ALL-CAUSE AND UNINTENTIONAL INJURY MORTALITY IN OREGON'S ADULT MEDICAID POPULATION: 1997–2001

A Thesis

By Jill M. Gelow

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CERTIFICATE OF APPROVAL

This is to certify that the Master of Public Health thesis of Jill Gelow has been approved.

Katrina Hedberg, MD, MPH
Committee Chair

[redacted]

Donald Austin, MD, MPH
Committee Member

[redacted]

Barna Tugwell, MD
Committee Member

[redacted]

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ABSTRACT

ALL-CAUSE AND UNINTENTIONAL INJURY MORTALITY IN OREGON'S ADULT MEDICAID POPULATION: 1997–2001

Background

Low income and low socioeconomic status (SES) is associated with increased all-cause mortality in the United States and may in part be explained by a higher prevalence of health risk behaviors and lack of health insurance. The Medicaid population is a unique subset of the low-income population that theoretically has access to adequate health care but also has a higher prevalence of health risk factors and medical morbidities than the general population. Although studies have demonstrated increased all-cause morality in Medicaid populations, overall, the burden of all-cause mortality in Medicaid populations remains poorly defined.

Unintentional injury is an important component of all-cause mortality to consider because it is the leading cause of premature mortality in the Untied States. Although unintentional injury mortality has been shown to be inversely associated with income and socioeconomic status, unintentional injury mortality has not been explored in Medicaid populations.

The burden of all-cause and unintentional injury mortality in Oregon's Medicaid population is of particular interest because the Oregon Health Plan provides Medicaid coverage to a greater number of low-income persons than are traditionally covered by Medicaid, based solely on income requirements.

Objective

The purpose of this investigation was to determine if, during the period from 1997–2001, the burden of all-cause mortality and unintentional injury mortality, including mortality from motor vehicle accidents (MVAs), poisonings and falls, in Oregon's adult Medicaid population was different than that in the non-Medicaid adult Oregon population and to determine subsets of the Medicaid population at increased risk of death from unintentional injuries.

Methods

This cross-sectional study was conducted using an original dataset created by linking Oregon Medicaid enrollment data with Oregon death certificate data. During the period from 1997–2001, trends in all-cause mortality, unintentional injury and specifically MVA, poisoning and fall mortality, were evaluated for both the Medicaid and non-Medicaid populations. Average annual age-sex specific mortality rates and 95% confidence intervals were calculated for all-cause mortality, unintentional injury mortality as well as for unintentional MVAs, falls and poisonings. Additionally, the relative risk of death and associated 95% confidence intervals for the Medicaid population compared to the non-Medicaid population was calculated for each age-sex category.

Results

All-cause mortality rates in the Medicaid population exceeded those in the non-Medicaid population for men and women each age-sex category. The average annual age-adjusted risk of unintentional injury death in the Medicaid population compared to the non-

Medicaid population was 1.4 (95% CI: 1.1, 1.7) for men and 1.5 (95% CI: 1.2, 2.0) for women. There was no difference in MVA mortality for both men and women in the Medicaid population compared to the non-Medicaid population, except for men ages 20–34 years for whom Medicaid enrollment was protective of MVA death (RR: 0.4, 95% CI: 0.2, 0.9). Both Medicaid men (RR: 2.9, 95% CI: 1.8, 4.8) and women (RR: 1.8, 95% CI: 1.1, 2.8) ages 65 years and older were at increased risk of death from unintentional falls compared to their non-Medicaid counterparts. In contrast, the relative risk of unintentional poisoning death was increased for both men and women ages 20–34 and 35–49 years compared to the non-Medicaid population. Medicaid men and women ages 35–49 years were more than five times as likely to die of an unintentional poisoning than their non-Medicaid counterparts.

Conclusions

Important information regarding all-cause and unintentional injury mortality has been obtained from the completion of this study. As expected, the burden of all-cause mortality was uniformly increased in the adult Oregon Medicaid population in comparison to the adult Oregon non-Medicaid population. Unintentional fall mortality among elderly Medicaid recipients and, more strikingly, unintentional poisoning mortality among Medicaid eligibles ages 20–34 and 35–49 years, emerged as specific types of fatal unintentional injures that disproportionately impact the adult Oregon Medicaid population. The results of this investigation may serve to guide future unintentional injury research and injury prevention interventions in the Oregon Medicaid population.

ALL-CAUSE AND UNINTENTIONAL INJURY MORTALITY IN OREGON'S ADULT MEDICAID POPULATION: 1997–2001

INTRODUCTION

Low income and socioeconomic status are associated with increased all-cause mortality in the United States.[1-18] The association between income and mortality may in part be explained by the higher prevalence of health behavior risk factors in low-income populations as well as by lack of health insurance to pay for medical care.[14, 19-20] Medicaid populations represent a unique subset of the low-income population that theoretically has access to adequate health care but also has a higher prevalence of health risk factors and medical morbidities than the general low-income population. As may be expected, all-cause mortality in the Medicaid population has been shown to be greater than mortality among privately insured populations.[19-24] However, overall the burden of all-cause mortality among Medicaid populations remains poorly characterized, particularly compared to a non-Medicaid population that includes both privately insured and uninsured persons.

Unintentional injuries, including motor vehicle accidents (MVAs), falls and poisonings, are the leading cause of premature mortality in the United States and, therefore, are an important component of all-cause mortality.[25, 26] Unintentional injuries represent an important public health problem not only because they result in disproportionate early mortality, measured by years of potential life lost (YPLL), but also because they are theoretically preventable. Unintentional injuries are also costly to the health care system and publicly funded insurance programs, such as Medicaid, which continually face pressure to contain costs and control spending. Although unintentional

injury death has been associated with low income and low socioeconomic status, the burden of unintentional injury mortality in Medicaid populations has not been explored.

Further defining the characteristics of all-cause mortality and, specifically, mortality from unintentional injuries in the Medicaid population will guide strategies for the prevention of unintentional injuries in this unique population. The Oregon Medicaid population is of particular interest in that the state Medicaid program provides health care access to a greater number of low-income individuals based only on income.

The purpose of this investigation is to determine whether the burden of all-cause mortality and unintentional injury mortality in Oregon's adult Medicaid population is different than that in the non-Medicaid adult Oregon population, and to identify subsets of the Medicaid population at increased risk of death from unintentional injuries.

BACKGROUND

All-cause Mortality

The relationship between socioeconomic status (SES) and health has long been an area of interest to researchers.[1] Multiple studies have demonstrated the inverse association of mortality and SES at both the individual and population level.[2-7] At the individual level, an analysis of the National Longitudinal Mortality Study found increased mortality rates in individuals with low income, less education, low-level occupations and in persons not in the work force. The associations were particularly strong among persons less than age 65 years. [3]

At the population level, studies have investigated the relationship between the income levels of geographic areas and the mortality rates of persons living in these areas.[8] A strong association exists between population level income measures such as the per capita gross national product (GNP) and age-adjusted mortality in developing countries. However, this association is less convincing in developed countries such as the United States. [7,8] In developed countries, it appears that the relative distribution of income in the population, as opposed to the absolute income, has the greatest impact on mortality. [7,9-13] For example, in the United States after adjustment for poverty, increasing income inequality in individual states is associated with increased age-adjusted mortality.[10]

Increased prevalence of health risk behaviors and lack of health insurance are two factors that could in part explain the association between low income and mortality. It has been argued that socioeconomically disadvantaged persons have higher mortality rates than persons of higher SES because they have a higher prevalence of health risk

behaviors.[14] However, in a variety of subpopulations, differences in mortality between lower and higher socioeconomic groups have remained after controlling for major lifestyle health risk factors. [15-18] For example, in a longitudinal study, low income was strongly associated with increased mortality, and this association persisted after controlling for the increased prevalence of health risk behaviors, including smoking, obesity and sedentary lifestyle, in the low income population.[14]

Medicaid populations are a unique subset of the low-income population; although they have a high prevalence of health risk behaviors, they also have a higher prevalence of preexisting medical conditions and disabilities than the general low-income population. This is in part because of the categorical requirements for Medicaid eligibility, which will be further explained in the sections that follow. However, even within expanded Medicaid populations wherein eligibility is determined solely by income, such as the population served by the Oregon Health Plan, persons are often prompted to enroll because of a condition that requires imminent medical care.

Insurance type, for example public verses private employer-based insurance, is undoubtedly correlated with income and SES. Persons with low income are more likely to be uninsured or receive public insurance. The relationship between health insurance, as a marker for health care access, and mortality is important to consider. Lack of heath insurance has been associated with increased all-cause mortality at all income levels compared to private employer-based insurance. Interestingly, public health insurance, such as Medicaid, has also been associated with increased mortality at all income levels compared to private, employer-based insurance.[19, 20]

In addition to all-cause mortality, disease-specific morbidity and mortality has been shown to differ based on insurance status. For example, uninsured and Medicaid breast cancer patients present with more advanced disease than privately insured patients and have overall increased breast cancer mortality due to the late stage of presentation.[21] Uninsured and Medicaid breast cancer patients with local and regional disease also have higher mortality rates than privately insured patients. [22-24] Thus, although access to health care measured by insurance status does improve health outcomes, mortality rates in the United States among publicly insured populations, such as Medicaid, remain higher than among those with private insurance.

Unintentional Injury Mortality

Unintentional injury is the leading cause of preventable premature mortality in the United States (U.S.). During 2000, a total of 97,900 persons died in the U.S. of unintentional injuries, amounting to 2,022,483 years of potential life lost (YPLL) before age 65.[25] Of these deaths, 88,351 (87.5%) occurred in adults age 20 years or older.[25] The unintentional injury mortality rate in the United States for adults ages 20 years and older is 45 per 100,000 persons.[25] Motor vehicle accidents (MVAs), falls and poisonings are among the most common causes of unintentional injury death in the United States, accounting for 43,353, 13,322 and 12,757 deaths respectively in 2000. Among adults ages 20 years and older in the year 2000, mortality rates from MVAs, falls and poisonings were 18.0, 6.7 and 6.3 per 100,000 persons respectively.[25]

In addition to resulting in a disproportionate number of YPLL, unintentional injuries represent an important public health problem because they are theoretically

preventable and they are costly to the health care system. In fact, injuries accounted for 12% of all medical spending in the United States in 1995, totaling an estimated 260 billion dollars in 1995.[26] Federal, state and local government funds pay for about 28% of all medical expenditures for injury.[27]

Many demographic patterns in injury mortality have been consistently reported. Injury is a leading cause of death for children but injury death rates are lowest for children age 15 and younger. In contrast, death rates from injury are highest among persons older than 75, despite the fact that injury is not a leading cause of death in the elderly. Injury death rates are higher for males than females in all age categories except infancy.[26] Males are specifically at higher risk than women for motor vehicle crashes, falls and drownings.[27]

Injury death rates vary with race and ethnicity. Injury mortality for persons age 15–34 years during 1993–1995 was higher for black and American Indian/Alaskan Native persons than for Hispanic, non-Hispanic white or Asian/Pacific Islander persons.[26] Death rates for unintentional injury are higher for American Indians compared to all other racial groups.[27]

Death from injury has also been associated with both individual and population level measures of low socioeconomic status. At the individual level, among employed adults in the United States, decreasing injury mortality rates have been demonstrated with increasing SES for both men and women.[28] Additionally, in an analysis of working age adults, low income, low education, blue collar occupation, unemployment and not being in the labor force were found to independently increase the risk of death due to injury.[29] Blue collar workers also face an increased risk of fatal occupational injuries. [30] At the

population level, low per capita income of the county of residence is significantly related to higher mortality rates from fatal unintentional injuries in all age groups.[31, 32]

Although many studies have shown an association between income and injury mortality, there is little reported information regarding the effect of insurance type on death from injury, including a lack of published literature on the burden of unintentional injury-related mortality among Medicaid recipients.

Understanding Medicaid in the United States

Medicaid was created, in conjunction with Medicare, in 1965 by Title XIX of the Social Security Act. Medicaid was intended to provide medical assistance for certain individuals and families with low incomes and inadequate resources. [33] Since its creation, Medicaid enrollment and, consequently, Medicaid expenditures have grown substantially. In 1998, Medicaid provided insurance for 12% of the total U.S. population compared to only 9.1% in 1978.[33] Medicaid is currently the third largest insurer in the United States after employer-based insurance and Medicare.[33]

Medicaid programs throughout the country are overseen by the federal government but administered at a state level.[33] The federal government establishes broad guidelines for the distribution of resources, but specific program requirements are established by individual states, including eligibility standards, the type, amount, duration and scope of services, the rate of payment for services and program administration. Accordingly, there are 56 different Medicaid programs in the United States, one in each state, territory and the District of Columbia.[34] Considerable variation exists not only among the Medicaid programs in each state but also within each specific state over time.

In general, Medicaid eligibility is means tested and based on a combination of financial and categorical requirements.[33] It is important to emphasize that Medicaid does not uniformly provide coverage to all low-income individuals but rather only to those persons meeting specific criteria. States are federally mandated to provide Medicaid services to low-income families with children, infants born to Medicaid-eligible pregnant women, Supplemental Security Income (SSI) recipients and recipients of adoption assistance and foster care. States have the option to provide coverage to higher-income pregnant women and children, up to 185% of the federal poverty level, as well as the medically needy, long-term care residents and the working disabled.[34] Low-income individuals not fitting into one of the above mandatory or optional coverage categories, such as a childless couple or adults without disabilities do not typically qualify for Medicaid coverage. However, Medicaid waiver programs do provide states with the opportunity to extend Medicaid services to this population.[33]

The services provided by each state's Medicaid program differ, although all states are required to provide coverage for designated "mandatory services." States may also provide coverage for up to 33 optional services. The federal government provides between 50% and 83% of service payments in each state's program.[33] The actual amount of funding provided to states, or the federal matching assistance percentage, is based on the average per capita income in each state and thus varies among states and within states over time.

Managed Care and Medicaid

A major change in the Medicaid program has resulted from the growth of managed care as a method of health care service delivery in an attempt to control the rising costs of Medicaid. From 1988 to 1998, expenditures for premium payments to Medicaid managed care increased from 700 million to 13.2 billion dollars. This shift in payment reflects the fact that, in 1991, less than 10% of Medicaid enrollees were covered by managed care plans compared to 54% of Medicaid enrollees in 1998.[33] Considerable state-to-state variation, however, exists regarding the extent to which managed care programs are utilized as a method of service delivery for Medicaid enrollees. Whereas Alaska and Wyoming had no managed care enrollment in 2000, twelve states including Oregon had greater than 75% managed care enrollment.[33]

Medicaid managed care program waivers have encouraged states to experiment with managed care models of delivering care to their respective Medicaid enrollees. Two types of waivers exist, the Section 1915 (b) "Freedom of Choice" waiver and the Section 1115 Research and Demonstration Projects. Section 1915 (b) waivers are used to 1) enroll Medicaid beneficiaries in managed care programs, 2) provide additional services from the saving produced by the managed care program, or 3) create a delivery system for specialty care such as mental health. During 1998, 35 states and the District of Columbia received Section 1915 (b) waivers.[33]

Section 1115 waivers allow states to test a new idea for health care delivery that has potential policy merit. With this waiver, states can implement small-scale projects or even major restructuring of the entire state Medicaid program. In 1998, 17 states received Section 1115 waivers.[33]

Oregon Medicaid

The Oregon Medicaid program is administered by the Office of Medical Assistance Programs (OMAP). Prior to 1994, Oregon's Medicaid program served low-income Oregonians in the following categories: 1) blind or disabled, 2) elderly individuals who needed supplementation to Medicare benefits, 3) families with dependent children and unemployed parents, 4) pregnant women, 5) adolescents and 6) deemed cash assistance recipients. In 1994, Oregon expanded its Medicaid services to include low-income families and individuals, simply on the basis of income, through the implementation of the landmark Oregon Health Plan (OHP). In 1998, Oregon Medicaid was further expanded to include a larger number of children through the federal Title XXI Children Health Insurance Program (CHIP). [35]

Discussions of health care service delivery and health care reform in Oregon came to the forefront in 1987 as the result of widespread media coverage of a seven-year-old Medicaid recipient who was unable to obtain a needed bone marrow transplant because it was among the optional services not funded by Oregon Medicaid. In response to the case, a state representative introduced a bill to fund bone marrow transplants in the Medicaid population.[36]

Dr. John Kitzhaber, then senate president, opposed this bill, raising concern regarding the growing number of uninsured Oregonians unable to access or pay for even routine medical services. Kitzahber argued that it would be wrong for the state to pay for services as costly as bone marrow transplants for the select portion of low-income Oregonians qualifying for Medicaid, when so many low-income Oregonians had no health insurance at all. [36]

Accordingly, in 1989, Kitzhaber sponsored a health care reform bill aimed at achieving 100% health insurance coverage for Oregonians. The bill consisted of two main parts: 1) an employer mandate requiring employers to provide all employees with health insurance and 2) an expansion of the state Medicaid program to provide services to all persons with income levels below the federal poverty limit, not just those meeting criteria for a specific category of low income such as blind or disabled.[36, 37] Unfortunately, the employer mandate faced significant opposition and after several delays failed, in 1996, to gain the federal waiver necessary for implementation. The failure to gain the employee mandate waiver significantly hindered Oregon's quest for 100% insurance coverage, particularly limiting the ability to secure coverage for the working poor.[36, 37]

The state's request for Medicaid reform was granted by the federal government in the form of a Section 1115 waiver. Oregon's innovative Medicaid reform program became known as the Oregon Health Plan (OHP) and consisted of three main parts: 1) expanding Medicaid eligibility to all Oregonians with income levels below the federal poverty level, 2) creating a high-risk insurance pool for people who were refused private health insurance based on preexisting medial conditions (the Oregon Medical Insurance Pool), and 3) providing an expanded range of health insurance options for small businesses and their employees (the Oregon Insurance Pool Governing Board).[38]

The OHP utilizes two primary strategies to control costs while expanding eligibility: increasing the role of managed care and limiting the extent of Medicaid benefits. In fact, as mentioned, Oregon is one of only 12 states to enroll over 75% of Medicaid eligibles in managed care programs.[33] The process of rationing health care

services was conducted through the creation of a prioritized list of health care services, which proved to be a more controversial means of controlling costs than expanding managed care programs.[36]

The Health Services Commission (HSC), which consisted of 11 members representing consumers, health care providers and social services professionals, was charged with establishing the prioritized list of services for Medicaid funding based on the extent to which these services benefited the Oregon population. The HSC initially reduced a list of over 10,000 medical procedures to 709 medical conditions and their associated treatments, which were called condition/treatment pairs. Condition/treatment pairs were then ranked according to 1) cost, 2) duration of benefit, 3) physician estimates of whether the treatment could reduce morbidity and mortality and 4) citizen opinions of the seriousness of the condition including functional limitations. Citizen opinion was elicited from community meetings and public opinion polls.[36, 37]

The prioritized list did undergo several revisions in part because the federal government initially denied Oregon's request for a Section 1115 waiver due to concerns that the initial prioritization violated the Americans with Disabilities Act. The final list, implemented in 1994, included 743 prioritized condition-treatment pairs.[36, 37] Each year, the Oregon legislature decides how much funding will be allocated to the OHP, and a line is drawn on the prioritized list indicating which services will and will not be funded based on the current year's budget. In the event of inadequate funding, the choice is either to increase the funding allocated to health care or move the allocation line further up the prioritized list, thereby reducing the services provided by Medicaid.[37]

The OHP was successful initially in decreasing the number of uninsured Oregonians. OMAP estimates that more than 1,000,000 people gained access to healthcare as a result of the Medicaid expansion.[38] More than 60,000 Oregonians obtained coverage in the private market through the Oregon Insurance Pool Governing Board and more than 15,000 individuals with preexisting medical conditions who had previously been denied coverage gained insurance coverage through the Oregon Medicaid Insurance Pool.[38]

As a result of the Oregon Medicaid reforms, the percentage of uninsured Oregonians decreased from 18% in 1990 to only 10% in 1999. At the same time, the percentage of uninsured Oregon children decreased from 21% in 1990 to 8% in 1999.[38] Secondary measures of access to care also demonstrated the success of the OHP. Hospital charity care decreased by about 30% from 1999 compared to 1994. During the same time period, emergency room use decreased by approximately 10%.

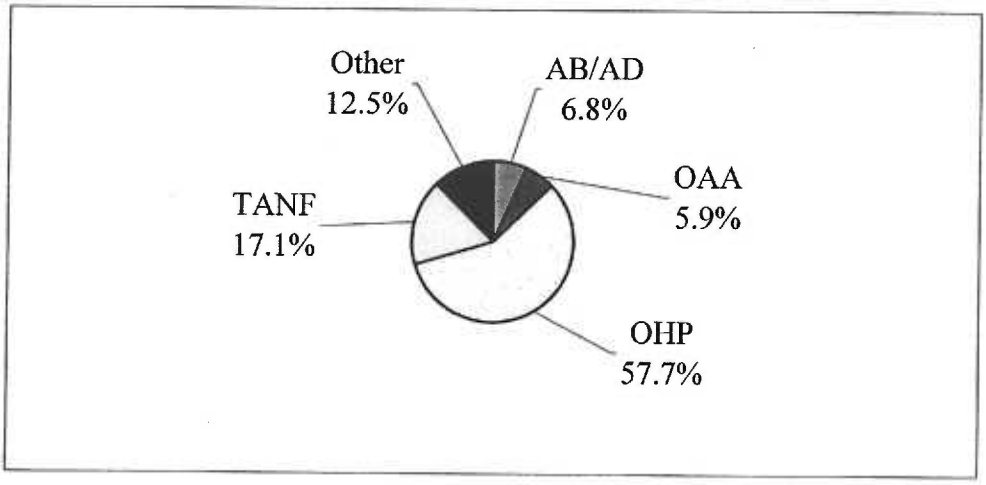
Yet despite the multiple benefits gained as a result of the creation and implementation of the Oregon Health Plan, considerable difficulty has been met, particularly with regards to OHP funding. The costs of sustaining OHP have increased significantly over the past decade, primarily attributed to increasing numbers of new eligibles, prescription drugs, dental services and mental health expenditures. Accordingly, OHP has been forced to undergo considerable reform.[37]

In 2001, in an attempt to control Medicaid expenditures, the Oregon legislature approved a proposal for OHP reform. The reformed OHP is often referred to as OHP-2 and was implemented in January through March 2003.[37] The main change resulting from this reform was the creation of two separate benefit packages for OHP eligibles referred

to as OHP Standard and OHP Plus. OHP standard is a limited benefit package, which is available to adults who qualify primarily on the basis of income. OHP Plus is a more comprehensive benefit package, which is offered primarily to children, pregnant women and persons with disabilities. Income requirements for both benefit packages were increased to 185% of the federal poverty level.[37]

Currently, in Oregon Medicaid eligibles are broadly categorized in the following groups: Aid to the Blind or Disabled (AB/AD), Old Age Assistance (OAA), Temporary Assistance to Needy Families (TANF), Oregon Health Plan (OHP), Foster and General Assistance Program Children (CHILDREN), Child Health Insurance Program (CHIP), Citizen/Alien Waived Emergent Medical (CAWEM) and others. Data from OMAP reveals that 1,067,119 persons were Medicaid-eligible at some time during the period from 1997–2001. The general distribution of eligibles in the AB/AD, OAA, TANF, OHP and other programs is displayed in Figure 1. It is important to note that persons less than age 20 years comprised approximately 46% of the Medicaid population from 1997–2001.

Figure 1: Percent Distribution of All Medicaid Eligibles by Program, 1997–2001.



Each year from 1997 to 2001, an increasing number of persons were Medicaid eligible (Table 1). Over the five-year time period a smaller proportion of Medicaid eligibles were enrolled in OHP, a similar proportion were enrolled in AB/AD, TANF and OAA, and an increasing number were enrolled in "other" programs, which includes CHIP and CAWEM (Table 1).

Table 1: Program Enrollment Among All Oregon Medicaid Eligibles by Year: 1997–2001

Year	**Medicaid Program (Percent of Eligible Enrolled)**				
	OHP	***AB/AD***	***TANF***	***OAA***	***Other***
1997 n =540,871	58.7	8.9	20.9	6.1	5.5
1998 n=541,002	57.9	9.1	19.6	6.3	7.7
1999 n=558,516	55.2	9.3	19.0	6.4	10.1
2000 n=581,905	51.9	9.4	18.0	6.3	14.5
2001 n=627,105	50.8	9.1	18.7	6.0	15.4

OBJECTIVES

The purposes of this investigation were to:

1) Identify trends in all-cause mortality in both the Medicaid and non-Medicaid populations and determine if the average annual burden of all-cause mortality in Oregon's adult Medicaid population is different than the corresponding burden of mortality in the non-Medicaid adult Oregon population.

2) Identify trends in unintentional injury mortality and specifically mortality from MVAs, falls and poisonings in both the Medicaid and non-Medicaid populations and determine if the average annual burden of unintentional injury mortality and mortality from unintentional MVAs, falls and poisonings is different than that in the non-Medicaid Oregon population.

3) Determine subsets of the Medicaid population, defined by age and sex, at increased risk of death from unintentional injuries and further explore demographics of unintentional poisoning deaths.

SIGNIFICANCE

It was expected that valuable information regarding all-cause and unintentional injury mortality in Oregon's Medicaid population would be gained from this investigation, which is important because data regarding mortality in U.S. Medicaid populations are limited. Unintentional injury mortality is of specific interest because it is theoretically preventable and results in a disproportionate number of years of potential life lost. The results of this investigation can be used to guide program policy within Oregon Medicaid and to direct injury prevention interventions.

RESEARCH DESIGN AND METHODS

Data Access

This investigation is a cross-sectional study of mortality in the Oregon Medicaid population, conducted using an original dataset created by linking existing Oregon Medicaid enrollment data with Oregon Vital Statistics death certificate data. Prior to the initiation of this study, access to Oregon Medicaid Technical/Encounter Data Services (TEDS) was obtained through the Oregon Office of Medical Assistance Programs' (OMAP) Public Health Medicaid Assessment Initiative. Access to the Oregon Vital Statistics death certificate data were obtained through the Oregon Department of Human Services Center for Health Statistics.

Data Management

Information was obtained from the Oregon Department of Health and Human Services Center for Health Statistics for all Oregon residents who died between 1997 and 2001. For Oregon residents dying during the years 1997 and 1998, death certificate number, full name, sex, race, date of birth, date of death, social security number, occupation, county and city of residence, zip code, education, marital status, tobacco relatedness to death, and injury information including country of injury, place of injury and time of injury, underlying causes of death and multiple causes of death were obtained from the International Classification of Diseases, 9th edition (ICD-9) death certificate database. Identical information was obtained from the International Classification of Diseases, 10th edition (ICD-10) death certificate database, for Oregon deaths occurring during the years 1999–2001.

Data obtained from the ICD-9 and ICD-10 death certificate databases were merged into a single death certificate file that contained information regarding all Oregon deaths occurring from 1997 through 2001. It is important to note that the merged death certificate file included all deaths in both the Medicaid and non-Medicaid populations between 1997 and 2001 and thus, in entirety, represented all deaths in the general Oregon population from 1997 to 2001.

OMAP regularly matches Medicaid enrollment files to the death file to ensure that benefits are not dispersed inappropriately to deceased persons. As a result, OMAP maintains a record of all deaths among Medicaid eligibles. Based on this information, OMAP created a unique dataset for this study which included the following unduplicated Oregon Medicaid TEDS data for the each year during the period from 1997–2001: the full name, date of birth, date of death, death certificate number, social security number and last program of enrollment of all Oregon residents who (a) received Medicaid benefits at anytime during the specified year, regardless of length of enrollment or program of enrollment and (b) died during the specified time period.

The Medicaid TEDS data were merged with the Oregon Vital Statistics death certificate database, using a combination of two unique identifiers, social security number and death certificate number, which were present in both datasets. The validity of the linking process was verified by a random review of a portion of the matched cases, ensuring the correct match of full name, birth date and death date, in addition to social security number and death certificate number.

After linking the Medicaid with the death certificate data, it was possible to designate each death in Oregon during 1997–2001 as a Medicaid or non-Medicaid death.

As a result, the linked database included death certificate information for deaths in the non-Medicaid population and death certificate and Medicaid enrollment data for deaths in the Medicaid population. Deaths occurring before age 20 years were excluded from the dataset due to concern that childhood deaths in the Medicaid population may be inappropriately classified and counted. Age 20 was selected because available denominator data for the Medicaid population, the ascertainment of which will be discussed below, was provided in five-year increments.

The classification of deaths in the linked dataset, as Medicaid or non-Medicaid was independently validated using an external dataset, which included all persons enrolled in Medicaid for any length of time from 1997 to 1998. This process revealed that approximately 0.35% of deaths in the Medicaid eligible population from 1997 to 1998 were inappropriately classified as non-Medicaid deaths, which was deemed to be an acceptably low occurrence of misclassification.

Denominator data were obtained independently for both the Medicaid and non-Medicaid populations. For each year from 1997 through 2001, the unduplicated total number of Oregon residents who were Medicaid-eligible at any time during the specified year, regardless of length of enrollment or program of enrollment, categorized by five-year age groups and sex, was obtained from OMAP and served as the denominator data for the Medicaid population. Denominator information for all persons in the general Oregon population, by age-sex category, was obtained from the Portland State University, College of Urban and Public Affair's Center for Population Research, for each year from 1997–2001. Yearly denominator data for the Oregon non-Medicaid

population was calculated by subtracting the age- and sex-specific Medicaid denominators from the total Oregon population.

Statistical Analysis

A common statistical analysis was conducted for all-cause mortality, unintentional injury mortality and, specifically, for unintentional injury mortality from MVAs, falls and poisonings. For 1997–1998, yearly mortality rates and 95% confidence intervals were calculated for both the Medicaid and non-Medicaid populations for all-cause mortality and each specific cause of death. Confidence intervals were calculated based on methodology from the National Center for Health Statistics, which is based on the Poisson distribution to account for the occurrence of rare events in large populations.[39] Using this methodology confidence intervals for rates based on less than 100 events are calculated differently than confidence intervals for rates based on greater than 100 events. It should be noted that formulas constructing rates on small numbers of events are approximations and should be interpreted with caution.

Death certificate coding of underlying cause of death changed beginning in 1999 as the result of the implementation of ICD-10 coding. Prior to this time underlying cause of death coding was based on the ICD-9 classification. To account for apparent changes in mortality rates resulting from differences in coding schemes between the ICD-9 and ICD-10 revisions, mortality rates and confidence intervals for 1997–1998 were adjusted based on standard ICD-10 comparability ratios using methodology published by the National Center for Vital Statistics.[39, 40]

For each year from 1997–2001, a chi square test of independence or Fisher's exact test was conducted and the relative risk and 95% confidence interval of death in the Medicaid, compared to the non-Medicaid population, was calculated. Additionally, after adjusting 1997 and 1998 deaths as indicated by the appropriate comparability ratios,

trends in mortality during the five-year period within the Medicaid and non-Medicaid populations were assessed with the chi-square test for linear trend.

For all-cause mortality and each specific cause of death, average annual age- and sex-specific mortality rates and 95% confidence intervals were calculated for the period from 1997–2001 for men and women in the following age categories: 20–34, 35–49, 50–64 and 65 and older. Persons age 65 years and older were included in a common age group because this age group is unique within Medicaid because they are recipients of Medicaid in supplement to Medicare. The relative risks of death for the Medicaid population compared to the non-Medicaid and associated 95% confidence intervals were calculated for each age-sex category.

All-Cause Mortality

All deaths were included in calculations of all-cause mortality. ICD-9/ICD-10 comparability ratios were not used as the total number of deaths in a population is unaffected by changes in underlying cause of death coding.

Unintentional Injury Mortality

Unintentional injury is a broad category of underlying cause of death which includes transport accidents, falls, accidental discharge of firearms, accidental drowning or submersion, accidental exposure to smoke, fire and flames, accidental poisoning or exposure to noxious substances and other unspecified unintentional injuries. Refer to Table 2a for a description of ICD-9 and ICD-10 mortality codes used to identify death from unintentional injuries. Unintentional injury mortality rates and corresponding 95% confidence intervals for the years 1997 and 1998 were adjusted according to the standard

ICD-9/ICD-10 comparability ratio (1.0305) and standard error (0.0014) for unintentional injury.[40]

Motor Vehicle Accident (MVA) Mortality

Motor vehicle accidents (MVAs) represent a specific subset of transport accidents, which also includes water, air and other land transport accidents. For this investigation all MVAs were considered in entirety regardless of whether the case was the driver, passenger or pedestrian. Refer to Table 2a for a description of ICD-9 and ICD-10 mortality codes used to identify death from MVA. MVA mortality rates and corresponding 95% confidence intervals from 1997–1998 were adjusted according to the standard ICD-9/ICD-10 comparability ratio (0.9754) and standard error (0.0006) for MVA.[40]

Unintentional Fall Mortality

Refer to Table 2a for ICD-9 and ICD-10 codes used to identify deaths wherein the underlying cause of death was attributed to an unintentional fall. Fall mortality rates and corresponding 95% confidence intervals from 1997–1998 were adjusted according to the standard ICD-9/ICD-10 comparability ratio (0.8409) and standard error (0.0049) for unintentional falls.

Due to the extremely small number of fatal unintentional falls occurring in persons younger than age 65, the 20–34, 35–44 and 45–64 age categories were collapsed into a single category. Thus, for all age-specific analyses of fall, only two age-categories were considered, ages 20–64 and ages 65 and older.

Table 2a: Description of ICD-9 and ICD-10 Mortality Codes

Underlying Cause of Death	**1997–1998 ICD-9 Mortality Codes**	**1999–2001 ICD-10 Mortality Codes**
Unintentional Injury (UI)	E800–E949	V01–X59 Y85–Y86
Motor Vehicle Accident (MVA)	E810–E825	V02–V04 V09.0–V09.2 V12–V14 V19.0–V19.2 V19.4–V19.6 V20–V79 V80.3–V80.5 V81.0–V81.1, V82.0–V82.1 V83–V86 V88.0–V88.8 V89.0–V89.2
Falls	E880–E888	W00–W19
Unintentional Poisoning	E850–E869	X40–X49
Unintentional poisoning by a drug or medicament	E850–E858	X40–X44
Unintentional poisoning by other noxious agents	E860–E869	X45–X49

Unintentional Poisoning Mortality

Unintentional poisoning is a broad category of unintentional injury death that includes accidental drug overdoses, drugs given in the wrong dose, drugs taken in error or drugs taken inadvertently. This category also includes adverse events resulting from accidents in the use of drugs, medicaments and biological substances in medical and surgical procedures. Unintentional poisoning excludes drugs administered with suicidal, homicidal or undetermined intent and adverse events caused by properly administered drugs given in therapeutic or prophylactic dosage.

Refer to Table 2a for a description of ICD-9 and ICD-10 mortality codes used to identify deaths attributed to unintentional poisonings. Due to the relatively small numbers of unintentional poisoning deaths, which results in unstable comparability estimates, an ICD-10 comparability ratio for unintentional poisonings has not been

published. Thus, 1997–1998 unintentional poisoning mortality rates were not adjusted for subsequent changes in underlying cause of death coding. Caution must therefore be exercised when interpreting trends in unintentional poisoning mortality during the period from 1997–2001.

For both the Medicaid and non-Medicaid populations, demographics of unintentional poisoning deaths, including age, sex, race/ethnicity, education, marital status and place of death, were investigated. For Medicaid deaths, the last Medicaid program of enrollment was determined.

Unintentional poisoning deaths were further classified into poisonings due to drugs and medicaments and poisonings by other noxious substances not categorized as a drug or medicament. ICD-9 and ICD-10 mortality codes used to distinguish these deaths are shown in Table 2a. The percentage of unintentional poisoning deaths attributed to a drug or medicament was further classified according to the specific drug class implicated in the death. The ICD-9 and ICD-10 coding schemes for the classification of drugs and/or medicaments are not directly comparable. Accordingly, the specific drug classes implicated in unintentional poisoning deaths were examined separately for deaths occurring between 1997–1998 (ICD-9 coding) and 1999–2001 (ICD-10 coding). Refer to the appendix for further detailed description of ICD-9 and ICD-10 unintentional poisoning mortality coding.

Due to concern regarding the potential for misclassification of the intention of poisoning deaths, mortality from all drug-induced deaths in the Medicaid compared to the non-Medicaid population was further explored. For both ICD-9 and ICD-10 coding schemes, intentional, unintentional and undetermined intent deaths due to drugs are

included in the broad category of 'drug-induced deaths' as are deaths from mental and behavioral disorders that resulted from the use of psychoactive substances. The ICD-9 and ICD-10 mortality codes that comprise all drug-induced deaths are depicted in Table 2b. Drug-induced mortality rates and corresponding 95% confidence intervals from 1997–1998 were adjusted according to the standard ICD-9/ICD-10 comparability ratio (1.1950) and standard error (0.0025) for drug-induced deaths.[40]

Table 2b: Description of ICD-9 and ICD-10 Mortality Codes for All Drug-Induced Deaths

Sub-Category of Drug-Induced Death	**ICD-9 Mortality Codes**	**ICD-10 Mortality Codes**
Unintentional Poisonings by Drugs or Medicaments	E850–E885	X40–X44
Intentional Poisonings by Drugs of Medicaments	E950.0–E950.5 E962	X60–X64 X85
Drug and Medicament Poisonings of Undetermined Intent	E980.0–E980.5	Y10–Y14
Deaths from mental and behavioral disorders resulting from use of psychoactive substances	292 304 305.2–305.9	F11.0–F11.5, F11.7–F11.9 F12.0–F12.5, F12.7–F12.9 F13.0–F13.5, F13.7–F13.9 F14.0–F14.5, F14.7–F14.9 F15.0–F15.5, F15.7–F15.9 F16.0–F16.5, F16.7–F16.9 F17.0–F17.3, F15.5–F17.9 F18.0–F18.5, F18.7–F18.9 F19.0–F19.5, F19.7–F19.9

RESULTS

All-Cause Mortality

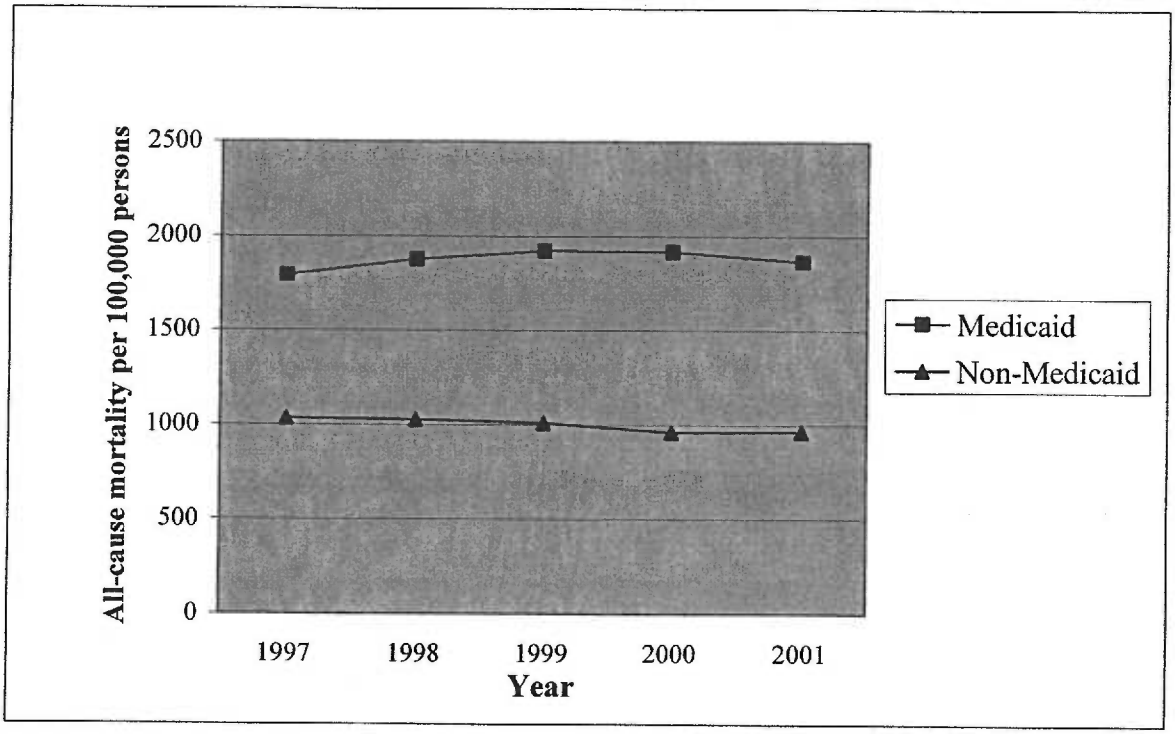
For each year from 1997–2001, all-cause mortality rates were higher in the adult Oregon Medicaid population, compared to the non-Medicaid population (Table 3). Over the five-year time period all-cause mortality in the Medicaid population increased significantly (X^2trend 5.0, p=0.03), whereas all-cause mortality in the non-Medicaid population decreased (X^2trend 87.4, p<0.0001) (Figure 2).

Table 3: Yearly All-Cause Mortality Rates 1997–2001

Year	**All-cause Mortality per 100,000 persons (95% CI)**		**Crude RR (95% CI)**	**Chi Square (Significance)**
	Medicaid	***Non-Medicaid***		
1997	1793 (1744, 1841)	1185 (1169, 1200)	1.5 (1.5, 1.6)	758.3 p<0.0001
1998	1877 (1827, 1926)	1171 (1156, 1186)	1.6 (1.6, 1.7)	1022.9 p<0.0001
1999	1921 (1871, 1971)	1154 (1140, 1169)	1.7 (1.6, 1.7)	1237.3 p<0.0001
2000	1918 (1869, 1967)	1098 (1084, 1112)	1.8 (1.7, 1.8)	1538.3 p<0.0001
2001	1864 (1818, 1910)	1113 (1099, 1127)	1.7 (1.6, 1.7)	1374.3 p<0.0001

RR: relative risk, CI: Confidence Interval

Figure 2: Trends in All-Cause Mortality in Oregon's Adult Medicaid and Non-Medicaid Populations: 1997–2001

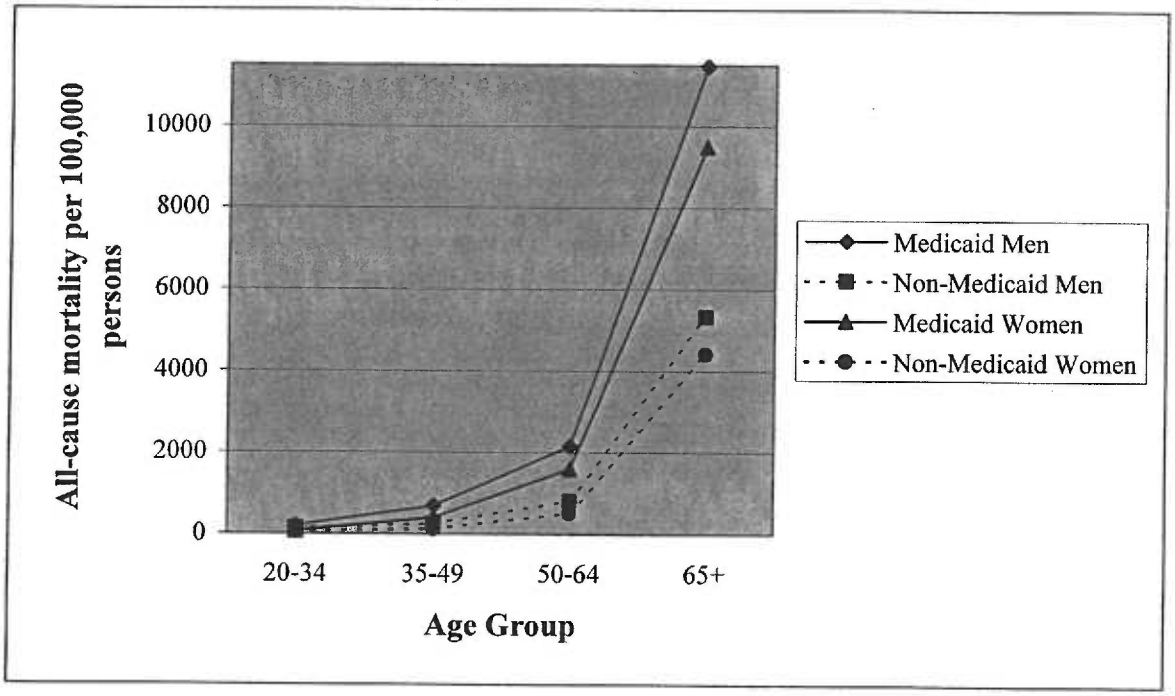


For women, the average annual all-cause mortality rate from 1997–2001 was 1899 and 1102 deaths per 100,000 persons per year for the Medicaid and non-Medicaid populations, respectively. For men, the average annual all-cause mortality rate in the Medicaid population from 1997–2001 was 1837 deaths per 100,000 persons per year compared to 1184 deaths per 100,000 persons per year for non-Medicaid men. The average annual crude risk of all-cause death in the Medicaid compared to the non-Medicaid population was 1.7 (95% CI: 1.7, 1.8) for women and 1.6 (95% CI: 1.5, 1.6) for men. After adjusting for age, however, the relative risk of all-cause mortality increased to 2.4 (95% CI: 2.3, 2.5) for both women and men.

For both populations, mortality rates for both men and women increased with increasing age category, as expected. In addition, for both the Medicaid and non-Medicaid populations, average annual age-specific mortality rates were greater for men

compared to women in all age groups. Average annual all-cause mortality rates were statistically significantly increased in the Medicaid population for each age-sex category compared to the non-Medicaid population (Figure 3). For all age categories except age 20–34 years, all-cause mortality rates for Medicaid women exceeded corresponding mortality rates for non-Medicaid men.

Figure 3: Age and Sex-Specific All-Cause Mortality Rates Among Oregon Medicaid and Non-Medicaid Adults: 1997–2001



Age was a statistically significant effect modifier for both women ($p<0.0001$) and men ($p<0.0001$). Specifically, for both men and women the relative risk of all-cause death in the Medicaid population compared to the non-Medicaid population was greatest in the age 35–49 and age 50–64 categories (Table 4).

Table 4: Average Annual Age-Specific All-Cause Mortality Rates: 1997–2001

Age Group	Women: All-Cause Mortality per 100,000 persons (95% CI)			Men: All-Cause Mortality per 100,000 persons (95% CI)		
	Medicaid	*Non-Medicaid*	*RR (95% CI)*	*Medicaid*	*Non-Medicaid*	*RR (95% CI)*
20–34	72 (55, 97)	52 (43, 61)	1.4 (1.0, 1.9)	200 (161, 246)	134 (121 148)	1.5 (1.2, 1.9)
35–49	398 (343, 453)	129 (117, 141)	3.1 (2.6, 3.6)	690 (612, 768)	249 (232, 265)	2.8 (2.4, 3.2)
50–64	1590 (1435, 1745)	507 (477, 536)	3.1 (2.8, 3.5)	2151 (1946, 2356)	818 (781, 855)	2.6 (2.4, 2.9)
65+	9500 (9151, 9848)	4406 (4319, 4493)	2.2 (2.1, 2.2)	11466 (10865, 12067)	5323 (5215, 5431)	2.2 (2.0, 2.3)

RR: Relative risk, CI: Confidence Interval

Unintentional Injury Mortality

Over the period from 1997–2001, unintentional injury mortality rates in the Medicaid population did not vary (X^2trend 0.1, p=0.8). In contrast, unintentional injury mortality in the non-Medicaid population decreased significantly (X^2trend 35.4, p<0.0001) (Figure 4). Although unintentional injury mortality rates between the Medicaid and non-Medicaid populations did not differ in 1997 and 1998, the risk of unintentional injury death in the Medicaid population was significantly increased compared to the non-Medicaid population in 1999–2001 (Table 5).

Figure 4: Trends in Unintentional Injury (UI) Mortality in Oregon's Adult Medicaid and Non-Medicaid populations: 1997–2001

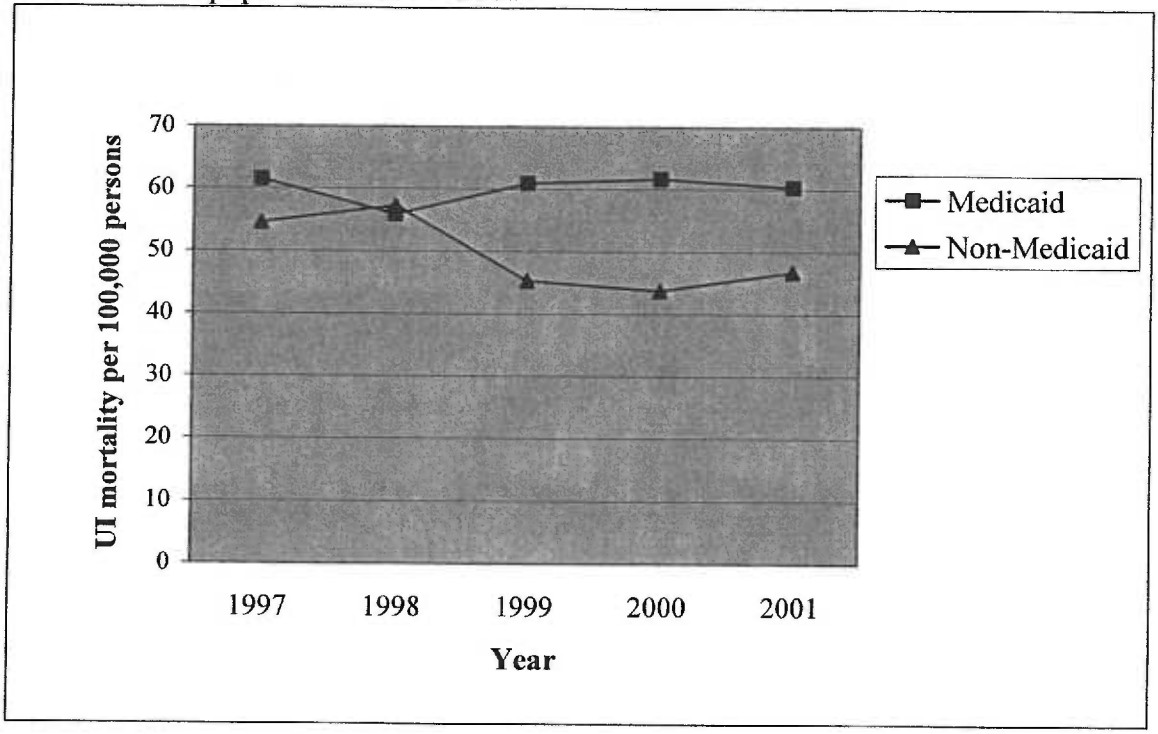


Table 5: Yearly Unintentional Injury Mortality Rates 1997–2001

Year	Unintentional Injury Mortality per 100,000 persons (95% CI)		Crude RR (95% CI)	Chi Square (Significance)
	Medicaid	*Non-Medicaid*		
1997	62 (50, 71)	55 (51, 58)	1.1 (1.0, 1.3)	2.2 p=0.1
1998	56 (47, 65)	57 (54, 61)	1.0 (0.8, 1.2)	0.1 p=0.8
1999	61 (52, 80)	45 (42, 48)	1.4 (1.2, 1.6)	13.5 p<0.0001
2000	62 (53, 70)	44 (41, 47)	1.4 (1.2, 1.7)	18.9 p<0.0001
2001	60 (52, 69)	47 (50, 44)	1.3 (1.1, 1.5)	11.1 p<0.0001

During the period from 1997–2001, the average annual unintentional injury mortality rate for adult women age 20 years and older was 43 per 100,000 in the

Medicaid population, compared to 32 per 100,000 in the non-Medicaid population. During the same time period, that rate for Medicaid men ages 20 and older was 85 per 100,000 compared to 66 deaths per 100,000 non-Medicaid men ages 20 and older. The average annual crude risk of unintentional injury death for the period from 1997–2001 in the Medicaid compared to the non-Medicaid population was 1.4 (95% CI: 1.1, 1.7) and 1.3 (95% CI: 1.1, 1.6) for women and men, respectively. After adjusting for age, the relative risk for unintentional injury death in Medicaid compared to the non-Medicaid population increased only slightly to 1.5 (95% CI: 1.2,2.0) for women and 1.4 (95% CI: 1.1, 1.7) for men.

For both the Medicaid and non-Medicaid populations, unintentional injury mortality rates were greater for men compared to women in all age groups (Figure 5). Age was a statistically significant effect modifier for women ($p= 0.03$) and men ($p=0.02$). The point estimates of the relative risks of unintentional injury death for men and women age 20–34 years, although not statistically significant, suggested that Medicaid persons were less likely than non-Medicaid persons to die from an unintentional injury. For all other age groups, except ages 50–64, for both men and women, the risk of unintentional injury death was significantly increased in the Medicaid population compared to the non-Medicaid population. The relative risk of unintentional injury death in the Medicaid compared to the non-Medicaid populations was greatest for persons age 35–49 for both women (2.6, 95% CI: 1.6, 4.3) and men (1.8, 95% CI: 1.3, 2.5) (Table 6).

Figure 5: Average Annual Age-Specific Unintentional Injury Mortality Rates Among Oregon Medicaid and Non-Medicaid Adults: 1997-2001

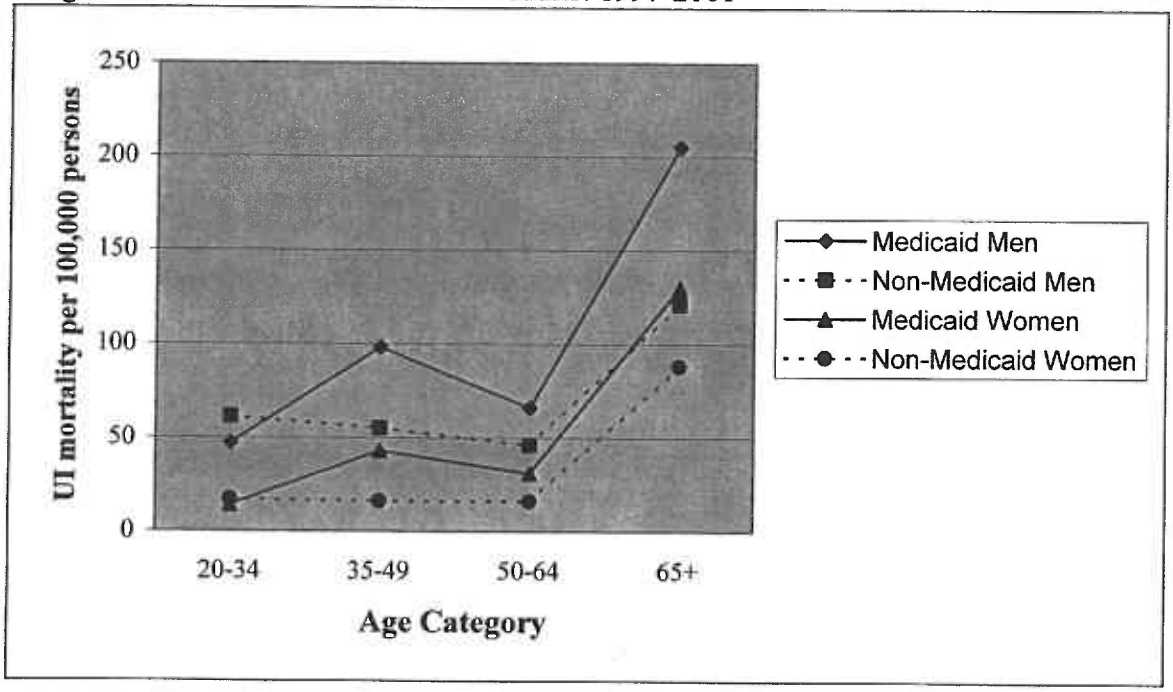


Table 6: Average Annual Age-Specific Unintentional Injury Mortality Rates: 1997–2001

Age Group	Women: Unintentional Injury Mortality per 100,000 persons (95% CI)			Men: Unintentional Injury Mortality per 100,000 persons (95% CI)		
	Medicaid	*Non-Medicaid*	*RR (95% CI)*	*Medicaid*	*Non-Medicaid*	*RR (95% CI)*
20–34	14 (7, 25)	18 (13, 24)	0.8 (0.4, 1.5)	48 (29, 71)	61 (52, 69)	0.8 (0.5, 1.2)
35–49	43 (27, 65)	16 (12, 21)	2.6 (1.6, 4.3)	98 (71, 132)	55 (47, 62)	1.8 (1.3, 2.5)
50–64	31 (14, 62)	16 (11, 22)	2.0 (0.9, 4.2)	66 (35, 113)	46 (38, 55)	1.4 (0.8, 2.6)
65+	130 (92, 177)	88 (76, 101)	1.5 (1.0, 2.1)	205 (133, 302)	121 (105, 137)	1.7 (1.1, 2.6)

RR: Relative Risk, CI: Confidence Interval

Consistent with national patterns of unintentional injury mortality, MVAs, falls and poisonings were the most common types of unintentional injury death in both the Medicaid and non-Medicaid populations. However, the proportion of unintentional injury deaths attributed to each of these causes in the Medicaid and non-Medicaid populations

differed. In the Medicaid population, MVAs comprised 24% of unintentional injury deaths, whereas falls and poisonings comprised 25% and 30% of unintentional injury deaths, respectively. In contrast, MVAs accounted for a greater proportion of unintentional injury deaths, 43%, in the non-Medicaid population, compared to 23% and 12% for falls and poisonings, respectively.

Unintentional MVA Mortality

After adjusting for changes in mortality coding, during the period from 1997–2001 MVA mortality rates increased significantly in the Medicaid population (X^2trend 4.4, p=0.04). Conversely, during the same time period, MVA mortality in the non-Medicaid population decreased significantly (X^2trend 13.1, p=0.0003) (Figure 6). In 1997 and 1998, the relative risk of MVA death in the Medicaid population was significantly reduced compared to the non-Medicaid population. However, as a result of the inverse trends in MVA mortality in the Medicaid and non-Medicaid populations, in 1999 through 2001 overall MVA mortality between the two populations did not differ significantly (Table 7).

Figure 6: Trends in MVA Mortality in Oregon's Adult Medicaid and Non-Medicaid Populations: 1997–2001

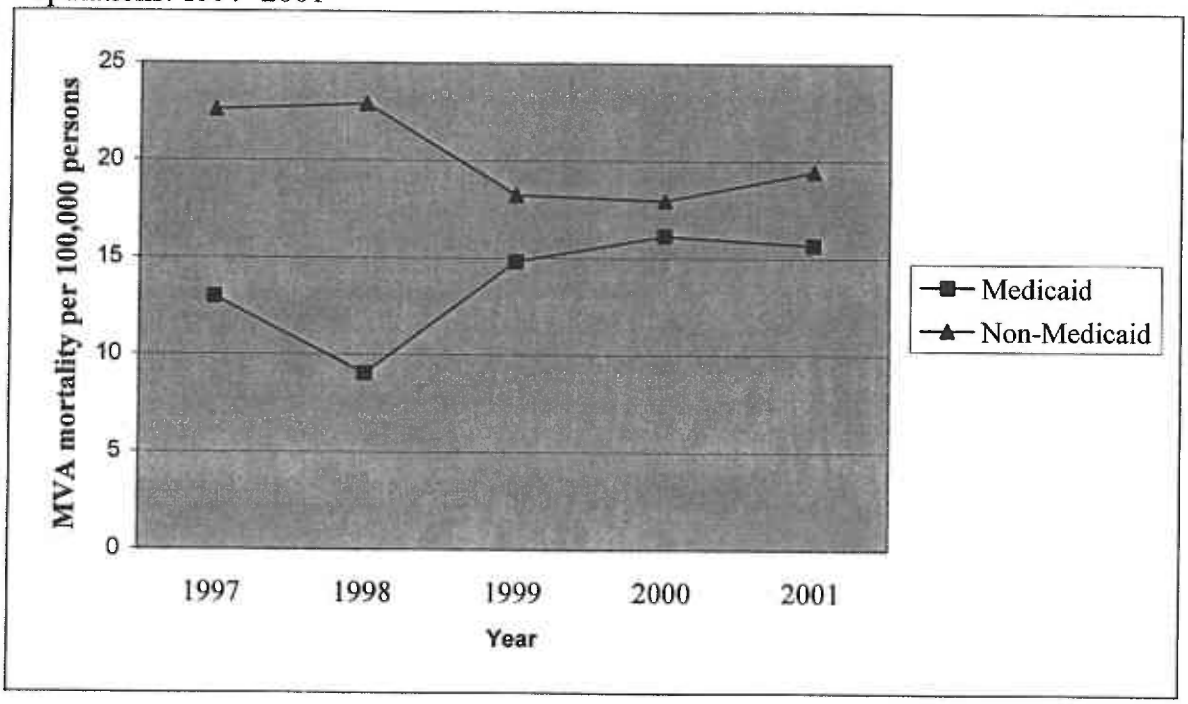


Table 7: Yearly MVA Mortality Rates 1997–2001

Year	Unintentional MVA Mortality per 100,000 persons (95% CI)		Crude RR (95% CI)	Chi-square (Significance)
	Medicaid	*Non-Medicaid*		
1997	13 (9, 18)	23 (21, 25)	0.6 (0.4, 0.8)	11.4 p=0.001
1998	9 (6, 13)	23 (21, 25)	0.4 (0.3, 0.6)	23.8 p<0.0001
1999	15 (11, 20)	18 (16, 20)	0.8 (0.6, 1.1)	1.7 p=0.2
2000	16 (12, 21)	18 (16, 20)	0.9 (0.7, 1.2)	0.5 p=0.5
2001	16 (12, 21)	19 (18, 21)	0.8 (0.6, 1.1)	2.2 p=0.1

RR: Relative Risk, CI: Confidence Interval

During 1997–2001, the average annual MVA mortality rate for Medicaid women was 10 deaths per 100,000 persons per year compared to 13 per 100,000 for non-Medicaid women. During the same time period, the average annual MVA mortality rates for Medicaid and non-Medicaid men ages 20 and older were 20 and 28 deaths per

100,000 persons, respectively. The crude average annual rates of MVA mortality for both men and women did not differ between the Medicaid and non-Medicaid populations for women (RR 0.9, 95% CI 0.5, 1.4) or men (RR 0.7, 95% CI 0.5, 1.1). The crude risk of MVA death among both men and women changed only minimally when adjusted for age.

For both the Medicaid and non-Medicaid adult populations, MVA mortality rates for men exceeded female MVA mortality rates in each age category. Age was a statistically significant effect modifier of the relationship between MVA mortality and Medicaid status for women (p=0.04). For women ages 20–24, although not statistically significant, the point estimate of the relative risk of MVA death suggested that Medicaid enrollment was protective of MVA death (0.4, 95% CI: 0.1, 1.2). The risk of MVA death among women ages 35–49 was marginally significantly increased for the Medicaid compared to non-Medicaid population (2.2, 95% CI: 1.0, 4.8). There was no significant difference in MVA mortality for Medicaid and non-Medicaid women ages 50–65 and ages 65 and older (Table 8).

Among men, age was not a statistically significant effect modifier of the relationship between MVA mortality and Medicaid status (p=0.2). The risk of MVA death in the male Medicaid population ages 20–34 was 0.4 (0.2, 0.9) times that of the corresponding non-Medicaid population. For all other age groups there was no difference in MVA mortality for Medicaid men and non-Medicaid men (Table 8).

Table 8: Age-Specific Average Annual MVA Mortality Rates: 1997–2001

Age Group	Women: Unintentional MVA Mortality per 100,000 persons (95% CI)			Men: Unintentional MVA Mortality per 100,000 persons (95% CI)		
	Medicaid	*Non-Medicaid*	*RR (95% CI)*	*Medicaid*	*Non-Medicaid*	*RR (95% CI)*
20–34	5 (1, 13)	12 (8, 18)	0.4 (0.1, 1.2)	13 (5, 29)	35 (28, 42)	0.4 (0.2, 0.9)
35–49	16 (7, 31)	7 (4, 12)	2.2 (1.0, 4.8)	23 (11, 42)	23 (18, 28)	1.0 (0.5, 1.9)
50–64	12 (2, 35)	20 (6, 14)	1.2 (0.4, 4.1)	25 (8, 59)	22 (16, 28)	1.2 (0.5, 2.9)
65+	13 (4, 34)	21 (15, 28)	0.6 (0.2, 1.8)	25 (5, 72)	35 (27, 45)	0.7 (0.2, 2.3)

RR: Relative Risk, CI: Confidence Interval

Unintentional Fall Mortality

Although fall mortality in the Medicaid population did not vary significantly from 1997–2001 (X^2trend 0.3, p=0.6), fall mortality in the non-Medicaid population increased significantly (X^2trend 6.2, p=0.01) (Figure 7). Although the relative risk estimates were increased for the Medicaid compared to the non-Medicaid populations for each year from 1997–2001, the difference in fall mortality between Medicaid and non-Medicaid populations was significant only in 1997 and 2000 (Table 9).

Figure 7: Trends in Unintentional Fall Mortality in Oregon's Adult Medicaid and Non-Medicaid Populations: 1997–2001

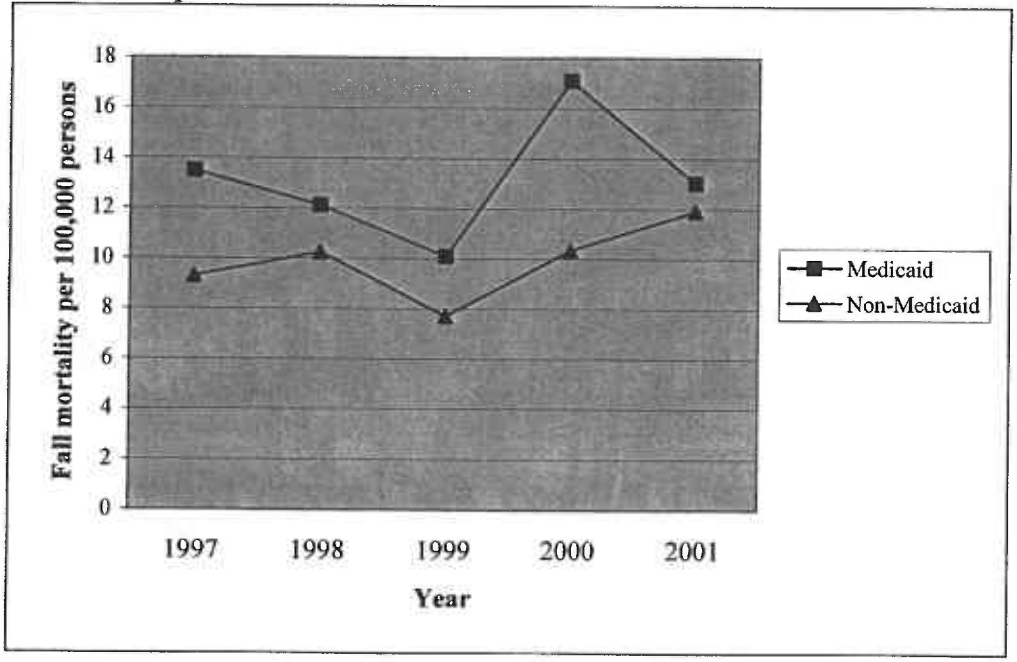


Table 9: Yearly Unintentional Fall Mortality Rates 1997–2001

Year	Unintentional Fall Mortality per 100,000 persons (95% CI)		Crude RR (95% CI)	Chi-square (Significance)
	Medicaid	*Non-Medicaid*		
1997	13 (10, 18)	9 (8, 11)	1.5 (1.1, 2.0)	5.5 p=0.02
1998	12 (9, 17)	10 (9, 12)	1.2 (0.9, 1.6)	1.0 p=0.3
1999	10 (7, 14)	8 (7, 9)	1.3 (0.9, 1.9)	1.9 p=0.2
2000	17 (13, 22)	10 (9, 12)	1.7 (1.2, 2.2)	11.2 p=0.001
2001	13 (9, 17)	12 (10, 13)	1.1 (0.8, 1.5)	0.3 p = 0.6

RR: Relative Risk, CI: Confidence Interval

The average annual fall mortality rate for Medicaid women ages 20 and older during the period from 1997 to 2001 was 14 deaths per 100,000 persons per year compared to 10 per 100,000 persons per year in the non-Medicaid female population.

Although the average annual relative risk of fall mortality for women in Medicaid compared to non-Medicaid women was not significant (1.4, 95% CI: 0.9, 2.1), statistical significance was attained after controlling for age. The age-adjusted average annual risk of fall death was 1.7 (95% CI: 1.1, 2.7) times greater for Medicaid women compared to non-Medicaid women ages 20 and older.

The average annual fall mortality rate for Medicaid men ages 20 and older during the period from 1997–2001 was 20 per 100,000 persons per year compared to 11 per 100,000 persons per year in the non-Medicaid adult male population. Among men, the average annual crude risk of fall death was 1.8 (95% CI: 1.2, 2.8) times greater in the Medicaid population compared to the non-Medicaid population, which increased to 2.5 (95% CI: 1.6, 3.9) after adjusting for age.

Age was not an effect modifier of the relationship between fall mortality and Medicaid status for either men ($p=0.3$) or women ($p=0.7$). For women ages 20–64 there was no significant difference in fall mortality between the Medicaid and non-Medicaid populations. In contrast, among women age 65 and older, the relative risk of fall death was 1.8 (95% CI: 1.1, 2.8) times greater in the Medicaid population (Table 10). Similarly, among men fall mortality did not differ between Medicaid and non-Medicaid men ages 20–64. In contrast, Medicaid men ages 65 and older were 2.9 (95% CI: 1.8, 4.8) times as likely to die of an unintentional fall than non-Medicaid men in the same age group (Table 10).

Table 10: Age-Specific Average Annual Fall Mortality Rates: 1997–2001

Age Group	Women: Unintentional Fall Mortality per 100,000 persons (95% CI)			Men: Unintentional Fall Mortality per 100,000 persons (95% CI)		
	Medicaid	*Non-Medicaid*	*RR (95% CI)*	*Medicaid*	*Non-Medicaid*	*RR (95% CI)*
20–64	1 (0.2, 5)	1 (0.4, 2)	1.3 (0.3, 6.3)	6 (2, 12)	3 (2, 5)	1.7 (0.7, 4.2)
65+	80 (51, 119)	45 (37, 54)	1.8 (1.1, 2.8)	147 (87, 233)	51 (41, 3)	2.9 (1.8, 4.8)

RR: Relative Risk, CI: Confidence Interval

Unintentional Poisoning Mortality

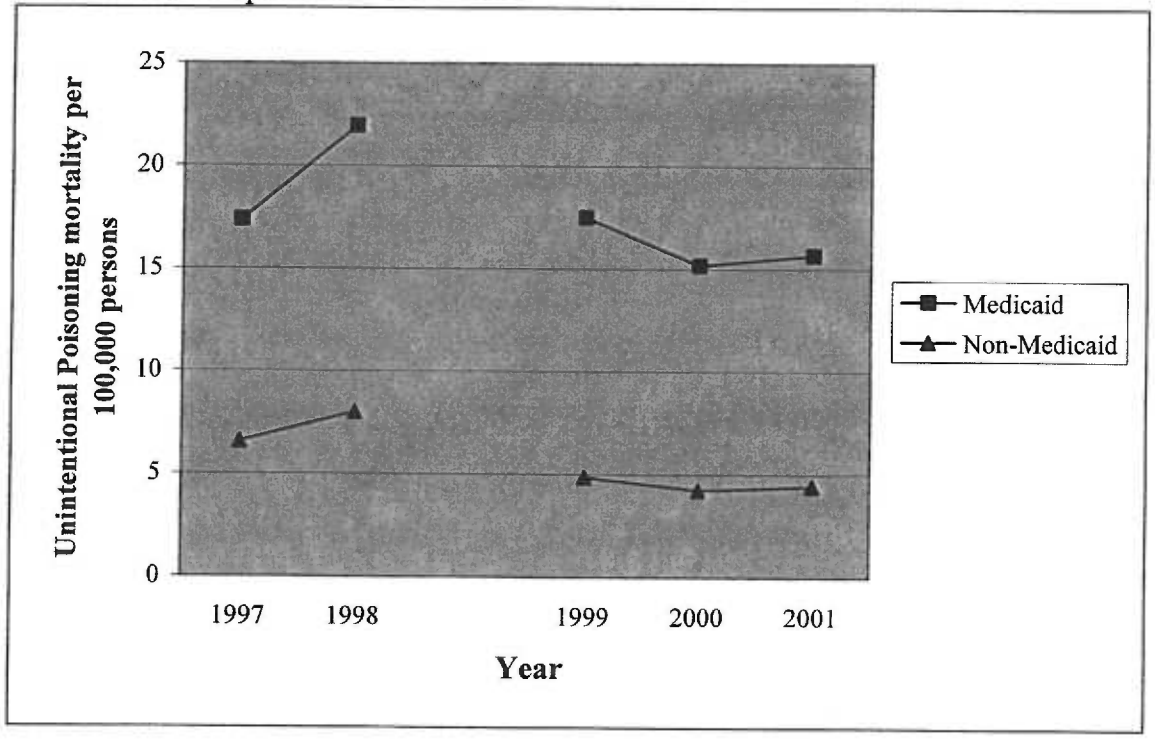
For each year from 1997–2001 the risk of death from unintentional poisoning in the Medicaid population was significantly greater than the corresponding risk in the non-Medicaid population. The relative risk of unintentional poisoning death in the Medicaid population compared to the non-Medicaid population ranged from 2.7 (95% CI: 1.9, 3.7), in 1997, to 3.6 (95% CI: 2.6, 5.0), in 1999 (Table 11). Due to the lack of a stable comparability ratio for unintentional poisoning deaths, trends in unintentional poisoning mortality across the entire five-year time period could not be assessed. However, during the time period from 1999–2001, during which ICD-10 mortality coding was consistently used, there was no statistically significant trend in unintentional poisoning mortality for either the Medicaid (X^2trend 0.3, p=0.6) or non-Medicaid (X^2trend 0.5, p=0.5) populations (Figure 8).

Table 11: Yearly Unintentional Poisoning Mortality 1997–2001

Year	Unintentional Poisoning Mortality per 100,000 persons (95% CI)		Crude RR (95% CI)	Chi-square (Significance)
	Medicaid	*Non-Medicaid*		
1997	17 (13, 23)	7 (5, 8)	2.7 (1.9, 3.7)	37.8 p<0.0001
1998	22 (17, 28)	8 (7, 9)	2.7 (2.1, 3.7)	51.1 p<0.0001
1999	18 (13, 23)	5 (4, 6)	3.6 (2.6, 5.0)	64.5 p<0.0001
2000	15 (11, 20)	4 (3, 5)	3.6 (2.5, 5.1)	58.2 p<0.0001
2001	16 (12, 21)	4 (3.5, 5)	3.6 (2.5, 5.0)	62.6 p<0.0001

RR: Relative Risk, CI: Confidence Interval

Figure 8: Trends in Unintentional Poisoning Mortality in Oregon's Adult Medicaid and Non-Medicaid Populations: 1997–2001



The average annual poisoning mortality rate for Medicaid women ages 20 and older during the period from 1997–2001 was 8 per 100,000 persons per year, compared to only 2 unintentional poisoning deaths per 100,000 persons per year in the non-Medicaid

population. The crude average annual risk of unintentional poisoning death was 4.1 (95% CI: 2.2, 7.8) times greater for Medicaid women compared to non-Medicaid women during the period from 1997–2001. After adjusting for age, the average annual risk of unintentional poisoning death for Medicaid women compared to non-Medicaid women increased only slightly to 4.3 (95% CI: 2.2, 8.3).

Medicaid men age 20 and older had an average annual unintentional poisoning mortality rate of 32 per 100,000 persons per year during the period from 1997–2001 compared to 9 per 100,000 in non-Medicaid men. The crude average annual risk of unintentional poisoning death was 4.5 (95% CI: 3.2, 6.1) times greater for Medicaid men compared to non-Medicaid men, which decreased slightly to 4.0 (95% CI: 2.9, 5.7) after adjusting for age.

For both the Medicaid and non-Medicaid populations, unintentional poisoning mortality rates were greater for men than women in all age categories (Figure 9). Age was not a significant effect modifier of the relationship between unintentional poisoning death and Medicaid status for either women ($p=0.9$) or men ($p=0.2$). For both women and men, the relative risk of unintentional poisoning death was increased in Medicaid compared non-Medicaid for all ages groups, except for ages 50–64 and ages 65 and older. The relative risk of unintentional poisoning death was greatest for both women and men ages 35–49. Medicaid women in this age group were 5.1 (95% CI: 2.1, 12.1) times as likely than non-Medicaid women to die of an unintentional poisoning. Similarly, Medicaid eligible men age 35–49 were 5.3 (95% CI: 3.4, 8.2) times as likely to die of an unintentional poisoning than their counterparts in the non-Medicaid population (Table 12).

Figure 9: Average Annual Age-Specific Unintentional Poisoning Mortality Rates in Oregon's Adult Medicaid and Non-Medicaid Populations: 1997–2001

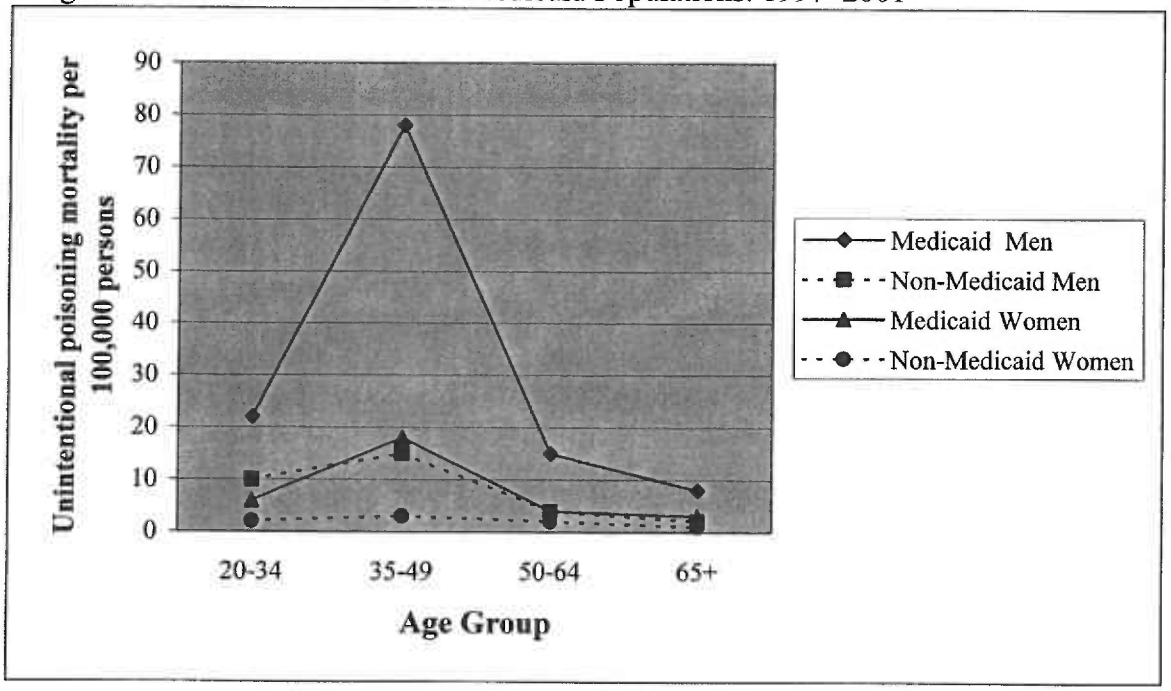


Table 12: Age-Specific Average Annual Unintentional Poisoning Mortality Rates: 1997–2001

Age Group	Women: Unintentional Poisoning Mortality per 100,000 persons (95% CI)			Men: Unintentional Poisoning Mortality per 100,000 persons (95% CI)		
	Medicaid	*Non-Medicaid*	*RR (95% CI)*	*Medicaid*	*Non-Medicaid*	*RR (95% CI)*
20–34	6 (2, 15)	2 (0.4, 4)	3.9 (1.1, 14.7)	22 (11, 41)	10 (7, 14)	2.3 (1.1, 4.7)
35–49	18 (8, 33)	3 (2, 6)	5.1 (2.2, 12.1)	78 (54, 109)	15 (11, 19)	5.3 (3.4, 8.2)
50–64	4 (0.1, 22)	2 (0.5, 4)	2.3 (0.3, 20.3)	15 (3, 45)	4 (8, 2)	3.5 (1.0, 12.6)
65+	3 (0.1, 19)	1 (0.1, 3)	3.7 (0.3, 40.8)	8 (0.2, 46)	2 (0.4, 5)	4.8 (0.5, 50.0)

RR: Relative Risk, CI: Confidence Interval

Demographics of Medicaid Unintentional Poisoning Deaths

Age

Between 1997 and 2001, 77 Medicaid women ages 20 and older died of unintentional poisonings. Of these deaths, 61.0% were age 35–49 years; only 27.5% of

the adult female Medicaid-eligible population were in this age group. Thus, a much greater proportion of adult female Medicaid unintentional poisoning deaths were ages 35–49 years compared to adult female Medicaid eligibles (Figures 10a and 10b).

Figure 10a: Age Distribution of Female Oregon Medicaid Unintentional Poisoning Deaths: 1997–2001

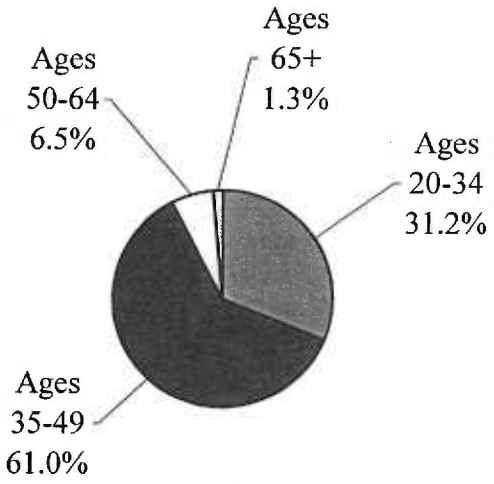
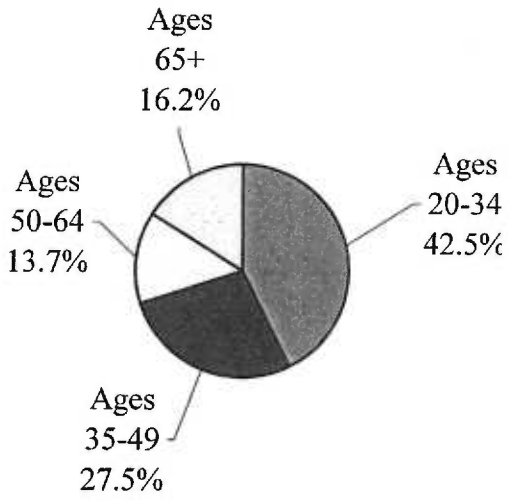


Figure 10b: Age Distribution of Female Oregon Medicaid Eligibles: 1997–2001



From 1997 through 2001, 190 Medicaid men ages 20 years and older died of unintentional poisonings in Oregon. Of these 190 deaths, 62.6% were ages 35–49 years. In comparison, only 36.3% of adult male Medicaid eligibles were ages 35–49 years. As was seen for Medicaid women, a greater proportion of adult male Medicaid unintentional poisoning deaths were ages 35–49 years compared to all adult Medicaid-eligible men (Figures 11a and 11b).

Figure 11a: Age Distribution of Male Oregon Medicaid Unintentional Poisoning Deaths: 1997–2001

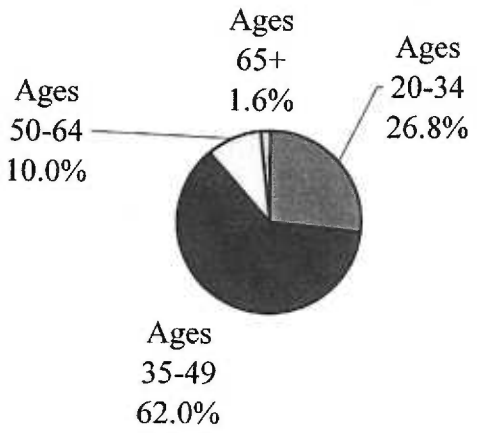
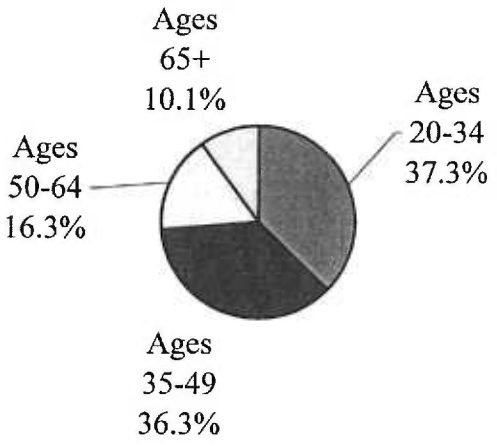


Figure 11b: Age Distribution of Male Oregon Medicaid Eligibles: 1997–2001



Similar patterns of age distribution were seen in the non-Medicaid population. During the period from 1997–2001, 114 women in the non-Medicaid population died unintentional poisonings. Of these, 53.5% were ages 35–49 years compared to 33.1% in the total female non-Medicaid population. During the same time period, 472 non-Medicaid men died of unintentional poisonings. Of these deaths, 55.3% were ages 35–49 years compared to 33.6% of all non-Medicaid Oregon men.

Sex

A greater proportion of the 267 Medicaid poisoning deaths that occurred between 1997 and 2001 were women (28.8%, 95% CI: 23.4%, 34.2%) compared to the proportion of the 586 non-Medicaid unintentional poisoning deaths (19.5%, 95% CI: 16.3%, 22.7%). However, women comprised 60.6% of the Medicaid eligible population from 1997–2001 compared to only 50% of the total non-Medicaid population. Although the proportion of female deaths from unintentional poisoning is much less than the total proportion of

females in both the Medicaid and non-Medicaid populations, this discrepancy is less pronounced in the Medicaid population.

Caveat

Although information on education, race and marital status were available from above described dataset for Medicaid and non-Medicaid poisoning deaths, this information was not available for all persons in the Medicaid and non-Medicaid populations. However, information regarding education, race and marital status for the Medicaid eligible population was available from unpublished data derived from a statewide survey of Medicaid recipients.[41] Information from this survey will be referenced in the sections that follow recognizing that, due to differences in methodology, it may not be directly comparable to the results obtained directly from this study.

Education

Of the 267 Medicaid unintentional poisoning deaths occurring in Oregon from 1997–2001, information on educational status was available from the death certificates of 254 persons (95.1%). Of these persons, 75.6% (95% CI: 70.3%, 80.9%) had an elementary or secondary education and 24.4% (95% CI: 19.1%, 29.7%) had attended at least some college or beyond. In contrast, unpublished data regarding characteristics of all Medicaid eligibles shows that a significantly greater proportion (35.4%, 95% CI: 33.4, 37.5) report some college education or beyond[41] (Figures 12a and 12b). Thus compared to all Medicaid eligibles, those eligibles dying from unintentional poisonings were more likely to lack a college education.

Figure 12a: Distribution of Educational Attainment Among Oregon Medicaid Unintentional Poisoning Deaths: 1997–2001

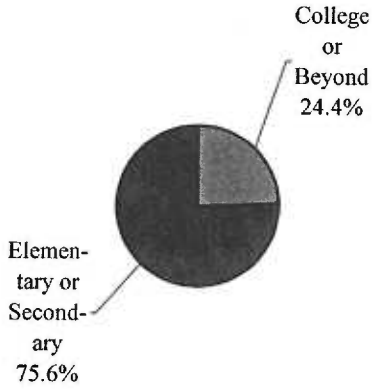
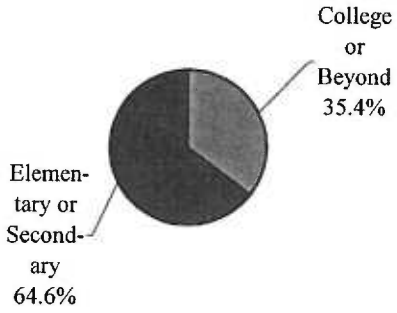


Figure 12b: Distribution of Educational Attainment Among Oregon Medicaid Eligibles



Source: Tugwell B, et al. Suicidal ideation and completion in Oregon's adult Medicaid population. Unpublished data. June, 2003.

Information regarding educational attainment was also available for 559 of the 586 (95.4%) non-Medicaid unintentional poisoning deaths that occurred in Oregon from 1997–2001. Similar to the distribution of educational attainment among Medicaid unintentional poisoning deaths, 74.6% (95% CI: 71.0%, 78.2%) of non-Medicaid unintentional poisoning deaths between 1997 and 2001 were reported to have an elementary or secondary school education whereas only 25.4% (95% CI: 21.8%, 29.0%) had at least some college education or beyond.

Race

The racial distribution of the 267 Oregon Medicaid unintentional poisoning deaths includes 90.3% (86.8, 93.9) non-Hispanic whites, 3.0% (95% CI: 1.0, 5.0) blacks, 3.7% (95% CI: 1.4. 6.0) Hispanics and 3% (95% CI: 1.0, 5.0) other races including Asian Pacific Islander and Alaskan Native/American Indian. Information regarding the

race/ethnicity of all Medicaid eligibles was also available from unpublished data.[41] In comparison to the subset of the Medicaid population dying from unintentional poisonings, the total Medicaid eligible population is 84.0% (95% CI: 82.3, 85.6) non-Hispanic white, 2.4% (95% CI: 1.9, 3.1) black, 6.6% (95% CI: 5.5, 7.8) Hispanic.[41] Thus, compared to the total Medicaid eligible population, Medicaid unintentional poisoning deaths were significantly more likely to occur among non-Hispanic whites (Figures 13a and 13b).

Figure 13a: Distribution of Race/Ethnicity Among Oregon Medicaid Unintentional Poisoning Deaths: 1997–2001

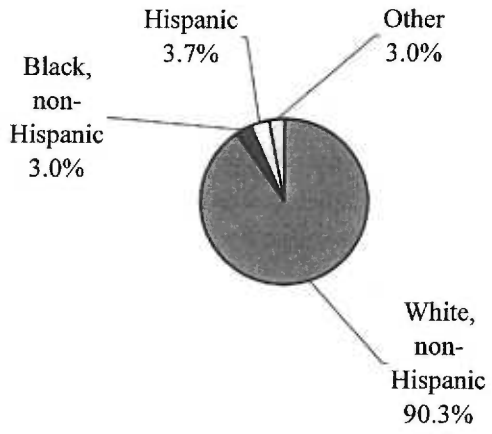
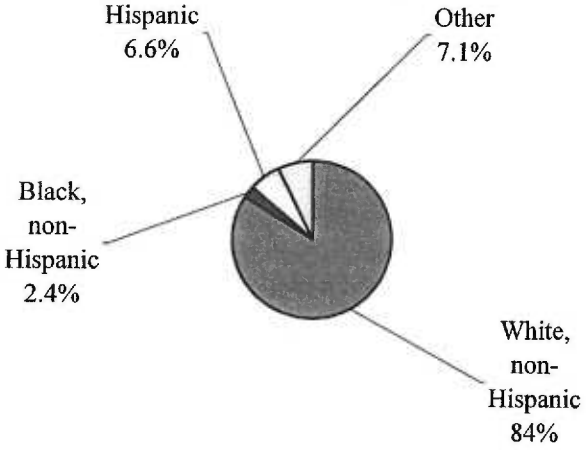


Figure 13b: Distribution of Race/Ethnicity Among Oregon Adult Medicaid Eligibles



Source: Tugwell B, et al. Suicidal ideation and completion in Oregon's adult Medicaid population. Unpublished data. June, 2003.

Of note, among the 586 non-Medicaid unintentional poisoning deaths, 87.9% (95% CI: 5.3, 90.5) were non-Hispanic white, 3.4% (95% CI: 1.9, 4.9) were non-Hispanic black, 3.8% (2.3, 5.3) were Hispanic and 4.9% (95% CI: 3.2, 6.6) were of other races including Asian/Pacific Islander and Alaskan Native/American Indian.

Marital Status

Information on marital status was available for 258 of the 267 (96.6%) Oregon Medicaid unintentional poisoning deaths that occurred among adults age 20 and older from 1997–2001. Medicaid eligibles dying from unintentional poisonings were more likely to be unmarried (79.1%, 95% CI: 74.1, 84.1) including single, divorced, widowed and separated, than married (20.9%, 95% CI: 15.9, 25.9). Unpublished data, however, illustrates that this pattern is also observed among all Medicaid eligibles as 26.1% (95% CI: 24.2, 28.6) are married compared to 73.9% (95% CI: 71.7, 75.8) who are single, divorced, separated or widowed (Figure 14a and 14b). [41]

Figure 14a: Distribution of Marital Status Among Oregon Unintentional Poisoning Deaths: 1997–2001

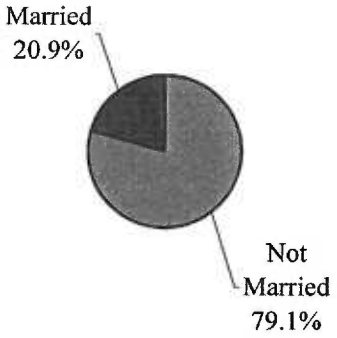
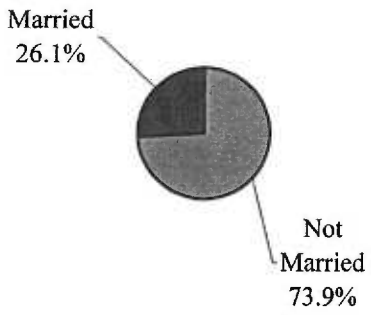


Figure 14b: Distribution of Marital Status Among Oregon Medicaid Eligibles



Source: Tugwell B, et al. Suicidal ideation and completion in Oregon's adult Medicaid population. Unpublished data. June, 2003.

Data on marital status were also available for 568 (96.9%) of the 586 non-Medicaid unintentional poisoning deaths that occurred among adults age 20 and older

from 1997–2001. Of the non-Medicaid persons dying from unintentional poisonings, 75.5% (95% CI: 72.0, 79.1) were unmarried, including single, divorced, widowed or separated, whereas 24.5% (95% CI: 20.9, 28.0) were married.

Place of Unintentional Poisoning Death

A significantly greater proportion of Medicaid unintentional poisoning deaths were reported to have occurred in the home compared to non-Medicaid unintentional poisoning deaths (Table 13).

Table 13: Place of Oregon Unintentional Poisoning Deaths: 1997–2001

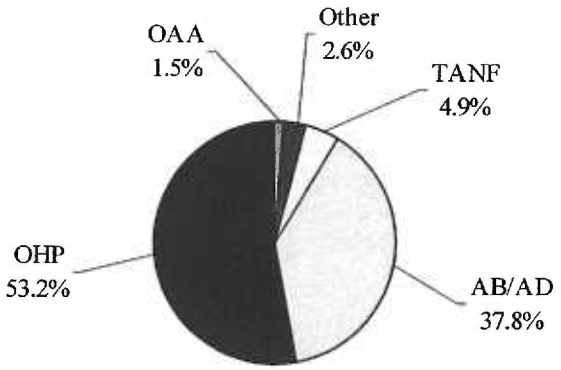
Place of Unintentional Poisoning Death	Percent of Unintentional Poisoning Deaths in the Medicaid Population	Percent of Unintentional Poisoning Deaths in the Non-Medicaid
Home	63.5% (95% CI: 57.7, 69.3)	53.6% (95% CI: 49.5, 57.7)
Public building or residential institution	9.9% (95% CI: 6.3, 13.5)	10.3% (95% CI: 7.8, 12.8)
Street/road or recreational place	2.7% (95% CI: 0.7, 4.6)	4.1% (95% CI: 2.5, 5.7)
Other specified place	12.9% (95% CI: 8.9, 17.0)	17.6% (95% CI: 14.5, 20.8)
Unknown	11.0% (95% CI: 7.2, 14.8)	14.5% (95% CI: 11.6, 17.4)

CI: Confidence Interval

Last Medicaid Program of Enrollment

The last Medicaid program of enrollment was available for all Medicaid unintentional poisoning deaths that occurred among Oregon adults age 20 and older from 1997–2001. The last Medicaid program of enrollment for the majority of unintentional poisoning deaths were Oregon Health Plan (OHP) (53.2%, 95% CI: 47.2, 59.1) and Aid to Blind and Disabled (AB/AD) (37.8%, 95% CI: 32.0, 43.6). Only 4.9% (95% CI: 2.3, 7.5) of Medicaid eligibles dying from unintentional poisoning deaths were enrolled in Temporary Assistance to Needy Families (TANF) and only 1.5% (95% CI: 0.04, 3.0) were enrolled in Old Age Assistance (OAA) (Figure 15).

Figure 15: Last Program of Medicaid Enrollment for Oregon Adult Medicaid Unintentional Poisoning Deaths: 1997–2001



Last Medicaid program of enrollment did vary with age group. All persons age 65 and older dying of unintentional poisonings were last enrolled in OAA. The most frequent last program of Medicaid enrollment among persons age 20–34 years and 35-49 years was OHP, compared to AB/AD for persons age 50–64 years (Table 14). The proportion of persons last enrolled in OHP prior to death decreased with increasing age group, while the proportion of persons last enrolled in AB/AD prior to unintentional poisoning death increased with increasing age group (Table 14).

Table 14: Last Program of Medicaid Enrollment by Age of Unintentional Poisoning Death

Age Group	**Last Medicaid Program of Enrollment** *Percent of Age Group Enrolled in Medicaid Program Prior to Death from Unintentional Poisoning*					**Total**
	TANF	*OHP*	*AB/AD*	*OAA*	*Other*	
20–34	8.0	66.7	22.7	0	2.6	100%
35–49	4.2	52.0	40.0	0	3.8	100%
50–64	0	22.7	77.3	0	0	100%
65 +	0	0	0	100.0	0	100%
All ages	4.9	53.2	37.8	1.5	2.6	100%

Type of Unintentional Poisonings Death

The vast majority of unintentional poisoning deaths were attributed to a drug and/or medicament as opposed to other non-drug substances. Among the 267 Medicaid unintentional poisoning deaths that occurred during 1997–2001, 97% (95% CI: 95, 99) were attributed to drugs and/or medicaments. Similarly, 93.5% (95% CI: 91.5, 95.5) of the 586 non-Medicaid unintentional poisoning deaths that occurred during the same time period were attributed to drugs and/or medicaments. The same results were observed when male and female unintentional poisoning deaths were analyzed separately.

"Analgesics/antipyretics/antirheumatics" was the most common ICD-9 category of drug identified as the underlying cause of death, accounting for 69.6% (61.4, 78.4) of the Medicaid deaths that were attributed to unintentional poisoning by drugs and/or medicaments from 1997–2001 (Figure 16a). It should be noted that ICD-9 coding includes opioid and narcotic analgesics within the broad category of "analgesics/antipyretics/antirheumatics." Similar results were obtained for non-Medicaid unintentional poisoning deaths by drugs and/or medicaments.

"Narcotics/psychodysleptics" was the most common ICD-10 category of drug identified as the underlying cause death, accounting for 61% (53.0, 68.9) of the Medicaid unintentional poisoning deaths attributed to drugs and/or medicaments from 1999 to 2001 (Figure 16b). Again, similar results regarding the categorization of drug and/or medicament unintentional poisoning deaths were seen in the non-Medicaid population. Refer to the appendix for a detailed description of the ICD-9 and ICD-10 classification of drug and/or medicament unintentional poisonings.

Figure 16a: Type of Drug and/or Medicament Unintentional Poisoning Death Among Oregon Medicaid Adults: 1997–1998

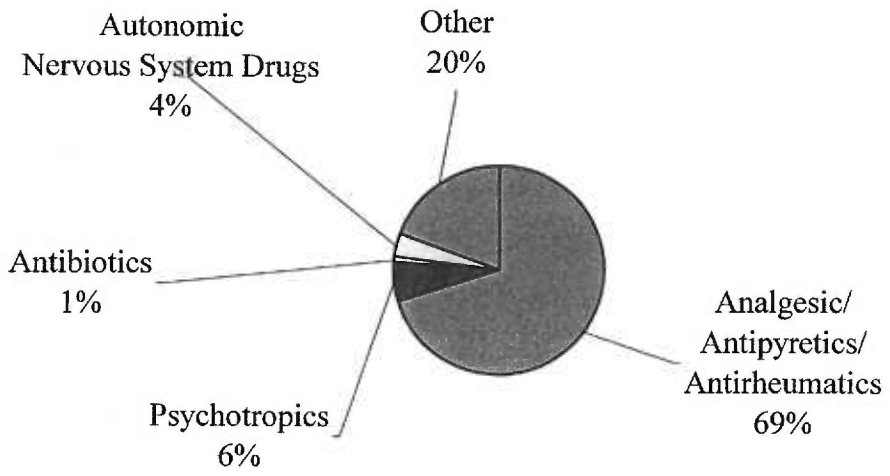
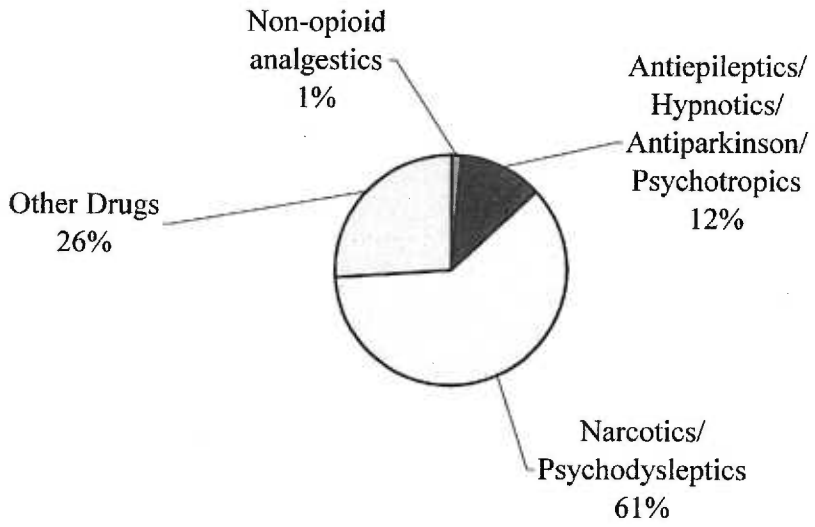


Figure 16b: Type of Drug and/or Medicament Unintentional Poisoning Death Among Oregon Medicaid Adults: 1999–2001



Drug-Induced Mortality

During the period from 1997–2001, there was no significant trend in all drug-induced mortality in the Medicaid population (X^2trend 1.21, p=0.27). In contrast, there was a significant decrease in the non-Medicaid population (X^2trend 18.48, p=0.00002).

For each year from 1997–2001, the relative risk of drug-induced death was statistically significantly increased in the Medicaid population compared to the non-Medicaid population (Table 15).

Table 15: Yearly Drug-Induced Death Mortality Rates 1997–2001

Year	Drug-induced Mortality per 100,000 persons (95% CI)		Crude RR (95% CI)	Chi-square (Significance)
	Medicaid	*Non-Medicaid*		
1997	35 (27, 45)	13 (11, 15)	2.7 (2.1, 3.5)	33.3 p<0.0001
1998	46 (38, 55)	14 (12, 16)	3.2 (2.6, 4.1)	121.3 p<0.0001
1999	38 (31, 45)	12 (10, 13)	3.3 (2.6, 4.1)	120.0 p<0.0001
2000	34 (40, 27)	11 (9, 12)	3.2 (2.5, 4.0)	107.0 p<0.0001
2001	36 (29, 42)	10 (8, 11)	3.6 (2.9, 4.6)	146.9 p<0.0001

RR: Relative Risk, CI: Confidence Interval

For both the Medicaid and non-Medicaid populations, drug-induced mortality rates were increased for men compared to women in all age groups. The relative risk of drug-induced death was statistically significantly increased for Medicaid women in all age groups, except women ages 65 and older and was greatest for Medicaid women ages 35–49 (3.9, 95% CI: 2.2, 6.7) (Table 16).

Consistent with the results obtained for women, the relative risk of drug-induced death was increased for Medicaid men compared to non-Medicaid men in all age categories except men ages 65 and older (Table 16). The relative risk of drug induced death was greatest for Medicaid men ages 50–54 (5.2, 95% CI: 2.4, 11.5).

Table 16: Age-Specific Average Annual Drug-Induced Mortality Rates: 1997-2001

Age Group	Women: Drug-induced Mortality per 100,000 persons (95% CI)			Men: Drug-induced Mortality per 100,000 persons (95% CI)		
	Medicaid	*Non-Medicaid*	*RR (95% CI)*	*Medicaid*	*Non-Medicaid*	*RR (95% CI)*
20–34	14 (7, 25)	4 (2, 8)	3.2 (1.4, 7.3)	33 (19, 55)	14 (10, 19)	2.4 (4.2, 1.3)
35–49	39 (24, 61)	10 (7, 14)	3.9 (2.2, 6.7)	101 (73, 135)	26 (21, 32)	3.8 (2.7, 5.5)
50–64	20 (6, 46)	5 (3, 9)	3.8 (1.3, 10.7)	46 (21, 87)	9 (5, 14)	5.2 (2.4, 11.5)
65+	3 (0.1,19)	4 (2, 7)	0.9 (0.1, 7.4)	8 (0.2, 46)	4 (2, 8)	2.1 (0.3, 16.7)

RR: Relative Risk, CI: Confidence Interval

DISCUSSION

All-Cause Mortality

As expected, the burden of all-cause mortality in Oregon's adult Medicaid population is greater than that in the non-Medicaid population. In fact, all-cause mortality rates in the Medicaid population exceeded those in the non-Medicaid population each year from 1997–2001 (Table 3), and average annual all-cause mortality rates in the Medicaid population were greater than non-Medicaid rates in all age-sex categories (Table 4).

The increased all-cause mortality in the Medicaid population most certainly reflects the fact that persons often enroll in Medicaid as a result of a chronic or disabling illness. For example, previous research has demonstrated that the prevalence of diabetes among adult Medicaid recipients is more than twice that of the general Oregon population.[42]

During the period from 1997 through 2001, all-cause mortality increased significantly in the Medicaid population (Figure 2). This trend likely reflects increasing enrollment of a previously at-risk population, due to changes in Oregon Medicaid eligibility criteria.

Unintentional Injury Mortality

Although unintentional injury mortality rates did not differ between the Medicaid and non-Medicaid populations in 1997–1998, the relative risk of unintentional injury death was significantly higher in Oregon's adult Medicaid population than in the non-Medicaid population from 1999–2001 (Table 5). This increased risk of unintentional injury death in the Medicaid population is primarily among men and women ages 35

years and older (Table 6). Medicaid men and women ages 20–34 years were no more likely than non-Medicaid men and women of the same ages to die of unintentional injuries (Table 6).

Unintentional MVA Mortality

Although rates of unintentional injury mortality were increased in Oregon's adult Medicaid population compared to the Oregon adult non-Medicaid population from 1999–2001, there was no significant difference in MVA mortality between the two populations during the same time period (Table 7). Additionally, there was no significant difference in average annual MVA mortality for either men or women ages 35–49, 50–64 or age 65 years and older in the Medicaid compared to the non-Medicaid populations (Table 8). Among men ages 20–34 years, Medicaid enrollment was actually protective of MVA mortality (Table 8). [27]

The significantly decreased risk of MVA mortality among Medicaid men ages 20–34 years compared to the corresponding non-Medicaid male population raises questions regarding the driving patterns of Medicaid men in this age group. It is possible that young Medicaid men have less access to motor vehicles and drive less frequently than non-Medicaid males of the same age, thus contributing less at-risk time for MVA fatalities. It is also possible that the incidence of MVAs is equal among Medicaid and non-Medicaid men ages 20–34 years, but that the incidence of fatal MVAs differs. Seat belt use or the prevalence of MVA risk factors such as alcohol or drug-use may also differ in the Medicaid compared to the non-Medicaid populations, contributing to discrepancies in MVA mortality between the two populations.

Unintentional Fall Mortality

The fact that unintentional injury mortality rates are increased in the Medicaid compared to the non-Medicaid population, while rates of MVA mortality are similar in the two populations, increases the importance of examining other causes of unintentional injury death such as falls and poisonings. Although nationwide mortality rates from unintentional falls and poisonings are lower than the rates of MVA mortality, the impact of these causes of death is disproportionately high in the Oregon Medicaid population.

Consistent with national patterns of fall mortality, average annual fall mortality rates were much greater for persons age 65 years and older compared to persons age 20–64 years, for both men and women in the Medicaid and non-Medicaid populations (Table 10). The average annual fall mortality rates for both men and women ages 20 years and older in the Medicaid population were not significantly different from the non-Medicaid population (Table 10). However, after adjusting for age, average annual fall mortality was higher in the Medicaid population than in the non-Medicaid population for men and women. Specifically, Medicaid men and women age 65 years and older were significantly more likely to die of an unintentional fall compared to their non-Medicaid counterparts (Table 10).

The increased risk of fall mortality in the elderly adult Medicaid population is not surprising. Persons aged 65 years and older in Medicaid are recipients of Medicaid services in supplement to Medicare and thus are typically either very impoverished or disabled. These persons may fall more frequently than non-Medicaid elderly due to an increased prevalence of medical morbidities and subsequently experience increased fall mortality. It is also possible that these persons fall at the same rate as the non-Medicaid

elderly but subsequently experience higher mortality rates due to poorer baseline health, which may increase the risk of complications during the rehabilitation period, particularly if a fracture is experienced.

Unintentional Poisoning Mortality

After MVAs, unintentional poisonings are the leading cause of years of potential life lost from unintentional injuries. Consistent with national patterns of unintentional poisoning mortality, for both the Medicaid and non-Medicaid population, unintentional poisoning mortality rates were higher for males than females and greatest, for both men and women, among persons age 35–49 years compared to persons age 20–34, 50–65 and ages 65 years and older.

For each year from 1997–2001, unintentional poisoning mortality rates were dramatically increased in the Medicaid compared to the non-Medicaid population (Table 11). Unlike MVA mortality, which was significantly decreased for Medicaid men ages 20–34 years, and fall mortality, which disproportionately impacted elderly Medicaid recipients, the increased risk of unintentional poisoning mortality occurred among Medicaid men and women ages 20–34 years and ages 35–49 years (Table 12).

It should be noted, however, that although not statistically significant, the point estimates of the relative risks of unintentional poisoning deaths for both men and women ages 50–64 and ages 65 and older in the Medicaid population suggested an increased risk in comparison to the non-Medicaid population. Failure to reach statistical significance may be in part due to the overall small numbers of persons in these age groups dying from unintentional poisonings (Table 12).

Medicaid unintentional poisoning deaths were more likely than all Medicaid eligibles to be non-Hispanic white (Figures 13a and 13b) and less likely to have a college education (Figures 12a and 12b). The majority of both Medicaid and non-Medicaid unintentional poisoning deaths were attributed to drugs and/or medicaments and it could be speculated that narcotics account for a large portion of these deaths (Figure 16a and 16b).

The greatest portion of Medicaid unintentional poisoning deaths occurred among persons last enrolled in OHP (53%) or AB/AD (37.8%) (Figure 15). However, whereas about 50% of all Medicaid-eligible adults are enrolled in OHP, only about 20% are enrolled in AB/AD. Thus AB/AD seems to be disproportionately represented among unintentional poisoning deaths.

Mortality in the Medicaid population was also increased for all drug-induced deaths, not solely unintentional poisoning deaths. In fact, the risk of drug-induced death was significantly increased for both Medicaid men and women ages 20–34, 35–49 and age 50–64 years compared to the corresponding non-Medicaid populations (Table 17).

The results of this investigation raise many questions regarding why unintentional poisoning mortality is increased in the Medicaid compared to the non-Medicaid population. It is interesting to consider the possibility that some Medicaid recipients have enrolled because a prior habit, such as injection drug use, that contributed to low-income and low socioeconomic status. In turn, this would result in increased unintentional poisoning rates in the Medicaid population. Furthermore, it could be speculated that disabled Medicaid persons may be more likely to receive prescription pain medications

such as methadone and thus have increased opportunity to unintentionally overdose using these drugs.

Additionally, data were not available to address specific differences in the types of drugs that were implicated in Medicaid verses non-Medicaid unintentional poisoning deaths. For example, are illicit drugs versus prescription drugs more likely to be the cause of unintentional poisoning death for the Medicaid compared to the non-Medicaid population?

Limitations

This study does have limitations that must be considered when interpreting the results of this study. These limitations result in part from the challenges encountered when studying the Medicaid population as well as from the use of two existing databases.

Defining the Medicaid Population

Nationally, the average length of time a person is enrolled in Medicaid in any given year is approximately nine, often nonconsecutive, months.[33] The transient nature of the Medicaid population creates challenges for defining and following Medicaid populations over time. Inconsistencies in the definition and counting of the Medicaid population can limit the comparability of Medicaid research.

The Medicaid population in this study was defined as any person enrolled in Medicaid, also referred to as Medicaid eligibles, regardless of length or consistency of enrollment. Accordingly, length of Medicaid enrollment could not be studied as a risk factor for death from unintentional injury. The extent to which the Medicaid population accessed services was also not considered in this study. Persons enrolled but never accessing Medicaid services, were treated the same as persons accessing services. Lastly, it was unknown whether persons classified as a Medicaid death were actually receiving Medicaid at the time of death. It is only known that they were receiving Medicaid sometime during the year of death.

The results of this study, therefore, apply to a broad, nonspecific, group of persons 'at-risk' for enrolling in Medicaid. Clarifying subgroups of this at-risk population that may be more likely to die from unintentional injuries would be beneficial. Accordingly, future studies may seek to determine the importance of length and

continuity of enrollment as risk factors for all-cause or unintentional injury mortality as well as investigate the relationship between the frequency and type of Medicaid services accessed and unintentional injury mortality. Future studies may also seek to determine if enrollment in Medicaid at the time of death (rather than at some point during the year of death) is associated with death from unintentional injury.

Defining the Comparison Population

In this investigation, mortality in the Medicaid population was compared to the non-Medicaid population, a mix of privately insured and uninsured individuals as well as recipients of Medicare. The heterogeneity of the comparison population must be considered when interpreting the results of this investigation. For example, although they never enrolled in Medicaid, many persons in the non-Medicaid population may actually meet criteria for Medicaid enrollment, particularly within the uninsured and elderly Medicare populations. However, inclusion of these persons in the non-Medicaid population would serve to bias differences in mortality between the Medicaid and non-Medicaid populations towards the null.

Cross-sectional Study Design

Reverse causality becomes an important issue in cross-sectional studies of Medicaid populations. Persons often enroll in Medicaid as the result of preexisting medical conditions that limit their ability to work and require substantial medical services. Accordingly, it is expected that the Medicaid population will have a higher burden of many chronic diseases than the general population and thus an increased risk of

mortality. It is also possible that Medicaid is a unique risk factor, or a surrogate for a risk factor, that independently increases the risk of certain adverse health outcomes. The cross-sectional design of this study prohibits determining whether an individual enrolled in Medicaid because of a disease or risk factor for a disease or developed the outcome after enrolling in Medicaid.

Fatal unintentional injuries may be less susceptible to reverse causality. For example, it is possible that a previously privately insured or uninsured person would enroll in Medicaid due to the development of a chronic disease such as diabetes or a potentially lethal disease such as lung cancer. In contrast, it is less likely that an individual's enrollment in Medicaid would be prompted by knowledge that they will experience a fatal unintentional injury. Fatal unintentional injuries, therefore, may be less prone to the limitations of reverse causality.

It is theoretically possible, however, that a fatal unintentional injury could precede Medicaid enrollment if enrollment occurred during the hospitalization or treatment of the ultimately fatal injury. The data on which this study is based, however, do not contain the information necessary to address this possible limitation.

Misclassification

This investigation relies on existing databases that were not created and maintained for the purpose of this research. It is important to realize that any errors in the death certificate database and Medicaid enrollment database (for example the misclassification of race on the death certificate or miscoding of cause of death) are incorporated into the new combined database. If this misclassification were non-

differential all results would be biased towards the null hypotheses that there is no difference in mortality between the Medicaid and non-Medicaid populations.

In contrast, differential misclassification could result in systematic bias that either artificially inflates or blunts differences in mortality between the Medicaid and non-Medicaid populations. For example, it is possible that differential bias could occur in the subjective determination of the intent of an injury death. Deaths in one population may be differentially investigated or medical examiners may differentially assign the intent of an injury. For example, if Medicaid injury deaths were more likely than non-Medicaid deaths to be classified as unintentional, rates of unintentional injury mortality in the Medicaid population would appear artificially elevated in comparison to the non-Medicaid population. If contrast, if Medicaid deaths were less likely than non-Medicaid injury deaths to be classified as unintentional, Medicaid unintentional injury mortality rates would appear blunted in comparison to the non-Medicaid population. No information was available to confirm the intent of Medicaid or non-Medicaid injury deaths.

Comparability ratios

The change of mortality coding from ICD-9 to ICD-10 coding in 1999 also limits the interpretation of the results of this study, because this investigation includes deaths occurring from 1997 through 2001. The change from ICD-9 to ICD-10 coding represents the most drastic in mortality coding that has occurred since the introduction of ICD coding in 1900 and it created significant discontinuity in mortality trend data. The discontinuity in mortality trends can be measured by standard national comparability

ratios that reflect the amount by which mortality rates calculated based on ICD-9 coding must be adjusted in order to be comparable to mortality rates calculated based on ICD-10 coding.[39]

Comparability ratios are calculated based on a large national dataset and, therefore, caution must be used when applying them to smaller geographical areas such as was done in this study.[39] At this time, however, there are no state-specific comparability ratios and thus the standard national ratios represent the best possible method for accurately adjusting trends in mortality spanning the 1999 change in mortality coding.

PUBLIC HEALTH IMPLICATIONS

In addition to quantifying the extent of the increased burden of all-cause mortality in the adult Oregon Medicaid population, the results of this study demonstrate that unintentional injury mortality rates are also increased in this unique population. The fact that the increased burden of unintentional injury mortality in the Medicaid population is not explained by MVAs is interesting. Among the Medicaid population ages 65 years and older, the risk of unintentional falls is substantially greater than the corresponding risk in the non-Medicaid population. In contrast, in the younger Medicaid population, particularly among adults ages 20–49 years, unintentional poisoning mortality is largely responsible for the increased risk of unintentional injury death.

These results have important public health implications, particularly regarding unintentional injury prevention efforts in the Medicaid population. Fall prevention should be a key focus of injury prevention programs for elderly Medicaid recipients enrolled in Old Age Assistance programs. In contrast, injury prevention efforts directed towards younger Medicaid recipients, particularly those in the AB/AD program, should focus largely on unintentional poisonings, particularly by narcotic analgesics.

Further information is needed regarding Medicaid unintentional fall and poisoning deaths before targeted injury prevention programs can be developed. Accordingly, Oregon Medicaid administrators may consider focusing future unintentional injury research on falls and poisonings.

SUMMARY

Important information regarding all-cause and unintentional injury mortality has been obtained from the completion of this study, which was based on data obtained by linking Oregon Medicaid enrollment data with Oregon vital statistics death certificate data. Unintentional fall mortality among elderly Medicaid recipients and, more strikingly, unintentional poisoning mortality among younger adult Medicaid recipients, emerged as specific types of fatal unintentional injures that disproportionately impact the adult Oregon Medicaid population. The results of this investigation may serve to guide future unintentional injury research and interventions in the Oregon Medicaid population.

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APPENDIX

ICD 9 (E850–E869)
Unintentional Poisoning
Accidental poisoning by and exposure to noxious substances

(E850–E858)
Accidental Poisoning
By Drugs and/or Medicaments

E850: Analgesics
Antipyretics
Antirheumatics
*850.0: Heroin
*850.1: Methadone
*850.2: Other opiates
*850.3: Salicylic acids
*850.4: Aromatic analgesics

E851: Barbiturates

E852: Other sedative/hypnotics

E853: Tranquilizers

E854: Psychotropics
*854.0: Antidepressants
*854.1: Psychodysleptics
*854.2: Psychostimulants

E855: Autonomic nervous system drugs

E856: Antibiotics

E857: Other Anti-infective

E858: Other drugs

(E860–E869)
Accidental Poisoning by Non-Drugs and/or Medicaments

E860: Alcohol
*860.0: Ethanol drinks
*860.1: Other ethanol
*860.2: Methyl-
*860.3: Isopropyl-
*860.4: Fuel

E861: Cleansing, polishing agents

E862: Petroleum products

E863: Agricultural and horticultural chemicals

E864: Corrosive and caustics

E865: Poisonous foodstuffs/plants

E866: Other solid and liquids

E867: Gas by pipeline

E868: Other utility gas or carbon monoxide

E869: Other gas or vapor

ICD 10 (X40–X49)
Unintentional Poisoning
Accidental poisoning by and exposure to noxious substances

(X40–X44)
Accidental Poisoning
By Drugs and/or Medicaments

X40: Non-opioid analgesics
Antipyretics
Antirheumatics

X41: Antiepileptic
Sedative hypnotics
Antiparkinsonism
Psychotropics not otherwise listed
*includes:
Antidepressants
Barbiturates
Hydantoin
Neuroleptics
Psychostimulants
Tranquillizers

X42: Narcotics
Psychodysleptics
*includes:
Cannabis
Codeine
Heroine
Methadone
Morphine
Opium

X43: Autonomic nervous system drugs

X44: Unspecified Drugs

(X45–X49)
Accidental Poisoning by Non-Drugs and/or Medicaments

X45: Alcohol
*includes:
Methyl-
Butyl-
Ethyl-
Isopropyl-

X46: Organic solvents and
Halogenated hydrocarbons

X47: Other gases and vapors
*includes:
Carbon monoxide
Motor vehicle exhaust

X48: Pesticides

X49: Unspecified chemicals
and noxious substances