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Cognitive Impairment and Length of Stay in Acute Care Hospitals: A Scoping Review of the Literature

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Article

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Résumé

Chez les personnes âgées, la durée de séjour prolongée (DSP) à l'hôpital et le report de congé (RC) peuvent contribuer à la dégradation de l'état de santé et du bien-être, et engendrer des coûts importants. Cette recension de la littérature visait à déterminer si les troubles cognitifs ont un impact sur la DSP et le RC en contexte de soins hospitaliers aigus. Une revue de portée a été réalisée et six bases de données ont été consultées jusqu'en novembre 2019. Deux réviseurs ont examiné les articles de façon indépendante. Une synthèse narrative a été utilisée pour répondre à la question de recherche et 58 études ont été retenues. Parmi celles-ci, 33 études ont mis en évidence une association positive entre les déficits cognitifs et la DSP ou le RC, huit études ont présenté des résultats mitigés et trois, une relation inverse. Un lien indirect entre des syndromes associés aux déficits cognitifs et la DSP ou le RC a été évoqué par 14 études. Ainsi, les troubles cognitifs sont souvent liés à une augmentation de la durée de séjour ou au report du congé. Les recherches futures devraient considérer les effets des troubles cognitifs simultanément à d'autres facteurs associés à la DSP ou au RC sur la prolongation des soins hospitaliers, pour clarifier l'association entre ces deux variables.

Abstract

Older persons experiencing a longer length of stay (LOS) or delayed discharge (DD) may see a decline in their health and well-being, generating significant costs. This review aimed to identify evidence on the impact of cognitive impairment (CI) on acute care hospital LOS/DD. A scoping review of studies examining the association between CI and LOS/DD was performed. We searched six databases; two reviewers independently screened references until November 2019. A narrative synthesis was used to answer the research question; 58 studies were included of which 33 found a positive association between CI and LOS or DD, 8 studies had mixed results, 3 found an inverse relationship, and 14 showed an indirect link between CI-related syndromes and LOS/DD. Thus, cognitive impairment seemed to be frequently associated with increased LOS/DD. Future research should consider CI together with other risks for LOS/DD and also focus on explaining the association between the two.

Introduction

As of 2015, among the estimated global population of 7.3 billion people, 617.1 million (9%) were 65 years of age and older. In Canada, the older population will increase from 15.3 per cent (as per 2013) to between 23.8 per cent and 27.8 per cent in 2063 (Bohnert, Chagnon, & Dion, 2015). With population aging, the number of dementia cases is expected to reach almost 1,000,000 people by 2030 from the approximately 500,000 affected now (McDowell and Canadian Study of Health and Aging Working Group, 1994), resulting in an increase of combined health care system and caregiver costs of more than 60 per cent, from 10.4 to 16.6 billion dollars per year (Public Health Agency of Canada, 2018). With disease progression, people with cognitive impairment (CI), including dementia, eventually require help with most aspects of daily living (Barberger-Gateau et al., 2004; Hsiung et al., 2008). Moreover, CI complicates the management of other medical conditions, necessitating complex medical care and its coordination across multiple sectors of care and community services (Bail & Grealish, 2016; Walker, 2011).

Older adults in acute care settings, while awaiting discharge, commonly experience decline in their overall health and well-being that may stem from complications related to their illness, such

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as delirium or deconditioning, but that may also stem from hospital-related factors. (Admi, Shadmi, Baruch, & Zisberg, 2015; Dewing & Dijk, 2016; Long, Brown, Ames, & Vincent, 2013; Möllers et al., 2019; Watkin, Blanchard, Tookman, & Sampson, 2012). Delayed discharge (DD), because of decline, can lead to long hospital stays for which, in medical literature, several terms are coined: "alternate level of care (ALC)", "extended stays", "long stay", "inappropriate length of stay", "overstaying", and "delayed discharge", as well as some that are pejorative or express ageism, such as "bed blocking" or "stranded patients". These terms are used to describe a situation in which a person is deemed medically fit for discharge, no longer in need of the intensity of care provided in an acute care setting, but is not discharged. Here we use "length of stay" (LOS) to denote the total number of days between admission and discharge, including any days that may have been ALC days. "Delayed discharge" is used to describe a length of stay beyond the day on which the patient is judged to be medically fit for discharge, as per the following criteria, which may be all or partially present in the literature: acute care treatments are completed, clinical stability is achieved, procedures for the continuing care are activated, and the family is informed (Bryan, Gage, & Gilbert, 2006). DD resulting in a lack of acute care beds is an ongoing concern, because it limits access to acute care services and results in inefficient use of hospital resources and poorer quality of care for all patients (Sutherland & Crump, 2013).

A recent systematic review of observational studies reports a longer hospitalization for patients with dementia than for patients without a dementia diagnosis (Möllers, Stocker, Wei, Perna, & Brenner, 2019). Because CI and its symptoms are often under-recognized in a clinical setting (Douzenis et al., 2010; Greco et al., 2005) and, as mentioned, lead to adverse outcomes for patients and increased costs, it is important to investigate whether there is an association between acute care hospital LOS, including ALC days, and any level of CI. The present scoping review of the literature investigates both this association, and problems with definitions of both LOS or DD and CI.

Methods

This scoping review's methodology was based on Arksey and O'Malley's (2005) iterative approach following five steps: (1) identifying the research question, (2) identifying potentially relevant studies, (3) selecting the relevant studies, (4) charting data, and (5) collating, summarizing, and reporting the results. Researchers must engage with each step in a reflective manner and, if necessary, revisit previous steps to ensure that the literature is comprehensively covered.

Identifying the Research Question

In our first approach to studying LOS or DD among older persons, we posed several questions. Which patients experience longer LOS or DD? Which age group is more prevalent among extended LOS or DD patients? Which diagnosis is more prevalent among them? Why are these patients' discharges delayed? When submitted to a literature search strategy, these questions generated a large number of references. Further discussion led us to refine this research question: what evidence exists in the literature of an association between CI and the LOS or DD?

Identifying Relevant Studies

Six bibliographic databases (Ovid Allied and Complementary Medicine [AMED], HealthSTAR, MEDLINE®, PsycINFO, Cumulative Index to Nursing and Allied Health Literature [CINAHL], and AgeLine) were searched for relevant publications between January 1997 and November 1, 2019. Considering the changes in health systems and the progress in the detection of CI, we decided to include studies published in roughly the last 20 years. The search strategy comprised a combination of free and controlled vocabulary including: length of stay, delayed discharge, alternate level of care, bed block, aged, and middle-aged (see Supplementary Material 1). "Middle-aged" was included to consider patients with early CI. Only publications in English, French, or German were considered. All identified references were imported into an EndNote library for record management, including the removal of duplicate copies.

Selecting Relevant Studies

The screening process is summarized in the Results section. Using Covidence, two reviewers independently examined the titles and abstracts first, and then the full text of the remaining references according to Population Intervention Comparison Outputs Study (PICOS) criteria (Figure 1). Subsequently, the reviewers included studies reporting on CI and durations of LOS or data on DD. Discrepancies between reviewers were resolved through discussion, or with the opinion of a third reviewer (E.K.) until consensus was obtained. Reference lists of relevant review articles and of included studies were screened for additional references. We did not screen grey literature.

Charting Data

For data extraction, we used the descriptive-analytical method within the narrative tradition described by Arksey and O'Malley (2005). This method involved applying a common analytical framework to all primary research reports, with data being filed in an Excel database of included studies. The data charting form comprised study references; study characteristics; measures of CI, LOS, or DD; and observed associations between CI and LOS or DD.

Results

Collating, Summarizing, and Reporting the Results

The database search yielded a total of 6,716 references (Figure 2). After removal of duplicates, the titles and abstracts of 4,373 references were screened and 447 references were retained for full-text screening. We retained 58 articles for further analysis after reading the text of all articles and applying the exclusion criteria. Although the search strategies included the term "middle-aged," the included studies dealt mostly with older adults.

The characteristics of the included studies are summarized in Figure 3. The subject has gained increased interest since 2014. Most of the studies adopted a quantitative approach (prospective or retrospective).

Assessment of LOS or DD

Although LOS was reported in most studies, different approaches were used to assess whether delayed discharge occurred. In 14 studies, the definition of DD was based on the clinical judgement of a multidisciplinary team, including a doctor or a nurse, for acute care patients who no longer required a hospital-based level of care and whose needs could be met in another setting (Bo et al., 2016; Canadian Institute for Health Information, 2009; Challis, Hughes,

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Inclusion criteria

Primary data

- **P**articipants: In-patients ≥ 45 years old
- **I**ntervention/exposure: Acute care hospitalization
- **C**omparison: Cognitive status
- **O**utcomes: LOS or DD
- **S**tudy design: All

Exclusion criteria

- Book, book chapters, editorials, commentaries, and letters
- Studies on in-patients with intellectual disabilities, at the end of life or in palliative care
- Setting other than an acute care hospital
- Incomplete data, such as a conference abstract

Figure 1. Population Intervention Comparison Outputs Study (PICOS) criteria for study selection

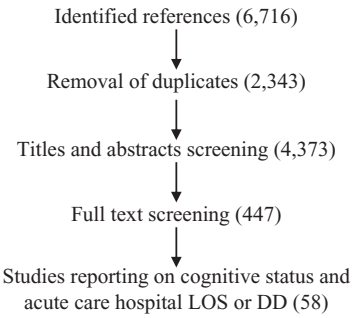

Figure 2. Flow diagram of the scoping review

Xie, & Jolley, 2014; Chin, Sahadevan, Tan, Ho, & Choo, 2001; Costa & Hirdes, 2010; Costa, Poss, Peirce, & Hirdes, 2012; Johansen & Fines, 2012; Landeiro, Leal, & Gray, 2016; Lenzi et al., 2014; Little, Hirdes, & Daniel, 2015; Mayo, Wood-Dauphinee, Gayton, & Scott, 1997; McCloskey, Jarrett, Stewart, & Nicholson, 2014; Tucker, Hargreaves, Wilberforce, Brand, & Challis, 2016; Walker, Morris, & Frood, 2009). The authors of six studies used fixed values such as: a LOS greater than 30 days (Barba et al., 2015; Kozyrskyi, De Coster, & St John, 2002; Lang et al., 2006), LOS greater than 10 days (Dent & Perez-Zepeda, 2015; McAlister & van Walraven, 2019), and, in one study LOS was categorized as low (< 8 days), intermediate (8–13 days), and high (> 13 days) (Beauchet et al., 2013). Finally, in eight articles, the actual LOS was compared with a relative value such as a hospital stay exceeding the diagnosis-related group LOS (Lang et al., 2006; McCusker, Cole, Dendukuri, & Belzile, 2003), the Healthcare Resource Groups (HRG)-predicted LOS by physical and cognitive function score (Carpenter, Bobby, Kulinskaya, & Seymour, 2007), not being discharged more than 24 hours after last time deemed clinically fit in a medical note (Moore, Hartley, & Romero-Ortuno, 2018), being two standard deviations above the mean (Foer, Ornstein, Soriano, Kathuria, & Dunn, 2012), being in the 75th percentile of the LOS distribution (Antonelli Incalzi et al., 2001), or being in the 90th percentile (Brousseau et al., 2019) greater than the fifth quintile limit (Lisk et al., 2019). Unfortunately, in the remaining studies, the criteria used for these assessments were not described in detail. It is of note that LOS and DD are not mutually exclusive: the total length of stay may include the number of days considered as delayed.

Association between Cognitive Impairment and LOS or DD

Thirty-three studies indicated a positive ($n = 31$) or a neutral ($n = 2$) (Antonelli Incalzi et al., 2001; Dinkel & Lebok, 1997) association between CI and LOS or DD, which are summarized in Table 1. Also, seven other studies, among those with mixed results, found an association with some aspects of CI (Table 2), and 14 others showed an indirect association (Table 3), mainly with scores that include an assessment of CI.

Among the 33 studies, some presented only observations without assessing associations. When the prevalence of CI among DD patients was reported (Antonelli Incalzi et al., 2001; Canadian Institute for Health Information, 2009; Costa & Hirdes, 2010; Costa et al., 2012; Little et al., 2015; McCloskey et al., 2014; Walker et al., 2009), it varied from 4.6 per cent to 63 per cent, illustrating the differences in population samples, in CI definitions (see Table 1, 5th column), and also in DD assessment (see Table 1, 6th column). Two studies showed that patients with a DD had poorer cognition (Costa & Hirdes, 2010; Moore et al., 2018).

According to 20 studies, patients with CI had a longer LOS or more frequent DD than those without (Beauchet et al., 2013; Briggs et al., 2016, 2017; Canadian Institute for Health Information, 2009; Connolly & O'Shea, 2015; Cullum, Metcalfe, Todd, & Brayne, 2008; Draper, Karmel, Gibson, Peut, & Anderson, 2011; Guijarro et al., 2010; King, Jones, & Brand, 2006; Kozyrskyi et al., 2002; Langsetmo et al., 2019; Lisk et al., 2019; Lyketsos, Sheppard, & Rabins, 2000; Möllers, Stocker, et al., 2019; Moore et al., 2018; Motzek, Werblow, Tesch, Marquardt, & Schmidt, 2018; Power et al., 2017; Tucker et al., 2016; Walker et al., 2009; Wolf, Rhein, Geschke, & Fellgiebel, 2019) whereas Dinkel and Lebok (1997) found that among the patients who were discharged from the hospital, a dementia diagnosis had only a minor effect on LOS, although they stressed that hospital mortality was double in cases of dementia.

Some of the aforementioned studies (Möllers, Stocker, et al., 2019; Power et al., 2017) and a further seven using more sophisticated statistical analyses, such as adjusted regression models, showed a significant association of CI with longer LOS (Barba et al., 2015; King et al., 2006; Lang et al., 2006; Lenzi et al., 2014; Loren Guerrero & Gascon Catalan, 2011; Tropea, LoGiudice, Liew, Gorelik, & Brand, 2017; Zhu et al., 2015). A Canadian population study reported that dementia and delirium, whether as primary or co-morbid conditions, were the neurocognitive diagnoses that accounted for the largest number of acute care hospital days

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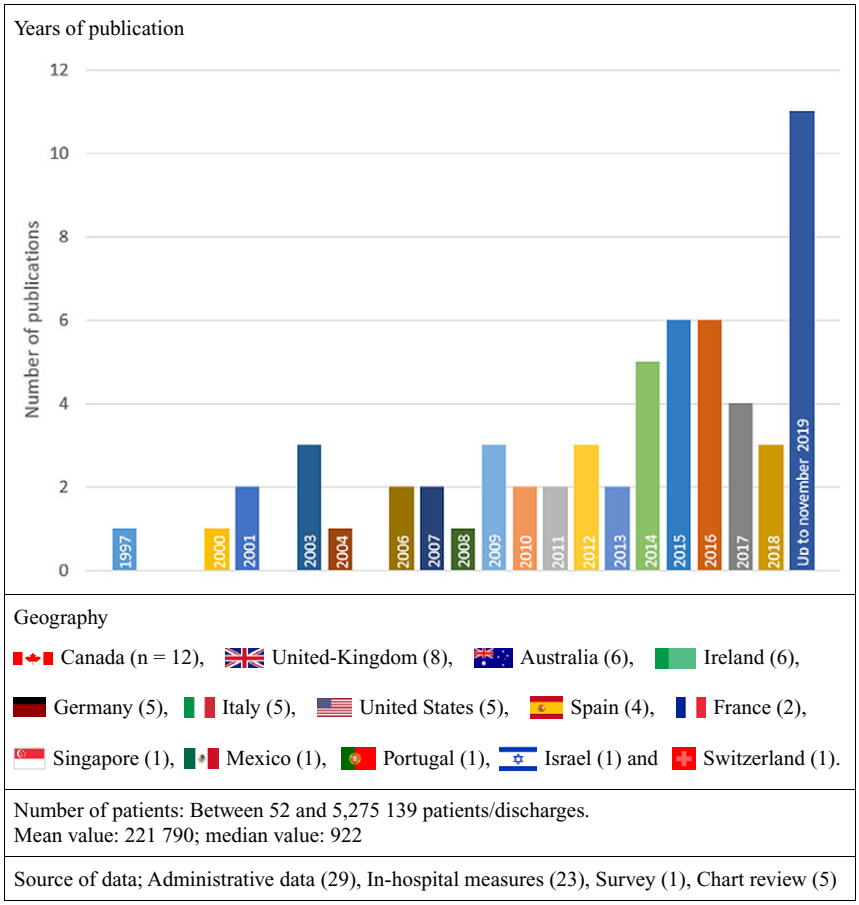

Figure 3. Characteristics of the included studies

(Johansen & Fines, 2012). Consistent with this, Saravay et al. (2004) showed that admission scores on rating scales of CI, delirium, and dementia predicted the emergence of mental and behavioural manifestations of delirium and dementia in hospital and greater LOS. Mental and behavioural manifestations seemed to be the proximate causes of greater LOS.

The association between CI and LOS was mixed or negative in eight studies (Table 2). In one of these studies, patients with "medium" cognitive impairment (Cognitive Performance Scale [CPS] score 1–3) had a LOS greater than the one predicted by their physical and cognitive function scores upon admission, whereas those with low or high CPS scores did not (Carpenter et al., 2007). Challis et al. (2014) found that CI was significantly associated with DD, but no longer a significant predictor of DD after discharge variables were considered. Fogg, Meridith, Bridges, Gould, and Griffith (2017) reported that patients with "cognitive impairment/no dementia" had significantly longer LOS than patients without CI or patients with a diagnosis of dementia. In two studies, univariate analyses indicated a relationship between CI and LOS, but this association was lost in multivariate analysis in favour of co-morbidity (Zekry et al., 2009), or in favour of a decline in basic activities of daily living capacity and need for skilled nursing (Chin et al., 2001). Another study by Bo et al. (2016) reported that greater CI was independently associated with prolonged LOS among patients admitted from home; however, for patients admitted from intermediate or long-term care facilities, it was lower CI that was independently associated with prolonged LOS. In a study comparing patients discharged from psychiatric hospitals in Turkey with similar patients in Ireland, the presence of delirium or dementia was not associated with LOS, but the proportion of such patients in the sample was low: 13.6 per cent in Turkey and 25.5 per cent in Ireland; the only factor significantly associated with LOS was living alone (Carpar et al., 2018). In the last mixed-results study, a trend towards longer stay was seen for dementia patients, which was only significant in the subgroup who lived with a family member (11.61 vs. 7.55 days, $p = 0.002$) (Ahern et al., 2019). Authors also found that people with dementia admitted for a surgical procedure had a shorter stay than people without dementia (2.4 vs. 5.87 days, $p = 0.001$). Three additional studies (Table 2) identified an inverse association between cognitive impairment and LOS. In one study, dementia was less prevalent in the long stay than in the non-long stay group (Foer et al., 2012). In another, authors reported that dementia was associated with a significant decrease in the likelihood of DD (Landeiro et al., 2016). In a third study, an inverse association was found between dementia and an increased LOS for electively admitted patients, which the authors (Vetrano et al. 2014) hypothesised was the result of a significantly higher mortality rate in demented patients, reducing their LOS.

There were also 14 studies pertaining to common frailty scores or frailty-related conditions of older adults, which are highly related to CI (Table 3). A comparison of four indices (Frailty Index [FI], Score Hospitalier d'Evaluation du Risque de Perte d'Autonomie [SHERPA], Hospital Admission Risk Profile [HARP], and Acute Physiology and Chronic Health Evaluation [APACHE] II) predicting adverse outcomes in hospitalised older Mexican adults showed that those indices that include cognitive scores correlated

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Table 1. Summary of studies reporting an association between cognitive status and hospital length of stay, by country

Country	Reference	Study Design	Participant Number (mean age ± SD)	Assessment of Cognitive Status	LOS or DD Assessment	Association between CI and LOS or DD
Canada	Canadian Institute for Health Information (2009) Walker et al. (2009)	Retrospective study	74,504 ALC patient (median 80 years); non-ALC patients (median 63 years)	Dementia diagnosis from hospitals databases	ALC: Patients who have completed the acute care phase of their treatment, but still occupy a bed because of ongoing post-acute care needs or the unavailability of supports in the community	57% of all hospitalizations had dementia as the main diagnosis and 25% of those with dementia as a co-morbidity had ≥1 ALC day. Dementia, as a main or co-morbid diagnosis, accounted for almost 25% of ALC hospitalizations and >33% of ALC days. Patients with dementia as a main diagnosis had a median ALC LOS of 23 days compared with 10 days for ALC patients overall.
	Costa and Hirdes (2010)	Retrospective study	126,961 (83.1±0.1 years)	InterRAI Cognitive Performance Scale (CPS). Moderate to severe CI defined as interRAI CPS ≥3 (equivalent MMSE 15-19)	ALC: Patients who no longer need acute hospital services, but have not been discharged because of ongoing post-acute care needs or inadequate supports in the community	ALC patients waiting for LTC had poorer cognitive status than older home care clients. The same is true for older ALC patients (≥75 years of age) versus the younger subgroup (<75 years of age). 36.3% of CI in ALC group versus 11.0% in the home care group.
	Costa et al. (2012)	Retrospective cohort study	17,111 acute hospital admissions designed as ALC. (77.1 years)	interRAI CPS	DD: Hospital episodes in which a patient exceeds the LOS deemed medically necessary.	CI was common among ALC patients waiting for NH admission, occurring in ≥ 50% of persons.
	Johansen and Fines (2012)	Retrospective study	2,069,690 records for hospital discharge over 1 year (excluding newborns, stillbirths, Quebec residents, patients not resident in Canada, and those without a usable patient identification number); 182,000 persons with a mental diagnosis All ages included.	Dementia diagnosis from hospital databases	LOS. ALC: Patients who have completed the acute care phase of their treatment, but still occupy a bed because of ongoing post-acute care needs or the unavailability of supports in the community	The 3 mental diagnoses accounting for the largest number of acute care hospital days were organic disorders: dementia, delirium (461,000), mood disorders (313,000), and schizophrenic/psychotic disorders (266,000). The 3 co-morbid mental diagnoses accounting for the largest numbers of days were organic disorders (1,404,000), mood disorders (600,000) and substance related disorders (537,000).
	Kozyrskyi et al. (2002)	Population-based study	22,749 discharges from 7 acute care hospitals. (≥18 years)	CI: dementia or other cognitive impairment	LOS. Long stay defined as LOS >30 days.	The presence of CI increased LOS by 16%.
	Little et al. (2015)	Retrospective study	10,390 (All ages)	Diagnosis reported in the OMHRS/RAI-MH system.	ALC: When a patient has achieved all treatment goals in a health care setting, but continues to remain in that setting while awaiting transfer to an alternate destination	Cognitive disorders occur significantly more often in the ALC group than in the non-ALC group (25.80% vs. 5.10%).

Continued

Table 1. *Continued*

Country	Reference	Study Design	Participant Number (mean age ± SD)	Assessment of Cognitive Status	LOS or DD Assessment	Association between CI and LOS or DD
	McCloskey et al. (2014)	Retrospective study	179 (79.3±12.7 years)	Reported diagnosis of dementia	ALC: People who occupy an acute care hospital bed and who can be cared for elsewhere but who, for some reason, remain in hospital	33% of the hospital beds were occupied by ALC patients; 63% had a diagnosis of dementia.
United Kingdom	Cullum et al. (2008)	Prospective cohort study	617 (≥65 years) Participants with moderately severe impaired congnitive function (AMTS < 6) were excluded.	Cognitive function using the AMTS: a cut-off of 7 or 8 is suggested to discriminate between CI and normality.	LOS	Median LOS increased with poorer cognitive function.
	Lisk et al. (2019)	Prospective cohort study	374 Median age: 85 (IQR: 78-90)	Impaired cognitive function: AMTS < 8	LOS Prolonged hospital stay: > 17 days (fifth quintile limit)	Statistically significant association between impaired cognitive function and prolonged hospital stay
	Moore et al. (2018)	Retrospective observational study	Total: 924 431 delayed, median age: 87 (IQR: 9) 493 not delayed, median age: 85 (IQR 9)	Dementia and delirium diagnoses in medical chart Indirect assessment via scores (Clinical Frailty Score [CFS], Elderly Mobility Score [EMS])	DD: still not discharged >24 h after the last "deemed clinically fit" in medical file note LOS	Significant association with dementia, delirium, a higher CFS, or lower EMS (both more impaired)
	Tucker et al. (2016)	Prospective cohort study	216 older people with mental health problems (76.7 years)	Data on the socio-demographic, functional, and clinical characteristics of each patient were collected by nominated ward nursing staff shortly after admission using a bespoke data collection tool.	LOS. DD: Staff considered whether each individual was medically ready for discharge and, if so, recorded the date.	Higher levels of CI and challenging behaviour were associated with longer LOS. More CI was associated with DD.
United States	Langsetmo et al. (2019)	Prospective cohort study	1,283 men (79.1±5.3 years)	3MS score	LOS	Cognitive function was associated with total LOS. Indirect association with a step count score
	Lyketsos et al. (2000)	Retrospective study	21,251 patients. Dementia (74 ± 8.2 years); No dementia (71±7.4 years).	Discharge diagnosis of dementia by ICD-9-CM criteria	LOS	Mean LOS for patients with dementia was 10.4±10.4 days compared with 6.5±6.4 days for patients without dementia (t=16.6, df=21249, p<0.0001). Modal LOS for patients with dementia was 3 days versus 1 day for those without dementia. A total of 18% (n=148) of the patients with dementia had LOS >15 days compared with 6.5% (n=1328) of the patients without dementia.

Continued

Table 1. *Continued*

Country	Reference	Study Design	Participant Number (mean age ± SD)	Assessment of Cognitive Status	LOS or DD Assessment	Association between CI and LOS or DD
	Saravay et al. (2004)	Prospective study	93 (≥65 years) CI patients (79 years); Not cognitively impaired (74.3 years)	Factor 1 is a composite: MMSE (<23 = impaired), Blessed Dementia rating scale score, Delirium rating scale score	LOS	Factor 1, as cognitive impairment, delirium, and dementia measured on admission, was correlated with increasing LOS (factor 1: r=0.25, p=0.02, n=85). Admission ratings of CI, delirium, and dementia predicted the emergence of mental and behavioural manifestations of delirium and dementia in the hospital and greater LOS.
	Zhu et al. (2015)	Retrospective study	2,026 Dementia (84±7.7 years); No dementia (77±6.5 years)	Dementia diagnosis by a conference of neurologists, psychiatrists, and neuropsychologists with test battery and evidence of functional alteration, according to DSM IV-R/ NINCDS-ADRDA criteria	LOS	Compared with propensity-matched individuals without dementia, individuals with dementia had significantly longer LOS (IRR=1.059, 95% CI 0.998-1.129). Cognitive deficits were significantly associated with higher hospital LOS.
	Draper et al. (2011)	Retrospective study	20,793 with dementia. (≥ 50 years)	ICD-10-AM codes for dementia from database	LOS	Mean LOS for people with dementia was longer than for people without dementia (16.5 vs. 8.9 days) This difference was more pronounced in younger people (55-69 years) with dementia, with mean LOS >20 days compared with <8 days in those without dementia.
Australia	King et al. (2006)	Case-control study	52 Cases (dementia), n=26 (83±6.5 years); Randomly selected controls (without dementia), n=26 (78±6.4 years).	Documented history of dementia or AMTS score <7	LOS	The mean±SD LOS for patients with dementia was significantly longer than for those without dementia (20.59±15.38 vs. 9.6±6.45 days, p=0.02). Multivariate regression showed that demented patients had LOS 1.54 times higher than that for controls
	Tropea et al. (2017)	Retrospective cohort study	93,300 admissions 50,261 patients Cognitively impaired, n=6459 (80±9 years); Not cognitively impaired (70±11 years)	CI defined as having dementia or delirium coded during the admission	Hospital database LOS	The unadjusted median LOS was longer for episodes associated with CI than for those without CI (9 days, IQR=5-16 vs. 5 days, IQR=2-8). Following adjustment, the median LOS remained significantly higher for the CI group than for the non-CI group (7.4 days, IQR 6.7-10.0 vs. 6.6 days, IQR 5.7-8.3; p<0.001).

Continued

Table 1. *Continued*

Country	Reference	Study Design	Participant Number (mean age ± SD)	Assessment of Cognitive Status	LOS or DD Assessment	Association between CI and LOS or DD
	Antonelli Incalzi et al. (2001)	Retrospective study	3,789 inpatients with exacerbated COPD (74.3±11.1 years)	Overall cognitive performance: AMTS. AMT score <7 is considered pathological Dementia according to DSMIII-R criteria.	Patients were grouped according to whether their LOS exceeded or the 75th percentile of stay distribution in each bimonthly period, or not.	A trend towards lower performance on the AMTS in the long-stay group was evident. Prevalence of dementia was 4.6% in the long-stay group versus 4.0 in the control group (p=0.412).
Italy	Lenzi et al. (2014)	Cross-sectional study	6,325 in-patients (73.9±15.9 years). DD, n=510 (78.4±12.5 years); No DD, n=5,815 (73.5±16.1 years).	ICD-9-CM dementia (codes 290.x, 294.1, 331.2)	DD: Patients deemed medically well enough for discharge, but unable to leave because arrangements for the continuing care they need have not been finalized, as determined by one trained physician and one nurse for each hospital.	Patients' characteristics associated with a higher likelihood of DD in multi-level logistic regression included a diagnosis of dementia.
	Barba et al. (2015)	Retrospective study	5,275.139 LOS ≤30 days (72.27±16.87 years); LOS >30 days (71.66±15.43 years)	ICD-9-CM (codes 290-290.9)	Prolonged LOS defined as LOS >30 days.	Prolonged LOS patients were more likely to have dementia (OR 1.10, 95% CI 1.08-1.13), after adjustment for age and gender.
Spain	Guijarro et al. (2010)	Retrospective study of hospital discharge databases	3,354,071 discharges Dementia was coded as the primary or secondary diagnosis in 40,482 discharges Men with dementia (78±7.9 years) Women with dementia (81±7.4 years)	ICD-9-CM (codes 290.0-290.43 and code 331.0)	LOS	Mean LOS for patients with dementia was 13.4 days, compared with 10.7 days for patients without dementia (p<0.0001). In 2003, among all study participants, those with dementia were hospitalized for 3,577 days longer than comparable participants without dementia.
	Loren Guerrero and Gascon Catalan (2011)	Descriptive, cross-sectional study using hospital chart review	81 (81.24±7.34 years)	The Pfeiffer Scale was used to assess the cognitive status.	LOS was compared between participants with and without severe intellectual deficit.	The most influential variable for longer hospitalization was CI; patients with severe intellectual deficit show longer hospital stays, on average 9 days longer than patients with a normal cognitive level (p<0.05).
	Beauchet et al. (2013)	Prospective cohort study	424 patients admitted to a hospital emergency department (84.0±6.5 years)	MMSE. Moderate-to-severe CI if MMSE score <20	Short LOS: <8 days; intermediate LOS 8-13 days; long LOS >13 days	Moderate-to-severe CI was associated with a long LOS (≥13 days) at p=0.095.
France	Lang et al. (2006)	Prospective multi-center study	908 inpatients. (84.0±4.8 years)	CI defined as MMSE score <25.	LOS. 2 limits used to define prolonged LOS: fixed at 30 days; LOS adjusted for the French DRG	For the 30-day limit, CI (OR 2.2, 95% CI 1.2-4.0) was identified as a marker for prolongation. For DRG adjustment, CI (OR 7.1, 95% CI 3–49.9) was found to be an early marker for prolonged LOS.

Continued

Table 1. *Continued*

Country	Reference	Study Design	Participant Number (mean age ± SD)	Assessment of Cognitive Status	LOS or DD Assessment	Association between CI and LOS or DD
	Briggs et al. (2016)	Comparative descriptive study	69,718 admissions; diagnosed dementia, *n*=929 (80.0 years)	ICD-10 dementia		The average LOS was 31.0 days in the dementia group and 14.1 days in those >65 years without dementia.
Ireland	Briggs et al. (2017)	Prospective observational study	190 patients (79 years) Dementia, *n*=73 (79.9±6.6 years) No dementia, *n*=117 (78.5±5.9 years)	Mini Mental State Examination, AD8 and Confusion Assessment Method for the Intensive Care Unit Dementia was defined as a score ≥ 2 on the AD8 screening test.	LOS	Dementia was present in 38% of patients. Of these patients, 36% had a prior documented diagnosis of dementia with the remaining being undiagnosed before presentation. The mean LOS±SD was 10.3±16.5 days for the dementia group and 8.2±18.4 days for the no dementia group (*p*=0.420)
	Connolly and O'Shea (2015)	Secondary analysis of inpatient discharges	548,917 discharges with no dementia diagnosis; 6702 with diagnosed dementia (age not reported)	Dementia-related diagnosis: ICD-10 codes F00-03, G30.	LOS	People with a recorded diagnosis of dementia had a significantly longer LOS than those with no recorded dementia. For patients 65-74 years of age, a diagnosis of dementia was associated with an excess average LOS of 15.7 days, whereas for those ≥85 years of age, it resulted in an additional 10.9 days.
	Dinkel and Lebok (1997)	Retrospective study	19,040 patients (≥60 years) 266 (1.42%) had diagnosed dementia	Database ICD-9 codes: 290, 293, 294 and 310	LOS	Among patients leaving the hospital alive, dementia has only a minor effect on LOS. *Hospital mortality is doubled in cases of dementia.*
	Power et al. (2017)	Prospective observational study	143 patients (78.1 years, range: 65-94)	Assessment battery (6-CIT +MMSE+MoCA), then diagnosis of normal cognition, MCI as per Petersen criteria, or dementia as per DSM IV criteria	LOS	Dementia was associated with longer hospital stays (*p*=0.01). (15.15 days longer than for the cognitively normal group [*p*=0.003] and 13.95 days longer than for those with MCI [*p*=0.042]).
Germany	Möllers et al. (2019)	Retrospective cohort study	7,139 dementia patients (78.2±7.2 years) 21,417 controls (77.2±7.2 years)	ICD-10 codes (German Modification)	LOS	Association between dementia or delirium and LOS 5.3 days longer when adjusted for age and sex Delirium was strongly associated with LOS both among persons with dementia (first LOS: +9.6 days; second LOS: +5.3 days) and the control group (first LOS: +13.7 days; second LOS: +7.2 days).

Continued

Table 1. *Continued*

Country	Reference	Study Design	Participant Number (mean age ± SD)	Assessment of Cognitive Status	LOS or DD Assessment	Association between CI and LOS or DD
	Motzek et al. (2018)	Retrospective database study	61,700 dementia patients (84.2±7 years) 183,488 dementia-free (84.1±7 years)	ICD-10 codes for dementia	LOS	People with dementia had on average 36% more hospital days per person-year (6.8 vs. 5.0 days per person-year). Considering only the length of a single hospital episode, there was only a slight difference of 0.1 days (8.5 vs. 8.4 days).
	Wolf et al. (2019)	Prospective cohort study	1,320 patients (79.8±5.8 years, range: 70-98) No/moderate CI: 1,090 (79.3±5.7 years) Severe CI: 230 (82.3±5.8 years)	MiniCog, dividing patients in 2 groups: no/moderate cognitive impairments (probably no dementia), and severe cognitive impairments (probable dementia)	LOS	Patients with severe cognitive impairments showed a significantly longer LOS (+1.4 days) than patients with no/moderate cognitive impairments.

Note. 3MS = Modified Mini Mental State Examination; 6-CIT = 6-item Cognitive Impairment Test; AD8 = Eight-item Informant Interview; ALC= alternate level of care; AMTS = Abbreviated Mental Test Score; AMT = Abbreviated Mental Test; CI = cognitive impairment; 95% CI = 95% confidence interval; COPD = chronic obstructive pulmonary disease; DD = delayed discharge; DRG = diagnosis-related group; DSM = *Diagnostic and Statistical Manual of Mental Disorders*; ICD = International Classification of Diseases; IQR = interquartile range; IRR = incidence rate ratios; LOS = length of stay; LTC = long-term care; MCI = mild cognitive impairment; MMSE = Mini Mental State Examination; MoCA = Montreal Cognitive Assessment; NH = nursing home; NINCDS-ADRDA = National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association; OR = odds ratio; OMHRS = Ontario Mental Health Reporting System; RAI: Resident Assessment Instrument-Mental Health; SD = standard deviation.

with the LOS (Dent & Perez-Zepeda, 2015). Two other studies showed an association of CI with a version of the FI (Basile et al., 2019; Brousseau et al., 2019). The Hospital Frailty Risk Score was used in a third study with similar conclusions. (McAlister & van Walraven, 2019) Two other studies investigated the value of prognostication scores and found an association with the Charlson Comorbidity Index (CCI) (Bahrmann et al., 2019) and the Multidimensional Prognostic Index (MPI) (Pilotto et al., 2019). In another study, frailty and delirium, but not dementia, were predictors of increased LOS (Basic & Shanley, 2015). In three studies, the impact of delirium was specifically investigated. In the first, an adjusted analysis found that patients with prevalent or incident subsyndromal delirium had longer LOS (Cole, McCusker, Dendukuri, & Han, 2003), whereas the second reported an association between prevalent delirium and LOS, but not with incident delirium (McCusker et al., 2003). Also, five geriatric syndromes including delirium were introduced in a model (Hospital-Associated Complications of Older People [HAC-OP]), showing an association of any of them with LOS and a graded correlation between a greater number of them and still longer LOS (Mudge et al., 2019). "Confusion" was also related to a longer LOS (Jasinarachchi et al., 2009; Mayo et al., 1997), as was agitation (Cots, Chiarello, Perez, Gracia, & Becerra, 2016). In Mizrahi, Arad, and Adunsky's (2016) study, pre-stroke patients with dementia had a shorter LOS than those without dementia; however, these authors found that the presence of lower gains on a scale measuring functional independence during the course of rehabilitation was frequently associated with earlier discharge.

Discussion

Extended LOS in acute care hospital settings and DD are major concerns to health care systems (Bryan et al., 2006; Canadian Institute for Health Information, 2012) and the well-being of hospitalized older persons (Allen, 2016; Hirsch, Sommers, Olsen, Mullen, & Winograd, 1990). This scoping review examined the impact of cognitive impairment on acute care hospital LOS. A positive association between cognitive impairment and LOS or DD was reported to some extent by 52 of the 58 identified studies, even if the definitions and ways to assess CI, as well as LOS or DD, varied among studies. The data we gathered indicate that the magnitude and direction of this association, with regard to the fact that both positive and inverse relationships were found, is influenced by CI or by factors related to its assessment, such as its prevalence in the studied samples (Carpenter et al., 2007) or the severity of the impairment. It is of note that LOS or DD are also influenced by other factors inherent in the patient, for example, the causes of hospitalization and co-morbidities (Fick, Steis, Waller, & Inouye, 2013). Such factors, including admission diagnoses, could therefore be confounding the association between CI and LOS or DD (Ahern et al., 2019) by leading to a specific health care trajectory. Conversely, the self-management of some health issues may require greater cognitive function and could play a role in delayed discharge in less-severely impaired patients who desire to return home but may need additional services not readily available (Costa & Hirdes, 2010; Costa et al., 2012). Additionally, LOS or DD is influenced by factors related to the life/health care environment, namely: the initial living arrangement of a patient (e.g., being admitted from home vs. from a care facility) (Ahern et al., 2019; Bo et al., 2016), the discharge destination, the availability of relevant services (Afilalo et al., 2015; Amador, Reyes-Ortiz, Reed, &

Table 2. Summary of studies presenting mixed results or a negative association between CI and LOS or DD, by country

Country	First Author, Year	Study Design	Participant Number (Mean Age±SD)	Assessment of Cognitive Status	LOS or DD Assessment	Association between CI and LOS or DD
United Kingdom	Carpenter, 2007	Prospective observational study	1,942 emergency admissions for stroke, fractured neck of femur, myocardial infarction, acute respiratory infection, chronic obstructive airway disease and falls) (74 years, IQR 66-84).	Cognitive Performance Scale (CPS). Cognitive function was divided into 3 groups: Low score (0), *n* = 1153 (68%); medium score (1-3), *n*=331 (20%); high score (4-6), *n*=93 (6%); CPS not available, *n*=108 (6%).	LOS. The observed LOS for each patient was compared with the HRG-predicted LOS by physical and cognitive function score at admission.	Patients with medium cognitive impairment (CPS score 1-3) had an LOS greater than predicted by HRG whereas those with low or high scores did not. *Results are not consistent for cognitive function scores, mainly because most patients had no CI.*
	Challis, 2014	Retrospective study	417 patients referred to the local authority adult social care services prior to discharge from hospital (79.0 years); DD group, *n*=186 (79.3 years); non-DD group, *n*=231 (78.8 years)	The presence but not the degree of CI was identified from examination of local authority case files, the ICD-10 codes from the hospital records and, in the absence of any other information, a judgement from one of the researchers.	LOS DD: The identification of patients whose discharge from hospital was subject to delay was derived from local arrangements established following the implementation of the Community Care (Delayed Discharges) Act.	The presence of CI was significantly associated with DD. CI was no longer a significant predictor of DD after the discharge variables were taken into account.
	Fogg, 2017	Retrospective observational study	19 269 No CI (83.4±5.6 years); CI (86.0±5.9 years); dementia (86.2±5.6 years)	Known diagnosis of dementia AMTS.	LOS	67% of patients with CI stayed at least 1 week versus 45% for patients with no CI. CI patients had significantly longer stays than both of the other groups (p<0.001).
United States	Foer, 2012	Retrospective observational pilot study	479 discharges; Non–long-stay patients, *n*=462 (80±15.6 years); long-stay patients, *n*=17 (74±18.2 years)	Diagnosed dementia from databases	LOS Long-stay patients: LOS ≥2 SD above the mean	The long-stay group had less dementia (29.4%) than the non–long-stay group (42.9%)
Ireland	Ahern, 2019		594 patients 175 (24.9%) with dementia	Previously-diagnosed according to medical chart Research-categorised with MMSE < 27 at admission	LOS	Only significant differences in LOS are : (i) the patient's living arrangements prior to admission to hospital (μ=11.61 days for dementia vs. μ=7.55 days), if living with a partner or other family member prior to admission. (ii) the primary diagnosis at admission, one that leads to a surgery procedure, shorter LOS in the dementia group (μ=2.4 days vs. 5.87 days) Longer mean and total LOS if discharged to home, for dementia patients, but not statistically significant

Continued

Table 2. *Continued*

Country	First Author, Year	Study Design	Participant Number (Mean Age±SD)	Assessment of Cognitive Status	LOS or DD Assessment	Association between CI and LOS or DD
						Shorter stay for dementia patients (not significant), if: admitted to rural hospital, orthopaedics ward, geriatric ward, coming from sheltered or nursing home - admitted for conditions : respiratory, infection, stroke, surgery/procedure - discharged to nursing homes to short-term care facilities - died in hospital
Ireland/ Turkey	Carpar, 2018	Retrospective observational study	356 patients (72.6±6.64 years) Ireland: 106 (77.5±6.34 years) Turkey: 256 (70.5±5.59 years)	ICD-10 diagnoses for delirium and dementia grouped as "organic diagnoses"	LOS	No significant contributory effect of the other remaining variables on LOS. (including the “organic diagnoses”), but low rates of cognitively impaired patients
Italy	Bo, 2016	Prospective observational study	1,568 patients admitted from the emergency department. (81.3±7.3 years)	Cognitive status assessed with the Short Portable Mental Status Questionnaire (SPMSQ). Cognitive deterioration is considered: Absent: 0-2 errors; Mild: 3-4 errors; Moderate: 5-7 errors; Severe: 8-10 errors.	DD defined as being discharged later than the date a patient was deemed medically ready for discharge by physicians.	Severity of CI was associated with prolonged LOS at univariate analysis. After multivariate analysis, greater CI (OR 1.12) was independently associated with prolonged LOS among patients admitted from home. Among patients admitted from intermediate or LTC facilities, lower CI (OR 0.59) was associated with prolonged stay.
	Vetrano, 2014	Multi-centre observational study	1,123 (82±7 years)	Cognitive status assessed using the 30-item MMSE.	LOS: Number of days from admission to discharge (or death) and categorized according to its median value (10 days)	For elective patients, dementia (OR 0.18; 95% CI 0.08-0.39) was inversely associated with increased LOS. *Patients affected by dementia presented higher mortality rates (7% vs. 3%; p=0.0001), reducing LOS of such patients.*
Portugal	Landeiro, 2016	Prospective cohort study	278 patients with hip fracture (85.5±5.8 years)	Not reported	DD, from medical records: Difference between the time a patient was deemed medically fit for discharge (able to stand up and be mobile with support, haemoglobin >8.5 g/dL, and no evidence of active infection) and the actual time of discharge	Dementia was associated with a significant decrease in the likelihood of DD (OR 0.29, 95 % CI 0.10-0.85).

Continued

Table 2. *Continued*

Country	First Author, Year	Study Design	Participant Number (Mean Age±SD)	Assessment of Cognitive Status	LOS or DD Assessment	Association between CI and LOS or DD
Switzerland	Zekry, 2009	Prospective study	435 (85.3±6.7 years); 48 with mild CI; 180 with dementia	The same neuropsychologist assessed all subjects for clinical dementia using the MMSE and the Short Cognitive Evaluation Battery (SCEB), then divided into normal cognition, mild CI, and dementia.	LOS	LOS increased with CI from a mean±SD of 29±29 in non-demented patients to 31±23 in mild CI, and 41.5±45 days in demented patients ($p<0.001$). In univariate analysis, moderate and severe dementia predicted a longer LOS. The introduction of all variables eliminated this association.
Singapore	Chin, 2001	Prospective study	172 geriatric unit inpatients (81.6±7.0 years)	CI: known dementia diagnosis or AMTS score ≤7.	DD: hospital stay after the patient was deemed fit for discharge as determined clinically by the geriatrician-in-charge.	In univariate analysis, higher prevalence of CI ($p=0.043$) among DD patients. This association was no longer significant in a multivariate logistic regression analysis.

Note. 95% CI = 95% confidence interval; AMTS = Abbreviated Mental Test Score; CI = cognitive impairment; DD = delayed discharge; HRG = Healthcare Resource Group; ICD = International Classification of Diseases; IQR = interquartile range; LOS = length of stay; LTC = longer-term care; MMSE = Mini Mental State Examination; OR = odds ratio; SD = standard deviation.

Lehman, 2007; Canadian Institute for Health Information, 2017; Costa & Hirdes, 2010; Costa et al., 2012) and other co-variates (Challis et al., 2014; Chin et al., 2001); hence, a cognitively impaired patient already living in a nursing home or having access to the relevant home care services at the time of admission might be discharged more rapidly.

With regard to our research question, the reviewed literature tends to show an association between CI at large, including delirium and dementia, and the length of hospital stay or the risk of a DD, although definitions of the latter may vary. However, few studies articulated the reasons for this association, and the results should be interpreted with caution because numerous factors may be confounding this association, such as delirium (Kozyrskyi et al., 2002; McCusker et al., 2003). Also, McCloskey et al. suggested that hospitals may actually be contributing to the functional decline experienced by patients as they await discharge, leading to an increase in the level of care needed when they return to the community (McCloskey et al., 2014). In addition, literature suggests that patients who experienced most of their decline before being admitted to the hospital may have a better recovery than those who mostly deteriorated in the hospital (Gagliardi et al., 2018), a development that may contribute to DD in an important way. Costa et al. suggested that CI limits the choice of accessible community-based institutions, and that therefore some patients who might theoretically benefit from community care are nevertheless admitted to nursing homes (Costa & Hirdes, 2010; Costa et al., 2012). Hence, those with the least potential to return to community care may remain longer in the acute care hospital awaiting a suitable setting. The contrary has also been described in aforementioned studies, which could be explained by the fact that some of the more impaired patients, or patients already living in long-term care, have a poorer recovery potential, higher mortality, or less uncertainty about their discharge destination, and, therefore, shorter LOS or DD. Three Canadian studies also suggested that the potential need for continuing care, or the lack of support in the community, could explain the association between cognitive impairment and LOS (Johansen & Fines, 2012; Mayo et al., 1997; Walker et al., 2009). In that context, it has been suggested to increase the number of beds in long-term care. However, although a lack of suitable housing and a shortage of community support were the reasons most commonly cited by treatment teams as barriers to discharge (Gigantesco et al., 2009), changes in bed supply may at best have mixed effects on LOS or DD, because in some contexts, for example in Canada, the population 75 years of age and older is growing faster than the number of long-term care beds could (De Coster, Bruce, & Kozyrskyi, 2005). Although a discharge plan tailored to the individual patient may bring a small reduction in hospital LOS, reduce the risk of readmission, and increase satisfaction with health care for patients and professionals, there is little evidence that such discharge planning reduces the costs of health service delivery (Goncalves-Bradley, Lannin, Clemson, Cameron, & Shepperd, 2016). Finally, the idea that patients' experiences in hospitals can be parcelled into neat categories, and resources varied accordingly, may be misleading. A recent commentary described many vulnerable patients as being "rehabbed to death" (Flint, David, & Smith, 2019). In this scenario, a patient who remained diminished after an acute illness, but did not meet certain administrative criteria for discharge, would be "transferred to rehabilitation". Such transfers may suggest that adverse outcomes, such as mental or behavioural symptoms of cognitive impairment, are in part caused by the lack of attention to medical issues that will not be addressed in the new

Table 3. Summary of studies presenting the relationship between cognition-related geriatric manifestations/scales and LOS or DD, by country

Country	First Author, Year	Study Design	Participants Number (Mean Age±SD)	Cognition-Related Geriatric Manifestations	LOS or DD Assessment	Cognition-Related Geriatric Manifestations and LOS or DD
Canada	Brousseau, 2019	Prospective cohort study, Canada-based with multinational participants	Canada: 2,153 (82.2 years) Multinational (Australia, Belgium, Germany, Iceland, India, and Sweden) 1,750 (82.7 years)	Included in the Emergency Department version of the Frailty Index (FI-ED)	ALC Prolonged Hospital Stay (> 90th percentile)	FI-ED showed a significant association with prolonged hospital stay, and, with ALC status in the Canadian cohort (17% of admitted patients were designated ALC).
	Cole, 2003	Prospective study	164 in-patients. No subsyndromal delirium (SSD), *n*=40 (81.3±5.4 years); prevalent SSD, *n*=101 (83.6±7 years); incident SSD, *n*=23 (86.0±5.4 years)	Patients who did not meet *Diagnostic and Statistical Manual of Mental Disorders* 3rd edition criteria for delirium classified into 3 groups on the presence of ≥2 core symptoms (clouding of consciousness, inattention, disorientation, perceptual disturbances) as measured by the CAM or the Delirium Index.	LOS obtained from the hospital database	Mean LOS±SD for no, prevalent, and incident SSD groups were 8.9±6.2, 16.6±14.8, and 14.2±10.8 days, respectively. Comparisons with no SDD were statistically significant (p<0.01) for both prevalent and incident SSD. In the adjusted analysis, patients with prevalent or incident SSD had mean LOS of 7.48 days (95% CI 2.43-12.53) and 5.49 days (95% CI 1.24-12.21), respectively, longer than patients with no SSD.
	Mayo, 2007	Retrospective cohort study	2,232 stroke patients (67.8±14.1 years)	Quebec's hospital database diagnosis	Non-medical bed-days were calculated as the difference between the time to meet specified criteria and the time of actual discharge.	Persons with any of confusion/ disorientation, sensory disturbance, aphasia, or lowerextremity paresis were more likely to have > 7 non-medical beddays (OR 1.3-2.1).
	McAlister & van Walraven, 2019	Retrospective cohort study	Total: 452,785 patients (83±5.6 years) Hospital Frailty Risk Score (HFRS) <5: 335,619 patients (82.6±5.4 years) HFRS 5-15: 105 275 patients (84.4±5.7 years) HFRS >15: 11,891 patients (84.8±5.5 years)	HFRS, which includes ICD-10 codes for cognitive impairment	Prolonged hospital stay (>10 days)	Patients with high or intermediate HFRS had significantly increased risks of prolonged hospitalization (70.0% (OR 8.64, 95% CI 8.30-8.99) or 49.7% (OR 3.66, 95% CI 3.60-3.71) versus 21.3% in low-risk HFRS group.
	McCusker, 2003	Prospective observational cohort study	359 Prevalent delirium, *n*=204 (83.61±7.40 years); incident delirium, *n*=37 (82.30±6.28 years; control (no delirium), *n*=118 (83.64±6.58 years)	Prevalent delirium cases identified first, using the SPMSQ. Patients with an SPMSQ score ≥3 errors or symptoms of delirium in the nursing notes were assessed with the CAM. Dementia was assessed using a 16-item IQCODE, using a cutoff of 3.5 to define dementia.	DRG-adjusted excess LOS was computed as the difference between the observed LOS and the average LOS for that DRG in similar Quebec hospitals.	Higher proportions of patients with prevalent delirium were demented. After controlling for covariates, prevalent delirium was not associated with a significantly longer LOS, but incident delirium was associated with an excess stay after diagnosis of 7.78 days (95% CI 3.07-12.48). Similar results were obtained using log-transformed or DRG-adjusted estimates of LOS.

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Table 3. *Continued*

Country	First Author, Year	Study Design	Participants Number (Mean Age±SD)	Cognition-Related Geriatric Manifestations	LOS or DD Assessment	Cognition-Related Geriatric Manifestations and LOS or DD
United Kingdom	Jasinarachchi, 2009	Prospective observational study	158 (82.5 years)	Confusion not otherwise specified	DD Patients who remained as in-patients for in-patient rehabilitation, and those who were discharged within 24 hours of being declared medically fit were not regarded as cases of DD.	Patients with DD were more likely to be confused (p=0.002).
Australia	Basic, 2015	Correlational study	2,125 patients (82.9 years).	Frailty level determined using the Canadian Study of Health and Aging Clinical Frailty Scale. Delirium according to the Australian Refined Diagnosis Related Groups classification system	LOS	Significant predictors of LOS included Frailty, hazard ratio=0.87 (95% CI 0.81-0.93, p=0.0001). Delirium, hazard ratio=0.85 (95% CI 0.74-0.98, p=0.03). *Dementia was not associated with LOS.*
	Mudge, 2019	Prospective cohort study	682 patients (76±7 years) 115 with SPMSQ < 8 (27%) 66 with delirium (15%)	Cognitive status according to SPMSQ (impairment if <8), and 3D-CAM for delirium, put into a multi-component measure including 5 geriatric syndromes (the HAC-OPs).	LOS	Any HAC-OP was strongly Associated with an increased LOS, and there was a strong and graded association between HAC-OP and LOS for any HAC-OP (9.1±7.4 days for any HAC-OP vs. 6.8±4.1 days for none, p<0.001).
	Pilotto, 2019	Prospective cohort study, Australia-based, with participants also from Western Europe	1,140 patients, mean SPMSQ: 4.1±3.5, 84.2±7.4 years MPI-1 (mild risk): 169 (14.8%), SPMSQ: 1.2±1.4, 81.5±6.9 years MPI-2 (moderate risk): 502 (44%), SPMSQ: 2.7±2.5, 83.8±7.2 years MPI-3 (severe risk): 469 (41.2%), SPMSQ: 6.7±3.1, 85.6±7.4 years	Multidimensional Prognostic Index (MPI) which includes cognitive assessment via SPMSQ	LOS	Higher MPI values are associated with higher mortality and other negative outcomes including LOS. p<0.001 for LOS and SPMSQ difference. Mean LOS±SD MPI-1: 8±5.6 days MPI-2: 13.6±10.5 days MPI-3: 16.6±13.6 days
Germany	Bahrmann, 2019	Prospective cohort study	307 patients (81±6 years) Charlson Comorbidity Index (CCI) score ≤2: 11 dementia on 105 patients (11%), 80±6 years. CCI score 3-4: 16 dementia on 95 patients (17%), 81±6 years. CCI score 5+: 23 dementia on 107 patients (22%), 81±6 years	CI as part of CCI	LOS	In the different linear regression models, CCI was identified as a predictor of LOS. CCI score ≤2: 7 days CCI score 3-4: 8 days CCI score ≥5: 10 days Adjusted Cox model for age, sex, and Barthel Index: HR 0.41, (0.02-0.81), p=0.041; unadjusted p<0.001
Spain	Cots, 2016	Retrospective study	355,496 hospital discharges. Diagnosed agitation, n=5,334 (80.5±11.2 years); no agitation, n=350 162 (68.3±17.2 years)	Discharge record diagnosis of agitation (ICD-9-CM code 293.0).	LOS	Among patients with a diagnosis of agitation, hospital stays were significantly longer (12.0±11.5 vs. 9.0±10.1 days).

Continued

Table 3. *Continued*

Country	First Author, Year	Study Design	Participants Number (Mean Age±SD)	Cognition-Related Geriatric Manifestations	LOS or DD Assessment	Cognition-Related Geriatric Manifestations and LOS or DD
Israel	Mizrahi, 2016	Retrospective case-control study	919 ischemic stroke patients. (75.70±7.94 years); pre-stroke dementia (PSD), *n*=106 (78.98±7.5 years); non-PSD, *n*=813 (75.3±7.9 years).	Registry data positive for dementia in the past (ICD-9-CM code 294.1)	LOS	Compared with non-PSD patients, those with pre-stroke dementia had a shorter LOS ($p<0.001$). *However, lower Functional Independence Measure gain per day during the course of rehabilitation is associated with earlier discharge policies.*
Italy	Basile, 2019	Prospective cohort study	156 patients (81.5±6.2 years) 42 (26.9%) with dementia	Frailty Index "Dementia": no specified criteria	LOS	The admission FI (aFI) was associated with the length of hospital stay (β = 6.937; p = 0.05), even after adjustment for age and sex.
Mexico	Dent & Perez-Zepeda, 2015	Prospective cohort study	254 (72.8±8.1 years)	Indices including cognitive assessments: Hospital Admission Risk Profile (HARP), Score Hospitalier d'Evaluation du Risque de Perte d'Autonomie (SHERPA), Acute Physiology and Chronic Health Evaluation II (APACHE II), and CCI	Long LOS: ≥10 days (time spent at the emergency room was not taken into account).	MMSE scores were 21.35±6.53 and 22.87±5.6 for the long LOS and the not-long LOS, respectively (p=0.058) FI, SHERPA, HARP, and APACHE II showed an association with LOS.

Note. 95% CI = 95% confidence interval; ALC = alternate level of care; CAM = Confusion Assessment Method; DD = delayed discharge; DRG = diagnosis-related group; HAC-OP = Hospital-Associated Complications of Older People; ICD = International Classification of Diseases; IQCODE = Informant Questionnaire On Cognitive Decline in the Elderly; LOS = length of stay; MMSE = Mini-Mental State Examination; OR = odds ratio; SD = standard deviation; SPMSQ = Short Portable Mental Status Questionnaire.

(rehabilitation) facility. Canadian experiences with patients labelled as "subacute" suggest an uncomfortable similarity here (Elbourne, Hominick, Mallery, & Rockwood, 2013). This approach also lets hospitals off the hook for their role in nosocomial dependency, especially reduced mobility. Likewise, the close relationship between a longer LOS or DD and common frailty syndromes associated with CI, for example, delirium and functional decline, supports the need for proactive cognitive/frailty screening so that hospitals can improve their care of people at risk for these common, costly, and unintended adverse outcome of current care practices (Muscedere et al., 2016) .

Limitations

We used a transparent approach to complete this scoping review. Six scientific databases were searched, but we excluded the grey literature. Although identified references were independently screened by two reviewers, the search strategy might have missed relevant studies. Although associations between a patient's physical status, including CI, and LOS or DD, can be understood across provincial and national boundaries, the practical interpretation of these results is largely regional and based on where each study was made. The management and availability of care resources specific to each region's health care setting may greatly influence a patient's trajectory to, and beyond, acute care. As such, the present scoping review is not aimed at making precise regionally based recommendations for reducing LOS or DD for cognitively impaired patients. There are also numerous possible confounders of the association between CI and LOS or DD, which have been described, and there is no consensus as to the definitions of CI or DD, which mandates care in the interpretation of the results and the inference of a causal link.

Conclusion

Although many factors may influence LOS or DD, we focused on CI, and the studies included in this scoping review point to an association between the two. Although CI among older in-patients has been estimated to vary between 15 per cent and 42 per cent in different countries (Jackson et al., 2017), McCloskey et al. (2014) found 63.6 per cent of a sample of seniors admitted for acute hospital care in New Brunswick, Canada to be affected by dementia, which is obviously higher. But, despite this, dementia tends to be under-recognized in acute care hospitals (Agarwal, Kazim, Xu, Borson, & Taffet, 2016; Crowther, Bennett, & Holmes, 2017; Douzenis et al., 2010; Greco et al., 2005; Jackson, MacLullich, Gladman, Lord, & Sheehan, 2016).

Hospitalization can have negative impacts not only on people with CI, but also on their family members and the hospital staff (Hirsch et al., 1990; Swinkels & Mitchell, 2008). Furthermore, the risk of functional decline is by far the greatest risk associated with the hospitalization of older adults (Admi et al., 2015), and it may be aggravated by longer stays. It is therefore essential that future studies aim to clarify the mechanisms underlying the relationship between cognitive impairment and LOS or DD in order to come up with solutions to this public health challenge. Practically speaking, a systematic screening for CI in older in-patients using a more consensual definition, and a standardization of DD assessment, could help to elicit these mechanisms, also allowing for the identification of other factors bearing on LOS. Recent data tend to show that such screening is feasible, allows to better target interventions

at this vulnerable group (Kurrle et al., 2019), and has been tried with tools such as the Mini-Cog© (Geschke, Weyer-Elberich, Mueller, Binder, & Fellgiebel, 2019) and the Frailty Index (Basile et al., 2019). Other data tend to show that providing a trained geriatric nurse to coordinate intra-hospital transitions (Bristol, 2019), facilitating the patient's attending an adult day-care service routinely before that person will need a hospitalization, or establishing dedicated geriatric intervention units implementing "personal engagement specialists"; that is, a type of nursing assistant offering one-on-one care (Sinvani et al., 2018), could lead to better outcomes in patients with CI by respectively reducing delirium incidence, need for hospitalization, emergency visits, LOS, and mortality. These means to mitigate or reduce DD may become important for the development of efficient and practical interventions, to inform future policy and research and to limit its negative impacts on these particularly vulnerable seniors.

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