



Short communication

Analysis of unused prescription opioids and benzodiazepines remaining after death among Medicare decedents

Laura Van Metre Baum^{a,*}, Emilie Bruzelius^b, Mathew V. Kiang^c, Keith Humphreys^{c,d}, Sanjay Basu^e, Aaron Baum^f

^a Vanderbilt University School of Medicine, United States

^b Columbia University Joseph L. Mailman School of Public Health, United States

^c Stanford University School of Medicine, United States

^d Veterans Affairs Palo Alto Health Care System, United States

^e Research and Analytics, Collective Health, United States

^f Icahn School of Medicine at Mount Sinai, United States

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ABSTRACT

Background: Millions of opioid and benzodiazepine prescriptions are dispensed near end-of-life. After death, patients' unused prescription pills belong to family members, who often save rather than dispose of them. We sought to quantify this exposure in Medicare beneficiaries.

Methods: We estimated the share of decedent Medicare beneficiaries who potentially left behind opioid or benzodiazepine pills at the time of death using Part D claims of a 20 % national sample of Medicare beneficiaries between 2006–2015 linked to the National Death Index.

Results: We estimated that 1 in 6 Medicare beneficiaries who died between 2006–2015 potentially left behind opioid pills, and 1 in 10 who died between 2013–2015 potentially left benzodiazepines as well. Leftover pills were more common among younger, dually enrolled, and lower-income beneficiaries, as well as beneficiaries living in non-urban areas and those with a history of mental illness, drug use disorders, and chronic pain. North American Natives and Non-Hispanic Whites had higher proportions than Black, Hispanic, and Asian decedents. **Conclusions:** Opioids and benzodiazepines are commonly left behind at death. Policies and interventions that encourage comprehensive and safe medication disposal after death may reduce risk for intra-household diversion and misuse of prescription opioids and benzodiazepines.

1. Introduction

Each year in the United States (US), millions of opioid and benzodiazepine prescriptions are dispensed near end-of-life (Sykes and Thorns, 2003). Decedents' unused pills legally belong to family members, who often save rather than dispose of them (Bicket et al., 2017). Improper disposal after death may increase risk of diversion or misuse by household members at a time of heightened emotional and financial strain. The majority of people who misuse prescription pills first obtain them from friends or relatives (Substance Abuse and Mental Health Services Administration, S., 2019), and rates of opioid initiation and overdose are greater among patients whose family members have been prescribed opioids (Khan et al., 2019; Seamans et al., 2018). Further, a

survey of hospice providers noted that household members are rarely screened for substance use disorders and that following death, unused opioids were frequently left in the home (Cagle et al., 2019). To our knowledge, the amount of unused non-hospice prescription opioids or benzodiazepines at the time of death has never been estimated.

2. Material and methods

We estimated the share of decedent Medicare beneficiaries who potentially left behind opioid or benzodiazepine pills at the time of death using Part D claims of a 20 % national sample of Medicare beneficiaries between 2006–2015 linked to the National Death Index. The study population included all decedent beneficiaries with ≥ 1 month of

* Corresponding author at: Division of Hematology and Oncology, Vanderbilt University Medical Center, 2229 Pierce Avenue, 777 Preston Research Building, Nashville, TN, 37232-6307, United States.

E-mail address: Laura.baum@vumc.org (L.V.M. Baum).

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Part D coverage in the 12 months prior to death. The primary outcome was the percentage of decedent beneficiaries who died before an opioid or benzodiazepine prescription's intended final date (calculated as initial date plus days' supply). Only outpatient prescriptions were included. Medication class was determined using National Drug Codes (NDC) with the Center for Disease Control's Morphine Milligram Equivalent (CDC MME) data file ([Center for Disease Control, 2019](#)). We stratified analyses by patient sex, age, race/ethnicity, health maintenance organization (HMO) enrollment, dual eligibility, low-income Part D subsidy, urbanicity (based on Rural-Urban Continuum code of zip code), chronic condition history, and hospice utilization. As benzodiazepines were excluded from the standard Part D plan until 2013, we only estimated the share of decedent Medicare beneficiaries who potentially left behind benzodiazepine pills and either opioid or benzodiazepine pills from 2013–2015. We also estimated a total combined count for the entire study period to ascertain the overall potential scope of the problem in the study period and to test our sensitivity analyses.

We conducted two sensitivity analyses. First, because controlled substance policies and prescribing practices have changed substantially since 2006 (the first year of our study period), we evaluated results when restricting the sample to beneficiaries who died in 2015 (the most recent year of the study period). Second, in the primary analysis we identified opioids and benzodiazepines prescriptions based on the NDC according to the CDC MME file. However, this method may misidentify drug class because NDCs are allowed to be reused by manufacturers. Thus, we manually reviewed the generic and brand names of all prescriptions identified as opioids and benzodiazepines in the primary analysis. Additionally, we conducted a sensitivity analysis that used this list of generic and brand names to identify opioids and benzodiazepines that may have been missed when matching on NDC.

The analysis was approved by Stanford's IRB (#52,826).

3. Results

The percentage of Medicare Part D beneficiaries who died before the intended final date of an opioid prescription was 16.7 % (452,093 of 2,707,141 decedent beneficiaries) between 2006–2015. About a third (34.3 %) of unused opioid prescriptions were long-acting, the median unused MME/day was 40 (IQR 20–80), and the median days' supply remaining was 9 (IQR 4–17). The median pill count remaining was 27 with a median MME per pill of 15 (IQR 5–23) (Table 2). The percentage who died before either an opioid or benzodiazepine prescription in the full study period was 19.1 % (517,064 of 2,707,141 decedent beneficiaries).

Among beneficiaries who died between 2013–2015 (the period benzodiazepines were included in the standard Part D plan), the percentage of Medicare Part D beneficiaries who died before the intended final date of a benzodiazepine prescription was 9.9 % (96,736 of 977,131 decedent beneficiaries) and who died before the intended final date of either an opioid prescription or benzodiazepine prescription was 21.2 % (207,542 of 977,131 decedent beneficiaries). The percentage with remaining opioids or benzodiazepines after death was larger among beneficiaries aged <65 years (33.5 %), dually enrolled in Medicaid (25.4 %), who ever received a low-income subsidy (26.0 %), or living in non-urban zip codes (25.2 %) (Table 1). Stratifying results by race/ethnicity showed higher prevalence amongst North American Natives (24.4 %) and Non-Hispanic Whites (20.6 %), compared to Blacks (16.4 %), Hispanics (17.0 %), and Asians (12.6 %). Stratifying results by chronic condition history, prevalence was highest (>25 %) among beneficiaries with a history of post-traumatic stress disorder (39.9 %), drug use disorder (35.2 %), personality disorders (33.8 %), migraines or other chronic headaches (33.7 %), bipolar disorder (30.9 %), fibromyalgia, chronic pain and fatigue (29.6 %), anxiety disorder (29.1 %), and tobacco use disorder (27.6 %). In contrast, the proportion was lower among beneficiaries with no history of a chronic condition (18.0 %).

Table 1

Counts of Decedent Medicare Part D Beneficiaries with Leftover Outpatient Prescription Opioid or Benzodiazepine Pills at the Time of Death, 2006–2015.

Variable	% Decedents with Unused Opioid or Benzodiazepine (2013–2015)	% Decedents with Unused Opioid (2006–2015)	% Decedents with Unused Benzodiazepine (2013–2015)
Sex			
Female	19.5	15.3	8.7
Male	22.6	17.7	10.8
Age (years)			
< 65	33.5	26.9	17.1
≥ 65	19.9	15.6	9.1
Race/ethnicity			
Asian	12.6	10.4	4.8
Black	16.4	14.0	5.3
Hispanic	17.0	10.9	9.0
North American Native	24.4	21.3	8.9
Other	15.3	12.3	6.4
Unknown	16.4	14.9	8.8
Non-Hispanic White	20.6	17.4	10.7
HMO Enrollment ^a			
No	22.0	17.5	10.3
Yes	19.9	14.9	9.2
Dual Eligible			
No	19.7	16.4	9.1
Yes	25.4	19.4	12.1
Low Income Subsidy			
No	17.4	12.9	8.1
Yes	26.0	20.7	12.9
Non-urban Zip code			
No	20.0	15.8	9.4
Yes	25.2	20.1	11.4
Chronic Condition History ^b			
Post-traumatic stress disorder	39.9	27.8	26.2
Drug use disorder	35.2	27.8	18.4
Personality disorders	33.8	24.4	21.6
Migraines or chronic headaches	33.7	27.7	18.6
Bipolar disorder	30.9	22.0	18.9
Fibromyalgia, chronic pain and fatigue	29.6	24.8	13.1
Anxiety disorder	29.1	21.1	9.9
Tobacco use disorder	27.6	22.8	13.2
No chronic condition	18.0	13.5	8.2
Cancer in Calendar Year ^c			
No	21.1	16.3	10.0
Yes	21.9	18.3	9.4
Hospice Use in Calendar Year			
No	23.8	17.5	11.1
Yes	18.6	15.7	8.7
Total	21.2	16.7	9.9

^a HMO enrollment equals "Yes" if the number of months during the year of the beneficiary's death that received their Part A and Part B benefits through a managed care plan (i.e., a Medicare Advantage plan) instead of the traditional fee-for-service program was greater than 0, and equals "No" otherwise.

^b Chronic condition history is from a list of 62 specific chronic conditions for which the beneficiary ever met the Chronic Condition Warehouse criteria. We only present results for the subset of chronic conditions for which the percentage of decedents with unused opioid or benzodiazepine pills who had a history of that chronic condition exceeded 25 %.

^c Cancer history equals "Yes" if the beneficiary ever met the Chronic Condition Warehouse criteria for breast, colorectal, prostate, lung, or endometrial cancer, and equals "No" otherwise.

In a sensitivity analysis restricting the sample to Medicare Part D beneficiaries who died in 2015, the estimated percentage of beneficiaries who died before the intended final date of an opioid or benzodiazepine prescription was 20.1 % (69,443 of 345,084 decedent beneficiaries). A manual review of the 262 generic and brand names of the prescriptions we identified as opioids and benzodiazepines confirmed all drugs were correctly classified. In an additional sensitivity analysis in which we identified opioid and benzodiazepine prescriptions using generic and brand names rather than NDCs, the estimated percentage of Medicare Part D beneficiaries who died before the intended final date of an opioid or benzodiazepine prescription between 2013–2015 was 21.3 %.

4. Discussion and conclusions

About 1 in 6 Medicare beneficiaries with Part D coverage who died between 2006–2015 potentially left behind opioid pills and about 1 in 10 beneficiaries with Part D coverage who died between 2013–2015 potentially left behind benzodiazepine pills. Extrapolating our findings to the total Medicare population, we estimate 100 million opioid pills comprising 1.5 billion MMEs – enough for a 1-month supply of around-the-clock high-dose opioid pain management for 2.5 million people (Dowell et al., 2016) – were unused 2006–2015 and 23 million benzodiazepine pills were unused 2013–2015.

Unused pills were more common amongst younger, low-income, and non-urban beneficiaries, and varied with beneficiaries' race/ethnicity and chronic condition history. Although some of these differences may reflect a greater share of cancer-related deaths among younger decedents and differences in prescribing practices across geographies, they are likely principally driven by different rates of opioid and benzodiazepine prescriptions across subpopulations (Han et al., 2017). For example, compared to aged Medicare beneficiaries and commercially

Table 2

MME and Counts of Unused Outpatient Prescription Opioid Pills at the Time of Death, By Demographic and Clinical Characteristics, 2006–2015.

Variable (No. decedents)	Median (interquartile range) of Unused MME per Pill per Decedent	No. of Unused Opioid Pills	Total MME of Unused Pills
Sex			
Female (1,138,324)	15 (8–29)	8,493,851	189,041,671
Male (1,567,906)	15 (6–27)	12,112,347	272,521,637
Age (years)			
< 65 (260,550)	15 (8–30)	5,169,957	147,069,266
≥ 65 (2,441,222)	15 (5–23)	15,436,305	314,494,657
Race/ethnicity			
Asian (45,641)	15 (8–29)	192,240	4,106,604
Black (298,342)	15 (8–29)	2,429,644	62,377,400
Hispanic (71,900)	15 (8–29)	321,325	6,180,604
North American Native (12,118)	15 (8–29)	133,985	3,017,935
Other (31,525)	15 (8–29)	177,516	3,921,053
Unknown (7392)	15 (8–29)	50,515	1,233,487
Non-Hispanic White (2,238,945)	15 (8–29)	17,301,038	380,726,841
HMO Enrollment ^a			
No (1,843,046)	15 (8–30)	13,951,377	314,679,769
Yes (855,467)	15 (6–23)	6,654,885	146,884,154
Dual Eligible			
No (2,440,346)	15 (8–30)	18,464,642	418,687,638
Yes (258,268)	15 (7–20)	2,141,621	42,876,285
Low Income Subsidy			
No (1,380,872)	15 (5–26)	8,077,181	165,976,573
Yes (1,323,018)	15 (8–28)	12,529,081	295,587,350
Non-urban Zip code			
No (2,000,165)	15 (8–24)	14,839,321	331,842,155
Yes (658,228)	15 (8–30)	5,766,942	129,721,768
Chronic Condition History ^b			
Post-traumatic stress disorder (18,094)	15 (8–30)	374,062	10,048,334
Drug use disorder (41,837)	15 (8–30)	692,331	16,940,650
Migraines or chronic headaches (66,503)	15 (8–30)	1,101,238	27,071,267
Personality disorders (43,731)	15 (8–30)	570,306	14,615,515
Fibromyalgia, chronic pain and fatigue (571,629)	15 (8–31)	7,321,678	182,549,740
Bipolar disorder (138,626)	15 (8–30)	1,580,837	37,942,209
Anxiety disorder (667,249)	15 (8–30)	6,530,038	149,735,717
Tobacco use disorder (418,917)	15 (8–30)	5,348,362	124,959,127
No chronic condition (252,941)	15 (6–23)	2,059,188	42,102,413
Cancer in Calendar Year ^c			
No (2,110,309)	15 (6–23)	16,001,770	345,671,380
Yes (586,956)	18 (8–33)	4,604,492	115,892,543
Hospice Use in Calendar Year			
No (1,469,216)	12 (5–23)	13,059,717	282,505,353
Yes (1,234,560)	20 (8–30)	7,546,545	179,058,570
Total (2,707,141)	15 (8–27)	20,606,262	461,563,923

^a HMO enrollment equals "Yes" if the number of months during the year of the beneficiary's death that received their Part A and Part B benefits through a managed care plan (i.e., a Medicare Advantage plan) instead of the traditional fee-for-service program was greater than 0, and equals "No" otherwise.

^b Chronic condition history is from a list of 62 specific chronic conditions for which the beneficiary ever met the Chronic Condition Warehouse criteria. We only present results for the subset of chronic conditions for which the percentage of decedents with unused opioid or benzodiazepine pills who had a history of that chronic condition exceeded 25 %.

^c Cancer in calendar year equals "Yes" if the beneficiary ever met the Chronic Condition Warehouse criteria for breast, colorectal, prostate, lung, or endometrial cancer, and equals "No" otherwise.

insured populations, Part D beneficiaries under 65 years old – who must have either a qualifying disability (receiving Social Security Disability Insurance for more than 24 months) or end-stage renal disease – have higher rates of opioid use (Jeffery et al., 2018). Though they only represent 15 % of the Medicare population, they account for over 80 % of Medicare opioid overdose deaths (Kuo et al., 2019). Similarly, the higher proportion of unused opioid and benzodiazepine prescriptions observed among patients with a history of mental illness, drug use disorders, and chronic pain is consistent with higher rates of opioid and benzodiazepine prescriptions and misuse in these patient populations (Kuo et al., 2016; National Institute on Drug Abuse, 2020). Likewise, the higher prevalence we observed among North American Natives and Non-Hispanic Whites are consistent with the disproportionate burden of opioid use disorder and overdose deaths these populations have experienced during the opioid epidemic (Friedman et al., 2019; Wilson et al., 2020). On the other hand, our results are not entirely consistent with previous research on variation in Medicare Part D opioid prescriptions across demographic subgroups. In particular, female gender and Black race were previously found to be associated with higher odds of opioid prescriptions (Kuo et al., 2016), whereas we observed lower prevalence of pills remaining after death in these subpopulations.

This analysis has several limitations. First, the extent to which decedents' unused medications contribute to the diverted or misused supply of prescription opioids and benzodiazepines is not known. We did not observe information regarding household members' use of opioids and benzodiazepines after death nor decedents' household composition, such as whether a decedent lived alone or had a next of kin who would be exposed to the remaining pills. However, without proper disposal the unused pills may be regarded as a potential diverted environmental supply regardless. Second, our estimate of the quantity of unused Part D prescription opioid and benzodiazepine pills remaining after death may be an undercount or over-count of overall remaining pills after death. For example, we are likely underestimating the number of unused opioid pills for beneficiaries utilizing hospice. In our sample, 45.7 % of decedents utilized hospice during their calendar year of death. Hospice patients overwhelmingly receive opioids and benzodiazepines, but Part D claims do not include hospice prescriptions. Similarly, Part D claims do not include prescriptions paid in cash or filled by alternative payers such as the Veterans Health Administration or Indian Health Services, potentially also contributing to an underestimate. Additionally, decedents may have previously accumulated unused pills from earlier completed prescriptions, particularly short-acting or "as-needed" rescue dose opioids (Bicket et al., 2017). As benzodiazepines were excluded from the standard Part D plan until 2013, we were unable to estimate their prevalence prior to 2013, though some beneficiaries accessed them through supplemental insurance plans or Medicaid. On the other hand, if patients accelerate opioid use at end-of-life relative to the prescribed dosing, then the unused supply could be inflated. We are unable to observe patients' use patterns before death. Third, we matched medications based on NDCs, which can change over time if manufacturers reuse them for new drugs. However, our results were unchanged when identifying opioid and benzodiazepine prescriptions based on their generic or brand name. Finally, although 72 % of Medicare enrollees are enrolled in Part D, enrollment in Part D is voluntary and thus Part D enrollees do not represent all Medicare beneficiaries, limiting generalizability (KFF, 2020).

For households that have accumulated unused medications, death presents an opportunity for comprehensive disposal. Unfortunately, disposal of opioids is very rarely addressed by providers, with patients and caregivers largely unaware of basic safety tenets including safe storage and disposal (Seehusen and Edwards, 2006). Further, it was illegal for pharmacies and hospices to take back controlled substances until Congressional action in 2010 and 2018, respectively. Interventions with potential to improve safe disposal include improving access to drop boxes (Maughan et al., 2016), drug buy-back programs (Liu et al., 2020), providing pre-paid return envelopes for voluntary disposal to mail order

pharmacies, routinely collecting unused medications on discharge from hospice, and staggering release of prescriptions near end-of-life to reduce quantity in the home (Maughan et al., 2016). The availability of controlled substance public disposal locations has dramatically improved in recent years, though drug take-back programs remain underused and thus ineffective (Egan et al., 2017), and non-urban locations remain notably underserved (GoogleMaps, 2020). Moreover, many families are unaware or unmotivated toward voluntary disposal, and policy reforms must be complemented by enhanced education for families. State prescription drug monitoring programs, which have demonstrated effectiveness in reducing overdoses (Haffajee et al., 2018), may pave the way politically for more intensive tracking of drug disposal. More research is warranted to assess risk of opioid and benzodiazepine misuse among household members and next of kin of decedents and on evidence-based interventions for ensuring safe disposal after death.

Contributors

All authors have materially participated in the research and/or article preparation. All authors have approved the final article.

Laura Van Metre Baum, MD: Study conception and design, Drafting of manuscript, Analysis and interpretation of data, Critical revision.

Emilie Bruzelius: Analysis and interpretation of data, Critical revision

Mathew Kiang, ScD: Analysis and interpretation of data, Critical revision

Keith Humphreys, PhD: Acquisition of data, Analysis and interpretation of data, Critical revision

Sanjay Basu, MD PhD: Acquisition of data, Analysis and interpretation of data, Critical revision

Aaron Baum, PhD: Study conception and design, Acquisition of data, Analysis and interpretation of data, Critical revision

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Declaration of Competing Interest

The authors have no competing interests or disclosures to declare.

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