| 70-74 | 11 | 27.27 | 9.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 75-79 | 8 | 25.00 | 37.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 80-84 | 2 | 50.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 85-89 | 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**Table 5 Urinalysis Positive Rates (Percent) at Baseline (1993-94) in the Study of High-risk Samples ($N$ = 4,503)**

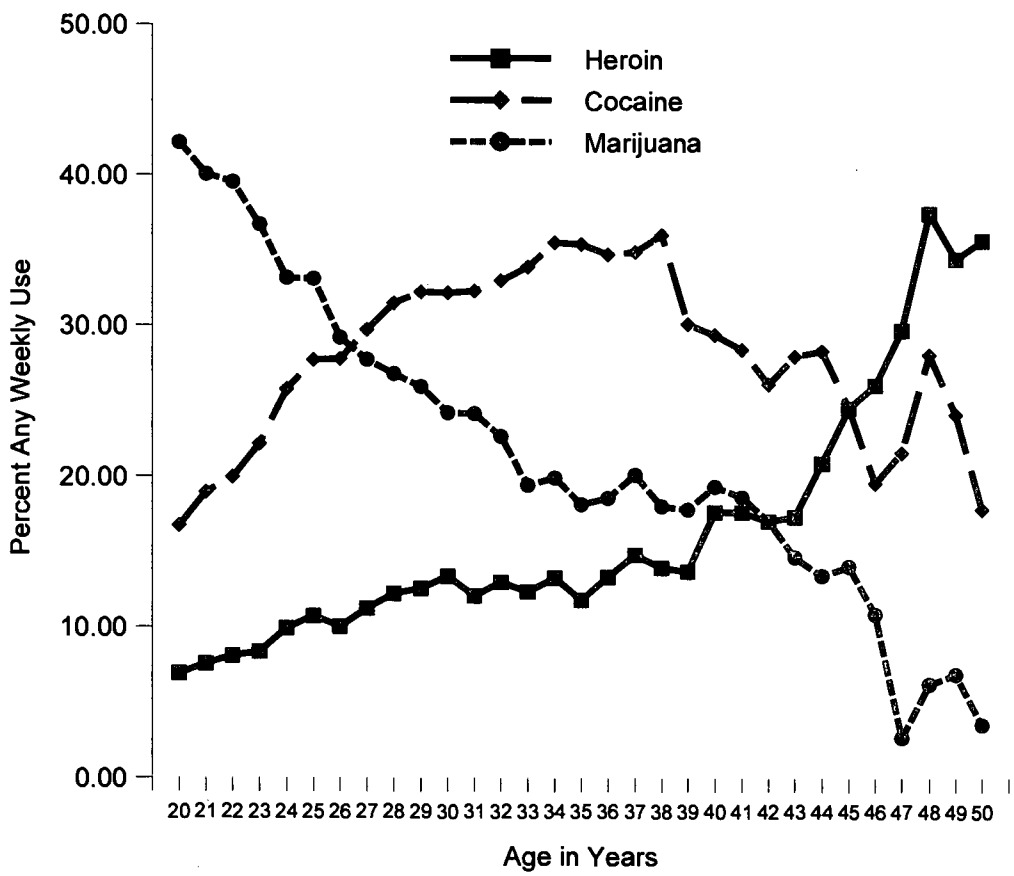
| Age Category (in 1992) | $N$ | Benzo-diazepines | Marijuana | PCP | Opiates | Cocaine | Methadone | Barbituates | Amphet-amines |
|---|---|---|---|---|---|---|---|---|---|
| 15-19 | 379 | 1.32 | 21.64 | 3.96 | 2.90 | 12.66 | 0.00 | 0.26 | 2.64 |
| 20-24 | 1,036 | 1.64 | 22.10 | 3.38 | 3.19 | 18.73 | 0.19 | 0.10 | 3.96 |
| 25-29 | 892 | 2.35 | 18.27 | 2.35 | 6.05 | 33.30 | 0.45 | 0.45 | 4.60 |
| 30-34 | 842 | 4.04 | 15.20 | 2.73 | 8.91 | 42.04 | 0.95 | 0.00 | 5.23 |
| 35-39 | 596 | 6.38 | 11.24 | 3.02 | 9.40 | 41.11 | 0.50 | 0.34 | 3.52 |
| 40-44 | 334 | 4.19 | 10.78 | 2.10 | 11.38 | 38.92 | 2.10 | 3.89 | 1.50 |
| 45-49 | 181 | 9.39 | 7.73 | 0.55 | 13.81 | 29.28 | 2.21 | 0.55 | 4.42 |
| 50-54 | 135 | 6.67 | 8.15 | 1.48 | 9.63 | 20.00 | 3.70 | 2.22 | 1.48 |
| 55-59 | 56 | 3.57 | 3.57 | 1.79 | 7.14 | 10.71 | 0.00 | 3.57 | 0.00 |
| 60-64 | 35 | 5.71 | 2.86 | 0.00 | 5.71 | 11.43 | 2.86 | 0.00 | 0.00 |
| 65-69 | 10 | 0.00 | 0.00 | 0.00 | 10.00 | 10.00 | 0.00 | 0.00 | 0.00 |
| 70-74 | 3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 75-79 | 4 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**Table 6 Self-Reported Use of Medications (Percent) in the Past 30 Days at Baseline (1993-94) in the Study of High-risk Samples ($N$ = 2,222)**

| Age Group | *N* | Pain Pill–Nonopiate | Pain Pill–Opiate | Sleeping Pill | Tran-quilizer | Anti-depressant | Diet, Pick-up–OTC | Diet, Pick-up, Pre-scription | Cold, Allergy–Nonopiate | Cold, Allergy–Opiate | Seizure Medi-cations | Blood Pressure Medication |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15-19 | 198 | 32.32 | 5.05 | 1.01 | 1.52 | 0.00 | 0.51 | 0.51 | 7.58 | 0.51 | 0.51 | 0.00 |
| 20-24 | 442 | 27.38 | 5.43 | 1.13 | 0.45 | 0.23 | 1.13 | 0.68 | 6.33 | 0.45 | 0.90 | 0.23 |
| 25-29 | 373 | 30.03 | 5.36 | 1.88 | 1.34 | 1.61 | 1.61 | 0.27 | 7.51 | 0.54 | 1.07 | 1.07 |
| 30-34 | 367 | 26.98 | 9.26 | 0.54 | 1.91 | 0.82 | 0.00 | 0.00 | 4.36 | 0.27 | 0.82 | 1.91 |
| 35-39 | 303 | 27.06 | 6.93 | 0.33 | 1.98 | 1.32 | 0.33 | 0.33 | 4.62 | 0.00 | 1.32 | 2.64 |
| 40-44 | 196 | 28.57 | 7.14 | 2.04 | 4.08 | 3.57 | 0.00 | 0.00 | 8.16 | 0.51 | 4.08 | 4.59 |
| 45-49 | 117 | 29.06 | 8.55 | 0.85 | 3.42 | 1.71 | 0.00 | 0.00 | 4.27 | 0.85 | 4.27 | 9.40 |
| 50-54 | 108 | 31.48 | 8.33 | 0.93 | 2.78 | 2.78 | 0.00 | 0.00 | 6.48 | 0.93 | 0.00 | 11.11 |
| 55-59 | 45 | 31.11 | 2.22 | 2.22 | 2.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 17.78 |
| 60-64 | 36 | 44.44 | 0.00 | 2.78 | 2.78 | 0.00 | 0.00 | 0.00 | 5.56 | 0.00 | 0.00 | 27.78 |
| 65-69 | 18 | 38.89 | 0.00 | 0.00 | 11.11 | 5.56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.56 |
| 70-74 | 8 | 25.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 12.50 |
| 75-79 | 8 | 25.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 12.50 | 0.00 | 12.50 | 12.50 |
| 80-84 | 2 | 50.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 50.00 |
| 85-89 | 1 | 100.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

*Drug use careers*. Many of these high-risk respondents used various types of drugs on a regular basis. Using the Follow-up 1 sample ($N = 941$) with drug users from three sources, approximately 75 percent of them used alcohol and marijuana regularly, followed by crack at 50 percent, cocaine at 34 percent, and opiates at about 17 percent. Natural histories of drug use were collected during Follow-up 2 ($N = 564$), and the rates of any weekly use of cocaine, heroin, and marijuana are shown over the evolution of the drug use careers (Figure 3). The rates of marijuana use showed a clearly linear decline as the cohort aged. Rates of cocaine use increased from age 20 until the mid-30s, then declined after the late 30s. Heroin use, on the other hand, remained at a fairly low level, but increased after the early 40s. A further examination indicates that fewer than 50 subjects were older than 45 years old, and most of these older respondents were heroin users; thus, they appeared to have contributed to a greater proportion of the later segment of the drug use careers and disproportionally increased the heroin use rates as the group aged.

**Figure 3 Self-Reported Any Weekly Use of Illicit Drugs, by Age, in 1992**



*Relapse and remission among drug users*. Because the sample has only been followed for 3 years, permanent recovery rates (i.e., 5-year abstinence) cannot be established for this sample. However, patterns of drug use over time can be studied year by year and over the three observation points. The probabilities of changing drug use status, given the drug use status in the previous year, are given in Table 7. Drug use included any use of illicit drugs in the year before an interview. Because each successive follow-up sample had a smaller sample size, the probabilities were calculated repeatedly for each of the three samples with varying observation points for replication purpose. The three samples did not appear to differ much in rates where comparable measures were available; thus, the Follow-up 3 sample was focused on because transition probabilities were available over 3 follow-up years. The likelihood of continued drug use over 2 consecutive years was very high, ranging from .59 to .70. The probabilities of quitting (i.e., stopping drug use during the current year among those who reported drug use in the previous year) were .41 in Follow-up 1, .30 in Follow-up 2, and .30 in Follow-up 3. High relapse rates (i.e., drug use during the current year while reporting no drug use during the previous year) were observed at .40 at Follow-up 2 and .27 at Follow-up 3.

**Table 7 Yearly Changes in Illicit Drug Use Status among Drug Users (Conditional Probabilities)**

| | Follow-up 1 Sample | Follow-up 2 Sample | Follow-up 3 Sample |
|---|---|---|---|
| **Baseline to Follow-up 1** | | | |
| Persist using | .55 | .57 | .59 |
| Quit | .45 | .42 | .41 |
| Relapse | N/A | N/A | N/A |
| **Follow-up 1 to Follow-up 2** | | | |
| Persist using | | .72 | .70 |
| Quit | | .28 | .30 |
| Relapse | | .37 | .40 |
| **Follow-up 2 to Follow-up 3** | | | |
| Persist using | | | .70 |
| Quit | | | .30 |
| Relapse | | | .27 |

## Comments

Long-term follow-up studies provide direct measurement of recovery and mortality in drug use careers. The California 33-year Follow-up Study is unique in that age-specific rates of recovery and mortality can be calculated for heroin users. The newer Study of High-risk Samples expands the longitudinal examination of drug use beyond heroin and can begin to provide some preliminary estimates of drug use relapse and remission. However, the two studies are not without limitations. The California 33-year Follow-up Study did not include women, and most of these heroin users were born before the period of the baby boomers. The Study of High-risk Samples had short follow-up periods, the sample decreased at each follow-up point, and the study did not include an adequate sample of older drug users. Samples included in both studies should not be considered nationally representative.

Nonetheless, both studies reveal several interesting results. The Study of High-risk Samples suggests that baby boomers generally showed greater levels of illicit drug use but comparable levels of use of medications. Another important finding is that the drug use progression and recovery process appears to differ depending on the type of drug used. Heroin use appeared to be most persistent with rates of permanent recovery remaining at about 50 percent even among those older than 50, with rates of use even increasing after age 40 among the high-risk samples. Furthermore, among the high-risk samples, marijuana use was linearly related to age (i.e., decreasing with age), and cocaine use and age were curvelinearly related (i.e., peaking at about ages 35 to 40). Had drug type been ignored, the group would have been extremely stable in drug use across ages.

The ranges of recovery and mortality rates appeared to be wide across these two studies and those reported in the literature. It is also difficult to compare these studies, as each study had different sample compositions (e.g., age, gender, alcohol or other drug type) and methodologies (e.g., length of follow-up period, retrospective vs. prospective study design). The morality rates ranged from 6 and 9 percent in DATOS and SROS, to 24 percent in the Moos VA study, and to 49 percent in the California heroin sample. Both the Moos study and the California study focused on older adults; therefore, it is not unexpected their death rates were higher than the treatment samples in DATOS or SROS where most of the patients were in their 30s or 40s. The relatively higher mortality rate in the California study than that in the Moos study, even after adjusting for age (Table 1) suggests that heroin users are at an even greater risk for premature death. However, it should be noted that the sample sizes for calculating mortality rates were small in most of these studies when compared with population estimates.

The recovery rates also showed a diverse range of estimates. Vaillant's alcohol abuse study reported 11 and 30 percent for recovery rates, and the California heroin sample showed 47 percent, while more general treatment samples in DATOS and SROS suggested 18 and 21 percent recovery rates. Even using the same database, different definitions of recovery also contribute to discrepant estimates. For example, in another chapter in this monograph, Ray used treatment readmission to operationally define "recovery" and reported a 50 percent recovery rate among patients followed in the SROS, while the present chapter defined recovery as "abstinence from any illicit drug use," which suggested a 21 percent recovery rate for SROS patients. Using yearly change rates across 3 follow-up years, the Study of High-risk Samples showed an overall yearly quitting rate at about 30 to 40 percent.

One obvious conclusion from these diverse findings is that data on age-specific recovery and mortality rates are needed to permit standardized comparisons, but these data are scarce at the present time. Much more research is needed to fill in these gaps so that informed decisions can be made on projecting future health care needs among populations as they age. Particularly, future studies addressing recovery and mortality issues need to improve sample representativeness, especially the sampling of women and the elderly, and they need to pay attention to the different types of drugs used by the individuals.

## Conclusions

- The Study of High-risk Samples indicated that baby boomers generally showed greater levels of illicit drug use than other age groups, but comparable levels of use of medications.

- The age-related drug use progression and recovery process appears to differ depending on the type of drug used.

- Heroin use appears to be most persistent with age, with a high death rate, and a recovery rate of about 50 percent even among those aged 50 or older.

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# Chapter 4. Age Differences in Multiple Drug Use: National Admissions to Publicly Funded Substance Abuse Treatment

Leigh A. Henderson,* Ph.D.

*Abstract*: This chapter examines the use of multiple drugs (polydrug use) by age group in national admissions to publicly funded substance abuse treatment with special focus on adults aged 55 or older. Data consist of 1,493,710 admissions aged 10 or older from the 1997 Treatment Episode Data Set (TEDS), a national dataset of admissions to publicly funded substance abuse treatment maintained by the Substance Abuse and Mental Health Services Administration (SAMHSA).

Older adults are seldom admitted to the publicly funded substance abuse treatment system. In 1997, 97 percent of TEDS admissions were younger than 55. Abuse of alcohol alone was the primary problem of the majority of persons aged 50 or older, and the proportion of admissions increased for each age group through age 74. Older persons admitted to publicly funded treatment were less likely to report problems with polydrug use. Peak polydrug use occurred among those younger than 40, with 60 to 70 percent reporting use of multiple substances, but remained a substantial problem for those aged 55 to 79, where 7 to 20 percent reported use of multiple substances. Polydrug use increased among those aged 75 or older to levels comparable with those for persons younger than 40. Abuse of tranquilizers and sedatives, although relatively low, increased with age, and the proportions of admissions for tranquilizers and sedatives were greatest among those aged 75 or older. Beginning at age 55, an increasing proportion of persons entering treatment were doing so for the first time, largely for abuse of alcohol alone. There were indications that the few persons aged 75 or older who entered the publicly funded treatment system had more severe and complex problems than those just a few years younger. They were more likely to be polydrug users and to have been in treatment previously. Referrals to treatment by health care providers increased with age from 6 percent at ages 15 to 19 to 19 percent at ages 75 to 79. Individual or self-referral was responsible for the largest proportion of admissions for those aged 30 to 65 and for those 75 or older.

The purpose of this chapter is to examine the use of multiple drugs (polydrug use) by age in national admissions to publicly funded substance abuse treatment with special focus on adults aged 55 or older. The Treatment Episode Data Set (TEDS), a national dataset of admissions to publicly funded substance abuse treatment (Office of Applied Studies [OAS], 2001), includes a

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substantial number of older adults and permits examination of the number and types of substances used by this population, their source of referral to treatment, and their prior experience with the substance abuse treatment system.

Polydrug use is a concern because of the potential for additive or interactive effects of the drugs. These may produce different and perhaps more severe adverse consequences. For example, in drug-related deaths reported to medical examiners in 41 metropolitan areas in 1998, an average of 2.5 drugs was found (OAS, 2000). The recent proliferation of prescription psychoactive drugs, and their aggressive marketing, has added significantly to the potential for polydrug use (National Institute for Health Care Management, 2001). Alcohol, illicit drugs, and prescription drugs diverted to the illicit marketplace have been the traditional sources of polydrug use. To these problems is now added the potential for misuse (intentional or unintentional) of one or more drugs prescribed by a medical practitioner. Polydrug use is of particular concern among older adults, where one study estimated that 30 percent of persons over 65 take eight or more prescription drugs daily (Sheahan, Hendricks, & Coons, 1989). Many of these drugs may be psychoactive, taken for sleep disorders, chronic pain, or mood disorders (Center for Substance Abuse Treatment [CSAT], 1998).

Although the problems engendered by polydrug use are drawing increasing attention, indicators of its prevalence nationally and of specific drug combinations are lacking, particularly among older adults. In part, this is because polydrug use has been seen as an illicit drug problem. Research in a longitudinal cohort has indicated that initiation of illicit drug use after age 28-29 is extremely rare (Chen & Kandel, 1995). By age 28-29, some 85 to 95 percent of users of drugs other than alcohol and marijuana had stopped their use (Raveis & Kandel, 1987). However, initiation of use of prescription psychoactives was an exception, and the cohort has not yet been followed beyond the age of 35. Among older adults, prescription polydrug use is more likely to be a problem than is illicit polydrug use.

In the general population, existing studies indicate that polydrug use is fairly widespread among adolescents and young adults. A community-based sample of persons aged 28 to 32 found that 31 percent used marijuana and alcohol, 28 percent used alcohol and illicit drugs other than marijuana, and 22 percent used marijuana and other illicit drugs (Earleywine & Newcomb, 1997). A study among 12$^{th}$ graders found that 29 percent reported simultaneous polydrug use (the use of two or more substances in combination) during the past year (Collins, Ellickson, & Bell, 1998).

Polydrug use has been demonstrated to be common among injection drug users and persons in correctional facilities. A study of injection drug users found that an average of 5.3 of 8

drug classes had been used in the 6 months prior to interview (Darke & Ross, 1997). Similarly, a study of heroin injectors and amphetamine users found that averages of 5.2 and 6.3 of 8 drug classes, respectively, had been used in the past 6 months (Darke & Hall, 1995). In a sample of injection drug users aged 16 to 45, 34 percent had used one substance in addition to their primary substance, 34 percent had used two, 19 percent had used three, and 13 percent had used four or more additional drugs (Klee, Faugier, Hayes, Boulton, & Morris, 1990). Among prison inmates, half reported using 5 or more of a list of 14 drugs (including alcohol), and 20 percent had tried 8 or more (Kassebaum & Chandler, 1994).

In substance abuse treatment populations, polydrug use has been studied primarily among alcoholics. National treatment population data indicate that use of alcohol and drugs is more common than use of either alone (Martin et al., 1996a). In a study of 212 persons in inpatient treatment for alcoholism (age range from 19 to 63, average 36.4), 61 percent reported current use of other drugs (Jensen, Cowley, & Walker, 1990). An average of 2.3 different combinations were reported. Among males in alcoholism treatment (age range from 20 to 68, average 42), an average of 3 drugs in addition to alcohol were found to have been abused (Martin, Kaczynski, Maisto, & Tarter, 1996b). In a study combining treatment and community populations of adolescents (average age 16.7), those with an alcohol dependence diagnosis had used an average 3.8 of 5 illicit drug classes, those with an alcohol abuse diagnosis had used an average of 3.0 illicit drugs, and those with no alcohol diagnosis had used an average of 1.9 drug classes (Belding, Iguchi, Lamb, Lakin, & Terry, 1995). The majority of subjects in each group had used illicit drugs (from 81 to 98 percent). Polydrug use in methadone maintenance is widely acknowledged (Iguchi, Stitzer, Bigelow, & Liebson, 1988; OAS, 1999), but published quantitative reports are rare.

Although studies have documented polydrug use in various populations, most have been limited in scope, focusing on a particular population (e.g., persons in alcohol treatment, injection drug users, adolescents). In this study, we examine polydrug use by 5-year age group as reported in TEDS, a record-based national data collection system for admissions to publicly funded substance abuse treatment. The substances inventoried in TEDS include alcohol and illicit drugs, as well as prescription drugs when they have caused dependence requiring treatment. This analysis will provide a benchmark against which changes in polydrug use in the treatment system can be measured. As the focus of this report is the baby boom generation born between 1946 and 1964, and what demands they may make on health care resources in the future, emphasis is placed in the analysis on this generation and on current older users of the treatment system. Prior experience with the treatment system and source of referral to treatment are included, as these may affect use of the system.

## Description of the Dataset

TEDS is maintained by OAS in the Substance Abuse and Mental Health Services Administration (SAMHSA). The TEDS system includes records for some 1.5 million substance abuse treatment admissions annually. TEDS comprises data that are routinely collected by States in monitoring their individual substance abuse treatment systems. It does not include data on facilities operated by Federal agencies (the Bureau of Prisons, the Department of Defense, and the Veterans Administration). Selected data items from the individual State data files are converted to a standardized format consistent across States, and these standardized data constitute TEDS. TEDS consists of a Minimum Data Set collected by nearly all States, and a Supplemental Data Set collected by some States. The Minimum Data Set consists of 19 items that include demographic information; primary, secondary, and tertiary substances of abuse and their route of administration, frequency of use, and age at first use; source of referral to treatment; number of prior treatment episodes; and service type, including planned use of methadone. The Supplemental Data Set consists of 15 items that include psychiatric, social, and economic measures.

### Study Population

This study is a cross-sectional analysis of 1,493,710 admissions reported to TEDS for 1997. Admissions represent treatment episodes during the year rather than the number of individuals seeking treatment. A person who entered residential treatment in February, transferred from residential to outpatient treatment in March, and completed outpatient treatment in April, but then reentered treatment in November, would be counted as having had two treatment episodes and thus two admissions. The transfer from residential to outpatient treatment is considered a continuation of the same episode and not a new admission. The report excludes 402 admissions who were younger than 10 years old.

## Analysis

For this analysis, both licit and illicit substances were classified according to the system used throughout this monograph. The following substance classes were used:

- *Alcohol*: alcohol;
- *Stimulants*: cocaine, methamphetamine, amphetamine, and other stimulants;

- *Opiates*: heroin, nonprescription methadone use, and other opiates and synthetics with morphine-like effects;
- *Cannabinoids*: marijuana, hashish, THC, and other *cannabis sativa* preparations;
- *Hallucinogens*: phencyclidine (PCP) and other hallucinogens (LSD, DMT, STP, mescaline, psilocybin, etc.);
- *Tranquilizers*: benzodiazepines and non-benzodiazepine tranquilizers;
- *Sedative/hypnotics*: barbiturates and non-barbiturate sedatives and hypnotics;
- *Inhalants*: ether, glue, chloroform, nitrous oxide, gasoline, paint thinner, etc.;
- *Over-the-counter*: aspirin, cough syrup, sleep aids, and other legally obtained nonprescription medications; and
- *Other*: other or unspecified substance.

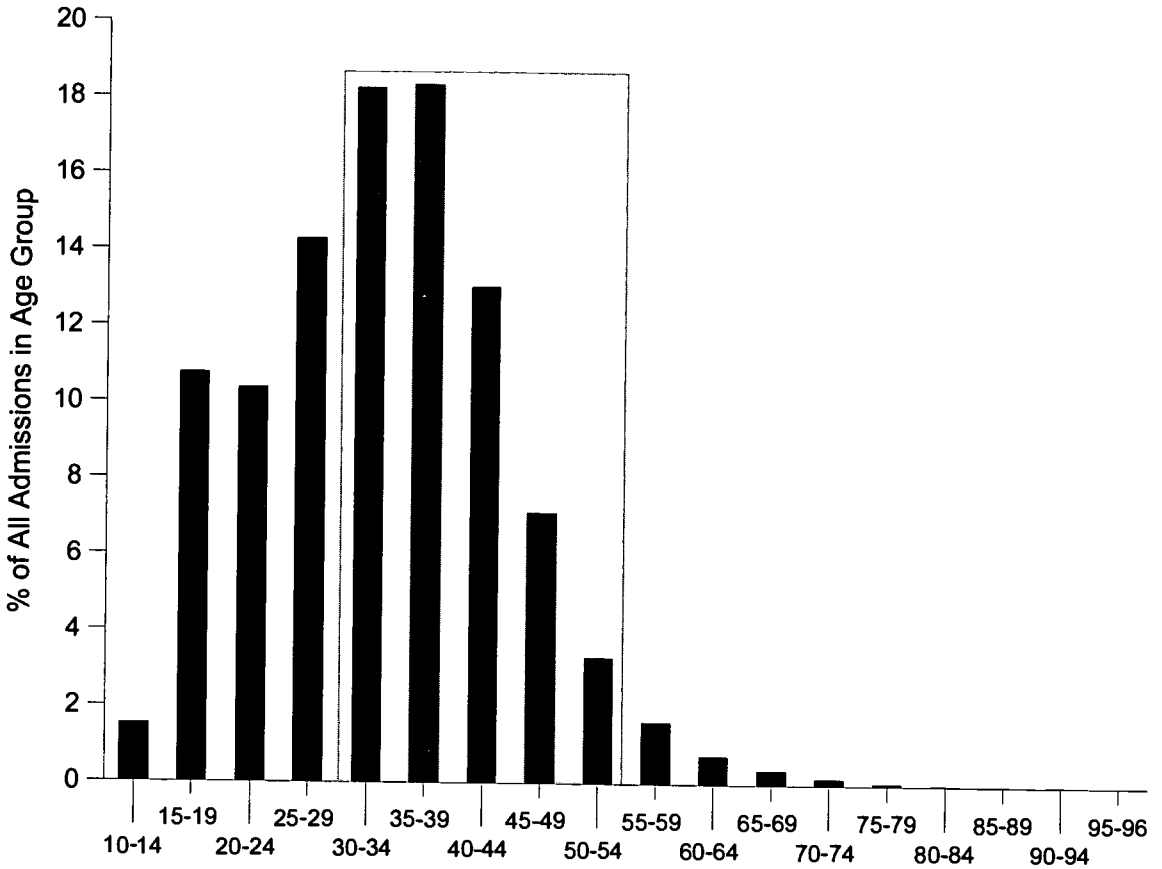
All data are reported by 5-year age group, the standard reference for the chapters in this report. The maximum age that the TEDS system could accommodate at the time of data entry was 96. In the tables and Figure 1, the age groups that include the baby boom generation (aged 33 to 51 in 1997) are highlighted.

## Results

Figure 1 shows the distribution by age of the 1997 TEDS admissions: 97 percent were younger than 55 in 1997, 2 percent were aged 55 to 64, and less than 1 percent were 65 or older. Only 118 were over 89 years of age. The greatest number of admissions were for ages 30 to 39; numbers were significantly lower for each subsequent age group. The baby boom generation made up 48 percent of all those entering treatment in 1997, when they were aged 33 to 51.

Table 1 shows the primary substance class, by age in 1997, reported at admission to treatment. Four substance classes accounted for 99 percent of all admissions. These were alcohol (50 percent), stimulants (20 percent), opiates (16 percent), and cannabinoids (13 percent). In no age group did other substances combined account for more than 4 percent of admissions. The proportion of admissions for primary alcohol abuse increased for each age group through age 74 (from 28 percent of those aged 10 to 14 to 89 percent of those aged 70 to 74), and then declined. Admissions for primary use of other substances peaked at ages 10 to 14 for cannabinoids, ages

**Figure 1 TEDS Admissions: 1997 Age Distribution**




Note: Data for age groups that include the baby boom generation (aged 33 to 51 in 1997) are highlighted.

Source: SAMHSA, Office of Applied Studies, Treatment Episode Data Set (TEDS), April 16, 2001.

25 to 34 for stimulants, and ages 40 to 49 for opiates. The proportions of admissions for tranquilizers and sedatives were greatest among those aged 75 or older.

Tables 1a and 1b show the same information as in Table 1, but for males and females separately. Men were more likely to be in treatment for alcohol at all but the youngest ages. Women were more likely to be in treatment for "hard" drugs, such as opiates and stimulants.

Table 2 shows the distribution by age of any use of a substance, either as primary, secondary, or tertiary. The average number of substance classes reported was 1.8 to 1.9 through age 39. This declined with age to 1.1 at ages 65 to 79, but rose again in each subsequent age group, to 1.8 at ages 95 to 96. Abuse of alcohol, either alone or as a secondary substance, was characteristic of most treatment admissions. Overall, 73 percent of all admissions used alcohol, 41 percent used stimulants, 36 percent used cannabinoids, and 19 percent used opiates. Use of alcohol was reported by at least 69 percent of all admissions in each age group, and it tended to

**Table 1 All Treatment Admissions, by Age Group and Primary Use of Substance, Treatment Episode Data Set (TEDS): 1997**

| Age at Admission | Total Number of Admissions[1] | Primary Substance at Admission | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | Alcohol | Stimulants | Opiates | Cannabinoids | Hallucinogens | Tranquilizers | Sedatives/ Hypnotics | Inhalants | Over-the-Counter | Other |
| All Ages | 1,493,710 | 100.0 | 49.6 | 20.0 | 15.9 | 13.3 | 0.3 | 0.3 | 0.2 | 0.1 | * | 0.2 |
| 10-14 | 22,883 | 100.0 | 27.7 | 4.1 | 0.5 | 63.7 | 0.8 | 0.1 | 0.1 | 1.9 | 0.2 | 1.0 |
| 15-19 | 160,773 | 100.0 | 32.5 | 9.3 | 4.2 | 51.9 | 1.0 | 0.1 | 0.1 | 0.4 | 0.1 | 0.4 |
| 20-24 | 154,867 | 100.0 | 43.3 | 19.3 | 13.2 | 22.9 | 0.6 | 0.2 | 0.1 | 0.1 | * | 0.2 |
| 25-29 | 213,360 | 100.0 | 44.6 | 27.8 | 15.8 | 10.9 | 0.3 | 0.2 | 0.2 | 0.1 | * | 0.2 |
| **30-34** | **272,528** | **100.0** | **48.3** | **28.1** | **16.1** | **6.6** | **0.2** | **0.3** | **0.2** | * | * | **0.2** |
| **35-39** | **273,880** | **100.0** | **52.6** | **23.8** | **17.8** | **4.9** | **0.1** | **0.3** | **0.2** | **0.1** | * | **0.2** |
| **40-44** | **194,620** | **100.0** | **55.5** | **17.4** | **22.5** | **3.6** | **0.1** | **0.4** | **0.3** | * | * | **0.2** |
| **45-49** | **106,180** | **100.0** | **60.5** | **12.1** | **23.9** | **2.6** | **0.1** | **0.4** | **0.2** | * | * | **0.2** |
| **50-54** | **49,417** | **100.0** | **71.5** | **8.0** | **17.7** | **1.8** | **0.1** | **0.4** | **0.3** | * | * | **0.2** |
| 55-59 | 24,261 | 100.0 | 78.8 | 5.1 | 13.8 | 1.2 | * | 0.5 | 0.3 | * | * | 0.2 |
| 60-64 | 11,101 | 100.0 | 84.0 | 3.2 | 10.7 | 0.8 | 0.1 | 0.6 | 0.4 | * | * | 0.2 |
| 65-69 | 5,670 | 100.0 | 86.8 | 2.0 | 8.7 | 0.9 | 0.1 | 0.5 | 0.7 | -- | 0.1 | 0.3 |
| 70-74 | 2,605 | 100.0 | 89.2 | 1.8 | 6.6 | 0.7 | -- | 0.8 | 0.6 | -- | 0.1 | 0.2 |
| 75-79 | 968 | 100.0 | 86.1 | 2.3 | 6.4 | 1.9 | 0.1 | 1.9 | 1.1 | -- | -- | 0.3 |
| 80-84 | 343 | 100.0 | 83.1 | 4.1 | 6.1 | 3.2 | -- | 1.8 | 1.5 | -- | -- | 0.3 |
| 85-89 | 136 | 100.0 | 66.2 | 14.0 | 14.0 | 3.7 | -- | 0.7 | 1.5 | -- | -- | -- |
| 90-94 | 101 | 100.0 | 52.5 | 13.9 | 23.8 | 6.9 | -- | 1.0 | 2.0 | -- | -- | -- |
| 95-96 | 17 | 100.0 | 47.1 | 29.4 | 5.9 | 17.7 | -- | -- | -- | -- | -- | -- |

* Less than 0.05 percent.
-- Quantity is zero.

Note: Data for age groups that include the baby boom generation (aged 33 to 51 in 1997) are in bold print.

[1] Includes 5,013 admissions where sex (i.e., gender) was not reported.

Source: SAMHSA, Office of Applied Studies, Treatment Episode Data Set (TEDS), April 16, 2001.

increase with age, peaking at 92 percent of admissions aged 70 to 74. Use of alcohol declined after age 85 to 71 percent among those 90 or older.

Use of substances other than alcohol reflected the underlying primary substance patterns. Peak use occurred at different ages for different substances, declined for subsequent age groups, but rose again among those aged 75 or older. Stimulant use increased from 13 percent of those aged 10 to 14 to over half of those aged 30 to 34. Use of marijuana was highest among the youngest age groups—85 percent of those aged 10 to 14 and 80 percent of those aged 15 to 19.

**Table 1a Male Treatment Admissions, by Age Group and Primary Use of Substance, Treatment Episode Data Set (TEDS): 1997**

| Age at Admission | Total Number of Admissions | Primary Substance at Admission: Total | Alcohol | Stimulants | Opiates | Cannabinoids | Hallucinogens | Tranquilizers | Sedatives/ Hypnotics | Inhalants | Over-the-Counter | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| All Ages | 1,045,149 | 100.0 | 53.0 | 16.7 | 14.7 | 14.6 | 0.3 | 0.2 | 0.1 | 0.1 | * | 0.2 |
| 10-14 | 14,184 | 100.0 | 23.4 | 2.6 | 0.4 | 69.9 | 0.6 | 0.1 | 0.1 | 2.0 | 0.1 | 1.0 |
| 15-19 | 118,675 | 100.0 | 31.9 | 6.9 | 3.4 | 55.8 | 1.0 | 0.1 | 0.1 | 0.4 | * | 0.3 |
| 20-24 | 112,293 | 100.0 | 47.0 | 14.6 | 11.6 | 25.5 | 0.6 | 0.1 | 0.1 | 0.1 | * | 0.2 |
| 25-29 | 142,126 | 100.0 | 50.2 | 22.1 | 14.6 | 12.3 | 0.3 | 0.1 | 0.1 | 0.1 | * | 0.2 |
| **30-34** | **177,465** | **100.0** | **53.5** | **23.8** | **14.8** | **7.2** | **0.2** | **0.2** | **0.1** | * | * | **0.2** |
| **35-39** | **183,908** | **100.0** | **56.8** | **21.2** | **16.2** | **5.2** | **0.1** | **0.2** | **0.1** | **0.1** | * | **0.1** |
| **40-44** | **140,016** | **100.0** | **58.2** | **16.1** | **21.3** | **3.7** | **0.1** | **0.2** | **0.2** | * | * | **0.2** |
| **45-49** | **80,993** | **100.0** | **61.7** | **11.4** | **23.6** | **2.7** | **0.1** | **0.2** | **0.1** | * | * | **0.1** |
| **50-54** | **39,065** | **100.0** | **72.6** | **7.8** | **17.3** | **1.8** | * | **0.2** | **0.1** | * | * | **0.2** |
| 55-59 | 19,685 | 100.0 | 79.2 | 5.2 | 14.0 | 1.2 | 0.1 | 0.2 | 0.1 | * | * | 0.2 |
| 60-64 | 9,043 | 100.0 | 84.4 | 3.3 | 10.8 | 0.8 | * | 0.2 | 0.2 | -- | * | 0.2 |
| 65-69 | 4,539 | 100.0 | 87.4 | 2.0 | 9.0 | 0.9 | * | 0.2 | 0.2 | -- | * | 0.2 |
| 70-74 | 2,037 | 100.0 | 90.6 | 1.9 | 6.2 | 0.7 | -- | 0.2 | 0.1 | -- | * | 0.2 |
| 75-79 | 708 | 100.0 | 88.6 | 2.4 | 5.7 | 2.1 | 0.1 | 0.4 | 0.4 | -- | -- | 0.3 |
| 80-84 | 231 | 100.0 | 86.1 | 3.5 | 5.2 | 3.5 | -- | 0.4 | 0.9 | -- | -- | 0.4 |
| 85-89 | 104 | 100.0 | 72.1 | 13.5 | 11.5 | 2.9 | -- | -- | -- | -- | -- | -- |
| 90-94 | 69 | 100.0 | 49.3 | 13.0 | 24.6 | 10.1 | -- | 1.4 | 1.4 | -- | -- | -- |
| 95-96 | 8 | 100.0 | 62.5 | -- | -- | 37.5 | -- | -- | -- | -- | -- | -- |

* Less than 0.05 percent.

-- Quantity is zero.

Note: Data for age groups that include the baby boom generation (aged 33 to 51 in 1997) are in bold print.

Source: SAMHSA, Office of Applied Studies, Treatment Episode Data Set (TEDS), April 16, 2001.

Use of opiates increased from 1 percent of those aged 10 to 14 to 28 percent of those aged 45 to 49.

Figure 2 and Table 3 depict polydrug use and polydrug combinations by age group. Overall, 44 percent of treatment admissions reported use of a single substance class, 36 percent reported use of two substance classes, and 20 percent reported use of three substance classes. The number and combination of substances used varied greatly by age. Generally, the likelihood of using a single substance class increased with age to ages 70 to 74. For persons aged 75 or older, the likelihood of using two or three substance classes increased with each age group. Among those reporting single substance classes, alcohol was the most common in all age groups except those younger than 20, where marijuana predominated. Among two-drug combinations, alcohol

**Table 1b Female Treatment Admissions, by Age Group and Primary Use of Substance, Treatment Episode Data Set (TEDS): 1997**

| Age at Admission | Total Number of Admissions | Primary Substance at Admission | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | Alcohol | Stimulants | Opiates | Cannabinoids | Hallucinogens | Tranquilizers | Sedatives/ Hypnotics | Inhalants | Over-the-Counter | Other |
| All Ages | 443,548 | 100.0 | 41.0 | 28.2 | 18.6 | 10.4 | 0.3 | 0.6 | 0.4 | 0.1 | 0.1 | 0.4 |
| 10-14 | 8,677 | 100.0 | 34.8 | 6.5 | 0.6 | 53.7 | 1.2 | 0.2 | 0.1 | 1.7 | 0.3 | 1.0 |
| 15-19 | 41,934 | 100.0 | 34.2 | 16.0 | 6.6 | 40.7 | 1.1 | 0.2 | 0.2 | 0.4 | 0.1 | 0.5 |
| 20-24 | 42,362 | 100.0 | 33.2 | 31.8 | 17.4 | 16.1 | 0.5 | 0.3 | 0.2 | 0.1 | 0.1 | 0.3 |
| 25-29 | 70,815 | 100.0 | 33.0 | 39.3 | 18.2 | 8.1 | 0.2 | 0.4 | 0.3 | 0.1 | * | 0.3 |
| **30-34** | **94,371** | **100.0** | **38.2** | **36.3** | **18.6** | **5.5** | **0.2** | **0.5** | **0.4** | * | * | **0.3** |
| **35-39** | **88,928** | **100.0** | **43.4** | **29.5** | **21.1** | **4.3** | **0.2** | **0.6** | **0.5** | **0.1** | * | **0.3** |
| **40-44** | **53,669** | **100.0** | **47.8** | **20.9** | **26.0** | **3.4** | **0.1** | **0.7** | **0.6** | **0.1** | **0.1** | **0.4** |
| **45-49** | **24,460** | **100.0** | **55.2** | **14.4** | **25.8** | **2.4** | **0.1** | **0.9** | **0.6** | * | * | **0.4** |
| **50-54** | **9,991** | **100.0** | **66.4** | **9.1** | **19.7** | **2.2** | **0.1** | **1.1** | **0.8** | * | **0.1** | **0.5** |
| 55-59 | 4,335 | 100.0 | 76.3 | 5.1 | 13.6 | 1.3 | -- | 1.7 | 1.4 | * | -- | 0.5 |
| 60-64 | 1,972 | 100.0 | 81.5 | 3.1 | 10.3 | 0.6 | 0.1 | 2.4 | 1.3 | 0.1 | 0.2 | 0.6 |
| 65-69 | 1,060 | 100.0 | 83.4 | 2.2 | 7.7 | 0.8 | 0.2 | 1.7 | 2.8 | -- | 0.3 | 0.8 |
| 70-74 | 555 | 100.0 | 83.8 | 1.8 | 7.9 | 0.9 | -- | 2.9 | 2.2 | -- | 0.2 | 0.4 |
| 75-79 | 248 | 100.0 | 78.2 | 2.0 | 8.9 | 1.2 | -- | 6.0 | 3.2 | -- | -- | 0.4 |
| 80-84 | 106 | 100.0 | 75.5 | 5.7 | 8.5 | 2.8 | -- | 4.7 | 2.8 | -- | -- | -- |
| 85-89 | 28 | 100.0 | 42.9 | 17.9 | 21.4 | 7.1 | -- | 3.6 | 7.1 | -- | -- | -- |
| 90-94 | 29 | 100.0 | 55.2 | 17.2 | 24.1 | -- | -- | -- | 3.4 | -- | -- | -- |
| 95-96 | 8 | 100.0 | 25.0 | 62.5 | 12.5 | -- | -- | -- | -- | -- | -- | -- |

* Less than 0.05 percent.

-- Quantity is zero.

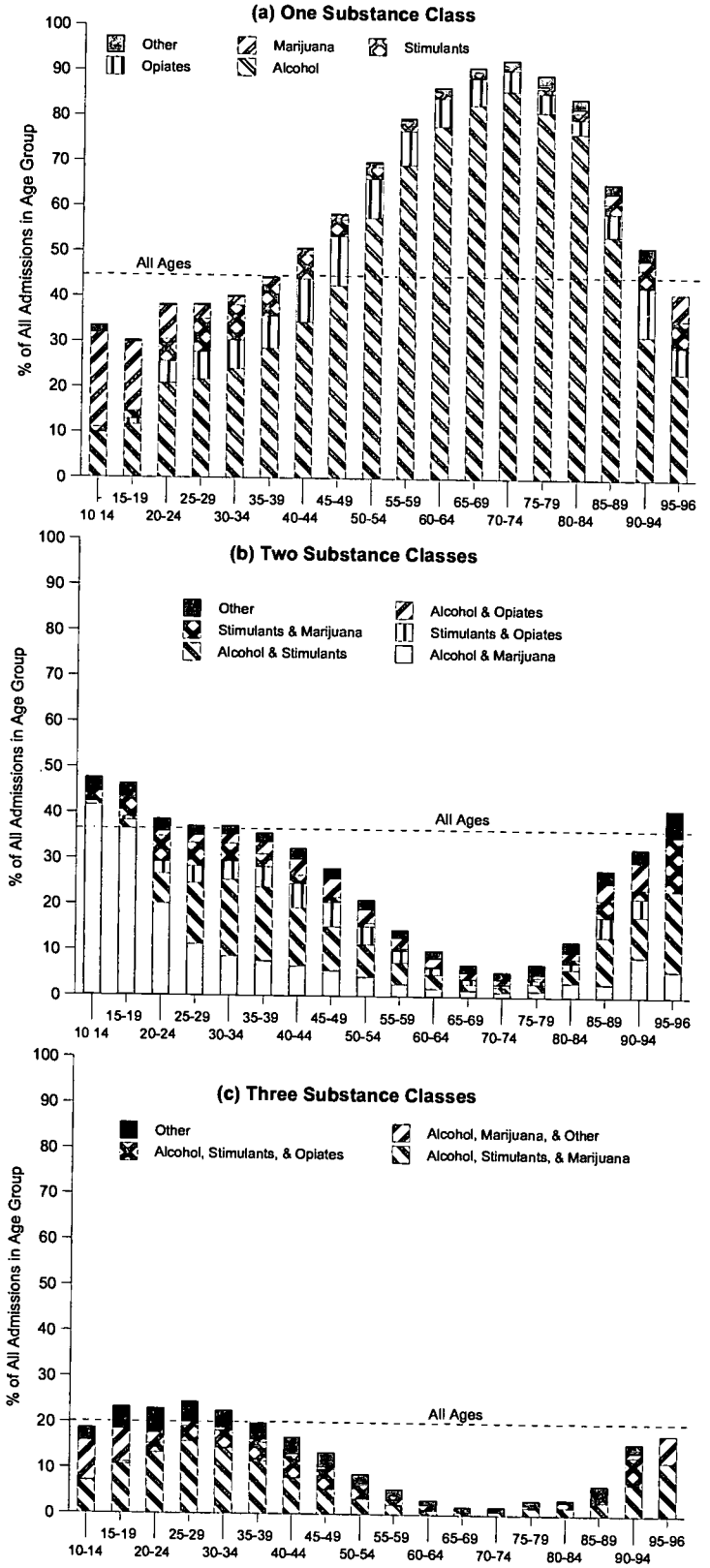
Note: Data for age groups that include the baby boom generation (aged 33 to 51 in 1997) are in bold print.

Source: SAMHSA, Office of Applied Studies, Treatment Episode Data Set (TEDS), April 16, 2001.

and marijuana were most common for those younger than 25. For those aged 25 or older, the most frequent combination was alcohol and stimulants. Among three-drug combinations, alcohol, stimulants, and marijuana were most common for all age groups except the youngest (ages 10 to 14), where alcohol, marijuana, and other drugs (primarily hallucinogens) predominated.

Table 4 shows the distribution by age of the number of prior treatment episodes. Overall, 42 percent of admissions were entering treatment for the first time. The proportion was high among the younger age groups, then declined to 33 percent of those aged 40 to 49. Among those aged 45 or older, the proportion of those entering treatment for the first time increased steadily until age 85.

## Figure 2 Polydrug Use, by Age Group




Source: SAMHSA, Office of Applied Studies, Treatment Episode Data Set (TEDS), April 16, 2001.

**Table 2 Treatment Admissions, by Age Group and Any Use of Substance, Treatment Episode Data Set (TEDS): 1997**

| Age at Admission | Total Number of Admissions | Average Number of Drug Categories | Alcohol | Stimulants | Cannabinoids | Opiates | Hallucinogens | Tranquilizers | Sedatives/ Hypnotics | Inhalants | Over-the-Counter | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| All Ages | 1,493,710 | 1.8 | 73.0 | 41.2 | 36.4 | 19.2 | 1.9 | 1.6 | 0.8 | 0.4 | 0.2 | 1.0 |
| 10-14 | 22,883 | 1.9 | 69.8 | 13.1 | 85.0 | 1.3 | 7.1 | 0.6 | 0.5 | 4.5 | 0.5 | 2.9 |
| 15-19 | 160,773 | 1.9 | 70.7 | 23.1 | 80.1 | 5.9 | 8.2 | 1.0 | 0.6 | 1.4 | 0.3 | 1.8 |
| 20-24 | 154,867 | 1.8 | 68.9 | 38.6 | 54.7 | 15.8 | 3.3 | 1.2 | 0.7 | 0.4 | 0.1 | 1.0 |
| 25-29 | 213,360 | 1.9 | 70.5 | 51.8 | 40.1 | 18.9 | 1.4 | 1.5 | 0.7 | 0.2 | 0.1 | 0.9 |
| **30-34** | **272,528** | **1.8** | **72.8** | **53.3** | **32.2** | **19.6** | **0.8** | **1.6** | **0.8** | **0.1** | **0.1** | **0.9** |
| **35-39** | **273,880** | **1.8** | **74.1** | **48.4** | **26.4** | **21.8** | **0.7** | **1.9** | **1.0** | **0.1** | **0.2** | **0.9** |
| **40-44** | **194,620** | **1.7** | **73.4** | **39.9** | **20.6** | **27.2** | **0.5** | **2.1** | **1.1** | **0.1** | **0.1** | **0.9** |
| **45-49** | **106,180** | **1.6** | **75.0** | **31.4** | **16.0** | **28.4** | **0.4** | **1.8** | **0.9** | **0.1** | **0.2** | **0.9** |
| **50-54** | **49,417** | **1.4** | **81.2** | **21.9** | **11.0** | **21.0** | **0.3** | **1.6** | **0.8** | **0.1** | **0.1** | **0.9** |
| 55-59 | 24,261 | 1.3 | 85.4 | 14.3 | 7.0 | 15.9 | 0.2 | 1.3 | 0.8 | * | 0.1 | 0.8 |
| 60-64 | 11,101 | 1.2 | 88.8 | 8.7 | 4.1 | 11.9 | 0.2 | 1.3 | 0.7 | * | 0.1 | 0.9 |
| 65-69 | 5,670 | 1.1 | 89.5 | 4.9 | 3.0 | 9.9 | 0.1 | 1.2 | 1.0 | -- | 0.1 | 1.0 |
| 70-74 | 2,605 | 1.1 | 92.1 | 3.7 | 2.6 | 7.1 | 0.1 | 1.6 | 0.8 | 0.1 | 0.2 | 0.8 |
| 75-79 | 968 | 1.1 | 89.1 | 6.8 | 4.9 | 7.3 | 0.4 | 2.3 | 2.3 | -- | 0.1 | 0.7 |
| 80-84 | 343 | 1.2 | 88.3 | 9.6 | 7.0 | 8.2 | 0.3 | 2.9 | 2.0 | -- | 0.3 | 0.6 |
| 85-89 | 136 | 1.4 | 76.5 | 26.5 | 14.7 | 17.6 | 0.7 | 1.5 | 2.2 | -- | -- | 1.5 |
| 90-94 | 101 | 1.6 | 71.3 | 32.7 | 23.8 | 29.7 | -- | 4.0 | 2.0 | -- | -- | 1.0 |
| 95-96 | 17 | 1.8 | 70.6 | 47.1 | 41.2 | 5.9 | -- | 5.9 | -- | -- | -- | 5.9 |

* Less than 0.05 percent.

-- Quantity is zero.

Note: Data for age groups that include the baby boom generation (aged 33 to 51 in 1997) are in bold print.

Source: SAMHSA, Office of Applied Studies, Treatment Episode Data Set (TEDS), April 16, 2001.

Table 5 shows the distribution by age of the source of referral to treatment. Overall, 35 percent of admissions were referred through the criminal justice system, 33 percent through individual or self-referral, 13 percent from other substance abuse treatment providers, and 7 percent through other health care providers. The criminal justice system was the most frequent source of referral to treatment for persons younger than 30 and for those aged 65 to 74. Individual or self-referral was responsible for the largest proportion of admissions for those aged 30 to 65 and for those 75 or older. Schools referred substantial proportions of those under 20 to treatment, but employee assistance programs (EAPs) contributed little to treatment entry in these publicly funded facilities. The proportion referred to substance abuse treatment through health care providers increased steadily from 6 percent at ages 15 to 19 to 19 percent at ages 75 to 79. Health care providers were the third leading source of treatment referral for persons aged 60 to 89.

## Table 3 Polydrug Combinations, by Age Group, Treatment Episode Data Set (TEDS): 1997

| Age at Admission | Total Number of Admissions | One-Drug Category | | | | | Two-Drug Categories | | | | | | Three-Drug Categories | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Alcohol | Opiates | Stimulants | Marijuana | Other** | Alcohol & Marijuana | Alcohol & Stimulants | Stimulants & Opiates | Stimulants & Marijuana | Alcohol & Opiates | Other Combinations* | Alcohol & Stimulants & Marijuana | Alcohol & Stimulants & Opiates | Alcohol & Marijuana & Other** | Other Combinations* |
| Total | 1,493,710 | 28.0 | 6.5 | 5.5 | 4.0 | 0.4 | 12.7 | 11.5 | 3.7 | 3.4 | 2.1 | 2.3 | 11.2 | 3.2 | 1.6 | 3.9 |
| 10-14 | 22,883 | 9.8 | 0.1 | 1.1 | 20.9 | 1.7 | 41.7 | 0.7 | 0.1 | 2.1 | 0.1 | 3.1 | 7.1 | 0.1 | 8.7 | 2.8 |
| 15-19 | 160,773 | 11.7 | 1.2 | 1.7 | 15.2 | 0.5 | 36.5 | 1.8 | 0.7 | 4.1 | 0.3 | 3.0 | 10.7 | 0.5 | 7.2 | 4.9 |
| 20-24 | 154,867 | 20.8 | 4.8 | 4.8 | 7.4 | 0.4 | 20.1 | 6.5 | 2.6 | 5.6 | 1.1 | 2.7 | 13.3 | 2.0 | 2.3 | 5.4 |
| 25-29 | 213,360 | 21.7 | 6.1 | 7.3 | 3.0 | 0.3 | 11.2 | 13.4 | 3.7 | 5.1 | 1.6 | 2.1 | 15.8 | 3.3 | 1.0 | 4.4 |
| **30-34** | **272,528** | **24.0** | **6.3** | **7.7** | **1.8** | **0.4** | **8.6** | **16.7** | **4.1** | **3.9** | **2.0** | **1.9** | **14.4** | **3.8** | **0.6** | **3.7** |
| **35-39** | **273,880** | **28.6** | **7.2** | **6.9** | **1.4** | **0.4** | **7.6** | **16.1** | **4.5** | **2.8** | **2.6** | **2.1** | **11.5** | **4.1** | **0.6** | **3.6** |
| **40-44** | **194,620** | **34.4** | **9.6** | **5.3** | **1.1** | **0.4** | **6.5** | **12.8** | **5.3** | **1.8** | **3.6** | **2.4** | **7.9** | **4.6** | **0.5** | **3.7** |
| **45-49** | **106,180** | **42.6** | **10.9** | **3.7** | **0.8** | **0.4** | **5.6** | **9.6** | **5.4** | **1.1** | **4.1** | **2.3** | **5.5** | **4.3** | **0.5** | **3.2** |
| **50-54** | **49,417** | **57.6** | **8.6** | **2.6** | **0.6** | **0.5** | **4.3** | **7.1** | **4.0** | **0.7** | **3.0** | **2.1** | **3.4** | **3.0** | **0.3** | **2.1** |
| 55-59 | 24,261 | 69.4 | 7.5 | 1.8 | 0.4 | 0.6 | 2.7 | 4.7 | 2.6 | 0.5 | 2.4 | 1.8 | 2.2 | 1.9 | 0.2 | 1.3 |
| 60-64 | 11,101 | 77.9 | 6.3 | 1.3 | 0.3 | 0.9 | 1.8 | 3.0 | 1.5 | 0.3 | 1.8 | 1.8 | 1.0 | 1.2 | 0.1 | 0.9 |
| 65-69 | 5,670 | 82.6 | 6.0 | 1.1 | 0.3 | 1.1 | 1.4 | 1.4 | 1.0 | 0.2 | 1.4 | 1.7 | 0.6 | 0.4 | 0.1 | 0.7 |
| 70-74 | 2,605 | 85.8 | 4.6 | 0.7 | 0.3 | 1.3 | 1.1 | 1.2 | 0.5 | 0.1 | 1.0 | 1.6 | 0.7 | 0.3 | 0.1 | 0.7 |
| 75-79 | 968 | 81.1 | 4.2 | 1.1 | 0.4 | 2.6 | 1.3 | 1.6 | 0.8 | 0.6 | 0.6 | 2.3 | 1.7 | 0.6 | 0.2 | 0.8 |
| 80-84 | 343 | 76.4 | 3.2 | 1.5 | 0.9 | 2.3 | 3.2 | 2.9 | 1.5 | 0.9 | 1.5 | 2.3 | 1.7 | 1.2 | -- | 0.6 |
| 85-89 | 136 | 53.7 | 5.1 | 2.2 | 2.2 | 2.2 | 2.9 | 10.3 | 4.4 | 3.7 | 3.7 | 2.9 | 2.9 | 0.7 | -- | 2.9 |
| 90-94 | 101 | 31.7 | 10.9 | 4.0 | 2.0 | 3.0 | 8.9 | 8.9 | 4.0 | 2.0 | 5.9 | 3.0 | 6.9 | 5.9 | 1.0 | 2.0 |
| 95-96 | 17 | 23.5 | 5.9 | 5.9 | 5.9 | -- | 5.9 | 17.6 | -- | 11.8 | -- | 5.9 | 11.8 | -- | 5.9 | -- |

* No combination was reported by more than 2 percent of total admissions or by more than 2 percent of any age group.

** Drugs other than alcohol, opiates, stimulants, or marijuana.

-- Quantity is zero.

Note: Data for age groups that include the baby boom generation (aged 33 to 51 in 1997) are in bold print.

Source: SAMHSA, Office of Applied Studies, Treatment Episode Data Set (TEDS), April 16, 2001.

**Table 4 Treatment Admissions, by Age Group and Number of Prior Treatments, Treatment Episode Data Set (TEDS): 1997**

| Age at Admission | Total Number of Admissions[1] | Total | Prior Treatment Episodes | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | None | 1 | 2 | 3 | 4 | 5 or More |
| All ages | 1,319,276 | 100.0 | 41.5 | 23.0 | 12.5 | 7.2 | 4.1 | 11.8 |
| 10-14 | 19,386 | 100.0 | 76.0 | 16.5 | 4.5 | 1.4 | 0.5 | 1.1 |
| 15-19 | 141,561 | 100.0 | 64.0 | 21.8 | 7.8 | 3.2 | 1.2 | 2.0 |
| 20-24 | 138,890 | 100.0 | 52.4 | 23.9 | 10.5 | 5.2 | 2.7 | 5.3 |
| 25-29 | 189,233 | 100.0 | 41.6 | 24.5 | 13.1 | 7.4 | 4.0 | 9.5 |
| **30-34** | **241,386** | **100.0** | **36.5** | **24.0** | **14.0** | **8.3** | **4.8** | **12.4** |
| **35-39** | **241,702** | **100.0** | **34.4** | **23.3** | **14.2** | **8.5** | **5.0** | **14.6** |
| **40-44** | **171,410** | **100.0** | **33.4** | **21.9** | **13.6** | **8.6** | **5.2** | **17.3** |
| **45-49** | **93,048** | **100.0** | **33.2** | **21.7** | **13.0** | **8.3** | **5.1** | **18.6** |
| **50-54** | **43,259** | **100.0** | **35.4** | **21.1** | **12.2** | **7.7** | **4.8** | **18.8** |
| 55-59 | 21,258 | 100.0 | 38.5 | 20.8 | 11.2 | 7.0 | 4.5 | 18.0 |
| 60-64 | 9,673 | 100.0 | 40.5 | 20.9 | 11.2 | 6.3 | 4.1 | 17.0 |
| 65-69 | 4,883 | 100.0 | 43.9 | 21.2 | 10.1 | 6.3 | 3.8 | 14.6 |
| 70-74 | 2,258 | 100.0 | 46.9 | 21.5 | 9.8 | 5.6 | 3.1 | 13.2 |
| 75-79 | 828 | 100.0 | 53.6 | 19.7 | 9.2 | 4.8 | 2.3 | 10.4 |
| 80-84 | 291 | 100.0 | 56.0 | 19.9 | 9.3 | 3.4 | 1.4 | 10.0 |
| 85-89 | 106 | 100.0 | 53.8 | 19.8 | 11.3 | 3.8 | 4.7 | 6.6 |
| 90-94 | 91 | 100.0 | 39.6 | 25.3 | 12.1 | 9.9 | 6.6 | 6.6 |
| 95-96 | 13 | 100.0 | 53.8 | 7.7 | 15.4 | 23.1 | -- | -- |

-- Quantity is zero.

Note: Data for age groups that include the baby boom generation (aged 33 to 51 in 1997) are in bold print.

[1] Excludes 174,434 admissions where number of prior treatment episodes was not reported.

Source: SAMHSA, Office of Applied Studies, Treatment Episode Data Set (TEDS), April 16, 2001.

## Conclusions

Older adults are seldom admitted to the publicly funded substance abuse treatment system. This may be because of reasons unrelated to the level of substance use problems in this population.

Abuse of alcohol alone was the primary problem of the majority of persons aged 50 or older who were admitted to publicly funded substance abuse treatment during 1997. This is in contrast to the younger treatment population, where admissions for polydrug use exceeded those for alcohol alone.

**Table 5 Treatment Admissions, by Age Group and Source of Referral to Treatment, Treatment Episode Data Set (TEDS): 1997**

| Age at Admission | Total Number of Admissions[1] | Total | Source of Referral to Treatment: Criminal Justice System | Individual | Substance Abuse Treatment Provider | Community Referral | Other Health Care Provider | School/ EAP |
|---|---|---|---|---|---|---|---|---|
| All Ages | 1,453,152 | 100.0 | 35.1 | 33.4 | 12.8 | 8.7 | 7.4 | 2.6 |
| 10-14 | 22,021 | 100.0 | 36.1 | 19.5 | 7.6 | 11.3 | 7.5 | 18.0 |
| 15-19 | 155,047 | 100.0 | 49.9 | 19.4 | 8.5 | 8.2 | 6.1 | 8.0 |
| 20-24 | 150,624 | 100.0 | 48.3 | 26.7 | 9.9 | 8.5 | 5.5 | 1.2 |
| 25-29 | 208,073 | 100.0 | 37.2 | 33.4 | 12.3 | 9.5 | 6.4 | 1.2 |
| **30-34** | **265,693** | **100.0** | **32.6** | **35.5** | **13.9** | **9.5** | **7.0** | **1.4** |
| **35-39** | **266,845** | **100.0** | **30.2** | **37.0** | **14.4** | **8.8** | **7.7** | **1.8** |
| **40-44** | **189,560** | **100.0** | **27.9** | **39.1** | **14.7** | **8.1** | **8.4** | **2.0** |
| **45-49** | **103,364** | **100.0** | **26.6** | **39.8** | **14.5** | **7.7** | **9.0** | **2.4** |
| **50-54** | **48,003** | **100.0** | **28.1** | **37.3** | **14.5** | **7.3** | **10.2** | **2.5** |
| 55-59 | 23,539 | 100.0 | 29.1 | 35.9 | 14.4 | 7.1 | 11.2 | 2.3 |
| 60-64 | 10,796 | 100.0 | 32.8 | 34.2 | 12.0 | 6.7 | 12.6 | 1.8 |
| 65-69 | 5,530 | 100.0 | 35.0 | 32.8 | 11.8 | 5.1 | 14.1 | 1.2 |
| 70-74 | 2,540 | 100.0 | 33.4 | 31.8 | 12.3 | 5.2 | 16.6 | 0.7 |
| 75-79 | 947 | 100.0 | 32.1 | 35.1 | 8.3 | 5.0 | 19.0 | 0.5 |
| 80-84 | 328 | 100.0 | 25.9 | 40.9 | 10.7 | 7.0 | 14.6 | 0.9 |
| 85-89 | 128 | 100.0 | 21.1 | 44.5 | 11.7 | 7.8 | 12.5 | 2.3 |
| 90-94 | 97 | 100.0 | 22.7 | 39.2 | 12.4 | 16.5 | 4.1 | 5.2 |
| 95-96 | 17 | 100.0 | 29.4 | 41.2 | 17.6 | -- | 11.8 | -- |

-- Quantity is zero.

Note: Data for age groups that include the baby boom generation (aged 33 to 51 in 1997) are in bold print.

[1] Excludes 40,558 admissions where referral source was not reported.

Source: SAMHSA, Office of Applied Studies, Treatment Episode Data Set (TEDS), April 16, 2001.

Older persons admitted to publicly funded treatment were less likely to report problems with polydrug use. Clinical reports indicate that older persons may be unaware that prescription drugs, in combination with each other or with alcohol, may contribute to a substance abuse problem. However, although peak polydrug use occurred among those younger than 40, with 60 to 70 percent reporting use of multiple substances, it remained a substantial problem for those aged 55 to 79, where 7 to 20 percent reported use of multiple substances. Polydrug use increased among those aged 75 or older to levels comparable with those for persons younger than 40.

Abuse of tranquilizers and sedatives, although relatively low, increased with age. This is consistent with reports in the clinical literature of problem prescription drug use among older adults.

TEDS data indicate that, beginning at age 55, an increasing proportion of persons entering treatment are doing so for the first time, largely for abuse of alcohol alone. This is consistent with reports of late-onset alcoholism (CSAT, 1998). There are indications in TEDS that the few persons aged 75 or older who entered the publicly funded treatment system had more severe and complex problems than those just a few years younger. They were more likely to be polydrug users and to have been in treatment previously.

Referrals to treatment by health care providers increased with age, possibly indicating an underlying increased use of health care providers. Older persons may be more likely to seek treatment for substance abuse from traditional health care providers if they are experiencing medical problems in addition to drug use.

Further research is needed on changes in substance abuse treatment admission patterns. Future TEDS research could include analysis of patterns among birth cohorts, and also analysis of drug use initiation cohorts, both for age at initiation and historical period of initiation.

## Limitations

Although TEDS is an exceptionally large and statistically powerful dataset, care must be taken that interpretation does not extend beyond the limitations of the data. TEDS does not represent the total national demand for substance abuse treatment, but it does comprise a significant proportion of all admissions to substance abuse treatment and includes those admissions that constitute a burden on public funds. SAMHSA has estimated that the TEDS system, for 1997, captured about two thirds of all admissions to substance abuse treatment (OAS, 1999). In general, facilities reporting TEDS data are those that receive State alcohol and/or drug agency funds (including Federal Block Grant funds) for the provision of substance abuse treatment services. TEDS does not include facilities operated by Federal agencies (the Bureau of Prisons, the Department of Defense, and the Veterans Administration). Hospital- and/or correctional system-based substance abuse treatment facilities, if not licensed through the State substance abuse agency, may also be excluded from the TEDS system.

TEDS probably underestimates the number of drug classes used because it requires reporting only of primary, secondary, and tertiary substances of abuse. The substances reported are those that led to the treatment episode and are not necessarily a complete enumeration of all

drug classes used at the time of admission. Twenty percent of all admissions reported the abuse of three drug classes (most frequently alcohol and two drugs). Some proportion of these undoubtedly abused additional substances. Assignment of drugs as primary, secondary, or tertiary may be influenced by the treatment reimbursement system in effect. It is generally accepted that treatment resources are inadequate to serve all those who desire treatment. Resources may be constrained by mandatory set-asides for treatment of specific drug problems. Thus, someone with both cocaine and alcohol addictions may find it easier obtain treatment as a primary cocaine addict than as a primary alcohol abuser with a secondary cocaine problem. Similarly, lack of resources may make it necessary to practice a triage system, admitting to treatment those who are addicted to "harder" (usually illicit) drugs.

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# Chapter 5. The Aging Baby Boom Cohort and Future Prevalence of Substance Abuse

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*Abstract*: Because of the size of the baby boom cohort and the relatively higher rate of substance use relative to earlier cohorts, there is concern that as this cohort ages, there will be a substantial increase in the number of older adults with substance abuse problems. To address this concern, projections of future substance abuse prevalence were developed using data from the 1999 National Household Survey on Drug Abuse. Regression models were developed to predict problematic substance abuse among the older adult population, defined here as those aged 50 or older. The regression parameters from these models were then applied to the projected 2020 population to obtain estimates of the number of older adults with substance abuse problems in 2020. The number of older adults with substance abuse problems is estimated to increase from 2.5 million in 1999 to 5.0 million in 2020. The aging baby boom cohort will place increasing demands on the substance abuse treatment system in the next two decades and will require a shift in focus to address the special needs of an older population of substance abusers. There is also a need to develop improved tools for measuring substance use and abuse among older adults.

Historically, alcohol and illicit drug abuse have been associated with young populations. Rates of problematic use have been shown by many studies to decline with increasing age, starting in the mid- to late 20s (National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2000; Office of Applied Studies [OAS], 2000a). This is primarily due to reduced use of both alcohol and illicit drugs by people as they age. When people are in their 20s and 30s, the reduced use is related to significant shifts in responsibilities, such as a having a regular job, marriage, and parenthood (Bachman, Wadsworth, O'Malley, Johnston, & Schulenberg, 1997; Gotham, Sher, & Wood, 1997). The continued reductions in prevalence rates at later ages could be related to "maturing out" (Winick, 1962) or to elevated mortality rates among substance abusers (Moos, Brennan, & Mertens, 1994).

Birth cohorts that experience high rates of illicit drug use in youth have subsequently shown higher rates of use and associated problems as they age, relative to other cohorts (OAS,

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2000a). Illicit drug use was rare in cohorts immediately preceding the baby boom cohort, defined as those born between 1946 and 1964. The rate peaked in 1979, when the baby boom cohort was aged 15 to 33. During that peak year, approximately 10 percent of the estimated 25 million current illicit drug users were aged 35 or older. In 1995, when the baby boom cohort was aged 31 to 49, the percentage of current illicit drug users who were over the age of 35 had increased to 27 percent. In 1995, 49 percent of the baby boom cohort had ever used illicit drugs in their lifetime compared with only 11 percent of adults aged 50 or older (OAS, 1996). In 1996, the baby boom cohort began to reach age 50. In addition to being more likely to have used illicit drugs than previous cohorts, the baby boom cohort is larger than earlier cohorts. Rates of heavy alcohol use have also been shown to be higher among baby boomers than in earlier cohorts (NIAAA, 2000).

Taken together, these data suggest that the prevalence of problematic substance use among older adults may increase as the baby boom cohort ages. In 1998, only 7 percent of admissions to publicly funded substance abuse treatment programs involved patients aged 50 or older (OAS, 2000b). The higher rates of problematic substance abuse among the baby boom cohort will likely lead to an increase in this number. This will require a shift in focus for treatment programs, which have dealt primarily with young populations, in order to address the special needs of an older population of substance abusers.

The purpose of this chapter is to estimate the number of persons with substance abuse problems in the year 2020. By that year, the 50 or older age group will include all of the surviving baby boomers as well as a post-baby boom cohort (born between 1965 and 1970) that experienced a high rate of illicit drug use during their youth (OAS, 1996). The methodology used is similar to that used in a previous study (Gfroerer & Epstein, 1999) and is based on data from the National Household Survey on Drug Abuse (NHSDA). Employing a narrow definition of illicit drug treatment need, the previous study estimated that the number of persons aged 50 or older who would need treatment for illicit drugs would increase from 147,000 in 1995 to 911,000 in 2020. The current study employs some methodological improvements and focuses on a broader population of substance abusers, including heavy users of alcohol as well as illicit drug users.

## Methods

The estimation of problem substance use among older adults involved two steps. First, a series of regression models was run predicting substance abuse among the older adult population in 1999. The purpose of these models was to determine parameter estimates that characterized the relationships between a set of independent variables and problem substance use among older adults. Second, the parameters estimated from these models were applied to the projected 2020

older adult population, whose values for the independent variables were determined from 1999 data, to generate estimates of substance abuse prevalence in 2020. These two steps are described in more detail below, following descriptions of the data source and definitions used.

**Data Source**

Data from the 1999 NHSDA were used in this study. Regression models were based on the data for respondents age 50 or older ($n$ = 5,292), and the projected older adult population in 2020 was constructed from the 1999 NHSDA respondents age 29 or older ($n$ = 16,744). The 1999 NHSDA was a nationally representative survey of the civilian, noninstitutional population aged 12 or older in the United States. The survey obtained data on substance use from 66,706 respondents interviewed anonymously in their homes using audio computer-assisted self-interviewing (ACASI) for all substance use questions. The household screening response rate (weighted) was 89.6 percent. The interview response rates (weighted) were 68.0 percent for those aged 30 to 49 and 64.6 percent for those aged 50 or older (OAS, 2000a).

**Definition of Problem Substance Use**

For this analysis, a broad definition of problem substance use was employed. To be classified as a problem substance user, at least one of the following had to be present:

1. *Dependence.* Meets the criteria for alcohol or drug dependence in the past year as defined in the 4th edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV, American Psychiatric Association [APA], 1994).

2. *Heavy Drug or Alcohol Use.* As indicated by any of the following: (a) used marijuana daily in the past year; (b) used an illicit drug other than marijuana at least 52 times in past year (drugs include inhalants, hallucinogens, cocaine, or nonmedical use of prescription-type stimulants, pain relievers, sedatives, or tranquilizers); (c) used heroin in any form or injected cocaine or stimulants at least once in the past year; and (d) had five or more drinks on five or more separate occasions in the past month.

3. *Treatment.* Received any type of treatment for a substance use problem in the past year.

Based on this definition, 196 of the 5,292 respondents aged 50 or older were classified as problem substance users. This corresponds to an estimate of 3.5 percent (weighted) of the population, which in turn translates to an estimated 2.5 million older adults being problem

substance users. Of these, 7.9 percent were problem illicit drug users only, 86.6 percent were problem alcohol users only, and 5.5 percent were both.

**Step One: Regression Models**

The 50 or older sample was split into three mutually exclusive groups with low, medium, or high risk of having substance abuse problems as older adults. Persons who had not used alcohol before age 30 were defined as low risk. This group accounted for 23.7 percent of the population of older adults in 1999. Those who had used alcohol before age 30 but not marijuana were defined as medium risk (67.6 percent of the population), and those who had used both alcohol and marijuana before age 30 were defined as high risk (8.8 percent of the population). The rates of problem substance use were 0.8 percent in the low risk group, 3.7 percent in the medium risk group, and 9.6 percent in the high risk group. Splitting the sample into these three groups made it possible to include age at first use of alcohol (a continuous variable) as a predictor in the models for the medium and high risk groups because all members of these groups had used alcohol in their lifetime and therefore had a legitimate value for this predictor. Similarly, age at first use of marijuana could be included in the model for the high risk group because all members of this group had used marijuana in their lifetime. Age at first use of alcohol and marijuana are known to be important predictors of later problem substance use (Anthony & Petronis, 1995; Gfroerer & Epstein, 1999; Grant & Dawson, 1997; OAS, 2000a).

Logistic regression models were run on each of these three groups. The dependent variable in all models was problem substance use, defined above. Independent variables are listed below. Only those predictors obtained by the NHSDA that could be assumed to remain unchanged as people age beyond age 29 were considered for the models. Because initiation of cigarettes, alcohol, or marijuana rarely occurs after age 29 (Chen & Kandel, 1995), the age at first use variables (as well as the definition of low, medium, and high risk) essentially correspond to "ever use" of these substances. Nevertheless, the models did take into account initiation after age 29 because a few cases with initiation at age 30 or older would be included in the sample and classified as "no use before age 30." In the following list, the reference group for categorical variables is the first category listed after the variable.

- *Included in all models*: Age (continuous), gender (female, male), race/ethnicity (white/other-not Hispanic, Hispanic, black-not Hispanic), cigarette use (never smoked daily before age 30, smoked daily before age 30).

- *Included in models for medium and high risk populations*: Age at first alcohol use (continuous).

- *Included in model for high risk population*: Age at first marijuana use (continuous).

Logistic regressions were run using analysis weights and SUrvey DAta ANalysis (SUDAAN) software to account for the complex sample design of the NHSDA in the calculation of parameter estimates and estimates of standard errors (Shah, Barnwell, & Bieler, 1998). An alpha level of .05 was used in determining statistical significance of regression parameters for the discussion of results.

To determine the adequacy of the fit of each model, the Hosmer-Lemeshow Lack-of-Fit statistic (Hosmer & Lemeshow, 1989) was utilized. Following the methodology proposed by Nagelkerke (1991), we also utilized a maximum rescaled R-square to determine the absolute percentage of variation explained by each model. These statistics are not available in SUDAAN, so model diagnostics were run using SAS V8.1.

**Step Two: Projection to 2020 Population**

A sample representing the total population aged 50 or older in 2020 was constructed from the 1999 NHSDA sample of respondents aged 29 or older. This was done by taking each respondent's age in 1999 and increasing it by 21 years. The gender, race/ethnicity, and substance use characteristics of each respondent in 1999 were assumed to be the same in 2020. Thus, all of the independent variables included in the regression models of the 50 or older population in 1999 were also known for the 29 or older population who will be aged 50 or older in 2020.

Two adjustments were made to the analysis weights of these sample cases to ensure that the sample appropriately represented the 2020 population. First, the age-gender-race distribution of the sample was forced through statistical adjustment to match population projections for the year 2020 developed by the U.S. Bureau of the Census (2000). This was done within the following groups:

- single-year-of-age-by-race-by-gender groups up to age 69,
- 5-year-age-groups-by-race-by-gender groups for ages 70 to 94, and
- a final race-by-gender group for ages 95 or older.

Second, we adjusted the weights of the sample cases to account for an expected higher death rate among substance abusers than among nonsubstance abusers. Based on their 1999 data, persons dependent on alcohol in 1999 were assumed to have a 1.7 times higher risk of death after 21 years, and persons dependent on illicit drugs in 1999 were assumed to have a 2.8 times higher

risk of death (Neumark, Van Etten, & Anthony, 2000a, 2000b). Persons who were dependent on both alcohol and illicit drugs in 1999 were assumed to have a $1.7 \times 2.8 = 4.8$ times higher risk of death. Thus, weights for respondents who were substance dependent in 1999 were reduced, while weights for nondependent cases were adjusted upward to result in a total (dependent plus nondependent) sum of weights in each age-race-gender group that matched the Census projection for that age-race-gender group.

The parameters estimated from the three regression models were then applied to the constructed 2020 population. A predicted probability of being a problem substance user was assigned to each sample case, based on the substance use category (low, medium, or high risk) the case fell into and the logistic regression model parameters associated with that category. Weighted sums of the predicted probabilities were then tabulated, representing the estimated prevalence in 2020.

**Estimation of Standard Errors and Confidence Intervals**

Standard errors for 1999 estimates were computed using SUDAAN software that accounts for the complex sample design of the NHSDA. Standard errors for the 2020 projections were calculated by applying a jackknife procedure in which the entire estimation process was repeated 38 times (19 superstrata by 2 replicates for each superstrata) with different random subsamples that each generated a different 2020 estimate. This methodology helps account for bias and variance associated with the modeling and prediction. Variances were calculated as follows:

$$Var(jk) = \sum_{h=1}^{19} \sum_{j=1}^{2} ((\Theta_{hj} - \Theta)^2)/2$$

where

$h$ = superstrata, defined as a State or aggregates of States;
$j$ = replicate number;
$\Theta_{hj}$ = estimate with the $j^{th}$ replicate from the $h^{th}$ superstrata removed and the weights of the remaining replicate doubled; and
$\Theta$ = estimate from the full sample

Because the estimated prevalence rates were small and necessarily between zero and one, asymmetric 95 percent confidence intervals were computed using a logit transformation. Standard errors and confidence intervals for the estimated numbers of persons were computed by multiplying the standard error and confidence intervals for corresponding rates by the population estimates.

## Results

### Model Diagnostics

The Hosmer-Lemeshow tests suggest that there was adequate fit in both the low risk ($p$ = 0.3861) and medium risk ($p$ = 0.7323) models. This test for the high risk model suggested that the model did not adequately fit the data ($p$ = 0.0003). The maximum rescaled R-squares were $r^2$ = .03 for the low risk model, $r^2$ = .09 for the medium risk model, and $r^2$ = .21 for the high risk model. Thus, the model diagnostics results were mixed, suggesting that other predictors may need to be identified to improve these projections. It is possible that splitting the sample into high, medium, and low risk groups was more important in the prediction of problem substance use than were the specific independent variables in the three models.

### Regression Models

None of the independent variables in the low risk model were significant predictors of problem substance use (Table 1). Because of the low prevalence of problem substance use and the small proportion of the population it represents, this model has a small impact on the overall estimates for 2020.

For the medium risk model, age, gender, and age at first alcohol use were all significant predictors of problem substance use. Probability of problem substance use declined with increasing age and with increasing age at first alcohol use. Males were more likely than females to have problem substance use (odds ratio [OR] = 3.1).

Among the high risk population, age, gender, and age at first use of marijuana were significant predictors of problem substance use. In this high risk population, the probability of problem substance abuse declined with increasing age, males were significantly more likely to have problem substance use (OR = 6.1) than females, and early use of marijuana was significantly associated with problem substance use. The OR for age at first use of marijuana (0.86) indicates that for each year marijuana initiation is delayed during youth, there is a 14 percent reduction in the risk of problem substance use after reaching age 50.

Although some predictors were not significant, there was consistency across the three models in the directions for these predictors. Daily smoking was not significant in any of the models, but the direction of the ORs suggested that daily smokers in all three risk groups were more likely to have a substance abuse problem. ORs for Hispanic and black-not Hispanic were greater than 1 in all models, suggesting that these groups were more likely to have a substance abuse problem than white/other-not Hispanics.

Table 1 Logistic Regression Modeling Results

| Covariates | β | SE of β | *p*-Value | Odds Ratio | 95 Percent Confidence Interval |
|---|---|---|---|---|---|
| **Low Risk Model** | | | | | |
| Intercept | -5.80 | 2.87 | 0.044 | -- | (-- - --) |
| Age (continuous) | 0.01 | 0.04 | 0.857 | 1.01 | (0.93 - 1.09) |
| Males vs. females | 0.56 | 0.95 | 0.554 | 1.75 | (0.27 - 11.27) |
| Hispanic vs. white/other-not Hispanic | 0.69 | 0.90 | 0.446 | 1.99 | (0.34 - 11.74) |
| Black-not Hispanic vs. white/other-not Hispanic | 1.20 | 1.12 | 0.283 | 3.33 | (0.37 - 29.91) |
| Smoked daily before age 30 vs. not smoked daily before age 30 | 0.35 | 1.00 | 0.727 | 1.42 | (0.20 - 10.06) |
| **Medium Risk Model** | | | | | |
| Intercept | -0.80 | 1.11 | 0.470 | -- | (-- - --) |
| Age (continuous) | -0.03 | 0.01 | 0.035 | 0.97 | (0.94 - 1.00) |
| Males vs. females | 1.14 | 0.32 | 0.000 | 3.12 | (1.67 - 5.82) |
| Hispanic vs. white-not Hispanic | 0.38 | 0.54 | 0.486 | 1.46 | (0.50 - 4.23) |
| Black-not Hispanic vs. white/other-not Hispanic | 0.61 | 0.50 | 0.223 | 1.84 | (0.69 - 4.88) |
| Smoked daily before age 30 vs. not smoked daily before age 30 | 0.44 | 0.32 | 0.159 | 1.56 | (0.84 - 2.89) |
| Age at first alcohol use (continuous) | -0.10 | 0.03 | 0.000 | 0.91 | (0.87 - 0.95) |
| **High Risk Model** | | | | | |
| Intercept | 6.02 | 3.10 | 0.052 | -- | (-- - --) |
| Age (continuous) | -0.13 | 0.05 | 0.009 | 0.88 | (0.80 - 0.97) |
| Males vs. females | 1.81 | 0.68 | 0.008 | 6.10 | (1.59 - 23.37) |
| Hispanic vs. white/other-not Hispanic | 0.13 | 0.93 | 0.888 | 1.14 | (0.18 - 7.13) |
| Black-not Hispanic vs. white/other-not Hispanic | 0.09 | 0.62 | 0.882 | 1.10 | (0.33 - 3.69) |
| Smoked daily before age 30 vs. not smoked daily before age 30 | 0.83 | 0.58 | 0.150 | 2.29 | (0.74 - 7.10) |
| Age at first alcohol use (continuous) | -0.03 | 0.06 | 0.650 | 0.97 | (0.87 - 1.09) |
| Age at first marijuana use (continuous) | -0.16 | 0.07 | 0.021 | 0.86 | (0.75 - 0.98) |

## 2020 Projections

Applying these regression results to the projected population in 2020 resulted in a doubling of the number of older adult problem substance users—from 2.5 million in 1999 to 5.0 million (95 percent confidence interval: 3.6 million to 6.9 million) in 2020. As shown in Table 2, this is the result of a 55 percent increase in the population size (from 72.4 million to 112.5 million) combined with a 29 percent increase in the rate of problem substance use (from 3.5 to 4.5 percent) in the older adult population. Increases are projected for all gender, racial, and age groups. More than half of the projected 2020 population of older adult problem substance users are aged 50 to 59, and more than four fifths are male.

**Table 2 Estimated 1999 and Projected 2020 Persons Aged 50 or Older with Problem Substance Use**

| | 1999 Estimates | | | 2020 Projections | | | |
|---|---|---|---|---|---|---|---|
| Domains of Interest | Population (1,000s) | Number of Persons with Problem Substance Use (1,000s) | Percentage of Population with Problem Substance Use (SE) | Population (1,000s) | Number of Persons with Problem Substance Use (1,000s) | Percentage of Population with Problem Substance Use | Percentage of Population Needing Treatment (SE)[1] |
| **Total** | 72,460 | 2,548 | 3.5 (0.4) | 112,476 | 5,037 | 4.5 | 4.5 (0.7) |
| **Gender** | | | | | | | |
| Male | 32,865 | 2,028 | 6.2 (0.7) | 52,424 | 4,060 | 7.7 | 7.7 (1.3) |
| Female | 39,595 | 519 | 1.3 (0.3) | 60,052 | 977 | 1.6 | 1.6 (0.5) |
| **Race/Ethnicity** | | | | | | | |
| Hispanic | 4,717 | 202 | 4.3 (1.7) | 12,298 | 552 | 4.5 | 4.5 (1.7) |
| Black-not Hispanic | 6,590 | 321 | 4.9 (1.5) | 12,147 | 593 | 4.9 | 4.9 (1.8) |
| White/other-not Hispanic | 61,152 | 2,025 | 3.3 (0.4) | 88,031 | 3,892 | 4.4 | 4.4 (0.8) |
| **Age Group in Years** | | | | | | | |
| 50-59 | 29,943 | 1,501 | 5.0 (0.7) | 40,935 | 3,131 | 7.6 | 7.6 (1.5) |
| 60-69 | 19,706 | 607 | 3.1 (0.6) | 37,927 | 1,296 | 3.4 | 3.4 (0.8) |
| 70-79 | 16,112 | 336 | 2.1 (0.6) | 22,759 | 436 | 1.9 | 1.9 (0.4) |
| 80-89 | 5,965 | 105 | 1.8 (0.8) | 8,636 | 147 | 1.7 | 1.7 (0.6) |
| 90+ | 734 | 0 | 0.0 (0.0) | 2,219 | 26 | 1.2 | 1.2 (0.6) |

[1] Standard errors for projections are derived through jackknife replication methodology.

## Discussion

These analyses suggest that the number of adults over the age of 50 with substance abuse problems will increase from approximately 2.5 million in 1999 to approximately 5 million in 2020. Although these analyses did not distinguish the specific kinds of problems that the estimated 5 million older adult substance abusers in 2020 will have, it is apparent that the increasing rate of problem substance use in this population is driven by an increase in problems related to the use of illicit drugs or nonmedical use of prescription drugs. In 1999, only 8.8 percent of persons 50 or older were classified in the high risk group defined in our regression models (used alcohol and marijuana before age 30). However, among those aged 29 to 49, the group projected to be aged 50 to 70 in 2020, 49.9 percent were in the high risk group. In an earlier analysis (Gfroerer & Epstein, 1999) that focused only on illicit drugs, the number of persons aged 50 or older needing treatment for illicit drugs was projected to increase over 500 percent between 1995 and 2020.

The methodology used here incorporated several improvements over the earlier work in making projections for the older adult population. The previous effort made projections for all ages 12 and older, which required the inclusion of estimates of drug initiates in future years. Because this chapter focuses only on older adults, assumptions about future rates of initiation were not critical and could be ignored. Projections in the earlier paper were based on the aging of the 1995 and 1996 NHSDA samples, with application of mortality rates by age, race, and gender. For the current study, we incorporated differential mortality rates for substance users and we adjusted the population to established Census projections for 2020 that take into account immigration.

To assess the impact of our adjustment for differential mortality, we reran the projections assuming no difference in mortality between substance abusers and nonsubstance abusers. This showed that the adjustment we used only reduced the estimated number of problem substance users in 2020 by about 100,000, or 2 percent of the total. It should also be noted that the adjustments we used were based on a 14-year follow-up of cohorts of drug- and alcohol-dependent persons. We had no basis for calculating a differential mortality over a 21-year period, so we used the estimates as they were published. Better data on the association between substance abuse and mortality is needed for future research on the aging of the baby boom cohort. Several available datasets could yield valuable information on the mortality of substance abusers:

- follow-up of the Baltimore Epidemiological Catchment Area survey (Neumark et al., 2000a, 2000b),

- National Longitudinal Survey of Youth (Fendrich & Vaughn, 1994; Kandel & Davies, 1991),
- Monitoring the Future follow-up sample (Bachman et al., 1997), and
- 1991 Drug Supplement to the National Health Interview Survey (Keer et al., 1994), which can be linked with the National Death Index.

Another improvement in the projection for the 50 or older population was to use only the sample of respondents aged 50 or older from the NHSDA to develop the regression models. This was possible because of the larger sample available in the 1999 NHSDA due to the expansion of the survey in that year. The prior study (Gfroerer & Epstein, 1999) was based on the combined 1995 and 1996 NHSDAs, which had a sample of only 200 lifetime marijuana users aged 50 or older. With that small sample and the focus on younger populations, we used a single model based on all respondents aged 35 or older to estimate projections for those aged 50 or older. Nevertheless, the difficulty in developing good models of rare characteristics with a limited set of predictors is evident from the somewhat unsatisfactory model diagnostics we obtained.

To build better models, more questions related to substance use history or other known predictors of future substance abuse could be added to future rounds of the NHSDA. For example, historical information on the quantity and frequency of use and problems associated with use at earlier ages would likely improve the prediction. The impact of the adjustment for differential mortality on projections might also increase with the use of better predictors in the models. Analysis of larger samples, either by combining several years of data or by increasing the older adult sample, would also help in developing better prediction models. In particular, it might be important to have separate regression models for age subgroups within the 50 or older population to account for potential age-related differences in the relationships between predictors and outcomes (e.g., late onset substance abuse disorders).

One important caveat of this study, as well as the prior one (Gfroerer & Epstein, 1999), is the implicit assumption that the models developed for the 50 or older population in 1999 are correct for future cohorts of older adults, particularly the 29 to 49 year olds in 1999. Recent research has suggested that patterns of progression from nonuse to alcohol/tobacco use to marijuana use to the use of hard drugs are different in different cohorts (Golub & Johnson, 2001). However, those results do not necessarily imply that our models of problem substance use are invalid for other cohorts. This is an important issue that can be studied as future waves of the expanded NHSDA become available.

Two additional caveats are of importance in interpreting these data. First, the population covered by the NHSDA excludes institutionalized and homeless persons and therefore will

underestimate the number of problem substance users. Secondly, the definition of problem substance use employed in this study may not be appropriate for elderly populations. DSM-IV criteria were developed and validated in young and middle-aged samples, so they may not be appropriate for elderly populations (Patterson & Jeste, 1999). Also, the thresholds for heavy drug or alcohol use in our definition may be higher than is appropriate for elderly populations.

Future research on substance abuse among older adults should look at alternative measures of substance abuse in the older adult population and distinguish between different categories of substance abuse. For example, specific groups of interest might include (a) persons in recovery, (b) persons abusing prescription drugs, (c) persons abusing primarily illicit drugs, and (d) persons with a DSM-IV diagnosis of substance dependence or abuse. The prevention and treatment approaches may need to be quite different for each of these groups. To adequately assess these specific characteristics using the NHSDA, it may be necessary to include new survey questions addressing these topics and designed specifically for administration to an elderly population. The current NHSDA questionnaire, for example, does not assess inadvertent misuse of prescription drugs, such as taking the wrong amounts or mix of drugs prescribed.

## Conclusions

These data support the growing consensus that the aging of the baby boom cohort, with its size and high rate of substance use, will place increasing demands on the substance abuse treatment system in this country in the next two decades. The estimates show a doubling of the number of problem substance users aged 50 or older during the next two decades—from 2.5 million in 1999 to 5.0 million in 2020.

In anticipation of this growing problem, it is essential that improved tools for measuring substance abuse among older adults be developed. Better data are needed for predicting the future trends and also for measuring current problems as they continue to emerge. Some of these data could be obtained from the NHSDA, with modifications to the questionnaire and sample design and size. It may also be necessary to develop new data systems tailored to the unique and unprecedented information needs related to substance abuse among the aging baby boom population.

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# Chapter 6. Substance Abuse Among Older Adults in 2020: Projections Using the Life Table Approach and the National Household Survey on Drug Abuse

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*Abstract*: One way of projecting substance abuse problems among older adults is to use a life table approach. The National Household Survey on Drug Abuse (NHSDA), a major data source on substance use and abuse among the U.S. civilian population aged 12 or older, could potentially be used in a life table approach. A review of the NHSDA shows that, even with its increase in sample size in 1999, the survey does not currently provide sufficient detailed data to be used in a life table approach. The survey could be expanded, however, with selected questions added in a special supplement so that a life table or other more sophisticated approach could be used to make projections of substance abuse problems among older adults.

## Introduction

Several methods could be used to estimate substance abuse among older adults in the future. The approach considered here employs a life table, which tracks the mortality or morbidity experience of a group, and the National Household Survey on Drug Abuse (NHSDA). The NHSDA is a rich data source on the prevalence of psychoactive and nonmedically used psychotherapeutic substances among older adults (Office of Applied Studies [OAS], 2001a). Psychoactive substances include marijuana, cocaine, heroin, hallucinogens, inhalants, and alcohol. Psychotherapeutic substances include the nonmedical use of prescription-type pain relievers, tranquilizers, stimulants, and sedatives. Since 1990, the NHSDA has annually surveyed the civilian, noninstitutionalized population of the United States aged 12 or older. Between 1971, the first year of the survey, and 1990, nine NHSDAs were fielded intermittently (i.e., in 1988, 1985, 1982, 1979, 1977, 1976, 1974, 1972, and 1971). In 1999, the sample size of the NHSDA was increased almost fourfold from prior years—to nearly 70,000 persons—with a concomitant increase in the number of older adults surveyed. The larger sample size of older adults in the NHSDA makes this survey a potential data source for a life table approach to project substance abuse among older adults.

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Current prevalence rates for older adults reported in the NHSDA can be applied to population projections to extrapolate the expected future number of older persons with substance abuse problems. When averaged NHSDA rates of past year drug dependence for persons aged 50 or older are multiplied by 2020 population estimates of persons aged 50 or older (U.S. Bureau of the Census, 2000), the number of past year alcohol- or drug-dependent[3] persons is expected to increase from 500,000 to 700,000 between 1999 and 2020. The number of those who used illicit drugs or drank heavily[4] is expected to increase from 930,000 to 1.1 million for the same time period. Simply applying an extrapolation of current rates to population projections, however, is inadequate to estimate the number of older persons with substance dependence or to measure prevalence beyond dependence and abuse because the NHSDA reports almost no information on recovery and none on death attributable to substance use. The various influences on substance use of older persons have been described in other sections of this publication. For example, there is growing evidence that the "baby boom" generation (i.e., those born between 1946 and 1964) will have an unprecedented level of substance-related health problems as it ages (see the first chapter by Korper and Raskin in this monograph). A simple extrapolation cannot account for these influences. A life table approach or other more sophisticated approach is needed.

This chapter reviews the NHSDA data and suggests what might be added to the NHSDA to make it more useful in a life table approach to project substance abuse at older ages. The analysis uses a comprehensive substance use categorization scheme (see the chapter by Ray in this monograph), then examines how these categories might be used in a projection. The proposed life table approach uses these categories to estimate the extent of substance abuse problems among older persons. If the NHSDA were to obtain more detailed information on substance users, this information could be used to project expected future substance use among older persons.

## Life Table Approach

Life tables have numerous applications, such as determining the mortality or longevity of a population or ascertaining the significance of differences in mortality, longevity, or morbidity among groups. Because they are used to track morbidity in populations over time, life tables can be the basis for estimating the extent of future substance abuse problems among older persons.

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[3] "Dependent on alcohol or any illicit drug during past year" is derived from an algorithm based on criteria in the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., DSM-IV) (American Psychiatric Association [APA], 1994).

[4] "Illicit drug use" and "heavy alcohol use" are defined in the subsequent narrative.

Kuzma (1984) and Selvin (1996) described three basic types of life tables: (a) the current life table; (b) the cohort, or generation, life table; and (c) the follow-up, or modified, life table. The current life table shows the effect of age-specific death rates on a population. The cohort life table shows the historical record from a point in time until the last person in the group has died. The follow-up life table provides the probability of survival of patients in a group following treatment or exposure to a disease. The follow-up type also offers the best fit for tracking a cohort of substance users (e.g., baby boomers) as they move into old age by 2020 or 2030.

To construct a follow-up life table, the starting and end points (years) have to be clearly specified. Given a specific time period and population categorized into age groups, it is possible to tally how many survive, how many die, how many enter into the group, and how many exit the group. An illustrative follow-up life table is shown in Table 1 for a hypothetical substance and starting with a population of 1,000 under the age of 5 years.

In the life table approach, cohorts are followed for a given period of time to determine their various outcomes. In the table, one cohort's drug use is followed as the cohort ages. The first value in column 1 and all values in column 2 for those initiating use and columns 4 and 5 for those who died or discontinued use are exogenous to the table; that is, they are determined independently from the table and are not calculated from it. Values for the other columns are calculated as noted in the formulas.[5] This approach is similar to a survivor analysis.

Each annual NHSDA survey provides a cross-section of the household population for only a year and does not follow individuals over time, but the survey series could be used to create cohorts. Conceptually, for example, NHSDA data could be used to create several cohorts of 5-year age groups. Two such NHSDA cohorts drawn from 5-year age group data could be created for two different years. The NHSDA would need to have a sufficiently large sample to provide cohort estimates precise enough for statistical comparison. Because NHSDA data have been collected for more than three decades, in theory several cohorts could be created, provided that their death rates and recovery rates from drug use can be estimated. An age group of 30 to 34 year olds in 1995 becomes the age group of 35 to 39 year olds in 2000 and so on. Even though the NHSDA does not currently track a cohort of 30 to 34 year olds from 1995 through 2000 when they would be 35 to 39 years of age, the two age groups in 1995 and 2000 are comparable in that they can be thought of as similar to a cohort.

Based on a known decline in substance use prevalence as age increases, one expects to see a proportionate decline in the estimates of substance abuse cohorts between the 2 years

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[5]Note that the proportion drug-free at the end of the interval (column 8) is made up of the combined products of the probabilities of being drug-free at the end of the interval and all prior intervals: $p_1 \times p_2 \times \ldots p_n = \prod p_i$.

**Table 1 Hypothetical Life Table of a Substance-Using Population**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Age Group | Drug-Free at Beginning of Interval<br>Col $1_t$ - (Col $2_{t-1}$ + Col $3_{t-1}$) | Began Drug Use During Interval | Cumulative Number of Drug Users<br>Col $2_t$ + Col $3_{t-1}$ | Died During Interval | Recovered During Interval | Potential Number of Drug Users<br>Col 1 - (Col 4 + Col 5) | Percent Beginning Drug Use During Interval<br>Col 2 / Col 6 | Percent Drug-Free During Interval<br>1 - Col 7 | Percent Drug-Free at End of Interval<br>Col $9_{t-1}$ × Col $8_t$ |
| 0-4 | 1,000 | 0 | 0 | 15 | 0 | 985 | 0.000% | 100.0% | 100.0% |
| 5-9 | 985 | 0 | 0 | 2 | 0 | 983 | 0.000% | 100.0% | 100.0% |
| 10-14 | 983 | 15 | 15 | 5 | 0 | 978 | 1.500% | 98.5% | 98.5% |
| 15-19 | 963 | 40 | 55 | 7 | 1 | 955 | 0.042% | 95.8% | 0.9% |
| 20-24 | 915 | 45 | 100 | 5 | 13 | 897 | 0.050% | 95.0% | 0.9% |
| 25-29 | 852 | 30 | 130 | 5 | 15 | 832 | 0.036% | 96.4% | 0.9% |
| 30-34 | 802 | 20 | 150 | 8 | 16 | 778 | 0.026% | 97.4% | 0.8% |
| 35-39 | 758 | 10 | 160 | 10 | 20 | 728 | 0.014% | 98.6% | 0.8% |
| 40-44 | 718 | 5 | 165 | 10 | 15 | 693 | 0.007% | 99.3% | 0.8% |
| 45-49 | 688 | 1 | 166 | 24 | 20 | 644 | 0.002% | 99.8% | 0.8% |
| 50-54 | 643 | 1 | 167 | 28 | 20 | 595 | 0.002% | 99.8% | 0.8% |
| 55-59 | 594 | 0 | 167 | 42 | 12 | 542 | 0.000% | 100.0% | 0.8% |
| 60-64 | 542 | 0 | 167 | 47 | 10 | 485 | 0.000% | 100.0% | 0.8% |
| 65-69 | 485 | 0 | 167 | 55 | 5 | 425 | 0.000% | 100.0% | 0.8% |
| etc. | | | | | | | | | |

Source: Adapted from a table provided by Leigh Henderson with persons used in place of person-years.

(i.e., 1995 and 2000). If one assumes that the expected declines across cohorts continue into the next two decades, the estimates can be extrapolated forward to the year 2020.[6] Thus, the original age group of 30- to 34-year-old substance-dependent persons would become the group aged 55 to 59 years in 2020,[7] and the group aged 30 to 39 years would become the group aged 60 to 64 years in 2020. The product of the projected rate difference between 1995 and 2000 and the projected population is the number of older persons dependent on substances in 2020.

Prevalence changes between age groups for particular years (e.g., 30 to 34 and 35 to 39 in 1995 and 2000) also can be compared. The expected declines are a measure of the change that can be extrapolated to 2020. This comparison does not have the same validity as an approach that tracks cohorts for a period of time and "trends" it forward, but it can be used to provide a quantitative estimate of future prevalence estimates. However, it does not measure those who begin substance use later in life.

NHSDA data cannot now be used for the exogenous values for columns 2, 3, and 4 in the life table example shown in Table 1. Moreover, the life table approach uses the number of new cases in a period of time (an incidence approach). Although the NHSDA is mostly used for prevalence information, it can be used for incidence analysis. For example, age of first use could be useful in the life table to estimate the number who began drug use during an interval. Therefore, the life table approach requires some modification when NHSDA data are used; it may also require a larger sample of older adults for categorizing into the life table columns. In place of drug use or drug-free, the following NHSDA data terms would be used:

- *Used illicit drugs or drank heavily*: Applying the NHSDA, illicit drug use includes at least one use of any of the following listed drugs: marijuana/hashish, cocaine (including crack), inhalants, hallucinogens (including PCP and LSD), heroin, or any prescription-type psychotherapeutic used nonmedically. Heavy alcohol use is defined as having five or more drinks on the same occasion on each of 5 or more days in the past 30 days.

- *Substance dependent*: In the NHSDA, dependence is based on seven DSM-IV criteria (APA, 1994). The number who are dependent is a subset of the number who have used substances (alcohol and illicit drugs).

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[6] Of course, this assumption may be unrealistic because the baby boom generation may have different substance use patterns from those of previous generations.

[7] A simple mathematical extrapolation is as follows: Let $X_t$ = cohort 30 to 34 years in 1994; then $X_{t+5}$ = cohort 35 to 39 in 1999. The decline, $-\Delta$, = $(X_{t+5} - X_t)/X_t$. For the cohort in 2004, $X_{t+10} = -\Delta * X_{t+5}$, and so on to the cohort at year 2020. Of course, such an extrapolation does not account for differences among generations (e.g., the baby boom generation).

- *Not substance dependent*: Estimates of the population who are determined to be not dependent in a given year are calculated from the total population aged 12 or older minus the number who are substance dependent.

- *Total population 12 years old or older*: The NHSDA draws data from the civilian, noninstitutionalized, resident population aged 12 or older, which includes almost 98 percent of the total U.S. population aged 12 or older. Excluded from the NHSDA are active military personnel, persons living in institutional group quarters, homeless persons not living in a shelter on the survey date, and U.S. citizens residing abroad. The NHSDA is adjusted to the civilian, noninstitutionalized population as of July 1st of the given year. The Census estimate is calculated from a demographic components of change model that incorporates information on natural change (births minus deaths) and net migration (net domestic migration and net movement from abroad) that has occurred in the area since the date of the 1990 Census.

The NHSDA can be used to produce reasonable estimates for the groups who used illicit drugs or drank heavily or who were substance dependent. These estimates are slightly underestimated because the NHSDA does not collect data on persons living in institutional group quarters or homeless persons, two groups known to experience proportionately more substance abuse problems than the general civilian, noninstitutionalized resident population. This underestimate applies particularly to younger ages when most institutionalized persons are in prison, but it is offset among younger ages because the NHSDA excludes military personnel, who have much lower rates of substance problems (Bray et al., 1999).[8] For those aged 50 or older, institutionalized persons probably have lower rates of substance problems.

NHSDA estimates of illicit drug use, heavy drinking, or substance dependence could be used by comparing cohorts over two time periods to provide a measure of new substance use (e.g., column 3 in Table 1). The estimates of those not dependent (or even using drugs) (e.g., column 2 in the table) could also be calculated.

## Limitations of the NHSDA

The NHSDA has several limitations that preclude fully applying the life table approach, even if it is modified. The NHSDA does not collect information on certain types of substance users (e.g., those who are in recovery or who died, making it difficult to measure column 4 in

[8] The military has a "zero-tolerance" policy for illicit drug use and routinely tests for these drugs; those who test positive are discharged (Bray et al., 1999).

Table 1). Also, changes to the NHSDA questionnaire limit the comparability of cohorts across years.

The NHSDA does not adequately identify those persons "in recovery." These can only be estimated from the NHSDA by determining the number who are no longer substance abuse dependent, using illicit drugs, or drinking heavily. This number is derived by counting those respondents who indicated that they had treatment for substance abuse but were not categorized as substance dependent, using illicit drugs, or drinking heavily. This determination is likely to be incomplete because the NHSDA does not report on individuals who had a problem with substance use/abuse and "recovered" without treatment.

Each NHSDA incorporates the total population who died during a year because the survey is adjusted to Census totals that include births and deaths. The survey, however, cannot measure the comparable item needed for a life table (e.g., the number of persons who had died and had used drugs). Alternatively, differential death rates for current and former heavy users or abusers could be compared with rates for nonusers or trivial users. Death rates for substance abusers can be estimated, but this determination is likely to be incomplete.

Changes to the questionnaire and sample sizes limit comparisons across years. If two recent NHSDA years are used (e.g., 1999 and 1994-1995),[9] differences in the questionnaires for 1999 and 1994-1995 permit only very approximate comparability for cohorts across the 2 years. The computer-assisted interviewing (CAI) estimates are different from comparable year paper-and-pencil-interviewing (PAPI) results (OAS, 2001a); no simple adjustments can be done to make PAPI and CAI estimates comparable or to compensate for differences in reporting due to the method of interview implementation. There could be a higher or lower reporting of dependence, and so on, depending on whether CAI or PAPI was used. In short, when a dependency variable for 1994-1995 PAPI is defined, estimates of the population who are dependent or not dependent are not directly comparable.

Because of the limited sample sizes for older populations in the NHSDA, the standard errors of the estimates for these measures by 5-year or 10-year groupings are sufficiently large so that cohort differences between two periods may not be calculated with statistical precision. The inability to calculate differences within accepted confidence intervals further impedes using a life table approach with NHSDA data.

[9] Data for 1995 are included with 1994 because the 1994 sample size is too small to produce precise estimates for detailed categories by age group.

## Possible Changes to the NHSDA

Several large, national databases have been used to describe the substance use and related problems of older persons. Each database has limitations that prevent it from forecasting future substance use and related problems among older persons in two decades or so. The National Longitudinal Alcohol Epidemiologic Survey (NLAES) was conducted only in 1992 and has no information on the frequency or quantity of nonalcoholic drugs (Stinson et al., 1998). The National Health and Nutrition Examination Survey (NHANES), although it had four waves of data from 1972 to 1992, collected only limited alcohol data (i.e., mean weekly drinking levels for these four waves) (see the chapter by Blow, Barry, Fuller, and Booth in this monograph). The Treatment Episode Data Set (TEDS) (OAS, 2001b) and the Department of Veterans Affairs' utilization data (see the chapter by Booth and Blow in this monograph), both large and statistically powerful datasets, represent demand for substance abuse treatment among special, not general, populations. Only the NHSDA, even with its limits, has enough historical data on incidence rates at younger ages and later problems and treatment from which projections can be made.

What would be needed to make the NHSDA more useful for the life table approach? The survey was never designed to be a national longitudinal survey to measure substance use, abuse, and health indicators across the life span. It could, however, ask selected questions of an expanded sample of older respondents. Using examples referred to above, an expansion of the cohorts who are in their 30s now would be in the 50 and older age groups in 2020. Their responses to these questions could be used in the life table.

Selected questions could be added as a special supplement to the NHSDA, as has been done for other special topics of public health concern. Questions could cover such topics as (a) permanent recovery to appropriate use or abstinence by age during the survey period, (b) incidence rates for major substances of abuse at older ages, (c) a measure of overlap among drugs, (d) current psychoactive prescription medications, and (e) first use of psychoactives by age. These questions would fill the gaps in information needed for the life table categories. For example, permanent recovery could be used to estimate those who are drug-free during the time interval. As another example, age of first use could be useful in the life table to estimate the number who began drug use during an interval.

There will still remain one limitation. The NHSDA cannot provide death rates for users by age because it accounts for these deaths as part of the total population who have died during a year, as the survey is adjusted to Census totals that account for births and deaths. Of course, more

than 1 year of such a supplement could provide the data necessary for projecting use and problems among older persons in the next two or three decades.

The data could be applied to more than a life table approach (e.g., to a more sophisticated model). With more comprehensive and more years of data, it may be possible to develop projection models of the complexity and utility of demographic forecast models. Until such data are available, the life table approach will remain a framework for creating future estimates.

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# Chapter 7. National Longitudinal Alcohol Epidemiologic Survey (NLAES): Alcohol and Drug Use Across Age Groups

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*Abstract*: Over the coming decades, the aging of the "baby boom" generation is likely to have an enormous impact on the need and demand for health care among older adults. Because little is known about the patterns of use of alcohol and other drugs or the rates of substance abuse or dependence across age cohorts, this study used data from the National Longitudinal Alcohol Epidemiologic Survey (NLAES), conducted in 1992 by the National Institute on Alcohol Abuse and Alcoholism (NIAAA), to determine rates of alcohol and other drug use and abuse by age cohort and gender. The baby boom generation was aged 28 to 46 at the time of data collection. NLAES was designed as a comprehensive survey of alcohol and other drug use, abuse, diagnosis, and treatment, as well as associated health conditions. A representative sample of 42,862 men and women aged 18 or older were sampled in the contiguous United States and the District of Columbia, with a response rate greater than 90 percent. Mean drinks/week for those who used alcohol were consistent with levels seen in other samples for similarly aged men and women, with the exception of the older ages, which were higher. Rates of alcohol abuse/dependence for both men and women were highest among young adults, dropping off substantially after age 64. Rates for drug abuse/dependence were by far the highest among young adults, trailing off rapidly in older age cohorts. The rate of marijuana use for both men and women in the baby boom generation remained higher than for any other drug. Results from this large, population-based national dataset suggest that there have been and will likely continue to be substantial changes in the patterns of substance use and abuse over different age cohorts, particularly among those born after World War II, that will have a dramatic impact on the content, focus, and delivery of specialized substance abuse prevention and interventions needed for adults in late life.

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## Introduction

With changes in the health care system and the growing population of older adults, primary disease prevention and efforts to promote healthy lifestyles in this group are gaining importance. The occurrence of a number of acute and chronic diseases in late life leads to the high utilization of health care among the elderly (Barry, 1997; Fuchs, 1999; Krop et al., 1998; Schneider & Guralnik, 1990; Waldo, Sonnefeld, McKusick, & Arnett, 1989). Many of these acute and chronic medical and psychiatric diseases are influenced by lifestyle choices and behaviors, such as the consumption of alcohol.

Because of the increased incidence of health care problems, older adults are more likely to seek health care on a regular or semiregular basis than younger adults (Fuchs, 1999; Krop et al., 1998; Schneider & Guralnik, 1990; Waldo et al., 1989). They are also more susceptible to the effects of alcohol. Combined with their increased risk of comorbid diseases and their use of prescription and over-the-counter medications, older adults may seek health care for a variety of conditions that are exacerbated by increased alcohol consumption. This is one of the primary reasons that systematic alcohol screening and intervention methods are particularly relevant to providing high-quality health care to the elderly. Older adults with alcohol problems are a special and vulnerable population who require elder-specific screening and intervention procedures focused on the unique issues associated with drinking in later life. As a group, this generation of adults (aged 65 or older) is less likely than younger cohorts to abuse illicit drugs. Problems related to alcohol use are by far the largest class of substance use problems seen in older adults today. However, as the "baby boom" generation reaches later life, providers may see a greater use of illicit drugs than in the current older cohort.

Heavier alcohol use is associated with a number of adverse health effects in this population. These include greater risk for harmful drug interactions, injury, depression, memory problems, liver disease, cardiovascular disease, cognitive changes, and sleep problems (Barry, 1997; Gambert & Katsoyannis, 1995; Liberto, Oslin, & Ruskin, 1992; Wetle, 1997). It has recently been suggested that screening and interventions that focus on lifestyle factors, including the use of alcohol, may be the most appropriate way to maximize health outcomes and minimize health care costs among older adults (Wetle, 1997).

Over the coming decades, the aging of the baby boomers is likely to have an enormous impact on the need and demand for health care among older adults (Day, 1996). Despite significant advances made over the last two decades—both in the understanding of the aging process, with its attendant health problems, and in the understanding and consequences of alcohol problems and alcoholism—little attention has been paid to the intersection of the fields

of gerontology or geriatrics and alcohol studies. However, in recent years there has been an increased interest in alcohol and other substance abuse problems among the elderly and in the potential impact of the future explosion of the elderly population as the baby boom generation reaches old age.

Although studies in this area are limited, prevalence estimates and typical characteristics of older problem drinkers have been reported (Adams, Barry, & Fleming, 1996; Center for Substance Abuse Treatment [CSAT], 1998; Robins & Regier, 1991). Specific treatment and intervention strategies for older adults who are alcohol dependent (Blow et al., 2000a) or at-risk drinkers (Fleming, Barry, Manwell, Johnson, & London, 1997) are beginning to be disseminated. At-risk or hazardous drinking can significantly affect a number of conditions in this age group (Fleming & Barry, 1992), including depressive symptoms (Coyne & Schwenk, 1997), as well as general health functioning (Blow, Walton, Chermack, Mudd, & Brower, 2000b). Depression has been linked to relapse in drinking and increased alcohol intake. Blow et al. (2000b) found a main effect of drinking status on general health, physical functioning, physical role functioning, pain, vitality, mental health, emotional role, and social functioning, controlling for race and gender, with low-risk drinkers scoring better than abstainers and better than hazardous drinkers. A focus on brief interventions with lifestyle factors, including the use of alcohol, may be one of the most appropriate methods to maximize health outcomes and minimize health care expenditures among older adults (Wetle, 1997).

**Prevalence and Patterns of Substance Use among Older Individuals**

In a large primary care clinical trial of at-risk and problem drinking that screened 17,695 primary care patients (Fleming et al., 1997), 15 to 20 percent of men and 8 to 10 percent of women drank at a risk or problem-drinking level (men: 15 or more drinks/week; women: 12 or more drinks/week). Prevalence estimates for older at-risk and problem drinking using community surveys have ranged from 1 to 15 percent (Adams et al., 1996; Gurland & Cross, 1982; Schuckit & Pastor, 1978). These rates vary widely depending on the definition of at-risk drinking, problem drinking, and alcohol abuse/dependence, as well as the methodology used to obtain samples. Several researchers have also questioned the accuracy of rates of alcohol problems for older adults because of the use of assessment instruments developed on younger hospitalized populations.

With the exception of a few studies, patterns of drinking among at-risk drinkers in older community-based populations have received little attention. Using data from the National Longitudinal Alcohol Epidemiologic Survey (NLAES)—a large epidemiological study that defined the parameters of alcohol use in the United States across the life span from adolescence

to older adulthood—researchers (Grant, 1997; Grant et al., 1994a) found varying trajectories of problematic alcohol use across cohorts. The study provided new knowledge regarding changes over time in the diagnoses of alcohol abuse and dependence. Epidemiological data indicated that problem use declines with increasing age. However, there is some diagnostic stability in diagnoses into later life (Grant, 1997). Men were more likely to sustain a diagnosis of alcohol abuse or dependence over time than were women. Grant (1997) pointed out that the social structure, attitudes, and expectancies of each cohort make a difference in the extent to which members of that cohort engage in heavier drinking and experience more alcohol-related problems. The impact on health of untreated heavy drinking has been well described but may be even greater among the elderly, who are already at increased risk for many health problems, including harmful drug interactions, injury, depression, memory problems, liver disease, cardiovascular disease, cognitive changes, and sleep disturbance (Gambert & Katsoyannis, 1995; Liberto et al., 1992).

Symptoms of harmful drinking often are less visible among older adults because they can be masked by social, medical, or psychological conditions. In addition, sensitivity to and tolerance of ethanol may be affected by the physiological aging processes (Rosin & Glatt, 1971), as well as by health conditions common to old age (Baker, 1985). Drinking produces higher blood alcohol levels in older adults than in younger persons when comparable amounts of alcohol are consumed; many problems common among older people, such as chronic illness, poor nutrition, and polypharmacy, may be exacerbated by even small amounts of alcohol (Vestal et al., 1977). What might be considered light or moderate drinking for individuals in their 30s may have untoward health effects in an older person.

Even lesser rates of consumption, termed hazardous or harmful use, could result in increased risk of injury or health problems and may occur in a large proportion of patients coming into contact with health care professionals (Cyr & Wartman, 1988; Moore et al., 1989). Drinking at hazardous levels (over recommended limits) increases the risk of hypertension and may increase the risk of breast cancer and diabetes, among other medical conditions in this population. Furthermore, there is emerging evidence that problem drinking in late life affects a larger proportion of the elderly population than previously thought (CSAT, 1998; Williams & Debakey, 1992). Prevalence estimates of older problem drinking using community surveys have ranged from 1 to 10 percent (CSAT, 1998; Robins & Regier, 1991). These rates vary widely depending on the definition of alcohol abuse/dependence and the methodology used in obtaining samples. Several researchers have questioned the accuracy of rates of alcohol problems for older adults because of the use of assessment instruments developed on younger populations (CSAT, 1998).

## Physical and Mental Health Consequences of Substance Abuse

The physical and mental health effects of hazardous drinking in young to middle adulthood (Willenbring, Johnson, & Tan, 1994) and old age (Blow et al., 2000a) have been studied separately in treatment populations, but only rarely in primary care samples (Fleming, Barry, Adams, Manwell, & Krecker, 2000; Fleming et al., 1997), or in population-based studies. In alcohol treatment samples, a greater number of concomitant problems have been noted in older adults, including more difficult alcohol withdrawal (Brower, Mudd, Blow, Young, & Hill, 1994), and worse physical health (Fleming & Barry, 1992). There has, however, been little work establishing differences in physical and mental health functioning across various age groups.

The potential interaction of medication and alcohol is of great concern for adults of all ages, particularly for older adults. For some younger and older individuals, any alcohol use at all combined with the use of specific over-the-counter or prescription medications can increase problematic consequences. Therefore, alcohol use recommendations for older adults are generally lower than those set for adults under 65 and are usually made on a case-by-case basis.

## Substance Use and Abuse Across Age Cohorts

There is strong evidence that the use and misuse of alcohol and other drugs decline with advancing age (Grant, 1997; National Institute on Alcohol Abuse and Alcoholism [NIAAA], 1998). Grant (1997) noted that over the past century, there has been a shift to increasingly earlier ages for the onset of alcohol use and an increased likelihood of alcohol dependence among cohorts of drinkers. Grant (1997) also reported increasing convergence in the patterns of substance abuse/dependence of men and women over the last century. These findings, along with those from other recent studies (Johnstone, Leino, Ager, Ferrer, & Fillmore, 1996; Nelson, Heath, & Kessler, 1998; NIAAA, 1998), support the idea that there have been, and will likely continue to be, substantial changes in the patterns of substance use and abuse in different age cohorts, particularly among those born after World War II. Furthermore, these changes will have a dramatic impact on the content, focus, and delivery of specialized substance abuse prevention and interventions needed for adults in late life.

Population-based data on the amount of alcohol and drug use, as well as substance abuse and dependence, by gender and age cohort, are essential to understand the potential impact of the baby boom generation on the need and demand for substance abuse services. Grant (1997) used 1992 NLAES data to describe the cumulative probability of alcohol use and alcohol dependence by cohort, as well as the NIAAA (1998) monograph on NLAES. Grant also has published global information on the categories of drinkers by age grouping. Few details, however, have been

described on the quantity of alcohol consumption among current drinkers, as well as other drug abuse/dependence. The purpose of this chapter is to explore in detail reported drinking amounts, and the rates of alcohol and other drug abuse and dependence, by gender and age cohort. Differences were expected by age cohort and gender on these key dimensions of alcohol and drug use and misuse.

## Methods

### Survey Specifics

NLAES was conducted in 1992 by the NIAAA to provide a comprehensive survey of alcohol use, abuse, diagnosis, treatment depression, and associated health conditions (Grant, 1997; NIAAA, 1998). A sample of 42,862 men and women aged 18 or older were sampled in the contiguous United States and the District of Columbia, with greater than a 90 percent response rate. Using a complex multistage stratified sampling frame developed by the U.S. Census Bureau, a cross-sectional survey of households was conducted with a large sample of individuals representative of the U.S. population. Oversampling of the black population was performed to secure adequate numbers for analytic purposes, and likewise for young adults between the ages of 18 and 29 at the household level to secure adequate numbers of this heavy alcohol- and substance-using subgroup. The NLAES design has been described in detail elsewhere (Grant, Peterson, Dawson, & Chou, 1994b; Massey, Moore, Parsons, & Tadros, 1989). No additional data were collected beyond 1992; therefore, all analyses are cross-sectional.

### Data Sources

Data were obtained from the Alcohol Epidemiologic Data System (AEDS), operated by CSR, Inc., under contract from the NIAAA. All analyses were generated using SUrvey DAta ANalysis (SUDAAN) statistical software (Shah, Barnwell, Hunt, & LaVange, 1994).

### Variables

*Weekly Drinking Levels.* Weekly drinking levels were calculated on the basis of two variables: how often an alcoholic beverage is consumed times the number of alcoholic beverages consumed on that occasion. Occasions and number of drinks were assessed in the NLAES dataset for beer, wine, and liquor. These estimates were converted to the number of days per week the person consumed alcohol. Abstainers were not included in Table 2 but are discussed in the Results section of this chapter.

Number of drinks of each type were assessed with one question: "What is the usual number of drinks of beer per usual drinking day? (when drinking size is less than 16 ounces)." Two other questions asked about beer sizes larger and smaller than these. A very small number of people answered the alternative item forms and thus were deleted from the analysis because (a) exact parallel items were unavailable for wine and liquor, and (b) using any size estimates inflated the extreme values of drinking and thus skewed the distribution and inflated the mean.

The algorithm for this variable was as follows:

*Total weekly drinks* = (*Drinking occasions for beer* × *Number of drinks*) +
(*Drinking occasions for wine* × *Number of drinks*) +
(*Number of occasions for liquor* × *Number of drinks*).

*Prescription and Illegal Drug Use.* Levels of drug use were collected by asking about use in the past 12 months and ever in the lifetime. These items were worded to reflect that the drug was used by the subject without a physician's recommendation. Eight categories of drug use were assessed: sedatives, tranquilizers, painkillers, stimulants, marijuana, cocaine or crack cocaine, heroin, and methadone. The respondent answered "yes" or "no" to each item. Missing data were an issue with this variable. A decision was made to transform missing data to the "no" category to ensure that the estimates of drug use included all participants.

*Diagnosis of Alcohol Abuse and Dependence.* One of the hallmarks of the NLAES dataset is that several alcohol consequences were assessed. These items paralleled the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-III-R and DSM-IV) criteria for alcohol abuse and dependence (American Psychiatric Association [APA], 1987, 1994). Therefore, code was developed for each of these criteria to perform diagnoses for all participants. Diagnoses used in this chapter were based on DSM-IV criteria. If a subject was diagnosed with alcohol dependence, he or she was excluded from an alcohol abuse diagnosis according to the DSM-IV. A dichotomous variable was also constructed based on whether the subject scored positive on DSM-IV criteria in the past 12 months.

*Diagnosis of Drug Abuse and Dependence.* Development of variables and scoring schemes for drug abuse and dependence paralleled those used for alcohol abuse/dependence.

*Depression Diagnosis.* A simple algorithm was developed to score the depression items because of complexities in scoring used in the DSM-IV criteria for major depressive disorder. In the NLAES database, the DSM-IV criterion variables for depression did not have clear time frame references. Three items contributed to the diagnosis of depression: (a) periods of 2 or more weeks when the subject felt depressed most of the time; (b) number of separate periods of 2 or

more weeks when the subject experienced low mood/not caring; and (c) whether all periods of depressed feelings occurred when ill, getting over illness, or after the death of someone close. Only if the answers to the first two items were yes and the answer to the third item 3 was no was a diagnosis of depression conferred.

*Age Categories*. Five-year age categories based on subject ages were constructed. Categories included younger than 24, 25 to 29, 30 to 34, 35 to 39, and so on up to age 105. Because NLAES assessed no one younger than 18, the lowest category had a range of 18 to 24. The age categories that most reflected the baby boom generation were the combined age groups of 25 through 34 and 35 through 44. Hence, results relating to this cohort are compilations of results in these two study age groups. The baby boom generation comprised approximately 57 percent of the sample (24,621 of 42,862).

## Results

Age and race distribution by gender is listed in Table 1. Mean drinks/week were consistent with levels seen in the National Health and Nutrition Examination Survey (NHANES) for similarly aged men and women, with the exception of the older ages (Table 2). Generally, NLAES subjects older than 55 had higher mean drinks/week than those in the NHANES database with corresponding ages. Rates of alcohol abuse/dependence for both men and women were highest among young adults, decreasing substantially after age 60 (Table 2). For the baby boom generation, rates of alcohol abuse averaged approximately 8 to 12 percent for men and 3 to 5 percent for women, depending on age subcategory. Rates of alcohol dependence were from 4 to 7 percent in men and around 2 to 3 percent in women. Rates for drug abuse/dependence were by far highest among young adults, trailing off rapidly in older age groups.

Not surprisingly, the most commonly used illegal drug was marijuana (see Table 3 for lifetime use and Table 4 for current use). The rate of marijuana use for both men and women in the baby boom generation remained higher than for any other drug. Current use of prescription drugs (painkillers, stimulants, sedatives, tranquilizers) was very low for all age groups. Males in the baby boom generation, in particular, had lifetime stimulant use rates of around 8 to 9 percent, but low rates of current use. Older adults reported virtually no illegal drug use, and their use of prescription drugs, with the exception of sedatives, was similarly absent.

Few individuals, regardless of age, reported concurrent problems with alcohol and illegal drugs in the 12 months prior to sampling with none in the 55 or older age groups. In the baby boom generation, less than 1 percent of women and less than 2 percent of men reported concurrent alcohol and drug abuse or dependence. More common was the co-occurrence of

**Table 1 Distribution of Age and Race, by Gender, from the NLAES Dataset**

| | | | Race | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | White | | Black | | Native American | | Asian | | Other | |
| Age | N | (%)* | N | %** | N | % | N | % | N | % | N | % |
| **Men** | | | | | | | | | | | | |
| < 24 | 2,323 | (50.06) | 1,836 | 79.36 | 338 | 13.17 | 24 | 1.46 | 72 | 3.41 | 53 | 2.60 |
| 25-34 | 4,099 | (49.63) | 3,366 | 80.47 | 464 | 11.73 | 31 | 0.90 | 156 | 4.43 | 82 | 2.47 |
| 35-44 | 3,862 | (49.41) | 3,207 | 83.10 | 445 | 11.11 | 22 | 0.61 | 106 | 2.96 | 82 | 2.21 |
| 45-54 | 2,438 | (48.94) | 2,031 | 84.99 | 300 | 9.64 | 13 | 0.65 | 64 | 3.16 | 30 | 1.57 |
| 55-64 | 2,082 | (47.54) | 1,760 | 87.00 | 259 | 8.93 | 9 | 0.47 | 30 | 2.31 | 24 | 1.28 |
| 65-74 | 1,808 | (44.19) | 1,550 | 88.45 | 204 | 7.85 | 6 | 0.32 | 27 | 2.30 | 21 | 1.08 |
| 75-84 | 995 | (38.60) | 862 | 90.15 | 112 | 7.11 | 2 | 0.18 | 10 | 1.46 | 9 | 1.10 |
| 85-94 | 204 | (32.44) | 175 | 87.76 | 25 | 8.29 | 1 | 0.34 | 2 | 2.73 | 1 | 0.89 |
| > 95 | 8 | (21.78) | 7 | 93.46 | 1 | 6.54 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| **Women** | | | | | | | | | | | | |
| < 24 | 2,773 | (49.94) | 2,013 | 75.75 | 544 | 15.23 | 35 | 1.57 | 99 | 4.41 | 82 | 3.05 |
| 25-34 | 5,721 | (50.37) | 4,349 | 79.30 | 1,045 | 14.13 | 42 | 0.82 | 152 | 3.19 | 133 | 2.56 |
| 35-44 | 5,137 | (50.59) | 4,053 | 81.02 | 806 | 12.86 | 34 | 0.75 | 149 | 3.58 | 95 | 1.79 |
| 45-54 | 3,063 | (51.06) | 2,446 | 83.58 | 471 | 11.16 | 28 | 0.90 | 73 | 2.66 | 45 | 1.71 |
| 55-64 | 2,776 | (52.46) | 2,279 | 85.66 | 412 | 10.53 | 14 | 0.46 | 33 | 1.70 | 38 | 1.66 |
| 65-74 | 2,944 | (55.81) | 2,502 | 88.64 | 386 | 8.89 | 8 | 0.31 | 17 | 0.88 | 31 | 1.27 |
| 75-84 | 2,037 | (61.40) | 1,760 | 89.71 | 238 | 7.96 | 6 | 0.33 | 15 | 0.99 | 18 | 1.01 |
| 85-94 | 562 | (67.56) | 501 | 90.14 | 53 | 7.95 | 3 | 0.56 | 1 | 0.40 | 4 | 0.95 |
| > 95 | 30 | (78.22) | 25 | 87.59 | 4 | 10.42 | 1 | 1.99 | 0 | 0.00 | 0 | 0.00 |

* Weighted percentage for gender within each age group in the population.
** Weighted row percentage within each age group in the population, by race and gender.

alcohol abuse/dependence and depression, but rates were low across the age groups. These are consistent with data from the National Comorbidity Study (Kessler et al., 1994).

## Discussion

NLAES is one of the most comprehensive and representative national epidemiological surveys on alcohol and drugs available with a large (over 45,000) sample size.

Recent research has suggested that older adults have unique drinking patterns, alcohol-related consequences, and intervention/treatment needs. Because of this, early identification and secondary prevention of alcohol problems in later life are likely to require innovative approaches. With changes in the health care system to managed models of care, the time is right to move forward into a comprehensive system of alcohol interventions with older

**Table 2 Alcohol Use Rates, by Gender and Age Group, from the NLAES Dataset**

| Age | Drinks Per Week (Drinkers Only) | Percent Alcohol Abuse (Entire Sample) | Percent Alcohol Dependence (Entire Sample) | Percent Drug Abuse (Entire Sample) | Percent Drug Dependence (Entire Sample) |
|---|---|---|---|---|---|
| | | | **Men** | | |
| < 24 | 8.42 (1,382)* | 15.78 | 12.52 | 4.94 | 2.90 |
| 25-34 | 7.86 (2,752) | 12.66 | 7.08 | 2.96 | 1.02 |
| 35-44 | 7.12 (2,371) | 7.97 | 4.02 | 1.35 | 0.69 |
| 45-54 | 8.09 (1,328) | 6.13 | 2.84 | 0.50 | 0.12 |
| 55-64 | 8.66 (972) | 2.79 | 2.09 | 0.00 | 0.03 |
| 65-74 | 7.93 (739) | 1.48 | 0.62 | 0.00 | 0.00 |
| 75-84 | 7.13 (285) | 0.34 | 0.40 | 0.12 | 0.00 |
| 85-94 | 6.77 (41) | 2.39 | 0.00 | 0.00 | 0.00 |
| > 95 | 6.12 (1) | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | **Women** | | |
| < 24 | 4.30 (1,132) | 8.53 | 6.13 | 1.55 | 1.57 |
| 25-34 | 3.34 (2,476) | 5.31 | 2.99 | 1.01 | 0.79 |
| 35-44 | 3.35 (2,098) | 2.70 | 1.73 | 0.44 | 0.36 |
| 45-54 | 3.92 (1,046) | 1.41 | 0.93 | 0.16 | 0.17 |
| 55-64 | 4.59 (7,626) | 0.60 | 0.67 | 0.02 | 0.04 |
| 65-74 | 4.96 (575) | 0.34 | 0.18 | 0.05 | 0.00 |
| 75-84 | 4.58 (233) | 0.07 | 0.20 | 0.00 | 0.00 |
| 85-94 | 3.60 (46) | 0.00 | 0.00 | 0.00 | 0.00 |
| > 95 | 9.19 (2) | 0.00 | 0.00 | 0.00 | 0.00 |

* Drinks per week category includes only those subjects who used alcohol; however, percentage estimates of abuse and dependence include the entire sample (drinkers and abstainers).

adults, considered one of the most vulnerable and the fastest growing segment of the U.S. population.

A limited number of public health strategies are available to identify and intervene with older adult at-risk and problem drinkers because many older adults are retired and some are isolated or have mobility problems. Because the majority of older adults are treated in primary care settings, this group of professionals has a unique opportunity to identify and help older adults who drink at risky levels. The availability of a range of prevention/intervention strategies for older adults—prevention/education for persons who are abstinent or low-risk drinkers, minimal advice, structured brief intervention protocols, and formalized treatment for older persons with alcohol abuse/dependence—provides the tools for health care providers to work with older adults across a spectrum of drinking patterns.

The major limitations of the dataset are that the study was conducted in 1992, and, while the initial intention of NLAES was to study individuals over time, only one wave was conducted.

**Table 3 Lifetime Drug Use Rates, by Gender and Age Group, from the NLAES Dataset**

| | Marijuana | | Cocaine | | Heroin | | Methadone | | Painkillers | | Stimulants | | Sedatives | | Tranquilizers | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| **Men** | | | | | | | | | | | | | | | | |
| < 24 | 513 | 22.87 | 118 | 4.92 | 8 | 0.26 | 11 | 0.42 | 79 | 3.23 | 124 | 5.22 | 49 | 1.93 | 66 | 2.63 |
| 25-34 | 1,276 | 29.79 | 415 | 9.71 | 29 | 0.69 | 26 | 0.61 | 226 | 5.46 | 356 | 8.46 | 219 | 5.17 | 235 | 5.56 |
| 35-44 | 1,124 | 27.29 | 321 | 7.59 | 65 | 1.73 | 36 | 0.89 | 170 | 4.29 | 363 | 9.30 | 206 | 4.96 | 197 | 5.08 |
| 45-54 | 242 | 8.82 | 51 | 1.76 | 17 | 0.71 | 8 | 0.37 | 60 | 2.40 | 80 | 2.97 | 50 | 1.79 | 49 | 1.92 |
| 55-64 | 46 | 1.69 | 6 | 0.28 | 2 | 0.06 | 0 | 0.00 | 12 | 0.58 | 18 | 0.72 | 13 | 0.58 | 12 | 0.55 |
| 65-74 | 2 | 0.59 | 2 | 0.11 | 2 | 0.06 | 1 | 0.03 | 7 | 0.40 | 5 | 0.30 | 6 | 0.28 | 1 | 0.03 |
| 75-84 | 1 | 0.05 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 3 | 0.19 | 1 | 0.11 | 2 | 0.17 | 7 | 0.52 |
| 85-94 | 2 | 2.11 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| > 95 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| **Women** | | | | | | | | | | | | | | | | |
| < 24 | 429 | 14.90 | 82 | 2.89 | 3 | 0.09 | 2 | 0.06 | 69 | 2.41 | 108 | 3.77 | 35 | 1.12 | 57 | 2.04 |
| 25-34 | 1,183 | 20.47 | 386 | 6.62 | 20 | 0.34 | 8 | 0.15 | 185 | 3.16 | 363 | 6.41 | 160 | 2.94 | 183 | 3.15 |
| 35-44 | 843 | 14.93 | 182 | 3.03 | 21 | 0.35 | 14 | 0.21 | 116 | 2.06 | 224 | 4.02 | 130 | 2.41 | 134 | 2.44 |
| 45-54 | 110 | 2.60 | 24 | 0.48 | 7 | 0.16 | 4 | 0.08 | 35 | 0.87 | 48 | 1.40 | 39 | 1.04 | 36 | 1.09 |
| 55-64 | 25 | 0.89 | 5 | 0.28 | 3 | 0.21 | 3 | 0.21 | 16 | 0.74 | 15 | 0.50 | 19 | 0.68 | 15 | 0.82 |
| 65-74 | 2 | 0.06 | 1 | 0.04 | 1 | 0.04 | 1 | 0.04 | 4 | 0.15 | 2 | 0.06 | 8 | 0.24 | 8 | 0.26 |
| 75-84 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 5 | 0.29 | 2 | 0.11 |
| 85-94 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.14 | 0 | 0.00 |
| > 95 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |

**Table 4 Rates of Drug Use in the Past 12 Months, by Gender and Age Group, from the NLAES Dataset**

| | Marijuana | | Cocaine | | Heroin | | Methadone | | Painkillers | | Stimulants | | Sedatives | | Tranquilizers | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| **Men** | | | | | | | | | | | | | | | | |
| < 24 | 305 | 13.76 | 37 | 1.55 | 0 | 0.00 | 1 | 0.02 | 30 | 1.30 | 35 | 1.50 | 10 | 0.39 | 17 | 0.55 |
| 25-34 | 401 | 9.00 | 82 | 1.72 | 2 | 0.04 | 3 | 0.09 | 41 | 0.84 | 45 | 0.94 | 14 | 0.25 | 46 | 1.05 |
| 35-44 | 227 | 5.00 | 44 | 0.90 | 5 | 0.12 | 2 | 0.04 | 31 | 0.76 | 10 | 0.26 | 10 | 0.18 | 36 | 0.92 |
| 45-54 | 35 | 1.21 | 6 | 0.13 | 2 | 0.06 | 1 | 0.04 | 7 | 0.25 | 1 | 0.02 | 4 | 0.11 | 7 | 0.18 |
| 55-64 | 10 | 0.24 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 7 | 0.32 | 0 | 0.00 | 4 | 0.22 | 2 | 0.05 |
| 65-74 | 2 | 0.18 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.06 | 0 | 0.00 | 2 | 0.08 | 0 | 0.00 |
| 75-84 | 1 | 0.05 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 2 | 0.12 | 0 | 0.00 | 1 | 0.06 | 3 | 0.24 |
| 85-94 | 1 | 0.34 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| > 95 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| **Women** | | | | | | | | | | | | | | | | |
| < 24 | 214 | 7.48 | 17 | 0.60 | 0 | 0.00 | 0 | 0.00 | 39 | 1.43 | 39 | 1.44 | 8 | 0.36 | 25 | 0.97 |
| 25-34 | 270 | 4.50 | 66 | 0.97 | 6 | 0.09 | 2 | 0.03 | 60 | 1.00 | 32 | 0.62 | 27 | 0.41 | 42 | 0.71 |
| 35-44 | 129 | 2.14 | 15 | 0.24 | 1 | 0.01 | 3 | 0.03 | 34 | 0.67 | 8 | 0.12 | 7 | 0.21 | 29 | 0.53 |
| 45-54 | 24 | 0.52 | 4 | 0.06 | 0 | 0.00 | 0 | 0.00 | 8 | 0.13 | 6 | 0.22 | 39 | 1.30 | 13 | 0.38 |
| 55-64 | 3 | 0.08 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 4 | 0.11 | 0 | 0.00 | 5 | 0.16 | 4 | 0.32 |
| 65-74 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 4 | 0.11 | 2 | 0.07 |
| 75-84 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.07 | 1 | 0.04 |
| 85-94 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.14 | 0 | 0.00 |
| > 95 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |

However, it remains one of the most representative and comprehensive datasets of its kind in the United States. It offers the opportunity to study specific cohorts at a point in their development and allows researchers to relate alcohol and drug findings from that time to newer data on the drug use of these cohorts as they age.

The opportunity to take an early snapshot of alcohol and drug use, particularly for the large cohort that is now at midlife and approaching older adulthood, will help to inform the extent to which services will be needed to meet the alcohol and drug prevention, intervention, and treatment needs of the aging population. It remains to be seen whether the baby boom generation, as they age, will continue the pattern of alcohol and drug use exhibited in the NLAES data. If they do, one of the challenges will be addressing the needs of members of the aging population who are misusing alcohol and/or medications/drugs in the context of a managed care environment, where providers are expected to deliver quality medical care for a wide variety of health problems within greater time constraints. The NLAES dataset has helped to define the drug and alcohol issues for an aging America. The development of short, effective techniques to address substance use issues in the growing population of older adults is one of the current and future foci for the substance use field (CSAT, 1999). Innovative screening, intervention, and treatment methods for alcohol and drug misuse among older adults, if successfully implemented, are steps in the process of assuring that current and future generations have the opportunity for improved physical and emotional quality in their lives.

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# Chapter 8. Analysis of the National Health and Nutrition Examination Survey (NHANES): Longitudinal Analysis of Drinking Over the Life Span

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*Abstract*: Recent research suggests that older adults currently have unique drinking patterns and alcohol-related consequences. The projected population expansion of the older adult population has serious implications both for the number of alcohol-related problems likely to occur among the elderly and the subsequent costs involved in responding to them. This study examined the changes in drinking patterns of a large sample of adults aged 25 years or older studied over a 20-year period from 1972 to 1992. Data from the National Health and Nutrition Examination Survey I (NHANES I) were analyzed over four waves of data collection. Mean weekly drinking levels for the four waves were calculated based on 5- and 10-year age categories. Only alcohol consumers were included in the mean weekly drinking analysis. Although consumption decreases with age, there are mean consumption changes for the baby boom generation, but these are less dramatic than for the current older adult cohort. Mean consumption appears to remain higher over time for the midlife group than for other age groups. These results suggest that the baby boom generation, as it continues to age, could maintain a higher level of alcohol consumption than in previous older adult cohorts.

## Introduction

### Overview of Extent of Problem Drinking in Current Elderly Cohort

Alcohol use disorders are important public health problems among older adults aged 60 years old or older. There is emerging evidence that problem drinking affects a larger proportion of the current cohort of older adults than previously thought (Adams, Barry, & Fleming, 1996; Williams & DeBakey, 1992). In the United States, an estimated 2.5 million older adults have problems related to alcohol, and 21 percent of hospitalized people over age 40 have a diagnosis

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of alcoholism. Related hospital costs are as high as $60 billion per year (Schonfeld & Dupree, 1995). In 1990, those over the age of 65 comprised 13 percent of the U.S. population; by the year 2030, older adults will account for 22 percent of the population (U.S. Bureau of the Census, 1996). Current projections remain high.

The projected population expansion has serious implications both for the number of alcohol-related problems likely to occur among the elderly and the subsequent costs involved in responding to these problems. In fact, the health costs of untreated alcoholism have been well described, but may be even greater among the elderly. Older adults are already at increased risk for many health problems (Adams et al., 1996), including greater risk for harmful drug interactions, injury, depression, memory problems, liver disease, cardiovascular disease, cognitive changes, and sleep problems (Blow et al., 1992). Treatment for alcohol abuse and dependence is important for economic and humane reasons (Graham, 1986); under-recognition and under-treatment may result in ineffective and costly use of health care resources while the underlying causes of the problem are not addressed. Less intense and brief alcohol interventions have demonstrated positive results with older adults (Fleming, Barry, Manwell, Johnson, & London, 1997) and can play an important role in helping older adults who are at-risk or problem drinkers.

**Prevalence of Alcohol Use in the Current Older Adult Populations**

Prevalence estimates for older at-risk and problem drinking using community surveys have ranged from 1 to 15 percent (Adams et al., 1996; Gurland & Cross, 1982; Robins & Regier, 1991; Schuckit & Pastor, 1978). Among adults over 60 in a large primary care study, 15 percent of the men and 12 percent of the women regularly drank in excess of the limits recommended by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) (Adams et al., 1996), which, at the time of the study, were "no more than 7 drinks/week for women and no more than 14 drinks/week for men." Rates of at-risk drinking have varied widely across studies depending on the definition of at-risk and problem drinking and the methodology used to obtain samples.

The elderly seen in medical settings—inpatient, primary care, and other health care settings—have consistently higher rates of at-risk drinking and alcohol-related problems (Adams, Yuan, Barboriak, & Rimm, 1993; Dufour & Fuller, 1995) than those in the general population. Among clinical populations, however, estimates of alcohol abuse/dependence are substantially higher because problem drinkers of all ages are more likely to seek health care than are other individuals (Beresford, 1979; Institute of Medicine, 1990). Among elderly patients seeking treatment in hospitals, primary care clinics, and nursing homes for medical or psychiatric problems, rates of concurrent alcoholism have been reported in the range of 15 to 58 percent

(Adams et al., 1996; Beresford, Blow, Hill, Singer, & Lucey, 1990; Buchsbaum, Buchanan, Centor, Schnoll, & Lawton, 1991; Gomberg, 1980; Schuckit, 1982). Rates for alcohol-related hospitalizations among older patients are similar to those for heart attacks (Adams et al., 1993).

The lifetime prevalence of alcohol dependence among randomly selected hospitalized medical patients was 20.4 percent for those aged 60 to 69, declining to 13.7 percent among patients aged 70 to 79 and to 0 percent for those 80 or older (Gambert & Katsoyannis, 1995; Liberto, Oslin, & Ruskin, 1992). The prevalence of alcohol dependence, defined as those patients currently drinking and meeting the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV) criteria for dependence, was somewhat lower for all patients, with 10.4 percent for those aged 60 to 69, 6.8 percent for those aged 70 to 79, and 0 percent for those 80 or older. Although the rates of alcohol dependence have generally been shown to decline with age, in one study using hospital discharge data, the 65 or older group consistently had the highest proportion (approximately 60 percent) of alcohol-related diagnoses that were not primary diagnoses (Stinson, Dufour, & Bertolucci, 1989). Prevalence rates often underestimate the problem because of their tendency to underestimate alcohol problems among older adults (Center for Substance Abuse Treatment [CSAT], 1998).

**Drinking Guidelines**

NIAAA's and CSAT's Treatment Improvement Protocol (TIP) on older adults recommended that older adults consume no more than one standard drink per day or seven standard drinks per week (CSAT, 1998; Dufour & Fuller, 1995; U.S. Department of Health and Human Services [DHHS], 2000). In addition, older adults should consume no more than two standard drinks on any drinking day. It is recommended that the limit for women should be *slightly less than one standard drink per day*. These guidelines are consistent with empirical evidence for health functioning and risk-free drinking among older adults (Chermack, Blow, Hill, & Mudd, 1996). Studies have addressed the benefits of alcohol use, and their recommendations are consistent with the current evidence on the positive health effects of drinking weighed with negative consequences (Doll, Peto, Hall, Wheatley, & Gray, 1994; Klatsky, Armstrong, & Friedman, 1997; Poikolainen, 1991). It is important to note that, because of concomitant medical conditions (e.g. diabetes, hypertension) or potential adverse interactions with medications, some older adults should be advised to abstain. What might be considered light or moderate drinking for individuals in their 30s may have multiple negative health effects in an older person. Therefore, clinicians who treat older patients need to assess alcohol use levels and be aware of health implications associated with that use.

### Future Older Adult Cohorts

The primary purpose of this chapter is to provide a better understanding of longitudinal changes in drinking among individuals across the adult life span, with a particular focus on the baby boom generation (i.e., those individuals born between 1946 and 1964). Numerous possible datasets were examined for the longitudinal analyses of change in drinking over time across age groups. After exploration of many datasets suggested by a Federal workgroup, the possibilities were narrowed to a large, nationally representative dataset—the long-term NHANES dataset.

NHANES I was an effort by the DHHS's National Center for Health Statistics (NCHS) to conduct a comprehensive examination of the health of Americans across the life span. (For access to more complete information on NHANES, see http://www.cdc.gov/nchs/nhanes.htm). The NHANES (Cycle I) surveys were designed to measure the nutritional status and health of the U.S. population aged 1 to 74 years and to obtain more detailed information on the health status and medical care needs of adults aged 25 to 74 years in the general U.S. population of noninstitutionalized persons in 1972-1974. Information was obtained by means of a household interview, along with extensive medical examinations. The National Health Epidemiological Follow-up Study (NHEFS), a longitudinal study, uses as its baseline the persons aged 25 to 74 who completed the full medical examination in the 1972-1974 NHANES I study ($N = 14,407$). This study was a joint venture by the NCHS and the National Institute on Aging (NIA), with collaboration from the National Institutes of Health (NIH) and other Public Health Service (PHS) agencies. Four waves of data were collected on this subset, with follow-ups in 1982, 1987, and 1992.

This chapter describes longitudinal trends in drinking across 20 years of assessments for individuals enrolled in NHANES I in 1972.

## Methods

### Survey Specifics

A multistage stratified probability sample of clusters of persons was used in NHANES I to obtain a total of 32,331 subjects, of whom 31,973 were interviewed and 23,808 had medical examinations. The study included adults aged 18 to 74. The NHEFS subset of the sample consisted of 14,407 of the original 20,729 persons. The first follow-up occurred 10 years after the initial data collection in 1982 and consisted of 13,383 people, 93 percent of the target sample. In 1987, all available nondeceased members of the original baseline study were assessed,

comprising a sample of 11,750. The fourth and final data collection occurred in 1992 and was conducted on the 11,195 members of the cohort who were successfully traced and assessed again.

However, of the 1992 sample, a total of 8,710 had relatively complete alcohol data for all data collection waves and were included in the current analysis.

**Data Sources**

All data and documentation were obtained from the Inter-University Consortium for Political and Social Research (ICPSR), located within the Institute for Social Research at the University of Michigan. Most data were retrieved from publicly accessible databases located on-line at http://www.icpsr.umich.edu. Access to the 1992 NHEFS data was restricted to faculty and staff at select universities and was ordered specially for this project.

**Longitudinal Dataset**

Data from the 1972 initial NHANES study and the 1982, 1987 and 1992 follow-up surveys were used for this analysis. Once obtained, the datasets were linked by subject identification number so that subject files contained data from four longitudinal time periods. Although the data were collected with a complex stratified sample design, no weights were used in the computation of means and standard deviations.

**Variables**

*Weekly Drinking Levels*. At all four time periods, data were collected on each participant's number of drinking occasions and number of drinks containing alcohol. Somewhat different questions were asked across the waves of data collection, but weekly number of drinks could be estimated for each wave. The following explicates the process that was used for each wave in order to estimate the weekly number of alcoholic drinks.

**1972-1974 NHANES I**

Only two questions assessed the number of drinks in this survey: (1) How often do you drink beer, wine, or liquor? (8 point scale); and (2) When you drink, how much do you usually drink over 24 hours? For the latter, the actual number was coded.

The total number of drinks was obtained by calculating the number of drinking occasions scaled in weeks multiplied by the number of drinks typically consumed in a 24-hour period.

When estimating the number of drinking days in *1 month*, the following transformations were used: everyday = 30.45; just about everyday = 25; 2 to 3 times a week = 10; 1 to 4 times a month = 2; more than 3, but fewer than 12 = .5; and no more than 2 to 3 = .1.

If the subject did not drink, the variable was set to missing to include only drinkers in later estimates. Thus, with this transformation, weekly drinking levels were calculated with the following formula:

*Weekly drinks 1972* = (*Number of drinks in a 24-hour period* × *Number of drinking days per month*) / *Number of weeks in 1 month* (i.e., 4.333333).

**1982-1984 NHEFS**

Although specific drinking questions were asked about the quantity and frequency of alcohol consumption, other items nested in the food intake section of the survey assessed the amount of beer, wine, and liquor consumed on various occasions. These items were used to calculate measures of the weekly number of drinks for this first follow-up study. One item was used to determine alcohol consumption: On average, how many (cans, bottles, glasses, shots, etc.) of (beer, wine, or liquor) do you drink every day, week, month, or year? Number of drinks was recorded, as well as the time frame for which the subject chose to respond. Three items assessed beer, wine, and liquor consumption separately. The following conversions were used for the time multiplier: day = 365.4, week = 52, month = 12, and year = 1. This conversion was then used in the following equation to assess weekly alcohol consumption:

*Weekly drinks 1982-1984* = (*Number of beers* × *Time multiplier*) + (*Number of glasses of wine* × *Time multiplier*) + (*Number of drinks of liquor* × *Time multiplier*).

**1987 and 1992 NHEFS Follow-Up**

The questions changed again for the last two data collection points. Three items were evaluated to determine the amount of alcohol consumed: (1) On average, how often do you drink beer?; (2) time period response (week, month, etc.); and (3) On days you drank beer, how many cans, bottles, or glasses did you drink? Thus, appropriate recoding was done to item 1 so that the number of drinks was reflected accurately and 3 to 12 times a year was coded as 6 and no more than 3 times a year was coded as 2. In item number 2, week = 52 and month = 12.

The following formula was used to calculate the weekly number of drinks consumed:

*Weekly drinks 1987 and 1992* = (*Number of beer drinking occasions* × *Time period response* × *Number of drinks per occasion*) + (*Number of wine drinking occasions* × *Time period response* × *Number of drinks per occasion*) + (*Number of liquor drinking occasions* × *Time period response* × *Number of drinks per occasion*) / 52).

These different strategies were necessary because of inconsistent items across the 20 years that data were collected for the NHANES I follow-up assessments. The estimates were coded to make them as similar as possible, so as not to bias results based on the data alone.

**Age Categories**

Although subject ages ranged from 18 to 105, due to small numbers on both ends of the distribution, age categories were constructed from the age of the subject at the time of the first NHANES assessment (1972-1974), adjusted, and included ages 25 to 75. The 10-year age category construction included subjects aged 25 to 34, 35 to 44, 55 to 64, and 65 to 75. The cohorts within the baby boom generation were approximately 50 percent of the youngest age category.

**Drinking Status**

Mean weekly drinking levels for the four waves of data were calculated based on 5- and 10-year age categories. Only drinkers were included to reflect the average drinking levels and variation among that group. Drinking categories were also constructed for a cross-tabulation analysis of changes in drinking status across the life span. For men, "lifetime abstinence" was defined as not taking a drink of alcohol in the time period assessed. The time period for each assessment included 1 year prior to each survey, as well as lifetime use. "Abstinence" was defined as having a score of zero for total weekly drinks; however, questions were asked to determine whether the subject drank at some point in his or her life or answered "2 to 3 drinks per year" on the number-of-drinks item, which would produce a total drinking score of less than .001. "Moderate drinking" was defined as having fewer than 15 drinks per week, and "heavy drinking" was defined as having more than 15 drinks per week. For women, these estimates were calculated separately so that moderate drinking was defined as having fewer than 12 drinks per week and heavy drinking as having more than 12 drinks per week.

### Data Analysis Strategy

Unweighted mean estimates for drinking were calculated for each 10- and 5-year age category and for each gender. Cross-tabulations were specified indicating differences by gender and by age. Further cross-tabulations were specified for calculating a 20-year change in drinking status from 1972 to 1992.

In addition, the four longitudinal values (lifetime abstinence; current 1-year abstinence; moderate use, heavy use) of total drinks from 1972, 1982, 1987, and 1992 were analyzed in a repeated measures analysis of variance (ANOVA), taking into account the unequal spacing between the years. Within effects were tested by running a polynomial analysis on the pattern of the four means to determine shape and linearity. Between-subjects effects were run for gender and age category to determine whether any effects differed by these variables. Interactions were also tested.

## Results

### Demographics

Table 1 includes demographic information for the subjects aged 25 to 75 who entered the study between 1972 and 1974. Because of the consistency in demographic data across age groups and for ease of reading, the data were divided into 10-year increments to depict demographics by age categories. The sample was 64 percent female and primarily Caucasian.

### Alcohol Consumption

Table 2 shows the mean alcohol consumption levels by age group over the four waves of data collection. Consistent with previous reports (CSAT, 1998), alcohol use decreased with increasing age. This can be seen within age groups across time, demonstrating the aging of the individual cohorts over the 20-year course of the study. In addition, there were mean consumption changes for the baby boom generation, but these were less dramatic than for the current older adult cohort. Mean consumption appeared to remain higher over time for the baby boom group than for other age groups.

### Changes in Drinking Categories

Analyses were performed to assess changes in drinking for all of the age cohorts in the study. Table 3 shows changes in drinking categories for the 1972 age 25 to 29 cohort from the

**Table 1 NHANES 1972 Sample Demographic Characteristics: 10-Year Age Categories**

| | Age Category | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 25 to 34 | | 35 to 44 | | 45 to 54 | | 55 to 64 | | 65 to 75 | |
| Variable | *N* | Percent | *N* | Percent | *N* | Percent | *N* | Percent | *N* | Percent |
| **Gender** | | | | | | | | | | |
| Male | 768 | 32.20 | 652 | 30.38 | 726 | 43.89 | 485 | 43.42 | 520 | 36.93 |
| Female | 1,617 | 67.80 | 1,494 | 69.62 | 928 | 56.11 | 632 | 56.58 | 888 | 63.07 |
| **Marital Status** | | | | | | | | | | |
| Divorced | 108 | 4.53 | 119 | 5.55 | 79 | 4.78 | 36 | 3.23 | 40 | 2.84 |
| Never married | 237 | 9.95 | 92 | 4.29 | 74 | 4.47 | 38 | 3.41 | 77 | 5.48 |
| Separated | 73 | 3.06 | 72 | 3.36 | 32 | 1.93 | 25 | 2.24 | 15 | 1.07 |
| Widowed | 16 | 0.67 | 48 | 2.24 | 75 | 4.53 | 139 | 12.46 | 388 | 27.60 |
| Married | 1,949 | 81.79 | 1,813 | 84.56 | 1,394 | 84.28 | 878 | 78.67 | 886 | 63.02 |
| **Race** | | | | | | | | | | |
| Asian | 16 | 0.67 | 27 | 1.26 | 7 | 0.42 | 6 | 0.54 | 4 | 0.28 |
| African American | 250 | 10.49 | 270 | 12.59 | 174 | 10.53 | 123 | 11.02 | 174 | 12.36 |
| Native American | 7 | 0.29 | 8 | 0.37 | 1 | 0.06 | 3 | 0.27 | 2 | 0.14 |
| Caucasian | 2,110 | 88.54 | 1,839 | 85.77 | 1,471 | 88.99 | 984 | 88.17 | 1,228 | 87.22 |
| **Education** | | | | | | | | | | |
| Grade school | 42 | 1.91 | 123 | 6.17 | 130 | 8.56 | 114 | 11.06 | 266 | 20.32 |
| Some high school | 348 | 15.82 | 525 | 26.33 | 519 | 34.17 | 419 | 40.64 | 589 | 45.00 |
| High school graduate | 805 | 36.59 | 641 | 33.65 | 469 | 30.88 | 264 | 25.61 | 223 | 17.04 |
| Some college | 398 | 18.09 | 260 | 13.04 | 165 | 10.86 | 109 | 10.57 | 121 | 9.24 |
| College graduate | 288 | 13.09 | 226 | 11.33 | 132 | 8.69 | 64 | 6.21 | 65 | 4.97 |
| Graduate school | 319 | 14.50 | 123 | 9.48 | 104 | 6.85 | 61 | 5.92 | 45 | 3.44 |

NHANES = National Health and Nutrition Examination Survey.

**Table 2 Mean Drinks Per Week, by Gender and Age Group (5-Year Increments), for 1972, 1982, 1987, and 1992 Data**

| | | Males | | | Females | | |
|---|---|---|---|---|---|---|---|
| Age | Year | Mean | Standard Deviation | *N* | Mean | Standard Deviation | *N* |
| **25 to 29** | 1972 | 5.16 | 8.78 | 445 | 1.51 | 3.84 | 851 |
| | 1982 | 7.09 | 12.21 | 424 | 2.37 | 5.78 | 816 |
| | 1987 | 6.44 | 12.20 | 421 | 2.23 | 6.87 | 810 |
| | 1992 | 4.67 | 8.86 | 417 | 1.70 | 3.72 | 801 |
| **30 to 34** | 1972 | 6.31 | 11.91 | 323 | 2.31 | 10.29 | 766 |
| | 1982 | 7.65 | 13.22 | 311 | 2.65 | 5.87 | 748 |
| | 1987 | 6.76 | 13.82 | 306 | 2.10 | 5.11 | 743 |
| | 1992 | 5.59 | 11.26 | 302 | 1.83 | 4.39 | 739 |
| **35 to 39** | 1972 | 6.48 | 9.53 | 327 | 1.99 | 4.50 | 753 |
| | 1982 | 8.81 | 14.84 | 321 | 2.90 | 6.60 | 738 |
| | 1987 | 6.92 | 14.85 | 315 | 2.30 | 9.02 | 722 |
| | 1992 | 5.03 | 8.82 | 305 | 1.52 | 3.93 | 713 |
| **40 to 44** | 1972 | 6.71 | 11.44 | 325 | 1.91 | 4.93 | 741 |
| | 1982 | 8.63 | 13.92 | 321 | 2.41 | 5.29 | 730 |
| | 1987 | 7.08 | 14.24 | 307 | 1.83 | 4.42 | 715 |
| | 1992 | 5.21 | 9.90 | 295 | 1.45 | 3.55 | 688 |
| **45 to 49** | 1972 | 8.52 | 18.07 | 362 | 2.00 | 5.10 | 469 |
| | 1982 | 7.66 | 15.46 | 361 | 1.82 | 4.18 | 461 |
| | 1987 | 7.02 | 17.89 | 339 | 1.50 | 3.94 | 448 |
| | 1992 | 4.79 | 9.55 | 312 | 1.20 | 3.30 | 423 |
| **50 to 54** | 1972 | 6.43 | 12.37 | 364 | 2.04 | 4.98 | 459 |
| | 1982 | 5.93 | 11.31 | 361 | 2.27 | 4.91 | 457 |
| | 1987 | 4.28 | 8.89 | 319 | 1.87 | 5.68 | 439 |
| | 1992 | 3.12 | 6.91 | 279 | 1.69 | 4.70 | 398 |
| **55 to 59** | 1972 | 5.42 | 11.17 | 286 | 1.59 | 4.60 | 343 |
| | 1982 | 5.97 | 10.30 | 283 | 1.52 | 4.16 | 343 |
| | 1987 | 5.00 | 10.74 | 265 | 1.07 | 3.42 | 335 |
| | 1992 | 2.90 | 5.76 | 203 | .82 | 2.66 | 292 |
| **60 to 64** | 1972 | 4.09 | 7.34 | 199 | 2.12 | 8.27 | 289 |
| | 1982 | 4.10 | 7.42 | 199 | 1.80 | 5.97 | 287 |
| | 1987 | 3.59 | 7.78 | 180 | .96 | 3.03 | 276 |
| | 1992 | 2.44 | 5.62 | 123 | .88 | 3.03 | 227 |
| **65 to 69** | 1972 | 4.98 | 13.63 | 350 | 1.13 | 3.53 | 554 |
| | 1982 | 4.73 | 10.34 | 350 | 1.00 | 3.21 | 551 |
| | 1989 | 2.15 | 5.00 | 299 | .63 | 2.47 | 499 |
| | 1992 | 1.87 | 4.89 | 151 | .29 | 1.45 | 325 |
| **70 to 75** | 1972 | 3.50 | 8.17 | 170 | .89 | 3.07 | 354 |
| | 1982 | 3.57 | 8.30 | 170 | .91 | 3.06 | 331 |
| | 1987 | 2.69 | 7.62 | 130 | .45 | 2.04 | 288 |
| | 1992 | 1.84 | 6.47 | 52 | .20 | 1.01 | 147 |

**Table 3 Drinking Categories, by Gender, for the 1972 Cohort Aged 25 to 29: Longitudinal Changes**

| | Female | | Male | |
|---|---|---|---|---|
| **Year / Age** | ***N*** | **Percent** | ***N*** | **Percent** |
| **1972 (aged 25 to 29)** | | | | |
| Lifetime abstinence | 147 | 11.40 | 40 | 3.10 |
| Current (one-year) abstinence | 146 | 11.32 | 34 | 2.64 |
| Moderate drinking | 535 | 41.47 | 342 | 26.51 |
| Heavy drinking | 17 | 1.32 | 29 | 2.25 |
| Total | 845 | 65.50 | 445 | 34.50 |
| Missing = 7 | | | | |
| **1982 (aged 35 to 39)** | | | | |
| Lifetime abstinence | 15 | 1.39 | 6 | 0.56 |
| Current (one-year) abstinence | 296 | 27.48 | 78 | 7.24 |
| Moderate drinking | 389 | 36.12 | 178 | 16.53 |
| Heavy drinking | 53 | 4.92 | 62 | 5.76 |
| Total | 753 | 69.92 | 324 | 30.08 |
| Missing = 3 | | | | |
| **1987 (aged 40 to 44)** | | | | |
| Lifetime abstinence | 26 | 2.44 | 18 | 1.69 |
| Current (one-year) abstinence | 302 | 28.36 | 74 | 6.95 |
| Moderate drinking | 387 | 36.34 | 187 | 17.56 |
| Heavy drinking | 26 | 2.44 | 45 | 4.23 |
| Total | 741 | 69.58 | 324 | 30.42 |
| Missing = 1 | | | | |
| **1992 (aged 45 to 49)** | | | | |
| Lifetime abstinence | 46 | 5.54 | 50 | 6.02 |
| Current (one-year) abstinence | 212 | 23.95 | 107 | 12.88 |
| Moderate drinking | 199 | 23.95 | 171 | 20.58 |
| Heavy drinking | 12 | 1.44 | 34 | 4.09 |
| Total | 469 | 56.44 | 362 | 43.56 |
| Missing = 0 | | | | |

first assessment in 1972 to the last assessment in 1992. The data in this table are presented for that group in particular because this cohort is now at midlife and encompasses a significant proportion of the baby boom group in this study. Higher consumers of alcohol generally decreased consumption over time across all cohorts. However, the youngest cohort, including the baby boom group, was less likely to become abstinent and more likely to remain in the higher drinking categories over time.

Using a multivariate ANOVA (MANOVA) test, there was a significant change in drinking levels over time (Wilk's lambda = .95; $f = 116.07$; $df = 3$; $p < .0001$). Two interactions in the within- and between-subject factors were also significant: consumption by age (Wilk's

lambda = .99; $f$ = 3.47; $df$ = 12; $p < .0001$) and consumption by gender (Wilk's lambda = .98; $f$ = 40.07; $df$ = 3; $p < .0001$). These findings imply that the patterns of means over time for total drinks per week are different across age category and gender.

The polynomial analysis also showed significant linear ($f$ = 85.09; $df$ = 1; $p < .0001$) and quadratic ($f$ = 147.98; $df$ = 1; $p < .0001$) effects for these means. The cubic trend was not significant. The linear and quadratic slopes were, however, significantly different between variables of the age category and gender. This shows that the trend in the series of four means of total drinks per week was largely quadratic in nature, indicating that early and late age drinking was less, whereas midlife drinking was much heavier. Further, the linear and quadratic trends varied by age category and by gender. This also explains the significant interactions between total drinks and age category, as well as total drinks and gender.

## Discussion

Results from this study demonstrate that drinking levels are higher for the midlife group, including those in the baby boom generation. These new findings are somewhat suggestive that future cohorts of older adults in the United States, particularly the cohort currently in midlife, could be faced with issues related to their alcohol consumption, and most importantly, at-risk drinking as they age. This will place increasingly large numbers of older persons at increased risk for negative health consequences for which the health care system needs to be prepared.

### Issues Unique to Older Adults

Record numbers of senior citizens are seeking costly health care for acute and chronic conditions (Schneider & Guralnick, 1990; Waldo, Sonnefeld, McKusick, & Arnett, 1989). At-risk drinking is a prevalent concern (Adams et al., 1996) and can significantly affect a number of health conditions in this age group, including hypertension, stroke, and cardiovascular problems (Fleming & Barry, 1992; Klatsky et al., 1997).

Recent research has suggested that elderly individuals currently have unique drinking patterns and alcohol-related consequences, social issues, and treatment needs. This is likely to continue with future cohorts of older adults, and in particular for the baby boom generation. Thus, early identification and secondary prevention of alcohol problems in late life are likely to require new elder-specific approaches. Older adults present challenges in applying brief intervention strategies for reducing alcohol consumption. Because drinking guidelines are lower for older adults and because historical and cultural stigma lead to feelings of disgrace, older adult problem drinkers find it particularly difficult to identify their own risky drinking. However,

because the midlife baby boom generation grew up with fewer prohibitions toward drinking and other drug use than the current older adult group, less shame and guilt regarding intervention for at-risk drinking may be present. Future research will need to include "age cohort" as a potential predictor variable to determine the most useful strategies for presenting this generation with health information related to at-risk drinking.

In addition, chronic medical conditions may make it more difficult for clinicians to recognize the role of alcohol in decreased functioning and quality of life. These issues present barriers to appropriate identification and targeted interventions for this vulnerable population.

**Drinking Guidelines for Older Adults**

The data from the current analyses should be placed in the context of the beneficial health effects of alcohol. In particular, the findings that drinking levels seem to increase in the baby boom generation over time suggests that this segment of the population may be appropriate targets for preventive interventions focused on moderating use with increasing age. NIAAA recommends that persons aged 65 or older consume no more than seven drinks per week or no more than one drink per day (Dufour & Fuller, 1995; NIAAA, 1995). Four or more drinks on two or more occasions per month is considered binge drinking. In the United States, one standard drink is 12 grams of alcohol; in the United Kingdom and Europe, one standard drink is 8 grams of alcohol. Adjustments in the recommended guidelines should be made by country.

As suggested earlier, older adults pose special concerns when setting drinking criteria. Compared with younger people, older adults have an increased sensitivity to alcohol and over-the-counter and prescription medications. There is an age-related decrease in lean body mass versus total volume of fat, and the resultant decrease in total body volume increases the total distribution of alcohol and other mood-altering chemicals in the body. Liver enzymes that metabolize alcohol and certain other drugs are less efficient with age, and central nervous system sensitivity increases with age. Of particular concern in this age group is the potential interaction of medication and alcohol. For some patients, any alcohol use in combination with the use of specific over-the-counter or prescription medications can be problematic. Because of age-related changes in how alcohol is metabolized and the potential interactions between medications and alcohol, alcohol use recommendations are generally lower than those set for adults younger than 65 and are usually made on an individual basis (CSAT, 1998).

Maintenance of heavy consumption by females in the midlife cohort is of particular concern because, based on metabolism, women across age groups are more sensitive to the effects of alcohol than men. Also, they are more likely than men to have a shorter trajectory from

low-risk to high-risk use and serious alcohol-related problems ("telescoping of symptoms") (CSAT, 1998). In the next 25 years, the health care field may see a trend for women to maintain heavier drinking patterns over time, thus leading to a greater need for prevention/intervention strategies (CSAT, 1999).

**Long-Term Patterns of Use: Future Needs**

With 20 years of follow-up data, NHANES is one of the longest longitudinal analyses of drinking data among adults. These results point to the future prevention and treatment needs among the baby boom generation. Future work in this area is needed to appropriately target those most at-risk for the negative health consequences related to alcohol use. Additionally, alcohol and prescription medication interactions are largely unknown and should also be a focus of future research in this area. The health care field is presented with a challenge to provide care to a greater number of older adults who may be experiencing the health-related effects of alcohol consumption. There is also a unique opportunity to continue to develop and test innovative methods to provide quality, cost-effective alcohol screening and brief interventions. This will ensure that the growing population of older adults receives state-of-the-art "best practices" care to promote health and minimize the emotional, physical, and financial costs associated with alcohol-related problems.

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# Chapter 9. Utilization of Veterans' Health Services for Substance Abuse: A Study of Aging Baby Boomer Veterans

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*Abstract*: The purpose of this chapter is to determine whether there were changes in veterans' utilization of substance abuse services as they became older. The study used national Department of Veterans Affairs (VA) inpatient utilization data from fiscal years 1988, 1991, 1994, and 1998, and national outpatient data from fiscal year 1998. Observations were selected if the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes for substance abuse or dependence, intoxication, or alcohol or drug psychoses were identified in any of the 10 diagnosis fields for the inpatient stay or outpatient visit. Observations were also identified as primary or secondary substance-related diagnoses. Utilization of inpatient substance use and non-substance use services by age cohorts, including baby boomers (i.e., those aged 30 to 44 years in 1992), was examined for all veterans with substance use diagnoses in each year, and utilization of outpatient substance use services was studied for 1998. Relative to other age groups defined for 1992, the proportionate use of VA inpatient substance use services by baby boomers remained relatively constant or increased over the years studied, while their proportionate use of other inpatient services increased. Results for the 1 year of outpatient utilization data that were available showed similar distributions to those from the comparable inpatient year. Therefore, veteran substance abusers from the baby boomer generation continue to occupy the largest proportion of VA substance abuse services, and there is little evidence of declining need for treatment or "aging out" among this group of substance-using veterans.

## Introduction

The purpose of this chapter is to determine whether there were cohort differences over time in veterans' utilization of substance abuse services as they became older. Epidemiologic data from the early 1980s indicates that the prevalence of substance use disorders decreases substantially with age (Helzer, Burnam, & McEvoy, 1991); however, recent national prevalence data to identify whether later cohorts of substance abusers continue to "age out" at similar rates are not available. Generally, substance abuse treatment programs have younger to early middle-aged clients (Weisner, 1993; Weisner, Greenfield, & Room, 1995), although a number of specialized programs focus on older adults (Atkinson, Tolson, & Turner, 1990; Blow, Walton,

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Chermack, Mudd, & Brower, 2000b; Center for Substance Abuse Treatment [CSAT], 1998; Willenbring, Olson, Bielinski, & Lynch, 1995). VA substance abuse treatment programs serve a substantial number of older adults (Moos, Mertens, & Brennan, 1994c), although these patients generally represent a small fraction (around 10 to 15 percent) of the overall treatment population (Booth, Blow, Cook, Bunn, & Fortney, 1992; Ross, Fortney, Lancaster, & Booth, 1998).

There is also evidence of a substantial number of older alcoholics in medical and psychiatric settings and in primary care (Beresford, Blow, Brower, Adams, & Hall, 1988; Blow et al., 2000a), especially in Department of Veterans Affairs (VA) hospitals (Booth et al., 1992; Booth, Blow, Cook, Bunn, & Fortney, 1997; Moos, Brennan, & Mertens, 1994a; Willenbring et al., 1995). Older alcoholic veterans are more likely to be present in medical and psychiatric settings than in substance abuse treatment (Booth et al., 1992, 1997), both because of the chronic medical conditions more common in the elderly and because of the medical and psychiatric consequences of alcohol abuse. However, many more VA medical inpatients are recovering alcoholics whose acute alcohol problems ended many years earlier (Booth, Blow, & Cook, 1998).

This chapter discusses the utilization of VA health services by baby boomers (individuals born between 1946 and 1964). Utilization of services was measured within the VA only. It focuses on whether the use of substance use treatment and other service utilization declined as this generation aged between 1998 and 1998. For this study, cross-sectional data were used over 11 years of VA utilization, and age in 1992 was examined to provide a common anchor-point to identify changes in utilization for specific birth cohorts. An alternative design was considered: a longitudinal analysis of a specific cohort of individuals identified at a single point in time and followed subsequently through their VA utilization. However, because of time and resource constraints, that design was not chosen.

## Methods

### Data Obtained

The VA's inpatient and outpatient databases (the "patient treatment file" and the "outpatient file," respectively) were used. These databases include records of all inpatient and outpatient care provided in VA medical centers and freestanding outpatient clinics and have been maintained by the VA since the early 1980s. There is one observation for each inpatient stay and each outpatient clinic visit. As many as 10 International Classification of Disease (ICD-9) diagnoses are available in the inpatient and outpatient data, as well as demographic information, including age, gender, and race/ethnicity.

Until recently, all substance abuse care in the VA was provided on an inpatient basis. Therefore, the patient treatment files for fiscal years (FY) 1988, 1991, 1994, and 1998 were used. Beginning in the mid-1990s, the VA began providing a substantial portion of its substance abuse and other care on an outpatient basis. By 1997-1998, almost all of the treatment was provided in the outpatient setting. FY 1998 was substituted for FY 1997 (which would have maintained the 3-year increments) because the outpatient file with patient diagnoses was very incomplete for FY 1997.

All discharge diagnoses for each observation, either inpatient or outpatient, were searched for ICD-9 substance use diagnoses, including alcohol abuse, drug abuse, alcohol intoxication, alcohol dependence, drug dependence, alcoholic psychosis, and drug-induced psychosis. Each identified observation was classified as either "primary diagnosis" (if the substance use diagnosis was the primary diagnosis on either the inpatient or outpatient data files), or "secondary diagnosis" (if the substance use diagnosis was listed in any of the other diagnosis fields). A secondary diagnosis of substance abuse could have been assigned from a variety of hospitalizations for medical, surgical, or psychiatric diagnoses.

For the inpatient data, the type of care was characterized according to primary or secondary diagnosis and length of stay. For example, a veteran with a liver cirrhosis diagnosis as a primary diagnosis and an alcohol diagnosis listed in one of the secondary diagnosis fields would be classified as secondary diagnosis; if the diagnoses were reversed, the veteran would be classified as primary diagnosis. If the primary diagnosis was substance use, two groups were created: length of stay of 1 to 5 days (an approximation for a detoxification or brief treatment episode) and length of stay of more than 5 days (an approximation for an extended treatment episode). If the substance use diagnosis was the secondary diagnosis, the type of care was labeled as secondary diagnosis and it was assumed that less direct substance abuse care was provided, although this assumption cannot be verified. For the outpatient FY 1998 data, the distribution of outpatient visits was examined, counts of substance use visits during the year were calculated, and patients were grouped by 1 to 5 visits, 6 to 19 visits, and 20 or more visits, and secondary diagnosis visits.

**Subjects**

An inpatient database was assembled of a single record per individual veteran for each fiscal year included. For each fiscal year and individual patient, the observation was chosen that represented the most intense amount of substance use care (e.g., longer substance abuse hospitalizations were selected first, followed by shorter brief treatments or detoxification,

followed by secondary diagnosis hospitalizations). Therefore, individuals will be duplicated across inpatient fiscal years but not within fiscal years.

Only one observation per individual in the outpatient data was included; preferential selection was made if an individual had at least one outpatient visit with a primary substance abuse diagnosis. Duplicates between the FY 1998 inpatient and outpatient data were not eliminated. Date of birth was available for only 72 percent of the outpatient substance abuse observations in FY 1998, even after searching a range of years of inpatient and outpatient data. Therefore, age was not available for approximately one fourth of the outpatient observations for that fiscal year, and those observations were dropped from further analysis.

To provide a context within which to view these age-related data for substance-abusing veterans, we also obtained the age distributions for all veterans who used the VA as inpatients or outpatients in the years studied.

### Analyses

Age groups with a base year of 1992 were defined to examine how similarly aged individuals with substance abuse were represented in the VA system over time. 1992 was chosen as the anchor because the National Institute on Alcohol Abuse and Alcoholism's (NIAAA's) National Longitudinal Epidemiologic Study (NLAES) was conducted in that year. All tables in this chapter are displayed with rows representing age in 1992. Baby boomers were aged 28 to 46 in 1992. Therefore, the age groups 30 to 44 years in 1992 capture the majority of baby boomers. Other age groups were defined as younger than 30 years, 45 to 59 years, and 60 or older in 1992.

## Results

Table 1 shows the age distribution of all veterans with substance abuse diagnoses using VA inpatient services from 1988 to 1998, together with the same age distributions for all VA inpatients in the same fiscal years. It is important to note the overall decline in absolute numbers of inpatients, both substance abusers and total population. Most of this decrease is attributable to the massive shifts that have occurred from inpatient to outpatient services during this time period. The proportion of substance-abusing baby boomers (aged 30 to 44 in 1992) within the total substance-abusing VA inpatient populations increased from 37.0 to 52.5 percent between fiscal years 1988 and 1998 (see Table 1). In each year, baby boomers represented the largest proportion of substance abusers by age group. In contrast, this age group represented substantially *smaller* proportions of the total VA inpatient population in the same years: 17.6 percent in 1988 and 26.0 percent in 1998. Even though the representation of younger substance-

abusing veterans (those aged 30 or younger in 1992) increased fivefold from 1988 to 1998, only 5.5 percent of the inpatients with substance abuse diagnoses in 1998 were from this youngest age group. In the entire VA inpatient system, there were smaller (threefold) increases in representation of this young age group. Corresponding decreases were observed in the older substance abusers—among those who were 60 or older in 1992. The representation of this age group among substance abusers declined by almost two thirds between 1988 and 1998, while the representation of the 60 or older group only decreased from 63.0 to 42.5 percent in the entire VA inpatient population. The decrease in the proportion of older substance abusers may have been a function of mortality, a decrease in prevalence of substance abuse, or even more frequent underdiagnosis of substance abuse problems in the elderly.

**Table 1 Distribution for Substance Abusers and All Inpatient Population in VA Inpatient Care for Fiscal Years 1988, 1991, 1994, and 1998, by Age**

| | 1988 | | 1991 | | 1994 | | 1998 | |
|---|---|---|---|---|---|---|---|---|
| Age Group | Substance Abusers | All VA Inpatients | Substance Abusers | All VA Inpatients | Substance Abusers | All VA Inpatients | Substance Abusers | All VA Inpatients |
| 60 or Older | 48,949 (33.74%) | 394,340 (63.03%) | 34,831 (26.91%) | 318,865 (57.64%) | 23,521 (18.70%) | 263,781 (49.90%) | 10,553 (12.70%) | 157,346 (42.50%) |
| 45 to 59 | 40,900 (28.19%) | 113,715 (18.18%) | 37,605 (29.05%) | 114,230 (20.65%) | 36,155 (28.74%) | 124,937 (23.64%) | 24,375 (29.32%) | 103,759 (28.02%) |
| 30 to 44 | 53,630 (36.96%) | 109,783 (17.55%) | 54,292 (41.94%) | 109,003 (19.70%) | 60,873 (48.39%) | 122,527 (23.18%) | 43,659 (52.52%) | 96,164 (25.97%) |
| Younger Than 30 | 1,608 (1.11%) | 7,819 (1.25%) | 2,726 (2.11%) | 11,110 (2.01%) | 5,243 (4.17%) | 17,360 (3.28%) | 4,539 (5.46%) | 12,979 (3.51%) |
| Total | 145,087 | 625,657 | 129,454 | 553,208 | 125,792 | 528,605 | 83,126 | 370,248 |

Note: Estimates are column percentages.

Between FY 1988 and FY 1998, the proportion of baby boomer substance-abusing veterans (aged 30 to 44 in 1992) in longer substance abuse hospitalizations actually increased over the same time interval, from 45.8 percent in 1988 to 57.1 percent in 1998 (Table 2). At the same time, this group also increased their representation in the secondary diagnosis group (primary diagnosis of another disorder and secondary diagnosis of substance abuse) from 24.8 percent in 1988 to 50.0 percent in 1998. On the other hand, the representation of the oldest veterans (60 or older in 1992) in longer inpatient substance abuse treatment stays decreased (Table 2). For example, in 1988, 22.5 percent of longer inpatient substance abuse hospitalizations were accounted for by veterans 60 or older in 1992. In contrast, this age group accounted for only 8.8 percent of longer inpatient substance abuse hospitalizations in 1998. Similarly, there was a concomitant decrease in secondary diagnosis hospitalizations by older substance-abusing veterans (45 or older) between 1988 and 1998 (74.5 and 44.7 percent, respectively). The substance-abusing group aged 45 to 59 in 1992 provides a useful contrast: Their representation

**Table 2 Relationship Between Age and Type of Inpatient Substance Abuse Services for Fiscal Years 1988, 1991, 1994, and 1998**

| | 1988 | | | 1991 | | | 1994 | | | 1998 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age Group | Treatment > 5 Days | Treatment 0-5 Days | Secondary Diagnosis | Treatment > 5 Days | Treatment 0-5 Days | Secondary Diagnosis | Treatment > 5 Days | Treatment 0-5 Days | Secondary Diagnosis | Treatment > 5 Days | Treatment 0-5 Days | Secondary Diagnosis |
| 60 or Older | 15,669 (22.48%) | 3,650 (23.62%) | 29,630 (49.44%) | 9,404 (15.41%) | 2,168 (17.56%) | 23,259 (41.47%) | 6,104 (9.88%) | 1,570 (11.87%) | 15,847 (31.21%) | 1,556 (8.81%) | 852 (7.15%) | 8,145 (15.21%) |
| 45 to 59 | 21,067 (30.22%) | 4,823 (31.21%) | 15,010 (25.04%) | 17,789 (29.15%) | 3,914 (31.70%) | 15,902 (28.35%) | 16,562 (26.80%) | 3,807 (28.79%) | 15,786 (31.09%) | 5,034 (28.50%) | 3,532 (29.65%) | 15,809 (29.52%) |
| 30 to 44 | 31,934 (45.82%) | 6,808 (44.06%) | 14,888 (24.84%) | 31,997 (52.43%) | 6,020 (48.76%) | 16,275 (29.02%) | 35,645 (57.68%) | 7,226 (54.65%) | 18,002 (35.45%) | 10,088 (57.11%) | 6,779 (56.91%) | 26,792 (50.03%) |
| Younger Than 30 | 1,032 (1.48%) | 170 (1.10%) | 406 (0.68%) | 1,833 (3.00%) | 245 (1.98%) | 648 (1.16%) | 3,483 (5.64%) | 619 (4.68%) | 1,141 (2.25%) | 986 (5.58%) | 748 (6.28%) | 2,805 (5.24%) |

Note: Estimates are column percentages.

in the longer substance abuse treatment episodes stayed relatively constant over the years studied (range of 26.8 to 30.2 percent), as did their representation in the secondary diagnosis group (range of 25.0 to 31.1 percent).

As a frame of reference for the total veteran inpatient populations in these years, the absolute numbers and proportions of the oldest group (60 or older) declined between 1988 and 1998 while the younger age groups increased in representation. However, the representation of baby boomer substance abusers in the secondary diagnosis group (Table 2) was consistently *greater* than in the entire VA inpatient population (Table 1).

Among veterans with substance abuse diagnoses using outpatient services in FY 1998, outpatient baby boomer veterans with substance abuse diagnoses occupied the largest age group (48.0 percent) in FY 1998 (Table 3). This proportion is very similar to that found in the inpatient data for the same fiscal year (52.5 percent, see Table 1). The next highest representation was among veterans who were aged 45 to 59 in 1992 (32.1 percent). On the other hand, baby boomer veterans were relatively less frequently represented in the total outpatient population—only 27.8 percent contrasted to the most frequent age group (those 60 or older in 1992) who comprised 36.6 percent of the total outpatient users (see Table 3).

**Table 3 Distribution for Substance Abusers and Outpatient Clinic Population in VA Outpatient Clinics for Fiscal Year 1998, by Age**

| | Substance Abuse Diagnosis | | All Outpatient Clinic Patients | |
|---|---|---|---|---|
| **Age Group** | *N* | % | *N* | % |
| 60 or Older | 43,386 | 15.7 | 1,164,734 | 36.6 |
| 45 to 59 | 88,576 | 32.1 | 870,599 | 27.4 |
| 30 to 44 | 132,484 | 48.0 | 884,023 | 27.8 |
| Younger Than 30 | 11,468 | 4.2 | 262,115 | 8.2 |
| Total | 275,914 | | 3,181,471 | |

Note: Estimates are column percentages.

Baby boomer veterans with substance use diagnoses were most heavily represented in all outpatient substance abuse utilization categories (Table 4). This group of veteran outpatients used 62.5 percent of the 20 or more visits category and 55.8 percent of the 6 to 19 visits category, as well as 46.3 percent of the secondary diagnosis visits, contrasted with older and younger age groups who were less frequently represented in any of the types of outpatient care. For example, veterans aged 45 to 59 in 1992 accounted for only 25.8 percent of the longer (20 or more) episodes of outpatient substance abuse care and 33.1 percent of the secondary diagnosis outpatient population.

**Table 4 Distribution for Type of VA Outpatient Substance Abuse Services for Fiscal Year 1998, by Age**

| | Substance Abuse Primary Diagnosis Visits | | | | | | Secondary Diagnosis Visits | |
|---|---|---|---|---|---|---|---|---|
| | 20 or More | | 6 to 19 | | 1 to 5 | | | |
| Age Group | *N* | % | *N* | % | *N* | % | *N* | % |
| 60 or Older | 628 | 5.66 | 1,398 | 9.28 | 11,726 | 15.40 | 29,634 | 17.07 |
| 45 to 59 | 2,870 | 25.85 | 4,333 | 28.76 | 23,980 | 31.50 | 57,393 | 33.06 |
| 30 to 44 | 6,937 | 62.48 | 8,414 | 55.84 | 36,732 | 48.25 | 80,401 | 46.31 |
| Younger Than 30 | 668 | 6.02 | 922 | 6.12 | 3,689 | 4.85 | 6,189 | 3.56 |

Note: Estimates are column percentages.

## Conclusions

There is no evidence of a relative decline in demand for VA substance abuse treatment services among veterans in the baby boomer generation as they age. Compared with the relative ages of the other veterans with substance abuse diagnoses who used VA health services, baby boomer veterans continued to consume directly associated substance abuse services in similar or greater proportions over the time period covered by this report. These analyses should be replicated with data from fiscal years 2001 and 2004 to examine whether this generation of veterans is still using treatment services in the same proportions. Particularly, it will be important to examine trends in outpatient utilization, given that we were able to study only one fiscal year of such data.

Therefore, there was no evidence that the need for treatment was declining with increasing age as might have been expected from prior community studies of the decreasing prevalence of substance use disorders with age, such as the National Institute of Mental Health's Epidemiologic Catchment Area (ECA) Study (Helzer et al., 1991). In particular, in the population of veterans using the VA health care system, there did not appear to be an aging-out phenomenon for baby boomer veterans, although only 11 years of data were examined. This finding suggests that this generation of veterans may not be decreasing their dependence on alcohol and drugs with increasing age, although a firm conclusion on this issue cannot be made without information from veterans in the general population who do not use VA services. It is clear that the VA must consider allocating more substance abuse treatment resources for older veterans in the next decade, probably at a higher level than current allocations allow.

Furthermore, because these veterans have already shown greater prevalence of medical and psychiatric comorbidity with increasing age as shown by their substantial hospitalizations and outpatient visits for primary diagnoses other than substance abuse, the VA also will need to

include programming to link substance abusers with medical and psychiatric services during substance abuse treatment. Even though it is likely that some of the increased utilization based on substance abuse as a secondary diagnosis was due to the physical consequences of substance abuse, it is more likely (from data not shown here) that most of the increased use was because of medical diagnoses associated with increasing age, such as cardiovascular disease and cancer. In addition, it will be important for the VA to strengthen linkages in the other direction—from medical care to substance abuse services, particularly for older veterans with substance abuse problems who are present in general medical and nonsubstance abuse settings.

As in other studies (Booth et al., 1992; Ross et al., 1998), our data suggest that older substance abusers are less likely to receive extended substance abuse treatment. The VA has already made substantial efforts toward general screening for alcohol problems in primary care. If the trends indicated in this report continue, medical settings will see more aging baby boomer veterans with the medical consequences of alcohol and drug abuse. The VA, therefore, will need to allocate resources to deal with the increased need for care for these medical complications, as well as to emphasize the importance of facilitating referrals to alcohol and drug treatment from medical and psychiatric settings.

Psychiatric and substance use disorders in medical and surgical inpatients are associated with decreased health-related quality of life and increased psychological distress, both during hospitalization and longitudinally (Booth et al., 1998; Booth, Blow, & Cook, 2001). Community population studies have shown that having a psychiatric disorder significantly raises the odds of substance use diagnosis (Regier et al., 1990) and point to the importance of dual diagnosis programs or at least attention to substance abuse in psychiatric settings. Long-term use of alcohol and drugs is associated with substantial medical complications (Moos et al., 1994b), although some of these are hard to separate from the consequences of smoking. If trends indicated in this study continue, VA medical settings will continue to be mindful of substance abuse as a comorbid condition to medical presentations.

There are a substantial number of benefits to these data and findings:

- The VA is a national health care system and, as such, includes representation from all States.
- The VA generally serves a low-income, disabled population, especially for substance abuse. As such, the VA provides some comparability with the public sector providing substance abuse treatment and with Medicaid clients.

- The VA is a comprehensive medical, psychiatric, and substance abuse health care system. Therefore, individuals with substance use disorders were included from the gamut of health care settings, including substantial samples of individuals with substance abuse as a comorbid condition who were receiving medical or psychiatric care.

- Because of military buildup during the Vietnam Era, large numbers of baby boomers, who are the target group of interest, could be studied.

- The ability to study a series of cross-sectional national samples from the same health care system across just over a decade is relatively rare. These samples enabled a determination to be made of the relative health care burden of baby boomers with substance abuse over time.

Several issues to be examined in further research. For example, one important factor—period of military service—was not examined. Many veterans aged 35 to 49 in 1992 would have been Vietnam Era veterans, who may have differing persistence of substance use disorders as compared with earlier and later eras. In addition, other important characteristics, such as race/ethnicity and gender, were not examined. It also will be important to look at mortality rates for the baby boomer veterans who are substance abusers.

There are limitations to these data. Substance use disorders are generally underdiagnosed in nonspecialty substance abuse treatment settings (Beresford et al., 1988; Moore et al., 1989). Therefore, prevalence of substance abuse as a comorbid condition (the secondary diagnosis group) is undoubtedly underestimated. It is also important to note that these data do not reflect the prevalence of substance use disorders in the overall veteran population but only *as diagnosed* among veterans using VA health services. Therefore, we cannot comment on the age-specific population incidence and prevalence of substance use disorders among veterans. Because substance use disorders are underdiagnosed in most hospital settings (Beresford et al., 1988; Moore et al., 1989), and this study is based on recorded diagnoses in medical records, these data cannot even reflect the prevalence of substance use disorders in VA health service settings. Also, these data represent veterans using the VA health care system and may not reflect the substance use utilization by veterans using non-VA health care services.

The impact of mortality in reducing the denominators for these analyses, especially among the older veterans, is not known. However, it is clear that baby boomer substance abusers occupied a greater proportion of substance abuse services compared with their representation in the overall VA inpatient population. This finding is particularly important given that the comparison group is all service users rather than a community sample or national estimates of community individuals (i.e., not necessarily service users). However, the onset of substance

abuse is in the earlier years of life (Helzer et al., 1991), so the variation in age distribution between the substance abusers and the general VA service population is not surprising.

Another issue that will certainly arise as veterans continue to age beyond Medicare eligibility is the generalizability of Medicare-eligible veterans who continue to use the VA. They do so for many reasons, including financial ones. The VA does not charge co-payments or deductibles, or for prescriptions, and will even mail prescriptions. Otherwise, many veterans continue to use the VA because of familiarity with the system and loyalty to the health service that has provided them with long-standing care. Finally, the VA provides the most available and comprehensive substance abuse treatment, other psychiatric services, and medical care in many areas of the country; the VA is often the system of choice for veterans with substance abuse.

Finally, these data include relatively few women (approximately 1 percent of the samples). In general, women veterans presenting to VA health care with substance abuse have high rates of psychiatric and medical comorbidity (Ross et al., 1998). It is not known whether these findings would generalize to larger populations of women.

These data provide strong empirical evidence for the massive shifting from inpatient to outpatient substance abuse services during the 1990s. This shift was done as part of national VA policy shifts away from costly inpatient services to less intensive and less costly outpatient services. This shift may have disproportionately affected substance-abusing veterans because of decreased access, lack of transportation, or the need for supportive housing. However, many VA medical centers have developed innovative programs for substance abusers without housing or transportation, including the use of domicilaries and halfway houses.

It is important to note that these data are not longitudinal data that follow a specific cohort of veterans over time to identify changes in diagnoses within individual veterans. Instead, four cross-sectional panels of data were analyzed over 11 years of VA health care. The advantage of using cross-sectional data is that the proportionate representation of the baby boomer generation with substance abuse within the VA health care system could be identified. Additional research is needed to identify a birth cohort at a particular time point and follow that cohort longitudinally. Such a study would allow identification of the incidence of comorbid conditions, including those associated with substance abuse, to identify changing patterns of health care utilization and to conduct mortality studies.

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# Chapter 10. Conclusions and Policy Implications

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Information contained in the chapters of this report documents the reasons for concern about the projected demand for substance abuse services over the next 20 to 30 years. Analysis of empirical evidence demonstrates the relatively higher illicit substance abuse and dependence among those born between 1946 to 1964 (baby boomers) and projects that this problematic pattern of use will moderate less in this group than has been the case in previous generations' cohorts. As noted in Chapter 1, there may be a doubling in the number of citizens with substance abuse problems in the next 20 years. However, such estimates are likely to fluctuate as more knowledge accrues. To make more reliable forecasts of the demand for substance abuse treatment services, more updated and expanded information on the life course of substance abuse problems is needed on those who abuse substances and are in recovery, those who continue to abuse substances throughout their lives and may or may not be in treatment, and those who begin abusing substances later in life. In addition, patterns of relapse and remission must be better understood. The chapters highlight uses of available data and provide examples of analyses and methodological issues required to refine forecasts of the demand for substance abuse services emerging over the next several decades.

A brief summary of evidence provided by the analyses in this report includes the following:

- Demographic projections suggest that the proportion of the population aged 65 years or older in the United States will rise from the current 12 percent to 20 percent by 2030. Moreover, the population will become more ethnically and racially diverse, live longer, and face higher health care service and prescription drug costs than ever before. This shift suggests that the labor force will be proportionally smaller and will increasingly support the rising health care costs of the older, nonworking population. The impact of substance abuse on these costs is unknown. To estimate this future impact, methods are needed that account for drug abuse/misuse incidence, prevalence, empirical evidence and recognition of the potential for recovery, and death throughout the life cycle (Korper and Raskin, Chapter 1; Ray, Chapter 2).

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- Few longitudinal studies provide direct measures of age-specific recovery, relapse, and mortality of substance abusers. In addition, they do not provide the characteristics of late onset abusers. A review of California follow-up data on heroin addicts indicates that rates of permanent recovery (5 years or more abstinence) increased from 36 percent in the 45 to 49 age category to about 50 percent for those older than 49, but no continuing increase of recovery after age 50. Overall mortality rates rose from about 33 percent for those in the younger age category to 76 percent or higher among those older than 65. Analysis of another California dataset of high-risk substance abusers indicated that baby boomers in emergency rooms and sexually transmitted disease clinics generally reported greater levels of illicit drug use but comparable levels of use of prescription medications. The relationship between age and the progression of drug use or the recovery process appears to differ depending on the type of drug used. Future studies need to include women and to improve sampling of the elderly (Chapter 3, Hser).

- Analysis of data from the Treatment Episode Data Set (TEDS), a component of the Substance Abuse and Mental Health Services Administration (SAMHSA) Drug and Alcohol Services Information System (DASIS) that collects information on clients admitted for substance abuse treatment, indicates that abuse of tranquilizers and sedatives, although relatively low, increases with age. This is consistent with reports in the clinical literature of problem prescription drug use among older adults. Beginning at age 55, an increasing proportion of persons entering treatment were doing so for the first time, largely for abuse of alcohol alone. The few aged 75 who entered the publicly funded treatment system had more severe and complex problems than those just a few years younger (i.e., they were more likely to be polydrug users and to have been in treatment previously). Future TEDS research could include analysis of patterns among birth cohorts and analysis of age and historical period of drug use initiation cohorts (Chapter 4, Henderson).

- Estimates suggest that there will be a doubling of the number of problem substance users aged 50 or older during the next two decades—from 2.5 million in 1999 to 5.0 million in 2020. (More recent work by these authors suggests that due to the combined increase in the number of older adults and the increase in the rate of treatment need in this population, that the aging baby boom cohort will place increasing demands on the substance abuse treatment system in the next two decades and will require a shift in focus to address the special needs of an older population of substance abusers (Gfroerer, Penne, Pemberton, & Folsom, in press). There is also a need to develop improved tools for measuring substance use and abuse among older adults (Chapter 5, Gfroerer et al.).

- The National Household Survey on Drug Abuse (NHSDA) should be supplemented with selected questions in order to use a life table approach for projecting substance abuse problems among older adults. It also may be necessary to develop new data systems tailored to substance abuse among the aging baby boom population (Chapter 6, Woodward).

- There have been and will likely continue to be substantial changes in the patterns of substance use and abuse over different age cohorts, particularly among those born after World War II, that will have a dramatic impact on the content, focus, and delivery of specialized substance abuse prevention and treatment interventions needed for adults in late life. The development of innovative and effective screening and treatment methods for substance misuse among older adults is an important focus of future research (Chapter 7, Blow et al.).

- Analysis of data from the National Health and Nutrition Examination Survey I (NHANES-I) indicate that mean alcohol consumption appears to remain higher over time for the midlife group (including the baby boom generation) than for other age groups. This suggests that the baby boom generation, as it continues to age, could maintain a higher level of alcohol consumption than in previous older cohorts (Chapter 8, Blow et al.).

- Military veteran substance abusers from the baby boom generation utilize the largest proportion of substance abuse services from the Department of Veterans Affairs (VA). There is little evidence of declining need for treatment or "aging out" among this group of substance-using veterans. Future research should attempt to follow longitudinally a birth cohort in order to identify incidence of comorbid conditions and changing patterns of health care use and to conduct mortality studies (Chapter 9, Booth and Blow).

This report has examined a series of representative data resources to provide a clearer understanding of the expected change in the magnitude and complexity of adult substance abuse in the coming decades. Complementing the well-documented accelerated aging of the U.S. population will be a new and expanded constellation of factors, including longer life span, changing demographic profile, greater per capita use of multiple prescription drugs for longer-term chronic disability, pronounced economic pressure to support a relatively larger group of retired elderly, pressure to retain older persons in the workforce, and an enhanced propensity of those entering their senior years to abuse both licit and illicit substances. The individual and collective impact of these factors on substance abuse and the ramifications for treatment resources and health policy choices will require novel solutions based upon understanding derived from novel analytical approaches.

Several of the analyses included in this report have estimated selected dimensions of the approaching problem of elderly drug abusers. These analyses emphasize the need to develop and include improved measures and undertake the collection of longitudinal (life course) data (e.g., changes in sampling the elderly and women, improving the representativeness of the datasets, and encompassing more sensitivity to the real potential of polydrug use in the elderly). Changes in the collection of information, however, will not significantly enhance the treatment system's readiness for a substantially modified arithmetic of aging and substance abuse over the next 20 to 30 years.

A review of the history of public health in the United States provides several important lessons concerning necessary caution in interpreting and projecting trends and impacts. This report's projected expansion in substance abuse among the elderly may be overstated. For example, the analyses in this report use 1992 as a base year. Fluctuations in substance abuse patterns since then may confound analysis and interpretation. Further, it is conceivable that future generations may benefit from advances in substance abuse treatment that evolve from gene therapy or new medications—the proverbial "magic bullet"—that have influenced the course and/or infectivity of many diseases (University of Texas, 2000). Research also has demonstrated that the elderly who continue to work have better perceived health and life satisfaction than those who do not participate in the labor force (Soumerai & Avorn, 1983). Improved general health and a reduction in polypharmacy and associated multiple drug interactions would mitigate against substance abuse among the elderly. *But can we count on such fortuitous events?*

In terms of *today's* knowledge and incentives, the health care system in the United States does not yet appear to have recognized or to be effectively dealing with the increased and increasing use and abuse of licit and illicit psychoactive substances by older populations (Office of National Drug Control Policy, 2001; The Robert Wood Johnson Foundation, 2001). Few incentives or widely shared information technologies are in place to counter the trend in polypharmacy and adverse prescription drug interactions. Few validated instruments to screen and assess substance abuse problems in older people exist. Many clinicians lack the sensitivity needed to understand differences in patient attitudes toward use of substances that may stem from different ethnic perspectives, or misdiagnose the confusion often present in the elderly. Given a significant expansion of this group of elderly abusers in the coming decades, more informed and active policy will require new approaches and investment in the following:

- data and analysis, with increased emphasis on documenting substance abuse in the elderly, in addition to the historical emphasis on alcohol abuse and mental health problems;

- expanded literature review, encompassing studies not considered in this report, some of which may not be specific to substance abuse but can offer new conceptual and methodological insights;

- prevention, treatment, and management strategies specifically tailored for the elderly from different ethnic, gender, and racial groups, including immigrant populations, and so on;

- monitoring of demographic shifts in heterogeneous elderly populations; and

- long-term projections of the demand for expanded clinical and public health services for substance abusers.

More information in and of itself, however, does not ensure the evolution of effective policies or immediate action to solve the future problem of drug abuse and the elderly. Policy action and related resource allocation in the near term are typically related to the current, politically felt presence of a problem and not to what might occur decades from now. Faced with the reality of competing budgetary demands, it will be difficult for health and budget planners to shift resources today to deal with the identified, far off impact of substance abuse by the elderly on the health care system. The need for timely action, however, is important in dealing with this particular health problem. First, absent a palliative or effective "magic bullet," the expected large increase in the problem of substance abuse and the elderly is likely to be understated rather than overstated. Forecasts are affected by incomplete knowledge, such as few longitudinal and generalizable studies of the problem, which could help to trace the complex and interactive nature of clinical and social factors that increase the use and abuse of substances by older populations. Further, the current data do not make adjustments that reflect the clinical propensity to underdiagnose substance abuse in the elderly and the presence of multiple diagnoses, where substance abuse may trigger, mask, or be undetected in the presence of other comorbidities (e.g., mental health problems or other chronic conditions). Clinicians can be trained to do a better job in diagnosing substance abuse problems, in general, and, specifically, in older populations. Much lead time, however, is required to train an adequate number of physicians in the detection and treatment of substance abuse by the elderly patient (Fishbein, 1999).

Second, as policymakers have come to recognize, inaction becomes a *de facto* policy decision. Doing nothing about a problem perceived as relatively remote incurs costs in terms of missed opportunities for early intervention. In the case of substance abuse in the aging population, the cost of not addressing the multifaceted health implications of a larger, older population in a timely manner is likely to be high. A policy decision not to take preemptive action will be costly given the projected population changes, substance abuse patterns of the baby boom generation, and other clinical and systemic changes associated with a major increase in the

elderly population. In the case of substance abuse and general health care of an older population, not investing current resources to investigate and prepare for the increased health care needs of the future elderly population will lead to a relatively uninformed and frenzied search for solutions, and a much higher bill for addressing the problem in a reactive rather than proactive mode.

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Reports in the DAWN Series provide data on the number and characteristics of (1) drug abuse related visits to a national representative sample of hospital emergency departments, and (2) drug abuse related deaths from selected medical examiner offices. The medical examiner cases are not from a national representative sample. DAWN is an ongoing data system that began in the early 1970's.

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- D-3: Year-End Preliminary Estimates from the 1996 Drug Abuse Warning Network
- D-4: Drug Abuse Warning Network Annual Medical Examiner Data 1996
- D-5: Mid-Year 1997 Preliminary Emergency Department Data from the Drug Abuse Warning Network
- D-6: Year-End 1997 Emergency Department Data from the Drug Abuse Warning Network
- D-7: Annual Emergency Department Data from the Drug Abuse Warning Network, 1995
- D-8: Annual Emergency Department Data from the Drug Abuse Warning Network, 1996
- D-9: Annual Emergency Department Data from the Drug Abuse Warning Network, 1997
- D-10: Mid-Year 1998 Preliminary Emergency Department Data from the Drug Abuse Warning Network
- D-11: Year-End 1998 Emergency Department Data from the Drug Abuse Warning Network
- D-12: Drug Abuse Warning Network Annual Medical Examiner Data 1997
- D-13: Drug Abuse Warning Network Annual Medical Examiner Data 1998
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- D-21: Emergency Department Trends From the Drug Abuse Warning Network, Final Estimates 1994 -2001
- D-22: Emergency Dept. Trends From the Drug Abuse Warning Network, Preliminary Estimates Jan.-June 2002



(Continued on next page)

**Drug and Alcohol Services Information System (DASIS) Series:**
Reports in the Services Series provide national and state level data on (1) the characteristics of specialty treatment facilities providing drug and alcohol services; (2) the number of persons in treatment; and (3) the demographic and drug use characteristics of treatment admissions. The Services Series also includes the National Directory of Drug and Alcohol Abuse Treatment Programs. The publications in this Series are based on SAMHSA's Drug and Alcohol Services Information System (DASIS).

"S" Series publications currently available:

- S-1: National Directory of Drug Abuse and Alcoholism Treatment and Prevention Programs 1996
- S-2: Uniform Facility Data Set (UFDS): Data for 1995 and 1980-1995
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- S-5: National Admissions to Substance Abuse Treatment Services: The Treatment Episode Data Set (TEDS) 1992-1996
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**Analytic Series:**
Reports in the Analytic Series address special topics relating to alcohol, drug abuse, and mental health. The Analytic Series generally provides data from outcome and other special studies, secondary analysis of multiple data sources, or more in-depth analysis of the data presented in the standard annual reports in the other Office of Applied Studies publication series.

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- A-20: The ADSS Cost Study: Costs of Substance Abuse Treatment in the Specialty Sector
- A-21: Substance Use by Older Adults: Estimates of Future Impact on the Treatment System

**Methodology Series:**
Reports in the Methodology Series address methodological issues concerning data collection systems conducted by SAMHSA's Office of Applied Studies. These reports include studies of new statistical techniques and theories, survey methods, sample design, survey instrument design, and objective evaluations of the reliability of collected data.

"M" Series publications currently available:

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