Patient and health system factors associated with hospital readmission in older adults without cognitive impairment

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ABSTRACT

Objective: To study the factors associated with hospital readmission.
Methods: Data used in this study came from a population-based survey of older adults without cognitive impairment. Cox regression was used to assess the factors associated with readmission within a 2-year follow-up period. According to Andersen's model of healthcare seeking behavior, study variables considered included predisposing, enabling and need factors at the individual and health system levels.
Results: Of the 433 participants with an index hospitalization, 97% were discharged with a physical and 3% with a psychiatric disorder. During follow-up, 29% (128/433) were readmitted with a median time to readmission reaching 83 days. The risk of readmission was associated with the following: age, marital status, attraction index of the region of residence for psychiatric services, the presence of an anxio-depressive and other mental disorder, as well as a disorder of the musculoskeletal system. The presence of a physical and psychiatric comorbidity was also associated with readmission.
Conclusions: Post-discharge follow-up of vulnerable populations with a history of mental disorders and improved availability of psychiatric services in the community are associated with a reduced risk of readmission.

1. Introduction

With the ageing of the population, the management of comorbid psychiatric and physical disorders is important [1]. These disorders are associated with an increased risk of admissions, poorer health outcomes and increased costs [2–4]. A recent review showed that 68% of adults with a mental disorder also have a physical condition [5]. In older adults, 40% with a physical condition also have a mental disorder [5,6] and additional costs reaching CAD $600 per capita [7]. The higher costs are in part attributed to the increased risk of readmissions [8,9], which is a quality of care indicator [10,11].

Several studies show that the presence of physical and psychiatric comorbidity is more common in patients readmitted than those with a single admission [12]. Other conflicting studies report a decreased likelihood of readmission by up to 41% among those with comorbid psychiatric and physical medical conditions [13,14]. In explaining these discordant results, Sprah and colleagues [5] highlight differences regarding healthcare systems, populations, and study observation periods ranging from 1 month to over 7 years.

A recent study on Medicaid enrollees showed that male gender, older age and an increased Charlson comorbidity index was associated with a reduced 30-day risk of readmission [15]. Possible explanations put forth include better treatment management and follow-up of individuals with comorbid physical medical conditions, and improved adherence rates to treatment [13,15].

Others have also observed an association between risk of readmission and marital status, medical insurance, having a regular physician [16], previous psychiatric admission [17–20] and length of previous inpatient stay [16,18,19]. Others have also suggested the importance of early follow-up with primary care physicians [21] and a hospital discharge plan [22] in reducing the rates of readmissions.

The presence of a physical and psychiatric comorbidity on hospital readmissions is still not well understood [12,15]. Aside from the methodological issues highlighted [5] one has to consider the specific environment of the patients [23]. Kansagara and colleagues review on predicting readmission risk models showed poor results with demographic and clinical variables. The authors argue for the need to consider patient health and social functioning as well as health system

Table 1
Ambulatory and inpatient discharge ICD-9 and ICD-10 codes.

Conditions	Codes
Respiratory disease	491.x; 492.x; 493.x; 496.x; J410; J411; J418; J42x; J439; J440; J441; J449; J4590
Other pulmonary diseases	515; J189; B909; J984; R91
Heart disease	3940; 3941; 3942; 3951; 3952; 3959; 428.x; 412.x; 413.x; 4273; 440.x–449.x; I050; I051; I058; I061; I062; I068; I069; I50x; I200; I201; I208x; I209; I252; I48x; I70
Other "heart disease"	414; 426; I251; I429; I453
Hypertension	401.x; 405.x; I10x; I150x; I158x
Acute myocardial infarction	410
Hyperlipidemia	2720; 2721; 2722; 2723; 2724; E780; E781; E782; E783; E784; E785
Other disorders of lipoprotein metabolism	E788; E789
Arthritis	7140; 7141; 7142; 7143; 715.x; M050; M053; M061; M069; M15x–M19x
Other arthritic diseases	M139; M479
Cancer	140.x–149.x, 150.x–159.x; 160.x–165.x; 170.x–175.x; 179.x–189.x; 190.x–199.x; 200.x–208.x; 230.x–234.x; C00x–C14x; C15x–C26x; C30x–C39x; C40x–C41x; C43x–C44x; C45x–C49x; C50x; C51x–C58x; C60x–C63x; C64x–C68x; C69x–C75x; C76x–C80x; C81x–C96x; C97x; D00x–D09x
Diabetes	250.x; E1010; E1011; E1021; E1031; E1036; E1040; E1051; E1061; E1062; E1063; E1064; E109; E110; E1121; E1131; E1136; E1140; E1151; E1161; E1162; E1163; E1164; E119
Other diabetes	E139; E149; E142
Cerebrovascular diseases	430.x–432.x; 434.x; 436.x; I60.–I64.x; G459
Disorder of the urinary system	585.x; 5933; 5934; 5935; 5937; 5938; 5939; 5951; 5952; 5959; 5978; 600 .x; 6011; 6013; 6018; 6019; 602 .x; N181; N182; N183; N184; N185; N188; N134; N135; N137; N138; N2882; N289; N301; N302; N309; N341; N342; N343; N40; N411; N413; N414; N418; N419; N420; N421; N429
Disorder of the genitourinary system	N814; N200; 403; N133; I12; N393; N202; N502; N813;N840; N19; N811; N832;D300; D27; 625; R102
Disorder of the Gastrointestinal system	5308; 5314; 5315; 5316; 5317; 5319; 555.x, 556.x, 5641; K219; K254; K255; K256; K257; K25.9; K501; K508; K509; K510; K514; K515; K518; K519; K589
Other disorder of the Gastrointestinal system	787; 547; K922; 553; 578; K801; 550; K610; 562; K590; K349; K499; K573; K559; K802
Disorder of the Musculoskeletal system	7231; 7241; 7242; 7243; 7244; 7245; 725.x; 7260; 7261; 7262; 7263; 7264; 7265; 7266; 7267; 7269; 7270; 7272; 7273; 7290; 7291; 7292; 7294; 7295
Disorder of the endocrine system	E269; E039
Disorders of the thyroid	240.x–246.x; E00–E07
Chronic liver disease	571.x; K76
Diseases of the eye	366x; 3793; H25x–H28x
Other eye disease	H358; 375; 361; H020; H218; H024; H353
Migraine	3078; 3460; 3461; 3462; 3468; 3469; 7840; G43x; G440; G441, G442,G443,G448
Diseases of the skin	1360; 4540; 4542; 6918; 6923; 6924; 6925; 6926; 6928; 6929; 6940; 6941; 6942; 6943; 6944; 6945; 6946; 6948; 6949; 6954; 6958; 6960; 6961; 6962; 6970; 6982; 6983; 7010; 7011; 7013; 7018; 7029; 7058; 7068; 7070; 7071; 7079; 7080; 7088; 7091; 7093; 7098; 7571; 7573; 7579; L10x; L12x; L13x; L20x; L23x; L28x; L301 L40x; L41x; L43x; L500; L508; L581; L85x; L89x; L93x; L94x; L95x; L97x; L984; Q80x; Q81x; Q822; Q829; I830; I832
Anxio/depressive disorder	296.x,300.x,311.x; F30.x–F48.x, F68.x
Other mental disorder	290.x–295.x; 297.x–299.x; 301.x–310.x; 312.x–319.x; F00.x–F29.x; F50.x–F66.x; F69.x–F99.x
Other diseases	722; 807; 808; 812; 813; 836; 843; S525; S526; S325; S622
	A403; A09; A081; B968; B962; B951; A084; A415; A047; A049; A498; A419; 079; 590; B379; C569;A045; A499; B9548; B349; B353; B370; B07
	G560; D594; D649; D500; D509; D62; 2166; D233; D171; E65; L602; Z031; Z038; Z470; E669; R074; M819; M653; 451; L031; D619; T854; M353; 780; R590; J329; I842; 354; D891; 627; 415; H813; 934; E8310; H812; D689; G9601; D6938; J90; E860; M720; M224; M7137; I832; S2781

factors in predicting readmission risk models [24].

The aim of this study was to assess the factors associated with a hospital readmission, over a two-year follow-up period in community-dwelling older adults without cognitive impairment. The framework considered was Andersen's conceptual model of healthcare seeking behavior, which includes the influence of predisposing, enabling and need factors, at the individual and health system levels [25]. Identifying factors associated with risk of readmission can inform healthcare professionals and decision makers on identifying at risk patients and modifiable factors to prevent recurrent hospitalizations.

This study includes a large representative sample of community living older adults for whom administrative data on medical service use was linked to health survey data allowing for the study of a number of individual and health system factors, not accounted for by many in the literature such as socio-economic, environmental, psycho-social and social determinants of disease [5]. To the best of our knowledge, no prior study has assessed the clinical, psychosocial and health system factors related to hospital readmissions among older adults covered under a universal healthcare system.

2. Methods

This is a secondary analysis of data from Quebec's health survey on

seniors health, also known as the *Enquête sur la santé des aînés* (ESA), conducted between 2005 and 2008. The study included French speaking community-dwelling adults aged 65 years and older and living in the province of Quebec ($N = 2811$). Participants were selected using random digit-dialing with stratification according to geographic area (metropolitan, urban and rural) where a proportional sample was constituted according to the 16 administrative regions of Quebec. More details on the methodology is available elsewhere [26]. The study was approved by the ethics committee of the affiliated University Institute.

2.1. Data collection

Trained health professionals conducted face-to-face interviews in each participant's home. Interviews lasted on average 90 min. Since memory problems affect the accuracy of responses, the Mini Mental State Examination (MMSE) questionnaire was administered at the start of interview [27]. Participants obtaining a score < 22 were excluded ($N = 27$) as this indicates the presence of moderate to severe cognitive impairment [28]. Of the 2784 participants who completed the interview, 89.9% ($n = 2503$) gave written consent for the team to access their information at the *Régie de l'assurance maladie du Québec* (RAMQ) on their use of medical and pharmaceutical services in the year prior and the two years following the baseline interview. Briefly, residents in