

Nonbenzodiazepine Sleep Medication Use and Hip Fractures in Nursing Home Residents

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Importance: It is important to understand the relationship between sleep medication use and injurious falls in nursing home residents.

Objective: To conduct a case-crossover study to estimate the association between nonbenzodiazepine hypnotic drug use (zolpidem tartrate, eszopiclone, or zaleplon) and the risk for hip fracture among a nationwide sample of long-stay nursing home residents, overall and stratified by individual and facility-level characteristics.

Design and Setting: Case-crossover study performed in an academic research setting.

Participants: The study participants included 15 528 long-stay US nursing home residents 50 years or older with a hip fracture documented in Medicare Part A and Part D fee-for-service claims between July 1, 2007, and December 31, 2008.

Main Outcome Measures: Odds ratios (ORs) of hip fracture were estimated using conditional logistic regression models by comparing the exposure to nonbenzodiazepine hypnotic drugs during the 0 to 29 days before the hip fracture (hazard period) with the exposure during the 60 to 89 and 120 to 149 days before the hip fracture (control periods). Analyses were stratified by individual and facility-level characteristics.

Results: Among the study participants, 1715 (11.0%) were dispensed a nonbenzodiazepine hypnotic drug before the hip fracture, with 927 exposure-discordant pairs included in the analyses. The mean (SD) age of participants was 81.0 (9.7) years, and 77.6% were female. The risk for hip fracture was elevated among users of a nonbenzodiazepine hypnotic drug (OR, 1.66; 95% CI, 1.45-1.90). The association between nonbenzodiazepine hypnotic drug use and hip fracture was somewhat greater in new users (OR, 2.20; 95% CI, 1.76-2.74) and in residents with mild vs moderate to severe impairment in cognition (OR, 1.86 vs 1.43; $P = .06$), with moderate vs total or severe functional impairment (OR, 1.71 vs 1.16; $P = .11$), with limited vs full assistance required with transfers (OR, 2.02 vs 1.43; $P = .02$), or in a facility with fewer Medicaid beds (OR, 1.90 vs 1.46; $P = .05$).

Conclusions and Relevance: The risk for hip fracture is elevated among nursing home residents using a nonbenzodiazepine hypnotic drug. New users and residents having mild to moderate cognitive impairment or requiring limited assistance with transfers may be most vulnerable to the use of these drugs. Caution should be exercised when prescribing sleep medications to nursing home residents.

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IN 2006, MEDICARE PART D INSTITUTED a restrictive policy that excluded benzodiazepines from mandatory drug coverage. Following Medicare's restriction of benzodiazepine coverage, nonbenzodiazepine sleep medications (eg, zolpidem tartrate) have been increasingly used to manage insomnia in US nursing homes.¹ Although initially believed to be safer than benzodiazepines with respect to fall risk, a case-control study² demonstrates that the use of nonbenzodiazepine hypnotic drugs is associated with a 2-fold increased risk for hip fracture, and the results of a retrospective cohort study³ suggest that nonbenzodiazepine hypnotic drug initiation

is associated with a 1.7 to 2.2 times greater risk for fracture compared with short-acting benzodiazepine use.

See Invited Commentary at end of article

Despite the suggestion of harm documented in these studies, it is possible that the results can be partly explained by intrinsic differences between persons prescribed a sleep medication compared with persons not prescribed a sleep medication. It is important to understand whether the use of sleep medications themselves is associated with an increased risk for frac-

ture because withholding hypnotic drugs may also have detrimental consequences: in a large cohort study⁴ of nursing home residents, there was a stronger association between falls and untreated insomnia compared with insomnia effectively treated with a hypnotic drug.

To address these uncertainties, we examined the association between nonbenzodiazepine hypnotic drug use and the risk for hip fracture using a self-controlled, case-crossover study design among 15 528 national long-stay nursing home residents. In addition, we stratified analyses by individual characteristics (ie, cognitive performance, functional status, ability to transfer, urinary incontinence, and bed restraint use) and by facility-level characteristics (ie, high ratio of residents to staff and percentage of Medicaid beds) to identify subgroups that are at greatest risk for hip fracture when using a nonbenzodiazepine hypnotic drug.

METHODS

PARTICIPANTS

For our source population, Medicare Part A and Part D claims were linked to nursing home resident assessments using unique, individual identifiers.⁵ Among more than 9 million patients identified with a Medicare Part A fee-for-service claim between July 1, 2007, and December 31, 2008, we identified 127 917 having a diagnosis of hip fracture (**Figure 1**). Of those patients, 127 253 (99.5%) had been enrolled in Medicare for a minimum of 6 months, and 23 882 had resided in a nursing home during the 6 months before the diagnosis of hip fracture. Included in our sample were 15 626 participants (65.4%) who were enrolled in Medicare Part D with complete prescription drug information. We excluded 98 participants younger than 50 years for a final sample size of 15 528 participants.

CASE-CROSSOVER STUDY DESIGN

The case-crossover design was specifically developed to assess the effects of a transient exposure on an acute event.⁶ The exposure during a relevant period preceding the event (hazard period) is compared with the exposure during periods without an event (control periods) in the same individual. In our study, we compared the exposure (ie, possession of nonbenzodiazepine hypnotic drugs) during the 0 to 29 days before the hip fracture (hazard period) with the exposure during the 60 to 89 and 120 to 149 days before the hip fracture (control periods) for each participant (**Figure 2**). By comparing participants with themselves, the potential effects of time-fixed, unmeasured confounders between participants using and not using the drug are eliminated. It remains possible that a change in severity of illness within a person (ie, worsening insomnia) contributed to both dispensing of the drug and the risk for hip fracture.

HIP FRACTURE

Hip fractures were ascertained through Medicare Part A claims data and were defined as the first hospitalization with an *International Classification of Diseases, Ninth Revision* diagnosis of 820.xx (fracture of the neck of femur) or 733.14 (pathologic fracture of neck of femur) in the presence of a procedure code for surgical repair during the hospitalization.⁷ The estimated positive predictive value using this definition is 98%, and similar definitions have yielded a sensitivity of 96%.⁸

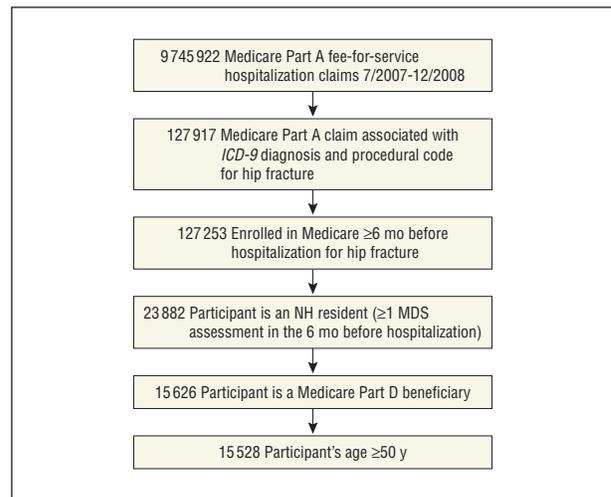


Figure 1. Selection process for participants in a case-crossover study of nonbenzodiazepine hypnotic drug use and hip fracture. *ICD-9* indicates *International Classification of Diseases, Ninth Revision*; MDS, Minimum Data Set; and NH, nursing home.

NONBENZODIAZEPINE SEDATIVE USE

Dispensings of a nonbenzodiazepine hypnotic drug (zolpidem, eszopiclone, or zaleplon) were ascertained using Medicare Part D pharmacy claims. For the primary analysis, we defined possession if the date of dispensing the hypnotic drug plus the days supplied fell within the hazard period or control periods.

We also considered the effect of “new use” of a nonbenzodiazepine hypnotic drug on the risk for hip fracture. New use was defined as a drug dispensing that occurred without drug possession in the preceding 60 days but with more remote possession possible. Although the use of nonbenzodiazepine hypnotic drugs was intermittent for all participants who contributed to the estimation of odds ratios (ORs), only a subset of patients were new users during the hazard period or control periods.

RESIDENT CHARACTERISTICS

The Minimum Data Set (MDS) is an instrument designed to measure quality and assess the individual needs of nursing home residents.⁹ The federal government mandates completion of the MDS for all residents in a certified Medicare or Medicaid nursing facility at the time of admission and then quarterly thereafter. The MDS is generally considered reliable and valid.^{10,11}

All resident characteristics, including those used to define subgroupings, were ascertained from the assessment (MDS, version 2.0; Centers for Medicare and Medicaid Services) closest to and preceding the control periods. Cognitive performance was ascertained using the validated Cognitive Performance Scale¹² and was categorized as normal or mild impairment (score range, 0-2) compared with moderate to severe impairment (score range, 3-6). Functional status was ascertained using the validated Activities of Daily Living Long Scale¹³ and was categorized as mild (score range, 0-7), moderate (score range, 8-20), or total or severe (score range, 21-28) impairment. Ability to transfer was categorized as independent (score, 0), requiring supervision or limited assistance (score range, 1-2), or requiring extensive or full assistance (score range, 3-4). Residents who were always continent or always incontinent of urine were grouped compared with residents who were intermittently incontinent. Bed restraint use was considered any use of a bed rail or side rail in the past 7 days.

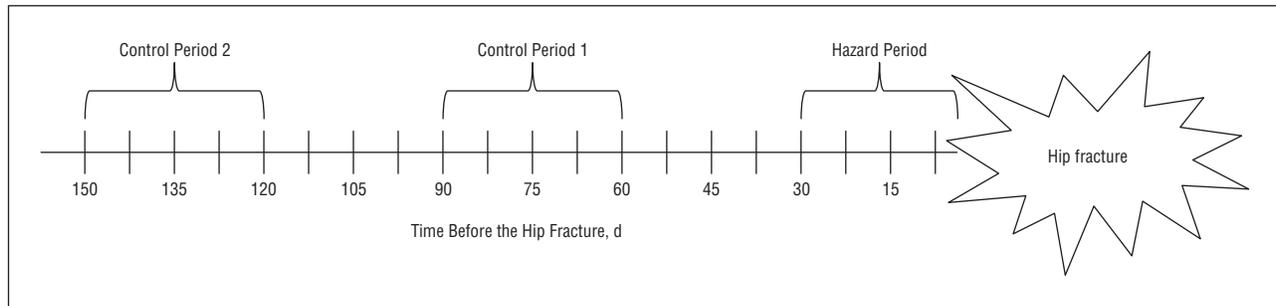


Figure 2. Case-crossover study design. We compared the exposure to nonbenzodiazepine hypnotic drugs during the 0 to 29 days before the hip fracture (hazard period) with the exposure during the 60 to 89 and 120 to 149 days before the hip fracture (control periods).

FACILITY-LEVEL CHARACTERISTICS

The Online Survey, Certification, and Reporting database (OSCAR) contains facility-level characteristics as obtained by a Department of Public Health surveyor. Estimates of facility-level characteristics using OSCAR are similar to data from the 1995 National Nursing Home Survey.¹⁴ For our study, facility-level characteristics were obtained using the OSCAR measure closest to and preceding the control periods and included the following characteristics, categorized as above or at or below the national median: ratio of residents to staff (total of registered nurse, licensed practical nurse, and certified nursing assistant hours per resident per day) and percentage of Medicaid beds.

STATISTICAL ANALYSIS

In the analysis of case-crossover studies, participants who are exposed in the hazard period or control periods (but not during both periods) contribute to the estimate of the OR.⁶ We used conditional logistic regression models (SAS, version 9.2; SAS Institute, Inc) to estimate ORs and 95% CIs of the risk for hip fracture in the 30 days following possession of a nonbenzodiazepine hypnotic drug compared with periods not documenting possession of a nonbenzodiazepine hypnotic drug. The resulting OR is interpretable as an incidence rate ratio.

Results of the case-crossover method can be sensitive to the classification of the exposure. Therefore, we considered an alternative, prespecified hazard period (0-14 days before the hip fracture), with corresponding control periods of 30 to 44 and 60 to 74 days before the hip fracture.

We performed analyses overall and stratified by individual and facility-level characteristics. For comparison of ORs within subgroups, we used the difference in the log OR between strata to calculate a *z* score and *P* values.

SENSITIVITY ANALYSES

We conducted 2 sensitivity analyses to test the validity of our findings. We addressed the concern that drugs affecting the risk for hip fracture (eg, antidepressants) could be coprescribed more often with nonbenzodiazepine hypnotic drug use compared with nonuse.¹⁵ To determine the degree of confounding that can be present by concomitant use of an antidepressant,¹⁶ we estimated the prevalence of the exposure to nonbenzodiazepine hypnotic drugs from our data (15.4%) and the prevalence of antidepressant use in the source data (state-level median, 38%),¹⁷ and we identified the association between antidepressant use (selective serotonin reuptake inhibitors) and the risk for hip fracture from the literature (OR, 2.0).¹⁸

The case-crossover method will provide spurious ORs when the prevalence of the exposure (ie, nonbenzodiazepine hypnotic drug use) changes during the observation period, as might

occur when the use of the drug increases in the general population. To understand the potential effect of this concern, we estimated the daily dispensing prevalence of nonbenzodiazepine hypnotic drugs among patients without a hip fracture who otherwise met eligibility criteria. These patients were assigned an index date sampled from index dates across calendar time in the case series. We then estimated the mean prevalence of the use of nonbenzodiazepine hypnotic drugs during the index hazard period and control periods for each resident without a hip fracture, and we calculated the mean difference of the prevalence estimates between the hazard period and control periods for each case.

RESULTS

Of 15 528 long-stay nursing home residents with hip fracture, 1715 (11.0%) had been dispensed a nonbenzodiazepine hypnotic drug. Characteristics of participants who used a nonbenzodiazepine hypnotic drug in the hazard period or control periods (but not in both periods) are summarized in **Table 1**. The mean (SD) age of participants was 81.0 (9.7) years, and 77.6% were female. There was a high prevalence of selected comorbidities, ranging from 6.8% for anemia to 49.9% for depression. Almost 40% of participants had moderate to severe cognitive impairment, and 65.4% had moderate impairment in functional status. The mean (SD) number of registered nurse, licensed practical nurse, or certified nursing assistant hours per resident per day was 3.4 (1.2) hours.

The risk for hip fracture within 30 days of possessing a nonbenzodiazepine hypnotic drug was elevated (OR, 1.66; 95% CI, 1.45-1.90) (**Table 2**). This elevated risk was similar when the hazard period was shortened to 15 days (OR, 1.47; 95% CI, 1.24-1.74). When new users of a nonbenzodiazepine hypnotic drug were considered separately, the risk for hip fracture was greatest in the first 15 days before the hip fracture (OR, 2.20; 95% CI, 1.76-2.74).

There was a trend toward an increased risk for hip fracture among nonbenzodiazepine hypnotic drug users having normal or mild impairment in cognition (OR, 1.86; 95% CI, 1.56-2.21) compared with those having moderate to severe impairment (OR, 1.43; 95% CI, 1.15-1.77) (*P* = .06) (**Table 3**). Residents having moderate impairment in functional status (OR, 1.71; 95% CI, 1.44-2.02) tended to be at greater risk for hip fracture when using a hypnotic drug compared with residents having

Table 1. Characteristics of 927 Nursing Home Residents With a Hip Fracture and Discordant Exposure to Nonbenzodiazepine Hypnotic Drugs Across Hazard and Control Periods (2007-2009)

Characteristic	Value
Individual Characteristics	
Age, mean (SD), y	81.0 (9.7)
Female sex, %	77.6
Race/ethnicity, %	
White, not Hispanic	89.7
Black, not Hispanic	3.3
Hispanic	4.5
Other	2.6
Comorbidity, %	
Anemia	6.8
Arthritis	8.9
Congestive heart failure	20.7
Depression	49.9
Diabetes mellitus	31.7
Stroke	15.2
Cognitive status, %	
Normal or mild impairment	60.4
Moderate to severe impairment	39.6
Functional status, %	
Mild impairment	24.6
Moderate impairment	65.4
Total or severe dependence	10.0
Ability to transfer, %	
Independent	18.1
Requires supervision or limited assistance	45.2
Requires extensive or full assistance	36.7
Urinary incontinence, %	
Always continent or always incontinent	63.5
Intermittently incontinent	36.5
Bed restraints used, %	23.3
Facility-Level Characteristics, Mean (SD)	
No. of RN, LPN, and CNA hours per resident per day	3.4 (1.2)
% of Medicaid beds	58.6 (21.9)

Abbreviations: CNA, certified nursing assistant; LPN, licensed practical nurse; RN, registered nurse.

Table 2. Effect of Nonbenzodiazepine Hypnotic Drug Use on the Risk for Hip Fracture in a Case-Crossover Study of Nursing Home Residents

Hazard Period	No. of Exposed Participants	Odds Ratio (95% CI)
Any nonbenzodiazepine hypnotic drug use		
0-15 d Before the hip fracture	622	1.47 (1.24-1.74)
0-30 d Before the hip fracture	927	1.66 (1.45-1.90)
New nonbenzodiazepine hypnotic drug use		
0-15 d Before the hip fracture	366	2.20 (1.76-2.74)
0-30 d Before the hip fracture	564	1.90 (1.60-2.26)

total or severe functional impairment (OR, 1.16; 95% CI, 0.75-1.79) ($P = .11$). Residents who used a hypnotic drug and required limited assistance with transfers (OR, 2.02; 95% CI, 1.65-2.48) tended to be at greater risk for hip fracture compared with residents who were independent (OR, 1.46; 95% CI, 1.06-2.01) ($P = .09$) or required full assistance with transfers (OR, 1.43; 95% CI, 1.14-1.79) ($P = .02$). No difference was noted in the risk for hip fracture among hypnotic drug users when stratified by urinary incontinence or bed restraint use.

Residents using a nonbenzodiazepine hypnotic drug in a facility with fewer Medicaid beds (OR, 1.90; 95% CI, 1.57-2.31) were at a greater risk for hip fracture com-

pared with those residing in a facility with more Medicaid beds (OR, 1.46; 95% CI, 1.20-1.77) ($P = .05$). Little difference was noted in the risk for hip fracture among hypnotic drug users when stratified by the ratio of residents to staff.

Under the assumptions described in the "Sensitivity Analyses" subsection of the "Methods" section for confounding by time-dependent use of antidepressants to explain the primary effect of nonbenzodiazepine hypnotic drug use on hip fracture (OR, 1.66), antidepressants must have been greater than 10 times more commonly used during periods of nonbenzodiazepine hypnotic drug use relative to periods of nonuse. Given the high baseline

Table 3. Effect of Nonbenzodiazepine Hypnotic Drug Use on the Risk for Hip Fracture as Stratified by Individual and Facility-Level Characteristics

Variable	No. of Exposed Participants ^a	Odds Ratio (95% CI)	P Value
Individual Characteristics			
Cognitive status			
Normal or mild impairment	558	1.86 (1.56-2.21)	.06
Moderate to severe impairment	366	1.43 (1.15-1.77)	
Functional status			
Mild impairment	227	1.84 (1.40-2.42)	.65
Moderate impairment	604	1.71 (1.44-2.02)	Reference
Total or severe dependence	92	1.16 (0.75-1.79)	.11
Ability to transfer			
Independent	167	1.46 (1.06-2.01)	.09
Requires supervision or limited assistance	417	2.02 (1.65-2.48)	Reference
Requires extensive or full assistance	339	1.43 (1.14-1.79)	.02
Urinary incontinence			
Always continent or always incontinent	587	1.70 (1.43-2.01)	.79
Intermittently incontinent	337	1.63 (1.30-2.04)	
Bed restraints used			
No bed rails or side rails	709	1.65 (1.41-1.93)	.78
Bed rails or side rails	215	1.73 (1.30-2.31)	
Facility-Level Characteristics			
No. of RN, LPN, and CNA hours per resident per day			
High	463	1.87 (1.52-2.27)	.11
Low	457	1.50 (1.23-1.82)	
% of Medicaid beds			
High	453	1.46 (1.20-1.77)	.05
Low	468	1.90 (1.57-2.31)	

Abbreviations: CNA, certified nursing assistant; LPN, licensed practical nurse; RN, registered nurse.
^aDuring the 30-day hazard period.

prevalence of antidepressant use (state-level median, 38%), this difference across periods is implausible, and confounding by antidepressant use could not explain the observed OR.

In **Figure 3**, part B shows no temporal trends in nonbenzodiazepine hypnotic drug use across the source population, while part A shows an increase in the prevalence of hypnotic drug use in the 30 days before the hip fracture. Therefore, temporal trends in hypnotic drug use could not explain the observed OR.

COMMENT

Our results from a large sample of US long-stay nursing home residents demonstrate a 66% increased risk for hip fracture within 30 days of using a nonbenzodiazepine hypnotic drug. The risk for hip fracture seems to be greatest in the first 15 days among new users. Residents requiring limited assistance with transfers seem to be particularly vulnerable to hypnotic drug use with respect to the risk for hip fracture. Although not statistically significant, residents with normal or mild impairment in cognition and residents with moderate functional impairment also seem to be more vulnerable to the use of these drugs.

Our results are consistent with prior studies. In a case-control study,² the use of zolpidem was associated with almost a 2-fold increased risk for hip fracture (OR, 1.95; 95% CI, 1.09-3.51). In a cohort study,³ the risk for nonvertebral fracture or dislocation was greatest in the 16 to 30 days following drug initiation

(rate ratio, 3.58; 95% CI, 1.90-6.75). These studies acknowledge that the risk for fracture associated with hypnotic drug use may have been somewhat overestimated given the inability to completely account for between-person confounding. Our study used a self-controlled, case-crossover design in an effort to minimize this type of confounding, and we found that the risk for hip fracture associated with nonbenzodiazepine hypnotic drug use was similar (OR, 1.66).

In our study, 11.0% of nursing home residents with a hip fracture had used a nonbenzodiazepine hypnotic drug, and we estimate that 15.4% of all nursing home residents used a nonbenzodiazepine hypnotic drug during the study period. This is comparable to or slightly higher than the proportion of nursing home residents who used a benzodiazepine in the 2004 National Nursing Home Survey (13%).¹⁹ Given the additional cost and similar unfavorable adverse effect profile of the newer drugs, restrictive policies on benzodiazepines that may have unintentionally caused an increase in nonbenzodiazepine hypnotic drug use in the nursing home should be carefully considered.

With the exploration of vulnerable subgroups, our study adds to the existing literature on hypnotic drug use and the risk for hip fracture. Because nonbenzodiazepine hypnotic drug use acutely affects memory, attention, and balance,^{20,21} we hypothesized that residents with cognitive and functional impairment would be at greater risk for hip fracture when using these drugs. Notably, our results suggest that residents with mild impairment in cognition who are using hypnotic

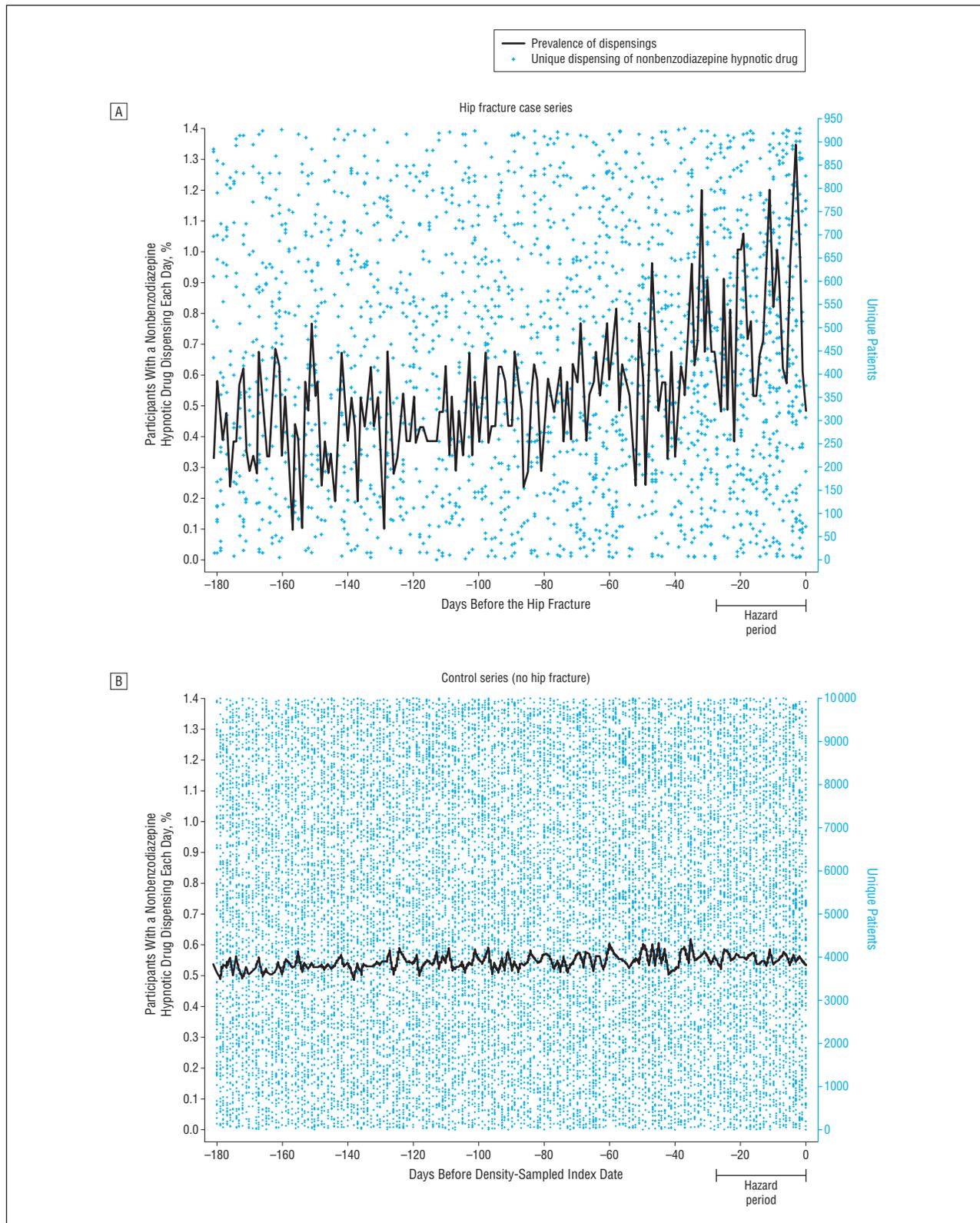


Figure 3. Density and daily prevalence of dispensings of nonbenzodiazepine hypnotic drugs. A, In the 180 days before the hip fracture for the case series. B, In the 180 days before a density-sampled index date for 10 000 noncases.

drugs are at greater risk for hip fracture. Residents with greater cognitive impairment may be less mobile and require more assistance with care. Previous studies^{22,23} have found that the ability to ambulate and

transfer independently is associated with an increased risk for fracture in frail community dwellers and nursing home residents. The results of our study also suggest that nursing home residents requiring limited

assistance with transfers are more vulnerable to hypnotic drugs with respect to fracture risk.

Many falls in the nursing home occur at night in the setting of toileting,²⁴ and urinary continence²⁵ or intermittent urinary incontinence²³ represent risk factors for hip fracture in nursing home residents. Bed restraint use, including bed rails and side rails, may also increase the risk for injurious falls.²⁶ We hypothesized that hypnotic drug users who are intermittently incontinent of urine or who use bed restraints would be at greatest risk for hip fracture, yet surprisingly we did not find a differential effect of hypnotic drug use on the risk for hip fracture based on these factors.

Facility-level characteristics, including a high ratio of residents to staff, have been associated with greater fall rates among some elderly,²⁷ and we expected to find a differential effect of hypnotic drug use on the risk for hip fracture by these factors. We found no difference in the association of hypnotic drug use based on the ratio of residents to staff, but we observed that residents using hypnotic drugs in a facility with fewer Medicaid beds were at greater risk for hip fracture when using these drugs. It is possible that this finding could be explained by chance.

Our study is the first to date to use a self-controlled, case-crossover study design to determine the effects of nonbenzodiazepine hypnotic drug use on the risk for hip fracture. Additional strengths of the study include a large sample of US nursing home residents with prescription drug data and functional characteristics available.

This study has some limitations. First, we did not consider nonbenzodiazepine hypnotic drug dosage, and residents dispensed higher doses may be at greater risk. Second, because traditional benzodiazepines are covered under Medicaid services, we are unable to consider whether interactions with benzodiazepines further increase the risk for fracture. Third, our study excluded 34.6% of residents who otherwise met eligibility criteria but were not enrolled in Medicare Part D. Compared with the study participants, residents not enrolled in Medicare Part D were more likely to be male (30.2% vs 22.4%), have normal or mild impairment in cognition (62.2% vs 47.1%), and require full assistance with transfers (43.4% vs 37.4%). Given that we performed stratified analyses, we do not expect that these differences would affect the generalizability of our results to residents without Medicare Part D coverage.

Fourth, we are unable to completely separate the effects of the hypnotic drug use from the associated medical condition (ie, insomnia) or a worsening in the medical condition with respect to the risk for hip fracture. This form of confounding by indication or time-dependent confounding is not unique to our study but applies to all observational pharmacoepidemiologic studies.²⁸ Our sensitivity analysis of antidepressant users suggests that at least unmeasured, time-varying confounders (eg, depressive symptoms and antidepressant use) are unlikely to explain our results. Regardless of our ability to tease out whether it is the underlying medical illness or sleep medication use that is resulting in an increased risk for hip fracture, the implications of our findings remain that nursing home residents using nonbenzodiazepine hypnotic

drugs should be closely monitored for falls and screened for osteoporosis in an effort to prevent fractures in the nursing home setting.

In summary, nursing home residents are at an increased risk for hip fracture when using nonbenzodiazepine hypnotic drugs. Given the high prevalence of hypnotic drugs in this setting (15%), the moderate increase in the risk for fracture is of clinical significance. Nursing home residents who may be the most vulnerable to nonbenzodiazepine hypnotic drug use include new users and residents having mild impairment in cognition and those requiring limited assistance with transfers. Caution should be exercised when prescribing nonbenzodiazepine hypnotic drugs to nursing home residents.

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INVITED COMMENTARY

What's to Blame for Falls and Fractures? Poor Sleep or the Sleeping Medication?

Sleep in nursing homes is both cherished yet fleeting. Most nursing home residents complain about the quality of their sleep,¹ which is notable for multiple nighttime awakenings, frequent daytime naps, and a high percentage of time spent awake in bed.² This fragmented nature of sleep can be attributed to multiple causes, including a high prevalence of primary sleep disorders (eg, central sleep apnea) and a care environment that pays little attention to sleep quality and structure.³

In response, physicians attempt to palliate this symptom with prescriptions of hypnotic drugs, resulting in high rates of use in this frail population. Approximately 13% of nursing home residents in 2004 used a benzodiazepine hypnotic,⁴ despite the risks for falls and fractures implicated with the use of these agents. Newer nonbenzodiazepine hypnotics (eg, zolpidem tartrate, zaleplon, and eszopiclone) are being used more often but have not been extensively studied in the long-term care setting. However, these agents have been shown in community-dwelling adults to impair balance compared with placebo,⁵ as well as being associated with falls and hip fractures.⁶

In this issue of the journal, Berry and colleagues⁷ give us further evidence of the danger of nonbenzodiazepine hypnotic drug use in nursing home residents. This study revealed that, among elderly Medicare patients residing

in nursing homes, 11.0% were prescribed a nonbenzodiazepine hypnotic within 150 days of a hip fracture. For their main analysis, the authors compared the use of nonbenzodiazepine hypnotic drugs during a hazard period (within 30 days before a hip fracture) with that during control periods (60-89 and 120-149 days before the hip fracture) for each individual patient. The result was a significant increased risk (odds ratio, 1.66; 95% CI, 1.45-1.90) in hip fracture within 30 days of using a nonbenzodiazepine hypnotic drug.

The authors minimized the potential effects of time-fixed unmeasured confounders by the use of a self-controlled, case-crossover study design. However, symptoms, such as sleep difficulties, are rarely static in time for individual patients. Therefore, we are left with the nagging question of whether it is poor sleep or the pharmacologic treatment of a worsening sleep disturbance that put these individuals at risk for hip fracture. Previous literature is somewhat mixed when attempting to answer this question because most studies that have implicated hypnotics as independent risk factors for falls and fractures do not account for the insomnia as a confounding variable (confounding by indication).

One study⁸ that accounted for insomnia included 34 163 elderly nursing home residents. Untreated insomnia was significantly associated with falls after adjustment for multiple potential confounders. However,