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Using a taxonomy of behaviour change techniques to define key components of Stop Delirium! a complex intervention to prevent delirium in care homes

Mahdi¹, Mahmoodi² & Siddiqi³

¹ School of Health and Related Research, University of Sheffield, UK

² School of Social Sciences, Leeds Beckett University, UK

³ Department of Health Sciences, University of York, UK

Corresponding Author:

Neda Mahmoodi, School of Social Sciences, Department of Psychology, City Campus, CL815 Calverley Building, Leeds Beckett University, Leeds, LS1 3HE, UK

Email: n.mahmoodi@leedsbeckett.ac.uk

Telephone: +44 (0)113 812 2934

Abstract

Objective: This paper aims to describe Behaviour Change Techniques (BCTs) used within a multi-component intervention to prevent delirium in older people living in care homes, called Stop Delirium!

Methods: The Behaviour Change Technique Taxonomy version 1 (BCTTv1) was used to code and characterise the ‘key ingredients’ within Stop Delirium!. Four sources of information were examined to identify BCTs used: intervention manual and toolkit; the delirium resource box; and contemporaneous written logs recorded by staff delivering the intervention in two feasibility studies. Details of BCTs used in each part of the intervention and whom they were targeting were recorded, as well as the frequency of each identified BCT.

Results: 31.2% of all BCTs described in the BCTTv1 were used in the Stop Delirium! intervention. The majority of BCTs focused on changing care home staff behaviour through enhanced education, training and empowerment. ‘Social support (practical)’ was the most frequently occurring BCT.

Conclusion: The large number of different BCTs identified within the Stop Delirium! intervention reflects the complexities of multicomponent interventions. The prominence of social support and empowerment further emphasises the group and organisational effort required to improve delirium care. By explicitly identifying and describing the BCTs used in Stop Delirium!, can enhance standardisation and replicability, and promote intervention fidelity for future trial evaluation and implementation of a multicomponent intervention to prevent delirium in long-term care.

Introduction

Delirium is defined as a state of impaired attention and cognitive function that develops quickly and fluctuates in severity (National Institute for Health and Clinical Excellence (NICE), 2010). Delirium commonly affects older people and is associated with considerable distress (Breitbart, Gibson, & Tremblay, 2002) and poor outcomes (Siddiqi, House, & Holmes, 2006). The care home population is changing rapidly, with the average age of residents, prevalence of dementia, and levels of co-morbid illness all rising (Bowman, Whistler, & Ellerby, 2004; Lindesay, Rockwood, & Rolfson, 2002; Stewart et al., 2014). This means that residents of care homes are likely to be at increased risk of delirium compared with the general population (Clegg, Heaven, Young, & Holt, 2014; McCusker et al., 2011; Siddiqi et al., 2016). However, delirium can be prevented. Multi-component interventions that target delirium risk factors have been shown to prevent around one-third of delirium episodes in hospitals (Inouye et al., 1999; Lundstrom et al., 2005; Marcantonio, Flacker, Wright, & Resnick, 2001), and have been recommended for both hospital and care home settings by national clinical guidelines (British Geriatrics Society and Royal College of Physicians, 2006; NICE, 2010). However, such multicomponent interventions, by their very nature, are ‘complex’ (Craig et al., 2008) making implementation and replication challenging (Victoria, Habicht, & Bryce, 2004). Moreover, the evidence base on which to base recommendations for implementation of delirium prevention interventions in care homes is still under development (Clegg et al., 2014).

Randomised controlled trials (RCTs) are the ‘gold standard’ to establish the effectiveness of interventions, be they single component, relatively ‘simple’ interventions or more multifaceted interventions targeting complex changes in healthcare practice; and meta-analyses of such trial evidence is accepted to be the highest order of evidence to guide

clinical practice (Wells, Williams, Treweek, Coyle, & Taylor, 2012). Replication, accumulation and application of evidence depend on the ability to reliably specify the details of the intervention being tested, both for primary research and for secondary evidence syntheses (Chan et al., 2013; Craig et al., 2008; Neumann et al., 2002; Schulz, Altman, & Moher, 2010).

Complex interventions have posed considerable challenges to researchers attempting to identify the mechanisms underpinning their effects and to replicate them. It is only through the systematic specification of the intervention to isolate its separate techniques, and the subsequent testing of specific techniques in factorial designs that we can fully evaluate which techniques are effective in changing health behaviour. For a complex intervention, what is required then is a detailed description and specification of all the components of which it is comprised, including the key 'active ingredients' implicated in changing whichever behaviours are being targeted. Recent advances in behavioural science permit such detailed identification and description of intervention components, using a comprehensive classification system with agreed definitions (Davidson et al., 2003; Hoffman et al., 2014; Michie, Fixsen, Grimshaw, & Eccles, 2009b; Proctor, Powell, & McMillen, 2013).

There has been considerable progress in the scientific literature on identification and isolation of the single components or techniques adopted in interventions to change behaviour. This has resulted in the development of taxonomies of the individual techniques that are effective in changing the antecedents of behaviour in health-related behavioural interventions. For example, 'MINDSPACE' an influential report from the UK's Institute of Government, is intended as a checklist for policymakers of the most important influences on behaviour (Institute for Government, 2010). The report recognises two systems by which human behaviour can be influenced - the reflective and the automatic - but it focuses on the latter

and does not attempt to link influences on behaviour with the reflective. An analysis by Michie, Stralen, and West (2011a) also suggests that it lacks coherence. A second example comes from the Cochrane Effective Practice and Organisation of Care Review Group (EPOC, 2010) taxonomy. This broader taxonomy contains a list of strategies, which has been used to categorise intervention content in systematic reviews (Tricco et al., 2012). The taxonomy includes methods aimed at system level change, and designed to improve health service delivery and practice. While the EPOC taxonomy helps to provide a common language, the terms used are not mutually exclusive, and it is limited by broad categories which include diverse types of interventions at different conceptual levels. Leeman, Baernholdt, and Sandelowski (2007) linked existing taxonomies with relevant theories (contingency, diffusion of innovation, and behavioural change theories) to develop a theory-based taxonomy of methods for implementing change in healthcare practice, with particular attention to nursing. By linking theory to methods, the taxonomy can be used for matching behaviour change strategies to differences in the nature and context of the practice change. However, the taxonomy can arguably be critiqued as 'impoverished' by a lack of process information and limited description of methods used.

Changing behaviour is challenging, but can be more effective if interventions are based on evidence-based principles of behaviour change (Abraham, Kelly, West, & Michie, 2009). It has been argued that behaviour change interventions based on theory are more effective (Albarracin et al., 2005; Gourlan, Bernard, & Bortholon, 2014; Ivers et al., 2012; Noar & Zimmerman, 2005) and where theory use is scant, identifying the intervention functions and behaviour change techniques (BCTs) used can reveal the implicit theoretical assumptions underpinning interventions (Gardner, Whittington, McAteer, Eccles, & Michie, 2010). A more recently developed method is to systematically describe and define the 'key

components' of a complex intervention and to identify the theory informed BCTs on which they are based. A BCT is defined as an “observable, replicable, and irreducible component of an intervention designed to alter or redirect causal processes that regulate behaviour, that is, a technique that is proposed to be an ‘active ingredient’ (p.82)” (Michie et al., 2013). Coding for BCTs in interventions can provide a useful summary of the broad strategies and specific techniques that have been employed (Gardner et al., 2010).

The last decade has seen the emergence of several comprehensive taxonomies of BCTs that can be used to classify active ingredients of interventions using agreed definitions. These taxonomies have been used to improve our understanding of the contents of interventions in a range of health behaviour contexts, and provide opportunities to synthesise evidence at a BCT level (Abraham and Michie, 2008; Avery, Flynn, van Wersch, Sniehotta, & Trenell, 2012; Dombrowski et al. 2012; Rodrigues, Sniehotta, & Araujo-Soares, 2013). Many have been developed and applied to particular behavioural areas focusing on patient and public physical activity and healthy eating (Michie et al., 2011b), alcohol consumption (Michie et al., 2012), smoking cessation (Michie, Hyder, Walia, & West, 2011c), prevention of sexually transmitted infections (Abraham, Good, Warren, Huedo-Medina, & Johnson, 2011; Albarracin et al., 2005) and changing professional behaviour (Ivers et al., 2012).

Abraham and Michie (2008) developed the first cross-behaviour BCT taxonomy, building on previous intervention content analyses (Hardeman, Griffin, Johnston, Kinmonth, & Wareham, 2000). Reliability was demonstrated by identifying 22 BCTs and 4 BCT packages across 221 intervention descriptions in papers and manuals. This method has been widely used internationally to report interventions, synthesise evidence (Araujo-Soares, MacIntyre, MacLennan, & Sniehotta, 2009; Gardner et al., 2010; Quinn, 2010; Michie, Jochelson, Markham, & Bridle, 2009c) and design interventions (Cahill, Moher, & Lancaster, 2008;

Michie, Johnston, Francis, Hardeman, & Eccles 2008). It has also enabled the specification of professional competences for delivering BCTs (Dixon & Johnston, 2012; Michie, Churchill, & West 2011d), and guidance has also been developed for incorporating BCTs in text-based interventions (Abraham, 2011).

More recently, a comprehensive version of the BCT taxonomy has been developed (Behaviour Change Techniques Taxonomy version 1- BCTTv1), which has wider applicability and includes 93 BCTs, organised into 16 domains (Michie et al., 2013). The BCTTv1 has recently been used to characterise the active ingredients in trials of implementation interventions for diabetes care (Presseau et al., 2015) and falls in old age (Vestjens, Kempen, Crutzen, Kok, & Zijlstra, 2015). It has been suggested that the prospective use of this taxonomy for developing and reporting intervention content would aid in building a cumulative science of implementation for complex health interventions (Presseau et al., 2015).

Few delirium interventions have been developed specifically for the care home setting, and to date, there have been no definitive trials of delirium prevention in long-term care. We recently completed a feasibility cluster randomised trial of Stop Delirium! in 14 care homes in the UK (Siddiqi et al., 2016). Stop Delirium! is a multi-component intervention designed to prevent delirium in older people living in care homes. The intervention is based on the evidence-base for delirium prevention and for changing professional practice (Inouye et al., 1999; Lundstrom et al., 2005; Marcantonio et al., 2001; Tabet et al., 2015). It is essentially an enhanced educational package which provides clinical staff with the relevant skills to identify and target risk factors associated with delirium. Our previous research showed that Stop Delirium! increases awareness of delirium and self-reported confidence in delirium care in care home staff (Siddiqi et al., 2011). This present paper sets out to identify and describe the

key components and BCTs used in the Stop Delirium! intervention and relate them to the BCTTv1 taxonomy for the purpose of increasing intervention fidelity and standardisation to support future trial implementation (Michie & Abraham, 2004). Such an endeavour is essential if the effectiveness of complex interventions that adopt BCTs is to be adequately evaluated.

Methods

The Stop Delirium! intervention has been described in an earlier paper by Siddiqi, Young, Cheater, and Harding (2008). The intervention was delivered to six care homes over a 10-month period. It aimed to place measures to identify and modify preventable risk factors in care home residents, make changes to the physical environment, modify organisational structures that may have a negative effect on delirium, and promote screening and early identification of delirium. Five key components make up the intervention: i) a specialist delirium practitioner, who trains support care staff to deliver the intervention and liaises with key professionals working in care homes to embed the intervention in the wider context of residents' care; ii) interactive educational sessions, which provide basic information about delirium; iii) facilitated working groups of care home staff, which enable staff to implement their education session learning into the care home; iv) a delirium champion, who oversees the continuous implementation of the intervention in the care home and continues to train staff in the absence of the specialist delirium practitioner; and v) a delirium box, which provides written education materials aimed at reinforcing learning and the NICE guidelines. The intervention is primarily designed to change care home staff behaviour, although it also includes written educational materials aimed at residents and relatives or friends. Figure 1 lists the broad principles of the Stop Delirium! intervention.

An earlier feasibility study reports on the effectiveness of The Stop Delirium! intervention in reducing the rates of delirium presentation within care homes (Siddiqi et al., 2011).

Qualitative and quantitative data was collected which provided clear insight into the potential impact of the trial and potential findings. Staff self-reported outcome measures showed a decrease in the number of drugs prescribed from baseline to post-intervention. Additional self-reported data suggested a decrease in residents with hospital admission, residents attending A&E, residents with urgent GP consultations, number of falls, and number of antibiotic prescriptions. Results also suggested an increase in recorded delirium episodes post-intervention in comparison to baseline. In addition, there was positive improvement post-intervention (N=68), in comparison to baseline (N=195), in staff confidence regarding their ability to recognise (75% vs. 47.7%), prevent (75% vs. 25.1%) and manage (69.1% vs. 34.4%) delirium, respectively.

Our main objective was to identify the key behaviour change techniques, according to the Behaviour Change Taxonomy, utilised within the Stop Delirium! intervention.

[INSERT] Figure 1: Principles of the Stop Delirium! intervention

We examined four data sources for the Stop Delirium! intervention:

- i) The Stop Delirium! intervention manual, which was developed following the initial development and feasibility study (Siddiqi et al., 2011), and which provides a ‘step by step’ guide to delivery of the intervention. The manual describes in detail each component that forms the interventions, as described above, and the competencies of the staff required to deliver the intervention.
- ii) The Stop Delirium! toolkit. This includes guidance on how to use the manual, and master copies of all the written materials and tools used in the intervention.

- iii) The delirium box, a resource for care homes, containing a range of educational materials and reminders. All material within the delirium box formed part of the intervention and was used for teaching and learning purposes. This included, care pathway cards (catheter care, constipation, dehydration, medication, dying of thirst, environment, good communication and pain), information for resident's leaflet, delirium poster, NICE guidance, delirium checklist, vignette book (this included case examples of delirium), how would you feel cards, bookmarks, how can I prevent...? cards and a quiz.
- iv) Contemporaneous written logs recorded by delirium practitioners (specialist practitioners who delivered the Stop Delirium! intervention). Logs were kept in both the earlier intervention development study (Siddiqi et al., 2011) and the recent feasibility trial (Siddiqi et al., 2016), and recorded the process and challenges faced by the delirium practitioners in implementation and delivery of the intervention. The written logs themselves did not form part of the intervention. They did, however, act as a data source in the form of a diary, as they provided insight into how the intervention was actually delivered by the delirium practitioner, as opposed to how it should have been delivered as advised in the manual.

Information was extracted and described in sufficient detail from these four data sources of the intervention, using the Template for Intervention Description and Replication (TIDieR) checklist (Hoffman et al., 2014), to allow replication.

Behaviour change technique coding

A researcher (SM), with no prior knowledge of the Stop Delirium! intervention, systematically examined the components (delirium practitioner role, working groups, education sessions, delirium box, and champion) and data sources of the intervention to

identify BCTs used, using the definitions and examples provided in the BCTTv1 coding manual.

A pre-piloted data extraction table was created which detailed: a) BCTs used in each component of the intervention; b) the target for the BCT (care home staff or relatives and friends); c) the data source; and d) extracts of the evidence on which judgments were made. All 93 BCTs were considered for each of the components of the Stop Delirium! intervention. Following coding, Excel software was used to generate a report of all BCTs coding and their frequency.

Where several examples of evidence for the same BCT were identified, these were grouped to avoid repetition. Coding of BCTs and themes were checked by a second researcher (NM), who also had no prior involvement in developing the Stop Delirium! intervention, and independently reviewed the data sources. Any differences in coding BCTs were noted and discussed with the first researcher to reach consensus; where consensus could not be reached, a third researcher, who had led the development of the intervention (NS) was consulted for clarification. NM also assisted with contextualisation of the themes and BCTs, as reflected in the findings. All researchers involved in this process had previously completed the recommended online coder training (Wood et al., 2015), and were experienced in using BCT taxonomies and in intervention development in health psychology.

Results

In line with the NICE (2010) Delirium guidelines, Stop Delirium! targets seven key risk factors for delirium: confusion, infection, poor mobility, pain, prescribed medication, difficulty hearing or seeing, and sleep problems. The majority of BCTs (n= 29, 31.2%) identified in the intervention focused on changing care home staff behaviour to address these

risk factors, through enhanced education and training. Two (2.2%) BCTs (*'shaping knowledge'* and *'information about health consequences'*), also targeted relatives or friends through materials provided in the delirium box.

Behaviour change techniques identified

In total, 14 of the 16 domains (87.5%) and 29 out of the 93 (31.2%) BCTs listed in the BCTTv1 taxonomy were identified in the Stop Delirium! intervention. Supplementary File 1 illustrates a comprehensive overview of the BCTs, target audience, data source, intervention component, and example evidence.

Twenty-five (26.9%) BCTs were identified within the working groups component of the intervention; 16 (17.2%) BCTs were identified within the delirium box; 10 (10.8%) BCTs were identified within education sessions; two BCTs (2.2%) were identified within the delirium champion component; and five (5.4%) were identified with the delirium practitioner. Table 1 lists the BCTS identified in each component of the Stop Delirium! intervention. The delirium practitioner was responsible for delivering the various other components of the intervention to staff. As such, all of the BCTs identified in the delirium practitioner part of the intervention, were also present in one or more of the other components. BCTs for this component were therefore not recorded separately. The BCTs identified within and form the intervention is a reflection of how the intervention was used to prevent delirium.

[INSERT] Table 1: BCTs identified in each component of the intervention

The most frequently used BCT, common to all components of the intervention, was *'social support (practical)'*. Examples of practical social support were demonstrated within education sessions, where staff were advised to “buddy up” in between teaching sessions to look out for delirium to facilitate learning. This BCT was also demonstrated through the

working groups component of the intervention. Working groups provided practical social support through peer support to put learning into practice. Care home staff were advised to aid residents' sleep by providing warm drinks at bedtime, increase residents' nutrition by providing them with the necessary aids they needed to eat, and prevent residents' pain by using alternative pain relief methods. The delirium box also included guidance on how to provide practical social support to care home residents. For example, staff were advised to attenuate disorientation in residents by checking their aids were clean and functional, whilst clearing ear wax regularly. Staff were also advised to provide clear signs to help navigation, provide safe footwear and walking aids to prevent environment falls, and to keep jugs and cups of water within reach to promote hydration. As well as staff, the delirium practitioner also demonstrated the BCT '*social support (practical)*', by acting as a mentor, and training and supervising the delirium champions to deliver the Stop Delirium! intervention. As can be seen within complex interventions, the recipient of the behaviour change technique can vary. In this case, social support was demonstrated at one time by the delirium practitioner towards the care home staff, and at other times care home staff provided social support to residents in order to try and reduce their risk of delirium.

There were also four other BCTs commonly used in the intervention:

1) '*Social support (unspecified)*' frequently targeted staff within working groups, the delirium box, and the delirium champion. Learning was encouraged and reinforced through sharing of knowledge and experiences between staff, whereas delirium champions were designed to help staff channel their knowledge on residents' needs in order to address specific risk factors for delirium.

2) '*Information about health consequence*' was demonstrated throughout education sessions, where information was provided on the negative outcomes of delirium, causes and risk

factors, including personal accounts. In addition, during working groups, care pathway cards were produced which discussed the risk factors of delirium covering aspects of disorientation, falls, immobility, sleep deprivation, dehydration, infections, medication, poor nutrition, and pain. The delirium box also provided information about dehydration for family and friends (amongst other risk factors) and discussed why older people are more at risk of delirium, including causes, consequences and signs of dehydration.

3) *'Demonstration of behaviour'* was demonstrated during education sessions where staff were provided with a "personal account of delirium" hand-out which provided an example of the symptoms of delirium. During working groups staff were also asked to engage in practical tasks that promote learning, such as observing their own fluid input/output. Vignette booklets were provided within the delirium box which described personal experiences of people with delirium.

4) Use of *'prompts/cues'* was also a common BCT used throughout the intervention. Delirium recognition cards, "How can I prevent..." cards and "How would you feel" bookmarks were used to help staff recognise delirium. During working groups, items of "homework" were also given to prompt groups into thinking about delirium risk factors in their own time. A delirium checklist was also produced which acted as a prompt to help staff screen residents, record observations and hand over information between shifts.

One of the core aspects emphasised within the intervention was the concept of 'empowerment'; staff were encouraged to take ownership of the day-to-day practices within care homes. As this was not well represented in the taxonomy, this concept was coded to the nearest BCTs (*'valued self-identity'* and *'verbal persuasion about capability'*).

The Delirium Practitioner empowered staff by highlighting the unique position, knowledge and expertise of staff that can contribute to preventing delirium. The Delirium Practitioner also ensured staff took ownership of their proposed ideas for changes to be made in care homes. Table 2 provides additional, but non-exhaustive, examples of how the behaviour change techniques identified throughout the Stop Delirium! intervention were demonstrated. The supplementary document provides a complete and detailed version of table 2.

[INSERT] Table 2: Illustrations of BCTs within Stop Delirium! intervention

Discussion

The aim of this paper was to identify the behaviour change techniques that formed a complex multi-faceted intervention that targeted delirium prevention. We identified just over one-third of all BCTs described in the BCTTv1 in the Stop Delirium! intervention. Our findings are similar to other studies (Presseau et al., 2015; Vestjens et al., 2015), which also identified a large number of BCTs within implementation and complex behaviour change interventions. This reflects the necessary level of complexity in interventions to change staff behaviour and organisational systems, which require diverse ‘active ingredients’ to generate positive changes in behaviour and improve outcomes. Future delirium prevention interventions, involving a component of staff and patient behaviour change, could be well-served to consider incorporating these BCTs given the positive outcomes of the Stop Delirium! intervention (Siddiqi et al., 2016).

The BCTs relating to the domain ‘*social support*’ featured significantly in the intervention, as has also been the case with other multicomponent interventions described in the literature (Presseau et al., 2015; Vestjens et al., 2015). This is perhaps not surprising; the work required to improve delirium care cannot be an individual endeavour, but rather requires changes and

support at staff group and organisation level. It could also be relevant that the majority of staff in care home settings do not have professional qualifications, and have limited influence on decisions about the organisation of care. Social support is vital for care home staff to be able to make use of any knowledge-giving or training intervention (Zimmerman et al., 2005).

Information about health consequences is considered an effective behaviour change technique and is prominent within the behaviour change literature. The Health Belief Model (Hochbaum, 1958; Rosenstock 1966), for instance, has specified perceived susceptibility and perceived seriousness of a health consequence as key variables that can shape an individual's perceived threat of a behaviour, which in turn can contribute towards actual behaviour change. In the case of the Stop Delirium! intervention, care home staffs' perceived risk of delirium was facilitated by providing them with information about the health consequences of delirium.

Bandura's Social Learning Theory (Bandura, 1977) provides a strong basis for how the demonstration of a target behaviour can inspire an individual to imitate such behaviour. Many behaviour change interventions have been designed around the notion of imitation, or modelling, and have primarily targeted behaviour change amongst children (Home, Tapper, Lower, Hardman, Jackson, & Woolner, 2004). In the Stop Delirium! intervention, care home staff were given the opportunity to learn about real-life instances in which delirium had occurred and the main symptoms to look out for. The inclusion of practical tasks allowed care home staff to learn about precautionary measures and checks that they ought to take and to get them in that habit of routine.

Many instances concerning behaviour change may fail to materialise not because an individual is averse to adopting a pro-health behaviour, but simply due to forgetfulness.

Learning Theory suggests that repeated exposure to cues and consequences can form habitual

behaviours (Blackman, 1974). Habits are formed when a certain context or cue automatically triggers a particular behaviour (Neal, Wood, Labrecque, & Lally, 2012). Care home staff behaviour may be enacted in a habitual manner where routine, rather than reasoning, may be the driving force behind decisions and actions (Bonetti et al. 2010). Therefore, the use of prompts and cues as a social stimulus, to constantly remind staff of their learning and delirium risk factors, can help break old habits where such behaviours did not take place and shape the basis of new habit formation.

The ‘empowerment’ aspect of the intervention was highly valued by these staff (Siddiqi et al., 2011) and again speaks of the need to promote and provide care staff additional support, confidence and skills to effect change in their environment and practice. Although ‘empowerment’ was a core aspect of the Stop Delirium! intervention, this was not listed as a BCT in the BCTTv1 (Michie et al., 2013). The research reports important findings showing that there are additional techniques that should be specified in addition to the BCTs outlined in the BCTTv1, if we are to fully describe interventions. The researchers mapped empowerment to the closest BCTs which resembled it: ‘*valued self-identity*’ and ‘*verbal persuasion about capability*’. The BCTTv1 has, to date, provided a common language and definitions for understanding and classifying behaviour change techniques, as well as informing the design and aiding accurate replication of future and present complex interventions, respectively. However, the taxonomy may not capture all pertinent behaviour change techniques. Indeed, the authors suggest that the taxonomy will continue to be added to, as it is applied to more interventions (Lorencatto, West, & Seymour, 2011; Michie et al., 2013). Research investigating multicomponent interventions to prevent delirium remains relatively limited. Although we are not proposing that a separate taxonomy be formulated for delirium care, such as has been formulated for smoking cessation (Michie et al, 2011c), we

agree that that taxonomy will need to be expanded to address the range of settings in which interventions may be implemented, and audiences that BCTs may target. The taxonomy may also benefit from more comprehensive definitions and guidance for coding BCTs, with particular attention on items that may have a degree of overlap. This will help promote standardisation of the mapping process, and narrow the possibility of subjective interpretation of BCTs and their respective definition within delirium practice.

Systematically identifying and describing in detail the components and BCTs in Stop Delirium! using BCTTv1, can enhance its replicability in future research and promote accurate implementation in delirium care. Future trial evaluations should include measurement of intervention fidelity in order not only to establish effectiveness, but also to identify the key techniques that influence outcomes. This will help establish whether a study reliably and validly implements a clinical intervention. Should an intervention be found to be effective (or ineffective) in a trial, if fidelity has not been monitored, it will remain unclear whether the findings are actually due to the intervention or have been influenced by unintentional inclusion of external factors or omission of intervention components (Cook & Campbell, 1979). Categorising a complex intervention into BCTs helps facilitate understanding of this process as it makes clear the behaviours targeted, and the techniques used to promote behaviour change. As a next step, it would be appropriate to develop an intervention fidelity tool to help assess the extent in which the Stop Delirium! intervention is being carried out as is prescribed and in accordance to the BCTs identified.

Recommendations of factors to consider in developing measures of fidelity have been outlined in Bellg et al. (2004). The authors have provided a breakdown of fidelity strategies for monitoring and improving provider training, delivery of treatment, receipt of treatment, and enactment of treatment skills.

In addition, these pre-defined behaviour change techniques can also be used as a source of intervention evaluation within service delivery, where individuals whom the intervention is targeting can rate how effective they felt each BCT was in helping them change their behaviour and reach the desired outcome. This would not only be used as a source of feedback for the individual delivering the intervention, but also feedback about which part of the intervention seemed most effective. Future studies should test which BCTs are most effective in promoting behaviour change and bringing about desirable behaviours, which could then, in effect, be used to simplify multicomponent, complex interventions. This would have a positive impact on the time required to deliver an intervention, and could potentially reduce the time demanded from care home staff for intervention implementation.

Our research focused on the identification of BCTs rather than mechanisms of change. Future research should further explore the mechanisms of change in complex health interventions, and identify the likely candidate mediators. In doing this it will enable the formation of more cost-effective and time-efficient revisions to the intervention, as well as help reduce its complexity so that it is easier to adopt and implement, which in turn may generate a greater interest in uptake. This would be highly desirable within care-home practice and delirium care; working within a fast-paced demanding environment, with irregular hours, reduces care home staff availability to participate in time-consuming interventions. Considering that delirium is an avoidable and preventable by-product of poor care for older people, it is essential to raise awareness among care home managers of the most frequently used BCTs that have emerged within this intervention so that they can consider adopting this through staff mentoring and training opportunities. Further implementing interventions should aim to categorise and make explicitly clear all of the BCTs adopted and coded using a taxonomy. Doing this will help promote a standardised

classification system which will enable future replicability of healthcare and delirium interventions. It will also allow comparisons to be made between different interventions with respect to the BCTs implemented; this will be considerably useful when conducting systematic reviews and meta-analyses investigating effectiveness of interventions for delirium care, especially considering the scarcity of trial evaluations. Through the use of the BCTTv1, randomised controlled trials and various interventions can all speak a common language when relating back to their methods and the techniques used to modify behaviour. This will reduce the potential for misclassification, misinterpretation and misrepresentation of similar, but distinctly different, behaviour change approaches.

Our approach to describing the components and BCTs in Stop Delirium! has some limitations. First, although two researchers independently examined and coded materials from previous studies of the intervention, no contemporaneous observations of BCTs during intervention delivery were made. Such post-hoc BCT coding is subjective to the coders' understanding of the intervention protocol, manual and resources used to deliver the intervention, and reports about its delivery, which may not reliably reflect practice. More explicit consideration of the target behaviours and mapping of the BCTs that can influence these prospectively during intervention development, along with contemporaneous documentation of the BCTs used during delivery would be desirable in future design of delirium interventions. Second, inter-rater reliability was not assessed between coders before consensus discussions took place. Third, although both researchers coding for BCTs were independent of the development of the intervention, a third researcher, who had led the work to design Stop Delirium! was used to address any discrepancies that could not be resolved through consensus. This may have influenced objectivity of the process. However, this was in fact only required in three instances.

This research did not seek to investigate which BCTs are the most effective, or active ingredients within the Stop Delirium! intervention, that significantly prevented delirium. This is an endeavour for future research. On the other hand, this study did seek to identify the BCTs, or active ingredients, that formed this complex intervention. We expect our research to advance knowledge by enhancing the conceptualisation and operationalisation of delirium interventions, by assessing the uniqueness of the Stop Delirium! techniques against the behaviour change techniques identified in the most recent BCTTv1 taxonomy. The identification of the specific techniques that make up the Stop Delirium! intervention will enable researchers to develop studies that may establish which of the techniques, or combination of techniques, is most effective in changing health behaviour in delirium care. In addition, the identification of techniques may assist in developing more efficient and parsimonious interventions by reducing redundancy and focusing on the techniques that are most effective. This will not only assist in identifying the key techniques, but will also assist delirium researchers and practitioners increase the efficiency of their interventions (Hardcastle et al., 2015).

Conclusion

To our knowledge, this was the first attempt to explore the utility and capacity of using the BCTTv1 to code an intervention for delirium care. The findings from this study show that it is possible to use a taxonomy that focuses on behaviour change in this clinical context. This study contributes to the ongoing emerging evidence demonstrating the reliability and applicability of taxonomy coding methods in understanding the contents of behaviour change interventions (Michie, Abraham, Whittington, McAteer, & Gupta 2009a; Michie et al., 2012; Siddiqi et al., 2011; West, Walia, Hyder, Shahab, & Michie, 2010). The BCTTv1 is a useful tool for characterising a delirium intervention content in more detail and offers a promising

way forward in identifying and analysing the active ingredients, which are necessarily complex. A challenge common to studies investigating effectiveness of complex interventions is the difficulty in identifying which of the many BCTs involved most influence behavioural outcomes. Identification of these BCTs could lead to simplification of interventions, improving implementation and reducing costs within delirium care. For research to improve service delivery for the treatment of delirium, there is a need to improve understanding of the BCTs being used, and to study fidelity to intervention components in process evaluations alongside effectiveness trials in order to develop streamlined evidence-based interventions. Future delirium intervention research should routinely include the use of behaviour change taxonomies in development, testing and implementation of interventions to improve delirium care.

Disclosure statement

The authors declare that they have no competing interests.

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Table 1: BCTs identified in each component of the Stop Delirium! intervention

BCT domain	BCT	Working groups (n=25)	Education sessions (n=10)	Delirium box (n=16)	Delirium champion (n=2)	Delirium Practitioner (n=5)
1	1.1 Goal setting	X				X
	1.2 Problem solving	X	X			X
	1.3 Action planning	X		X		
2	2.1 Monitoring of behaviour by others without feedback	X		X		
	2.2 Feedback on behaviour					X
	2.5 Monitoring outcome(s) of behaviour by others without feedback	X		X		
	2.6 Biofeedback	X		X		
3	3.1 Social support (unspecified)	X		X	X	
	3.2 Social Support (practical)	X	X	X	X	X
4	4.1 Instruction on how to perform a behaviour	X		X		X
	4.3 Re-attribution		X			
5	5.1 Information about health consequences	X	X	X		
	5.3 Information about social and environmental consequences		X			
6	6.1 Demonstration of the behaviour	X	X	X		
	6.2 Social comparison	X				
7	7.1 Prompts/cues	X	X	X		
	7.5 Remove aversive stimulus	X		X		
8	8.1 Behavioural practice/ rehearsal	X				
	8.2 Behaviour substitution	X				
9	9.1 Credible source	X	X			

	10.1 Material incentive (behaviour)	X	
10	10.3 Non-specific reward	X	
	11.1 Pharmacological support	X	X
11	11.3 Conserving mental resources	X	
	12.1 Restructuring the physical environment	X	X
12	12.2 Restructuring the social environment	X	X
	12.5 Adding objects to the environment	X	X
	12.6 Body changes	X	X
13	13.4 Valued self-identity	X	
15	15.1 Verbal persuasion about capability	X	

Table 2: Illustrations of BCTs within Stop Delirium! intervention

1. Goals and planning

Staff produce specific care pathways e.g. prevent dementia and cognitive impairment through encouraging stimulating activities for residents (1.1 *Goal setting (behaviour)*).

Staff identify solutions to identified problems – e.g. care home cook to discuss with residents how to improve diet (1.2 *Problem solving*).

Prevent constipation - The manager invited the cook to join the working group and agreed actions to provide a better diet to the residents (1.4 *Action planning*).

2. Feedback and monitoring

Staff to check for signs indicative of residents’ mood: relaxation, distress and confusion level (2.1 *Monitoring of behaviours by others without feedback*).

As part of the constipation care pathway staff should monitor residents’ mental and physical state for 48 hours, record fluid and bowel movement (2.5 *Monitoring outcome(s) of behaviour by others without feedback*).

Complete the delirium checklist, a checklist that is used to record feedback about the patient’s state (2.6 *Biofeedback*)

3. Social support

Learning is encouraged and reinforced through sharing of learning and experiences between staff (3.1 *Social support (unspecified)*).

Staff are advised to “buddy up” in between teaching sessions to look out for delirium so to facilitate learning (3.2 *Social support (practical)*).

4. Shaping knowledge

Control residents’ pain by administering prescribed medication/analgesia; Call GP; use checklist to describe symptoms (4.1 *Instructions on how to perform a behaviour*).

Staff taught to differentiate between delirium, dementia and depression (4.3 *Re-attribution*).

5. Natural consequences

Information provided on the negative outcomes of delirium, causes and risk factors, including personal accounts (5.1 *Information about health consequences*).

Information provided on the consequences of delirium, including why delirium is important and stressful for staff, residents and visitors (5.3 *Information about social and environmental consequences*).

6. Comparison of behaviour

Staff are asked to engage in practical tasks that promote learning, such as observing own fluid input/output (6.1 *Demonstration of the behaviour*).

Outputs of working groups and ideas are shared across homes (6.2 *Social comparison*).

7. Associations

Prevent resident disorientation by providing clear signs around the home to help residents find their way (7.1 *Prompts/cues*).

Prevent medication effects - ensure medications are kept securely to prevent them being taken by other residents who are confused (7.5 *Remove aversive stimulus*).

8. Repetition and substitution

Prevent resident from acquiring infections by encouraging regular hand-washing for staff, residents and visitors (8.1 *Behavioural practice/rehearsal*).

Replace sedentary behaviour with activities such as, dance, music and movement, singing, serving food, walks, and hobbies (8.2 *Behaviour substitution*).

9. Comparison of outcomes

Refer to NICE guidance regarding impact, risks and causes, prevention and management, and implementing changes (9.1 *Credible source*).

Receive certificate after completion of education sessions (10.1 *Material incentive (behaviour)*).

Complete quiz and word search puzzle after completion of education sessions (10.3 *Non-specific reward*).

11. Regulation

Prevent resident pain by involving health professionals to manage pain; if pain medication is prescribed, remember to offer it regularly if indicated (11.1 *Pharmacological support*).

Prevent resident disorientation by providing them with cue cards which can help express basic needs and aid with communication difficulties (11.3 *Conserving mental resources*).

12. Antecedents

Improve residents' sleep by providing a relaxing quiet environment, not too hot or cold (12.1 *Restructuring the physical environment*).

Prevent sleep disruption by providing most care during waking hours (12.2 *Restructuring the social environment*).

Prevent resident pain by providing walking aids within easy reach (12.5 *Adding objects to the environment*).

Prevent resident pain through physical activity to improve muscle strength and flexibility, TENS, warmth, massage (12.6 *Body changes*).

13. Identity

Delirium practitioner highlights unique position, knowledge and expertise of staff (specialists) on residents and their needs that can contribute to prevent delirium, specifically tailored to each care home. Ensure ownership of proposed changes to staff responsible (13.4 *Valued self-identity*).

15. Self-belief

Trusted nurse from a local practice gives staff the confidence to start implementing checklist (15.1 *Verbal persuasion about capability*).
