

Utilization of Health Care Resources by Long-term Care Residents as a Function of Pain Status

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Objective: We estimated the association between the presence of pain and health care utilization among older adults residing in long-term care (LTC) facilities.

Materials and Methods: Using administrative health data maintained by the Saskatchewan ministry of health and time-to-event analyses with multivariable frailty models, we tested for differences in health care use (hospitalization, physician and specialist visits, and prescription drug dispensations) as a function of pain status among LTC residents after admission to an LTC. Specifically, we contrasted LTC residents with daily pain or less than daily pain but with moderate or severe intensity (ie, clinically significant pain group; CSP) to residents with no pain or nondaily mild pain (NP/NDMP group).

Results: Our cohort consisted of 24,870 Saskatchewan LTC residents between 2004 and 2015 with an average age of 85 years (63.2% female; 63.0% in urban facilities). Roughly one third had CSP at their LTC admission date. Health care use after admission to LTC was strongly associated with pain status, even after adjusting for residents' demographic and facility characteristics, prior comorbidities and health care utilization 1 year before the study index date. In any given quarter, compared with NP/NDMP residents, those with CSP had an increased risk of hospitalization, specialist visit, follow-up general practitioner visit, and onset of polypharmacy (ie, 3 or more medication classes).

Discussion: To our knowledge, this is the first large-scale project to examine the utilization of health care resources as a function of pain status among LTC facility residents. Improved pain management in LTC facilities could lead to reduced health care use.

Key Words: pain, dementia, health care utilization

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Pain is ubiquitous. Its prevalence in the general population is estimated to be between 10% and more than 50%, depending on the method used to gather data and the population studied.¹ Older adults are especially vulnerable to pain, largely due to a variety of medical conditions that often accompany old age. Pain prevalence estimates for persons over 65 years of age living in the community range from 25% to 65%; for those residing in long-term care (LTC) the estimates are as high as 80%.² Despite its high prevalence, pain is frequently undertreated among older persons.³ The problem of pain under treatment is more significant for older adults who reside in LTC and have a high likelihood of a dementia diagnosis.⁴ As dementia can interfere with the effective communication of pain and its fluctuations, pain problems are often missed by LTC staff. Undertreated pain can lead to behavioral disturbance in people with severe dementia.⁵ Such behavioral disturbance due to pain may be misattributed to a psychiatric problem and is frequently treated with psychotropic rather than analgesic medications⁶ increasing the risk of death.⁷ Moreover, pain can be a risk factor for falling which is very frequent among LTC residents.^{8,9}

A wide variety of effective observational methods designed to assess pain in people with dementia and limited ability to communicate have been developed and are available.¹⁰ In fact, regular pain assessment in LTC has been shown to have a variety of benefits. Specifically, it can result in nurse-assessed reductions in pain levels, increases the use of analgesic medications, and decreases the use of benzodiazepines that are associated with an increased risk of death in frail older persons.^{11,12} Moreover, regular pain assessment in LTC reduces staff stress and burnout.¹¹

Best practice protocols for effective pain assessment among people with dementia are available.¹³ These protocols are based on a variety of expert consensus statements,^{13–15} several of which have been produced and/or endorsed by prominent professional organizations such as the American Medical Directors Association,¹⁶ the American Society for Pain Management Nursing,¹⁷ and the National Nursing Home Collaborative.¹⁸ Such protocols tend to recommend use of standardized pain assessment tools (including observational assessment tools for LTC residents who have limited ability to communicate verbally), frequent pain assessments for all LTC residents, timely implementation of pain management plans with follow-up assessments to help ensure that interventions are successful, solicitation of proxy reports, and other related practices. Some of these protocols were specifically developed with the aim of requiring minimal extra resources when regularly implemented in nursing homes.¹⁴ Despite this, best practice protocols are not routinely implemented.¹⁰ Generally, these protocols may fail because of management concerns that the extra resources needed for effective pain assessment, despite being modest, may be unattainable.

Part of the difficulty that exists in convincing policy makers and LTC administrators to work toward the implementation of systematic pain assessment protocols, is that implications of pain and undertreated pain in LTC health care utilization are not fully understood because utilization and costing investigations have rarely been conducted. Given this context, the purpose of this study was to estimate the association between the presence of pain and health care utilization among older persons residing in LTC facilities. Specifically, we tested for differences in health care use (hospitalization, physician and specialist visits, and prescription drugs) as a function of pain status among residents after admission to LTC. We classified the residents into 2 groups: (1) residents with clinically significant pain (CSP; defined as daily pain or moderate to severe nondaily pain); and (2) residents with no pain or residents with nondaily, mild pain (NP/NDMP). We considered the former group to include individuals for whom pain was a more salient clinical issue compared with the latter group. Our study hypothesis was: LTC residents with CSP will have higher rates of hospitalization, physician and specialists' visits, and prescription drug use compared with residents with NP/NDMP. To the best of our knowledge, this is the first population-based study examining pain as a factor affecting health care use subsequent to LTC admission.

MATERIALS AND METHODS

Data Sources

We used administrative health data maintained by the Saskatchewan Ministry of Health and eHealth Saskatchewan and accessed at the Saskatchewan Health Quality Council to test for differences in health care use among LTC residents with CSP and NP/NDMP. The province of Saskatchewan, Canada, has a population of ~1.1 million according to the 2016 Statistics Canada Census, and has universal health care; it maintains comprehensive health care databases for all publicly funded services in electronic format; these services include outpatient physician visits, inpatient and outpatient hospital services, home care, LTC, and out-of-hospital pharmaceutical dispensations. These databases can be anonymously linked via a unique personal health number.

Study data were from the Resident Assessment Instrument-Minimum Data Set (RAI-MDS), person health registry system, Discharge Abstract Database (DAD), prescription drug file, and physician claims databases. The RAI-MDS, captures information about care, functioning, and health status of LTC residents at admission, as well as from quarterly and annual assessments, and from assessments made whenever there is a major change in a resident's health status.^{19,20} The person health registry system provides residents' location of residence, sociodemographic information, and health insurance coverage information. The DAD provides information on all acute care inpatient separations and day surgeries for patients of acute care facilities. Hospital abstracts are completed when a patient is discharged from an acute care facility, and diagnoses are recorded using International Classification of Diseases, 10th revision, Canadian version (ICD-10-CA) codes.²¹ The prescription drug database captures information on outpatient medication dispensed to eligible provincial residents. It excludes inpatient medications, individuals who receive federal prescription coverage such as the military, federal police, federal prisoners, First Nations (aboriginal) population. Each available record includes the date of

dispensation and the national drug identification number. Physician claims data provide information on general physician (GP) and specialist claims. Physicians that are paid on a fee-for-service basis submit their claims to the Ministry of Health. A single diagnosis is recorded on each claim using International Classification of Diseases (ICD-9) codes.²² Physicians who are salaried submit billing claims for administrative purposes, a practice known as shadow billing, although some do not comply with this practice. Prior research on this issue has led to the conclusion that loss of claims related to incomplete information from physicians is minimal and that, the validity of the Canadian physician claims data remains high.^{23,24} Similarly, studies have found the Saskatchewan's administrative health data to have a high degree of reliability, validity, comparability, and completeness.^{25,26} These data sets have also been used previously for research involving LTC residents.²⁶ With the approval of the Research Ethics Board of our institution, data were accessed and analyzed at the Saskatchewan Health Quality Council in accordance with a standing data sharing agreement between that organization and the Ministry of Health and eHealth Saskatchewan.

Study Cohort

The study cohort includes all Saskatchewan LTC residents, age 65 years and older, who were admitted to LTC between January 1, 2004 and March 31, 2015 and had a minimum of 365 days of health care coverage before their LTC admission date (ie, index date). Residents from a total of 165 LTC facilities were followed up to 365 days following the index date, or until censored due to an outcome event (described below), death or discharge from LTC, whichever came first. It is important to note that we did not stop examining other outcomes once the first outcome occurred. Instead, we ran a separate analysis for each outcome of interest: first hospitalization, first specialist visit, repeat physician visit, and onset of polypharmacy.

Cohort exclusion criteria were: (1) discharge from LTC or death within 90 days of admission (ie, within the baseline period), (2) below 65 years of age at the index date, (3) missing admission and baseline (ie, 90 d) pain assessment, (4) gaps in health care coverage > 90 days in the 365 days preceding the cohort entry date, and (5) inconsistent and incomplete data (eg, residents whose LTC discharge date was before the LTC admission date, or residents who stayed for <1 d in an LTC were excluded). Notwithstanding our first exclusion criterion, there was a small number of instances where residents were discharged from LTC and readmitted back into LTC within 5 days. Each of these readmissions was treated as a single admission episode. There were fewer than 6 residents with one of these readmissions. Figure 1 details the flowchart for cohort selection.

Study Variables

Outcomes

The utilization outcomes of interest included inpatient hospitalization, specialist visit, follow-up GP visit, and occurrence of polypharmacy. The inpatient hospitalization and specialist visit were defined as the occurrence of first hospitalization and first specialist visit, respectively, after the study index date. Follow-up GP visit was defined as the occurrence of the second GP visit after the index date. Polypharmacy was defined as the occurrence of 3 or more different types of prescription medications (ie, different drug class) in the study period. Drug classes were defined using the American Hospital

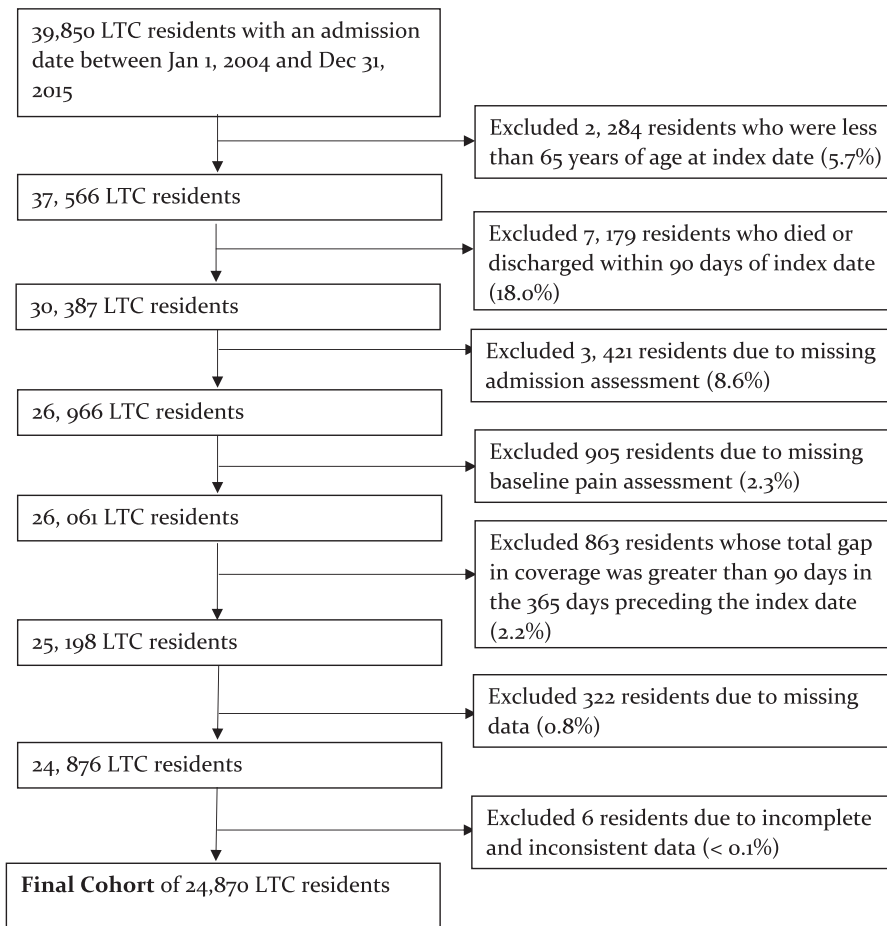


FIGURE 1. Cohort selection flowchart. LTC indicates long-term care.

Formulary System (AHFS) major class category of which there are 31 classes; the AHFS groups drugs with similar characteristics (pharmacologic, therapeutic, and/or chemical) into a 4-tier hierarchy (<https://ashp.org>).

Exposure

The primary exposure was a dichotomous measure of pain derived from RAI-MDS data. The RAI-MDS captures information on pain frequency (ie, 0 = no pain, 1 = pain less than daily, 2 = daily pain) and its intensity (ie, 1 = mild pain, 2 = moderate pain, 3 = when pain is horrible or excruciating), which is assessed by LTC nursing staff on admission and every 90 days thereafter. Although this MDS pain scale has some limitations in that it can be influenced by clinician's subjective opinion, it does provide pain assessment information for the majority of Canadian LTC residents²⁷ and its validity has been supported.²⁸

LTC residents with daily pain or less than daily pain but with moderate or severe intensity were classified as having CSP. Residents with NP/NDMP group were considered to have less salient difficulties with pain than the CSP group with respect to health care use. This categorization was captured for residents at the index date and quarterly thereafter.

Covariates

Sociodemographic variables of age, sex, rural/urban residence, and health region of residence were defined at the

index date. Age was categorized as 65 to 69, 70 to 74, 75 to 79, 80 to 84, 85 to 89, 90+. Urban or rural region of residence was assigned based on the postal code in the person registry data at the index date (ie, at the time of admission). Those living in 1 of the 2 health regions containing major urban centers were classified as urban residents, whereas individuals living in the remaining 11 health regions were deemed rural residents. Health regions were assigned to one of the following: Northern Saskatchewan, Central Saskatchewan, Saskatoon Health Region, Southwest Saskatchewan, Regina Qu'Appelle Health Region, and Southeast Saskatchewan.

Health care variables included the Charlson comorbidity index and the health care utilization for the 1-year period before the index date. The Charlson comorbidity index is a method to create a single summary value indicating the burden of comorbidity using ICD-9 and ICD-10 diagnosis codes.^{29,30} The Charlson comorbidity index was calculated using diagnoses captured in DAD and physician data over the 1 year before admission to LTC.³¹ The index is based on diagnoses for 17 conditions and each condition is assigned a weight from 1 to 6.²⁹ The index score is the sum of the weights for all identified conditions. Charlson comorbidity index was then categorized into 4 groups, where a higher score indicates greater comorbidity: 0 (no comorbidities), 1, 2, 3+. Health care utilization data include the number of general practice (GP) and specialist visits, number of inpatient hospitalizations, and the number of

prescription drug dispensations. *Facility characteristics* captured in the Saskatchewan RAI-MDS data include the type of facility, which was classified as integrated, special care homes, and hospital/special care homes. Integrated LTC facilities incorporates the functions of an acute care facility and a special care home. Special care homes are public facilities for which residence is determined based on need, whereas hospital-based continuing care facilities serve individuals who may not be ready for discharge from hospital but who no longer need acute care services.

Statistical Analysis

Frequencies, percentages, medians, means, and SD were used to describe the data. Descriptive statistics were stratified by pain group membership at the index date and the χ^2 statistics was used to test between-group differences.

Separate analyses were conducted for each outcome variable of interest. For the hospitalization outcome, the data were censored at the first hospitalization, death, discharge, or end of the 1-year follow-up whichever came first. For the specialist outcome, the data were censored at the date of the first specialist visit, death, discharge or end of the 1-year follow-up whichever came first. For the repeated GP visit outcome, the data were censored at the second GP visit, death, discharge, or end of the 1-year follow-up whichever came first. For the polypharmacy outcome, the data were censored at the date on which the third prescription drug was dispensed, death, discharge, or end of the 1-year follow-up whichever came first.

The association between pain and health care utilization was initially described using the nonparametric Kaplan-Meier estimator. The log rank test statistic was used to test for differences between the CSP and NP/NDMP groups.

Subsequently, inferential analyses were conducted using time-to-event analysis with multivariable frailty models.³² Frailty models, also known as random-effects models, are extensions of the Cox proportional hazards model that take into account the heterogeneity caused by unobserved covariates and clustered data. We incorporated the random effects (the frailty) to account for within-facility clustering. For instance, individuals within each LTC facility may share common features that may correlate with each other. First, an unadjusted model was specified for each outcome variable that contained only the time-varying pain group covariate. We then undertook a fully adjusted Cox proportional hazards analyses for each outcome variable that incorporated all patient and facility characteristics. Hazard ratios (HRs) along with 95% confidence intervals (CIs) are reported for all covariates. SAS (SAS Institute Inc, Cary, NC) was used to perform all analyses.

RESULTS

Cohort Characteristics

There were a total of 39,850 LTC residents in Saskatchewan between January 1, 2004 and December 31, 2015. Close to two thirds (62.4%, n = 24,870) met the study inclusion criteria (Fig. 1). The residents were from 165 LTC facilities with on average 151 patients per facility (median = 100, SD = 142.2) during this period. Among all included individuals in the cohort, 63.2% (n = 15,724) were female, 63.0% (n = 15,677) were urban residents and the mean age was 85 years (SD = 7.14) (Table 1). More than a quarter of residents (27.9%, n = 6934) had 3 or more comorbidities in the year before the index date and about 90% of the residents were in the integrated facility type.

TABLE 1. Baseline Characteristics (ie, Covariates) of Study Cohort Stratified by Pain Group

| | n (%) | | P |
|--|-------------------|-------------------------|---------|
| | CSP (n = 8951) | NP/NDMP (n = 15,919) | |
| Age (y): mean (median, SD) | 84.9 (86, 7.4) | 85.1 (86, 7.4) | 0.46 |
| Sex | | | <0.0001 |
| Females | 6032 (67.4) | 9692 (60.9) | |
| Males | 2919 (32.6) | 6227 (39.1) | |
| Location of residence | | | <0.0001 |
| Urban | 5492 (61.4) | 10,185 (64.0) | |
| Rural | 3459 (38.6) | 5734 (36.0) | |
| Charlson Comorbidity Index | | | <0.0001 |
| 0 | 2168 (24.2) | 4544 (28.5) | |
| 1 | 2309 (25.8) | 4409 (27.7) | |
| 2 | 1618 (18.1) | 2888 (18.1) | |
| 3+ | 2856 (31.9) | 4078 (25.6) | |
| Health care utilization (1 y before LTC admission) | | | |
| Physician visits: mean (median, SD) | 26.1 (23, 17.0) | 22.4 (19, 15.7) | <0.0001 |
| Specialist visits: mean (median, SD) | 14.4 (7, 23.4) | 12.6 (6, 20.2) | <0.0001 |
| Prescription drugs: mean (median, SD) | 4.9 (5, 4.0) | 4.9 (5, 3.5) | <0.0001 |
| Inpatient hospitalizations: mean (median, SD) | 1.9 (2, 1.8) | 1.6 (1, 1.6) | <0.0001 |
| Long-term care facility type | | | 0.018 |
| Integrated | 8001 (89.4) | 14,385 (90.4) | |
| Special care home | 484 (5.4) | 738 (4.6) | |
| Hospital/special care home | 466 (5.2) | 796 (5.0) | |

CSP indicates clinically significant pain; LTC, long-term care; NP/NDMP, no pain or nondaily mild pain.

Roughly one third (35.9%, n = 8951) had CSP at the index date. Residents with CSP had higher comorbidity and were more likely to be female.

In the study observation period, a total of 28.5% (n = 7076) of cohort members had an inpatient hospitalization, 52.1% (n = 12,953) had a specialist visit, 96.6% (n = 24,014) had a follow-up GP visit, and 93.9% (n = 23,345) had polypharmacy. The mean (median, SD) duration of follow-up from the index date for each outcome measure is reported in Table 2.

Kaplan-Meier Results

Figure 2 provides the Kaplan-Meier survival curves for the 4 study outcomes stratified by pain group. The 12 months observed risk of hospitalization, specialist and follow-up physician visits, and polypharmacy was greater in the CSP group compared with NP/NDMP group (log rank statistic $P < 0.001$ for all outcomes; Fig. 2).

Frailty Model Results

The unadjusted results reported in Table 3 suggest that CSP residents had higher risk of hospitalization (crude HR

TABLE 2. Length of Follow-up (d) for Each Outcome Measure From the Index Date, Overall, and by Pain Group

| Outcome Measure | Mean (Median, SD) | | |
|-----------------------------------|----------------------|----------------------|----------------------|
| | Overall | CSP | NP/NDMP |
| Hospitalization | 264.3 (366, 123.3) | 248.7 (297.0, 126.1) | 273.1 (366, 120.8) |
| Specialist visit | 196.0 (173.5, 142.5) | 183.5 (152.0, 140.0) | 202.7 (187.0, 143.5) |
| Follow-up general physician visit | 31 (10, 66.4) | 28 (10, 60.8) | 33 (11, 69.3) |
| Polypharmacy | 42 (12, 84.5) | 34.5 (9, 75.4) | 45.5 (14, 89.0) |

CSP indicates clinically significant pain; NP/NDMP, no pain or nondaily mild pain.

1.28; 95% CI, 1.22-1.35), specialist visit (crude HR 1.14; 95% CI, 1.10-1.18), repeated GP visit (crude HR 1.13; 95% CI, 1.10-1.16), and onset of polypharmacy (crude HR 1.22; 95% CI, 1.18-1.25). Table 4 reports the fully adjusted HRs with 95% CIs. We found that health care use after admission to LTC was strongly associated with pain group, even after adjusting for covariates (Table 4). In any given quarter, compared with residents with NP/NDMP, CSP residents had a higher risk of hospitalization (HR 1.22; 95% CI, 1.16-1.28), specialist visit (HR 1.09; 95% CI, 1.05-1.13), follow-up GP visit (HR 1.10; 95% CI, 1.07-1.13), and onset of polypharmacy

(HR 1.09; 95% CI, 1.06-1.12). As expected, health care use was also statistically significantly associated with sociodemographic measures and prior health care utilization.

DISCUSSION

To the best of our knowledge, this is the first large-scale project to examine the utilization of health care resources as a function of pain among older adults who reside in LTC facilities. Consistent with our hypothesis, we found increased health care utilization as a function of pain in LTC. Residents

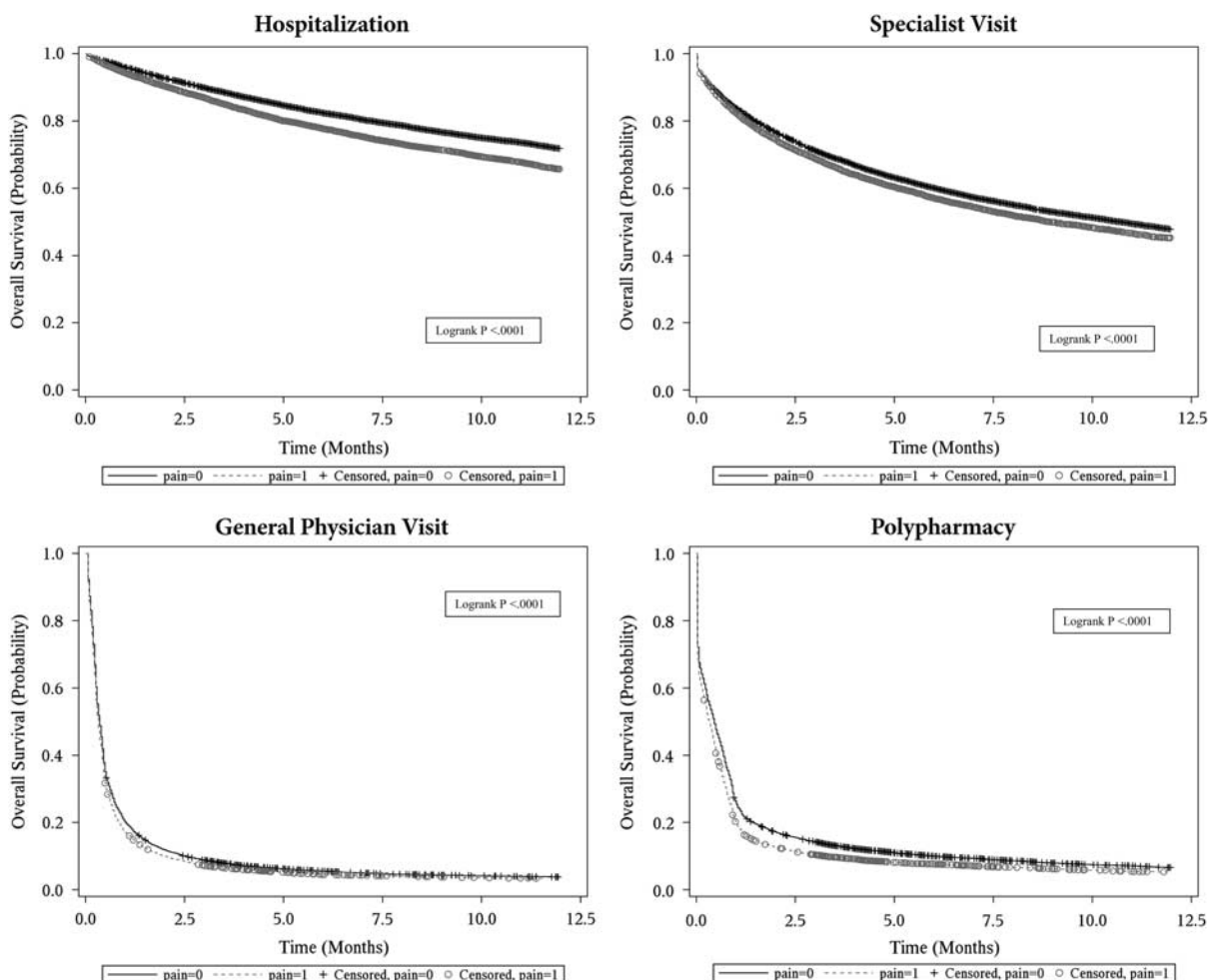


FIGURE 2. Kaplan-Meier survival curves for each health care event subsequent to admission to long-term care, stratified by the clinically significant pain (coded as pain = 1) and the no pain or nondaily mild pain (coded as pain = 0) cohorts.

TABLE 3. Unadjusted HRs for the Association Between Clinically Significant Pain and Health Care Use in LTC Residents (Reference NP/NDMP)

| | Unadjusted HRs | 95% CI |
|-----------------------------------|----------------|-----------|
| Hospitalization | 1.28 | 1.22-1.35 |
| Specialist visit | 1.14 | 1.10-1.18 |
| Follow-up general physician visit | 1.13 | 1.10-1.16 |
| Polypharmacy | 1.22 | 1.18-1.25 |

Bold values indicate statistical significance at $P < 0.01$ level.
 CI indicates confidence interval; HR, hazard ratios; LTC, long-term care; NP/NDMP, no pain or nondaily pain mild pain.

with CSP had higher risk of hospitalization (22%), specialist visits (9%), repeated physician visits (10%), and onset of polypharmacy (9%) compared with NP/NDMP residents, after adjusting for several other confounders. This finding is consistent with the patterns identified in research based on a large-scale survey on over 15,000 persons who were 12 years of age or older.³³ Specifically, Schopflocher³³ found that those reporting severe pain had 4 times higher rates of hospitalization and 4 times the number of consultations with medical professionals. Similarly a study by Pérez et al³⁴ has demonstrated that pain intensity is a predictor of increased health care utilization and that early treatment reduces subsequent health care utilization.³⁵ Interestingly, the impact of chronic pain on medication use in the Schopflocher sample was much more significant than in our study including higher self-reported use of over-the-counter pain medications, 6 times greater use of opioids and 4 times the average number

of medications taken. Our study is based on administrative databases that include objective documentation of medication use. We found that chronic pain did not seem to have as high an impact on medication use in LTC as it did in the large community sample of persons over 12 years.³³ This may reflect pain under treatment which has also been observed in other LTC studies.^{14,36,37} That said, we examined only broad classes of medications (based on the AHFS), and, as such, we do not know for certain how many medications patients received within each class. Future research examining the use of specific medication classes could clarify whether pain is indeed undertreated in LTC. It is possible that more frequent (than the current mandated minimum of every 3 mo in Canada²⁷) and more thorough assessment of pain would lead to better management and earlier detection of illnesses and conditions that impact both health care utilization (eg, reduced frequency of hospital admissions) and resident well-being.

In addition to the overall findings concerning the impact of CSP in LTC, we found that sex also affected the results with female residents having higher risk of first hospitalization (25%), specialist visits (9%), and repeated GP (3%) visits compared with male residents. This may be due, in part, to women being at greater risk for certain conditions such as osteoporosis and associated fractures,³⁸ given the high frequency of injurious falls in LTC with as many as 85% of residents experiencing at least 1 fall over a 19-month period.³⁹ Indeed, data from our study indicate that 17% of first hospitalizations after admission to LTC were due to injury and external causes. Almost three quarters (73%) of these hospitalizations involved female patients.

TABLE 4. Multivariable Frailty Models for Health Care Use in LTC Residents

| | Hazard Ratios (95% CI) | | | |
|---|--------------------------|--------------------------|-----------------------------------|--------------------------|
| | Hospitalization | Specialist Visit | Follow-up General Physician Visit | Polypharmacy |
| CSP (reference NP/NDMP group) | 1.22 (1.16, 1.28) | 1.09 (1.05, 1.13) | 1.10 (1.07, 1.13) | 1.09 (1.06, 1.12) |
| Females (reference males) | 1.25 (1.19, 1.31) | 1.09 (1.05, 1.13) | 1.03 (1.00, 1.06) | 0.96 (0.93, 0.98) |
| Age groups (reference 65-74) | | | | |
| 75-79 | 1.00 (0.91, 1.1) | 0.91 (0.85, 0.97) | 1.04 (0.99, 1.10) | 1.00 (0.94, 1.06) |
| 80-84 | 0.93 (0.85, 1.01) | 0.85 (0.8, 0.91) | 1.03 (0.98, 1.08) | 0.97 (0.92, 1.02) |
| 85-89 | 0.94 (0.86, 1.02) | 0.80 (0.75, 0.85) | 1.02 (0.97, 1.07) | 0.99 (0.94, 1.04) |
| 90-94 | 0.87 (0.8, 0.95) | 0.71 (0.66, 0.75) | 1.01 (0.96, 1.06) | 1.02 (0.97, 1.07) |
| 95+ | 0.73 (0.64, 0.82) | 0.57 (0.53, 0.63) | 1.01 (0.95, 1.07) | 1.04 (0.97, 1.10) |
| Location of residence (reference urban) | 1.01 (0.95, 1.07) | 0.99 (0.94, 1.03) | 1.03 (0.99, 1.06) | 1.00 (0.96, 1.03) |
| Health region (reference Regina Qu'Appelle) | | | | |
| Northern Saskatchewan | 0.92 (0.60, 1.40) | 1.11 (0.75, 1.62) | 0.93 (0.64, 1.35) | 0.98 (0.71, 1.36) |
| Central Saskatchewan | 0.83 (0.72, 0.95) | 0.99 (0.85, 1.15) | 0.93 (0.81, 1.07) | 0.94 (0.83, 1.06) |
| Saskatoon health region | 0.85 (0.75, 0.98) | 1.19 (1.04, 1.36) | 1.02 (0.9, 1.15) | 0.99 (0.89, 1.11) |
| Southwest Saskatchewan | 0.78 (0.68, 0.89) | 0.96 (0.83, 1.11) | 0.95 (0.84, 1.08) | 0.92 (0.82, 1.03) |
| Southeast Saskatchewan | 0.98 (0.86, 1.12) | 0.90 (0.78, 1.03) | 1.08 (0.96, 1.22) | 1.02 (0.92, 1.14) |
| Charlson Comorbidity Index (reference 3+) | | | | |
| 0 vs. 3+ | 0.73 (0.68, 0.79) | 0.84 (0.79, 0.88) | 0.86 (0.82, 0.89) | 0.91 (0.87, 0.95) |
| 1 vs. 3+ | 0.78 (0.73, 0.83) | 0.88 (0.84, 0.93) | 0.94 (0.91, 0.98) | 0.98 (0.94, 1.02) |
| 2 vs. 3+ | 0.85 (0.79, 0.91) | 0.93 (0.88, 0.98) | 0.97 (0.94, 1.01) | 1.05 (1.01, 1.10) |
| Prior health care utilization | | | | |
| No. of physician visits | 1.00 (1.00, 1.00) | 1.00 (1.00, 1.00) | 1.01 (1.01, 1.01) | 0.99 (0.99, 0.99) |
| No. of specialist visits | 1.01 (1.01, 1.02) | 1.02 (1.02, 1.02) | 1.00 (1.00, 1.00) | 1.00 (1.00, 1.00) |
| No. of prescription drugs | 1.03 (1.02, 1.04) | 1.03 (1.02, 1.03) | 1.02 (1.01, 1.02) | 1.24 (1.24, 1.25) |
| No. of inpatient hospitalizations | 1.11 (1.09, 1.13) | 1.06 (1.05, 1.08) | 1.02 (1.01, 1.03) | 0.99 (0.98, 1.01) |
| Long-term care facility type (reference integrated) | | | | |
| Special care homes | 1.14 (0.91, 1.43) | 1.03 (0.77, 1.37) | 0.60 (0.41, 0.86) | 0.50 (0.38, 0.65) |
| Hospital/special care home | 1.03 (0.88, 1.21) | 1.02 (0.84, 1.24) | 0.82 (0.64, 1.05) | 0.91 (0.76, 1.08) |

Bold values indicate statistical significance at $P < 0.05$ level.
 CI indicates confidence interval; CSP, clinically significant pain; LTC, long-term care; NP/NDMP, no pain or nondaily mild pain.

The number of comorbidities and health care utilization in 1-year period before LTC admission also increased the risk of subsequent health care use. Although this research took place in a largely rural Canadian province, we did not find any statistically significant effect on of health care utilization as a function of location of residence, regional health authority, and by the type of LTC facility. This is consistent with the idea that any health care disparities between rural areas and urban centers are small.

Although our study provides insights on the role of CSP pain and other risk factors for health care utilization among LTC residents, we recognize some limitations. First, RAI-MDS (version 2) pain assessment relies heavily on subjective nursing staff opinion, which may have affected our estimates on pain especially for residents with limited ability to communicate because of dementia. Future research focusing on specialized and standardized objective (eg, observational) pain assessment tools would be desirable. Second, excluding individuals who died or were discharged within 90 days of admission to LTC may have biased our inclusion criteria as the included patients may present relatively less risk. It should be noted that we could not include these individuals as pain is assessed quarterly. Third, our results may be subject to the omitted variable bias problem. There could be some patient-level and facility-level characteristics that may have influenced the outcomes but were currently not available in the databases. However, the random-effect modeling to some extent captures the effect of unobserved covariates. It should be noted that while health care utilization is not equivalent to cost (ie, 5 general practitioner visits would be less expensive than a 24-h hospital stay), it is strongly associated with cost. Future research, is therefore, needed to estimate the fiscal implications of the pain-related utilization identified herein. Future research is also needed to estimate the impact of untreated versus treated pain in health care utilization.

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