Prevalence of Long-Term Opioid Use in Long-Stay Nursing Home Residents

Jacob N. Hunnicutt, MPH, Stavroula A. Chrysanthopoulou, PhD,* Christine M. Ulbricht, PhD,* Anne L. Hume, PharmD,†‡ Jennifer Tjia, MD,* and Kate L. Lapane, PhD**

BACKGROUND/OBJECTIVES: Overall and long-term opioid use among older adults have increased since 1999. Less is known about opioid use in older adults in nursing homes (NHs).

DESIGN: Cross-sectional.

SETTING: U.S. NHs (N = 13,522).

PARTICIPANTS: Long-stay NH resident Medicare beneficiaries with a Minimum Data Set 3.0 (MDS) assessment between April 1, 2012, and June 30, 2012, and 120 days of follow-up (N = 315,949).

MEASUREMENTS: We used Medicare Part D claims to measure length of opioid use in the 120 days from the index assessment (short-term: ≤30 days, medium-term: >30–89 days, long-term: ≥90 days), adjuvants (e.g., anticonvulsants), and other pain medications (e.g., corticosteroids). MDS assessments in the follow-up period were used to measure nonpharmacological pain management use. Modified Poisson models were used to estimate adjusted prevalence ratios (aPR) and 95% confidence intervals (CI) for age, gender, race and ethnicity, cognitive and physical impairment, and long-term opioid use.

RESULTS: Of all long-stay residents, 32.4% were prescribed any opioid, and 15.5% were prescribed opioids long-term. Opioid users (versus nonusers) were more commonly prescribed pain adjuvants (32.9% vs 14.9%), other pain medications (25.5% vs 11.0%), and nonpharmacological pain management (24.5% vs 9.3%). Long-term opioid use was higher in women (aPR = 1.21, 95% CI = 1.18–1.23) and lower in racial and ethnic minorities (non-Hispanic blacks vs whites: APR = 0.93, 95% CI = 0.90–0.94) and those with severe cognitive impairment (vs no or mild impairment, aPR = 0.82, 95% CI = 0.79–0.83).

CONCLUSION: One in seven NH residents was prescribed opioids long-term. Recent guidelines on opioid prescribing for pain recommend reducing long-term opioid use, but this is challenging in NHs because residents may not benefit from nonpharmacological and nonopioid interventions. Studies to address concerns about opioid safety and effectiveness (e.g., on pain and functional status) in NHs are needed. **J Am Geriatr Soc 66:48–55, 2018.**

Key words: opioids; pain management; nursing homes; pain adjuvants

In the United States, prescription opioid use quadrupled to more than 240 million prescriptions annually from 1999 to 2010.[1] At the same time, rates of opioid misuse, abuse, addiction, and fatal and nonfatal overdoses increased for younger and older adults.[2–5] In response to this epidemic, the Centers for Disease Control and Prevention (CDC) released guidelines for managing chronic pain that caution against opioid use and warn that the benefits for improving pain and function must outweigh the risks when prescribing opioids.[6] The short-term effectiveness of opioids for pain management has been documented.[7,8] No study has demonstrated that long-term opioid use (≥3 months) is effective, while many studies have documented risks (e.g., falls, fractures, overdoses).[9] Despite this, long-term opioid use has increased in community-dwelling older adults.[10,11] To our knowledge, no studies have described long-term opioid use in older adults living in nursing homes (NHs).

Managing pain in NHs is challenging, with many residents having their pain undertreated[12–15] Prescribers must balance the risks associated with untreated or undertreated pain (e.g., dependence in activities of daily living anxiety, depression)[16–18] with potential risks of opioids. Opioids are prescribed to 60% of NH residents in persistent pain.[14,19] Older NH residents may be uniquely vulnerable

From the *Department of Quantitative Health Sciences, University of Massachusetts Medical School, Worcester, Massachusetts; †Department of Family Medicine, Alpert Medical School, Brown University, Memorial Hospital of Rhode Island, Providence, Rhode Island; and ‡Department of Pharmacy Practice, College of Pharmacy, University of Rhode Island, Kingston, Rhode Island.

Address correspondence to Jacob N. Hunnicutt, Department of Quantitative Health Sciences, University of Massachusetts Medical School, 55 Lake Road North, Worcester, MA 01655. E-mail: jacob.hunnicutt@umassmed.edu

DOI: 10.1111/jgs.15080

0002-8614/18/$15.00

to the sedating side effects of opioids (even at therapeutic doses) and adverse drug events because of their older age, greater frailty, and higher burden of comorbidities and polypharmacy than in community-dwelling older adults,[20–23] yet little is known about how opioids and concurrent pharmacological and nonpharmacological therapies for pain are being used in NHs despite the potential harms associated with long-term opioid use.[6,9]

Opioid prescribing guidelines and national campaigns have largely focused on younger adults and community-dwelling older adults and may not be applicable to NH residents despite the burden of pain and extensive analgesic use in this population.[6,24–26] We conducted this study to estimate the prevalence of overall and long-term opioid use, describe patterns of opioid and other pharmacological and nonpharmacological pain management by length of opioid use, and describe variation in long-term opioid use by key resident characteristics.

METHODS

Study Design and Data Sources

This cross-sectional study (approved by the University of Massachusetts Medical School Internal Review Board) used routinely collected, federally required administrative data from 2012 for all NH residents in Medicare- and Medicaid-certified NHs (Minimum Data Set (MDS) 3.0; covering ~96% of U.S. NHs) merged with facility characteristics data (Certification and Survey Provider Enhanced Reporting) and pharmacy claims (Medicare Part D). The MDS 3.0 is a standardized assessment conducted by trained, registered nurses and consists of more than 400 items to assess residents' health including medical conditions, cognitive and physical functioning, and pain and pain management.[27–29] Based on medical record review and interviews with staff and direct caregivers, assessments are conducted at admission and quarterly thereafter. Measures have demonstrated validity and reliability (kappa≥0.78 for pain management measures).[27]

Study Sample

Our cohort included Medicare beneficiaries who were long-stay residents (>100 consecutive days in NH) and had a MDS assessment between April 1, 2012, and June 30, 2012 (n = 602,122). The first eligible MDS assessment was selected. Long-stay residents were included because they generally require extensive, long-term assistance from NHs to manage their chronic disabilities.[30] After restricting to those aged 65 and older without a cancer diagnosis or receiving hospice care, 315,949 residents met inclusion and exclusion criteria applied for practical purposes (e.g., missing data; Supplementary Figure S1).

Opioid Use

We were conceptually interested in opioid use during 120 days of follow-up, which we operationalized using Medicare Part D claims. Part D claims provided information on the generic drug name (used to identify opioids), prescription fill date, days' supply, dosage form, and dosage strength. Opioids were classified according to their duration of action (short vs long acting). The number of prescribed opioids during the 120 days of follow-up was calculated. Dosage form was categorized as oral, injected, transdermal, or other.

We estimated cumulative days of opioid use during the 120-day study period based on opioid prescription fill dates plus days' supply, assuming that the opioid was used on the fill date and daily for as long as the medication was prescribed.[31] We assumed that residents with overlapping opioid prescriptions (e.g., filling a second opioid prescription with ≥1 days of opioid use still remaining from the previous prescription) used both medications simultaneously as prescribed. We categorized opioid use as long-term (≥90 days cumulative use during the 120 days)[32,33], medium-term (31–89 cumulative days), and short-term (1–30 days). We categorized the average daily dose in oral morphine equivalents (OMEs) using recent CDC guidelines as less than 50 mg, 50 to 89 mg, and 90 mg or more OMEs per day.[6,34]

Part D claims provide no information on the administration of pain medications. Although not specific to opioids, MDS assessments during follow-up (items J0100A and J0100B) were used to broadly describe pain management regimens in the preceding 5 days as scheduled or as needed (PRN).

Pain Management and Other Medications

Part D claims provided information on total number of nonopioid medications, alternative analgesics, pain adjuvants prescribed during the 120-day follow-up. Non-opioid pharmacotherapies included prescribed nonsteroidal anti-inflammatory drugs (NSAIDS; excluding aspirin). The American Geriatrics Society 2009 guidelines[26] were used to identify pain adjuvants and other medications used for pain.

MDS assessments during follow-up provided information on potentially contraindicated psychopharmacological medication use in the 7 days preceding the MDS (anxiolytics, hypnotics).[6] We used the MDS because Part D did not cover benzodiazepines in 2012. We also measured the percentage of residents receiving two or more antipsychotics, anxiolytics, or hypnotics because concurrent use of two or more central nervous system–active medications with opioids can increase the risk of falls and fractures beyond that of opioid use alone.[9,35]

Guidelines recommend that persons receiving opioids receive nonpharmacological interventions.[6] MDS 3.0 item J0100C documented receipt of nonpharmacological pain management in the 5 days before the assessment.[27]

Resident Characteristics

Information on age (65–74, 76–84, ≥85), gender, race and ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, Asian, other), physical impairment, and cognitive impairment, which have been documented to influence opioid use,[12–16,36] came from the MDS. Physical impairment was measured using the MDS activity of daily living (ADL) scale.[37] Cognitive impairment was classified using CMS definitions.[38] We also evaluated persistent (pain

lasting ≥3 months),[26] and intermittent pain.[15] We considered resident characteristics that might be potential confounders, including length of NH stay (<1, 1–2, 2–3, ≥3 years), marital status (married vs other), comorbidities known to cause pain (e.g., arthritis, fractures), and total comorbidity burden (based on MDS 3.0 Section I; categorized into quartiles).

Analysis

Descriptive statistics were used to summarize resident characteristics by age group, medication use and characteristics of use by length of opioid use during follow-up, and length of opioid use by resident characteristics. Modified Poisson models with robust variance estimation (using generalized estimating equations and exchangeable correlation structure) were used to estimate crude and adjusted prevalence ratios (aPRs) with 95% confidence intervals (CIs) for resident characteristics and long-term opioid use.[39] Adjusted analyses included state of NH residence and all resident characteristics. We conducted analyses restricted to residents in persistent pain to provide further information on this vulnerable subgroup and to compare our results with those of prior studies.[12,14,15]

Supplemental analyses examined potential selection bias due to loss to follow-up by estimating the prevalence of any opioid use in those who were censored (excluding those who died or received hospice care).

RESULTS

The mean age of long-stay residents was 84.4 ± 8.7; 76.2% were women, and 80.6% were non-Hispanic white. Median length of stay of was 2.1 years (interquartile range (IQR) 1.3–3.6; Table 1). Most residents were moderately or severely physically or cognitively impaired or both, with a higher prevalence of severe cognitive impairment and dementia in older age groups. More than 40% of residents had seven or more comorbidities, and painful comorbidities, including arthritis (32.8%; more prevalent in older groups), anxiety (25.8%), depression (54.5%), and diabetes mellitus (31.6%; more prevalent in younger groups) were common. Persistent pain occurred in 15.5% of residents and intermittent pain in 16.1%.

Thirty-two percent were prescribed any opioids during the 120 day follow-up period, with 10.4%, 6.5%, and 15.5% of all participants prescribed opioids for short-, medium-, and long-term, respectively (Table 2). The most common opioids were hydrocodone (52.6%; see Supplementary Table S1 for further detail), tramadol (31.8%), fentanyl (12.5%), and oxycodone (11.8%). The majority of short- (99.0%), medium- (94.5%), and long- (65.7%) term opioid users were prescribed short-acting opioids only. Long-term opioid users were prescribed more long-acting opioids (34.1% of long-term vs 1.0% of short-term users) and had higher average daily doses (16.0% of long-term users had average daily dose ≥90 mg OME/day vs 3.3% of short-term users). The majority of opioid prescriptions were oral formulations, although nearly one-quarter of long-term users received transdermal prescriptions (fentanyl). The majority of long-term users received scheduled analgesics (97.0%), with 29.5% receiving PRN analgesics. Scheduled analgesic use was lower for short-term (scheduled: 43.5%, PRN: 42.0%) and medium-term users (scheduled: 77.6%, PRN: 47.6%).

The median number of unique nonopioid medications prescribed during 120 days was 12 in opioid users (IQR 8–16) and 9 in nonusers (IQR 6–12). When examining other medications used during follow-up (Table 2), 16.1% of residents prescribed opioids had stand-alone prescription NSAID claims, versus 8.4% of nonusers. Pain adjuvants (32.9% of opioid users) and other medications used for pain (25.5% of opioid users) were more than twice as common in opioid users as in nonusers. Anxiolytics and hypnotics were more common in opioid users than nonusers (31.6% vs 17.5%), as were two or more psychopharmacologics (13.1% vs 8.0%) (see Supplementary Table S2 for specific medications).

Nine percent of nonusers, 19.8% of short-term users, 26.0% of medium-term users, and 25.4% of long-term users received nonpharmacological pain management.

Women (vs men; overall: 34.1% vs 26.8%; long-term: 16.7% vs 11.6%), non-Hispanic whites (vs non-Hispanic blacks; overall: 33.9% vs 27.3%; long-term: 16.6% vs 11.7%), those with no or mild cognitive impairment (vs severe impairment; overall: 44.5% vs 25.4%; long-term: 21.9% vs 12.1%), and those in persistent pain (vs no pain; overall: 69.8% vs 20.5%; long-term: 35.6% vs 9.6%) had greater overall opioid and long-term opioid use (Figure 1).

Table 3 shows that resident factors associated with greater prevalence of long-term opioid use included being severely physically impaired (vs no or mild impairment; aPR = 1.25, 95% CI = 1.22–1.28) or women (vs men; aPR = 1.21, 95% CI = 1.18–1.23). Prevalence of long-term use was lower in racial and ethnic minorities than in non-Hispanic whites: non-Hispanic blacks (aPR = 0.93 95% CI = 0.90–0.95), Hispanics (aPR = 0.84, 95% CI = 0.80–0.88), Asians (aPR = 0.69, 95% CI = 0.61–0.77), and other (aPR = 0.89, 95% CI = 0.80–0.99). Prevalence of long-term opioid use was lower in those with moderate to severe cognitive impairment (severe vs no or mild; aPR = 0.82, 95% CI = 0.79–0.83). When restricting to residents in persistent pain, aPRs were qualitatively similar albeit attenuated for gender and physical impairment (Supplementary Table S3).

In supplemental analyses of opioid use in residents excluded because of censoring (other than death or hospice), overall opioid use was higher than in our analytical sample (41.8% vs 32.4%; Supplementary Text S1).

DISCUSSION

We found that nearly one-third of long-stay residents in 2012 were prescribed opioids during 120 days of follow-up, with one in seven residents prescribed opioids long-term. We identified interesting patterns of nonopioid analgesic, adjuvant, and nonpharmacological pain management use in opioid users and nonusers that begin to fill knowledge gaps in NH resident pain management. Although we reported a lower prevalence of persistent pain than previous studies,[12,40] the extent to which this is due to the opioids, other medications, or methodologic differences cannot be disentangled.[15] Given that no studies

Table 1. Characteristics of Long-Stay Nursing Home Medicare Beneficiaries in 2012, Overall and Stratified According to Age in Years (N = 315,949)

Characteristic	Overall, N = 315,949	65–74, n = 50,005	75–84, n = 95,297	≥85, n = 170,647
	%			
Women	76.2	55.5	70.8	85.3
Race and ethnicity				
Non-Hispanic white	80.6	73.2	77.3	84.6
Non-Hispanic black	12.6	19.4	14.5	9.5
Hispanic	4.7	5.5	5.8	3.9
Asian	1.5	1.2	1.6	1.5
Other	0.6	0.8	0.8	0.5
Married	15.7	18.6	21.1	11.8
Length of nursing home stay, years				
<1	17.2	17.9	18.6	16.2
1–2	31.1	31.7	32.5	30.1
2–3	19.4	18.2	19.4	19.9
>3	32.3	32.3	29.6	33.8
Physical impairment[a]				
Moderate	50.9	46.6	49.2	53.2
Severe	25.5	24.3	26.4	25.4
Cognitive impairment[b]				
Moderate	29.4	29.2	29.8	29.3
Severe	44.7	29.8	42.1	50.6
Comorbidities				
Arthritis	30.5	20.6	27.6	35.0
Osteoporosis	19.5	11.6	16.6	23.4
Hip fracture	1.1	0.5	1.0	1.3
Other fracture	1.6	1.1	1.4	1.7
Diabetes mellitus	31.6	42.6	37.7	24.9
Dementia	64.5	45.7	64.5	70.0
Parkinson's disease	7.2	7.7	9.4	5.9
Pressure ulcers	3.0	3.2	3.0	2.9
Anxiety	25.8	26.9	27.0	24.7
Depression	54.5	57.2	56.9	52.5
Asthma, chronic obstructive lung disease, chronic lung failure	18.3	22.6	19.8	16.2
Respiratory failure	0.6	1.3	0.6	0.3
Renal failure	7.8	8.0	7.8	7.8
>8 comorbidities[c]	19.1	21.0	20.7	17.8
Pain[d]				
Intermittent	16.1	15.7	16.0	16.2
Persistent	15.5	18.4	16.4	14.1

Columns may not add to 100% because of rounding.

[a]Defined using the Minimum Data Set (MDS) activity of daily living Self-Performance Hierarchy Scale (range 0–7): none to mild (0–2), moderate (3–4), severe (5–6).

[b]Defined using the Brief Interview for Mental Status (BIMS; range 0–15) or Cognitive Performance Scale (CPS; range 0–7): no to mild impairment (BIMS 13–15, CPS 0–2), moderate (BIMS 8–12, CPS 3–4), severe (BIMS 0–7, CPS 5–6)

[c]Total comorbidity burden was defined by summing all comorbidities in MDS 3.0 section I on index assessment and categorizing into quartiles. Only top quartile is displayed.

[d]Any self-reported or staff-assessed pain on the index MDS assessment and a preceding MDS assessment (90 ± 20 days before the index assessment) was categorized as persistent pain. Any pain on one assessment (but not the other) was categorized as intermittent pain.

have demonstrated the long-term effectiveness of opioids and concerns that NH residents may be more vulnerable to adverse side effects of opioids,[9,20–23] our findings inform discussions about improving opioid use with other pain management strategies in NHs.

The high prevalence of long-term opioid use in NHs is more than twofold the prescribing seen in community-dwelling older adults.[10,11] This may be warranted due to residents' pain and painful comorbidity burden and the historical undertreatment of pain in this care setting,[12–16,36] which has distressing consequences including poor quality of life, decreased physical functioning, anxiety, and depression.[16–18] Similar to community-dwelling populations, most residents received only short-acting opioids.[41] This may be insufficient for managing chronic pain, which may require scheduled, long-acting opioids for adequate pain management.[26] However, the risks of opioid use are not adequately understood in NHs, as few studies of opioid effectiveness and safety have included NH residents.[9,42] The high frequency of fentanyl initiation in opioid-naïve residents also raises concerns about suboptimal opioid prescribing.[43,44] In community-dwelling

Table 2. Characteristics of Opioids, Nonopioid Pharmacological Alternatives, and Potentially Contraindicated Psychopharmacologic Medications Prescribed During 120 Days of Follow-Up in Long-Stay Nursing Home Residents in 2012, Stratified by Length of Opioid Use (N = 315,949)

Medication Use During Follow-Up	No Opioid Use, n = 213,652	Short-Term, n = 32,841	Medium-Term, n = 20,615	Long-Term, n = 48,841
Opioid use[a]				
Number of opioid claims, median (interquartile range)	—	1 (1–2)	5 (3–7)	6 (5–10)
Duration of action, %				
Short-acting only	—	99.0	94.5	65.7
Long-acting only	—	0.6	1.8	12.5
Short- and long-acting	—	0.4	3.6	21.8
Average daily dose, mg/d, (oral morphine equivalents), %[b]				
<50	—	78.4	77.2	68.1
50–89	—	18.4	19.0	15.9
≥90	—	3.3	3.8	16.0
Dosage form, %[c]				
Oral	—	99.5	98.8	91.5
Injected	—	0.2	0.1	0.1
Transdermal	—	0.7	3.6	24.3
Other	—	0.01	0.0	0.0
Nonopioid pharmacological alternatives				
Standalone prescription nonsteroidal anti-inflammatory drugs, %	8.4	15.3	17.5	16.0
Any pain adjuvants or other medications used for pain, %[d]	23.4	41.4	50.3	50.3
Pain adjuvants	14.9	27.6	34.7	35.7
Anticonvulsants	9.7	19.7	25.5	25.4
Antidepressants	6.4	11.6	15.6	17.1
Other medications used for pain	11.0	21.8	27.4	27.2
Corticosteroids	6.5	11.2	13.1	12.2
Muscle relaxants	2.7	6.6	9.1	9.6
Transdermal lidocaine	2.4	6.2	9.2	9.5
Potentially contraindicated medication use, %[e]				
Any anxiolytic or hypnotic	17.5	27.6	35.5	32.7
≥2 antipsychotics, anxiolytics, or hypnotics[e]	8.0	11.5	14.8	13.5

Percentages may not add up to 100% because of rounding.

[a]Short-acting opioids included codeine, dihydrocodeine, hydrocodone, hydromorphone, meperidine, morphine, nalbuphine, oxycodone, oxymorphone, pentazocine, tapentadol, and tramadol. Long-acting opioids included buprenorphine, butorphanol, transdermal fentanyl, hydromorphone extended release (ER), methadone, morphine ER, oxycodone ER, oxymorphone ER, tapentadol ER, and tramadol ER.

[b]Calculated by estimating average daily dose of each unique opioid prescription, converting each prescription to oral morphine equivalents, summing the oral morphine equivalents for all prescriptions, and dividing by estimated cumulative days of opioid use.

[c]Percentages add up to >100% because some participants were prescribed multiple opioids with different dosage forms.

[d]Antidepressents commonly used as adjuvants included desipramine, nortriptyline, amitriptyline, duloxetine, venlafaxine, and milnacipran.[26] Anticonvulsants included carbamazepine, gabapentin, lamotrigine, and pregabalin. Corticosteroids included dexamethasone, prednisone, prednisolone, and methylprednisolone. Muscle relaxants included baclofen, carisoprodol, chlorzoxazone, cyclobenzaprine, dantrolene, metaxalone, methocarbamol, orphenadrine, and tizanidine. Subcategory percentages may not add up to overall categorical percentages because some residents were prescribed multiple medications.

[e]Defined using MDS assessments during 120-day follow-up (excludes index MDS assessment).

populations, opioids have been linked to falls, fractures, overdoses, and all-cause mortality; further work is needed to characterize risks in NH residents.[6,9]

Our findings suggest that greater use of nonopioid analgesics and nonpharmacological pain management may be potential areas for improvement in NHs, although these recommendations are not without limitations.[6,26] Nonopioid medications used for pain are recommended as first-line treatment for chronic nonmalignant pain and can be used concurrently with opioids to provide potentially greater benefits to residents.[6] We found that pain adjuvants and other medications for pain were prescribed only to approximately half of opioid users during follow-up. Whether this is appropriate remains unclear because these agents also have potential risks. For example, NSAIDS are known to be associated with hepatic, gastrointestinal, renal, and cardiovascular events in older adults and may not be appropriate opioid substitutes.[26,35] American Geriatrics Society and CDC guidelines recommend nonpharmacological pain management, which can be combined with opioid therapy to provide potentially greater pain relief to residents.[6,45] We found that nonpharmacological therapies were used in only one-quarter of opioid users. Although we could not ascertain specific nonpharmacological interventions used with the MDS 3.0, common approaches in NHs include biofeedback, applying heat and cold, massage, physical therapy, nerve block, stretching and strengthening exercises, and electrical stimulation.[46] Their use—along with other nonopioid analgesics—are associated with short-term benefits and lower risks than opioids[6] but may have limited applicability to cognitively impaired residents and may be difficult to implement given NH staffing and reimbursement constraints.

We noted several potentially modifiable risk factors for opioid prescribing, particularly in long-term users. Long-term users had higher daily doses than short- and

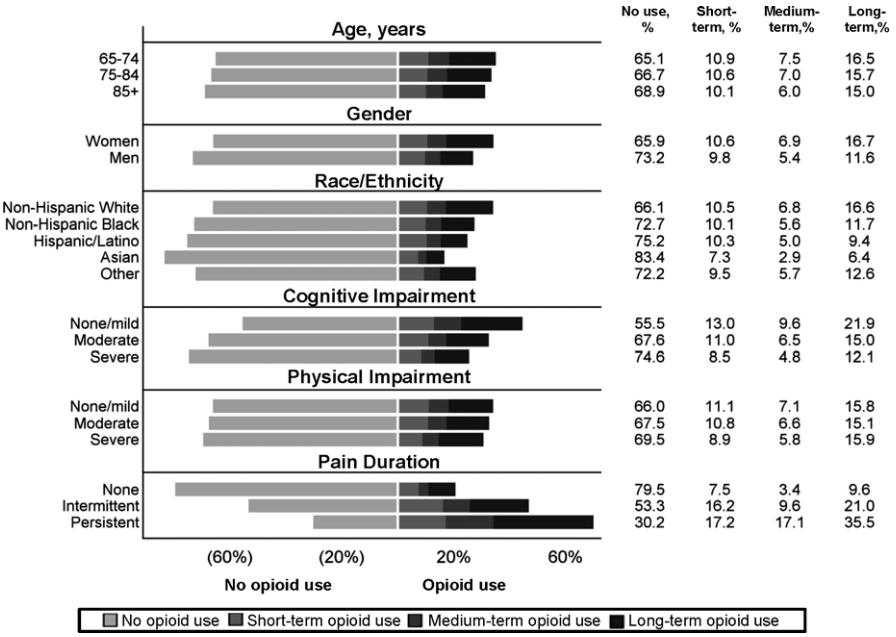

Figure 1. Crude prevalence of short-, medium-, and long-term opioid use according to age, gender, race and ethnicity, cognitive impairment, physical impairment, and pain duration for long-stay nursing home residents in 2012 (N = 315,949).

Table 3. Association Between Resident Characteristics and Long-Term Opioid Use (N = 315,949)

Characteristic	Long-Term Opioid Use, %	Crude	Adjusted[a]
		PR (95% Confidence Interval)	
Age, years			
65–74	16.5	Reference	Reference
75–84	15.7	0.93 (0.91–0.95)	0.97 (0.95–1.00)
≥85	15.0	0.88 (0.86–0.90)	0.94 (0.92–0.97)
Gender			
Men	11.6	Reference	Reference
Women	16.7	1.40 (1.37–1.43)	1.21 (1.18–1.23)
Race and ethnicity			
Non-Hispanic white	16.6	Reference	Reference
Non-Hispanic black	11.7	0.77 (0.75–0.80)	0.93 (0.90–0.95)
Hispanic	9.4	0.69 (0.66–0.73)	0.84 (0.80–0.88)
Asian	6.4	0.51 (0.46–0.57)	0.69 (0.61–0.77)
Other	12.6	0.81 (0.72–0.90)	0.89 (0.80–0.99)
Cognitive impairment			
None to mild	21.9	Reference	Reference
Moderate	15.0	0.69 (0.68–0.71)	0.89 (0.87–0.91)
Severe	12.1	0.56 (0.54–0.57)	0.82 (0.79–0.83)
Physical impairment			
None to mild	15.8	Reference	Reference
Moderate	15.1	0.95 (0.93–0.97)	1.04 (1.02–1.06)
Severe	15.9	1.04 (1.02–1.07)	1.25 (1.22–1.28)

Prevalence ratios (PRs) were estimated using modified Poisson models (using generalized estimating equations to account for clustering within nursing homes).[39]

[a]Models were adjusted for all resident characteristics in Table 1 and state of residence.

medium-term users. Although long-term users may need higher doses because of greater opioid tolerance, many adverse events linked to opioids are dose-dependent,[9] and the CDC prescribing guidelines recommend reassessing individual risks and benefits at doses of 50 OME or more per day and avoiding or carefully justifying doses of 90 OME or more per day.[6] Opioid users had a high prevalence of anxiolytic and hypnotic use. Direct measurement of benzodiazepines was not possible because Part D did not cover them. Yet, before Part D, benzodiazepine use was more common than other anxiolytics and hypnotics in NHs.[47] Benzodiazepines should never be co-prescribed with opioids,[6] although further work is needed to evaluate this in NHs. Finally, 13% of opioid users received two or more medications known to increase the risks of falls and fractures during follow-up (antipsychotics, anxiolytics, hypnotics).[35] When possible, prescribers should optimize concurrent psychopharmacological use to address concerns about drug-drug interactions and the co-occurrence of anxiety and depression with pain, which can interfere with pain management.[6,35] Although the use of antipsychotics has fallen since 2012, antipsychotics, anxiolytics, and hypnotics are still commonly used.[48,49]

Findings that long-term opioid use was higher in women, non-Hispanic whites, individuals with severe physical impairment, and those with no or mild cognitive impairment are consistent with prior studies examining the correlates of untreated or undertreated persistent pain in long-stay residents.[14,15] Contrasting with prior studies,[14,15] we did not observe a strong relationship between age and opioid use, perhaps because of the higher burden of certain painful comorbidities (e.g., arthritis) in those aged 85 and older, although caution is warranted when using long-term opioids in this population because of residents' frailty. Identifying whether some residents are more susceptible to opioid-related adverse events is warranted.

This study has several strengths and limitations. National MDS 3.0 data linked to Part D claims provided national, comprehensive information on long-stay residents

who were Medicare beneficiaries. We provided detailed information on opioid use not previously examined, including specific opioids used, dosage strength, and length of opioid use over 120 days of follow-up. We characterized nonopioid pharmacological alternatives for pain, nonpharmacological pain management, and concurrent psychopharmacological medication use. Although the data were from 2012, they provided an important, more-recent snapshot of opioid prescribing during the height of national opioid prescribing.[4,14,15] Although we had loss to follow-up by requiring residents to be in the NH for 120 days, the sensitivity analysis suggests that our estimates may be conservative because those lost to follow-up had higher opioid use. We recognize that classifying opioid use according to cumulative number of days discarded important information on patterns of opioid use. We believe this affected our results focusing on long-term opioid use minimally. Operationalizing medication use through Part D claims may overestimate opioid use if residents did not use medications; multiple opioid claims among those prescribed opioids suggest that this issue may be minimal. We cannot know from Part D claims how medications were administered, though data from MDS assessments show that most long-term opioid users received scheduled analgesics. We have limited information on indications for medication use, resulting in potential misclassification (e.g., medications classified as pain adjuvants when they are prescribed for other indications). We could not evaluate over-the-counter medications from Part D (e.g., over-the-counter NSAIDS). No information on resident or staff pain management preferences was available.

In conclusion, long-term opioid use in older NH residents is twice as prevalent as in community settings.[11] Cautious and consistent monitoring of opioid doses; optimizing concurrent psychopharmacological medication use; and increasing use of nonopioid analgesics, adjuvants, and nonpharmacological interventions when appropriate may be warranted to improve the quality of opioid use in NHs. Interventions to improve opioid prescribing should incorporate complex systems approaches that engage all providers, including physicians, nurses, pharmacists, and other staff, to improve opioid prescribing (e.g., through education, greater use of alternatives, adverse event monitoring).[50] Comparative effectiveness studies that focus on physical function, pain control and quality-of-life endpoints, and comparative safety studies of opioids in NHs could help healthcare providers, residents, and their families make informed decisions on opioid use.

ACKNOWLEDGMENTS

Financial Disclosure: This work was funded by National Institutes of Health Grants 1TL1TR001454 (Hunnicutt, Lapane) and 1R56NR015498–01 (Lapane, Tjia, Ulbricht).

Conflict of Interest: Dr. Tjia was supported by a Sojourns Scholar Leadership Award from the Cambia Health Foundation and is a consultant for the CVS Caremark Pharmacy and Therapeutics Committee. Drs. Hume and Chrysanthopoulou report no financial conflicts.

Author Contributions: Mr. Hunnicutt had full access to all of the data and takes responsibility for the integrity and accuracy of the data analysis. Study concept and design: Hunnicutt, Lapane, Chrysanthopoulou, Ulbricht, Hume, Tjia. Acquisition of data: Lapane. Preparation of manuscript: Hunnicutt, Lapane. Critical revision of manuscript: Hunnicutt, Lapane, Chrysanthopoulou, Ulbricht, Hume, Tjia. Statistical analysis and interpretation: Hunnicutt, Lapane and Chrysanthopoulou. Obtained funding: Mr. Hunnicutt; Dr. Lapane. Final approval of the manuscript: Hunnicutt, Lapane, Chrysanthopoulou, Ulbricht, Hume, Tjia.

Sponsor's Role: None of the funders had a role in design, methods, data collection, analysis, or preparation of this manuscript.

REFERENCES

1. Centers for Disease Control and Prevention. Vital signs: Overdoses of prescription opioid pain relievers—United States, 1999–2008. MMWR Morb Mortal Wkly Rep 2011;60:1487–1492.
2. Rudd R, Aleshire N, Zibbell JE et al. Increases in drug and opioid overdose deaths—United States, 2000–2014. MMWR Morb Mortal Wkly Rep 2016;64:1378–1382.
3. Okie S. A flood of opioids, a rising tide of deaths. N Engl J Med 2010;363:1981–1985.
4. Dart RC, Surratt HL, Cicero TJ et al. Trends in opioid analgesic abuse and mortality in the United States. N Engl J Med 2015;372:241–248.
5. Barnett ML, Olenski AR, Jena AB. Opioid-prescribing patterns of emergency physicians and risk of long-term use. N Engl J Med 2017;376:663–673.
6. Dowell D, Haegerich TM, Chou R. CDC guideline for prescribing opioids for chronic pain—United States, 2016. JAMA 2016;315:1624–1645.
7. Papaleontiou M, Henderson CR Jr, Turner BJ et al. Outcomes associated with opioid use in the treatment of chronic noncancer pain in older adults: A systematic review and meta-analysis. J Am Geriatr Soc 2010;58:1353–1369.
8. Manchikanti L, Abdi S, Atluri S et al. American Society of Interventional Pain Physicians (ASIPP) guidelines for responsible opioid prescribing in chronic non-cancer pain: Part 2—guidance. Pain Physician 2012;15:S67–S116.
9. Chou R, Turner JA, Devine EB et al. The effectiveness and risks of long-term opioid therapy for chronic pain: A systematic review for a National Institutes of Health Pathways to Prevention Workshop. Ann Intern Med 2015;162:276–286.
10. Campbell CI, Weisner C, Leresche L et al. Age and gender trends in long-term opioid analgesic use for noncancer pain. Am J Public Health 2010;100:2541–2547.
11. Kuo YF, Raji MA, Chen NW et al. Trends in opioid prescriptions among Part D Medicare recipients from 2007 to 2012. Am J Med 2016;129:221.e21–221.e30.
12. Won AB, Lapane KL, Vallow S et al. Persistent nonmalignant pain and analgesic prescribing patterns in elderly nursing home residents. J Am Geriatr Soc 2004;52:867–874.
13. Pimentel CB, Briesacher BA, Gurwitz JH et al. Pain management in nursing home residents with cancer. J Am Geriatr Soc 2015;63:633–641.
14. Fain K, Alexander GC, Dore DD et al. Frequency and predictors of analgesic prescribing in US nursing home residents with persistent pain. J Am Geriatr Soc 2017;65:286–293.
15. Hunnicutt JN, Ulbricht CM, Tjia J et al. Pain and pharmacologic pain management in long-stay nursing home residents. Pain 2017;158:1091–1099.
16. Won A, Lapane K, Gambassi G et al. Correlates and management of nonmalignant pain in the nursing home. SAGE Study Group. Systematic Assessment of Geriatric drug use via Epidemiology. J Am Geriatr Soc 1999;47:936–942.
17. Lapane KL, Quilliam BJ, Chow W et al. The association between pain and measures of well-being among nursing home residents. J Am Med Dir Assoc 2013;13:344–349.
18. Cadogan MP, Edelen MO, Lorenz KA et al. The relationship of reported pain severity to perceived effect on function of nursing home residents. J Gerontol A Biol Sci Med Sci 2008;63:969–973.
19. Lapane KL, Quilliam BJ, Chow W et al. Pharmacologic management of non cancer pain among nursing home residents. J Pain Symptom Manage 2013;45:33–42.
20. Field TS, Gurwitz JH, Avorn J et al. Risk factors for adverse drug events among nursing home residents. Arch Intern Med 2001;161:1629–1634.

21. Freedman VA, Spillman BC. The residential continuum from home to nursing home: Size, characteristics and unmet needs of older adults. J Gerontol B Psychol Sci Soc Sci 2014;69:S42–S50.
22. Jokanovic N, Tan EC, Dooley MJ et al. Prevalence and factors associated with polypharmacy in long-term care facilities: A systematic review. J Am Med Dir Assoc 2015;16:535.e1–535.e12.
23. Makris UE, Abrams RC, Gurland B et al. Management of persistent pain in the older patient: A clinical review. JAMA 2014;312:825–836.
24. Nuckols TK, Anderson L, Popescu I et al. Opioid prescribing: A systematic review and critical appraisal of guidelines for chronic pain. Ann Intern Med 2014;160:38–47.
25. Califf RM, Woodcock J, Ostroff S. A proactive response to prescription opioid abuse. N Engl J Med 2016;374:1480–1485.
26. American Geriatrics Society Panel on Pharmacological Management of Persistent Pain in Older Persons. Pharmacological management of persistent pain in older persons. J Am Geriatr Soc 2009;57:1331–1346.
27. Saliba D, Buchanan J. Development and Validation of a Revised Nursing Home Assessment Tool: MDS 3.0. Santa Monica, CA: Rand Corp, 2008.
28. Saliba D, Buchanan J. Making the investment count: Revision of the Minimum Data Set for nursing homes, MDS 3.0. J Am Med Dir Assoc 2012;13:602–610.
29. Saliba D, Jones M, Streim J et al. Overview of significant changes in the Minimum Data Set for nursing homes version 3.0. J Am Med Dir Assoc 2012;14:595–601.
30. Wei YJ, Simoni-Wastila L, Zuckerman IH et al. Algorithm for identifying nursing home days using Medicare claims and Minimum Data Set Assessment data. Med Care 2016;54:e73–e77.
31. Leslie RS. Using arrays to calculate medication utilization. SAS Global forum [on-line]. Available at http://www2.sas.com/proceedings/forum2007/043–2007.pdf Accessed April 21, 2017.
32. Dunn KM, Saunders KW, Rutter CM et al. Opioid prescriptions for chronic pain and overdose: A cohort study. Ann Intern Med 2010;152:85–92.
33. Braden JB, Russo J, Fan MY et al. Emergency department visits among recipients of chronic opioid therapy. Arch Intern Med 2010;170:1425–1432.
34. Nielsen S, Degenhardt L, Hoban B et al. A synthesis of oral morphine equivalents (OME) for opioid utilisation studies. Pharmacoepidemiol Drug Saf 2016;25:733–737.
35. American Geriatrics Society. Beers Criteria Update Expert Panel. Updated beers criteria for potentially inappropriate medication use in older adults. J Am Geriatr Soc 2015;2015:2227–2246.
36. Bernabei R, Gambassi G, Lapane K et al. Management of pain in elderly patients with cancer. JAMA 1998;279:1877–1882.
37. Morris JN, Fries BE, Morris SA. Scaling ADLs within the MDS. J Gerontol A Biol Sci Med Sci 1999;54:M546–M553.
38. Centers for Medicare and Medicaid Services. Nursing Home Data Compendium 2015 edition. CMS [on-line]. Available at https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/CertificationandComplianc/Downloads/nursinghomedatacompendium_508–2015.pdf Accessed April 21, 2017.
39. Zou GY, Donner A. Extension of the modified Poisson regression model to prospective studies with correlated binary data. Stat Methods Med Res 2013;22:661–670.
40. Teno JM, Weitzen S, Wetle T et al. Persistent pain in nursing homes. JAMA 2001;285:2081.
41. Von Korff M, Saunders K, Thomas Ray G et al. Defacto long-term opioid therapy for non-cancer pain. Clin J Pain 2008;24:521–527.
42. Won A, Lapane KL, Vallow S et al. Long-term effects of analgesics in a population of elderly nursing home residents with persistent nonmalignant pain. J Gerontol Ser A Biol Sci Med Sci 2006;61:165–169.
43. Pimentel CB, Gurwitz JH, Tjia J et al. New initiation of long-acting opioids in long-stay nursing home residents. J Am Geriatr Soc 2016;64:1772–1778.
44. Fain KM, Castillo-Salgado C, Dore DD et al. Inappropriate fentanyl prescribing among nursing home residents in the United States. J Am Med Dir Assoc 2017;18:138–144.
45. AGS Panel on Persistent Pain in Older Persons. The management of persistent pain in older persons. J Am Geriatr Soc 2002;50:S205–S224.
46. Long-Term Care Facility Resident Assessment Instrument 3.0 User's Manual, version 1.14. 2016, pp. 355–388 [on-line]. Available at: https://downloads.cms.gov/files/MDS-30-RAI-Manual-V114-October-2016.pdf Accessed July 5, 2017.
47. Briesacher BA, Soumerai SB, Field TS et al. Medicare Part D's exclusion of benzodiazepines and fracture risk in nursing homes. Arch Intern Med 2010;170:693–698.
48. Centers for Medicare and Medicaid Services. Update Report on the National Partnership to Improve Dementia Care in Nursing Homes. CMS [on-line]. Available at https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/SurveyCertificationGenInfo/Downloads/Survey-and-Cert-Letter-16–28.pdf Accessed April 21, 2017.
49. Tjia J, Hunnicutt JN, Hernon L et al. Association of a communication training program with use of antipsychotics in nursing homes. JAMA Intern Med (epublished ahead of print) 2017;177:846–853.
50. El-Sayed AM, Galea S. Systems Science and Population Health, 1st Ed. New York: Oxford University Press, 2017.

SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Figure S1. Selection of participants into study.

Table S1. Specific opioid medications prescribed to study participants during the 120 day follow-up window (N = 315,949)

Table S2. Specific NSAIDS, pain adjuvants, and other medications used for pain and prescribed to study participants (overall and stratified by any opioid use and length of opioid use) during the 120 day follow-up window (N = 315,949)

Table S3. Associaton between resident characteristics and long-term opioid use, restricted to residents in persistent pain (n = 48,922)

Text S1. Examining opioids prescribed to censored residents.

Please note: Wiley-Blackwell is not responsible for the content, accuracy, errors, or functionality of any supporting materials supplied by the authors. Any queries (other than missing material) should be directed to the corresponding author for the article.