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Unintentional Overdose Deaths in the North Carolina Medicaid Population: Prevalence, Prescription Drug Use, and Medical Care Services

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Abstract

Purpose: Between 2000 and 2007, the unintentional overdose (UO) death rate in North Carolina more than doubled (106.3% increase). A majority of the 2007 deaths were caused by opioid analgesic use, and methadone was associated with 34.1 percent of the deaths. To gain a better understanding of unintentional overdoses, we examined medical and prescription drug paid claims among the North Carolina Medicaid population.

Methods: North Carolina UO death certificate records were linked to Medicaid enrollment and paid claim records for calendar year 2007. All 2006 and 2007 claim records were examined for the UO death and methadone prescription populations, focusing on medical care and associated costs for these two groups. Results were compared with a random sample of the Medicaid population.

Results: Of the 901 UO deaths in 2007, 301 (33.4%) were enrolled in Medicaid. Methadone was a contributing cause of death for 98 (32.6%) of the UO deaths. Of the 98 methadone-related deaths among Medicaid enrollees, only 26 (26.5%) had received a Medicaid-paid methadone prescription or methadone clinic services within one year of death.

Conclusions: The North Carolina Medicaid population experienced a much higher rate of overdose deaths than the North Carolina population. This study suggests that fatal overdose among the Medicaid population are associated with claims for mental health disorders, substance abuse, and routine medical care for pain management. Most of the methadone-related deaths among the Medicaid population did not involve a prescription for the drug, suggesting methadone was obtained by illegal or unauthorized means.

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Introduction

Unintentional overdose^a (UO) deaths have become the second leading cause of unintentional injury deaths in the United States, exceeded only by motor vehicle injuries. Current UO death rates are four to five times higher than they were during the black tar heroin epidemic of the mid-1970s and twice as high as they were during the peak of crack cocaine use in the early 1990s.¹⁻³ An examination of UO deaths since 1990 reveals a dramatic shift, not only in the rise in UO death rates, but in the specific types of drugs associated with UO deaths.

Reports from the Centers for Disease Control and Prevention (CDC) show that during much of the 1990s, U.S. deaths increased for all types of unintentional overdoses. From 1990–2001, the U.S. unintentional and undetermined (in intent) overdose death rate increased 56 percent, from 5.0/100,000 to 7.8/100,000 in 2001.⁴ In a subsequent report presenting age-adjusted unintentional and undetermined overdose death rates between 1999 and 2004, a 62.5 percent increase was observed.⁵

North Carolina UO death rates exceed the national average.^{4,6} Mortality data from the State Center for Health Statistics show that between 2000 and 2007, the UO death rate increased from 4.8 to 9.9/100,000, representing a 106.3 percent change.⁷ The 2007 North Carolina UO death rate was higher than the death rates for hypertension, chronic liver disease and cirrhosis, homicide, and human immunodeficiency virus disease.⁸

Historically, unintentional overdoses in the United States have been caused primarily by illicit drugs, such as cocaine and heroin, but in the last decade prescription drugs have played a greater role in UO deaths.⁹⁻¹¹ A closer look at the types of drugs associated with UO deaths in 2002 reveals that 36.5 percent involve prescription opioid analgesic drugs.¹⁰ Although deaths by illicit drugs have increased in recent years as well, opioid analgesics have replaced heroin and cocaine as the leading causes of UO deaths.⁹ Opioid analgesic deaths in the United States increased 91 percent between 1999 and 2002; and deaths due to methadone (an opioid analgesic) increased 213 percent during the same time period.¹⁰ A recent report by the National Center for Health Statistics shows that the number of deaths mentioning methadone increased 468 percent from 1999 to 2005.³

A similar increase in methadone deaths has occurred in North Carolina. Mortality data for 2000–2005 for unintentional and undetermined methadone deaths from the State Center for Health Statistics show a 240 percent

increase in the unintentional and undetermined methadone death rate.⁷ Sanford observed that methadone caused or contributed to 23 percent of drug deaths in 2001.⁶ In 2006, the percentage of drug deaths attributed to methadone increased to 32 percent. In addition, other synthetic and unspecified opioid analgesics accounted for approximately 30 percent of UO deaths and cocaine comprised another 32 percent.⁶ By 2007 methadone contributed to approximately one-third of poison deaths.⁷

Methadone has been successfully used to treat heroin addiction since the 1960s and has also been used for the treatment of prescription drug addiction. In addition, it is used as an effective analgesic for pain.^{12,13} The overriding public health concern is with the misuse and abuse of methadone that may lead to overdose.

Although the research literature suggests that methadone deaths have been associated with substance abuse,^{10,12,14} studies also suggest the rise in methadone deaths since 1990 coincides with large increases in opioid analgesic prescriptions.^{3,6,10} Until recently, it has been unclear to what extent methadone deaths may be attributed to substance abuse versus prescribing practices, improper taking of the medications, or diversion of methadone from the patient to someone else.³ Using multiple data sources, Hall, et al. found that among West Virginia decedents with methadone as a contributing cause of death in 2006, only 32.1 percent actually received a valid prescription for methadone.¹⁵

The objective of this study was to gain a better understanding of the prevalence, population characteristics, prescription trends, and medical care services associated with unintentional overdoses among the North Carolina Medicaid population. We focused on the Medicaid population because of the availability of medical claim data and higher prevalence of prescription opioid use among lower income and Medicaid populations.^{15,16} Results from this study may guide Medicaid pharmacy policy in an effort to help reduce the chances of overdose among Medicaid recipients.

Methods

All 75,803 North Carolina resident death records for calendar year 2007 were examined for an underlying (primary) diagnosis of unintentional overdose, using the *International Classification of Disease, Tenth Revision* (ICD-10) codes X40–X49, “Accidental poisoning by and exposure to noxious substances.” There were 901 unintentional overdose deaths identified. Contributing cause of death fields indicating “Poisoning by drugs,

medicaments, and biological substances” were identified using ICD-10 codes T36–T50. Methadone deaths were identified using the code T40.3. Age, sex, race, county of residence, education, and marital status were examined from the death certificate records.

Of the 901 UO decedents in 2007, 888 had death records that contained Social Security numbers that were used for matching to Medicaid records. Of the 888, 301 (33.4%) matched with Medicaid enrollment records during the same calendar year. From these enrollment records, Medicaid ID numbers were obtained and used to match to Medicaid paid claim records. There were 40,415 paid claims selected in 2006 and 2007 for 281 of the 301 Medicaid decedents.

Two decedent populations were examined. The UO death population consists of the 301 overall unintentional overdose deaths matched to Medicaid enrollment records. The methadone death population is a subset of the UO death population, consisting of the 98 decedents that had methadone listed as a contributing cause of death.

Living arrangements and eligibility status were drawn from the Medicaid paid claim records. Emergency department paid claims were identified using revenue procedure codes RC450–RC459. Inpatient hospital stays and prescription drug claims were identified by claim type. A rural/urban classification variable was created based on the North Carolina Accountability Regions.¹⁷ To examine drug and medical claims near the time of death, a length-of-time variable was created based on claim service dates and the date of death.

We aggregated ICD-9-CM diagnosis codes recorded on Medicaid medical paid claims to create diagnostic categories. Mental disorders were defined by primary diagnosis codes 290–303 and 306–319; drug dependence, 304–305; circulatory system, 390–459; respiratory system, 460–519; musculoskeletal and connective tissue, 710–739; and injury and poisoning, 800–999.

The North Carolina Controlled Substances Reporting System (CSRS) is a prescription drug monitoring program that captures prescriptions for controlled substances dispensed statewide.¹⁸ The CSRS was used to identify methadone prescriptions where there may have been a cash payment or payment by some other provider than Medicaid. Since the CSRS began data collection on July 1, 2007, prescription information was only obtained for 37 decedents with death dates between August and December 2007. Only Medicaid, third party, and cash transactions between July and December 2007 were captured.

To compare all paid Medicaid claims within 12 months of death for the two Medicaid death populations with the overall Medicaid population, a simple random sample of 2,500 living Medicaid participants was drawn from Medicaid eligibility records located in the North Carolina Medicaid data warehouse. Since the age and sex distributions of the Medicaid population (32% 21–64 and 60% female) in state fiscal year 2007¹⁹ were significantly different ($p < .001$ and $p < .01$, respectively) from the UO population (85% 25–64 and 52.2% female), the sample was drawn using the same sex distribution as the overall UO population. In addition, the comparison sample was restricted to only those Medicaid enrollees between the ages 25 and 64 and no one from the decedent population was included in the sample. The Medicaid IDs for the comparison sample were used to select their paid claims with service dates in 2007. The data set for the comparison sample contained 143,972 paid claim records. We conducted z and t tests to check for significant differences in the means and percentages between the decedent populations and the comparison sample.

Results

Among the Medicaid population, the age-adjusted UO death rates was 34.9/100,000. In 2007, the North Carolina UO death rate was 9.9/100,000. Of the 901 North Carolina UO deaths identified in 2007, 301 (33.4%) were enrolled in Medicaid in 2007. Another 161 decedents (17.9%) were enrolled in Medicaid at some time during 2003–2006, but were not counted in the Medicaid group for purposes of this study.

Demographics

We compared the demographic information for the Medicaid UO death population and the comparison sample. This information is presented in Table 1. Information regarding decedent’s education and marital status were obtained from death certificate records and as such were not available for the Medicaid comparison sample.

Diagnostic patterns

Table 2 shows the 10 most frequent diagnoses recorded on the Medicaid paid claims within one year of death for the decedent population and recorded during 2007 for the comparison sample, along with z test results. The most frequently occurring diagnosis code was “other and unspecified disorders of the back” for the Medicaid UO population, but ranked sixth among those in the

Table 1
Demographics for Medicaid Unintentional Overdose (UO)
Death Population and Comparison Sample

| Demographic Category | Medicaid UO Death Population (N=301) | | Comparison Sample Ages 25–64 (N=2,500) | |
|---|--------------------------------------|------------|--|---------|
| | Number | Percent | Number | Percent |
| Eligibility Aid Category† | | | | |
| Aged | 10 | 3.3* | 38 | 1.5 |
| Blind | 1 | 0.3 | 4 | 0.2 |
| Disabled | 188 | 62.5** | 1,369 | 54.8 |
| Temporary Assistance for Needy Families | 74 | 24.6*** | 930 | 37.2 |
| Infants and Children | 10 | 3.3*** | 0 | 0 |
| Pregnant Women | 1 | 0.3 | 156 | 6.2 |
| Qualified Medicare Beneficiary | 93 | 30.9 | 737 | 29.5 |
| Refugee | 0 | 0 | 2 | 0.1 |
| Client Race | | | | |
| White | 262 | 87.0*** | 1,210 | 48.4 |
| African American | 35 | 11.6*** | 1,056 | 42.2 |
| Other | 4 | 1.3*** | 234 | 9.4 |
| Client Sex | | | | |
| Male | 144 | 47.8 (N/A) | 1,200 | 48.0 |
| Female | 157 | 52.2 (N/A) | 1,300 | 52.0 |
| Client Age | | | | |
| <18 | 7 | 2.3 (N/A) | 0 | 0 |
| 18–24 | 26 | 8.6 (N/A) | 0 | 0 |
| 25–44 | 133 | 44.2*** | 1,408 | 56.3 |
| 45–64 | 123 | 40.9 | 1,092 | 43.7 |
| 65+ | 12 | 4.0 (N/A) | 0 | 0 |
| Residence | | | | |
| Urban | 89 | 29.6 | 849 | 34.0 |
| Rural | 212 | 70.4 | 1,651 | 66.0 |
| Education†† | | | | |
| Less than 12 Years | 140 | 46.5 | — | — |
| High School Graduate | 116 | 38.5 | — | — |
| Greater than High School | 38 | 12.6 | — | — |
| Unknown | 7 | 2.3 | — | — |
| Marital Status†† | | | | |
| Never Married | 74 | 24.6 | — | — |
| Married | 99 | 32.9 | — | — |
| Widowed | 18 | 6.0 | — | — |
| Divorced | 109 | 36.2 | — | — |
| Unknown | 1 | 0.3 | — | — |

Note: N/A indicates the tests between proportions are not applicable because the comparison sample sex and age distributions were selected to match that of the decedent population.

† The latest eligibility information on record is reported, except for dual Medicaid/Medicare eligibility. Therefore, decedents may be counted in more than one eligibility group.

†† Education and marital status were unavailable for comparison sample.

* p < .05

** p < .01

*** p < .001

Table 2
Top 10 Diagnoses on Medicaid Medical Claims†

| Medicaid Unintentional Overdose (UO) Death Population†† Diagnosis within One Year of Death (N=301) | | | | | |
|---|-------------------|--|-------------------------|----------------------------|---|
| Rank | ICD-9 Code | Description | Number of Claims | Number of Decedents | Percentage of Total Decedents††† |
| 1 | 724 | Other and unspecified disorders of back | 394 | 84 | 27.9*** |
| 2 | 296 | Episodic mood disorders | 1,038 | 79 | 26.2*** |
| 3 | 786 | Symptoms involving respiratory system and other chest symptoms | 245 | 78 | 25.9*** |
| 4 | 780 | General symptoms | 282 | 71 | 23.6*** |
| 5 | 719 | Other and unspecified disorders of joint | 181 | 59 | 19.6*** |
| 6 | 729 | Other disorders of soft tissue | 143 | 55 | 18.3*** |
| 7 | 300 | Anxiety, dissociative and somatoform disorders | 181 | 49 | 16.3*** |
| 8 | 789 | Other symptoms involving abdomen and pelvis | 182 | 48 | 16.0*** |
| 9 | 401 | Essential hypertension | 245 | 42 | 14.0 |
| 10 | 722 | Intervertebral disc disorders | 171 | 42 | 14.0*** |

| Medicaid Methadone Death Population†† Diagnosis Within One Year of Death (N=98) | | | | | |
|--|-------------------|--|-------------------------|----------------------------|---|
| Rank | ICD-9 Code | Description | Number of Claims | Number of Decedents | Percentage of Total Decedents††† |
| 1 | 724 | Other and unspecified disorders of back | 181 | 34 | 34.7*** |
| 2 | 786 | Symptoms involving respiratory system and other chest symptoms | 84 | 33 | 33.7*** |
| 3 | 296 | Episodic mood disorders | 306 | 31 | 31.6*** |
| 4 | 729 | Other disorders of soft tissue | 76 | 28 | 28.6*** |
| 5 | 719 | Other and unspecified disorders of joint | 75 | 25 | 25.5*** |
| 6 | 780 | General symptoms | 73 | 24 | 24.5*** |
| 7 | 300 | Anxiety, dissociative and somatoform disorders | 72 | 22 | 22.4*** |
| 8 | 304 | Drug dependence | 733 | 18 | 18.4*** |
| 9 | 722 | Intervertebral disc disorders | 76 | 17 | 17.3*** |
| 10 | 789 | Other symptoms involving abdomen and pelvis | 55 | 16 | 16.3* |

| Comparison Medicaid Sample†† (N=2,500) | | | | | |
|---|-------------------|---|-------------------------|-----------------------------|--|
| Rank | ICD-9 Code | Description | Number of Claims | Number of Recipients | Percentage of Total Recipients††† |
| 1 | 786 | Symptoms involving respiratory system and other chest symptoms. | 1,278 | 375 | 15.0 |
| 2 | 401 | Essential hypertension | 2,033 | 361 | 14.4 |
| 3 | 367 | Disorders of refraction and accommodation | 301 | 300 | 12.0 |
| 4 | 780 | General symptoms | 1,016 | 299 | 12.0 |
| 5 | 789 | Other symptoms involving abdomen and pelvis | 650 | 249 | 10.0 |
| 6 | 724 | Other and unspecified disorders of back | 718 | 248 | 9.9 |
| 7 | 250 | Diabetes mellitus | 2,191 | 242 | 9.7 |
| 8 | 719 | Other and unspecified disorders of joint | 549 | 234 | 9.4 |
| 9 | 296 | Episodic mood disorders | 2,348 | 210 | 8.4 |
| 10 | 729 | Other disorders of soft tissue | 325 | 180 | 7.2 |

† Encounters of Administrative Purpose (ICD-9 V68) had the highest ranking, but since these diagnoses are not associated with illness, they were excluded from the ranking. An asterisk indicates there is a statistically significant difference between the percent with a diagnosis for each decedent population compared with the comparison sample.

†† A person may be counted in more than one diagnostic category if that person received more than one diagnosis within the one-year period.

††† The number of decedents or recipients who had a claim for the diagnosis divided by the total number of decedents.

* p < .05
 ** p < .01
 *** p < .001

comparison sample. Drug dependence ranked eighth (18.4% of decedents) among the methadone death population and ranked 48th (2.3%) among those in the comparison sample. All percentages for the decedent populations were significantly different from the percentages for the comparison sample with the exception of essential hypertension.

In Table 3, individual diagnoses were grouped into broader diagnostic categories and are presented for the UO death population, the Methadone death population (as subset of the UO deaths), and the comparison sample. The percentages for the comparison sample are for one or more diagnoses in the category on a medical claim in 2007. The decedent populations had higher percentages for every diagnosis category shown in the table. Furthermore, all decedent percentages were significantly different from the percentages for the comparison sample at the $p < .001$ significance level, with the exception of the circulatory system category for the methadone death population.

Prescription drug patterns

Table 4 presents the percentages and z test results for the 10 most frequently prescribed Medicaid-paid prescription drugs. For the UO death population and methadone death population, this includes Medicaid drug claims paid within one year of death. For the comparison sample, the 10 most frequent prescription drugs paid by Medicaid in 2007 are presented. See Appendix A for information regarding the brand name and therapeutic class for all generic drugs listed in Table 4.

Prescription trends show hydrocodone is the leading prescription and alprazolam ranks second for both decedent populations. Results show 36.5 percent of the UO death population and 43.9 percent of the methadone death population received a prescription for hydrocodone/acetaminophen in the year prior to death. For the comparison sample it was 20.6 percent. Results also showed that 30.9 percent of the UO death population and 37.8 percent of the methadone death population received a prescription for oxycodone/acetaminophen, compared to 15.1 percent of the comparison sample.

Additionally, we grouped Medicaid-paid prescriptions with clinical methadone administration to examine the burden of authorized use of methadone within Medicaid. We found that among the 98 methadone death population, only 26 (26.5%) received a Medicaid-paid prescription for methadone or received a Medicaid-paid methadone administration within one year of death. A review of Medicaid medication history showed that of the 26 methadone decedents, eight (30.7%) had a Medicaid-paid claim for methadone drug services (HCPCS code H0020) and 15 (57.7%) had a methadone prescription filled within 34 days^b of death. Also within 34 days of death, 21 (80.7%) were prescribed anti-anxiety medications, 13 (50.0%) were prescribed antidepressants, 12 (46.2%) had other narcotics prescriptions, 11 (46.3%) were prescribed antipsychotics, nine (34.6%) muscle relaxants, and eight (30.7%) anticonvulsants. Four (15.4%) decedents had a dual eligibility status and may have had other drug claims paid by Medicare that are not reflected in the above prescription patterns.

Table 3
Percentage of Unintentional Overdose (UO) Death Population and Comparison Sample with Medical Claims within One Year by Select Diagnosis Groups

| ICD-9 CM Class | UO Death Population (N=301) | | Methadone Death Population (N=98) | | Comparison Sample (N=2,500) | |
|----------------------|-----------------------------|---------|-----------------------------------|---------|-----------------------------|---------|
| | Number | Percent | Number | Percent | Number | Percent |
| Musculoskeletal | 130 | 43.2*** | 52 | 53.1*** | 623 | 24.9 |
| Mental Disorders† | 125 | 41.5*** | 47 | 48.0*** | 525 | 21.0 |
| Injury and Poisoning | 108 | 35.9*** | 45 | 45.9*** | 397 | 15.9 |
| Respiratory System | 94 | 31.2*** | 34 | 34.7*** | 497 | 19.9 |
| Circulatory System | 90 | 29.9*** | 25 | 25.5 | 500 | 20.0 |
| Drug Dependence | 47 | 15.6*** | 23 | 23.5*** | 91 | 3.6 |

† Excludes drug dependence.

* $p < .05$

** $p < .01$

*** $p < .001$

Table 4
10 Most Commonly Prescribed Drugs†

Unintentional Overdose Death Population Prescriptions within One Year of Death (N=301)

| Rank | Generic Drug | Number of Claims | Number of Decedents | Percentage of Deaths†† |
|------|---------------------------|------------------|---------------------|------------------------|
| 1 | Hydrocodone/Acetaminophen | 701 | 110 | 36.5*** |
| 2 | Alprazolam | 811 | 101 | 33.6*** |
| 3 | Oxycodone/Acetaminophen | 416 | 93 | 30.9*** |
| 4 | Clonazepam | 521 | 76 | 25.2*** |
| 5 | Diazepam | 302 | 50 | 16.6*** |
| 6 | Quetiapine Fumarate | 284 | 47 | 15.6*** |
| 7 | Zolpidem Tartrate | 220 | 44 | 14.6*** |
| 8 | Promethazine | 136 | 41 | 13.6*** |
| 9 | Cyclobenzaprine | 98 | 38 | 12.6*** |
| 10 | Lorazepam | 186 | 37 | 12.3*** |

Methadone Death Population Prescriptions within One Year of Death (N=98)

| Rank | Generic Drug | Number of Claims | Number of Decedents | Percentage of Deaths†† |
|------|---------------------------|------------------|---------------------|------------------------|
| 1 | Hydrocodone/Acetaminophen | 240 | 43 | 43.9*** |
| 2 | Alprazolam | 334 | 40 | 40.8*** |
| 3 | Oxycodone/Acetaminophen | 165 | 37 | 37.8*** |
| 4 | Clonazepam | 238 | 35 | 35.7*** |
| 5 | Methadone | 141 | 18 | 18.4*** |
| 6 | Promethazine | 64 | 18 | 18.4*** |
| 7 | Quetiapine Fumarate | 106 | 18 | 18.4*** |
| 8 | Zolpidem Tartrate | 93 | 17 | 17.3*** |
| 9 | Diazepam | 84 | 16 | 16.3*** |
| 10 | Trazodone | 72 | 16 | 16.3*** |

Medicaid Comparison Sample Prescriptions within CY 2007 (N=2,500)

| Rank | Generic Drug | Number of Claims | Number of Recipients | Percentage of Population†† |
|------|---------------------------|------------------|----------------------|----------------------------|
| 1 | Hydrocodone/Acetaminophen | 1,821 | 514 | 20.6 |
| 2 | Oxycodone/Acetaminophen | 1,172 | 377 | 15.1 |
| 3 | Ibuprofen | 463 | 269 | 10.8 |
| 4 | Azithromycin | 283 | 212 | 8.5 |
| 5 | Omeprazole | 684 | 203 | 8.1 |
| 6 | Alprazolam | 1,249 | 189 | 7.6 |
| 7 | Amoxicillin Trihydrate | 255 | 187 | 7.5 |
| 8 | Clonazepam | 1,085 | 164 | 6.6 |
| 9 | Promethazine | 336 | 162 | 6.5 |
| 10 | Cyclobenzaprine | 339 | 156 | 6.2 |

† Decedents and those in the Medicaid comparison sample may be counted in more than one drug category if they were prescribed more than one drug type during the time period.

†† The number of decedents or recipients who had a claim for a drug divided by the total number of decedents.

* p < .05

** p < .01

*** p < .001

For the 37 Methadone decedents that we were able to match to the CSRS, Medicaid prescription profiles were compared with CSRS data. No additional methadone prescriptions were found in the CSRS for these 37 decedents, indicating that there were no cash or third-party transactions and all of the methadone prescriptions during July through December 2007 were billed to Medicaid.

Medical services

We examined the types of medical services used among those who had paid claims within one year of death. Medicaid services for decedent population and comparison sample are presented (with *t* test results) in Table 5.

Among those who received any Medicaid service, the average cost of Medicaid claims per person was \$12,653 for the UO death population, \$13,266 for the methadone death population, and \$9,771 for the comparison sample. On average, there were approximately 104 paid claims within one year of death for the UO death population, 114 paid claims for the methadone death population, and 58

paid claims in 2007 for the comparison sample.

Among those who received any Medicaid services, 88 percent of the UO death population and 92 percent of the methadone death population received one or more Medicaid-paid prescription drugs within one year of death, compared with 68 percent of the comparison sample receiving one or more Medicaid-paid prescription drugs in 2007. The average cost of prescription drugs per person was much higher among the decedent populations than among the comparison sample. The average annual amount paid for prescriptions was \$2,831 for the methadone death population, \$3,484 for the UO death population, and \$1,753 for the comparison sample.

Among those who received any Medicaid service, 80.3 percent of the UO death population, 84.1 percent of the methadone death population, and 41.6 percent of the comparison sample had one or more emergency department visits within the year. The average number of emergency department visits for the decedent population

Table 5
Use of Medicaid Medical Services

| | Unintentional Overdose Death Population† | Methadone Death Population† | Comparison Sample |
|--|---|--------------------------------|-----------------------------|
| Total Services | | | |
| Total number of persons with claims ^{††} | 274 (91.0%) | 88 (89.8%) | 2,500 (100%) ^{†††} |
| Average number of claims per person with a claim | 103.9 ^{***} | 113.5 ^{***} | 57.5 |
| Average cost per person with a claim | \$12,653 ^{***} | \$13,253 [*] | \$9,771 |
| Prescriptions | | | |
| Total number of persons with drug claims | 240 (87.6%) | 81 (92.0%) | 1,702 (68.0%) |
| Average number of prescriptions per person with a claim | 41 ^{***} | 45 ^{***} | 25 |
| Average drug cost per person with a claim | \$2,831 ^{***} | \$3,484 ^{***} | \$1,753 |
| Emergency Department (ED) Visits | | | |
| Total number of persons with ED visit | 220 (80.3%) | 74 (84.1%) | 1,040 (41.6%) |
| Average number of ED visits per person with a claim | 5.0 ^{***} | 5.0 ^{***} | 2.6 |
| Average ED cost per person with a claim | \$562 ^{***} | \$657 ^{***} | \$299 |
| Inpatient Hospital Stays | | | |
| Total number of persons hospitalized | 84 (30.5%) | 30 (34.1%) | 421 (16.8%) |
| Average number of hospitalizations per person with a claim | 2.2 ^{***} | 2.1 ^{**} | 1.5 |
| Average hospital cost per person with a claim | \$11,140 | \$11,503 | \$9,400 |

† Total use of Medicaid-paid services within one year of death.

†† The number of decedents who had one or more Medicaid-paid claims in 2007.

††† Unlike the decedent populations which were matched to eligibility, the comparison sample was selected from the Medicaid claims.

* *p* < .10

** *p* < .05

*** *p* < .01

was 5.0, versus an average of 2.5 for the comparison sample.

The rates for inpatient hospitalization among the decedent populations were also much higher than the comparison sample. The UO death population had an average of 2.2 hospital stays within the year before death and the methadone death population had an average of 2.1 stays, versus 1.5 for the comparison sample in 2007. Average costs of inpatient hospitalization per person were \$11,140 for the UO death population, \$11,503 for the methadone death population, and \$9,400 for the comparison sample.

Discussion

Implications of results

The Medicaid population represented approximately 20 percent of the overall state population in 2007, but it experienced one-third of the unintentional overdose deaths. Consistent with the overall North Carolina population in 2007, about one-third of the UO deaths could be attributed to methadone. Medicaid decedent populations had about twice the average number of emergency department visits, higher than average inpatient hospital stays, and higher than average numbers of prescriptions filled than the comparison sample.

Those who died from unintentional overdoses received more Medicaid-paid services for drug dependence, mental disorders, joint and back disorders, diseases of the musculoskeletal system and soft tissue, and diseases of the respiratory and circulatory system than the comparison sample. Diagnoses for mental disorders occurred at about twice the rate for the UO death population than in the comparison sample. Several of the drugs on the Top 10 list for the decedent populations were for the treatment of mental health disorders, such as anxiety. Findings for diagnoses also suggest that substance abuse may be associated with unintentional overdose deaths.

With the emphasis that has been given in the literature to the problem of methadone overdose by legitimate prescriptions, one unexpected finding was that only around one-fourth of the Medicaid decedents that had methadone as a contributing cause of death on the death certificate were found to have a Medicaid-paid prescription for methadone or received Medicaid-paid methadone clinic services. Based on our match of Medicaid UO decedents with the Controlled Substance Reporting System data, it appears that a large proportion of the methadone

deaths occurred as a result of taking methadone that was unauthorized or purchased illegally. We do acknowledge that we were unable to capture any authorized prescriptions that may have occurred prior to the July 1, 2007 CSRS start date.

Limitations

One limitation of the study was that the number of deaths caused by unintentional overdose could have been undercounted because, in some cases, the cause of death may be pending an autopsy from the Office of the Chief Medical Examiner (OCME). The annual vital statistics death files produced by the State Center for Health Statistics are updated for at least six months following the file year and are closed out thereafter. In contrast, the OCME files are never closed and may be updated at any time. Consequently, there may be 2007 deaths that were determined to be unintentional overdoses at a later point in time and not captured in the present study.

There were trade-offs in setting the cut-offs for the examination of prescription and medical services away from the date of death. Frequently occurring prescriptions were also examined within one month of the date of death. Although the ranking was slightly different than what was observed at one year, only carisoprodol and pregabalin dropped from the 10 most frequently occurring prescriptions at one year.

Given the sharp rise in the methadone death rates over the past few years, we decided to focus on methadone in the current study. Other opioid analgesics, such as hydrocodone and oxycodone, continue to be of public health concern because of the level of abuse and occurrences of overdose, and warrant further study.^{20,21} Oxycodone was also prescribed at high rates among our decedent populations. Further research needs to examine the relationship between oxycodone use and unintentional overdose deaths.

Policy implications

Numerous studies have shown a rise in unintentional overdose death rates in the United States that coincides with a large increase in opioid analgesic prescriptions.⁹⁻¹¹ The present study of North Carolina Medicaid decedent populations suggests that opioid analgesic overdoses may be more closely associated with substance abuse and mental health disorders than with routine medical care for pain management. However, given the complexity of the problem, a broader set of prevention strategies

are needed. The North Carolina Drug Overdose Task Force has recognized this complexity and outlines 24 recommendations across seven categories.²² As outlined by the North Carolina Drug Overdose Task Force, comprehensive prevention programs which merge the efforts of law enforcement, mental health, public health, and medical community organizations are urgently needed. Unintentional overdose death rates may be reduced to some extent by educating the general public about the dangers of taking drugs and educating prescribers about following opioid treatment guidelines.

Notes

^a Unintentional overdose deaths described in this report are the result of accidental overdose of drugs, medicaments, and biological substances as defined by the *International Classification of Diseases, Ninth Revision* codes ‘960’–‘979’ and *International Classification of Diseases Tenth Revision* codes ‘X40’–‘X49.’ Leonard Paulozzi, of the National Center for Injury Prevention and Control, provided a definition of these overdoses in a 2007 testimony before the U.S. Congress, describing poisonings as, “. . . any substance that is harmful to your body when ingested (eaten), inhaled (breathed), injected, or absorbed through the skin. Any substance, taken in excess, including a prescription drug, can be a poison. Therefore the CDC categorizes drug overdoses as drug poisonings. Drug overdose does not include adverse reactions to medications taken in correct amounts.” (Source: Paulozzi, 2007.)⁵

^b A 34-day window was examined because a Medicaid recipient may get up to a 34-day supply of a medication each month.

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Appendix A Commonly Prescribed Drugs from Table 4 with Associated Brand Names and Therapeutic Class

| Generic Name | Brand Name | Therapeutic Class |
|---------------------------|---|---|
| Alprazolam | Xanax | Benzodiazepine Antianxiety |
| Amoxicillin | Amoxil, Trimox | Penicillin Anti-infective |
| Azithromycin | Zithromax | Macrolide Anti-infective |
| Clonazepam | Klonopin | Benzodiazepine Antianxiety |
| Carisoprodol | Soma | Muscle Relaxant |
| Cyclobenzaprine | Flexeril, Flexmid, Amrix | Muscle Relaxant |
| Diazepam | Valium | Benzodiazepine Antianxiety |
| Hydrocodone/Acetaminophen | Vicodin, Lortab, Anexsia, Norco, Zydone | Opioid Analgesic |
| Ibuprofen | Motrin | Nonsteroidal Anti-inflammatory |
| Lorazepam | Ativan | Benzodiazepine Antianxiety |
| Methadone | Methadose, Dolophine | Opioid Analgesic |
| Omeprazole | Prilosec | Proton Pump Inhibitor, Gastrointestinal Agent |
| Oxycodone/Acetaminophen | Percocet, Roxicet, Tylox | Opioid Analgesic |
| Pregabalin | Lyrica | Anticonvulsant/Fibromyalgia |
| Promethazine | Phenergan | Antinausea |
| Quetiapine Fumarate | Seroquel | Atypical Antipsychotic |
| Trazodone | Desyrel | Antidepressant |
| Zolpidem Tartrate | Ambien | Sedative Hypnotic |

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