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The impact of patient-facility language discordance on potentially inappropriate prescribing of antipsychotics in long-term care home in Ontario, Canada: a retrospective population health cohort study

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Abstract

Background Appropriate use of medication is a key indicator of the quality of care provided in long-term care (LTC). The objective of this study was to determine whether resident-facility language concordance/discordance is associated with the odds of potentially inappropriate prescribing of antipsychotics (PIP-AP) in LTC.

Methods We conducted a population-based, retrospective cohort study of LTC residents in Ontario, Canada from 2010 to 2019. We obtained resident language from standardized resident assessments, and derived facility language by determining the proportion of residents belonging to each linguistic group within individual LTC homes. Using linked administrative databases, we identified all instances of PIP-AP during a 1-year follow-up period. PIP-AP was defined using the STOPP-START criteria, which have previously been shown to predict adverse clinical events such as emergency department (ED) visits and hospitalizations. The association between linguistic factors and PIP-AP was assessed using adjusted multivariable logistic regression analysis.

Results We identified 198,729 LTC residents consisting of 162,814 Anglophones (81.9%), 6,230 Francophones (3.1%), and 29,685 Allophones (14.9%). The odds of PIP-AP of were higher for both Francophones (aOR 1.15, 95% CI 1.08–1.23) and Allophones (aOR 1.11, 95% CI 1.08–1.15) when compared to Anglophones. When compared to English LTC homes, French LTC homes had greater odds of PIP-AP (aOR 1.12, 95% CI 1.05–1.20), while Allophone homes had lower odds of PIP-AP (aOR 0.82, 95% CI 0.77–0.86). Residents living in language-discordant LTC homes had higher odds of PIP-AP when compared to LTC residents living in language-concordant LTC homes (aOR 1.07, 95% CI 1.04–1.10).

Conclusion This study identified linguistic factors related to the odds of PIP-AP in LTC, suggesting that the linguistic environment may have an impact on the quality of care provided to residents.

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Introduction

Long-term care (LTC) homes provide care to individuals who are unable to live in the community due to functional limitations [1, 2]. LTC homes offer different levels of care but generally provide 24-hour care from nurses and/or personal support workers [1, 2]. The number of residents living in LTC homes in Canada has increased steadily over the last few decades, and is expected to continue to increase as the baby-boomer generation reaches the age of retirement. In Canada, the number of LTC residents and cost for their care is expected to double in the next 10–15 years [3].

Performance indicators are routinely used to monitor and optimize the quality and safety of care provided in LTC homes [4–7]. Examples of indicators include the prevalence of behavioral symptoms, depression, falls, pain, use of physical restraints, as well as potentially inappropriate prescribing (PIP), which is defined as the prescription of medications without an appropriate indication, and/or for which the harms may outweigh the benefits [8]. PIP is prevalent among frail, older patients, with recent reports estimating that nearly 1 in 5 LTC residents in Canada without a diagnosis of psychosis were taking an antipsychotic [9]. PIP has also been shown to significantly increase the risk of emergency department (ED) visits [10–13], hospitalizations [14], as well in-hospital morbidity and mortality [15], especially among frail, older patients, who are predisposed to adverse clinical events related to PIP as a result of physiologic changes of aging and multiple chronic diseases [16]. Studies have also found that PIP is associated with significant health care costs (i.e., beyond medication costs) [11, 12]. Several indicators have been developed to identify occurrences of PIP; one such example are the STOPP-START criteria [17, 18], which have been shown to predict adverse clinical events such as ED visits and hospitalizations [19–21].

In North America, nearly one quarter of the population lives in a minority language community [22, 23], a situation that occurs when an individual's primary language does not correspond to the language spoken by the majority of the population in the region in which they live [22, 24]. Recent systematic reviews and meta-analyses have highlighted several health disparities across linguistic groups, especially among individuals living in minority language communities [25–28]. However, many of these studies did not assess the impact of language discordance, which occurs when patients receive care in a language other than their primary language. Previous research on language concordance in healthcare has found that language-concordant care is associated with lower risk of in-hospital harm, including mortality [29, 30]. However, prior studies have largely excluded frail, older patients residing in LTC homes, even though these patients are more likely to experience both communication problems (limited second language skills and hearing impairment) and poor health outcomes [31–33]. The impact of language discordance on the quality and safety in LTC homes therefore warrants further investigation, as it represents a potentially modifiable risk factor which could be the target of interventions at the health systems level (i.e., by asking individuals to specify their preferred language at the time of entry into LTC, and providing them with the option of living in a language-concordant LTC home, whenever possible). Specifically, language discordance may have an impact on the prevalence of PIP in LTC homes, especially in settings where non-pharmacologic interventions cannot be implemented due to language barriers [8].

The objectives of this study were: (1) determine the proportion of LTC residents who experienced PIP of antipsychotics (PIP-AP), stratified by resident language and facility language, (2) calculate the odds of experiencing PIP-AP based on patient-facility language concordance/discordance in LTC home. We hypothesized that patient-facility language discordance would be associated with an increase in the odds of PIP-AP.

Methods

Study design and population

We conducted a population-based, retrospective cohort study in Ontario, Canada. Our cohort consisted of all residents who moved into a LTC home between April 1, 2010 and February 28, 2019. We used the first assessment performed during the study period to define the cohort and determine residents' baseline characteristics (*index assessment*). We excluded those who: (1) were younger than 66 or older than 105 years at the index assessment, (2) were not eligible for the Ontario Health Insurance Plan (OHIP) in the 2 years preceding the index assessment, (3) had an invalid death date (i.e., death date occurred before index assessment). This study complied with the Reporting of studies Conducted using Observational Routinely-collected health Data (RECORD) guidelines (Appendix 1) [34].

Data sources

We used administrative databases at ICES (ices.on.ca), an independent, nonprofit research institute whose legal status under Ontario's health information privacy law allows it to collect and analyze health care and

demographic data, without consent, for health system evaluation and improvement. We obtained data on LTC residents through the Continuing Care Reporting System (CCRS), which collects information on all LTC residents using the Resident Assessment Instrument Minimum Dataset (RAI-MDS) version 2.0, an instrument which has been shown to reliability assess the functional status and physical health of frail older adults living in long-term care homes in several different countries [35], including Canada [36, 37]. All LTC residents undergo a complete assessment annually, and abbreviated assessments are performed every 3 months (or at more frequent intervals if there is a significant change in health status).

We linked the CCRS to numerous administrative databases using unique encoded identifiers. The Registered Persons Database (RPDB) provided residents' age, sex and postal code. We linked resident and LTC home postal codes to the 2016 Statistics Canada Census to obtain neighbourhood income quintile and urban/rural status (for both the resident's dwelling prior to entry into LTC, and the LTC home). The Immigration, Refugees and Citizenship Canada (IRCC) Permanent Resident's Database was used to identify immigrants who became permanent residents after 1985 (and up until May 2017). We ascertained chronic conditions using algorithms validated by ICES and applied in previous studies (see Appendix 2). Finally, the Ontario Drug Benefit (ODB) database was used to identify all medications prescribed to patients who are covered by the ODB program (i.e., all OHIP eligible residents over the age of 65, receiving home care services, or living in LTC homes) [38]. These datasets were linked using unique encoded identifiers and analyzed at ICES.

Exposure

We obtained resident language using the primary language collected during resident assessments and recorded in CCRS. During resident assessments, interviewers are instructed to determine the resident's primary language by listening, observing and, if necessary, asking the resident (or their family member or care provider) to specify their primary language. We defined Anglophones and Francophones as residents' whose primary language was English and French, respectively, while we defined all other residents as Allophones (which is a term used by Statistics Canada to identify Canadians whose mother tongue is a language other than English or French) [22].

Next, we derived the language of the LTC home by determining the proportion of residents belonging to each linguistic group within individual LTC homes. For consistency with previous work [39], we derived the language of the home using the frequency of resident languages within each LTC home. To do so, we calculated the person-time representation of each linguistic group (English, French, and all Allophone languages) as a proportion of all languages spoken by residents in the home. We divided the total person-days for each linguistic group by the overall person-days (i.e., overall length of stay in days during the study period). We defined LTC homes as French homes when Francophone residents contributed more than 25% of the person-days, and Allophone homes when Allophone residents contributed more than 50% of the person-days. All remaining LTC homes were defined as English homes. Prior analyses performed by our group revealed that a threshold of 25% had better sensitivity and specificity (85% and 97%, respectively) when compared to a threshold of 50% for the purposes of identifying homes that were designated by law to provide services in French, as per the *French Language Services Act* [40].

Finally, we determined whether each resident was living in a language concordant or discordant LTC home by considering the interaction between the resident's language and the language of the LTC home. Residents who lived in a LTC home where the language of the LTC home corresponded to their primary language were said to be receiving language-concordant care, while all other residents were said to be receiving language-discordant care.

Covariates

We identified the following baseline covariates: age at time of index assessment, sex, immigration status, neighbourhood income quintile of the resident prior to entry into LTC, urban or rural residence of the resident prior to entry into LTC, geographic region of the resident prior to entry into LTC, geographic region of the LTC home, number of chronic conditions, mental health-related conditions (anxiety, delusions, dementia, depression, hallucinations), active prescription of antipsychotic at time of index assessment (yes/no), number of medications used in the last 7 days (Table 1).

Outcomes

Our primary outcome was the occurrence of any PIP-AP during the first year after index assessment (i.e., after April 1, 2010 and before February 28, 2020). We created a mutually exclusive binary outcome denoting absence or presence of PIP-AP (i.e., 0 instances of PIP-AP vs. >= 1 instance of PIP-AP). Some residents experienced multiple instances of PIP-AP; these residents were included in the latter group consisting of all residents with >=1 instance of PIP-AP. PIP-AP was defined according to the 2015 STOPP-START criteria (specifically criterion K2) [41], which identifies as potentially inappropriate the use of any neuroleptic (antipsychotic) medications, as they may cause gait dyspraxia or parkinsonism in the elderly [42, 43]. This study did not make use of the Beers criteria [17], as they are not sufficiently specific to assess antipsychotic

Table 1 Individual level characteristics of the cohort, by language group ($n=198,729$)

		Anglophones ($n=162,814$)	Francophone ($n=6,230$)	Allophones ($n=29,685$)
Age	Mean (SD)	84.3 (7.5)	83.8 (7.3)	85.1 (6.78)
	Median (Q1-Q3)	85 (79–90)	84 (79–89)	86 (81–90)
Sex	Female	105,659 (64.9%)	4,076 (65.4%)	19,385 (65.3%)
	Male	57,155 (35.1%)	2,154 (34.6%)	10,300 (34.7%)
Immigration Status (since 1985)	Yes	2,627 (1.6%)	50 (0.8%)	6,191 (20.9%)
	No	160,187 (98.4%)	6,180 (99.2%)	23,494 (79.1%)
Resident Neighbourhood Income Quintile Before moving to LTC	1 – Lowest	45,455 (27.9%)	1,497 (24.0%)	8,682 (29.2%)
	2	35,072 (21.5%)	1,359 (21.8%)	6,727 (22.7%)
	3	31,767 (19.5%)	1,348 (21.6%)	5,456 (18.4%)
	4	26,197 (16.1%)	1,092 (17.5%)	4,565 (15.4%)
	5 – Highest	22,573 (13.9%)	844 (13.5%)	3,963 (13.4%)
	Missing Data	1,750 (1.1%)	90 (1.4%)	292 (1.0%)
Resident Rurality Before moving to LTC	Urban	137,274 (84.3%)	4,695 (75.4%)	28,609 (96.4%)
	Rural	24,055 (14.8%)	1,464 (23.5%)	804 (2.7%)
	Missing Data	1,485 (0.9%)	71 (1.1%)	272 (0.9%)
Geographic Region of Ontario Location of Residence Before moving to LTC	Eastern	14,508 (8.9%)	3,196 (51.3%)	1,219 (4.1%)
	Northern	13,697 (8.4%)	2,048 (32.9%)	1,125 (3.8%)
	Southwestern	134,024 (82.3%)	971 (15.6%)	27,221 (91.7%)
	Missing Data	585 (0.4%)	15 (0.2%)	120 (0.4%)
Number of medications used in past 7-days	Mean (SD)	10.1 (4.6)	10.8 (4.7)	9.5 (4.4)
	Median (Q1-Q3)	10 (7–13)	10 (8–14)	9 (6–12)
Active Prescription of AP medication at index	Yes	41,817 (25.7%)	1,737 (27.9%)	8,201 (27.6%)
	No	120,997 (74.3%)	4,493 (72.1%)	21,484 (72.4%)
Number of Chronic Conditions	0	265 (0.2%)	9 (0.1%)	55 (0.2%)
	1	1,922 (1.2%)	67 (1.1%)	310 (1.0%)
	2	5,865 (3.6%)	230 (3.7%)	1,028 (3.5%)
	3+	154,762 (95.1%)	5,924 (95.1%)	28,292 (95.3%)
Mental Health	Anxiety	14,404 (8.8%)	885 (14.2%)	1,936 (6.5%)
	Depression	35,415 (21.8%)	1,575 (25.3%)	5,820 (19.6%)
	Delusions	6,694 (4.1%)	204 (3.3%)	731 (2.5%)
	Hallucinations	3,815 (2.3%)	120 (1.9%)	539 (1.8%)
	Dementia	105,117 (64.6%)	4,160 (66.8%)	19,292 (65.0%)

use alone. The coding strategy used to identify PIP-AP from administrative databases is described elsewhere [44]. Of note, the coding strategy was designed to identify only antipsychotics that were dispensed, thereby minimizing the risk of identifying standardized prescriptions that were not administered to the patient [44].

Statistical analysis

We performed descriptive analyses to compare resident characteristics and outcomes across linguistic groups. The risk of PIP-AP based on linguistic factors was assessed using multivariable logistic regression analysis. We ran two separate models with the following exposures: (1) resident language and facility language, (2) resident language, facility language, and resident-facility language concordance/discordance. Adjusted analyses included the potential confounders of age, sex, neighbourhood income quintile of the resident prior to entry into LTC, urban or rural residence of the resident prior to entry into LTC, geographic region of the LTC home (Eastern Ontario, Northern Ontario, Southwestern Ontario), immigration status, number of chronic conditions, diagnosis of dementia, mental health-related conditions (anxiety, delusions, depression, dementia, hallucinations), medication use in the last 7 days. We performed complete case analysis by excluding all observations with missing data for any of the variables included as a covariate in the regression analysis ($n=766$). Residents who died during the 1-year follow up period were censored at death date. Statistical tests were 2-tailed and the significance threshold was $\alpha=0.05$. Goodness of fit for unadjusted (univariable) and adjusted (multivariable) logistic regression models were compared using R-squared measures.

Results

Cohort

The study cohort included a total of 198,729 LTC residents (Fig. 1). Among Allophones, we retained the 10 most commonly spoken language groups, including: Arabic (n=522), Dravidian (n=573), East Slavic (n=1,677), Greek (n=1,028), Ibero-Romance (n=2,719), Indo-Aryan (n=806), Italian (n=7,551), Mandarin (n=2,645), West Germanic (n=2,200), West Slavic (n=1,652), Other (n=8,312). We excluded 26 respondents who communicated via artificial or sign languages. A complete list of languages corresponding to each language group can be found in Appendix 3.

Baseline characteristics

Descriptive statistics of the cohort, stratified by primary language of the LTC residents, are presented in Table 1. The majority of LTC residents were Anglophone (81.9%), while Francophones and Allophones represented 3.1% and 14.9% of the cohort, respectively. The age and sex distribution of the LTC residents was similar across linguistic groups. Francophones were more likely to have resided in rural areas in Eastern and Northern Ontario prior to entry into LTC, while the majority of Allophones lived in urban areas in Southwestern Ontario prior to entry into LTC. A slightly greater proportion of Anglophones and Allophones resided in lower-income neighbourhoods before moving into LTC home. The prevalence of chronic diseases was similar across linguistic groups. Francophones tended to have more anxiety and depression than Anglophones and Allophones at baseline, while the prevalence of other mental health-related conditions (delusions, dementia, hallucinations) were similar across linguistic groups. The number of medications prescribed was similar across linguistic groups; however, Francophones were much more likely to have an active prescription for an antipsychotic at the time of index assessment (72.1%) when compared to Anglophones (25.7%) and Allophones (27.6%).

LTC residents in our cohort lived in a total of 648 LTC homes. We identified 574 English LTC homes (88.6%), 37 French LTC homes (5.7%), and 37 Allophone LTC homes (5.7%). Of the 37 Allophone LTC homes, 11 (29.7%) were Italian and 6 (16.2%) were Mandarin; the remaining 20 LTC homes (54.1%) were represented by other

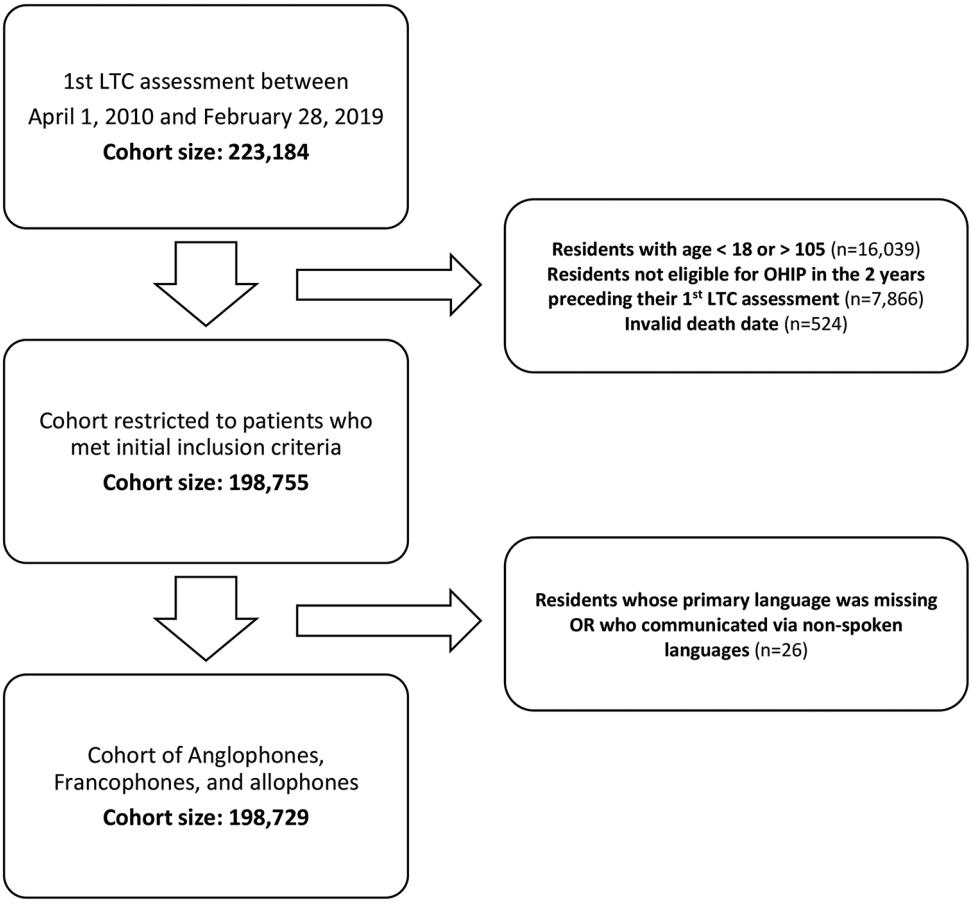

Fig. 1 Study flow diagram

languages for which facility-level language data could not be reported due to small cells.

The majority of Anglophones (95.7%) lived in English homes, while only 58.7% of Francophones and 22.7% of Allophones lived in language-concordant LTC homes. When compared to Anglophones and Francophones, Allophones tended to live in LTC homes that were located in lower income neighbourhoods. The overwhelming majority of Anglophones and Allophones lived in LTC homes in Southwestern Ontario (82.8% and 92.2%, respectively), while the majority of Francophones lived in LTC homes in Eastern or Northern Ontario (51.7% and 32.7%, respectively). The proportion of residents living in rural LTC homes was greatest for Francophones (23.7% compared to 15.0% for Anglophones and 2.3% for Allophones). Finally, Allophones tended to live in LTC homes that were larger in size than those habited by Anglophones and Francophones (Table 2).

Outcomes

Of the 198,729 LTC residents included in this cohort, 53,766 (27.1%) experienced at least one instance of PIP-AP. The proportion of patients with 3 or more chronic conditions was similar amongst those who experienced at least one instance of PIP-AP (95.4%) when compared to those who did not experience an instance of PIP-AP (95.0%). However, when compared to patients who did not experience an instance of PIP-AP, patients who experienced at least one instance of PIP were more likely to have an anxiety disorder (11.7% vs. 7.6%, $p<0.01$), depression (26.0% vs. 19.9%, $p<0.01$), delusions (8.3% vs. 2.2%, $p<0.01$), hallucinations (4.9% vs. 1.3%, $p<0.01$), and dementia (84.3% vs. 57.4%, $p<0.01$). The remaining baseline characteristics were similar for patients who did and did not experience at least one instance of PIP-AP (Table 3).

In the adjusted regression analysis (Table 4), the odds of PIP-AP were higher for both Francophones (OR 1.15, 95% CI 1.08–1.23) and Allophones (OR 1.11, 95% CI 1.08–1.15) compared to Anglophones. Compared to English LTC homes, French LTC homes had greater odds of their residents experiencing PIP-AP (OR 1.12, 95% CI 1.05–1.20), while Allophone home residents had lower odds of PIP-AP (OR 0.82, 95% CI 0.77–0.86). Overall, residents living in language-discordant LTC settings had higher odds of PIP-AP when compared to LTC residents living in language-concordant LTC settings (OR 1.07, 95% CI 1.04–1.10). When compared to Anglophones living in language-concordant LTC homes, Allophones living in language-discordant LTC homes had higher odds of PIP-AP (OR 1.12, 95% CI 1.08–1.16), while the odds of PIP-AP were not significantly different for Allophones living in language-concordant homes (OR 1.05, 95% CI 0.99–1.12). The opposite was true for Francophones; the odds of PIP-AP were higher for Francophones living in language-concordant LTC homes (OR 1.17, 95% CI 1.08–1.27) and not significantly different in language-discordant LTC homes (OR 1.05, 95% CI 0.95–1.16) when compared to Anglophones living in language-concordant LTC homes (reference group).

Table 2 Facility level characteristics of the cohort, by language group ($n=198,729$)

		Anglophones ($n=162,814$)	Francophone ($n=6,230$)	Allophones ($n=29,685$)
Derived Facility Language (Based on person-days)	English	155,797 (95.7%)	2,554 (41.0%)	20,406 (68.7%)
	French	3,710 (2.3%)	3,656 (58.7%)	232 (0.8%)
	Other	3,307 (2.0%)	20 (0.3%)	9,047 (30.5%)
Resident Language Concordance	Concordant	155,797 (95.7%)	3,656 (58.7%)	6,744 (22.7%)
	Discordant	7,017 (4.3%)	2,574 (41.3%)	22,941 (77.3%)
Facility Neighbourhood Income Quintile	1 – Lowest	50,360 (30.9%)	2,002 (32.1%)	12,627 (42.5%)
	2	33,520 (20.6%)	1,476 (23.7%)	5,722 (19.3%)
	3	28,197 (17.3%)	936 (15.0%)	4,707 (15.9%)
	4	28,821 (17.7%)	1,176 (18.9%)	3,602 (12.1%)
	5 – Highest	21,386 (13.1%)	638 (10.3%)	3,017 (10.2%)
	Missing Data	530 (0.3%)	2 (0.0%)	10 (0.0%)
Facility Rurality	Urban	138,024 (84.8%)	4,750 (76.2%)	28,988 (97.7%)
	Rural	24,380 (15.0%)	1,478 (23.7%)	687 (2.3%)
	Missing Data	410 (0.3%)	2 (0.0%)	10 (0.0%)
Facility Geographic Region of Ontario	Eastern	14,596 (9.0%)	3,223 (51.7%)	1,208 (4.1%)
	Northern	13,450 (8.3%)	2,040 (32.7%)	1,097 (3.7%)
	Southwestern	134,768 (82.8%)	967 (15.5%)	27,380 (92.2%)
Facility Size	1 to 19	580 (0.4%)	62 (1.0%)	29 (0.1%)
	20 to 49	5,008 (3.1%)	176 (2.8%)	420 (1.4%)
	50 to 99	35,315 (21.7%)	1,599 (25.7%)	3,196 (10.8%)
	100+	121,911 (74.9%)	4,393 (70.5%)	26,040 (87.7%)

Table 3 Descriptive statistics of the cohort, by PIP of antipsychotics

		0 PIP of antipsychotics (*n* = 144,953)		At least 1 PIP of antipsychotics (*n* = 53,776)	
Age	Mean (SD)	84.7 (7.4)		83.4 (7.4)	
	Median (Q1-Q3)	86 (80–90)		84 (78–89)	
Sex	Female	95,981	66.2%	33,139	61.6%
	Male	48,972	33.8%	20,637	38.4%
Immigration Status	Yes	7,012	4.8%	1,856	3.5%
	No	137,941	95.2%	51,920	96.5%
Resident Neighbourhood Income Quintile Before moving to LTC	1 – Lowest	41,038	28.3%	14,596	27.1%
	2	31,756	21.9%	11,402	21.2%
	3	28,048	19.3%	10,523	19.6%
	4	22,806	15.7%	9,048	16.8%
	5 – Highest	19,766	13.6%	7,614	14.2%
Resident Rurality Before moving to LTC	Urban	124,651	86.0%	45,927	85.4%
	Rural	18,983	13.1%	7,340	13.6%
Resident Language	Anglophone	118,635	81.8%	44,179	82.2%
	Francophone	4,452	3.1%	1,778	3.3%
	Allophone	21,866	15.1%	7,819	14.5%
Derived Facility Language (Based on person-days)	English	129,789	89.5%	48,968	91.1%
	French	5,449	3.8%	2,149	4.0%
	Other	9,715	6.7%	2,659	4.9%
Resident Language Concordance	Concordant	121,018	83.5%	45,179	84.0%
	Discordant	23,935	16.5%	8,597	16.0%
Number of Chronic Conditions	0	284	0.2%	45	0.1%
	1	1,728	1.2%	571	1.1%
	2	5,241	3.6%	1,882	3.5%
	3+	137,700	95.0%	51,278	95.4%
Mental Health	Anxiety	10,948	7.6%	6,277	11.7%
	Depression	28,850	19.9%	13,960	26.0%
	Delusions	3,175	2.2%	4,454	8.3%
	Hallucinations	1,856	1.3%	2,618	4.9%
	Dementia	83,270	57.4%	45,299	84.3%

[a]Percentages may not sum to 100% due to rounding

[b]Calculated using two-tailed, independent t-test of proportions

Discussion

In this study of LTC residents living in Ontario, Canada, we found that both individual-level and facility-level linguistic factors were associated with the odds of PIP-AP. Francophone and Allophone residents had greater odds of PIP-AP when compared to Anglophones, even after adjusting for potentially confounding variables. However, the association was strongest for facility language; when compared to English LTC homes, the odds of PIP-AP were significantly higher in French LTC homes, but significantly lower in Allophone LTC homes. We hypothesize that the differences in odds of PIP-AP across LTC homes could be explained, at least in part, by characteristics of the LTC homes. Since French LTC homes were more likely to be located in rural parts of the province, staffing shortage could have contributed to a clinical environment where antipsychotics were utilized sooner in the management of patients with behavioural symptoms, simply because non-pharmacologic interventions that require human resources (e.g., hydration, mobilization, re-orientation, sleep hygiene) could not be implemented [8]. While critical staffing shortages have been reported in LTC homes across Ontario, the level of understaffing has previously been shown to be worse in both Northern and rural parts of the province, with up to 50% of positions vacant [45]. Similar findings have been reported within LTC homes in Israel and mental health facilities in Italy, where staffing shortages were found to be associated with antipsychotic prescribing [46, 47]. It is also possible that cultural differences across residents and healthcare providers in French LTC homes could have contributed to different prescribing patterns; however, we do not know of any literature to support this. Subgroup analyses stratified by characteristics of the LTC homes, as well as a qualitative study of healthcare

Table 4 Regression analysis of instances of PIP of antipsychotics (STOPP-START criteria) by linguistic factors

		Unadjusted (univariable) model		Adjusted (multivariable) model	
		OR[a] (95% CI)	*R*-squared	aOR[b, c] (95% CI)	*R*-squared
Resident Language	Anglophone	Ref.	N/A	Ref.	N/A
	Francophone	1.07 (1.01–1.13)	< 0.0001	1.15 (1.08–1.23)	-[d]
	Allophone	0.96 (0.93–0.99)	< 0.0001	1.11 (1.08–1.15)	-[d]
Facility Language	English	Ref.	N/A	Ref.	N/A
	French	1.05 (0.93–1.10)	0.001	1.12 (1.05–1.12)	-[d]
	Other	0.73 (0.69–0.76)	0.001	0.82 (0.77–0.86)	-[d]
Any Language Concordance	Concordant	Ref.	N/A	Ref.	N/A
	Discordant	0.96 (0.94–0.99)	< 0.0001	1.07 (1.04–1.10)	-[d]
Language Concordance – Between Resident Language and Derived Facility Language	Concordant Anglophone	Ref.	N/A	Ref.	N/A
	Discordant Anglophone	0.82 (0.78–0.87)	0.004	0.92 (0.86–0.98)	-[d]
	Concordant Francophone	1.07 (0.99–1.15)	0.004	1.17 (1.08–1.27)	-[d]
	Discordant Francophone	1.05 (0.96–1.15)	0.004	1.05 (0.95–1.16)	-[d]
	Concordant Allophone	0.83 (0.79–0.88)	0.004	1.05 (0.99–1.12)	-[d]
	Discordant Allophone	0.99 (0.96–1.02)	0.004	1.12 (1.08–1.16)	-[d]

[a]Sample size of 198,729

[b]Sample size of 197,963 (766 observations excluded due to missing data in one of the variables included as a covariate in the regression analysis)

[c]Adjusted for age at time of index assessment, sex, immigration status, neighbourhood income quintile of the resident prior to entry into LTC, urban or rural residence of the resident prior to entry into LTC, geographic region of the LTC home, number of chronic conditions, mental health-related conditions (anxiety, delusions, depression, dementia, hallucinations), active prescription of antipsychotic at time of index assessment, medication use in the last 7 days

[d]R-squared for adjusted (multivariable) model was 0.13

providers working in these homes are necessary to better understand the impact of each of these factors.

Resident-facility language discordance was an independent risk factor for PIP-AP, even after controlling for resident language, facility language, and potentially confounding variables. Regression analyses which modeled the interaction between individual resident language and resident-facility language concordance/discordance revealed that this effect was primarily driven by Allophones, who had higher odds of PIP-AP in language-discordant LTC homes. Despite making up only 14.9% of the cohort, Allophones represented nearly half of residents living in language-discordant LTC homes, a finding that can be explained by the relatively few Allophone LTC homes (n=37) compared to English or French LTC homes (n=611). We hypothesize that the increase in odds of PIP-AP observed among Allophones living in language-discordant LTC homes could be due to the early use of pharmacologic interventions in situations where non-pharmacologic interventions could not be successfully implemented due to the presence of cultural and/or language barriers. A recent study found that non-English language preference was an independent risk factor for antipsychotic medication use and physical restraints among patients admitted to two hospitals in Ontario, Canada. However, the authors of this study did not control for the language of the provider and therefore could not attribute these differences to patient-provider language discordance [48]. Another study conducted in Ontario, Canada showed that Francophones living in LTC homes that were required by law to provide services in French had better outcomes according to standardized quality and safety indicators [49]. Lastly, patient-provider language discordance could have increased the incidence of delirium for Allophones living in language-discordant LTC homes, as reported in a study which found that non-English language was an independent risk factor for delirium in two intensive care units in the United States [50].

Limitations

The resident language variable was obtained from RAI-MDS assessments, during which interviewers are instructed to record the patient's primary language after

listening and observing the resident in their surroundings. Our group previously performed a study to validate the language variables used in administrative health data; we found that the language variable obtained from long-term care assessments had substantial agreement ($\kappa=0.76$) with the language most often spoken at home recorded in the Canadian Community Health Survey [51, 52]. However, since interviewers can only record a single language, we are not able to distinguish unilingual residents from multilingual residents who may have been able to receive language-concordant care in multiple languages. As such, some residents may have been incorrectly classified as having received language-discordant care, which should bias the results towards the null. We also did not account for residents' hearing status, which could have acted as an effect modifier (i.e., larger disparities amongst residents with intact hearing when compared to residents with impaired hearing). Next, we defined LTC homes as French or Allophone based on the proportion of Francophones and Allophones within each LTC home. Our interpretation of the results assumes that Francophone and Allophone LTC homes are more likely to be staffed by healthcare providers who speak French or an Allophone language, respectively. This assumption may be flawed, as we have no information on the language(s) spoken by healthcare providers within LTC homes to confirm that this is true. Furthermore, we do not have individual-level data regarding the use of trained interpreters, which could have mitigated language barriers experienced by residents living in language-discordant LTC homes. Our study was conducted in Ontario, where legislation guarantees the provision of health care services to minority linguistic communities, in accordance with the *French Language Services Act* [40]. Thus, the results of our study may not be generalizable to other jurisdictions. Finally, residents who were prescribed an antipsychotic for an underlying psychotic disorder could have been misclassified as having experienced an instance of PIP-AP. However, since the prevalence of delusions and hallucinations at baseline were low (3.8% and 2.3%, respectively), we feel that such misclassification should have resulted in minimal bias. As we do not have information regarding the clinical encounter that resulted in a prescription for antipsychotics, we are unable to determine whether instances of PIP-AP identified in this study contributed to adverse medication events.

Conclusion

Ontarians living in language-discordant LTC homes had higher odds of PIP-AP when compared to Ontarians living in language-concordant LTC homes. The inconsistencies in clinical prescribing patterns across LTC homes could be addressed by further education and training of health care providers to ensure appropriate and safe prescribing patterns. Finally, the findings of this study also add to the growing body of evidence supporting the notion that language discordance is a social determinant of health that contributes to adverse events and poor outcomes. In the LTC setting, the effects of language discordance could be mitigated by: asking individuals their preferred language, modifying the LTC placement process to favour placement of residents in language concordant homes, and by ensuring that multilingual staff and/or trained interpreters are readily available.

Abbreviations

ED	Emergency department
PIP	Potentially inappropriate prescribing
PIP-AP	Potentially inappropriate prescribing of antipsychotics
LTC	Long-term care
OHIP	Ontario Health Insurance Plan
ODB	Ontario Drug Benefit
CCRS	Continuing Care Reporting System
RPDB	Registered Persons Database
IRCC	Immigration, Refugees and Citizenship Canada
OR	Odds ratio
CI	Confidence interval

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

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Not applicable.

Author contributions

All authors contributed to conceiving the original idea and to the study design. M.P. managed the data and performed the statistical analyses, and M.R., C.P., M.P., P.T., R.B. and L.M.B. interpreted the study results. The main manuscript was drafted by M.R., C.P. and L.M.B., and the figures, tables and supplemental materials were prepared by M.R. and C.P. All authors critically reviewed and revised the manuscript. All authors had full access to all the study data and had the final decision on content and publication submission.

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Data availability

The data sets used for this study were held securely in a linked, de-identified form and analyzed at ICES. While data sharing agreements prohibit ICES from making the data set publicly available, access may be granted to those who meet pre-specified criteria for confidential access, available at www.ices.on.ca/

DAS. If you are interested in requesting ICES Data & Analytic Services, please contact ICES DAS (e-mail: das@ices.on.ca or at 1-888-480-1327).

Declarations

Ethics approval

ICES is a prescribed entity under Sect. 45 of Ontario's Personal Health Information Protection Act [49]. Section 45 authorizes ICES to collect personal health information, without consent, for the purpose of analysis or compiling statistical information with respect to the management of, evaluation or monitoring of, allocation of resources to or planning for all or part of the health system [50]. Projects that use data collected by ICES under Sect. 45 of PHIPA, and use no other data, are exempt from REB review. The use of the data in this project is authorized under Sect. 45 and was approved by ICES' Privacy and Legal Office.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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