ORIGINAL RESEARCH

Understanding Local Consultation Patterns of Inpatient Geriatric Medicine Teams: a Cross-Sectional Study

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ABSTRACT

Background

Geriatric consultation for Comprehensive Geriatric Assessment (CGA) improves outcomes of older adults living with frailty who are hospitalized, but consultation patterns and utilization of inpatient geriatric consultation teams by other hospital-based services are poorly understood.

Methods

We conducted a cross-sectional study using linked health administrative data to describe characteristics of older adults (≥ 65 years) who received a CGA while hospitalized between January 1, and December 31, 2019. We identified hospital-based services requesting CGA and the frequency and reasons for referral. We used multivariable logistic regression to estimate the association between patient-level characteristics and receiving a CGA.

Results

A total of 29,090 older adults were admitted to hospital; 38.7% were classified as frail and 5.4% (1,563 patients) received at least one CGA. The top three reasons for requesting a CGA were to assess the need for care on an inpatient geriatric rehabilitation unit (43%), and for assessment and management of delirium (27%) and dementia (24%). Referrals were most frequently received from Hospitalists (48%). Frailty was associated with increased odds of receiving a CGA (adjusted odds ratio [aOR] 12.02; 95% confidence interval [CI] 9.67-14.82). A diagnosis of cancer was associated with lower odds of receiving a CGA (aOR 0.75; 95% CI 0.60-0.93).

Conclusions

Inpatient geriatric consultation teams support 5.4% of hospitalized older adults. With the rapidly growing aging population, future efforts are needed to explore the optimal delivery of inpatient geriatric services to support its sustainable provision.

Key words: comprehensive geriatric assessment, consultation patterns, inpatient geriatric consultation teams, older adults, geriatric medicine, acute care, hospitalization, frailty

INTRODUCTION

Canadians are now living longer due to improved health behaviors, medical technology advancements, and better disease detection and management.(1) Worldwide, the population of people aged 60 years and over is projected to double from 12% to 22% by 2050, compared to 2015.(2) A rapidly aging population, however, comes with health risks and chronic conditions, thereby increasing the need for medical services.(1) This relates to frailty syndromes associated with aging, multimorbidity, and acute illness, all of which place older adults at increased risk for adverse outcomes including falls, delirium, functional dependency, and death.(3,4)

The Comprehensive Geriatric Assessment (CGA) is an evidenced-based interdisciplinary, multidimensional, diagnostic, and therapeutic approach to care that assesses an older person's medical, psychological, and functional capacity.(5) Numerous studies provide substantial evidence supporting the effectiveness of CGA for older adults living with frailty and complex issues, both in the outpatient and inpatient settings.(3,5-15) In hospitalized older adults, CGA is associated with a reduced mortality rate at six and eight months postdischarge,(7) an increased likelihood of being alive and living at home, and a lower likelihood of nursing home admission.(3) Moreover, CGA and geriatric co-management care have improved clinical outcomes for hospitalized older adults living with frailty across disciplines, including Cardiology,(9) Oncology,(10) and multiple surgical specialties.(11-15)

To address the complex care needs of hospitalized older adults living with frailty, two CGA models have been introduced: a ward-based model and a consultation team model. The latter involves inpatient geriatric consultation teams (IGCTs) that are dedicated to assisting older adults admitted

to nongeriatric hospital wards.[7] Consultation requests from inpatient services and interhospital transfers are a critical component of a tertiary geriatric practice; however, there is limited knowledge on the utilization of subspecialty IGCTs for CGA from hospital-based services. We aim to characterize consultation patterns of IGCTs. Specifically, we describe which services utilize the IGCTs, the frequency and reasons for referral, and whether specific patient factors are associated with its utilization.

METHODS

Study Design and Setting

We performed a cross-sectional study using administrative data to describe the adult population aged 65 years and older who were admitted to acute care hospitals in Calgary, Alberta from January 1, 2019, to December 31, 2019. Data from the year 2020 were not included, as the results would be impacted by the SARS-CoV-2 pandemic.

Data Sources

Data were extracted from multiple population-based administrative databases contained in the Alberta Health Services Enterprise Data Warehouse: Discharge Abstract Database, which contains data on hospital discharges; National Ambulatory Care Reporting System, which contains data on ambulatory encounters, including emergency department, same-day surgery and day procedures; Practitioner Claims data on health service claims submitted for payment by practitioners under the Alberta Health Care Insurance Plan; Pharmaceutical Information Network; and Provincial Registry. Sunrise Clinical Manager, the Electronic Medical Record used in all hospitals in Calgary, Alberta at the time of data collection, was used to obtain detailed clinical data. It includes data on patient demographics, care providers, clinical care orders (e.g., laboratory tests, diagnostic imaging, medications, consultations, and referrals), results, and diagnoses.[16] These datasets were linked using unique patient identifiers. In Alberta, every patient is assigned a unique provincial health number, which allows us to accurately link different datasets on a patient level. The data were extracted by members of the Provincial Research Data Services team within the Data and Analytics department of Alberta Health Services. Deidentified data were requested and released to the research team to maintain patient confidentiality. Ethics approval was obtained through the Conjoint Health Research Ethics Board of the University of Calgary (REB20-1447).

Study Sample

We included older adults (≥65 years) who were admitted to hospital in Calgary, Alberta from January 1 to December 31, 2019 and received an inpatient geriatric consultation for CGA. This group was compared to older adults (≥65 years) admitted to hospital who did not receive a CGA. We excluded patients who had missing, incomplete or out-of-province provincial health numbers.

The index admission for patients who received a CGA was defined as the first admission the patient received a CGA. The index admission for patients who did not receive a CGA in hospital was defined as the first admission of the year. The index admissions were defined differently to capture and describe all patients who received a CGA over the year as not all patients in this group received a CGA on their first admission.

Inpatient Geriatric Consultation Team

At all four hospitals, a referral to the IGCT for a CGA leads to consultation with a board-certified geriatrician and a team consisting of either a nurse practitioner, a nurse clinician specialist, and/or a geriatric trainee(s). Any physician, surgeon, or resident can request an inpatient geriatric consultation. Following the CGA, written recommendations are provided to the referring team. Recommendations may or may not be followed by the admitting service.

We established 21 predetermined reasons for CGA by drawing upon geriatric clinical expertise and relevant literature (Appendix Table A1). Reasons for referral include assessment of functional status (e.g., falls risks, rehabilitation potential), cognitive/mental status (e.g., delirium, dementia, depression), nutritional status, frailty, polypharmacy, bowel and bladder function, osteoporosis, mood, pain, palliative care, and socioenvironmental factors.[6,12,17-21] Specific to Calgary, Alberta, one of the local hospitals implements a CGA ward-based model, known as the Acute Geriatric Unit. The Acute Geriatric Unit encompasses both acute care and inpatient rehabilitation. Eligibility for rehabilitation on this unit is a common reason for referral. The free text of each geriatric consultation order for CGA was reviewed by KR and coded with the predetermined reasons for CGA. If a consultation request had multiple reasons for referral, it was coded for all corresponding reasons.

Data Variables

Multiple variables were examined to characterize the study sample, including age, sex, and Charlson Comorbidity Index, a predictor of in-hospital and long-term mortality.[22,23] The primary diagnosis for reason for admission was defined by International Classification Disease 10 (ICD-10) codes from the Discharge Abstract Database (Appendix Table A2). Comorbidities were defined by validated algorithms using administrative data with a look-back period of two years.[24-26] Sunrise Clinical Manager was used to identify patients who received a geriatric consultation order for CGA, the referring admitting service, and clinical variables, such as orders for physical restraint use and assessments from Physiotherapy, Occupational Therapy, and Transition Services. Transition Services support hospital discharge planning and coordinate community services including referrals for Home Care Services and placement in various streams of continuing care. For each inpatient CGA request, data on reasons for referral and the admitting service (i.e., the service of the most responsible physician) at the time of consultation were extracted from the geriatric consultation order.

Frailty was defined using the Hospital Frailty Risk Score (HFRS).[27] This score was chosen as a validated frailty risk score derived from 109 ICD-10 codes selected a priori as markers of frailty relevant for use in hospital databases worldwide. The ICD-10 codes are weighted and added together to create a final frailty risk score with a look-back period of two years before the index admission.[27] A list of the ICD-10 codes and methods to derive the score are found in the appendix of Gilbert *et al*.[27] Frailty risk is defined as low, intermediate, or high risk and was shown to have moderate agreement with the Rockwood Frailty Index. Those in the intermediate risk and high-risk categories are classified as frail.[27]

Statistical Analysis

Descriptive statistics were performed for each variable, comparing inpatients with and without CGA. Categorical variables are presented as percentages and analyzed using chi-squared tests. Continuous variables were compared using Wilcoxon rank sum tests and reported as medians and interquartile ranges (IQR).

A multivariable logistic regression model was used to estimate the association between patient-level variables and odds of having a CGA. Variables included in the model are listed in Table 3 and were chosen as having possible associations with receiving an inpatient CGA, identified based on clinical expertise, known common geriatric syndromes,[20,21,28] common age-related diseases,[20] risk factors for geriatric syndromes,[29-31] and known reasons for CGA referral.[6,12,17-19] All variables were modeled as categorical except age, which was modeled as continuous. Two-sided *p* values are reported, and p values $< .05$ were considered statistically significant. All statistical analyses were conducted using SAS 9.4 (SAS Institute Inc., Cary, NC; licenced at University of Alberta); the multivariable logistic regression analysis and multicollinearity testing was completed using SPSS Version 26.0 (IBM SPSS Statistics, Armonk, NY; licenced at University of Calgary).

This study adhered to the reporting of studies conducted using the observational routinely collected health data (RECORD) statement for reporting observational studies.[32]

RESULTS

Description of Study Sample

A total of 29,090 older adults (≥65 years) were admitted to hospital during the one-year period, of whom 38.7% (n=11,263) were categorized as frail, defined by the HFRS. A total of 5.4% (n=1,563) participants received at least one CGA; of these participants, there were a total of 1,838 consultation orders for CGA, as some participants received more than one geriatric consultation during their hospitalization. Compared to participants who did not receive a CGA, those who received a CGA were older (82 (IQR 75-87) years vs. 75 (IQR 70-83) years; $p < .001$) and had a significantly longer median length of stay. A higher proportion of participants who received a CGA were living with frailty (87.6 vs. 35.9%). However, in the subgroup of all participants who were categorized as frail, only 12% (n=1,370) received a CGA. Approximately half of the participants were female in both groups (Table 1).

Participants who received a CGA had a higher proportion of geriatric syndromes as comorbidities including dementia, Parkinson's disease (PD), osteoporosis, stroke, depression, chronic pain, constipation, and osteoarthritis; had a larger proportion of admissions to hospital due to common geriatric syndromes such as trauma with injury, delirium, and complications of osteoporosis, dementia, and PD; and had a larger proportion of multidisciplinary team assessments (Table 1). Participants who did not receive a CGA had a higher proportion of cancer as a comorbidity and reasons for admissions to hospital being complications of cancer, osteoarthritis, ischemic heart disease, atrial fibrillation, pancreaticobiliary disease, acute abdomen, and urological disorders (Table 1).

Common Reasons for Comprehensive Geriatric Assessment

The most common reasons for CGA were assessment for inpatient geriatric rehabilitation (i.e., transfer to the Acute Geriatric Unit) (43%), assessment and management of delirium (27%) and dementia (24%), and assessment for falls risk (21%), and disposition planning (19%). Of 1,838 referrals, 63% of referrals had more than one reason for CGA. Less than 1% (n=20) of referrals were for geriatric preoperative assessment, frailty, and prognostication. There were no referrals for osteoporosis management (Figure 1). However, this does not encompass the work of our Fracture Liaison Service. In this service, osteoporosis management of patients who are admitted to hospital with hip fracture is led by a registered nurse and the geriatrician on the IGCT.

Admitting Services Who Consult Inpatient Geriatric Medicine Teams

Twenty-three different admitting services consulted an IGCT for CGA (Figure 2). Of the 1,838 referrals for CGA, the admitting services that consulted most frequently were the Hospitalist (Family Medicine) service (48% of all consultations), General Internal Medicine service (17%), Orthopedic service (9.4%), and Trauma service (5.1%). The other medical and surgical services were infrequent users of IGCTs, with less than 5% of referrals coming from Cardiology (4.5%) and General Surgery (3.8%), and less than 2% from Respirology (1.8%), Vascular surgery (1.5%), and Cardiac surgery (1.5%). Less than 1% of referrals were from all other admitting services including Neurology, Hematology, Intensive Care, Urology, Psychiatry, Nephrology, Stroke, and Oncology. There were missing data on the admitting service for 2.2% (n=42) of geriatric consultation orders for CGA.

Characteristics Associated with Receiving a Comprehensive Geriatric Assessment

Many geriatric syndromes were associated with receiving a CGA. The variable associated with the greatest odds of receiving a CGA was being at high risk for frailty based

TABLE 1 (part 1 of 2).
Demographics of hospitalized older adults who received and did not receive a comprehensive geriatric assessment (CGA)

Variables	*Older adults (≥ 65 years) who received CGA (n=1563)*	*Older adults (≥ 65 years) who did not receive CGA (n=27527)*	*P value*
Age (years)			
median (IQR)	82.0 (75-87)	75.0 (70-83)	<.001
Sex % (n)			
Female	50.0 (782)	49.5 (13628)	.69
Length of stay (days)			
Median (IQR)	17.0 (8.0-40.0)	4.0 (2.0-9.0)	<.001
Hospital Frailty Risk Score % (n)			
Low risk (< 5)	12.3 (193)	64.1 (17634)	<.001
Intermediate risk (5-15)	44.5 (696)	26.2 (7224)	
High risk (> 15)	43.1 (674)	9.7(2669)	
Charlson Comorbidity Index Score % (n)			
0	24.0 (375)	41.1 (11306)	<.001
1	24.8 (388)	20.7 (5688)	
2	19.4 (304)	17.3 (4753)	
3	15.9 (249)	9.6 (2655)	
4	8.3 (130)	3.9 (1080)	
5^{+}	7.5 (117)	7.4 (2045)	
Co-Morbidities % (n)			
Alcohol misuse	3.8 (60)	2.3 (625)	<.001
Atrial fibrillation	14 (219)	8.8 (2432)	<.001
Chronic heart failure	28.3 (443)	15.3 (4213)	<.001
Chronic kidney disease	33.1 (517)	19.3 (5325)	<.001
Cirrhosis	1.3 (20)	0.8 (226)	.06
Depression	18.4 (288)	8.4 (2324)	<.001
Epilepsy	3.5 (55)	1.6 (435)	<.001
Hypothyroidism	4.6 (72)	3.1 (865)	.002
Osteoporosis and fragility fracture	29.9 (468)	15.1 (4158)	<.001
Parkinson's disease	7.5 (118)	1.8 (503)	<.001
Chronic pain	11.6 (182)	8.2 (2247)	<.001
Constipation	6.8 (106)	3.2 (888)	<.001
Stroke or TIA	13.5 (211)	9.0 (2480)	<.001
Osteoarthritis	7.2 (112)	5.5 (1520)	.01
Peptic ulcer disease	1.0 (15)	0.8 (228)	.57
Diabetes	35.7 (558)	28.7 (7909)	<.001
Hypertension	67.7 (1058)	63.9 (17576)	.002
Cancer	9.3 (146)	16.3 (4480)	<.001
Peripheral vascular disease	14.1 (221)	9.2 (2541)	<.001
Chronic obstructive pulmonary disease or asthma	22.8 (357)	20.9 (5740)	.06
Dementia	33.5 (524)	11.7 (3230)	<.001
Prior myocardial infarction	7.0 (110)	9.0 (2489)	.01
Reason for admission % (n)[a]			
Trauma with injury	9.7 (151)	6.5 (1777)	<.001
Cancer	4.0 (62)	9.9 (2735)	<.001
Diabetes	1.6 (25)	0.9 (245)	<.001
Psychiatric disorder	2.2 (35)	1.4 (373)	.01
Delirium	7.8 (124)	1.3 (347)	.003
Dementia	6.0 (93)	1.3 (364)	<.001
Nervous system disorder	2.9 (46)	1.3 (346)	<.001
Parkinson's disease	1.3 (21)	0.2 (46)	<.001
Ischemic heart disease	3.1 (49)	5.9 (1619)	<.001
Stroke	2.4 (38)	3.3 (896)	.08

TABLE 1 (part 2 of 2).
Demographics of hospitalized older adults who received and did not receive a comprehensive geriatric assessment (CGA)

Variables	*Older adults (≥ 65 years) who received CGA (n=1563)*	*Older adults (≥ 65 years) who did not receive CGA (n=27527)*	*P value*
Reason for admission % (n)[a] (continued)			
Vascular disorder	1.3 (21)	1.6 (435)	.40
Atrial fibrillation and flutter	0.6 (10)	1.5 (410)	.01
Arrhythmias (excluding atrial fibrillation)	0.6 (10)	1.3 (356)	.25
Heart failure	5.0 (78)	3.7 (1024)	.01
Aortic stenosis	0.9 (14)	0.9 (258)	1.0
Cardiac arrest, shock, respiratory failure	4.3 (67)	2.2 (607)	<.001
Gall bladder or pancreatic disease	0.6 (10)	2.4 (663)	<.001
Acute abdomen	0.6 (10)	1.8 (497)	<.001
Gastroesophageal reflux disease, esophagitis and gastrointestinal ulcer	1.2 (18)	1.2 (322)	.98
Pneumonia	3.5 (54)	4.2 (1151)	.17
Chronic obstructive pulmonary disease or asthma	2.9 (45)	3.3 (906)	.42
Osteoarthritis	1.5 (15)	7.8 (2160)	<.001
Osteoporosis and fractures	7.7 (121)	3.8 (1038)	<.001
Inflammatory arthritis	0.9 (14)	1.4 (391)	.10
Skin and soft tissue infection	0.6 (10)	0.6 (172)	.87
Renal disease (acute and chronic kidney disease)	1.5 (23)	1.0 (282)	.10
Urinary tract infection or pyelonephritis	2.2 (34)	1.6 (431)	.07
Other urological disorders	1.2 (18)	4.5 (1242)	<.001
Electrolyte disorder	0.8 (13)	0.9 (250)	.89
Other	21.4 (335)	22.4 (6163)	.40
Physical Restraint use % (n)[b]	14.0 (219)	3.8 (1036)	<.001
Multidisciplinary consultation % (n) [b]			
Physiotherapy	86.7 (1355)	52.4 (14429)	<.001
Occupational Therapy	2.4 (37)	0.8 (222)	<.001
Transition Services	87.5 (1368)	38.8 (10687)	<.001

[a]Reason for admission was defined by International Classification Disease 10 codes from the Discharge Abstract Database (Table A2).
[b]Order for restraint and multidisciplinary consultation were identified through Sunrise Clinical Manager; this represents the proportion of patients who received at least one order for restraints or multidisciplinary consultation during the index admission.
CGA = comprehensive geriatric assessment; TIA = transient ischemic attack.

on the HFRS; these participants were 12 times more likely to receive an order for a CGA (adjusted odds ratio [aOR] 12.02; 95% CI 9.76-14.82). Admission for delirium (aOR 2.63; 95% CI 1.98-3.50), trauma with injury (aOR 1.48; 95% CI 1.17-1.87), and complications of PD (aOR 4.18; 95% CI 2.02-8.64) and dementia (aOR 1.95; 95% CI 1.41-2.70) were also associated with receiving a CGA. Furthermore, common geriatric syndromes, including intermediate risk for frailty (aOR 5.57; 95% 4.63-6.70), known diagnosis of PD (aOR 2.17; 95% CI 1.63-2.88), and receiving an order for physical restraints (aOR 3.60; 95% CI 2.80-4.60), physiotherapy (aOR 5.39; 95% CI 4.58-6.35) and Transition Services assessment (aOR 9.45; 95% CI 8.04-11.1) were associated with receiving a CGA. A diagnosis of cancer (aOR 0.77; 95% CI 0.62-0.97), female sex (aOR 0.84; 95% CI 0.74-0.95), and being admitted for complications of osteoarthritis (aOR 0.32; 95% CI 0.18-0.57) were negatively associated with receiving a CGA. The odds ratios of receiving a CGA associated with other relevant characteristics are found in Table 2. Variance inflation factors were less than 4, demonstrating little multicollinearity among the variables.

DISCUSSION

Our IGCTs support 5.4% of all hospitalized older adults (≥ 65 years). They are predominantly consulted for assessments around function, cognition, fall risk, and socioenvironmental factors. These domains are often addressed and managed in CGAs performed on patients with geriatric syndromes.[6,17,18] Patient characteristics associated with receiving a CGA include living with frailty, previous diagnosis of PD and admission for trauma with injury, PD, delirium, and dementia. Physical restraint order and physiotherapy and Transition Services assessments were also associated with receiving a CGA. Our findings suggest that the IGCTs are receiving appropriate referrals for CGA.

The proportion of hospitalized older adults referred for CGA is comparable to other sites across North America,

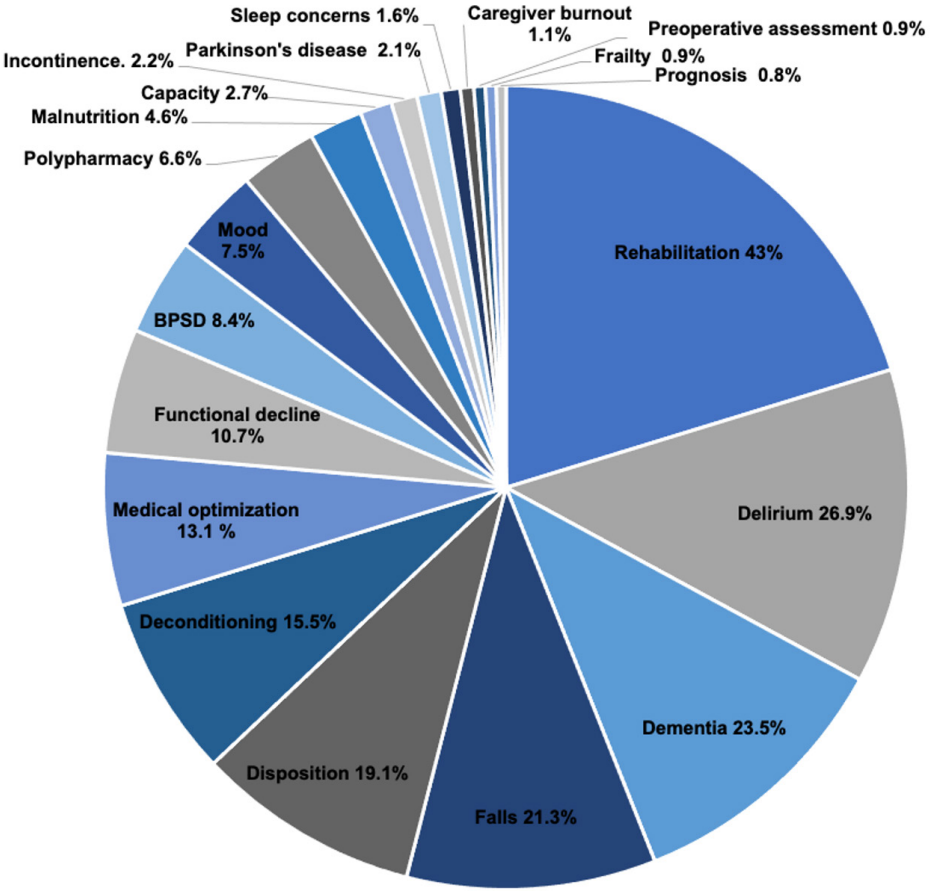

FIGURE 1. The frequency of reasons for receiving a comprehensive geriatric assessment (CGA) in hospital
BPSD = behavioral and psychological symptoms in dementia.

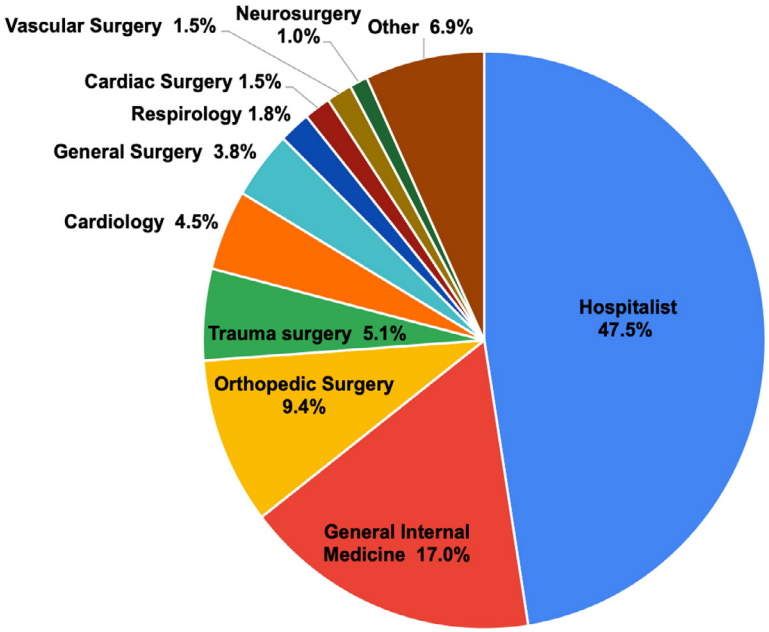

FIGURE 2. Proportion of requests for comprehensive geriatric assessment (CGA) from each hospital based admitting service; there were missing data on the type of admitting service for 42 of 1,838 CGA orders
[a]Admitting services in the 'other' category include the following: Neurology (n=15), Hematology (n=13), Intensive Care (n=12), Urology (n=8), Psychiatry (n=7), Nephrology (n=6), Stroke (n=4), Thoracic surgery (n=3), Otolaryngology (n=3), Radiation Oncology (n=2), Plastic Surgery (n=2), Medical Oncology (n=1), and Gastroenterology (n=1).

where such teams support approximately 4.4–5.3% of older adults.[33-35] However, the sustainability of IGCTs must be considered as the older population in Canada is expected to grow.[36] Meeting the healthcare needs of 5% of hospitalized older adults will require an increase in the number of geriatricians overseeing this service locally and across North America.

The literature provides little data describing what services utilize the IGCT.[33-35,37] In our study, approximately 80% of all inpatient geriatric consultations were requested from the Hospitalist, General Internal Medicine, Orthopedic, and Trauma services. Braes *et al*.[37] showed that when using a case-finding approach, Cardiology (23.7%) and Trauma/Orthopedics (14.7%) were hospital-based services that most frequently requested CGA. This suggests that a greater number of patients admitted under Cardiology in our study may be suitable for CGA, given that only 4.5% of our current referrals come from Cardiology. We observe a comparable number of referrals for those admitted under Orthopedic and Trauma services, a practice well supported in the literature.[11,12] This suggests our IGCTs have similar engagement with these services.

The remaining 20% of referrals for CGA in our study were from other medical and surgical admitting services that infrequently utilize IGCTs. Based on the literature, we speculate that there are older adults cared for by these inpatient services who would benefit from a CGA.[9-15,33-35,37] We know that patients from Oncology, Cardiology, and multiple surgical specialties (e.g., General Surgery, Urology, and Vascular Surgery) have improved outcomes following CGA,[9-15] and yet in our study, less than 5% of our referrals came from these subspecialty services. In fact, having a diagnosis of cancer

TABLE 2 (part 1 of 2).
Odds ratios of receiving a comprehensive geriatric assessment among older adults admitted to hospital

Variables	*Unadjusted Odds Ratio (95% CI)*[a]	*Adjusted Odds Ratio (95% CI)*[a]
Patient Characteristics		
Age	**1.06 (1.06-1.07)**	**1.02 (1.02-1.03)**
Sex		
Female	1.02 (0.92-1.13)	**0.83 (0.73-0.95)**
Frailty (compared to low risk)		
Intermediate risk	**8.80 (7.48-10.34)**	**6.05 (5.04-7.26)**
High risk	**23.07 (19.56-27.21)**	**12.02 (9.76-14.82)**
Charlson Comorbidity Index (CCI) (compared to score 0)		
1	**2.06 (1.77-2.37)**	1.11 (0.92-1.33)
2	**1.92 (1.65-2.25)**	1.06 (0.86-1.30)
3	**2.83 (2.39-3.34)**	1.10 (0.85-1.41)
4	**3.62 (2.95-4.47)**	1.07 (0.79-1.46)
5^{+}	**1.73 (1.39-2.13)**	0.73 (0.53-1.01)
Comorbidities		
Alcohol misuse	**1.72 (1.31-2.25)**	0.87 (0.61-1.22)
Chronic heart failure	**2.19 (1.95-2.46)**	**1.38 (1.16-1.64)**
Depression	**2.45 (2.14-2.80)**	1.09 (0.91-1.30)
Osteoporosis and fragility fracture	**2.03 (1.80-2.30)**	1.13 (0.95-1.35)
Parkinson's disease	**4.38 (3.56-5.40)**	**2.19 (1.65-2.90)**
Stroke or TIA	**1.58 (1.36-1.83)**	1.07 (0.88-1.31)
Cancer	**0.53 (0.45-0.63)**	**0.75 (0.60-0.93)**
Dementia	**3.79 (3.39-4.24)**	1.13 (0.97-1.32)
Peripheral vascular disease	**1.62 (1.40-1.88)**	1.11 (0.92-1.34)
Atrial fibrillation	**1.68 (1.45-1.95)**	1.13 (0.94-1.36)
Chronic kidney disease	**2.06 (1.85-2.30)**	1.04 (0.89-1.21)
Cirrhosis	1.57 (0.99-2.48)	1.22 (0.69-2.15)
Epilepsy	**2.27 (1.71-3.02)**	1.33 (0.94-1.88)
Hypothyroidism	**1.49 (1.16-1.90)**	1.04 (0.77-1.41)
Chronic pain	**1.48 (1.26-1.74)**	1.18 (0.96-1.44)
Constipation	**2.18 (1.77-2.69)**	0.99 (0.76-1.27)
Osteoarthritis	**1.32 (1.08-1.61)**	1.15 (0.91-1.47)
Diabetes	**1.38 (1.23-1.53)**	1.13 (0.97-1.32)
Hypertension	**1.19 (1.06-1.32)**	0.91 (0.80-1.04)
Chronic obstructive pulmonary disease or asthma	1.12 (0.99-1.27)	0.89 (0.76-1.04)
Prior myocardial infarction	**0.76 (0.63-0.93)**	0.81 (0.63-1.04)
Peptic ulcer disease	**1.16 (0.70-1.96)**	0.80 (0.44-1.47)

TABLE 2 (part 2 of 2).
Odds ratios of receiving a comprehensive geriatric assessment among older adults admitted to hospital

Variables	*Unadjusted Odds Ratio (95% CI)*[a]	*Adjusted Odds Ratio (95% CI)*[a]
Reason for Admission		
Delirium	**6.36 (5.15-7.85)**	**2.63 (1.98-3.50)**
Dementia	**4.72 (3.74-5.96)**	**1.95 (1.41-2.70)**
Psychiatric disorder	**1.67 (1.17-2.37)**	**1.78 (1.14-2.79)**
Nervous system disorder	**2.38 (1.74-3.25)**	**2.06 (1.37-3.09)**
Parkinson's disease	**8.14 (4.84-13.67)**	**4.18 (2.02-8.64)**
Osteoporosis and fractures	**2.14 (1.76-2.60)**	1.11 (0.83-1.48)
Trauma with injury	**1.55 (1.30-1.85)**	**1.48 (1.17-1.87)**
Heart failure	**1.36 (1.07-1.72)**	0.75 (0.55-1.03)
Cardiac arrest, shock, respiratory failure	**1.99 (1.53-2.57)**	1.31 (0.94-1.82)
Cancer	**0.37 (0.29-0.48)**	0.99 (0.72-1.38)
Stroke	0.74 (0.53-1.03)	0.75 (0.49-1.14)
Ischemic heart disease	**0.51 (0.39-0.69)**	0.87 (0.61-1.24)
Gall bladder or pancreatic disease	**0.26 (0.14-0.49)**	0.53 (0.27-1.04)
Diabetes	1.81 (1.20-2.74)	1.29 (0.78-2.12)
Atrial fibrillation and flutter	**0.43 (0.23-0.80)**	0.85 (0.42-1.69)
Arrythmias (excluding atrial fibrillation)	**0.49 (0.26-0.92)**	0.83 (0.42-1.67)
Renal disease (acute and chronic kidney disease)	1.44 (0.94 - 2.21)	1.27 (0.77-2.09)
Urinary tract infection or pyelonephritis	1.40 (0.98- 1.99)	**0.56 (0.37-0.84)**
Vascular disorder	0.81 (0.51-1.27)	1.24 (0.72-2.14)
Aortic stenosis	0.96 (0.56-1.64)	1.23 (0.65-2.33)
Pneumonia	0.82 (0.61-1.08)	**0.63 (0.46-0.87)**
Chronic obstructive pulmonary disease or asthma	0.87 (0.64-1.18)	0.98 (0.67-1.43)
Skin and soft tissue infection	1.02 (0.54-1.94)	0.64 (0.31-1.30)
Electrolyte disorder	0.92 (0.52-1.60)	0.64 (0.34-1.20)
Gastroesophageal reflux disease, esophagitis and gastrointestinal ulcer	0.98 (0.61-1.59)	1.66 (0.97-2.86)
Inflammatory arthritis	0.63 (0.37-1.07)	1.13 (0.61-2.10)
Osteoarthritis	**0.11 (0.07 - 0.19)**	**0.32 (0.18-0.57)**
In-Hospital Order		
Physical restraint	**4.17 (3.57-4.87)**	**4.86 (3.84-6.15)**
Occupational Therapy	**2.98 (2.10-4.24)**	1.83 (0.98-3.39)
Physiotherapy	**5.90 (5.10-6.86)**	**5.19 (4.42-6.09)**
Transition Services	**11.05 (9.49-12.87)**	**9.66 (8.23-11.34)**

[a] Bolded odd ratios represent statistically significant effects.
TIA = transient ischemic attack.

was negatively associated with receiving a CGA. We were unable to explore the characteristics of these patient subgroups to determine if they would benefit from a CGA; however, assuming these subgroups are reflective of the populations described in the literature, this represents an opportunity to educate these admitting services on the value and role of inpatient geriatric services.

We highlight the needs of patients living with frailty who require specialized geriatric care. Frailty is commonly observed among hospitalized older adults and is associated with poor outcomes including mortality, longer length of stay, and institutionalization.[28] Canadian data from the Canadian Institute for Health Information estimate that approximately 38% of hospitalized older adults in the same fiscal year were at risk for frailty.[38] This is in keeping with our results, where close to 40% of older adults admitted to hospital were categorized as frail. CGAs are an established evidence-based intervention for early identification and management of frailty and improve outcomes for these patients,[3,7,8] and yet, only 12% of hospitalized older adults living with frailty in our study received a CGA. While there is a growing demand for geriatricians and elder-friendly environments, the infrastructure falls short of meeting the needs of all hospitalized older adults living with frailty. Implementing geriatric-friendly interventions to address frailty across hospitals and identifying patients who benefit the most from CGA should be a health priority across North America.

While female sex was found to be negatively associated with receiving a CGA, there are no comparable studies that have examined patient factors associated with geriatric medicine service utilization in hospital to support or refute this finding. Female sex is a greater risk factor for Alzheimer's

dementia[39] and, therefore, we would expect female sex to be more likely associated with geriatric consultation for cognitive assessment. As a result, given that the magnitude is small, we suspect this may represent residual confounding, although this could be explored in a future study to better understand its significance. As for the negative association between being admitted for complications of osteoarthritis and receiving a CGA, this is likely partly explained by the Fracture Liaison Service and may have led to an underestimation of the extent that Orthopedics utilizes the IGCT.

There are several limitations to our study. Using different definitions for the index dates of both groups could lead to selection bias. We addressed this by adjusting for a number of relevant factors in our logistic regression model; however, possible residual confounding remains, and we were unable to control for other relevant factors including functional status, race, gender, residence (community vs. alternative level of care), medications prior to and during admission, and past healthcare utilization. As this was a cross-sectional study, only associations between variables and receiving a CGA can be interpreted; we cannot determine causation. Furthermore, we only captured formal consultations, and reasons for requesting a CGA were from the perspective of the consulting service; discussions between providers not documented in administrative data could not be captured. Some caution should be considered when evaluating the accuracy and reliability of the coding as this was only done by one author and in interpreting the accuracy of the 1,838 geriatric consultation orders. We did not confirm that every order resulted in a consultation; repeat referrals for geriatric consultation likely did not result in a full CGA if a patient already had one performed earlier in their hospital stay; there is a possibility of duplicate orders for geriatric consultation on the same patient at the same time point in hospital. Lastly, the HFRS was validated in an older population (hospitalized adults 75 years and older) compared to this study population.

CONCLUSION

Roughly 5% of older adults admitted to hospital were referred to IGCTs for CGA, and there are likely other hospitalized older adults who would benefit from this service. If demand for CGA remains consistent at a minimum of 5% of hospitalized older adults, further resources, including increased specialized geriatric personnel, elder-friendly environmental changes, geriatric-targeted interventions, increased specialized geriatric training among non-geriatric healthcare providers, and increased specialized geriatric community resources, are necessary to support this rapidly growing population. Future efforts exploring the optimal delivery of inpatient geriatric services are necessary to support its sustainable provision and expand its support to those who have yet to benefit from this service.

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CONFLICT OF INTEREST DISCLOSURES

We have read and understood the *Canadian Geriatrics Journal*'s policy on conflicts of interest disclosure and we have none to declare.

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APPENDIX TABLE A1. Predetermined reasons for comprehensive geriatric assessment of older adults admitted to hospital

Reasons for Receiving a Comprehensive Geriatric Assessment
Assessment and Management of:
Delirium
Dementia
Mood
Malnutrition
Falls
Behavioral and psychological symptoms in dementia (BPSD)
Sleep concerns
Functional decline
Caregiver burnout
Medical optimization
Deconditioning
Frailty
Polypharmacy
Incontinence
Parkinson's disease
Osteoporosis
Assessment for:
Capacity
Disposition
Rehabilitation/transfer to the Acute Geriatric Unit
Preoperative assessment
Prognosis

APPENDIX TABLE A2. ICD-10 codes that define 30 primary diagnoses as reason for admission to hospital

Most Responsible Diagnosis for Admission	*ICD-10 Codes*
Cancer	C00- D49
Diabetes	E08-E14
Electrolyte disorder	E86, E87
Psychiatric disorder	F04 – F 99, excluding F05
Delirium	F05
Dementia	F01-F03, G30, G31.1
Nervous system disorder	G00-G99, exclude G30, G31.1, G20-22
Parkinson's disease	G20-G22
Ischemic heart disease	I20 – I25
Cerebrovascular disease	I60 – I69
Vascular Disorder (arterial and venous)	I70 – I79, I80-I83, I86-I89, exclude I81
Atrial fibrillation and flutter	I48
Arrhythmias (excluding atrial fibrillation)	I44-I45, I47, I49
Heart failure	I500, I509, I09.9, I25.5, I42.0, I42.5-I42.9, I43, I50, J81
Aortic stenosis	I35
Cardiac arrest, shock, respiratory failure	I46, I95, I97, I99, J96
Gall bladder or pancreatic disease	K80-K87
Acute abdomen (peritonitis, appendicitis, intestinal obstruction)	K65, K35-K38, K56
Gastroesophageal reflux disease, esophagitis and gastrointestinal ulcer	K20-K31
Pneumonia	J09-J18, J20-J22, J85, J86, J69
Chronic obstructive pulmonary disease or asthma	J43*, J44*, J45*
Skin and soft tissue infection	I96, L00-L08, L10-L14, L20-L30
Osteoarthritis	M15 – M19, M87
Inflammatory arthritis	M04-M14, M30-M36, M45-M49
Osteoporosis and fractures (hip, pelvic, vertebral, femur, or periprosthetic)	M80-M85, M97, S72*, S31.2, S32.3-S32.5, S32.7-S32.8, S22.0-S22.1, S32.0, S32.7-S32.8
Renal disease (acute and chronic kidney disease)	N17, N19, N00, N01
Urinary tract infection or pyelonephritis	N10, N33, N390
Other urological disorders	N13, N20-N23, N39.3, N39.4, N39.8, N39.9, N25-N29, N31-N37, N41-N53, N99, N40
Trauma with injury	S00-T88, exclude S72, V00-Y99
Other	Other ICD-10 codes not included above