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Associations of Frequent Emergency Department Use with Older Age, Multimorbidity, and Perceived Health: A Population-Based Study

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Article

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Abstract

The purpose of this retrospective population-based study of adults aged ≥50 years was to examine associations between older age, multimorbidity, and self-rated perceptions of health with frequent emergency department (ED) visits. Using Canadian Community Health Survey (CCHS) 2015–16 data, a multivariate logistic regression model was generated to evaluate associations between predictor variables and frequent ED use. The study sample included data for 57,138 participants across Canada, equating to approximately 13,091,592 when sampling weights applied. Frequent ED use was associated with older age, male sex, multimorbidity, and lower household income. Lower self-rated levels of health were most strongly associated with frequent ED use. Having a primary health care provider was not a significant predictor in univariate or multivariate analyses. Older adults who are frequent ED attenders are a distinct population whose characteristics need to be understood to target strategies for those who most need them to improve quality care and outcomes.

Résumé

Cette étude rétrospective basée sur une population d'adultes âgés de 50 ans et plus visait à examiner les associations entre l'âge avancé, la multimorbidité et les perceptions de santé autoévaluées, dans le contexte de visites fréquentes aux services des urgences. À partir des données de 2015–2016 de l'Enquête sur la santé dans les collectivités canadiennes (ESCC), un modèle de régression logistique multivariée a été conçu pour évaluer les associations entre les variables prédictives et le recours fréquent aux services des urgences. L'échantillon de l'étude comprenait des données recueillies auprès de 57 138 participants dans l'ensemble du Canada, ce qui équivaut à environ 13 091 592 sujets après application des pondérations d'échantillonnage. Le recours fréquent aux services des urgences était associé à l'âge avancé, au sexe masculin, à la multimorbidité et à un faible revenu familial. Les niveaux de santé autoévalués comme faibles étaient les plus fortement associés à un recours fréquent aux services des urgences. Le fait d'avoir un fournisseur de soins de santé primaire n'était pas un facteur prédictif significatif dans les analyses univariées ou multivariées. Les personnes âgées qui fréquentent souvent les services des urgences constituent une population distincte, dont les caractéristiques doivent être comprises afin de cibler les stratégies destinées à celles qui en ont le plus besoin et d'améliorer la qualité des soins et les résultats.

Background

Life expectancy in Canada is increasing, and people want to live in their homes longer (Statistics Canada, 2018). As life expectancies increase, so does the proportion of older people living in the community with multiple common comorbidities (e.g., hypertension, ischemic heart disease, diabetes, and dementia) (Fisher et al., 2016; Gruneir et al., 2016; Tonelli et al., 2017). Three out of four people in Canada aged 65 years and older report having at least one chronic condition, with almost one-quarter of older adults reporting three or more chronic health conditions (i.e., multimorbidity) (Canadian Institute for Health Information [CIHI], 2011). Multimorbidity increases with age (Salive, 2013) and is felt to be a key driver of health care costs and sustainability of health systems (Tran et al., 2022). For example, older adults with multimorbidity have been found to use three times the health care resources as those without (CIHI, 2011).

Most community-dwelling older adults have a primary care provider; however, they often use the emergency department (ED) when seeking help to manage acute health issues (CIHI, 2011; Greenwald et al., 2014; Greenwald et al., 2016; Samaras et al., 2010) and have a disproportionately high use of the ED. For example, in 2023–2024, those over 65 years of age comprised 25% of all

ED visits (CIHI, 2024a) while representing 19% of the population (Statistics Canada, 2024). Many processes associated with ED care (e.g., rapid triage, long wait times, and chaotic care environments) often exacerbate the acute health issues older adults face (e.g., increase risk of acute infection and delirium; Barron & Holmes, 2013; Quach et al., 2012) and put them at greater risk for poorer outcomes (e.g., loss of independence, mortality, and unplanned ED return visits and hospitalization; Aminzadeh & Dalziel, 2002). Those in the oldest old portion of the population (≥80 years) are particularly susceptible to these poorer outcomes (Greenwald et al., 2014; Hendin et al., 2018; Street, Mohebbi, et al., 2018), even more so if they frequently attend the ED for care (Legramante et al., 2016; Street, Berry, & Considine, 2018).

There is no standardized definition of frequent ED attendance; however, four or more ED visits within 12 months are a commonly used threshold to define this population (Dufour et al., 2020; Legramante et al., 2016; Street, Berry, & Considine, 2018). Although recent efforts have been made to gain understanding about older adults who frequently visit the ED, it has been highlighted that a knowledge gap remains in examining important self-reported variables, such as perceived level of health, and their association with multimorbidity and frequent ED use in older adults (Dufour et al., 2020). As the proportion of older adults is growing and people are living longer, it is important to better characterize older adults who are more likely to frequently present to the ED to help guide efforts to improve ED quality of care and outcomes for this population.

Purpose

The purpose of this study was to examine the associations (independently and jointly) between older age, multimorbidity, and self-rated perceptions of health with frequent ED use.

Methods

Data source

This study was conducted using data from the Canadian Community Health Survey (CCHS) 2015–16, which is a national population-based longitudinal study (Statistics Canada, 2016). The CCHS uses a multistage stratified cluster sampling strategy to collect information on health status, health care utilization, and determinants of health, covering approximately 98% of the Canadian population. The excluded 2% are people who live on First Nations Reserves, Crown Lands, institutions, or are Canadian Forces full-time members. Responding to the survey is voluntary, and questions are asked in a computer-assisted interview. Information about ED use is obtained by asking about the number of visits to health care professionals, including the ED, within the past 12 months, and information about comorbidities is obtained by asking if respondents had conditions diagnosed by a health care professional that had lasted or were expected to last at least 6 months. Detailed descriptions of the survey methods are available elsewhere (Statistics Canada, 2016).

The 2015–16 CCHS cycle was chosen because it included a 2-year theme content collected in all regions on a wider range of chronic health conditions than that which is collected in the regular core content. During each CCHS annual cycle, there is theme content collected in all health regions as well as other optional content that can be selected by each province. It was decided to only select variables that were part of the core content or 2-year theme content collected in all health regions to obtain a nationally representative sample. Other potential variables of interest were not included in this study due to a decrease in representativeness and potential limits imposed on the generalizability of the findings. For example, questions related to medication use were only collected in Prince Edward Island, the Yukon, and the North West Territories, and questions related to cognitive health status were only collected in the three territories.

Sample

The study population included all community-dwelling Canadians aged 50 years and older. A threshold of 50 years of age was chosen because evidence suggests that health care utilization increases exponentially after this age (Alemayehu & Warner, 2004), and those who are younger frequent ED attenders have different characteristics (e.g., mental health and substance issues) compared to those who are older (Colligan et al., 2016; Leporatti et al., 2016; van Tiel et al., 2015).

Outcome and predictor variables

The primary outcome in the present study is being a frequent ED user, defined as participants self-reporting four or more ED visits in the past 12 months. This question is reported as a count variable in the CCHS dataset and therefore was dichotomized to reflect those with infrequent ED use (< 4 ED visits) and frequent ED users (≥ 4 visits).

The comorbid conditions included were asthma, chronic obstructive pulmonary disease, fibromyalgia, arthritis, osteoporosis, hypertension, heart disease, past stroke, diabetes, cancer, as well as mood and anxiety disorders. The list was selected based on previous research examining multimorbidity using validated algorithms for population-based administrative data (Dufour et al., 2020; Griffith et al., 2016; Tonelli et al., 2017), the CIHI definition of ambulatory care sensitive conditions (CIHI, 2012), as well as variables available to reflect these conditions in the CCHS dataset. The current study uses survey data based on participants' self-reports of diagnosed chronic conditions and does not rely on identifying conditions using diagnosis codes, such as when using administrative data; therefore, a validated algorithm for identifying conditions was not necessary in this study. Questions regarding chronic conditions are all asked in a yes/no format (e.g., Do you have heart disease?). A dichotomous variable for multimorbidity was created by computing the number of chronic conditions reported by each participant, then classified as having multimorbidity if they reported having three or more conditions or not if they reported having fewer than 3 conditions.

Other variables were collected to help explain the associations of health status, sociodemographics (i.e., age, income, and sex [male/female]), and community supports (i.e., primary health care provider and living situation) on frequent ED use. Self-reported health status is collected in the CCHS on a 5-point Likert scale (i.e., In general, would you say your health is excellent, very good, good, fair, or poor?). This variable was left on the 5-point scale for this analysis as the impact of various levels on self-reported health is unknown (Dufour et al., 2020). Age was categorized into three groups for descriptive analysis (younger, <65 years, older, 65–79 years, and oldest old ≥80 years) and further dichotomized into younger (<80 years) and oldest old (≥ 80 years) based on previous research as a clinically meaningful

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threshold (Greenwald et al., 2014; Hendin et al., 2018; Street, Mohebbi, et al., 2018). Total household income is reported in quintiles in the CCHS; as there is no compelling evidence on a threshold for income, it was included in the analysis in the predefined quintiles (Statistics Canada, 2016). Variables to reflect potential community supports that may impact ED use were dichotomized: have a regular primary health care provider (yes or no) and living situation (lives alone or lives with someone else [i.e., spouse, children, relative, friend or other]).

Statistical analyses

Descriptive statistics appropriate for the level of measurement (unweighted and weighted) were generated to examine the characteristics of each study variable. As the variables in this study are categorical, weighted chi-square tests were used to examine differences between infrequent and frequent ED users. To account for survey design effects, such as clustering and unequal selection of probabilities, as well as to ensure results are representative of the Canadian population, the set of replicate sampling weights developed for the CCHS 2015–16 by Statistics Canada was used for all final analyses (Statistics Canada, 2016).

Next, a multivariate logistic regression model was used to test the association between predictor variables and being a frequent ED user. Prior to regression analyses, assessment of the univariate and bivariate descriptive statistics was conducted to ensure that the assumptions underlying the statistical test were satisfied. To check for multicollinearity issues, a preliminary linear regression was conducted using the number of ED visits as a continuous variable. Results of this assessment suggests that there were no collinearity issues with variance inflation factors (VIFs) ranging from 1.06 to 1.21. Purposeful selection was used to fit the multivariate logistic regression model and report the adjusted odds ratios (ORs) and 95% confidence intervals (CIs). Appropriateness of combining the two younger age categories (i.e., 5–64 years and 65–79 years) was tested to confirm there were no statistically significant differences between these age groups (F-value, 1.87[1,57137]; $p = .1710$). Two-way interactions between all predictors were examined as part of the model building process, as well as potentially clinically meaningful three-way interactions (e.g., between age, multimorbidity, and perceived health status). An unweighted multivariate logistic regression was used to conduct the post hoc assessment of the model fit. Overall measures of model fit (including Hosmer and Lemeshow goodness-of-fit test, as well as comparing receiver operation characteristic [ROC] curves and associated statistics) and diagnostic statistics for individual components of the summary statistics were examined for this assessment.

All analyses were conducted using two-tailed tests with alpha preset at .05. Analyses were performed using SAS® on Demand for Academics, which is a cloud-hosted online platform used the access the latest SAS® software.

Results

Data were obtained for 57,138 participants across Canada which equates to an estimated 13,091,592 when sampling weights were applied. Approximately 2 per cent of the sample were considered frequent ED users with the number of visits in the past 12 months ranging from 0 to 31. Approximately three-quarters of the sample had no ED visits in the past 12 months (IQR: 0.0, 0.0). The number of comorbidities reported by participants ranged from 0 to 11 (median = 0.7; IQR: 0.0, 1.8). Table 1 provides the characteristics of the study sample. Unlike infrequent ED users, frequent users were older (≥ 80 years, 16.9% versus 8.6%) and presented with a higher proportion of multimorbidity (52.8% versus 20.2%), had self-rated level of health as fair or poor (28.8%, 27.1% versus 11.5%, 4.6%), they also tended to live alone (29.8% versus 23.2%) and have a lower total household income (<$40,000, 41.6% versus 26.3%). The results suggest that there are statistically significant differences between infrequent and frequent ED user groups for all variables except sex ($p = .61$) and having a primary health care provider ($p = .23$).

Results of the multivariate logistic regression with adjusted ORs and 95% CI are presented in Table 2. Variables significantly associated with frequent ED use among Canadians 50 years of age and older are: older age (≥ 80 years; OR, 1.37; 95% CI, 1.06–1.76), male sex (OR, 1.23; 95% CI, 1.01–1.51), presence of multimorbidity (OR, 2.03; 95% CI, 1.55–2.66), lower self-rated level of health, as well as all levels of total household income below $80,000 per year. Lower self-rated levels of health were most strongly associated with frequent ED use with the odds of being a frequent ED user increasing 5 times for those rating their health as "fair" compared to "excellent" (OR, 4.95; 95% CI, 2.50–9.82), and increasing 10 times for those rating their health as "poor" compared to "excellent" (OR, 10.04; 95% CI, 5.12–19.68) while controlling for other factors. There were no significant interactions found between any of the predictor variables that made a contribution to improving the model fit. Although there were no 2-way or 3-way interactions included in the final model, there was statistical adjustment when sex was included as a predictor in the multivariate model suggesting sex is a strong confounder, as it was not statistically significant in the univariate analysis. Conversely, although living alone was statistically significant in the univariate analysis, it was not significant in the multivariate model and did not contribute to any significant statistical adjustment to the model. Having a primary health care provider was not a significant predictor in univariate or multivariate analyses.

Discussion

Results from the current study contribute to the ED literature by identifying factors associated with frequent ED use in older adults. In this nationally representative sample of Canadians 50 years of age and older, frequent ED attenders were more likely to be 80 years of age or older, male, have multimorbidity, lower income, and lower self-rated perceptions of health. This study makes a unique contribution because it is the first known study to examine the association of perceived health status with frequent ED use in older Canadians. Perceived health status had the strongest association with frequent ED use, with those reporting a self-perceived poor level of health being 10 times more likely to be a frequent ED attender compared to those reporting an excellent level of health.

Having a primary care provider was not found to be a significant factor of frequent ED use in older adults in the current study. Although this was an unexpected finding, it aligns with a recent report by CIHI (2024b), which showed that adults 65 years of age and older had the lowest proportion of ED visits (9.2%) for conditions defined as possible to have been managed by primary care (e.g., sore throats, ear infections, and prescription refills) compared to all other age groups. Despite older adults representing the lowest proportion of identified visits that could have been managed by primary care, they consistently have a disproportionately high use

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Table 1. Descriptive statistics for study sample (N = 13,091,592)[a]

Variable *n* (%)	Total population	Infrequent ED use (*n* = 12,839,659)	Frequent ED use (*n* = 251,933)	*p*-value[b]
Age (years)				<.0001
50 to 64	7,499,633 (57.29)	7,375,504 (57.44)	124,129 (49.27)	
65 to 79	4,447,708 (33.97)	4,362,381 (33.98)	85,327 (33.87)	
> = 80	1,144,251 (8.74)	1,107,774 (8.58)	42,477 (16.86)	
Sex				.6064
Female	6,781,048 (51.79)	6,653,834 (51.82)	127,214 (50.49)	
Male	6,310,544 (48.20)	6,185,825 (48.18)	124,719 (49.50)	
Multimorbidity				<.0001
No	10,362,502 (79.15)	10,243,588 (79.78)	118,914 (47.20)	
Yes	2,729,090 (20.85)	2,596,071 (20.22)	133,019 (52.80)	
Health[c]				<.0001
0	2,520,510 (19.25)	2,504,979 (19.51)	15,531 (6.16)	
1	4,336,536 (33.12)	4,306,221 (33.54)	30,315 (12.03)	
2	4,027,888 (30.77)	3,962,725 (30.86)	65,163 (25.87)	
3	1,545,748 (11.81)	1,473,147 (11.47)	72,601 (28.82)	
4	660,910 (5.05)	592,587 (4.62)	68,323 (27.12)	
Primary care provider (*n* = 12,885,000)				.2349
Yes	11,719,072 (90.95)	11,486,356 (90.92)	232,716 (92.47)	
No	1,165,928 (9.05)	1,146,711 (9.08)	19,217 (7.63)	
Lives alone (*n* = 12,207,328)				.0004
No	9,357,012 (76.65)	9,192,354 (76.78)	164,657 (70.18)	
Yes	2,850,317 (23.25)	2,780,341 (23.22)	69,976 (29.82)	
Income Level[d]				<.0001
0	5,455,925 (41.68)	5,401,356 (42.07)	54,569 (21.66)	
1	1,890,948 (14.44)	1,845,804 (14.38)	45,144 (17.92)	
2	2,266,425 (17.31)	2,219,087 (17.28)	47,338 (18.79)	
3	2,470,221 (18.87)	2,403,124 (18.72)	67,097 (26.63)	
4	1,008,073 (7.70)	970,288 (7.56)	37,786 (15.00)	

[a]weighted distribution; ED, emergency department.
[b]groups were compared using chi-square tests.
[c]Self-rated level of health: 0 = Excellent, 1 = Very good, 2 = Good, 3 = Fair, 4 = Poor.
[d]Income level: 0 = > $80,000, 1 = $60 to $79,999, 2 = $40 to $59,999, 3 = $20 to $39,999, 4 = < $20,000.

of the ED in general (i.e., representing 25% of all ED visits, while representing 19% of the population in 2023–2024; CIHI, 2024a). Current ED care processes have shown to increase poorer outcomes for older ED patients (Barron & Holmes, 2013; Hendin et al., 2018; Lowthian et al., 2015); however, they are presenting with conditions that are not manageable by primary care. This suggests that older frequent ED users currently have unmet care needs throughout the care continuum, such as lack of supports to transition back to, and stay in, the community after receiving acute or emergent care to successfully manage their chronic conditions in a care setting that does not put them at risk for poorer outcomes.

These unmet care needs have persisted for over a decade, reflected by similar proportions of ED visits by older adults during 2015–2016 versus 2023–2024 (i.e., 21% versus 25%; CIHI, 2017, 2024a). Furthermore, EDs across Canada are still attempting to mitigate issues that have also been ongoing for over a decade, such as ED overcrowding (Haas et al., 2023). These issues create barriers to high-quality care delivery for populations more vulnerable to poorer outcomes, such as older adults with multimorbidity. The 2015–2016 CCHS dataset used in the current study was chosen specifically because it contained special themed content on a wider range of chronic health conditions to gain knowledge about important associations between multimorbidity and other factors affecting the frequency of ED attendance. Furthermore, these data were collected prior to the COVID-19 pandemic. CIHI (2024a) reported that ED use has recently returned to pre-pandemic levels. Therefore, the results of this study are relevant to provide information about older frequent ED attenders during the current post-pandemic recovery period, more so than data obtained in recent years during the pandemic. These nationally representative findings about older frequent ED attenders are important to help inform who this population is to develop targeted strategies to meet their unmet care needs.

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Table 2. Multivariate logistic regression model of predictors of frequent ED use (N = 13,091,592)

Predictor	df	Estimate	SE	Chi-Square (*p*-value)	Adjusted OR (95% CI)
Age					
> =80	1	0.31	0.13	2.39 (.0169)	1.37 (1.06 to 1.77)
Sex					
Male	1	0.21	0.10	2.03 (.0418)	1.23 (1.01 to 1.51)
Multimorbidity					
Yes	1	0.71	0.14	5.14 (<.0001)	2.03 (1.55 to 2.66)
Health[a]					
1	1	0.03	0.31	0.08 (.9335)	1.03 (0.56 to 1.89)
2	1	0.71	0.32	2.25 (.0245)	2.03 (1.20 to 3.77)
3	1	1.60	0.35	4.58 (<.0001)	4.95 (2.50 to 9.82)
4	1	2.31	0.34	6.71 (<.0001)	10.04 (5.12 to 19.68)
Income Level[b]					
1	1	0.69	0.21	3.33 (.0009)	1.99 (1.33 to 3.00)
2	1	0.41	0.14	2.89 (.0039)	1.51 (1.14 to 1.99)
3	1	0.44	0.13	3.30 (.0010)	1.56 (1.20 to 2.03)
4	1	0.50	0.16	3.22 (.0013)	1.65 (1.22 to 2.23)
Intercept	1	−5.53	0.31	−17.89 (<.0001)	

Notes: df = degrees of freedom; SE = standard error; OR = Odds Ratio; 95% CI = 95% confidence interval; Reference groups: Age 50–79 years, Female sex, No multimorbidity (i.e., < 3 reported comorbidities), Excellent self-rated level of health, Income > = $80,000.
[a]Self-rated level of health: 1 = Very good, 2 = Good, 3 = Fair, 4 = Poor.
[b]Income level: 1 = $60 to $79,999, 2 = $40 to $59,999, 3 = $20 to $39,999, 4 = < $20,000.

Many of the present results support past studies. First, those in the oldest segment of the population (i.e., ≥ 80 years) are more likely to be frequent ED attenders (Dufour et al., 2020; Street, Berry, & Considine, 2018). Furthermore, in a recent multicentre longitudinal cohort study of older adults in the United States, Castillo et al. (2019) found those with multiple comorbidities were more likely to be frequent ED attenders (Castillo et al., 2019). In addition, in their population-based cohort study of Albertan adults 65 years of age and older, Tonelli et al. (2017) found older age and multimorbidity were strongly associated with ED use, as well as adverse outcomes such as mortality and long-term care placement (Tonelli et al., 2017). Tonelli et al. (2017) also found that the presence of dementia was strongly associated with increased health care utilization, including ED visits.

Approximately 26 to 42% of older people who seek care in the ED also have some form of cognitive impairment, such as dementia (Gray et al., 2013; Hirschman et al., 2011; Hunt et al., 2018; LaMantia et al., 2016). Although dementia has been highlighted as an important public health issue (Public Health Agency of Canada, 2019), it remains a condition that is underdetected and underdiagnosed, especially in community-dwelling older adults (Lang et al., 2017). Efforts are needed to better identify older adults with cognitive impairment, especially at a major point of entry into the health care system, such as the ED. Potential variables to examine this concept were available in the CCHS 2015–16 dataset; however, they were part of the theme content that was optional for provinces to collect on participants in their regions. For example, a variable for self-reported cognitive health status was only collected in the three territories. Therefore, the inability to include this potentially important variable is a limitation of the current study.

National survey data provide access to a range of variables such as health and sociodemographic variables, as well as the opportunity to generalize results to large populations. Nevertheless, it does not give a comprehensive picture of all the health characteristics of the population, as many of the variables rely on self-report by participants or their proxies and are not verified by any other source. Self-report measures are easily implemented for large samples but have limitations such as recall/response bias, introspective ability, and social desirability bias. Combining national survey data with administrative databases would reduce these limitations and support the optimization of understanding, describing, and predicting health outcomes. For example, this study indicates that self-perceived health status is strongly associated with frequent ED use; however, it does not shed light on aspects of the health system that may be changed to improve a person's self-perceived level of health or reduce their likelihood of using the ED such as by routinely collecting variables measuring unmet health care needs, access to health care services, or medication use. Merging data from multiple sources are relevant for policy makers, clinicians, and researchers as it improves accurate measurement of health care delivery and patient outcomes, and can also provide information to help design interventions based on relevant variables (Bohensky et al., 2010). Conducting such work is an important area of future research, which builds on the findings from this study.

Conclusion

Older adults who are frequent ED attenders are a distinct population whose characteristics need to be understood to target strategies for those who most need them to provide better quality of care in the most appropriate health care setting, which may in turn reduce ED use. Future studies combining national surveys

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and administrative data will increase our understanding of this complex population to better meet their health care needs.

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