Which behaviour change techniques are effective in promoting physical activity among older people with dementia? A call for research into three underexplored avenues

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People with dementia represent a growing proportion of the older adult population. Estimates suggest 46.8 million people worldwide had dementia in 2015, that this figure will rise to 131.5 million by 2050 (Prince et al., 2015), and that 90% of people with dementia are aged 65 and above (World Health Organization, 2012). These degenerative diseases gradually impair memory, executive functioning, and communication (Butler & Radhakrishnan, 2012; Prince et al., 2015). Nonetheless, people with dementia should be encouraged to continue to enjoy good health for as long as possible as part of a public health strategy and for their continued quality of life (Ginis et al., 2017; Nyman & Szymczynska, 2016).

Behaviour change techniques (BCTs) are widely used in health promotion interventions and in particular the promotion of physical activity. However, the use of BCTs in physical activity promotion that rely on cognitive processes may be ineffective among people with dementia because of their cognitive impairment. There is currently no direct evidence to address this issue amongst people with dementia and so it is open to empirical study (van der Wardt et al., 2017). Inconclusive evidence comes from a recent systematic review of BCTs used to promote physical activity among people with dementia (Nyman, Adamczewska, & Howlett, 2018). While potential promise was found for goal setting (behaviour), this BCT was not used in isolation but used with other BCTs that also had potential promise: social support (unspecified) and using a credible source. Therefore, the effectiveness of these three BCTs when used in isolation with people with dementia is unknown, and the remaining BCTs reviewed were either used too infrequently to identify potential promise or were only used in ineffective interventions. Therefore, research is

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needed to identify which BCTs are effective in promoting physical activity among people with dementia.

In this editorial, I encourage physical activity researchers and clinicians working with older people with dementia to explore the use of approaches that do not rely on cognitive processes. These approaches may be shown to be more effective when working with people with cognitive impairment given the nature of their condition, and stimulate novel strategies for encouraging uptake and adherence to physical activities. Further research might also illuminate when particular BCTs are more useful in considering the severity of an individual’s dementia symptoms. People with dementia are heterogeneous and may have relatively mild, moderate, or severe symptoms. Therefore the trajectory of use of BCTs that do not rely on cognitive processes may gradually become more useful as a person with dementia’s severity worsens. In the following, I illustrate the predominant use of BCTs that rely on cognitive processes with reference to a widely-used taxonomy of BCTs (Michie et al., 2013). I then propose three avenues of research where BCTs could be more effectively tested with people with dementia: partnership with carers, behaviourist approaches, and choice architecture.

**Predominant use of behaviour change techniques that rely on cognitive processes**

By way of illustration, a taxonomy of BCTs and two systematic reviews of BCTs used in physical activity interventions demonstrate the current predominant use of BCTs that rely on cognitive processes. A widely used taxonomy identified 93 BCTs to use in health promotion (Michie et al., 2013). Of these, the majority rely on cognitive processes (n=65), with the remaining relying on non-conscious processes (18 and 10 that can be categorised under behaviourist and choice architecture approaches respectively) (see Table 1, online supplementary material). Similarly, researchers have predominantly used BCTs that rely on

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cognitive processes (see Sheeran, Klein, & Rothman, 2017), as shown in a sample of two systematic reviews that have used Michie et al.’s (2013) taxonomy or similar with older people (French, Olander, Chisholm, & McSharry, 2014) and people with dementia (Nyman et al., 2018) (see Table 2, online supplementary material). Similar observations can be drawn from other recently conducted systematic reviews of BCTs used to improve exercise adherence among older people (Room, Hannink, Dawes, & Barker, 2017) and by physiotherapists to promote physical activity (Kunstler et al., 2018). From these systematic reviews, it is evident that the potential for BCTs that do not rely on cognitive processes is relatively underexplored. Rather than use BCTs that rely on the cognitive processing ability of people with dementia, three alternative approaches hold promise for future physical activity interventions that are outlined below.

**Partnership with carers**

The cognitive processing of informal carers could be enlisted to support people with dementia to engage with BCTs for the purpose of promoting physical activity. Enlisting the support of carers is perhaps the most frequently used approach by clinicians working with people with dementia (e.g. by physiotherapists co-developing therapeutic goal plans). Carers could be effectively used in numerous BCTs, including sharing the task of setting goals, action and coping planning, or reminding the people with dementia of distal rewards. While there is currently no direct evidence of shared cognitive processing for behaviour change among people with dementia and their informal carers, there are some studies with the general adult population that have tested the use of working with couples rather than individuals to enact behaviour change. For example, a randomised controlled trial tested a couple-based telephone intervention where individuals made goals and action plans for behaviour change and their partners were encouraged to support these plans. While the goals

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and plans were not jointly created by couples, the couple-based intervention led to an improvement in health behaviours such as an increase in moderate physical activity and reduction in fat consumption, among patients who needed to reduce their cholesterol to avert coronary heart disease (Voils et al., 2013). Other studies suggest that the social support of a partner may well facilitate behaviour change efforts. For example, a study found that couples where both partners participate in a physical activity intervention are more likely to increase their physical activity levels than couples where only one partner participates or among those with no intimate partner (Gellert, Ziegelmann, Warner, & Schwarzer, 2011).

While there is potential for enlisting the support of carers of people with dementia in the use of BCTs to promote physical activity, a systematic review found self-regulatory BCTs to be associated with both lower levels of physical activity self-efficacy and behaviour among adults aged 60+ (French et al., 2014). This is in contrast to previous systematic reviews that identified evidence for the use of self-regulatory BCTs with the general adult population to improve diet and physical activity participation (Greaves et al., 2011; Michie et al., 2009). A recent systematic review also suggests greater potential for self-regulatory BCTs to improve exercise adherence among older people (Room et al., 2017). In addition, as noted above, a recent systematic review identified potential promise for the use of self-regulatory BCTs to promote physical activity among people with dementia (Nyman et al., 2018). Further experimental studies will be able to clarify the effectiveness of self-regulatory BCTs among older people and people with dementia, and under what conditions shared cognitive processing with an informal carer might facilitate behaviour change.

As people with dementia’s symptoms worsen and they become more dependent on their informal carers, it is then likely that the role of the carer becomes increasingly important in facilitating physical activity. However this may come at a cost of to the carer and potentially lead to carer burden (van Alphen, Hortobágyi, & van Heuvelen, 2016). In future
research there are four challenges that may arise when working in partnership with informal carers to promote physical activity. First, one assumes that there is an informal carer available to provide support for the people with dementia. In the UK, approximately a third of people with dementia in the community live alone and therefore are not supported by a spouse (Miranda-Castillo, Woods, & Orrell, 2010). Second, for people with dementia who are supported by a spouse, the carer may not be able to support them in the prescribed manner. Informal caregivers themselves may have poor health; one study with informal carers found that 81.5% had at least one chronic illness and 60.5% had two or more (Wang, Robinson, & Carter-Harris, 2014). Measures of burnout and depression among carers of people with dementia have also been reported to be as high as 23-42% and 30% respectively (Schoenmakers, Buntinx, & De Lepeleire, 2009; Truzzi et al., 2012). Third, some BCTs engage individuals to take ownership of their regular physical activity level through goal-setting and a plan of implementation. If this process for the people with dementia is shared with their carer, then ownership of the goal and its associated plan may become diluted. This may become a barrier to adherence especially if the people with dementia’s memory of setting the goal and forming the action plan diminishes. Prompting by the carer to continue to adhere to the action plan and reach the goal may then be perceived as purely in the carer’s interest, and performance of the behaviour would shift from intrinsic motivation (to meet a goal that one wants to achieve) to extrinsic (to comply with another’s wishes), which may negatively impact on adherence (Deci & Ryan, 2000). Fourth, the above approach assumes that people with dementia want to be supported by their informal carer, which is usually their spouse. A previous study has found that for a weight-loss programme, while women achieved greater weight loss when supported by their husband, men achieved greater weight loss when working alone (Wing, Marcus, Epstein, & Jawad, 1991). Therefore, the demographic factors, individual circumstances, and wider sociocultural context may have great influence on the

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relationship dynamic and whether the people with dementia will be facilitated or inhibited in their physical activity behaviour change by the support of their carer.

**Behaviourist approaches**

Non-conscious approaches to promoting health could be used as an alternative to relying on the cognitive processing ability of people with dementia. It has been demonstrated that people can learn behaviours implicitly, i.e. via non-conscious processes (Hollands, Marteau, & Fletcher, 2016; Marteau, Hollands, & Fletcher, 2012; Zwart, Vissers, Kessels, & Maes, 2017). While the role of cognitive processes in implicit learning has been acknowledged (Kirsch, Lynn, Vigorito, & Miller, 2004; Papies, 2016; Shanks & St John, 1994), the essence of behaviourist approaches is on non-conscious processes for behaviour change (Johnston, 2015).

Behaviourist approaches such as operant and classical conditioning could be more widely applied with people with dementia to promote physical activity. Such approaches have been used in a therapeutic context to reduce unsociable behaviours and symptoms that can develop among people with dementia (Rabins, 1994). For example, operant conditioning has been used to reduce aggressive behaviour among people with dementia in long-term care (Vaccaro, 1988). With classical conditioning, the pairing of two stimuli could develop expectation of one feature in the environment to arise on presentation of the other and vice versa (Pavlov, 1927). For example, one could stimulate people with dementia to engage in exercise or facilitate their memory of particular exercises through repeated pairing of stimulus such as always conducting them to the same music.

Previous studies have shown people with dementia can learn behaviours implicitly via cue-outcome associations despite impaired explicit memory (Eldridge, Masterman, & Knowlton, 2002). To promote physical activity, one could stimulate the development of

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muscle or kinaesthetic memory whereby movements are performed in a set pattern and are repeated. This would reflect other motor tasks that once learned are performed without conscious awareness (e.g. to ride a bike) (Lally & Gardner, 2013). This route of learning holds particular promise due to the simplicity of implicit learning approaches and as motor tasks are the last form of memory to decline in people with dementia (van Halteren-van Tilborg, Scherder, & Hulstijn, 2007). However, the challenge for testing implicit learning BCTs is to design studies where they can be isolated from other BCTs. For example, classical conditioning experiments in care homes could be difficult to test if routines are already established that pair stimuli.

Choice architecture

Another approach to the use of non-conscious processes for behaviour change is choice architecture or ‘nudging’ (Thaler & Sunstein, 2008). The approach is not new, in that it builds on the last century’s psychological and sociological knowledge of the impact of the environment on behaviour. Though, its appeal lies in encouraging people to adopt healthy behaviours without the use of legislation, regulation, or altering economic incentives (Marteau, Ogilvie, Roland, Suhrcke, & Kelly, 2011). Choice architecture has potential for increasing public health by ‘nudging’ people to choose a healthy behavioural choice at the point when the behaviour is required. For example, this might be encouraging people to use the stairs in a shopping centre by displaying a sign at the elevator that informs people of the health benefits of using the stairs. Use of such signage or ‘point-of-decision prompts’ have been effective in increasing stair use in public places (Soler et al., 2015).

For behaviour change with people with dementia, this approach has promise as an avenue for future research as its premise is that the desired behaviour (e.g. walking up the stairs) is prompted by altering the environment to be performed immediately (i.e., does not
require planning ahead or remembering to do an action later) and with minimal cognitive effort (i.e., not by attempting to change an individual’s beliefs but only their behaviour at that particular moment), assuming that the point of decision prompts are not cognitively demanding to read and process. Use of this approach may also be desirable for simultaneously achieving both public health and inclusivity agendas including the promotion of active and healthy ageing (Annear et al., 2014; World Health Organization, 2002, 2010) and for communities and societies be more inclusive and ‘dementia friendly’ (Department of Health, 2012; World Health Organization, 2012). For example, environments designed to encourage people to be more physically active via non-cognitively demanding interventions (e.g. making outdoor shopping areas more pleasant to walk around, provide benches for people to rest, and restricting motor traffic in such areas) may be effective in promoting physical activity for people of all ages and abilities. Choice architecture interventions may also be useful for dementia-specific contexts. For example, the frequency of behaviours among people with dementia that carers find challenging - disorientated walking, repetition (e.g. picking or vocalisations), and inappropriate sexual behaviour - have been reduced in an institutional setting through changes to the environment, for example, through the use of colour cues to reduce disorientated walking (Hussian, 1982).

However, caution has been raised about the lack of rigorous scientific evidence to support choice architecture (Marteau et al., 2011). The effectiveness of a choice architecture intervention would also depend on the nature of the specific intervention deployed and its context (Skov, Lourenço, Hansen, Mikkelsen, & Schofield, 2013). Recent work has provided a typology of choice architecture interventions in micro-environments and mapped available evidence to this typology (Hollands et al., 2013; 2017). However, there is currently no guidance on which specific choice architecture interventions should be deployed and with whom.

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Conclusion

In testing the effectiveness of BCTs to promote physical activity, researchers have predominantly used approaches that rely on cognitive processes. Such approaches may be ineffective among people with dementia due to their cognitive impairment. Three avenues for future research have been proposed that may be more effective in promoting physical activity among people with dementia by drawing on the cognitive processing of others (partnership with carers), and non-conscious processes (behaviourist and choice architecture approaches). Researchers are encouraged to test the effectiveness of each of these promising approaches to identify when, where, and with whom such BCTs may be most effective in promoting physical activity among people with dementia to better promote health amongst this growing segment of the older adult population.

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Supplementary material

Table 1

List of behaviour change techniques as reported in the BCT Taxonomy V1 (Michie et al., 2013) and categorised for use in future with people with dementia according to reliance on cognitive processes (partnership with carers) or non-conscious processes (behaviourist approaches or choice architecture)

<table>
<thead>
<tr>
<th>Behaviour change technique</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1. Goal setting (behaviour)</td>
<td>Partnership with carers</td>
</tr>
<tr>
<td>1.2. Problem solving</td>
<td>Partnership with carers</td>
</tr>
<tr>
<td>1.3. Goal setting (outcome)</td>
<td>Partnership with carers</td>
</tr>
<tr>
<td>1.4. Action planning</td>
<td>Partnership with carers</td>
</tr>
<tr>
<td>1.5. Review behaviour goal(s)</td>
<td>Partnership with carers</td>
</tr>
<tr>
<td>1.6. Discrepancy between current behaviour and goal</td>
<td>Partnership with carers</td>
</tr>
<tr>
<td>1.7. Review outcome goal(s)</td>
<td>Partnership with carers</td>
</tr>
<tr>
<td>1.8. Behavioural contract</td>
<td>Partnership with carers</td>
</tr>
<tr>
<td>1.9. Commitment</td>
<td>Partnership with carers</td>
</tr>
<tr>
<td>2.1. Monitoring of behaviour by others without feedback</td>
<td>Partnership with carers</td>
</tr>
<tr>
<td>2.2. Feedback on behaviour</td>
<td>Partnership with carers</td>
</tr>
<tr>
<td>2.3. Self-monitoring of behaviour</td>
<td>Partnership with carers</td>
</tr>
<tr>
<td>2.4. Self-monitoring of outcome(s) of behaviour</td>
<td>Partnership with carers</td>
</tr>
<tr>
<td>2.5. Monitoring of outcome(s) of behaviour without feedback</td>
<td>Partnership with carers</td>
</tr>
<tr>
<td>2.6. Biofeedback</td>
<td>Partnership with carers</td>
</tr>
<tr>
<td>2.7. Feedback on outcome(s) of behaviour</td>
<td>Partnership with carers</td>
</tr>
<tr>
<td>3.1. Social support (unspecified)</td>
<td>Partnership with carers</td>
</tr>
<tr>
<td>3.2. Social support (practical)</td>
<td>Partnership with carers</td>
</tr>
</tbody>
</table>

3.3. Social support (emotional)  
4.1. Instruction on how to perform the behaviour  
4.2. Information about antecedents  
4.3. Re-attribution  
4.4. Behavioural experiments  
5.1. Information about health consequences  
5.2. Salience of consequences  
5.3. Information about social and environmental consequences  
5.4. Monitoring of emotional consequences  
5.5. Anticipated regret  
5.6. Information about emotional consequences  
6.1. Demonstration of the behaviour  
6.2. Social comparison  
6.3. Information about others’ approval  
7.1. Prompts/cues  
7.2. Cue signalling reward  
7.3. Reduce prompts/cues  
7.4. Remove access to the reward  
7.5. Remove aversive stimulus  
7.6. Satiation  
7.7. Exposure  
7.8. Associative learning  
8.1. Behavioural practice/rehearsal  
8.2. Behaviour substitution  
8.3. Habit formation

<table>
<thead>
<tr>
<th>Technique</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partnership with carers</td>
<td></td>
</tr>
<tr>
<td>Choice architecture</td>
<td></td>
</tr>
<tr>
<td>Behaviourist</td>
<td></td>
</tr>
</tbody>
</table>

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8.4. Habit reversal | Behaviourist
8.5. Overcorrection | Behaviourist
8.6. Generalisation of target behaviour | Behaviourist
8.7. Graded tasks | Behaviourist
9.1. Credible source | Partnership with carers
9.2. Pros and cons | Partnership with carers
9.3. Comparative imagining of future outcomes | Partnership with carers
10.1. Material incentive (behaviour) | Partnership with carers
10.2. Material reward (behaviour) | Partnership with carers
10.3. Non-specific reward | Partnership with carers
10.4. Social reward | Partnership with carers
10.5. Social incentive | Partnership with carers
10.6. Non-specific incentive | Partnership with carers
10.7. Self-incentive | Partnership with carers
10.8. Incentive (outcome) | Partnership with carers
10.9. Self-reward | Partnership with carers
10.10. Reward (outcome) | Partnership with carers
10.11. Future punishment | Partnership with carers
11.1. Pharmacological support | Partnership with carers
11.2. Reduce negative emotions | Partnership with carers
11.3. Conserving mental resources | Partnership with carers
11.4. Paradoxical instructions | Partnership with carers
12.1. Restructuring the physical environment | Choice architecture
12.2. Restructuring the social environment | Choice architecture
12.3. Avoidance/reducing exposure to cues for the behaviour | Choice architecture

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12.4. Distraction | Choice architecture
12.5. Adding objects to the environment | Choice architecture
12.6. Body changes | Choice architecture
13.1. Identification of self as role model | Partnership with carers
13.2. Framing/reframing | Partnership with carers
13.3. Incompatible beliefs | Partnership with carers
13.4. Valued self-identify | Partnership with carers
13.5. Identity associated with changed behaviour | Partnership with carers
14.1. Behaviour cost | Partnership with carers
14.2. Punishment | Behaviourist
14.3. Remove reward | Behaviourist
14.4. Reward approximation | Behaviourist
14.5. Rewarding completion | Partnership with carers
14.6. Situation-specific reward | Behaviourist
14.7. Reward incompatible behaviour | Behaviourist
14.8. Reward alternative behaviour | Behaviourist
14.9. Reduce reward frequency | Behaviourist
14.10. Remove punishment | Partnership with carers
15.1. Verbal persuasion about capability | Partnership with carers
15.2. Mental rehearsal of successful performance | Partnership with carers
15.3. Focus on past success | Partnership with carers
15.4. Self-talk | Partnership with carers
16.1. Imaginary punishment | Partnership with carers
16.2. Imaginary reward | Partnership with carers
16.3. Vicarious consequences | Partnership with carers

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Table 2

*Frequency of behaviour change techniques reported in two systematic reviews of interventions to promote physical activity*

<table>
<thead>
<tr>
<th>Systematic review</th>
<th>French et al. (2014)</th>
<th>Nyman et al. (2018)¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>Older adults</td>
<td>People with dementia</td>
</tr>
</tbody>
</table>

Behaviour change technique reported using numbers from BCT taxonomy V1 (Michie et al., 2013)²

### 1. Partnership with carers (frequency %)

<table>
<thead>
<tr>
<th>Technique</th>
<th>French et al.</th>
<th>Nyman et al.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1. Goal setting (behaviour)</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>1.2 Problem solving</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>1.2. Relapse prevention</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>1.4 Action planning</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>1.5 Review behaviour goal(s)</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>2.1 Monitoring of behaviour by others without feedback</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2.2 / 2.7 Provide feedback on performance</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>2.3 Self-monitoring of behaviour</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>2.4 Self-monitoring of outcome(s) of behaviour</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3.1 Social support (unspecified)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3.1. Plan social support/ social change</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>3.1. Motivational interviewing</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3.3 Social support (emotional)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

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4.1 Instruction on how to perform the behaviour

<table>
<thead>
<tr>
<th>Behaviour</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1 Provide information on where and when to perform the behaviour</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>5.3 / 5.6 Provide information on consequences</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>5.3 / 5.6 Provide information on consequences of behaviour in general</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>5.3 / 5.6 Provide information on consequences of behaviour for the individual</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>6.1 Demonstration of the behaviour</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>6.2 Social comparison</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>9.1 Credible source</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>10.2 /10.3/10.4/10.9/10.10 Provide contingent rewards</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>10.2 /10.3/10.4/10.9/10.10 Provide rewards contingent on successful behaviour</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>11.2 Reduce negative emotions</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>15.2 Mental rehearsal of successful performance</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>15.3 Focus on past success</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

**Behaviourist approaches (frequency %)**

<table>
<thead>
<tr>
<th>Behaviour</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioural practice/rehearsal</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>Graded tasks</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Choice architecture (frequency %)</strong></td>
<td></td>
<td>1%</td>
</tr>
<tr>
<td>Reduce prompts/cues</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>137</td>
<td>31</td>
</tr>
</tbody>
</table>

Nyman, S. R. (in press). Which behaviour change techniques are effective in promoting physical activity among older people with dementia? A call for research into three underexplored avenues. *Journal of Aging and Physical Activity.*
Note. ¹Only trials that reported physical activity behaviour were included. ²Where BCT reporting was ambiguous in relation to the taxonomy, more than one behaviour change technique is listed together (e.g. “provide feedback on performance” could be either 2.2 feedback on behaviour or 2.7 feedback on outcome(s) of behaviour. Separate lines have been included in instances where the behaviour change technique was detailed with greater specificity than the taxonomy (e.g. “1.2 Prompt barrier identification includes relapse prevention).