Interventions to support recovery following an episode of delirium: a realist synthesis

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Abstract

Objectives: Persistent delirium is associated with poor outcomes in older adults but little is known about how to support longer-term recovery from delirium. The aim of this review was to identify and synthesise literature to understand mechanisms of recovery from delirium as a basis for designing an intervention that enables more effective recovery.

Methods: A systematic search of literature relevant to the research question was conducted in two phases. Phase one focused on studies evaluating the efficacy of interventions to support recovery from delirium, and stage two used a wider search strategy to identify other relevant literature including similar patient groups and wider methodologies. Synthesis of the literature followed realist principles.

Results: Phase one identified four relevant studies and stage two identified a further forty-six studies. Three interdependent recovery domains and four recovery facilitators were identified. Recovery domains were: 1) support for physical recovery through structured exercise programmes; 2) support for cognitive recovery through reality orientation and cognitive stimulation; 3) support for emotional recovery through talking with skilled helpers. Recovery facilitators were: 1) involvement and support of carers; 2) tailoring intervention to individual needs, preferences and abilities; 3) interpersonal connectivity and continuity in relationships and; 4) facilitating positive expressions of self.

Conclusions: Multicomponent interventions with elements that address all recovery domains and facilitators may have the most promise. Future research should build on this review and explore patients', carers', and professionals' tacit theories about the persistence of delirium or recovery from delirium in order to inform an effective intervention.

Keywords: delirium, realist review, older adults, rehabilitation.

Introduction

Delirium is a neurocognitive disorder common in older adults. The primary feature is disturbance in attention and awareness, accompanied by impairments in cognition and changes in behaviour. It arises as a direct physiological consequence of another medical condition, and has an acute onset and fluctuating course (American Psychiatric Association, 2013). Delirium

is associated with poor outcomes: increased length of stay in hospital, hospital acquired complications, distress, poor functional recovery and increased mortality (Andrew, Freter, & Rockwood, 2005; Bickel, Gradinger, Kochs, & Förstl, 2008; Davis et al 2017; O'Keeffe & Lavan, 1997; Partridge, Martin, Harari, & Dhesi, 2012; Siddiqi, House, & Holmes, 2006; Witlox et al., 2010). Delirium was initially thought of as a transient phenomenon, but several studies have shown that it is often persistent, sometimes for months or years (Cole, Ciampi, Belzile, & Zhong, 2008; Dasgupta & Brymer, 2014; Kelly et al., 2001; McCusker, Cole, Dendukuri, Han, & Belzile, 2003; Witlox et al., 2013). People who do not fully recover from delirium are more likely to require an increased level of care or institutionalisation (Siddiqi et al., 2006) and delirium is associated with subsequent dementia (Bickel et al., 2008; Cole et al., 2015; Levkoff et al., 1994).

Previous research and guidelines have addressed the prevention of delirium in both hospitals and care homes (Hshieh et al., 2015; Young, Murthy, Westby, Akunne, & O'Mahony, 2010). However, up to 20% of medical admissions in older people already have delirium on admission (Siddiqi et al., 2006). Despite the evidence of persisting symptoms, little is currently known about what causes better or poorer recovery from delirium, and therefore also about the support needs of people with delirium and their carers. Therefore, the purpose of this realist review was to identify and synthesise literature relevant to longer-term recovery from delirium to answer the research question: *What strategies for the treatment and care of people after delirium might improve recovery from delirium, and how, why and in what circumstances and for what types of patient are they more likely to be effective and practically feasible?*

Methods

The realist synthesis method was developed by (Pawson, 2006) for synthesising research and other evidence about complex social interventions. Realist evaluation and synthesis seeks to answer not only "*what works*", but "*what works for whom under what circumstances and why?*" Realist review is informed by a realist philosophy of social science and asserts that interventions generate change (outcomes – O) though the influence of intervention resources on human reasoning (mechanisms – M) in specific contexts (context – C). Realist reviews seek to explore how relationships between context and mechanism lead to particular outcomes, conceptualised using context-mechanism-outcome (CMO) configurations (Pawson, 2006; Pawson, Greenhalgh, Harvey, & Walshe, 2005). That is, they seek to produce

progressively refined explanations, or programme theories, that explicitly link the underlying mechanisms of interventions to the theorised causes of the targeted problem.

Realist review was appropriate for this study as the evidence base for delirium recovery interventions is sparse and underdeveloped. Realist review allowed us to draw on wider literature and study types to develop a richer understanding of delirium recovery interventions. We adopted Pawson's (2006) framework for conducting a realist synthesis. A two-stage literature search was undertaken in October 2019 to identify components and mechanisms of similar, previous interventions, and to look for wider evidence to develop and refine these initial insights. This review has been reported in accordance with the RAMESES publication standards for realist syntheses presented in supplementary material 1 –see pages 36-38 below. (Wong, Greenhalgh, Westhorp, Buckingham, & Pawson, 2013).

Stage one

We conducted a systematic search to identify a core set of previous interventions that were designed to support recovery after delirium. We used this first group of studies to glean initial insights as how such interventions work and to focus the research question. This search strategy was designed with advice from an experienced information specialist and conducted on 17th October 2019. The search terms are presented in supplementary material 2 – see pages 39 - 40 below. Full details about the search strategy, including inclusion criteria, for stage one is presented in table 1.

Stage two

Based on the results from stage one we purposively searched for further literature to help us to refine and revise our understanding of interventions to support recovery after delirium. For this second stage we used broader inclusion criteria to identify other relevant literature. Consistent with realist methodology, no literature was excluded based on study methodology. The search was iterative, as relevant studies were located, initial theories were refined and refuted and new theories were created which in turn lead to new areas of literature to examine. Literature was searched until the inclusion of new literature did not add any new information. Full details of the search strategy used in stage two are presented in table 1.

Table 1 – see pages 22 - 23 below

Data extraction

Full texts of potentially relevant manuscripts were screened case by case for relevance (whether the paper contributed to theory building about how the intervention might work) and rigour (whether the inferences may by the author were supported by the evidence presented and whether the method used to generate the data was credible or trustworthy) (Wong et al., 2013). Assessment of relevance was made during full-text screening, and assessment of rigour was made during synthesis.

Data were extracted by DP and GOR using a bespoke data extraction template organised to extract data on the nature of the intervention (what works) the type of participants (for whom), the duration and intensity of the intervention and other contextual information (in what circumstances) and theories about why the intervention may/may not work presented by the authors (why). The data extraction template can be found in supplementary material 2 – see below.

Data synthesis

Data synthesis aimed to develop and refine theory in relation to the research question. We searched for patterns of context, mechanism, and outcomes across the literature and evidence was used to interrogate and refine emerging theories. Stage one of the study originally aimed to provide evidence to inform the development of an initial programme theory which could then be refined through the addition of wider literature in stage two. However, due to the scarcity of literature meeting the inclusion criteria in stage one, we decided that it was important to first identify the core components that are likely to be effective in an intervention to support recovery from delirium – answering the first part of the question "*What strategies for the treatment and care of people after delirium might improve recovery from delirium*". To address this question we identified recovery domains by clustering of the core activities of the included interventions and interrogation of the processes and mechanisms associated with these activities.

Next, to answer the second part of the research question, ("*how, why and in what circumstances and for what types of patient are they more likely to be effective and practically feasible?")* recovery facilitators were identified through collecting and collating of programme theories of the original interventions, tacit theories uncovered by qualitative studies, and information regarding contextual factors that affected the efficacy of the interventions. Collected theory statements were then iteratively grouped into shared patterns. This process enabled the identification of a number of themes which were iteratively refined with discussions among the research group.

Results

Stage 1 yielded four relevant articles. Backwards and forwards citation chasing of included articles yielded no additional articles that met our inclusion criteria. Stage two resulted in an additional 46 studies. A full report of the study selection process can be found in the PRISMA diagram in figure 1.

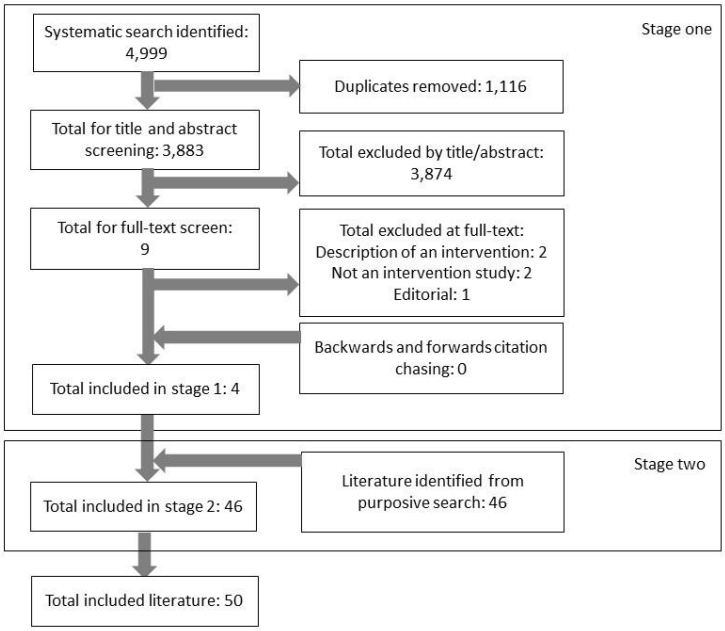

Figure 1. PRISMA flow diagram of study search and selection.

Study characteristics

Table 2 shows a summary of the four studies included in stage one. 451 patients and 16 caregivers participated in the studies in stage one. Table 3 shows a summary of the forty-six studies included in stage two. 8,797 patients, 87 caregivers, and 91 professionals participated in the primary studies in stage 2.

Table 2 – see page 24 below

Table 3 – see pages 25 - 35 below

Findings

Findings are presented in two sections. First, we set out three inter-related recovery domains: physical, cognitive and emotional, with potential components or features of interventions in each. A theory statement is offered for each domain, followed by a brief summary of supporting evidence. Second, we describe potential intervention design features that act across all three recovery domains.

Recovery Domains

1. Support for physical recovery

Theory statement*: Older people with persistent delirium who are frail or physically impaired (**context)** may be engaged in individualised physical exercise programmes (**mechanism resource 1**), which bring about biological changes that help to reduce frailty / physical impairment (**outcome 1**). Biological changes associated with reduced frailty / physical impairment may also contribute to improvements in cognition (**outcome 2**).*

Delirium interacts with frailty in many older people, with pre-existing frailty being associated with poor delirium outcomes (Caplan, Coconis, Board, Sayers, & Woods, 2006; Kiely et al., 2004). Physical rehabilitation has been frequently cited as a means of supporting recovery from delirium in hospital and following discharge. Interventions cited include improving upper extremity function (Alvarez et al., 2017) balance and gait training, progressive resistance exercise (Martínez-Velilla et al., 2018), and walking and lower-limb exercise (Jackson et al., 2012).

Characteristics of effective programmes included oversight of the programme by professionals or trained volunteers, starting intensity at the patient's individual level of function, regularity, and gradually increasing difficulty / intensity. Physical rehabilitation was also augmented with functional rehabilitation, which could enhance the effects of exercise training on mobility confidence and the incorporation of acquired skills into everyday life (Alvarez et al., 2017; Bergmann, Murphy, Kiely, Jones, & Marcantonio, 2005; Jackson et al., 2012; Pozzi et al., 2017). Physical exercise rehabilitation interventions have been associated with improved independence and reversal of hospital-related functional impairment (Martínez-Velilla et al., 2018). Physical rehabilitation / recovery has also been linked to positive cognitive effects, in particular improvements in executive function in patients with post-ICU syndrome (Jackson et al., 2012).

2. Support for cognitive recovery

Theory statement: *Older people with persistent delirium including continuing cognitive impairment (**context**) may be engaged in individualised programmes of cognitive exercise (**mechanism resource 1**) which bring about changes in brain function that lead to improvements in cognition (**outcome 1**). Improved cognition may also contribute to improved psychological well-being (**outcome2**).*

Pre-existing cognitive impairment and dementia are associated with worse outcomes from delirium, specifically long-term persistence of delirium, partial or no recovery, and increased mortality (Kiely, Bergmann, Jones, Murphy, Orav and Marcantonio, 2004; Kolanowski et al., 2016); Tow et al., 2016). The importance of supporting cognitive recovery was stressed throughout the literature. The two most commonly used strategies for patients with delirium were reality orientation and cognitive stimulation.

The aim of reality orientation was to reduce patients' confusion and accompanying anxiety by reinstating awareness of time, place, and circumstances. A closer connection with reality could improve patients' resilience to psychoactive symptoms of delirium such as hallucinations and delusions (Bergmann et al., 2005; Mailhot et al., 2017). Reality orientation has been delivered actively through structured activities with an individual or group e.g. use and discussion of memory diaries (Martin, 2018); or passively by introducing familiar objects to hospital / care environments (Bergmann et al., 2005; Caplan et al., 2006). Early supported discharge to the familiar home environment (as opposed to a potentially disorienting hospital ward) was an effective form of passive reality orientation in some studies (Caplan et al., 2006; Eeles et al., 2016). Supporting patients to return home was associated with improvements in cognitive scores and improvements in pain and mobility (Naylor et al., 2007), and a home-based rehabilitation programme was associated with shorter duration of delirium (Caplan et al., 2006). A number of studies stressed the importance of reality orientation being delivered in a non-confrontational way that is enjoyable to those experiencing it (Bergmann et al., 2005; Neal & Barton Wright, 2003; Woodrow, 1998). Others suggested that family carers can play an important part by remaining with the patient and providing them with reassurance and reorienting information (Halloway, 2014; Pozzi et al., 2017).

Interventions using cognitive stimulation aimed to 'exercise' cognitive abilities through activities that called on capacities for reasoning and problem solving. Cognitive stimulation

has been delivered either globally (targeting multiple cognitive domains simultaneously), or more specifically, with targeted activities aimed at particular aspects of cognition e.g. alertness, attention, problem solving, memory or executive function (Alvarez et al., 2017). Evidence from this review suggested that global cognitive stimulation supported broader positive outcomes (Farina et al., 2006). Cognitive stimulation was associated with lower delirium scores at discharge (Danila et al., 2018), improved executive function (Kolanowski et al., 2016) and improvements in cognition and self-reported quality of life in people with mild-moderate dementia (Woods, Aguirre, Spector, & Orrell, 2012).

A wide range of activities have been used, including games, puzzles, quizzes, arts and crafts, and discussion groups. Effectiveness appeared to be enhanced where activities reflected personal interests and preferences (Alvarez et al., 2017; Blair, Anderson, & Bateman, 2018; Kolanowski et al., 2016; Waszynski et al., 2013; Woods et al., 2012). Personalised recreation-based cognitive stimulation could also improve psychological wellbeing, being associated with patient satisfaction (Danila et al., 2018) decreased agitation (Waszynski et al., 2013) and reduction in caregiver distress (Farina et al., 2006).

Kolanowski et al (2010, 2016) developed and tested a recreation-based cognitive stimulation intervention for patients with DSD informed by cognitive reserve theory which proposes that individuals have differing levels of efficiency in the use of brain networks with some being better able to deploy cognitive strategies to cope with brain pathology. Such 'active reserve' is plastic and therefore capable of being boosted through cognitive exercise (Kolanowski, Fick, Clare, Therrien, & Gill, 2010). Cognitive stimulation attempts to boost active reserve and offset the negative cognitive effects of the delirium. Kolanowski et al (2016) found that their intervention was associated with improvements in executive function and reduced length of stay in patients with DSD in post-acute care (Kolanowski et al., 2016).

3. Support for emotional recovery

Theory statement: *Older people with persistent delirium may have lasting negative emotions and/or a sense of incomprehension at what they have experienced. Talking about their experience to a person with appropriate skills (**mechanism resource 1**) may help them to manage / resolve the negative emotions / make sense of their experience (**mechanism reasoning 1**) resulting in better coping / recovery over the longer term (**outcome**).*

Theory statement: *Carers who have observed the person they care for during an episode of delirium may be left with lasting negative emotions following the experience (**context**). Talking about their experience to a person with appropriate skills (**mechanism resource 1**) may help them to manage / resolve their negative emotions (**mechanism reasoning 1**).*

Many patients reported ongoing emotional distress after an episode of delirium (Bélanger & Ducharme, 2011; Schmitt et al., 2017). This was often related to loss of control (Schmitt et al., 2017), the nature and content of delusional thoughts (Partridge et al., 2012) and negative feelings such as remorse, guilt, and embarrassment (Pollard, Fitzgerald, & Ford, 2015). Some were left with continuing doubts about reality and fear that the delirium will return causing significant suffering with potential to develop into post-traumatic stress disorder or other mental health problems (Pollard et al., 2015). Carers could also experience negative emotions as the result of witnessing their loved one with delirium, including guilt, anxiety, worry, helplessness, frustration, loss, and insecurity (Partridge et al., 2012). Such feelings could continue for some time after the event (Conn & Lieff, 2001).

Therefore, an important aspect of recovery from an episode of delirium involved dealing with negative emotions as well as wider 'sense making' of the experience (Conn & Lieff, 2001). Patients reported that opportunities to discuss their experiences with someone with appropriate knowledge and skills could help them feel safe and comfortable, and was a starting point for understanding their experience (Bélanger & Ducharme, 2011; Morandi et al., 2015). Knowing that others have had similar experiences has been reported as comforting by patients (Pollard et al., 2015). For carers, skilled listening could reduce immediate distress and carefully delivered explanatory information could help to reduce anxiety for the future (Partridge et al., 2012).

While no intervention in this review primarily targeted the emotional impact of delirium, many suggested indirect effects. For example, cognitive and physical rehabilitation provided a distraction and a break from monotony, and an opportunity for social interaction that could improve patients' sense of competence and wellbeing (Danila et al., 2018; Tsuchiya et al., 2016). Similarly, reality orientation and cognitive stimulation served as vehicles that enabled patients to express their feelings and fears (Danila et al., 2018), and for staff to provide reassurance, information and support (Conn & Lieff, 2001; Naylor et al., 2007).

Multi-component interventions

While we have separated out physical, cognitive and emotional recovery domains for the purpose of this paper, it is important to stress their interdependence. Persistent delirium is multi-factorial with many modifiable risk factors (Bogardus et al., 2003; Jackson et al., 2012). Therefore, multi-component interventions that address needs across all three recovery domains may be more effective in supporting global recovery from persistent delirium. Multi-component interventions have been associated with potentiation of positive outcomes across recovery domains. For example, there is good evidence to support the positive effects of exercise on cognition (Jackson et al., 2012; Martínez-Velilla et al., 2018).

Recovery Facilitators

The three recovery domains might be regarded as core components of an intervention to support longer term recovery from delirium. Four recovery facilitators acting across recovery domains have also been discerned from the literature as shown in Figure 2.

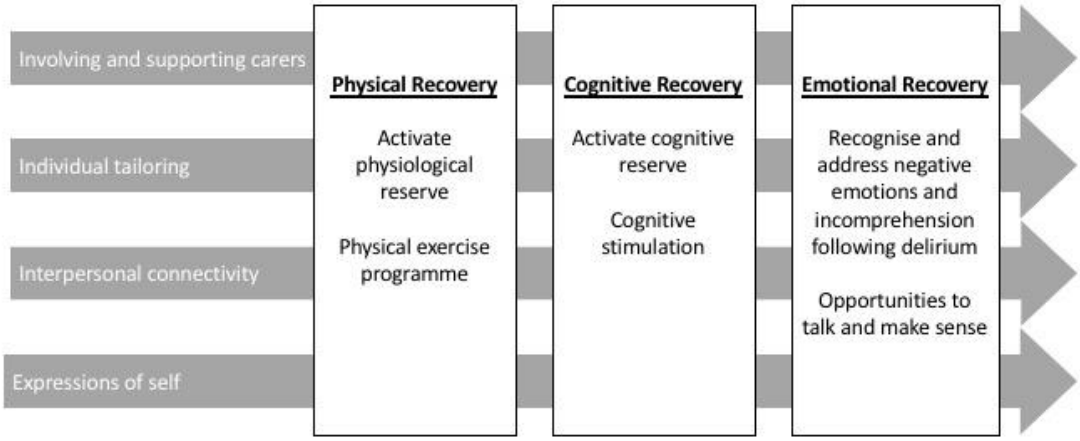

Figure 2. Recovery domains and facilitators.

1. Involving and supporting carers

Carers could offer a familiar and reassuring presence during an episode of delirium, especially during transitions between care settings (Halloway, 2014; Partridge et al., 2012). When adequately prepared and supported carers were often best placed to deliver aspects of

recovery programmes; improving engagement with the intervention by ensuring practice of skills in between sessions (Clare et al., 2019).

Supporting caregivers' involvement was associated with improved outcomes for both patients and caregivers. For example, a nursing intervention designed to support family caregiver's self-efficacy in supporting patients experiencing delirium was associated with better psycho-functional recovery scores (Mailhot et al., 2017). Education of family caregivers also improved the chances of patients returning home (Pozzi et al., 2017). Increased awareness and understanding by family caregivers helped them to have more patience with the patient, improving their relationship, and their ability to cope with the challenges associated with being a carer (Clare et al., 2019; Halloway, 2014; Woods et al., 2012)

2. Tailoring intervention to patients' individual needs, preferences and abilities

Interventions to support recovery from delirium were likely to be most effective when adapted to the needs and preferences of each patient. This helped the intervention to be optimized to patients' individual abilities and needs. Having a range of activities and a flexible intervention allowed providers to adapt the level of difficulty of each activity and tailor activities for the participants (Woods, Thorgrimsen, Spector, Royan, & Orrell, 2006). Optimizing the intervention is useful as patients with higher levels of impairment were not able to engage with some components of interventions if they were too difficult, or they required a more intensive intervention to account for greater impairments (Kurz, Pohl, Ramsenthaler, & Sorg, 2009; Martínez-Velilla et al., 2018).

Recreation-based cognitive stimulation that is based on patients' personal history and activities that they find enjoyable helped to capture and sustain attention, provide more enjoyment, empowerment and a sense of achievement, and improve engagement with activities (Clare et al., 2019; A. Kolanowski et al., 2016; A. M. Kolanowski et al., 2010; Waszynski et al., 2013). Personalised and enjoyable activities were less stressful, less obtrusive, and more easily implementable across care settings (Kolanowski et al., 2016; Kolanowski et al., 2010). If interventions were too challenging, effortful, or repetitive, patients got bored, tired or frustrated which could reduce engagement (Clare et al., 2019).

Carers' knowledge of patients' histories, needs and preferences informed the tailoring of recovery interventions, improving understanding of how recovery programs could be adapted (Halloway, 2014; Mailhot et al., 2017; Verloo, Goulet, Morin, & von Gunten, 2016). This included ways in which hallucinations and delusions related to personal biography e.g. by mixing past with present (Partridge et al., 2012), as well as awareness of significant and

enjoyable occupations and hobbies (Kolanowski et al., 2010; Tsuchiya et al., 2016; Woods et al., 2006).

3. Interpersonal connectivity and continuity in relationships of care

A trusting relationship with staff could enhance patients' feelings of safety, helping the patient feel relaxed and at ease, and supporting the effectiveness of the intervention by providing a vehicle for open communication (Clare et al., 2019; Partridge et al., 2012; Pollard et al., 2015). Quality in relationships of care provided delirious patients with the confidence to overcome some of the fear and isolation they were feeling; making them more willing / able to communicate perceptual disturbances and other distressing symptoms to staff (Bélanger & Ducharme, 2011; Partridge et al., 2012; Pollard et al., 2015). Delirium was associated with feelings of isolation, disconnect, and distance from others (Bélanger & Ducharme, 2011; Partridge et al., 2012; Pollard et al., 2015). Patients reported that this disconnect was exacerbated when they felt abandoned or dismissed by staff (Pollard et al., 2015). Being given opportunities to discuss their experiences with staff gave patients the chance to make sense of their experience, have their questions answered, and for the staff member to provide information about delirium and give reassurance (Pollard et al., 2015).

Continuity in relationships of care appeared to be particularly important in recovery from delirium (Blair et al., 2018; Bogardus et al., 2003). Continuity in relationships of care could be structured over different timescales, e.g. as nursing assignments across shifts (Bergmann et al., 2005) or during extended transition from hospital to home (Naylor et al., 2007). Rahkonen et al (2001) report on a trial in which community care of older adults after an episode of delirium was enhanced through a long term (> one year) relationship with a specialist nurse. This intervention helped to reduce rates of admission to care homes. Importantly, the specialist nurses became a 'trusted friend' to patients and family carers (Rahkonen et al., 2001).

The latter point highlights the value of meaningful social interaction in recovery from delirium. Regular visits from an intervention provider provided social contact and a positive routine (Clare et al., 2019). The role of social interaction in facilitating the positive effects of interventions is under-explored, and as such in some studies included in this review it was unclear whether benefits arose from the recovery intervention itself, or as a result of person-centred social interaction through which they were delivered (Farina et al., 2006; Neal & Barton Wright, 2003; Waszynski et al., 2013).

4. Facilitating positive expressions of self

Delirium was associated with a sense of powerlessness, entrapment, and loss of agency (Pollard et al., 2015). Interventions were used to help patients to regain a sense of self that may have been damaged as the result of experiencing delirium. Interventions were structured as opportunities to discuss personal experiences and feelings arising from them, or as opportunities for positive self-expression (Danila et al., 2018; Waszynski et al., 2013). Interventions were also delivered in ways that supported patients to improve their feelings of self-efficacy and self-worth, and increase their motivation to achieve recovery goals (Clare et al., 2019; Tsuchiya et al., 2016).

Discussion

This review aimed to identify and synthesise evidence pertaining to strategies for supporting longer term recovery after an episode of delirium. Three interconnected recovery domains and four recovery facilitators acting across domains have been identified. These might be regarded as the components of a potential intervention, but not the full design. Further components might still be added and the method by which components are combined is yet to be determined.

Before considering the design in more depth, it is important to strike a note of caution about the strength of evidence and its specific application to recovery from delirium. Whilst physical rehabilitation and cognitive stimulation have been widely applied in delirium prevention and treatment strategies, evidence of their efficacy in supporting longer-term recovery from delirium is limited. Only two studies in the review demonstrated a reduction in delirium symptoms or duration as the result of an intervention. Danila (2018) found that an arts-based cognitive stimulation was associated with a significantly lower delirium score at hospital discharge, and Alvarez (2017) found that occupational therapy with cognitive stimulation was associated with a lower incidence of delirium in the ICU.

However, physical rehabilitation and cognitive stimulation have been more reliably associated with improved outcomes for people with cognitive impairments more generally. This includes improved executive function (Kolanowski et al., 2016), memory (Kurz et al., 2009) and general cognitive improvement (Alvarez et al., 2017; Martínez-Velilla et al., 2018). Therefore, whilst the evidence for the effectiveness of these interventions in improving recovery from delirium is sparse, their association with improved cognitive outcomes in similar

populations more generally suggests they are valuable interventions to explore in further research.

The third recovery domain to emerge from the literature involves emotional recovery and reveals the experience of delirium as one that can have a serious and enduring impact on wellbeing. Qualitative accounts of the experience of delirium have identified an unmet need for emotional support, however they have not provided evidence of the potential efficacy of interventions to support emotional recovery. Neither have they suggested the form that such support might take, except in the broadest of terms. There is a case for further investigation with stakeholders.

Evidence supporting the importance and potential efficacy of broader recovery facilitators is also mixed. A number of studies have identifed the value of involving carers in identification, prevention and treatment of delirium in hospital settings. This is generalisable to longer term recovery at home, where the carer is likely to play a leading role in delivering / supporting recovery interventions; and strongly emphasises the need for effective carer support and continuity of relationships with professionals. Other recovery facilitators are perhaps most associated with emotional recovery after delirium, particularly recovery of 'self' in terms of tailoring the activities of recovery interventions to make them personally relevant and enjoyable, promoting sociability, and restoring confidence in self-identity.

Implications for research

This review has provided insights into the potential mechanisms and outcomes of interventions to support recovery from delirium, however further detail is needed regarding how the core components fit together. An overarching message appears to be the importance of understanding how the different components of a recovery intervention might interact, recognising the inter-relationship between different aspects of the experience of delirium, and the need for recovery to be supported and coordinated in a holistic way. Therefore a further focus for investigation with stakeholders is the extent to which the various aspects of recovery can and should be combined in a single multi-component intervention. Interviews with key stakeholders could be used to gain a deeper understanding of what current interventions are used, how they are thought to improve outcomes (for patients or carers), how they are regarded by patients, professionals and carers, and how acceptable and effective they are perceived to be. Interviews may also explore whether the recovery priorities of professionals, patients, and carers are aligned.

Strengths and limitations

A number of challenges presented themselves during the course of the review. There is a lack of direct evidence within the literature reviewed that demonstrates the efficacy of any interventions to support recovery after an episode of delirium. This, in part, reflects a conceptual confusion between recovery *from* delirium, where treatment of root causes is the first line of action to address a continuing episode of delirium; and recovery *after* delirium, which calls for remediation of lasting effects that are separate but related to delirium. It goes to the heart of whether the underlying causes of persistent delirium are the same as delirium itself, or whether new mechanisms play a part. Much of the research literature is unclear in this respect and future research should involve further exploration of this distinction and its significance for the development of an intervention to support recovery from delirium.

Evidence has been drawn from a wide body of literature comprising a diverse range of study designs. Most of the studies offer only weak to moderate evidence to inform the development of a recovery intervention and it has not been possible to discern particular characteristics or groups of patients that might benefit most from interventions, beyond the general observation that pre-existing frailty and cognitive impairment indicates poorer delirium outcomes. Most of the evidence is indirect and has been drawn mainly from fragments of studies pieced together so that cumulatively they provide indications of a possible way forward. As such, our findings are based on inferences drawn from original studies beyond the context in which they were conceived and conducted. However, a strength of realist methodology is that it allows for knowledge to be drawn from multiple sources, and we have taken care to ensure that the inferences we have made are not at odds with the general findings of the studies from which they have been derived.

Conclusion

Three recovery domains – physical, cognitive, and emotional - of an intervention to support long term recovery from delirium have been identified from a wide body of literature. Multicomponent interventions with elements that address all recovery domains and facilitators may have the most promise. Notwithstanding the limitations of the review, we consider the theory statements set out above to be sufficiently robust to serve as a starting point for designing an intervention with a wider group of stakeholders.

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Table 1: Search strategies for stages one and two.

	Stage One	***Stage Two***
Eligibility criteria	Intervention studies, including RCTs, pre/post study designs, and other comparative studies.	Intervention studies, pilot studies, descriptions of interventions, qualitative studies, reviews, and grey literature.
Types of intervention	Non-pharmacological single and multi-component interventions to support recovery after delirium. Interventions aiming to increase identification of delirium or prevent episodes of delirium, and pharmacological interventions, were excluded.	Wider inclusion criteria including interventions to support recovery and rehabilitation after hospitalisation, interventions to treat delirium in the acute phase, and similar interventions targeting different patient groups (e.g. people with dementia).
Types of participants	Studies that involved adults over fifty years of age with or without a prior diagnosis of dementia who had experienced an episode of delirium in hospital.	A wider patient group was included in this search, including ICU survivors and persons with dementia.
Date and language	Studies written in English and published after 1990 were included.	
Database search	MEDLINE (OvidSP), PsycInfo (Ovid SP), EMBASE (Ovid SP) and CINAHL (EBSCO) were searched with syntax being modified appropriately for each database.	Articles excluded from stage one were re-searched using the broader inclusion criteria. Articles were also identified by hand searching google scholar and through recommendations from clinical experts.
Search terms	The search strategy used a combination of free text terms organised by delirium, intervention, and study type. Database specific controlled vocabulary (medical subject headings, MeSH) was also used.	Broader search terms such as 'cognitive rehabilitation', and 'delirium recovery/ rehabilitation' were used.
Additional sources	Both searches were supplemented by backwards and forwards citation chasing of included studies.	

Screening	Titles and abstracts were screened independently against the inclusion criteria by both DP and GOR. Full texts of selected papers were retained for inspection by DP and GOR. Any discrepancies were discussed and resolved in a series of meetings.	Titles and abstracts were screened independently by either DP or GOR. If there was any uncertainty about the relevance of the article this would be discussed and resolved by DP and GOR in a series of meetings.
Data management	All references were managed in Endnote X7.8.	
Data extraction	Data were extracted by DP and GOR using a bespoke data extraction sheets were developed in Microsoft Excel and piloted with three papers. The sheet was used to extract an overview of each study and extracted data on study design, participants, results, and conclusions.	

Table 2: Characteristics of studies included in stage one.

Study	Country	Design	Participants	Setting	Delirium measure	Intervention	Outcome
Danila et al (2018)	US	Observation pre-post	50 older adult inpatients with delirium.	Acute care for elders in an academic medical centre.	Nu-DESC.	Patients were read a story or poem based on their own interests by artist-in-residence. Interactive session designed to give patients the opportunity to reflect and share stories.	High patient satisfaction and lower delirium scores at discharge.
Eeles et al (2016)	Australia	Before and after prospective pilot study	16 patients with delirium admitted acutely to internal medicine or geriatrics with a diagnosis of delirium and full-time carer at home.	General medicine service at metropolitan hospital.	CAM.	Hospital in the home delirium pathway including carer information and support and a patient management plan. Patients received daily interventions at home including physiotherapy, occupational therapy, nursing, medical review, social work, accompanied walks and card games.	High patient and carer acceptability and satisfaction.
Kolanowski et al (2016)	US	Single blind randomised clinical trial	283 community dwelling older adults with mild-moderate delirium admitted to post-acute care.	Post-acute care facilities.	CAM – 2 or more positive features.	Recreation-based cognitive stimulation.	Did not improve delirium but were associated with improved executive function and reduced length of stay (LOS).
Rahkonen et al (2001)	Finland	Matched pairs	102 Community dwelling older adults admitted as emergency cases to hospital with delirium around admission.	Private rehabilitation centre.	DSM-III-R.	Continuous and systematic support via specialist nurse as case manager; plus one rehabilitation period a year at a research and rehabilitation centre.	Prolonged community care (delayed institutionalisation).

Table 3. Characteristics of studies included in stage two.

Intervention Studies							
Study	**Country**	**Design**	**Participants**	**Setting**	**Delirium/ cognitive measure**	**Intervention**	**Outcome**
Mailhot et al (2017)	Canada	Randomised pilot study.	30 patient-family caregiver dyads. Patients were older adults experiencing delirium after cardiac surgery.	ICU or surgical ward.	Delirium Index.	Nursing intervention designed to foster the family caregiver's self-efficacy in supporting the patient during a delirium episode.	The intervention was acceptable and feasible. Intervention group showed better psycho-functional recovery scores but mean delirium severity scores were similar in intervention and control groups.
Naylor et al (2007)	US	Two pilot studies and two case studies.	Pilot 1: 145 hospitalised elders. Pilot 2: 11 patient-carer dyads	Hospital to home.	MMSE and CAM.	Advanced practice nurse care provided transitional care over 16 weeks.	Intervention associated with improvements in MMSE scores. Particular improvements in pain and mobility.
Jackson et al (2012)	US	Single site feasibility, pilot randomised trial.	13 medical/ surgical ICU survivors with either cognitive or functional impairment at discharge.	Home (post-ICU).	TOWER test.	Multicomponent tele-rehabilitation program including cognitive, physical and functional rehabilitation over 12 weeks.	The intervention was tolerated. Intervention group demonstrated significantly better executive function and improvements in ADLs.
Martin (2018)	US	Observational.	Patients with acute memory deficits. Number not reported.	Inpatient acute rehab.	Not reported	Memory diaries provided to patients with delirium.	Memory diaries were used often and well received but use became sporadic.

Alvarez et al (2017)	Chile	Pilot randomised clinical trial.	140 patients hospitalised in the ICU for post-surgical observation or decompensated illness.	ICU	CAM and DRS	Occupational therapy including poly-sensory stimulation and cognitive stimulation.	Intervention group had lower duration and incidence of delirium, and higher scores on motor functional independence, cognitive state, and grip strength.
Anderson et al (2016)	Australia	Repeated measures supplemented by multiple one-time measures.	Participants were: (a) 118 older patients with dementia (b) 76 staff in the units who consented to participate (c) senior staff in residential aged care facilities (RACFs) to which patients were discharged	Transitional Behavioural Assessment and Intervention Service Units.	Cohen-Mansfield Agitation Inventory	Integrated impatient and community service providing multi-disciplinary assessments, Development and implementation of individualised bio-psychosocial management plans. Facilitated appropriate discharge of people with significant levels of Behavioural and Psychological Symptoms in Dementia (T-BASIS).	Shortened LOS, patient turnover increased, and lower re-admission rates in T-BASIS centres. Facilitated a move from sedation to psychosocial management of BPS.
Blair et al (2018)	Australia	Non-randomised controlled trial.	458 older adults living with dementia, experiencing delirium, or having risk factors for delirium.	Acute hospital	MMSE and/or CAM	Trained volunteers provided 1:1 person-centered care with a focus on nutrition and hydration support, hearing and visual aids, activities, and orientation and emotional support	Significant reduction in rates of 1:1 specialing and 28 day readmission rates.
Caplan et al (2006)	Australia	Randomised controlled trial.	104 patients referred for geriatric rehabilitation.	Tertiary referral hospital and home.	CAM and MMSE.	Multidisciplinary home-based rehabilitation provided by nurses, physiotherapists,	The home group had lower likelihood of developing delirium during rehabilitation, shorter duration of rehabilitation, and fewer

						occupational therapists and doctors.	hospital bed days. There was no difference in MMSE scores
Martinez-Velilla et al (2018)	Spain	Single-centre, single-blind randomised clinical trial.	370 very elderly patients undergoing acute-care hospitalisation.	Acute care unit in tertiary public hospital.	MMSE, CAM.	Individualised moderate-intensity resistance, balance, gait, and walking exercises.	Intervention group showed mean increase in independence and physical performance tests, reversal of hospital-related functional impairment, cognitive improvement.
Pozzi et al (2017)	Italy	Cohort study.	6 older adults diagnosed with delirium and dementia.	Rehabilitation centre	MMSE.	Personalised occupational therapy including multisensory cognitive stimulation, basic activities of daily living, family education and involvement, and a healing environment.	83% of patients were discharged to home, one patient was institutionalised.
Tsuchiya et al (2006)	Japan	Quasi-RCT.	48 people with dementia or cognitive impairment.	Day-care setting of an acute hospital.	MOSES.	Brain-activating rehabilitation including body exercise, collage, singing, origami, and reality orientation.	The intervention group showed significant improvement in the MOSES subscales for dementia.
Verloo et al (2016)	Switzerland	Randomised clinical pilot trial with before/after design.	103 older people discharged from hospital.	Home (post-discharge)	CAM, MSSE, Katz and Lawton index of ADL.	Multicomponent nursing intervention to detect and reduce delirium after discharge from hospital.	Participants and family caregivers stated that all of the interventions provided during the homecare visits improved quality of life and decreased discomfort.
Waszynski et al (2013)	USA	Observational cohort study.	74 hospitalised patients suffering from agitation and receiving	Hospital (trauma centre)	Agitated behaviour scale (ABS).	Individualised therapeutic activities to reduce agitation, including playing cards, puzzles, music, games etc.	There was a sustained decrease in agitation and increased positive non-verbal cues such as smiling and improved social interaction.

			continuous observation.				
McGilton et al (2013)	Canada	Quasi-experimental design.	149 older patients with or without CI admitted to rehabilitation centre after receiving surgery for hip fracture.	Community hospital inpatient rehabilitation units.	MMSE, FIMMS.	Patient-centred multicomponent rehabilitation model (PCRM-CI), including dementia management, delirium prevention, education and support for healthcare providers and family caregivers.	No difference in mobility gains. Intervention patients were more likely to return home.
Farina et al (2006)	Italy	Non-randomised comparative study.	32 patients with possible AD, or mild/moderate CI	Alzheimer assessment unit.	CDR, MMSE,	Compared recreation-based global cognitive stimulation with cognitive specific activities.	Global activities were associated with a reduction in behavioural disturbances and caregiver distress.
Kurz et al (2009)	Germany	Randomised controlled trial.	28 people with mild cognitive impairment or Alzheimer's disease.	Day clinic	CRD, MMSE,	8 week cognitive rehabilitation programme including problem-solving, assertiveness training, relaxation and stress management. Information and support for carers.	MCI patients showed significant improvements in ADL, mood, verbal and non-verbal memory and episodic memory. AD patients exhibited slight increase in verbal memory.
Woods et al (2007)	UK	Further analysis of RCT data.	201 people with dementia	Participants were resident in a care homes or attending a day centre	DSM-IV criteria for dementia; MMSE	14 session programme of CST over seven weeks. Topics included using money; word games; the present day; and famous faces. Reminiscence and multisensory stimulation were used.	Improvements in QoL did not appear to arise from non-specific factors, such as enjoyment and social interaction, although these factors may also have contributed to positive changes in cognition. The CST in this trial appeared to be an independent cause of

							improvement in both cognition and QoL.
Bogardus et al (2003)	US	Controlled trial.	705 people aged 70+	Surviving at least six months after in-patient stay in a medical centre.	CAM and MMSE	Intervention targeted at major risk factors for delirium. Cognitive impairment; sleep deprivation; immobility; visual impairment; hearing impairment; dehydration.	There was no evidence of a lasting beneficial effect from the intervention. Other strategies are needed after hospital discharge to deter deterioration in susceptible elderly people.
Qualitative studies							
Study	**Country**	**Method**	**Participants**	**Setting**	**Findings**		
Morandi et al (2015)	Italy	Prospective cohort study using mixed (quantitative and qualitative) methods.	30 patient and family carer dyads with delirium superimposed on dementia. Mean age of patients = 83 years.	Rehabilitation Ward and Home (post discharge)	Qualitative interviews revealed six main aspects of patients' delirium experiences: emotions; cognitive impairment; psychosis; memories; awareness of change; and physical symptoms. Patients who experienced delirium with perceptual disturbances were often reluctant to mention this to staff. Knowing that unreal experiences were common and knowledge about plans for their ongoing care helped patients feel safe and reassured. Health care staff can help patients understand their experience, and provide support to minimize stress experienced during both the acute and recovery phases.		
Schmitt et al (2017)	USA	Qualitative study using semi-structured interviews and interpretative analysis.	18 patients aged 70+. 16 family carers. 15 nurses.	Hospital	Three major themes of delirium-related burden were common among patients, family caregivers and nurses: symptom burden; emotional burden; and situational burden. These burdens arose from different sources among the three groups and were experienced by each in different ways. System wide approaches are required to reduce delirium-related burden.		
Partridge et al (2012)	International (English language)	Synthesis drawing on qualitative and	Not stated	Mostly ICU and palliative care	Evidence suggested that some patients recall delirium and that recollections were generally distressing. Distress was sometimes greater in relatives witnessing delirium and was also reported in professional staff. This distress may result in longer-term psychological sequelae. Remedial action, such as		

		quantitative literature			explanatory information to patients and their families, may reduce distress and psychological morbidity.
Pollard et al (2015)	Australia	Qualitative descriptive approach.	11 patients aged 54 to 87 years.	Hospital orthopaedic ward (post – surgery).	The participants had vivid recollections of their episodes of delirium that portrayed intense suffering related to the high degree of general mistrust and suspicion; a sense of powerlessness and inability to escape; of being alone and abandoned; feeling dismissed by staff and others; and disconnection from reality. Feelings of guilt, shame and fear persisted after delirium. Delirium can have emotional consequences similar to PTSD.

Reviews				
Study	**Scope**	**Focus**	**Studies/Participants**	**Findings**
Belanger & Ducharme (2011)	CINAHL and Medline search for English and French language articles since 1990.	Review of qualitative literature on the experience of having delirium or nurses caring for a person with delirium. Hospital settings.	One literature review. Nine studies of patient / caregivers' experience. Seven studies of nurses' experience.	Delirious patients experienced incomprehension and various feelings of discomfort. Understanding; support; believing what they are experiencing; explanations; the presence of family/friends; and the possibility of talking about the lived experience were interventions that helped them get through such episodes more easily. Nurses who tend to delirious patients failed to comprehend the utterances and behaviours of the persons cared for and experienced various feelings of discomfort as well.
Abraha et al (2016)	Medline, Cochrane, CINAHL and PsychINFO search and evaluation by clinical experts.	Review of evidence relevant to non-pharmacological interventions to prevent or treat delirium in older people and development of clinical recommendations.	Two RCTs	Weak recommendations were provided for the use of multicomponent interventions to treat delirium of older patients in medical wards.
Conn & Lieff (2001)	Medline search for articles published 1996-1998.	Current approaches to diagnosing and managing delirium in the elderly	Two RCTs plus review articles and practice guidelines published by the American Psychological Association.	Advice about general measures to relieve suffering was unsupported by empirical evidence; frequently self-contradictory; and often impractical. However common-sense advice must include instructions to optimize levels of stimulation; minimize the unfamiliarity of the environment; minimize disorientation; and support and educate family members.

Abraha et al (2015)	Medline search for English language articles.	Clarification of definitions of recovery from delirium used in the literature.	56 articles containing definitions of recovery derived from longitudinal studies.	A variety of 16 different terms were used to define the recovery. The definitions of each term also varied. Studies using severity scales used either cut-off points or percentage reduction between assessments, while others using dichotomous scales (yes/no) defined recovery as one or more days of negative delirium. Given that, especially in elderly people, a full recovery may never be achieved, it is perhaps better to define recovery according to a symptomatic status that can be measured by a variety of diagnostic instruments.
Blair et al (2019)	PubMed search and analytic review.	Review of evidence for non-pharmacologic management and pharmacologic minimization strategies for prevention and treatment of delirium ICU patients.	Not stated.	Ten actionable steps were discernible from the literature. Optimise pain management; avoid deep sedation; avoid deliriogenic medication; facilitate ventilator weaning; remove lines and tubes; avoid physical restraints; reorient patients; promote normal sleep/wake cycle; engage patients and families; facilitate early mobilisation.
Neal & Barton-Wright (2003)	Cochrane review.	Evaluate the effectiveness of validation therapy for people diagnosed as having dementia of any type, or cognitive impairment.	Three studies incorporating data on a total of 116 patients.	There was insufficient evidence from randomised trials to allow any conclusion about the efficacy of validation therapy for people with dementia or cognitive impairment.
Woods et al (2012)	Cochrane systematic review.	Evaluation or cognitive stimulation as an intervention to reduce the rate of cognitive decline in people with mild or moderate dementia.	15 RCTs meta-analysis of data from 718 participants.	The findings suggested that cognitive stimulation has a beneficial effect on the memory and thinking test scores of people with dementia. There was evidence of improved quality of life. Participants were able to communicate and interact better than previously. No evidence was found of improvements in the mood of participants or their ability to care for themselves or function independently, and there was no reduction in behaviour found difficult by staff or caregivers. Family caregivers, including those who were trained to deliver the intervention, did not report increased levels of strain or burden.
Young et al (2010)	NICE guideline	Expert evaluation of available evidence and consultation of stakeholders in order to develop a clinical guideline.	Evidence is obtained from a range of sources including RCTs, observational studies	Although delirium is common, recognition of the disorder has been poor in the UK, possibly because of a lack of awareness and difficulties in distinguishing it from dementia. There has been a paucity of high quality research on the topic, particularly in long term

			and expert opinion (of clinical professionals and / or patients).	care settings. Review of the literature shows that delirium can be prevented in about one third of patients at risk by using a multicomponent non-pharmacological intervention in the hospital setting.
Abraha et al (2015)	Systematic overview via PubMed, Cochrane, EMBASE, CINHAL, and PsychINFO search.	Systematic overview of systematic reviews of comparative studies concerning non-pharmacological intervention to treat or prevent delirium in older patients.	24 systematic reviews with 31 primary studies.	Overall, multicomponent non-pharmacological interventions significantly reduced the incidence of delirium in surgical wards. There was no evidence supporting the efficacy of non-pharmacological interventions to prevent delirium in low risk populations. For patients who have developed delirium, the available evidence did not support the efficacy of multi component non-pharmacological interventions. Among single component interventions only staff education, reorientation protocol and Geriatric Risk Assessment resulted effective in preventing delirium.
Haley et al (2018)	CINAHL, Medline, PEDro, Cochrane and Embase search. English language articles to 2017	Systematic review, qualitative synthesis and meta-analysis of RCTs testing the efficacy of physical training in preventing delirium or improving outcomes for adult patients with delirium in the hospital setting.	Seven trials, five of which were multi-component. Total of 1646 participants.	The odds of developing delirium were lower for patients who received physical training compared with a control intervention. There was insufficient evidence to draw conclusions about managing established delirium. Strategies incorporating physical training appeared to prevent delirium in the hospital setting. More research is required regarding management of established delirium.
Halloway (2014)	PubMed, CINAHL, SciVerse, Scopus, PsycInfo and Cochrane search.	Comprehensive review of literature evaluating approaches to delirium management that incorporate approaches to family involvement.	Eleven original or primary research studies.	The review of the articles did not determine if the involvement of families in delirium management improved patient outcomes; however, the review revealed potential for program development and future courses of research.

Cohort Studies					
Study	**Country**	**Participants**	**Setting**	**Delirium/ cognitive measure**	**Findings**

Tow et al (2016)	US	142 older surgical patients.	Surgical	CAM, MDAS	Higher participation in cognitive activities but not higher literacy was associated with decreased delirium incidence and severity in older surgical patients. Supports the case for pre-habilitation
Burton et al (2018)	Scotland	5570 older adults with and without Cognitive Spectrum Disorder (CSD)	Home from hospital	OPRAA	CSD was associated with a reduced likelihood of positive outcomes, specifically dementia and delirium superimposed onto dementia was associated with a greater risk of not being discharged to home and care home admission.
Lenze et al (2004)	US	57 older adults	Rehabilitation hospital	MMSE, Motor FIM, Ham-D	Depression and cognitive impairment were predictive of negative outcomes in elderly patients' rehabilitation from hip fracture. This effect was mediated by rehabilitation participation, and ratings in this area may serve as a potentially useful clinical and research tool for the rehabilitation environment.
Chong et al (2015)	Singapore	234 older adults, majority with hyperactive delirium	Acute geriatric setting	Chinese MMSE, DRS-R98.	The cognitively-impaired hospitalised older adults tended to present with greater impairments in delirium symptoms, namely in cognitive items, suggesting that delirious patients with underlying dementia had poorer cognitive reserves, and that these cognitive functions were likely to deteriorate markedly if delirium arises

Other Articles

Study	**Country**	**Type of article**	**Findings**
Kolanowski et al (2010)	US	Description of an intervention for DSD based on cognitive reserve theory.	Cognitive reserve theory proposes that individuals have differing levels of efficiency in the use of brain networks with some being better able to deploy cognitive strategies to cope with brain pathology. Such 'active reserve', is plastic and therefore capable of being boosted through cognitive exercise. Cognitive reserve theory Intervention designed to rescue remaining cognitive reserve by 1) supporting attentional skills affected by delirium and 2) maximising activity dependent plasticity. Recreation-based cognitive stimulation may activate attention and offer training in multiple cognitive components.
Kolanowski et al (2011)	US	Protocol for trial to test the efficacy of a recreation-based cognitive stimulation for older adults with DSD.	Kolanowski and colleagues described a recreation-based cognitive stimulation intervention. Basing the intervention on participants' individual interests was thought likely to improve motivation and facilitate cognitive processing in the domains affected by delirium – attention, orientation, memory, abstract thinking, and executive function.

Woodrow (1998c)	UK	Editorial discussing healthcare beliefs and values about dementia care.	The old dementia care culture can lead to dehumanisation and second class status of PWD. Based on the work of Kitwood (1995), Woodrow argued for greater attention to non-cognitive expressions of personhood and against what he describes as 'malignant social psychology' resulting in attempts by cognitively impaired people to communicate with others being largely ignored. This calls particular attention to the importance of optimising expressive and receptive communication which may be interrupted in delirium.
Bergmann et al (2005)	US	Description of the development, implementation, and refinement of a nurse-led multifactorial model of care.	The multifactorial delirium abatement program (DAP) is a model of care for older patients admitted to a post-acute nursing facility with delirium. Consisted of screening for delirium, assessment and treatment of potential causes, prevention and management of common complications, and restoration of patient cognitive and self-care function with a rehabilitative environment.
Woodrow (1998a)	UK	Explored issues around quality of life in confusion and dementia.	Human interaction and recreation could contribute to health and quality of life with people with dementia.
Boettger & Breitbart (2011)	US	Examined the differences in phenomenology between hypoactive and hyperactive subtypes of delirium.	Perceptual disturbances and delusions were more prevalent in hyperactive delirium, however are still common in hypoactive delirium.
Green et al (2018)	UK	Investigated language production and comprehension in delirium.	Production of spontaneous speech, word quantity, speech content, and verbal and written language comprehension were impaired in delirious patients compared to cognitively unimpaired patients. Highlights the need for communication strategies adapted to the respective needs of patients and delirium focussed communication guidelines.
Kiely et al (2004)	US	Described the rate of, and baseline patient characteristics that are associated with, delirium persistence.	Four factors were associated with delirium persistence at one month in patients in a post-acute care setting: older age (+85 years), severe delirium at admission, prehospital cognitive impairment and presence of all eight modified delirium symptom interview symptoms at admission.
Delfino et al (2019)	Brazil	Investigated association between management and communication strategies used by caregivers and the presence of NPS presented by older adults with AD.	The use of communication strategies did not differ between groups with or without NPS. Criticism management and active management strategies are strongly associated with NPS.

Key

ABS	Agitated Behaviour Scale	FMIMMS	Functional Independence Measure Motor Subscale
AD	Alzheimer's Disease	Ham-D	Hamilton Depression Rating Scale

ADL	Activities of Daily Living	ICU	Intensive Care Unit
CAM	Confusion Assessment Method	MDAS	Memorial Delirium Assessment Scale
CDR	Clinical Dementia Rating	MOSES	Multidimensional Observational Scale for Elderly Subjects
CI	Cognitive Impairment	Motor-FIM	Motor Functional Independence Measure
CSD	Cognitive Spectrum Disorder	NPS	Neuropsychiatric Symptoms
DRS	Delirium Rating Scale	Nu-DESC	Nursing Delirium Screening Scale
DSD	Delirium Superimposed onto Dementia	OPRAA	Older People's Routine Acute Assessment
DSM-III-R	Diagnostic and Statistical Manual of Mental Disorders. Three-Revised	TOWER	Tower of London Test of Executive Function

Supplementary Material 1: Rameses Reporting Checklist

TITLE			**Page reference**
1		In the title, identify the document as a realist synthesis or review	Page 1
ABSTRACT			
2		While acknowledging publication requirements and house style, abstracts should ideally contain brief details of: the study's background, review question or objectives; search strategy; methods of selection, appraisal, analysis and synthesis of sources; main results; and implications for practice.	Page 1
INTRODUCTION			
3	Rationale for review	Explain why the review is needed and what it is likely to contribute to existing understanding of the topic area.	Page 2
4	Objectives and focus of review	State the objective(s) of the review and/or the review question(s). Define and provide a rationale for the focus of the review.	Page 2
METHODS			
5	Changes in the review process	Any changes made to the review process that was initially planned should be briefly described and justified.	Page 4
6	Rationale for using realist synthesis	Explain why realist synthesis was considered the most appropriate method to use.	Page 3

TITLE			Page reference
7	Scoping the literature	Describe and justify the initial process of exploratory scoping of the literature.	Page 3
8	Searching processes	While considering specific requirements of the journal or other publication outlet, state and provide a rationale for how the iterative searching was done. Provide details on all the sources accessed for information in the review. Where searching in electronic databases has taken place, the details should include, for example, name of database, search terms, dates of coverage and date last searched. If individuals familiar with the relevant literature and/or topic area were contacted, indicate how they were identified and selected.	Page 3-4 Table 1
9	Selection and appraisal of documents	Explain how judgements were made about including and excluding data from documents, and justify these.	Page 4-5
10	Data extraction	Describe and explain which data or information were extracted from the included documents and justify this selection.	Page 4-5
11	Analysis and synthesis processes	Describe the analysis and synthesis processes in detail. This section should include information on the constructs analyzed and describe the analytic process.	Page 4-5
RESULTS			
12	Document flow diagram	Provide details on the number of documents assessed for eligibility and included in the review with reasons for exclusion at each stage as well as an indication of their source of origin (for example, from searching databases, reference lists and so on). You may consider using the example templates (which are likely to need modification to suit the data) that are provided.	Page 6, figure 1

TITLE			Page reference
13	Document characteristics	Provide information on the characteristics of the documents included in the review.	Page 6. Tables 2 and 3
14	Main findings	Present the key findings with a specific focus on theory building and testing.	Pages 6-14
DISCUSSION			
15	Summary of findings	Summarize the main findings, taking into account the review's objective(s), research question(s), focus and intended audience(s).	Page 14
16	Strengths, limitations and future research directions	Discuss both the strengths of the review and its limitations. These should include (but need not be restricted to) (a) consideration of all the steps in the review process and (b) comment on the overall strength of evidence supporting the explanatory insights which emerged. The limitations identified may point to areas where further work is needed.	Page 16
17	Comparison with existing literature	Where applicable, compare and contrast the review's findings with the existing literature (for example, other reviews) on the same topic.	N/A
18	Conclusion and recommendations	List the main implications of the findings and place these in the context of other relevant literature. If appropriate, offer recommendations for policy and practice.	Page 15-16
19	Funding	Provide details of funding source (if any) for the review, the role played by the funder (if any) and any conflicts of interests of the reviewers.	Page 17

Supplementary Material 2: Search Terms for Stage 1 and data extraction template

Population	Intervention	Study Type
MEDLINE, Embase, PsychINFO (Ovid SP)		
Delirium Acute confusion* <u>MeSH</u> Delirium, Confusion	Rehabilitation Reablement Congitiv* Stimulat* Intervention Goal management training Physiotherapy Physical Therapy Occupational Therapy <u>MeSH</u> Exp Rehabilitation	randomi?ed.tw. rct*.tw. (trial* or controlled or "control group*").tw. ((single or doubl* or tripl* or treb*) and (blind* or mask*)).tw. ("4 arm" or "four arm").tw. ((before adj4 after) or "BA stud*" or "CBA stud*").tw. ("pre post" or "pre test*" or pretest* or posttest* or "post test*" or (pre adj3 post)).tw. (interrupt* adj2 "time series").tw. ("time points" adj3 (over or multiple or three or four or five or six or seven or eight or nine or ten or eleven or twelve or month* or hour* or day* or "more than")).tw. (("quasi experiment*" or quasiexperiment* or "quasi random*" or quasirandom* or "quasi control*" or quasicontrol*) adj3 (method* or stud* or design*)).tw. randomized controlled trial.pt. controlled clinical trial.pt. or/66-77
CINAHL (Ebsco)		
(AB (delirium or acute confusion or confusion or disorientation) OR TI (delirium or acute confusion or confusion or disorientation))	AND (AB (rehabilitation or reablement or congitiv* stimulat* or intervention or goal management training or physiotherapy or physical therapy or occupational therapy) OR TI (rehabilitation or reablement or congitiv* Stimulat* or Intervention or Goal management training or Physiotherapy or Physical Therapy or Occupational Therapy))	N/A in EBSCO

Data extraction template

Title of paper. Author(s) and date	
Study details	Country / Countries:

	Objective(s):
	Setting(s):
	Number of participants / subjects:
	Characteristics of participants / subjects:
Methods	
Study design	
Background, context, problem	
WHAT action / intervention / process	
WHY is it thought to work (programme theory)	
Duration / intensity / delivered by	
Outcomes	
Conclusion	
Context	Positive
	Negative
Key strengths and limitations	Strengths
	Limitations