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ORIGINAL RESEARCH ARTICLE

Prevalence of, and Resident and Facility Characteristics Associated With Antipsychotic Use in Assisted Living vs. Long-Term Care Facilities: A Cross-Sectional Analysis from Alberta, Canada

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Abstract

Background Potentially inappropriate antipsychotic use in long-term care (LTC) facilities has been the focus of significant policy and clinical attention over the past 20 years. However, most initiatives aimed at reducing the use of these medications have overlooked assisted living (AL) settings.

Objective We sought to compare the prevalence of antipsychotic use (including *potentially inappropriate* use) among older AL and LTC residents and to explore the resident and facility-level factors associated with use in these two populations.

Methods We performed cross-sectional analyses of 1089 residents (mean age 85 years; 77% female) from 59 AL facilities and 1000 residents (mean age 85 years; 66% female) from 54 LTC facilities, in Alberta, Canada. Research nurses completed comprehensive resident assessments at baseline (2006–2007). Facility-level factors were assessed using standardized administrator interviews. Generalized linear models were used to estimate odds ratios for associations, accounting for clustering by facility.

Results Over a quarter of residents in AL (26.4%) and LTC (31.8%) were using antipsychotics ($p = 0.006$). Prevalence of *potentially inappropriate* use was similar in AL and LTC (23.4 vs. 26.8%, $p = 0.09$). However, among users, the proportion of antipsychotic use deemed *potentially inappropriate* was significantly higher in AL than LTC (AL: 231/287 = 80.5%; LTC: 224/318 = 70.4%; $p = 0.004$). In both settings, comparable findings regarding associations between resident characteristics (including dementia, psychiatric disorders, frailty, behavioral symptoms, and antidepressant use) and antipsychotic use were observed. Few facility characteristics were associated with overall antipsychotic use, but having a pharmacist on staff (AL), or an affiliated physician (LTC) was associated with a lower likelihood of *potentially inappropriate* antipsychotic use.

Conclusion Our findings illustrate the importance of including AL settings in clinical and policy initiatives aimed at reducing inappropriate antipsychotic use among older vulnerable residents.

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Key Points

Overall and potentially inappropriate antipsychotic use were common in both assisted living (26.4 and 23.4%) and long-term care (31.8 and 26.8%) settings.

Correlates of antipsychotic use were similar among assisted living and long-term care residents, including potentially concerning associations with dementia, frailty, and other psychotropic medication use.

This study provides evidence to support the expansion of initiatives aimed at reducing inappropriate antipsychotic use in long-term care settings to include assisted living facilities.

1 Introduction

The widespread use of antipsychotic medications in long-term care (LTC) facilities has been the focus of considerable clinical, research, and policy attention [1–4]. This attention has largely been fueled by doubts regarding the effectiveness of antipsychotics coupled with concerns about associated adverse effects [5], including death [6] and stroke [7, 8], particularly when used by individuals with dementia [9–11].

Government-approved indications for antipsychotics vary by country [12, 13] and have evolved over time with emerging research on older and younger populations [14, 15]. Health Canada approved indications specific to adults include use for schizophrenia and related psychotic disorders, bipolar disorders, and major depression as well as the short-term use of risperidone for aggression and psychotic symptoms in individuals with severe dementia of the Alzheimer type [16]. Regulatory bodies in both Canada and USA have issued warnings regarding the increased risk of death associated with the use of antipsychotics in older adults with dementia [17, 18]. Despite these warnings and reports that the drugs offer limited benefit to those with dementia [19–21], various antipsychotics are frequently prescribed for unapproved indications, often to manage behavioral concerns associated with dementia [14, 22, 23]. Another major concern associated with antipsychotics is that their use is often continued long term in continuing care settings [24], and frequently occurs without adequate medication review to re-assess appropriateness [25].

Both the Canadian Coalition for Seniors Mental Health [22] and Choosing Wisely Canada [26] encourage the use of non-pharmacological interventions to address behavioral and psychological symptoms of dementia prior to the prescription of antipsychotics. With these recommendations, the aim of both groups is to limit adverse outcomes related to the use of antipsychotics among those with dementia, while recognizing that they may be the most effective option in some cases [21].

The Canadian Foundation for Healthcare Improvement is supporting efforts to reduce potentially inappropriate antipsychotic use (i.e., use among those without a diagnosis of psychoses) through staff training and accreditation initiatives in LTC facilities [27]. As with similar initiatives in USA and Canada, [3, 28, 29] their focus is to enhance understanding of the drivers of antipsychotic use among LTC residents with the aim of reducing inappropriate use through targeted interventions [22]. However, compared with the LTC sector, there has been little research exploring antipsychotic use among older residents of assisted living (AL) settings, with no studies done in Canada. As recently noted by Zimmerman and colleagues [30], AL facilities have typically not been included in initiatives aimed at reducing inappropriate antipsychotic use within the continuing care sector.

AL facilities aim to offer supportive care, emphasizing autonomy and privacy in a home-like setting. AL residents typically have substantial health needs albeit fewer compared with LTC residents. Data from USA and Canada indicate that rates of dementia are high in AL (upwards of 60%) [31, 32]. Within some regions, AL is viewed as a substitute for LTC facility-based care [33, 34], but staffing levels are often lower with fewer skilled staff members per resident [35–37].

With current research limitations in mind, the objectives of this study were to: (1) examine the prevalence of antipsychotic use, including *potentially inappropriate* use (using a definition currently employed by Canadian health and quality monitoring organizations) among older (aged 65+ years) residents of AL and LTC facilities in Alberta, Canada; and, (2) explore and compare the resident and facility-level characteristics associated with antipsychotic use in these two care settings. We hoped to provide empirical data to assess whether AL facilities should be included in initiatives aimed at reducing inappropriate antipsychotic use among continuing care residents.

2 Methods

2.1 Analytic Sample

This investigation used data from the Alberta Continuing Care Epidemiological Studies (ACCES), a longitudinal study of older (aged 65+ years) residents of designated

(publicly funded) assisted living (DAL) and LTC facilities in Alberta, Canada who were assessed and followed from 2006 to 2009. Resident assessments as well as interviews with family caregivers and facility representatives were conducted. For both settings, residents in participating sites were excluded if they were <65 years of age, recently admitted (<21 days), receiving palliative care (expected survival <6 months), and/or their participation was otherwise deemed inappropriate by staff or family. Approximately 18% of DAL (52/291) and 4% of LTC (9/227) residents were ineligible based on this last criterion, which included those in hospital at baseline. For residents capable of making their own informed decisions (as reported by facility representatives), written informed consent for participation was obtained by research nurses after an initial independent approach and introduction by facility staff. For residents with moderate to severe cognitive impairment (as determined by facility representatives) or with an enacted personal directive, written consent was obtained from designated surrogate decision makers.

DAL study participants were 1089 of 1510 eligible residents (72.1% response rate) from 59 participating (out of 60 eligible) DAL facilities. Of those not enrolled, 339 (22.5% of eligible residents) refused to participate and for the remaining 82 (5.4%) their legally designated surrogate could not be contacted. Age and sex were available for 364 (86.5%) of the 421 nonparticipants and showed a similar distribution (mean age 84.4 ± 7.1 years, 74% women) to that of participants (mean age 84.9 ± 7.3 years, 77% women). At the time of the ACCES, there were considerably more LTC than DAL residents potentially eligible for participation. Consequently, a random sample of 1731 eligible LTC residents was drawn from 54 facilities with a final sample of 1000 participants (57.8% response rate). Age and sex were available for 665/731 (91%) of nonparticipants and showed a similar distribution (mean age 84.7 ± 7.5 years, 67% women) to participants (mean age 84.9 ± 7.6 years, 66% women). Additional information regarding the ACCES study has been previously published [38–40].

Ethical approval for the ACCES study was originally obtained from the University of Calgary Conjoint Health Research Ethics Board, the University of Alberta Research Ethics Board, and the University of Lethbridge Human Subject Research Committee. This ACCES sub-study was granted ethics approval by the University of Waterloo, Office of Research Ethics.

2.2 Resident Characteristics

Trained research nurses administered the Resident Assessment Instrument for Assisted Living or LTC Facility (interRAI-AL or interRAI-LTCF) among DAL and LTC residents (respectively) at baseline (2006–2008). These validated assessment tools capture information on residents' sociodemographic characteristics, health conditions, physical and cognitive status, behavioral problems, and use of medications and services [41–43]. A comprehensive list of all prescribed and non-prescribed medications taken by the resident over the previous 3 days was captured by research nurses as part of the assessment through consultation with the resident and staff members (with examination of drug containers and facility drug lists where available and current).

Resident characteristics examined included age, sex, dementia diagnosis (along with treatment status by acetylcholinesterase inhibitors and/or memantine), diagnosis of depression, diagnoses of other psychiatric conditions (schizophrenia, bipolar disorder, anxiety), presence of delusions and/or hallucinations, diagnoses of cardiovascular conditions (hypertension, coronary heart disease, congestive heart failure, peripheral vascular disease, cardiac dysrhythmia, valvular stenosis, venous thromboembolism or lipid abnormalities), diagnoses of cerebrovascular conditions, number of medications (excluding antipsychotics), history of falls, length of stay in facility, location prior to admission, history of inpatient hospitalizations and/or emergency department visits, frailty status (based on comparable 86-item [DAL] and 83-item [LTC] Frailty Index [44, 45] measures derived from the respective interRAI assessment tools and with cut-off points of >0.3 for frail, 0.2–0.3 for pre-frail, and <0.2 for robust), aggressive behavior (modeled on the interRAI-derived Aggressive Behavior Scale [46]), elopement attempts, wandering behavior, use of physical restraints, use of antidepressant medication, use of anxiolytic medication, and use of hypnotic and/or sedative medication.

The main outcome was current antipsychotic use, defined as use of one or more medications classified as an antipsychotic (included those used pro re nata) by the Anatomical Therapeutic Classification system, based on the assessment of medication use performed by study nurses as described above.

Sensitivity analyses were conducted to examine the prevalence and correlates of *potentially inappropriate* antipsychotic use in both settings, and to compare these findings with those for *overall* antipsychotic use. For these analyses, *potentially inappropriate* antipsychotic use was defined using criteria adopted by the Canadian Institute for Health Information [47] to permit a comparison of our findings with existing Canadian data. Specifically, antipsychotic use was defined as being *potentially inappropriate* when it occurred in the absence of a diagnosis of psychosis (schizophrenia) or Huntington's disease, and/or symptoms of delusions and/or hallucinations. Residents with end-stage disease or receiving palliative care were excluded from the ACCES study.

2.3 Facility Characteristics

For each facility, an administrator, manager, or director of care (i.e., someone familiar with the facility and with direct knowledge about the residents) was surveyed about midway during the 1-year follow-up period of the full ACCES study regarding baseline facility characteristics. Facility-level variables considered included the presence of designated dementia beds in the facility, for-profit/not-for-profit ownership, status as part of an AL and/or LTC chain, availability of other levels of care on site (including LTC and acute care beds), availability of licensed practical nurses and/or registered nurses on site 24 h a day/7 days a week, affiliation of a physician with facility, involvement of a pharmacist within the past month, and the health region in which the facility was located. It should be noted that health region (as defined at the time of the ACCES study) captures provincial variation in health policies, services, facility types as well as community size and urban/rural status.

2.4 Analytical Approach

Descriptive analyses were conducted to examine the distribution of baseline resident and facility characteristics (overall and associated with antipsychotic use) among DAL and LTC residents. Resident and facility-level characteristics were assessed for their association with prevalent antipsychotic use in bivariate analyses. Categorical versions of continuous variables were derived using cut-off points based on the sample distribution and previous ACCES reports [38, 40]. These associations were further examined using generalized linear models with a binomial distribution and logit link to estimate odds ratios (ORs), also accounting for clustering with generalized estimating equations. Variables considered relevant based on the initial age/sex-adjusted models ($p < 0.05$) and existing literature [48–50] were considered for inclusion in a multivariable model to adjust for potential confounders and identify variables independently associated with use of antipsychotics. Resident variables included in the final model were assessed using bi-directional stepwise selection; those that remained significant with p values <0.10 were retained in the final model to permit comparison across settings for selected variables, including variables potentially limited by small cell sizes in a particular setting. Owing to relatively high correlations among facility characteristics, each facility-level variable was examined in a separate model adjusting for all relevant resident-level variables.

For the LTC models, frailty status was considered as a binary variable (with robust and pre-frail residents grouped compared with frail residents), owing to the small sample of robust LTC residents using antipsychotics ($n = 14$).

All analyses were carried out using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA).

3 Results

In both DAL and LTC, the mean age of residents was 84.9 years and most were women (77 and 66%, respectively) (Table 1). Overall antipsychotic use at baseline was 26.4% ($n = 287$) in DAL and 31.8% ($n = 318$) in LTC ($p = 0.006$). Among DAL and LTC residents, 57.6 and 70.8% had a diagnosis of dementia ($p < 0.0001$), 18.5 and 22.2% had a diagnosis of a psychiatric disorder (schizophrenia, bipolar disorder, anxiety) [$p = 0.0458$], and 29.2 and 65.9% were assessed as having some degree of aggressive behavior (Aggressive Behaviour Scale [ABS] score >0) [$p < 0.0001$], respectively. After excluding residents with schizophrenia, Huntington's disease, delusions and/or hallucinations, the prevalence of *potentially inappropriate* antipsychotic use was 23.4% ($n = 231/989$) in DAL, with a slightly higher prevalence of 26.8% ($n = 224/835$) in LTC ($p = 0.088$). Most antipsychotic users in both settings met criteria for *potentially inappropriate* use, with a significantly greater ($p = 0.004$) proportion among users in DAL (231/287 or 80.5%) compared with LTC (224/318 or 70.4%).

The distribution of resident and facility-level characteristics among DAL and LTC residents by antipsychotic use are shown in Tables 1 and 2, respectively. Within each setting, antipsychotic users had a lower mean age, and the proportion of residents using antipsychotics was significantly higher among residents with dementia, psychiatric disorders, depression, delusions and/or hallucinations, highest frailty level, more severe aggressive behaviors, and those who exhibited elopement attempts or threats, wandered, or used antidepressants, compared with residents without these conditions. Use of antipsychotic medication was also significantly associated with anxiolytic use, hypnotic and/or sedative use, physical restraint use, and history of falls among LTC (but not DAL) residents. Among DAL residents, antipsychotic use was significantly less prevalent in those with a reported diagnosis of cardiovascular or cerebrovascular disease whereas among LTC residents, use was significantly less prevalent among those with a diagnosis of cerebrovascular disease only. Antipsychotic use was more common among residents who had lived in DAL for a longer period of time, but no such association was observed among LTC residents.

Table 3 presents findings regarding resident characteristics associated with antipsychotic use from fully adjusted

Table 1 Resident characteristics (DAL vs. LTC), overall and in relation to antipsychotic use (row%)

Characteristic *n* (%), unless otherwise noted	DAL residents			LTC residents		
	Total sample (*n* = 1089)	Antipsychotic users (*n* = 287 [26.4%])	Antipsychotic non-users (*n* = 802 [73.6%])	Total sample (*n* = 1000)	Antipsychotic users (*n* = 318 [31.8%])	Antipsychotic non-users (*n* = 682 [68.2%])
Sociodemographic						
Age, years						
Mean ± SD	84.9 ± 7.3	84.2 ± 7.3	85.2 ± 7.3**	84.9 ± 7.6	83.9 ± 7.5	85.4 ± 7.6*
65–79	272 (25.0)	84 (30.9)	188 (69.1)	231 (23.1)	89 (38.5)	142 (61.5)*
80–85	285 (26.2)	78 (27.4)	207 (72.6)	256 (25.6)	83 (32.4)	173 (67.6)
86–89	247 (22.7)	61 (24.7)	186 (75.3)	216 (21.6)	68 (31.5)	148 (68.5)
≥90	285 (26.1)	64 (22.5)	221 (77.5)	297 (29.7)	78 (26.3)	219 (73.7)
Sex						
Male	254 (23.3)	66 (26.0)	188 (74.0)	343 (34.3)	113 (32.9)	230 (67.1)
Female	835 (76.7)	221 (26.5)	614 (73.5)	657 (65.7)	205 (31.2)	452 (68.8)
Facility length of stay, months						
Mean ± SD	23.0 ± 19.7	25.4 ± 21.9	22.1 ± 18.9*	36.8 ± 39.2	36.1 ± 34.1	37.1 ± 41.4
<12	377 (34.6)	80 (21.2)	297 (78.8)*	264 (26.4)	74 (28.0)	190 (72.0)
12–24	314 (28.8)	86 (27.4)	228 (72.6)	222 (22.2)	75 (33.8)	147 (66.2)
>24	398 (36.6)	121 (30.4)	277 (69.6)	514 (51.4)	169 (32.9)	345 (67.1)
Location prior to admission						
Home	409 (37.6)	102 (24.9)	307 (75.1)	148 (14.8)	49 (33.1)	99 (66.9)
Hospital	326 (29.9)	90 (27.6)	236 (72.4)	445 (44.6)	139 (31.2)	306 (68.8)
Institution (AL/LTC/other)	354 (32.5)	95 (26.8)	259 (73.2)	404 (40.5)	127 (31.4)	277 (68.6)
Health and functional status						
Dementia and treatment status[a]						
No dementia	462 (42.4)	62 (13.4)	400 (86.6)*	292 (29.2)	53 (18.2)	239 (81.8)*
Dementia, not treated	361 (33.2)	127 (35.2)	234 (64.8)	557 (55.7)	197 (35.4)	360 (64.6)
Dementia, treated	266 (24.4)	98 (36.8)	168 (63.2)	151 (15.1)	68 (45.0)	83 (55.0)
Psychiatric diagnoses[b]						
No	888 (81.5)	202 (22.7)	686 (77.3)*	778 (77.8)	206 (26.5)	572 (73.5)*
Yes	201 (18.5)	85 (42.3)	116 (57.7)	222 (22.2)	112 (50.5)	110 (49.5)
Depression diagnosis						
No	715 (65.7)	170 (23.8)	545 (76.2)*	563 (56.3)	153 (27.2)	410 (72.8)*
Yes	374 (34.3)	117 (31.3)	257 (68.7)	437 (43.7)	165 (37.8)	272 (62.2)
Depression symptoms (DRS score)[c]						
No (<3)	880 (80.8)	199 (22.6)	681 (77.4)*	492 (49.3)	124 (25.2)	368 (74.8)*
Yes (≥3)	209 (19.2)	88 (42.1)	121 (57.9)	505 (50.7)	194 (38.4)	311 (61.6)
Delusions/hallucinations						
No	999 (91.7)	241 (24.1)	758 (75.9)*	845 (84.5)	233 (27.6)	612 (72.4)*
Yes	90 (8.3)	46 (51.1)	44 (48.9)	155 (15.5)	85 (54.8)	70 (45.2)
Cardiovascular disease[d]						
No	284 (26.1)	94 (33.1)	190 (66.9)*	238 (23.8)	83 (34.9)	155 (65.1)
Yes	805 (73.9)	193 (24.0)	612 (76.0)	762 (76.2)	235 (30.8)	527 (69.2)
Cerebrovascular disease[e]						
No	823 (75.6)	239 (29.0)	584 (71.0)*	687 (68.7)	230 (33.5)	457 (66.5)**
Yes	266 (24.4)	48 (18.0)	218 (82.0)	313 (31.3)	88 (28.1)	225 (71.9)
No. of co-morbidities						
Mean ± SD	4.6 ± 2.0	4.7 ± 2.2	4.6 ± 1.9	5.2 ± 2.0	5.3 ± 2.1	5.2 ± 2.0
0–3	333 (30.6)	103 (30.9)	230 (69.1)*	202 (20.2)	67 (33.2)	135 (66.8)

Table 1 continued

Characteristic *n* (%), unless otherwise noted	DAL residents			LTC residents		
	Total sample (*n* = 1089)	Antipsychotic users (*n* = 287 [26.4%])	Antipsychotic non-users (*n* = 802 [73.6%])	Total sample (*n* = 1000)	Antipsychotic users (*n* = 318 [31.8%])	Antipsychotic non-users (*n* = 682 [68.2%])
4 or 5	406 (37.3)	88 (21.7)	318 (78.3)	379 (37.9)	109 (28.8)	270 (71.2)
≥6	350 (32.1)	96 (27.4)	254 (72.6)	419 (41.9)	142 (33.9)	277 (66.1)
No. of medications[f]						
Mean ± SD	8.0 ± 3.6	7.8 ± 3.5	8.1 ± 3.7	7.6 ± 3.6	7.7 ± 3.4	7.6 ± 3.7
0–6	391 (35.9)	108 (27.6)	283 (72.4)	402 (40.2)	131 (32.6)	271 (67.4)
7–8	242 (22.2)	71 (29.3)	171 (70.7)	208 (20.8)	61 (29.3)	147 (70.7)
9–10	207 (19.0)	50 (24.2)	157 (75.8)	187 (18.7)	63 (33.7)	124 (66.3)
≥11	249 (22.9)	58 (23.3)	191 (76.7)	203 (20.3)	63 (31.0)	140 (69.0)
Antidepressants						
No	600 (55.1)	121 (20.2)	479 (79.8)*	519 (51.9)	122 (23.5)	397 (76.5)*
Yes	489 (44.9)	166 (33.9)	323 (66.1)	481 (48.1)	196 (40.7)	285 (59.3)
Anxiolytics						
No	975 (89.5)	252 (25.8)	723 (74.2)	897 (89.7)	274 (30.5)	623 (69.5)*
Yes	114 (10.5)	35 (30.7)	79 (69.3)	103 (10.3)	44 (42.7)	59 (57.3)
Sedatives/hypnotics						
No	844 (77.5)	221 (26.2)	623 (73.8)	801 (80.1)	242 (30.2)	559 (69.8)*
Yes	245 (22.5)	66 (26.9)	179 (73.1)	199 (19.9)	76 (38.2)	123 (61.8)
FI						
Robust (FI score <0.2)	366 (33.6)	66 (18.0)	300 (82.0)*	62 (6.2)	14 (22.6)	48 (77.4)*
Pre-frail (FI score 0.2–0.3)	424 (38.9)	99 (23.3)	325 (76.7)	197 (19.7)	26 (13.2)	171 (86.8)
Frail (FI score >0.3)	299 (27.5)	122 (40.8)	177 (59.2)	741 (74.1)	278 (37.5)	463 (62.5)
Falls						
None	780 (71.6)	203 (26.0)	577 (74.0)	730 (73.0)	217 (29.7)	513 (70.3)*
≥1 falls/90 days	309 (28.4)	84 (27.2)	225 (72.8)	270 (27.0)	101 (37.4)	169 (62.6)
Physical restraints						
No	1057 (97.1)	278 (26.3)	779 (73.7)	594 (59.4)	168 (28.3)	426 (71.7)*
Yes	32 (2.9)	9 (28.1)	23 (71.9)	406 (40.6)	150 (36.9)	256 (63.1)
Any inpatient hospitalizations and/or ED visits (past 90 days)						
None	840 (77.1)	229 (27.3)	611 (72.7)	899 (89.9)	290 (32.3)	609 (67.7)
≥1	249 (22.9)	58 (23.3)	191 (76.7)	101 (10.1)	28 (27.7)	73 (72.3)
Behavioral characteristics						
Aggressive behavior (ABS Score)[g]						
None (0)	771 (70.8)	156 (20.2)	615 (79.8)*	341 (34.1)	63 (18.5)	278 (81.5)*
Moderate (1–2)	183 (16.8)	63 (34.4)	120 (65.6)	203 (20.3)	66 (32.5)	137 (67.5)
Severe to very severe (≥3)	135 (12.4)	68 (50.4)	67 (49.6)	456 (45.6)	189 (41.4)	267 (58.6)
Elopement attempts or threats						
No	985 (90.4)	234 (23.8)	751 (76.2)*	832 (83.2)	230 (27.6)	602 (72.4)*
Yes	104 (9.6)	53 (51.0)	51 (49.0)	168 (16.8)	88 (52.4)	80 (47.6)
Wandering						
No	967 (88.8)	226 (23.4)	741 (76.6)*	770 (77.0)	210 (27.3)	560 (72.7)*

Table 1 continued

Characteristic *n* (%), unless otherwise noted	DAL residents			LTC residents		
	Total sample (*n* = 1089)	Antipsychotic users (*n* = 287 [26.4%])	Antipsychotic non-users (*n* = 802 [73.6%])	Total sample (*n* = 1000)	Antipsychotic users (*n* = 318 [31.8%])	Antipsychotic non-users (*n* = 682 [68.2%])
Yes	122 (11.2)	61 (50.0)	61 (50.0)	230 (23.0)	108 (47.0)	122 (53.0)

ABS Aggressive Behavior Scale, *AL* assisted living, *DAL* designated assisted living, *DRS* Depression Rating Scale, *ED* emergency department, *FI* Frailty Index, *LTC* long-term care, *SD* standard deviation

* $p < 0.05$; ** $p < 0.1$

[a] Dementia treatment defined as use of acetylcholinesterase inhibitors (donepezil, rivastigmine, galantamine) or memantine

[b] Psychiatric diagnoses defined as a diagnosis of schizophrenia, bipolar disorder, or anxiety

[c] DRS, 3 LTC residents missing; *n* = 997

[d] Cardiovascular diseases defined as diagnoses of hypertension, coronary heart disease, congestive heart failure, peripheral vascular disease, cardiac dysrhythmia, valvular stenosis, venous thromboembolism, or lipid abnormalities

[e] Cerebrovascular diseases defined as history of stroke or diagnosis of cerebrovascular disease

[f] Number of medications excludes antipsychotics

[g] ABS: a summary scale of four behaviors (verbal abuse, physical abuse, socially inappropriate or disruptive, resists care), with higher scores indicating a greater number and frequency of behavioral issues

models for DAL and LTC settings. Among DAL residents, characteristics significantly associated with antipsychotic use included a diagnosis of dementia (OR 2.73, 95% confidence interval (CI) 1.98–3.74 and OR 2.45, 95% CI 1.55–3.86 for untreated [with a cognitive enhancer] and treated dementia, respectively), diagnosis of a psychiatric disorder (OR 2.06, 95% CI 1.27–3.33), presence of delusions and/or hallucinations (OR 1.76, 95% CI 0.99–3.14), being frail (OR 1.92, 95% CI 1.29–2.86), increased length of stay in DAL (OR 1.66, 95% CI 1.17–2.35 for stays >2 years vs. <1 year), severe aggressive behavior (OR 2.12, 95% CI 1.37–3.29 for ABS scores >2 vs. score = 0), history of elopement attempts or threats (OR 1.63, 95% CI 1.05–2.54), and concurrent use of antidepressants (OR 1.99, 95% CI 1.43–2.75). Variables significantly associated with a lower likelihood of antipsychotic use included age 90 years or over (OR 0.64, 95% CI 0.40–1.01) vs. 65–79, and diagnoses of cardiovascular (OR 0.73, 95% CI 0.54–1.00) or cerebrovascular disease (OR 0.55, 95% CI 0.34–0.89).

With a few exceptions, similar associations between resident characteristics and antipsychotic use were observed among LTC residents in fully adjusted models (Table 3). However, no significant independent association with use was observed for residents with cardiovascular or cerebrovascular disease or for those with longer lengths of stay in LTC. In addition, relative to the youngest age group, all residents aged 80 years or older showed a significantly lower likelihood for antipsychotic use among the LTC sample. Further, more indicators of behavioral challenges (in addition to aggressive behavior and elopement attempts/threats) were retained in the final LTC model, including wandering (OR 1.48, 95% CI 0.99–2.23) and use of physical restraints (OR 1.35, 95% CI 0.97–1.89). All the other psychotropic medications remained significantly associated with antipsychotic use among LTC residents, including antidepressants (OR 2.18, 95% CI 1.56–3.05), anxiolytics (OR 1.82, 95% CI 1.17–2.81), and sedatives/hypnotics (OR 1.56, 95% CI 1.06–2.28).

Adjusting for resident characteristics and exploring each of the facility characteristics in separate models, the presence of designated dementia beds in the facility was significantly associated with antipsychotic use in DAL (OR 1.61, 95% CI 1.07–2.44) (Table 4). Conversely, the presence of a pharmacist on staff (OR 0.48, 95% CI 0.23–1.03), affiliation with an AL chain (OR 0.57, 95% CI 0.31–1.05), and facility location in two of the five health regions (OR 0.58, 95% CI 0.35–0.94 and OR 0.56, 95% CI 0.30–1.05 for a mixed urban/rural region and a rural region, respectively, vs. an urban region) were associated with a lower odds of antipsychotic use. For the LTC setting (Table 4), following adjustment for resident characteristics, health region was the only facility variable significantly associated with antipsychotic use (OR 0.59, 95% CI 0.35–0.97 for region 3 [rural] vs. region 1 [urban]).

The results of the sensitivity analysis revealed fairly consistent associations between resident and facility characteristics and *potentially inappropriate* antipsychotic use across both settings, with a few exceptions (Supplemental Tables 1 and 2). Among DAL residents, cardiovascular disease was not significantly associated with *potentially inappropriate* use (unlike total antipsychotic use), while residing in a DAL facility that also offered a higher level of care (i.e., LTC, acute care) was associated with a lower likelihood of *potentially inappropriate* use (OR 0.67, 95% CI 0.44–1.04). Selected health regions also showed weaker

Table 2 Facility characteristics (DAL vs. LTC), overall and in relation to antipsychotic use (row%)

Characteristic *n* (%), unless otherwise noted	DAL residents			LTC residents		
	Total sample (*n* = 1089)	Antipsychotic users (*n* = 287 [26.4%])	Antipsychotic non-users (*n* = 802 [73.6%])	Total sample (*n* = 1000)	Antipsychotic users (*n* = 318 [31.8%])	Antipsychotic non-users (*n* = 682 [68.2%])
Dementia beds						
No	427 (39.2)	74 (17.3)	353 (82.7)*	427 (42.7)	125 (29.3)	302 (70.7)
Yes	662 (60.8)	213 (32.2)	449 (67.8)	573 (57.3)	193 (33.7)	380 (66.3)
Ownership						
For-profit	430 (39.5)	121 (28.1)	309 (71.9)	281 (28.1)	96 (34.2)	185 (65.8)
Not-for-profit or RHA	659 (60.5)	166 (25.2)	493 (74.8)	719 (71.9)	222 (30.9)	497 (69.1)
Part of a chain						
Not in a chain	159 (14.6)	42 (26.4)	117 (73.6)*	349 (34.9)	103 (29.5)	246 (70.5)
Part of (AL or LTC) chain	343 (31.5)	74 (21.6)	269 (78.4)	320 (32.0)	101 (31.6)	219 (68.4)
Part of AL and LTC chain	587 (53.9)	171 (29.1)	416 (70.9)	331 (33.1)	114 (34.4)	217 (65.6)
Level of care						
DAL (LTC) only or DAL (LTC) + equivalent/lower	876 (80.4)	244 (27.9)	632 (72.1)*	799 (79.9)	265 (33.2)	534 (66.8)**
DAL (LTC) + higher	213 (19.6)	43 (20.2)	170 (79.8)	201 (20.1)	53 (26.4)	148 (73.6)
LPN/RN coverage on site						
Neither on site	297 (27.3)	63 (21.2)	234 (78.8)*			
LPN and/or RN <24/7	118 (10.8)	27 (22.9)	91 (77.1)			
LPN and/or RN 24/7	674 (61.9)	197 (29.2)	477 (70.8)	1,000 (100)		
Physician (GP) affiliated with site						
No	700 (64.3)	189 (27.0)	511 (73.0)	18 (1.8)	6 (33.3)	12 (66.7)
Yes, no office on site	214 (19.7)	52 (24.3)	162 (75.7)	718 (71.8)	220 (30.6)	498 (69.4)
Yes, office on site	175 (16.1)	46 (26.3)	129 (73.7)	264 (26.4)	92 (34.8)	172 (65.2)
Pharmacist involved with site (past month)						
No	366 (33.6)	90 (24.6)	276 (75.4)**			
Yes, on staff	29 (2.7)	3 (10.3)	26 (89.7)	393 (39.3)	128 (32.6)	265 (67.4)
Yes, as consultant	694 (63.7)	194 (28.0)	500 (72.0)	607 (60.7)	190 (31.3)	417 (68.7)
Health region						
1 (urban)	311 (28.6)	94 (30.2)	217 (69.8)**	296 (29.6)	109 (36.8)	187 (63.2)
2 (mixed urban/rural)	234 (21.5)	57 (24.4)	177 (75.6)	206 (20.6)	63 (30.6)	143 (69.4)
3 (rural)	155 (14.2)	32 (20.6)	123 (79.4)	149 (14.9)	37 (24.8)	112 (75.2)
4 (urban)	281 (25.8)	82 (29.2)	199 (70.8)	239 (23.9)	73 (30.5)	166 (69.5)
5 (rural)	108 (9.9)	22 (20.4)	86 (79.6)	110 (11.0)	36 (32.7)	74 (67.3)

AL assisted living, *DAL* designated assisted living, *GP* general practitioner, *LPN* licenced practical nurse, *LTC* long-term care, *RHA* regional health authority, *RN* registered nurse

* $p < 0.05$; ** $p < 0.1$

associations with *potentially inappropriate* use among DAL residents. Among LTC residents, use of sedative/hypnotic drugs and health region were not significantly associated with *potentially inappropriate* antipsychotic use (unlike total antipsychotic use), while residents residing in a facility with an affiliated physician were significantly less likely to use *potentially inappropriate* antipsychotics (OR 0.56, 95% CI 0.32–0.96 and OR 0.46, 95% CI 0.30–0.70 for a physician with an office on site and without an office on site, respectively, relative to sites with no affiliated physician).

4 Discussion

Approximately one quarter of DAL residents (26%) were using antipsychotics, a finding comparable to rates reported in USA (21%) [51] and France (28%) [48] AL settings.

Table 3 Adjusted odds ratios (95% confidence intervals) for antipsychotic use associated with resident characteristics (DAL and LTC)

Resident characteristic	Odds ratio (95% confidence interval)	
	DAL (n = 1089)[a]	LTC (n = 1000)[b]
Sociodemographic		
Age, years		
65–79 (ref gp)	1.00	1.00
80–85	0.72 (0.49–1.06)**	0.65 (0.43–1.00)*
86–89	0.67 (0.42–1.06)**	0.57 (0.34–0.96)*
≥90	0.64 (0.40–1.01)**	0.60 (0.38–0.96)*
Sex		
Male	1.15 (0.80–1.65)	1.22 (0.87–1.72)
Facility length of stay, months		
<12 (ref gp)	1.00	
12–24	1.36 (0.95–1.96)**	
>24	1.66 (1.17–2.35)*	
Health and functional status		
Dementia and treatment status		
No dementia (ref gp)	1.00	1.00
Dementia, not treated	2.73 (1.98–3.74)*	1.97 (1.37–2.84)*
Dementia, treated	2.45 (1.55–3.86)*	3.09 (1.91–5.00)*
Psychiatric diagnoses	2.06 (1.27–3.33)*	2.14 (1.48–3.11)*
Delusions/hallucinations	1.76 (0.99–3.14)**	2.01 (1.35–3.00)*
Cardiovascular disease	0.73 (0.54–1.00)*	
Cerebrovascular disease	0.55 (0.34–0.89)*	
Antidepressants	1.99 (1.43–2.75)*	2.18 (1.56–3.05)*
Anxiolytics		1.82 (1.17–2.81)*
Sedatives/hypnotics		1.56 (1.06–2.28)*
FI		
Robust (FI score <0.2) (ref gp)	1.00	
Pre-frail (FI score 0.2–0.3)	1.18 (0.79–1.74)	
Frail (FI score >0.3)	1.92 (1.29–2.86)*	
FI (binary)[c]		
Robust/pre-frail (FI score ≤0.3)		1.00
Frail (FI score >0.3)		1.82 (1.15–2.87)*
Physical restraints		1.35 (0.97–1.89)**
Behavioral characteristics		
Aggressive behavior (ABS score)		
None (0) (ref gp)	1.00	1.00
Moderate (1–2)	1.41 (0.86–2.30)	1.53 (1.00–2.35)**
Severe to very severe (≥3)	2.12 (1.37–3.29)*	2.05 (1.36–3.09)*
Elopement attempts or threats[d]	1.63 (1.05–2.54)*	1.68 (1.07–2.62)*
Wandering[d]		1.48 (0.99–2.23)**

ABS Aggressive Behavior Scale, *AL* assisted living, *DAL* designated assisted living, *FI* Frailty Index, *LTC* long-term care, *ref gp* reference group

[a] The full multivariable logistic model for DAL adjusts for: age, sex, dementia/treatment status, psychiatric diagnoses, presence of delusions/hallucinations, frailty status, cardiovascular diagnoses, cerebrovascular diagnoses, AL length of stay, ABS score, elopement attempts or threats, and use of antidepressant medication

[b] The full multivariable logistic model for LTC adjusts for: age, sex, dementia/treatment status, psychiatric diagnoses, presence of delusions/hallucinations, frailty status, ABS score, elopement attempts or threats, wandering, use of physical restraints, and use of antidepressant, anxiolytic, and sedative/hypnotic medications

[c] Because of the small sample of LTC residents found to be robust by the FI, a binary variable was used for LTC analyses (robust/pre-frail residents combined for comparison with frail residents)

[d] Because of collinearity, the variables elopement attempts/threats and wandering could not be retained together in the fully-adjusted model for DAL. Elopement attempts/threats was retained in the model on the basis of its p-value (p = 0.030) compared with wandering (p = 0.044) when included separately in the full model

* $p < 0.05$; ** $p < 0.1$

Antipsychotic use was slightly higher among LTC residents (32%) but consistent with the typical range of estimates reported for Canadian LTC settings (29–41%) [3, 52]. The prevalence estimates observed in both settings were considerably higher than those reported among community-dwelling older Canadians (4.4%) [52].

The majority of antipsychotic use in both settings would be considered *potentially inappropriate* (80.5 and 70.4% of use in DAL and LTC, respectively) according to Canadian guidelines. Although consistent with current Canada-wide estimates for LTC [53], our observed prevalence of *potentially inappropriate* antipsychotic use in LTC (26.8%) is higher than that reported in recent years for LTC sites in Alberta (e.g., 21% in 2014–2015) [53]. This likely reflects a reduction in use secondary to targeted initiatives aimed at reducing antipsychotic use in Alberta LTC since the time of the ACCES study [54]. However, it is not known whether the prevalence of antipsychotic use in DAL sites, which were not included in the initiative, has undergone a similar reduction. Given their exclusion, there is cause for concern that the rate of potentially inappropriate antipsychotic use may be unchanged (or even on the rise) in this care setting.

Similar to previous studies, DAL and LTC residents with diagnoses of dementia [48–50, 55] psychiatric disorders [48–50, 55, 56], and related behavioral symptoms

Table 4 Adjusted odds ratios (95% confidence intervals) for antipsychotic use associated with facility characteristics (DAL and LTC)

Facility characteristics (added to multivariable models one at a time)	Odds ratio (95% confidence interval)	
	DAL (n = 1089)[a]	LTC (n = 1000)[b]
Dementia beds	1.61 (1.07–2.44)*	1.03 (0.72–1.48)
Ownership		
For-profit (ref gp)	1.00	1.00
Not-for-profit or RHA	0.76 (0.50–1.15)	0.82 (0.57–1.18)
Part of a chain		
Not in a chain (ref gp)	1.00	1.00
Part of [AL or LTC] chain	0.57 (0.31–1.05)**	0.98 (0.65–1.47)
Part of AL and LTC chain	0.83 (0.50–1.35)	1.05 (0.69–1.61)
Level of care		
Specified level only or specified level + equivalent/lower (ref gp)	1.00	1.00
Specified level + higher	0.70 (0.42–1.17)	0.87 (0.52–1.46)
LPN/RN coverage on site[c]		
Neither on site (ref gp)	1.00	
LPN and/or RN <24/7	1.13 (0.57–2.26)	
LPN and/or RN 24/7	1.34 (0.88–2.02)	
Physician (GP) affiliated with site		
No (ref gp)	1.00	1.00
Yes, no office on site	0.97 (0.53–1.77)	0.81 (0.57–1.14)
Yes, office on site	1.01 (0.62–1.64)	0.94 (0.59–1.49)
Pharmacist involved with site (past month)[d]		
No (ref gp DAL)	1.00	
Yes, on staff (ref gp LTC)	0.48 (0.23–1.03)**	1.00
Yes, as consultant	1.25 (0.88–1.77)	1.06 (0.75–1.49)
Health region		
1 (urban) (ref gp)	1.00	1.00
2 (mixed urban/rural)	0.58 (0.35–0.94)*	1.19 (0.78–1.81)
3 (rural)	0.56 (0.30–1.05)**	0.59 (0.35–0.97)*
4 (urban)	0.80 (0.49–1.30)	1.09 (0.64–1.85)
5 (rural)	0.62 (0.30–1.26)	1.35 (0.71–2.54)

ABS Aggressive Behavior Scale, *AL* assisted living, *DAL* designated assisted living, *GP* general practitioner, *LPN* licensed practical nurse, *LTC* long-term care, *ref gp* reference group, *RHA* regional health authority, *RN* registered nurse

[a] For DAL, each model adjusts for age, sex, dementia/treatment status, psychiatric diagnoses, presence of delusions/hallucinations, frailty status, cardiovascular diagnoses, cerebrovascular diagnoses, AL length of stay, ABS score, elopement attempts or threats, and use of antidepressant medications

[b] For LTC, each model adjusts for age, sex, dementia/treatment status, psychiatric diagnoses, presence of delusions/hallucinations, frailty status, ABS score, elopement attempts or threats, wandering, use of physical restraints, and use of antidepressant, anxiolytic and sedative/hypnotic medications

[c] All LTC facilities had 24/7 LPN/RN coverage, and thus the LPN/RN coverage variable was only considered for the DAL analyses

[d] All LTC facilities had pharmacist involvement as either staff or consultant

* $p < 0.05$; ** $p < 0.1$

[4, 48–50, 55, 57, 58] (specifically severe aggressive behaviors and recent elopement attempts/threats, in this study) were significantly more likely to use antipsychotics than residents without these conditions. The independent association observed for residents with dementia (even after adjusting for, or excluding cases of 'appropriate use') raises concerns about suboptimal prescribing practices and possible risks for adverse health outcomes in both settings. Among LTC (but not DAL) residents, use of physical restraints was also independently associated with antipsychotic use (OR 1.35, 95% CI 0.97–1.89), possibly reflecting the higher prevalence of restraint use in the LTC vs.

DAL setting. The combined use of physical restraints and antipsychotic medications has been linked to a higher risk of functional and cognitive decline among older adults with dementia [59]. Should AL facilities continue to evolve as a preferred residential setting for older adults with dementia [32], there will be a heightened need to monitor changes in the prevalence of both inappropriate physical and chemical restraints.

Although no independent association was identified between antipsychotic use and length of stay in a French AL study [48], we found that a greater length of time spent living in DAL (but not LTC) was positively associated with antipsychotic use. This observation may be related to worsening of behavioral symptoms over time among DAL residents (not detected by the assessment tool). Alternatively, it may point to the relative absence of skilled staff, ongoing clinical oversight, and prescription reviews in these facilities [35–37], an issue that has been noted as a source of concern with respect to potentially inappropriate medication use [60], including antipsychotic use across care settings [25, 61].

In a previous study of older patients discharged to residential care from acute care [62], those who were identified as frail (by the Frailty Index) were at a significantly increased risk for prescription of potentially inappropriate medications. Similarly, we found that both DAL and LTC residents identified as frail were significantly more likely to use antipsychotics even after adjusting for some of the clinical components of frailty (e.g., cognitive impairment, comorbidities). This association may be explained by the social and functional deficits that are also used to derive the Frailty Index, as previous studies [50, 55, 57] have reported positive associations between antipsychotic use and measures of social isolation and activities of daily living impairment in LTC. It is also possible that the use of antipsychotics may have had a role in the development or worsening of frailty among residents. Because of the cross-sectional nature of the study, it is not possible to draw conclusions regarding the direction of these observed associations. Nevertheless, given the increased risk of adverse outcomes associated with frailty [63, 64], antipsychotic use in such vulnerable older residents raises concerns. Frailty status has been observed to act as an effect modifier of the association between antipsychotic use and hospitalization risk, with frail individuals being more likely than non-frail or pre-frail individuals to be hospitalized when using antipsychotics [65].

Within both settings, we observed a significant positive association between the use of antidepressants and antipsychotics whereas a similar independent association was not observed for those with a depression diagnosis, suggesting a tendency toward the use of multiple pharmacological interventions [66] to manage behavioral symptoms in DAL and LTC residents. As might be expected from past research [49], this was most evident among LTC residents where there was a significantly increased likelihood of antipsychotic use for those also using anxiolytics and hypnotics or sedatives.

The inverse association between antipsychotic use and cerebrovascular disease (also reported in previous studies [48, 55]) and cardiovascular disease among DAL residents may indicate a trend toward responsible prescribing decisions given the reported risk of sudden cardiac death [6] and stroke [7, 8] associated with antipsychotics (although the association with cardiovascular disease did not remain statistically significant when considering *potentially inappropriate* antipsychotic use). Similar associations were not observed among LTC residents, a finding which may point to less cautious antipsychotic prescribing in LTC, but may also be explained by the greater complexity of LTC residents, leading to challenges in optimizing medication use for individual resident needs.

Contrary to previous US research [49], we found few significant associations between the various facility level characteristics and overall antipsychotic use among both DAL and LTC settings. In this regard, our findings are more consistent with recent data from residential care facilities in New Zealand [58]. However, the capacity to detect facility-level associations in our study and the New Zealand [58] study may have been limited by the relatively smaller sample sizes (and potentially lower heterogeneity) of facilities, relative to the prior US study [49]. The significantly lower likelihood for antipsychotic use observed among residents from DAL facilities located in selected health regions may reflect unmeasured characteristics of these facilities given that considerable differences in antipsychotic prescribing rates have been observed between different aged care facilities (independent of resident characteristics) in several studies [67–69]. Involvement of a pharmacist on staff in DAL facilities was independently associated with a lower likelihood of overall (and *potentially inappropriate*) antipsychotic use among residents. Similarly, residents living in a DAL facility that also offered higher levels of care, and residents of LTC facilities with an affiliated physician were significantly less likely to use antipsychotics (when defined as *potentially inappropriate*). It seems plausible that direct integration of highly trained and knowledgeable practitioners into continuing care facilities (as well as enhanced resident-centered care) [58] may encourage more responsible and appropriate use of antipsychotics among residents. As several of the above facility level factors may be modified, further targeted interventions to better integrate health care providers in DAL settings are warranted.

The finding that residents of DAL facilities with designated dementia beds were significantly more likely to use

antipsychotics (overall and when defined as *potentially inappropriate*) was somewhat unexpected. One might hypothesize that the presence of such designated spaces might be associated with the presence of more highly educated or trained staff with expertise in the appropriate care of older vulnerable adults with dementia. Interestingly, a recent US study by Kronhaus et al. [56] also found that among residents with dementia, those residing in AL facilities with a memory care unit were significantly more likely to be prescribed antipsychotics than those from facilities without such a unit. The authors noted that a plausible explanation for their finding was the increased likelihood for more aggressive or disruptive behaviors among those residing in AL facilities with memory care units. However, our finding of a significant association between residence in a DAL facility with designated dementia beds and antipsychotic use, even with adjustment for the presence and severity of aggressive behaviors and other relevant clinical characteristics, suggests further investigation of the importance and impact of dementia special care units within the AL context may be needed.

Some limitations of our study should be noted. Because of its cross-sectional nature, no conclusions of causality can be drawn with respect to the observed associations. The assessment of antipsychotic use was restricted to active prescriptions and actual use in the last 3 days, which means that some residents with potentially relevant exposure (e.g., in past week but not in previous 3 days) may have been misclassified as unexposed at baseline. Similarly, it is not possible to say whether the findings are representative of residents' typical state. The definition of *potentially inappropriate* antipsychotic use employed in our study offers the opportunity for others to compare our findings with current reports on potentially inappropriate antipsychotic use across settings in Canada. However, this definition is relatively crude and may not reflect appropriate or inappropriate use at the actual patient or resident level. Additionally, data collection for the ACCES study occurred from 2006 to 2009; consequently, our findings may not represent the current state of care across AL and LTC in Alberta. As our study involved residents of designated (publicly funded) AL facilities in Alberta, the results may not be generalizable to private AL facilities or those located outside of Alberta. Our exclusion criteria and response rates should also be considered, particularly in relation to the potential limited generalizability of our findings to relatively more acutely or chronically ill residents in both settings. At the same time, we believe our findings are relevant and provide an important addition to the current knowledge base on antipsychotic use in community care settings. While acknowledging that changes in drug patterns may occur over time, our reported prevalence estimates for antipsychotic use in both settings are consistent with the current range of estimates noted for LTC settings across Canada [3, 52, 53]. As there have been very few studies of antipsychotic use in AL [30, 70], and none to date in Canada, our prevalence estimates for this setting also provide an important benchmark to assess future trends in use as well as the impact of relevant clinical and/or policy interventions. This is especially important given that AL is emerging as a particularly attractive residential care option for older adults with dementia [31, 32]. Among the 19 studies included in a recent systematic review on care-delivery interventions to manage agitation and aggressive in dementia among residents of AL and LTC [71], only one small study was from AL and it did not report the impact of the intervention on antipsychotic use [72]. The associations we observed between resident and facility characteristics and antipsychotic use are relevant and valid even if there have been recent changes in the prevalence of use. These observed associations have direct relevance to other care settings that may share similar resident, facility, or system characteristics (e.g., in demographics, clinical acuity, staffing, services, and clinical oversight).

In addition to providing important baseline data for the growing AL sector, the sample size, diversity of care settings, and availability of comprehensive resident and facility-level data (assessed by trained research nurses with standardized and validated tools) represent important strengths of our study. Further, we captured actual medication use by residents rather than relying on drug exposure data determined by prescription or dispensation claims. This represents an important strength given the common use of pro re nata orders for antipsychotics in these settings.

5 Conclusions

Antipsychotic use was observed to be prevalent among older residents of Alberta DAL (26%) and LTC (32%) facilities. Further, the proportion of antipsychotic use considered potentially inappropriate was higher among DAL than LTC residents. Despite some limited findings suggesting more cautious prescribing of antipsychotics among residents with existing (cardiovascular and cerebrovascular) risk factors in DAL vs. LTC, many of the resident characteristics significantly associated with antipsychotic use (including potentially inappropriate use) among LTC residents were also evident for those in DAL settings. Of particular concern was the finding of an increased likelihood of potentially inappropriate antipsychotic use among older and frail residents with dementia across both settings. Our results suggest that similar to recent successes in the LTC sector, there may be significant opportunity to optimize pharmacotherapy and reduce

inappropriate antipsychotic use within AL settings via targeted policies aimed at enhancing the availability and integration of skilled healthcare providers and clinical services.

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Compliance with Ethical Standards

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Conflict of interest Ms. Stock, Dr. Amuah, Dr. Hogan, and Dr. Maxwell declare that they have no conflicts of interest. Dr. Lapane has previously served as a consultant to Janssen and Glaxo Smith Kline on projects unrelated to the current work.

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