Ageing & Society **38**, 2018, 2590–2616. © Cambridge University Press 2017
doi:10.1017/S0144686X17001027

Behaviour change techniques to facilitate physical activity in older adults: what and how

URSKA ARNAUTOVSKA*, FRANCES O'CALLAGHAN* and KYRA HAMILTON*†

ABSTRACT

Physical inactivity in older adults presents a significant problem within modern societies globally. Using a mixed-method approach, this study explored strategies for the development and delivery of physical activity (PA) interventions by investigating what behaviour change techniques (BCTs) are useful, and how these techniques should be implemented to be feasible for older adults. Sixty-six older adults completed a survey indicating the most useful BCTs, mapping on to motivational, volitional and automatic factors. Of these, 48 older adults participated in an interview exploring strategies for a PA intervention targeted at older adults. The most useful BCT identified in the survey was autonomy support (61.3%), followed by instruction to perform the behaviour (43.5%) and having a credible source of information about PA (42.6%). The key themes discussed in the interviews included providing support in making an informed choice, instruction on how to perform PA, information about health consequences, social support, goal setting, action and coping plans, behavioural demonstration and practice, and monitoring PA. The interviews also revealed key aspects of programme implementation including face-to-face delivery, followed up with additional materials; low cost; age-appropriate PA level; and individualised approach. Interventions assisting older adults in increasing their PA participation across a range of settings should incorporate BCTs targeting multiple processes, while tailoring their delivery to older adults' preferences to ensure their feasibility in supporting regular PA engagement.

KEY WORDS– physical activity, older adults, behaviour change techniques, implementation strategies, intervention development.

Introduction

In light of significant benefits associated with physical activity (PA) engagement in older age (Pereira, Baptista and Cruz-Ferreira 2016), such as

* School of Applied Psychology and Menzies Health Institute Queensland, Griffith University, Brisbane, Australia.
† School of Psychology and Speech Pathology and Health Psychology and Behavioural Medicine Research Group, Curtin University, Perth, Australia.

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

prevention of falls and consequent injuries (Sherrington *et al.* 2011), coupled with a majority of older adults not meeting the current PA guidelines (Sims *et al.* 2014; Sun, Norman and While 2013), several reviews have been conducted to assess the effectiveness of PA interventions targeting older adults. Overall, these reviews found a lack of interventions targeting specifically older adults (Chase 2015), with existing interventions producing only small effects on PA (D. P. French *et al.* 2014). Furthermore, maintenance of improvements in PA behaviour over the long term (>12 months) is unclear (Hobbs *et al.* 2013). The reasons for the limited effects of PA programmes may be due, in part, to a lack of clarity about key intervention components (S. D. French *et al.* 2012), lack of a theoretical framework to inform intervention development (Baert *et al.* 2011) and/or behaviour change techniques (BCTs) being inappropriate for the target population (Fleig *et al.* 2016). Prior research has indicated that intervention effectiveness may be improved by using theory to develop programmes (Chase 2015; Prestwich, Webb and Conner 2015), as well as by tailoring programmes to the relevant population (King and King 2010; Müller-Riemenschneider *et al.* 2008; Ziegelmann and Knoll 2015). It is therefore important that PA interventions are designed based on theory and to suit the specific needs and preferences of older adults.

Extant research reports a wide range of barriers to older adults' PA, such as health/physical impairment, and lack of willpower, competence, and time and social support (Arnautovska, O'Callaghan and Hamilton 2017*a*; Baert *et al.* 2011). Additionally, the endorsement of ageing stereotypes and the negative view of ageing can also negatively impact one's PA participation (Emile *et al.* 2014; Ory *et al.* 2003). While a long list of perceived barriers to PA can inform the development of targeted PA programmes, a selection of useful BCTs to facilitate PA effectively can also be guided by carefully integrating multiple theories (Prestwich, Webb and Conner 2015), allowing identification of the most parsimonious set of factors to target in interventions delivered across various social settings. Indeed, by applying an integrated theory-based approach, recent studies have demonstrated that multiple decision-making processes, including reflective (consisting of motivational and volitional factors) and automatic (habitual) processes, impact health behaviour (Hagger *et al.* 2017; Hamilton *et al.* 2017), including PA engagement (Allom *et al.* 2016; Hagger and Chatzisarantis 2014; Mullan *et al.* 2016). Within motivational processes, the key factors include attitudes, social norms, self-efficacy and behavioural control, and intention (Sheeran *et al.* 2016*a*), in line with the theory of planned behaviour (TPB; Ajzen 1991). However, experimental evidence from at least two TPB-based interventions to promote walking is equivocal (Darker *et al.* 2010; Williams *et al.* 2015). Williams *et al.* (2015), who

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

failed to find significant effects of their intervention on participants' walking, concluded that the lack of effects may have resulted from the unsuitability of included BCTs for the population investigated, thereby highlighting the importance of tailoring programmes to the specific population.

Studies within the PA domain have indicated that belief-based TPB constructs may be predicted by autonomous motivation, characterised by a sense of autonomy and inherent joy in engaging in PA (Hagger and Chatzisarantis 2009; Hamilton, Cox and White 2012; Kosma 2014). For example, individuals with higher levels of intrinsic motivation (Thøgersen-Ntoumani *et al.* 2016), and autonomous forms of extrinsic motivation (Ferrand, Martinent and Bonnefoy 2014), tend to engage in more PA. Thus, techniques targeting autonomous motivation from the self-determination theory (Deci and Ryan 2008), may also be important in promoting older adults' PA.

Furthermore, in line with theories of volition, such as the health action process approach (Schwarzer 2008), individuals are more likely to realise their health-related intentions by employing volitional strategies to bridge the intention–behaviour gap (Orbell and Sheeran 1998; Rhodes and de Bruijn 2013; Reyes Fernández *et al.* 2016; Zhou *et al.* 2015*a*). Indeed, there is growing evidence for the use of self-regulatory strategies (*e.g.* implementation intention, action planning and coping planning) in interventions promoting health behaviour (Hagger *et al.* 2016; Kwasnicka *et al.* 2013; Sniehotta *et al.* 2005; Zhou *et al.* 2015*b*). However, a meta-analysis of the effectiveness of BCTs aimed at increasing self-efficacy and PA in older adults (D. P. French *et al.* 2014) identified specific self-regulatory strategies, such as goal setting and planning for relapses, to be associated with decreased levels of both self-efficacy and PA behaviour. More recently, Warner *et al.* (2016) also failed to find positive effects of including self-regulatory techniques in an intervention to increase PA among older adults. It is possible that the effectiveness of planning strategies for facilitating PA in older adults may depend on a person's cognitive capacities, particularly prospective memory (Wolff *et al.* 2016). Alternatively, self-regulatory BCTs may not suit older adults' preferences about planning where, when and how to do PA (action planning) and how to deal with potential barriers (coping planning) because of lack of time, perceived low value (and that of broader society; Emile *et al.* 2014) of PA (Barnett, Guell and Ogilvie 2012), or low awareness of perceived environmental support, such as people, to rely on in their neighbourhood and PA opportunities (Addy *et al.* 2004).

One desired outcome of PA interventions across all settings is habit formation (Fleig *et al.* 2016). By repeating an activity in a consistent context,

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

the behaviour becomes triggered automatically, without a person's conscious control and deliberation (Lally and Gardner 2013; Verplanken and Melkevik 2008). BCTs to facilitate repetition frequency include behavioural-type components, such as prompting rehearsal of the behaviour in the same context, behaviour substitution or restructuring the physical environment by introducing prompts and cues for the desired behaviour (Michie *et al.* 2013). Indeed, a meta-analysis of interventions to promote PA in older adults (Chase 2015) found that a combination of cognitive-type (*e.g.* problem solving) and behavioural-type (*e.g.* self-monitoring and prompting) intervention components is more effective in increasing PA than interventions with either a cognitive or behavioural component alone. Thus, behavioural techniques that would strengthen automatic engagement in behaviour (Gardner 2015) may be useful in complementing cognitive strategies to facilitate regular PA.

However, in developing health behaviour interventions, while theory and empirical evidence are of paramount importance (Chase 2015; Hamilton and Hagger 2014; Prestwich, Webb and Conner 2015), practical issues determine which BCTs are appropriate for a specific target group and setting (S. D. French *et al.* 2012). While standardised taxonomies of BCTs have been developed (Kok *et al.* 2015; Michie *et al.* 2013), currently, there is a limited understanding of how specific theory-based targets for promotion of PA should be implemented in order to produce positive behavioural outcomes (S. D. French *et al.* 2012). In addition, given the equivocal evidence on the use of certain BCTs, such as those based on self-regulatory or planning principles, for promotion of PA in older adults (D. P. French *et al.* 2014), it remains unclear which BCTs are acceptable for older adults specifically. The BCTs that have been identified to increase intervention effectiveness for older adults' PA include barrier identification/problem solving, provision of rewards contingent on successful behaviour and modelling/demonstrating the behaviour (D. P. French *et al.* 2014).

There is, however, a gap in understanding how these potentially effective BCTs should be matched with the needs and characteristics of the older adult population. This lack of understanding is particularly significant given that studies consistently demonstrate that tailoring health behaviour interventions can produce significantly larger effect sizes than no tailoring at all (Courtney *et al.* 2009; Noar, Benac and Harris 2007). To address this gap, the use of qualitative methodology has been suggested to explore the acceptability of BCTs for promoting PA in older adults (S. D. French *et al.* 2012). Previous qualitative studies have provided valuable insight into the strategies employed by older athletes in sustaining their PA performance (Dionigi, Horton and Baker 2013), as well as into the needs regarding appropriate strategies for delivering a PA programme

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

among specific population groups such as parents of young children (Hamilton and White 2014). It may be beneficial to apply a similar approach to examine what older adults would like from a PA intervention, and how PA programmes targeting older adults should be delivered to be acceptable for them. Such formative research in developing theoretically and empirically based health interventions may improve the effectiveness of future interventions (Epton *et al.* 2014; Hagger 2010).

The purpose of the current study was to explore strategies for the development and implementation of intervention programmes designed to increase PA in older adults, using a mixed-method approach. To achieve this, we aimed to investigate what specific BCTs would be most useful for facilitating PA in older adults, and second, explore the strategies for how best to design and deliver such techniques in a PA intervention for older adults. The uniqueness of this study is in its focus on the perspective of older adults in understanding which strategies they prefer and how they should be included in interventions designed to increase PA levels in older age.

Method

This study builds on previous work which has provided preliminary evidence of factors that may influence older adults' PA (Arnautovska, O'Callaghan and Hamilton 2017*b*; Arnautovska *et al.* 2017). Specifically, the current study focused on strategies for the development and implementation of interventions aimed at increasing PA in older adults.

Participants and procedure

Participants were older adults (64.6% women) who participated in a previous study investigating older adults' PA and who provided consent to be contacted for future research. Selection criteria included being 65 years of age and over, residing independently in a community dwelling and being able to engage in PA of at least moderate intensity (determined by the absence of medical advice to refrain from PA due to health reasons). All participants received a hard-copy of the survey, and if they provided consent to participate in a follow-up interview, they were subsequently contacted to arrange an interview.

Measures

Quantitative measures. Participants completed questions assessing their socio-demographic characteristics (age, sex, employment status and multi-

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

morbidity) and current level of PA, using a single item that assessed the number of days in the past week that participants accumulated at least 30 minutes of at least moderate-intensity PA (Hamilton, White and Cuddihy 2012). Moderate-intensity PA was defined as activity that causes faster heartbeat and some shortness of breath, while still being able to talk comfortably. Participants were informed that in the remainder of the survey, regular PA was defined as behaviour that is of at least moderate-intensity and performed for at least 30 minutes on five or more days of the week. To assess the functionality of the survey, four older adults completed a pilot version and provided their feedback on individual questions as well as the overall survey. Following feedback, minor formatting and language adjustments were made (*e.g.* adding 'indicate *by ticking or circling the number*' and simplifying the descriptions of some BCTs), and scale descriptions for the 1 to 5 ratings were slightly modified to improve clarity among ratings.[1]

The survey involved seven groups of techniques, selected predominantly based on recent empirical evidence (Arnautovska *et al.* 2017), to target the constructs of autonomous motivation, attitudes, self-efficacy and behavioural control, social influences, intention, planning, and habit. These constructs have been positively associated with PA also in previous research across a range of population groups (Cowie and Hamilton 2014; Hagger and Luszczynska 2014; Hamilton and White 2012; Maher and Conroy 2015; Sheeran *et al.* 2016*b*; Warner *et al.* 2011). For each construct, participants were provided with five examples of BCTs, which were chosen based on prior qualitative studies about older adults' views and experiences of PA (Arnautovska, O'Callaghan and Hamilton 2017*a*), as well as the taxonomy of BCTs (Michie *et al.* 2013). The techniques were chosen from the taxonomy by matching the content of each construct with a relevant group of BCTs. For example, the *natural consequences* technique was considered to tap into the concept of attitudes, so BCTs to target attitudes were predominantly chosen from this group. In the same manner, the concept of habit was found to be included in the group *repetition and substitution*, so habit-stimulating BCTs were chosen from this group. For each construct, the participants were asked to indicate one strategy that they considered would be most useful for helping them improve and/or maintain their PA. For instance, for intention, one of the BCTs listed was 'Advising on how to set a general goal; for example, to make a resolution, such as "I will do daily walks of 20 minutes next week"'.

Qualitative measures. Participants who agreed to take part in a semi-structured interview were interviewed by author UA two weeks after receipt of the survey. The interview began by asking participants what kind of techniques would motivate them to engage or continue engaging in PA.

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

Subsequent questions focused on the techniques that, in the survey, the participant had selected as the most useful technique from each of the seven groups (*e.g.* 'Can you please explain in more detail how you see this technique being used in your everyday life?'; 'How could we use this technique in a programme?'; 'How, in your view, should this technique be delivered to be most effective for you?'). We included prompts regarding intervention delivery, based on previous studies investigating techniques and interventions to promote PA in older adults (Chase 2015; D. P. French *et al.* 2014). At the end of the interview, the participants were asked for other useful ways of facilitating PA that had not been mentioned previously. Interviews, lasting between 13 and 30 minutes, were audiotaped and transcribed verbatim by the first author.

Data analysis

For the quantitative data, frequencies of responses regarding the most useful BCTs for all participants, and separately for active and non-active participants, were calculated. For the qualitative data, the Framework Method (Gale *et al.* 2013) was used to facilitate systematic analysis of the interview data. Authors UA and FO independently familiarised themselves with the interview transcripts and coded six of the interviews, then together identified a working analytical framework of codes for BCTs that emerged in the interviews. Author UA applied the analytical framework to the remaining transcripts by coding the interviews line-by-line, using a combination of a deductive approach (coding based on a pre-existing code of BCTs) and an inductive approach (adding any new codes), to ensure all important aspects of the data were considered (Gale *et al.* 2013). Charting the data (summarising data by codes from each transcript) was done first manually on paper, followed by recoding the data into a generated framework matrix (rows presenting codes and columns presenting cases) in an Excel spreadsheet. The matrix output allowed all the authors to compare and contrast summarised data across both cases and categories of codes, obtaining a comprehensive, descriptive overview of the data-set. The Framework Method has been used in previous studies exploring older adults' perceptions of the feasibility of a PA intervention (Fleig *et al.* 2016).

Findings were summarised within two broad categories: (a) what techniques to include and (b) how to implement them in a PA intervention. Identified themes were supported by relevant quotes; with each quote, we added sex (M for male, F for female), age and PA level, indicating whether the participant met Department of Health (2014) guidelines for PA (ACT) or not (NACT).

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

Results

Of a total of 113 older adults, 66 (58.4%) returned the survey (57.6% women; age range = 65–92 years, mean = 74.2, standard deviation (SD) = 6.3). The majority (86.4%) reported being retired and 13.6% were working part-time. Regarding education, 29.2 per cent completed grade 12 or less, 24.6 per cent had a diploma or trade certificate, and 46.2 per cent completed a university degree. Over two-thirds (81.8%) reported experiencing at least one health condition, and nearly half (45.5%) reported at least two, with the most common being arthritis (33.3%) and high blood pressure (31.8%). According to the physical activity recommendations for older adults (Department of Health 2014), 31 (47%) participants were sufficiently active (*i.e.* engaging in a minimum of 30 minutes of at least moderate PA on five or more days per week) and 35 (53%) were insufficiently active.

Of those who returned the survey, 50 (75.8%) participants agreed to engage in a follow-up interview. Phone-based interviews were conducted with 48 older adults (60.4% women; age range = 65–91 years, mean = 73.3, SD = 5.3) of whom 89.8 per cent were retired. According to the PA guidelines (Department of Health 2014), 22 participants were sufficiently and 26 were insufficiently active.

Table 1, referring to the results obtained in the survey, provides participants' nominations of BCTs considered useful for facilitating PA across the seven groups. Participants selected autonomy support as the most useful technique (61.3%), followed by behavioural instruction (43.5%) and information provided from a credible source (41.9%). In addition, behavioural demonstration including practice and rehearsal, as well as self-monitoring of PA, were also considered useful, both by active and non-active participants (46.4% and 30.0%, and 32.1% and 40.0%, respectively). Techniques selected by the least participants (3.2%) were monitoring of emotional consequences, provision of information about emotional consequences of PA and tips on replacement of sitting activities with more active activities.

The following two sections are based on interview data. The section 'What techniques to include' includes eight themes which are presented according to the three processes of decision-making (*i.e.* motivational, volitional and automatic).

What techniques to include

Motivational processes. Providing support in making an informed choice: A common theme, discussed among participants, revolved around the importance of being supported in making an informed choice about the type of

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

TABLE 1. *Participants' nominations of the most useful techniques to facilitate physical activity*

	All		Active		Non-active	
Behaviour change technique	N	%	N	%	N	%
N	66		31		35	
Autonomous motivation:						
Autonomy support	38	61.3	15	53.6	23	67.6
Identification of self as a role model	13	21.0	5	17.9	8	23.5
Anticipated regret	5	8.1	3	10.7	2	5.9
Identity associated with behaviour	4	6.5	3	10.7	1	2.9
Monitoring of emotional consequences	2	3.2	2	7.1	0	–
Attitude:						
Credible source	26	42.6	12	42.9	14	41.2
Information about health consequences	16	26.2	7	25.0	9	26.5
Information about emotional consequences	12	19.7	6	21.4	6	17.6
Pros and cons	5	8.2	2	7.1	3	8.8
Salience of consequences	2	3.3	0	–	2	5.9
Perceived behavioural control:						
Instruction to perform the behaviour[1]	27	43.5	12	41.4	15	45.5
Verbal persuasion about capability	13	21.0	9	31.0	4	12.1
Self-belief	9	14.5	2	6.9	7	21.2
Vicarious experience	8	12.9	2	6.9	6	18.2
Graded tasks	5	8.1	4	13.8	1	3.0
Social influence:						
Social support (emotional)	14	25.9	7	28.0	7	24.1
Social support (unspecified)	13	24.1	5	20.0	8	27.6
Social comparison	10	18.5	5	20.0	5	17.2
Information about others' approval	10	18.5	5	20.0	5	17.2
Social support (practical)	7	13.0	3	12.0	4	13.8
Intention:						
Rewarding completion	16	29.6	9	34.6	7	25.0
Goal setting (outcome)	12	22.2	6	23.1	6	21.4
Goal setting (behaviour)	11	20.4	5	19.2	6	21.4
Behavioural contract	9	16.7	3	11.5	6	21.4
Commitment	6	11.1	3	11.5	3	10.7
Planning:						
Action planning (supported)	16	30.2	8	34.8	8	26.7
Forming implementation intentions	14	26.4	9	39.1	5	16.7
Coping planning (supported)	9	17.0	4	17.4	5	16.7
Coping planning	8	15.1	1	4.3	7	23.3
Action planning	6	11.3	1	4.3	5	16.7
Habit:						
Demonstration of the behaviour[2]	22	37.9	13	46.4	9	30.0
Self-monitoring of behaviour	21	36.2	9	32.1	12	40.0
Prompts/cues	7	12.1	3	10.7	4	13.3
Behavioural practice and habit formation	6	10.3	3	10.7	3	10.0
Behaviour substitution and habit reversal	2	3.4	0	–	2	6.7

Notes: 1. Includes demonstration and modelling. 2. Includes behavioural practice and rehearsal and modelling. Data were missing as follows: four (6.1%) for 'autonomous motivation' and 'perceived behavioural control'; five (7.6%) for 'attitude'; eight (12.1%) for 'habit'; 12 (18.2%) for 'social influence' and 'intention'; and 13 (19.7%) for 'planning'.

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

appropriate exercise. They expressed the need for 'guidance, someone to sort of lead me down the right path' (M, 75, NACT), to 'make sure that I'm doing the right exercises' (F, 70, ACT). In particular, participants wanted to be informed about 'things that are safe and are not going to risk my health or my joints too much' (F, 67, NACT), activities that would complement their usual PA type ('I need to think about something else, apart from just walking … Possibly if advised on the best form of activity for my age'; F, 76, NACT) and benefit their specific health condition ('Somebody who'd say "look that's not a wise idea, because you've got osteoarthritis". That … would be useful'; F, 72, ACT).

Most commonly, participants thought that providing such informative advice was a role for health professionals, with their advice most needed regarding specific health restrictions: 'It would need to be a specialised person to say "Look, I think we probably need to stop doing this at the moment, but perhaps you can replace it with whatever"' (F, 70, NACT); 'The exercises that I do all came either from my doctor or from my physio, and of course they know limits, they can keep an eye on me' (F, 75, ACT).

Instruction on how to perform behaviour: In discussions about how to increase older adults' beliefs about control and ability to engage in PA, providing instruction on how to perform an activity safely and correctly, in order to avoid injury, emerged as an important strategy for over half of participants. Participants suggested having 'someone who's actually at the front and I can follow' (F, 69, ACT) and

> who has some skills to advise how to do the exercise without injuring yourself … it doesn't necessarily have to be somebody with a physiology degree, as long as someone has done even a short course, so that older people don't get injured. (F, 69, NACT)

Being provided with behavioural instruction was particularly relevant in the context of managing or recovering from a health issue:

> If anything happened to me, where I couldn't be physically active, say for instance I was sick for a prolonged period of time and I wasn't able to participate in PA, and then I'd gone on the road to recovery, then probably programmes would help me. (F, 75, ACT)

Information about health consequences: The need to be informed about the PA–health link was discussed in almost half of participants ('Knowledge about health is probably the most important for me'; F, 68, ACT). This information appeared to be valuable mainly because it reassured the person that they are doing something beneficial for themselves:

> The main thing that keeps me going is that feeling of wellbeing and I guess a certain sense of pride and achievement that I'm sort of keeping up with it … Because I am aware of the positive health outcomes of staying active. (F, 73, NACT)

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

Some participants wanted to be reminded '*why* I need to do this [exercise]', which was discussed in the context of maintaining health and independence as they aged: 'I still want to be able to bounce in and out of the chair, and look after myself. And so keeping the weight under control, avoiding chronic diseases, and stiffness and arthritis' (F, 67, NACT). However, messages regarding PA benefits tended not to be appreciated if loss-framed: 'I find it annoying if people try to scare you into doing it because of all sorts of things that might happen: "you might have a heart attack, stroke". I feel insulted by that sort of treatment' (F, 73, NACT).

Furthermore, the source of information appeared to determine whether a person would be receptive to it: 'If it's from somebody that I thought "well, this person knows what they're talking about", I probably would take it under consideration' (M, 73, ACT). Having trust and respect in the person delivering the intervention seemed crucial: 'Depends on how it is presented … You need to get a certain respect from that person' (M, 83, ACT). Additionally, there was a preference for the intervention provider being 'somebody specific to older people' (F, 76, NACT), having personal experience in PA engagement ('I haven't got a lot of faith in these people who are not out there in the real world … They don't know how people live in the real time, so not just out of a textbook'; M, 75, NACT).

Social support: About half of participants considered social support an important part of a PA intervention. This support included general support in the form of checking about a person's PA ('Even if it's just somebody who says "have you gone for a walk today?"'; M, 72, ACT), informational support about local opportunities to do PA ('Just to point you in the right direction … "Here's a list of activities in this area for people over 50"'; M, 70, ACT) as well as practical support ('When my arm was so sore recently, to have someone that would drive me to something like hydrotherapy, I'd love that!'; F, 70, NACT). It also involved emotional support: 'If someone would come to you and say "I'm here and I'm waiting for you, and this is what we're going to do" … that would help. It's all about the connection' (F, 66, ACT).

The most motivating aspect of social support was 'having somebody who's prepared to join in' (F, 70, ACT), such as 'having a friend to go with [to the gym]' (F, 73, NACT). Participants explained that 'it's safer to be in a group … gives you more encouragement' (F, 91, NACT) and 'it's more fun' (F, 71, NACT). However, although participants enjoyed the group setting, they 'wouldn't go just for that. I'd need to be doing exercises as well' (F, 73, NACT). The power of engaging in PA together with someone was also in making a commitment to another person: 'You'd get a responsibility to go because if you didn't go, then maybe they wouldn't go, and if they didn't go, then you'd feel as if you'd let that person down' (M, 65, NACT).

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

Goal setting: Techniques to strengthen an individual's intention for regular PA were considered useful by a few participants. These techniques involved goal setting in several different ways: achieving a minimum set of exercises ('My intention when I get to the pool is to do ten laps of the pool'; M, 66, ACT); performing an activity by a certain age ('I'm making a commitment to myself that I'd like to continue playing tennis until I'm 90. And I do the same with golf. While I can walk around 18 holes, then I will keep playing'; F, 75, ACT); and conditioning a goal to an outcome, which tended to be related to losing weight ('I've actually set myself that very goal in my diet diary app … Since I've started it at the beginning of the year, I've lost 3 kilos'; F, 70, ACT). For some participants, having the capacity to achieve a goal elicited a sense of competence ('It makes you feel as if you've achieved something'; F, 91, NACT), which appeared motivating: 'Setting yourself a 20 kilometre ride it's something that you do and so it's rewarding in itself to be able to do that' (M, 71, ACT). However, setting goals was not appreciated by participants who were satisfied with their current PA level ('I'm happy with my goal right now. I play croquet once a week and I swim twice a week, and that's what my programme is'; M, 82, NACT).

Volitional processes. Action and coping plans: The value of specific strategies for planning PA appeared in discussions with some participants. For example, to ensure time for PA, participants used a diary ('I keep them in my head at the moment, but I do have a diary to note things'; F, 69, ACT) or calendar ('I actually do put gym appointments in my calendar so that I get a reminder. I still sometimes dismiss them, but it does make me stop and think'; F, 67, NACT). However, participants found it important that such plans are flexible: 'I will have my own plan in my head and I will do my best to achieve it and if things get in the way, I'll adjust and then get back into it' (F, 70, ACT); 'I normally go on a Monday, Wednesday and Friday. But if something comes up, well I won't go that day and I'll go the following day, to make up' (M, 72, NACT).

On the contrary, some older adults' reservations about planning specifically when, where and how to do activities seemed to reflect a personal preference for a more spontaneous lifestyle. As one participant explained:

> I'm not a person big on plans. In my life, I've tried to plan daily routines and all that type of things, and it takes one or two phone calls to throw it all into chaos. So to me, if something came up, then, I'd go and do it. (M, 65, NACT)

One strategy suggested to organise PA-specific times was 'learning a better time management … to manage my time well enough so that I can do what I want to do' (F, 70, NACT). However, it appeared that older adults perceived

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

support in planning PA as intruding on their autonomy: 'I'm capable of managing my own life' (F, 73, NACT); 'You have to be a bit of a problem-solver. You don't need someone else to tell you' (F, 73, NACT).

A few participants also contemplated planning how to overcome potential barriers of PA engagement, which appeared closely related to the reason obstructing one's PA ('Would depend on why I couldn't do it'; F, 68, ACT). As participants explained: 'I'd stop, I'm ok with that. I wouldn't keep going. If that would be something that happened just occasionally, that's ok, but if that's something that's happening consistently, I'd have to go and find out what does this mean' (F, 69, ACT); 'If all of a sudden I had a stroke or, I was debilitated in any way, I'd want to investigate what options I would have to keep physically fit' (F, 75, ACT).

Automatic processes. Demonstration of the behaviour and behavioural practice and rehearsal: Nearly half of the participants discussed the importance of being provided with a demonstration of an activity, in order to then continue practising it alone: 'My tummy-strengthening exercises, as I call them, are specific from my physio. I need to be shown, and then I'm pretty good at doing them, at keeping up with it' (F, 75, ACT). It was acknowledged that demonstration would be more appropriate for less-active individuals:

> Certainly some sort of teaching, showing how and what to do, and talking you through with your walk, or your gym programme, and if you personally feel it's beneficial, then I guess you're in a position to create a habit out of it … I think it's more for a beginner. (M, 72, ACT)

Those with an established routine of activities, however, suggested someone 'reviewing those, every now and again', in order to 'set more targets for various things' (M, 73, NACT).

However, demonstration of PA with the view to practising and rehearsing on their own was not appreciated when a person's established daily life precluded them from having set times of PA ('The problem is that my life is quite complicated and I can't always make it totally predictable'; F, 69, NACT), which was either due to work commitments ('Because of time restraints, I'm quite happy doing as much as I can now. I work part time'; M, 72, NACT) or preferring a more incidental PA engagement ('Gardening and walking is all I do, and I've got no inclination to go to a gym whatsoever. I'm in this routine now that I please myself and do what I like'; F, 71, NACT).

Self-monitoring of behaviour. Monitoring PA was considered useful by about a third of participants. Using a Fitbit (Fitbit 2017) or pedometer helped older adults to reach their target PA amount ('I wear one of those Fitbit

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

watches to try and get in my 10,000 steps every day'; M, 73, NACT), maintain their PA routine ('I like doing that because it keeps me quite focused'; F, 69, ACT) and motivated them by demonstrating their progress:

> To have a record would be an incentive for me to say 'well, I could only do this in January, but I can now do this in March and I can do this in June', so there's some sort of written record that I can see that I've improved'. (F, 70, NACT)

Participants also appreciated that monitoring devices enabled them to understand better the effects of an activity on one's body: 'Anything that shows you what's happening when you're exercising would be good' (F, 76, NACT). While overall positively accepted, self-monitoring of PA was believed to have only short-term effects: 'It is quite useful up to a point. After a certain point, you kind of think "yeah, all right"' (F, 68, ACT); 'Because when you go write things down, you keep it up for a while and then you get a bit slack with it' (F, 71, NACT).

How to implement techniques

Participants discussed several ways of delivering a PA intervention for older adults. This typically included a combination of multiple cognitive and behavioural components, tailored to the individual's capacities and health condition. The majority of participants reported face-to-face delivery as the most useful strategy to deliver a PA intervention: 'Face-to-face [interaction] would be better' (F, 82, NACT), since it would 'remove a lot of barriers … you build a relationship with that person and you put more trust in your judgements about that person when you meet them face-to-face than you do on the phone' (M, 83, ACT). However, older adults also suggested a face-to-face intervention should be followed up with additional instructional materials:

> The follow-up of a leaflet or a brochure, it's there with you all the time. You don't always remember every detail of what someone tells you, so for me to have someone tell you, that's great, but it would be backed up by something that you've got … You've got the brochure there to look up. (F, 69, ACT)

Online videos were also frequently mentioned as a feasible mode: 'A video might because I could just be here [at home], I wouldn't need to go anywhere, it wouldn't cost me anything' (F, 70, NACT); 'You can up-date it regularly … personalised would always work better' (M, 71, NACT). Material related to PA published in newspapers and magazines, however, tended to be viewed as a less-credible source of information.

While having a 'physical instructor that knows exactly how to do it' was considered 'the ideal situation' (M, 81, ACT) for delivering a PA

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

intervention, the cost involved with such an approach was considered to be a notable barrier:

> A personal tuition of maybe a day, or half day to start with and left you with maybe rough diagrams, little bit of plans to follow, that would be a help … You really need some little description of the individual exercises to be able to follow it … That's beyond my pocket, I'm afraid. (M, 72, NACT)

Similarly, the importance of a low-cost programme was also discussed regarding group activities: 'There would be a cost factor that because I'm retired, I don't want to spend a lot of money paying for an exercise group' (F, 69, NACT). Thus, subsidising an exercise programme was considered helpful in enabling older adults to access PA classes:

> I belong to a health benefits fund and I pay $6 for every session and the fund pays about $8. The idea is to make it cheap enough for any seniors … Otherwise you'd think twice. Gym memberships are very expensive. (F, 73, NACT)

Furthermore, participation in a PA programme was conditional upon the appropriate level (intensity) of activities, reflecting older adults' preference for a same-aged group: 'Probably for me, similar age. I'm 67 so I have some limitations and if I was to be exercising with 30-year-old men, I wouldn't feel right' (F, 67, NACT). A preference for similar age was also noted with respect to the intervention provider: 'That would be better for me than someone who's 30 … They don't know how an older person feels, it might be great advice, but they don't know what an older person is going through' (F, 69, ACT). Older adults also discussed the importance of gaining physical benefits from a PA intervention: 'I'd want to join with something that was going to make me puff a little bit and feel like I have done something at the end of it' (F, 72, ACT).

In the discussions about supporting older adults in planning PA, as well as in making an informed choice regarding changing their activities, it seemed that an individualised approach appealed to this target group: 'I suppose a GP. He knows the histories of your health and everything' (F, 68, ACT). It was suggested that the intervention would incorporate an initial assessment of an individual, which would then allow planning appropriate activities:

> They'd do the assessment of you, then they'd be able to determine your current level of fitness and they'd be able to determine what you could cope with in the short, medium and longer term and then build a plan on that. (M, 71, NACT)

To assist older adults in establishing a PA routine by monitoring one's PA engagement, it was revealed that older adults would benefit from a combination of self-monitoring devices (*e.g.* pedometers and Fitbits) and recording sheets: 'I think both of them would be good, because then you can record on your sheet' (F, 70, NACT). E-mail monitoring of one's progress in PA

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

activities was generally positively accepted. In addition, to promote the use of self-monitoring devices, older adults thought that these 'would need to come with fairly explicit directions as to how to use them' (F, 80, ACT).

Discussion

Tailoring health interventions to the needs of the target population (Ziegelmann and Knoll 2015) is considered to facilitate intervention effectiveness. Gathering evidence on how specific BCTs could be best delivered in practice is particularly important within the context of promoting PA among population groups at risk for physical inactivity, such as older adults. The aim of the current study was to explore strategies for the development and implementation of intervention programmes designed to increase PA in older adults, to understand better what older adults would need to benefit from such a programme. Specifically, we investigated which BCTs would be most useful for facilitating older adults' PA and, in addition, explored the strategies for designing and delivering such techniques in a PA intervention targeting older adults.

Using a mixed-methods approach, the data indicated a range of cognitive- and behavioural-type techniques that older adults considered useful. In the survey, the majority of older adults nominated being supported in making an informed decision about PA as the most useful technique. Other techniques considered useful were credible information about health consequences of PA, instruction to perform behaviour, social support (*e.g.* engaging in PA with others) and goal-directed strategies (*e.g.* goal setting). In addition, self-regulatory strategies (*e.g.* action planning) as well as behavioural-type techniques to help with maintenance of PA (*e.g.* demonstrating behaviour with practice/rehearsal and self-monitoring) were nominated as useful components of a PA intervention.

In contrast, techniques such as monitoring of emotional consequences and provision of information about emotional consequences of PA were among the least frequently reported. This finding is somewhat surprising given that studies on younger adults (Rhodes and Courneya 2003) and adult samples in general (Lawton, Conner and McEachan 2009) indicate that affective attitudes are stronger predictors of PA than cognitive attitudes, while in older adults, the experience of pleasure is an important aspect of PA among those already active (Phoenix and Orr 2014). One reason why appeal to positive emotions was not considered particularly useful for older adults in the current study may be that 53 per cent of the sample represented insufficiently active older adults. Having fewer opportunities to experience positive emotions due to lower PA engagement, they may

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

find it harder to recognise the value of PA for their psychological health. In addition, given that a larger body of empirical evidence underpinning PA recommendations for older adults relates to benefits of physical health compared to psychological health (Sims *et al.* 2016), this is likely to be reflected in the public debate, making benefits of PA on older adults' physical health more, and emotional consequences of PA less, prominent.

Supporting the quantitative findings, older adults were strongly in favour of techniques that could inform their decisions regarding appropriate activities. In particular, health professionals were perceived as crucial in providing advice about activities that would suit an individual's needs. Provision of information about health benefits of specific activities by a credible source, such as a general practitioner or physiotherapist, in combination with information about local opportunities to engage in PA, were emphasised. Highlighting one's ability to gain health benefits might improve the feasibility of this strategy, as older adults often spoke about the importance of obtaining various benefits from PA.

Professional support in choosing the right activity was perceived as particularly important when experiencing a health condition, such as a stroke or hip replacement. This finding is not surprising, given that chronic conditions through experience of various symptoms (*e.g.* loss of balance, pain) can undermine a person's confidence in performing a specific activity (Clarke and Bennett 2013). However, what our findings add to this relationship, in the context of facilitating PA, is the important role of a person's autonomy in choosing particular activities. While techniques such as provision of relevant and credible information may assist older adults' PA decision-making, it may also be important that such information is delivered in a way that reinforces a person's sense of agency for facilitating change. This assumption is supported by the majority of participants reporting autonomy support as the most useful technique in helping them engage in regular PA. In addition, the importance of autonomy was mirrored in other themes throughout the interviews (*e.g.* 'I do as I please'). These findings complement and extend research demonstrating that autonomous motivation, characterised by a sense of choice and autonomy, in accord with the self-determination theory (Deci and Ryan 2008), is one of the key influences on PA (Brunet and Sabiston 2011; Hagger and Chatzisarantis 2014; Hamilton, Cox and White 2012; Kosma 2014; Thøgersen-Ntoumani *et al.* 2016).

The importance of behavioural demonstration, as identified in the current study, is consistent with recent research examining the effectiveness of BCTs on older adults' PA (D. P. French *et al.* 2014), as well as the benefits of individualised exercise classes on some falls risk factors (Lord *et al.* 2005). However, this study extends knowledge about what older adults specifically

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

value about this technique, and how it should be delivered in a PA programme to be feasible for them to use. Specifically, having an example to follow, preferably face-to-face, provided older adults with a sense of confidence – akin to the concept of self-efficacy, a person's belief in their ability to perform a specific activity – in engaging in activities that are safe and meaningful for their personal health condition, which was considered crucial in the rehabilitation context. As such, it was suggested that intervention providers (*e.g.* rehabilitation therapists, physiotherapists conducting an exercise class) conduct an overall assessment of a person, and based on the results provide suggestions about appropriate activities, as well as plan relevant goals. This finding underscores the value of interventions that would facilitate PA engagement specifically among older rehabilitation patients, in line with existing interventions (Fleig *et al.* 2013).

In addition, the importance of confidence, obtained through a face-to-face demonstration, implies that future interventions should include BCTs that will increase older adults' self-efficacy beliefs as one of the key programme objectives, which is then likely to lead to changes in PA behaviour (Sheeran *et al.* 2016*a*). Current findings corroborate research evaluating older adults' preferences about the implementation of home- and group-based exercise falls prevention programmes (Day *et al.* 2016), which highlighted the importance of ensuring balance safety across different capability levels. Furthermore, considering the cost-effectiveness of face-to-face interventions, it may be useful to examine whether the level of confidence and motivation to engage in health-protective behaviours such as PA could also be effectively facilitated with other delivery methods, such as the provision of an educational DVD, as this was demonstrated in the context of falls prevention education for older adults in hospital (Hill *et al.* 2009).

Previous research suggests that older adults with a supportive social environment engage in more PA behaviour (Baert *et al.* 2011). Our findings add to this evidence by identifying key aspects of social support and providing insight into how these could be implemented in PA interventions targeting older adults. Of greatest importance was engaging in PA with others, such as a friend or group of people with similar physical capacities. Setting up a community buddy system may be one strategy of facilitating PA among older adults. Our findings suggest that older adults would feel obliged to follow through with their PA arrangements with a peer. In addition, making group activities enjoyable and fun may be appealing to older adults. However, while the social interaction obtained by engaging in PA with peers may be valuable for older adults (Welmer, Morck and Dahlin-Ivanoff 2012), our findings also suggest that the level of social PA activities should be appropriate to a person's individual capacities, so that they can

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

obtain health benefits that they expect from PA. In designing group PA interventions, it may, therefore, be important to offer different levels of PA as well as a possibility to tailor activities to the individual's capacities.

Concerning strategies to target volitional constructs, in line with the health action process approach (Schwarzer 2008), our findings provide some support for their usefulness in PA interventions targeting older adults. However, older adults also discussed their reservations about making specific plans for when, where and how to do PA, and preferred any plans made to be flexible to accommodate their more spontaneous lifestyle and difficulty in managing competing priorities (*e.g.* family commitments, paid or voluntary work). Using a diary, calendar or learning better time management skills may be useful techniques for some individuals, especially for those with weak PA habits (Maher and Conroy 2015). While these findings do not entirely support a large body of previous evidence emphasising the role of planning for health behaviour such as PA (Hagger *et al.* 2016; Hamilton, Cox and White 2012; Kwasnicka *et al.* 2013), they do corroborate recent evidence investigating the effectiveness of self-regulatory strategies such as action planning for PA interventions targeting older adults specifically (D. P. French *et al.* 2014; Warner *et al.* 2016).

While evidence indicates that PA interventions can increase PA over the long term (Müller-Riemenschneider *et al.* 2008), long-term effectiveness of PA interventions targeting older adults, who are challenged by a range of age-related illness and disease, is unclear (Hobbs *et al.* 2013). Our findings indicate that to facilitate habitual engagement in and maintenance of PA, it may be useful for older adults to be provided with demonstrations of behaviour to practise and rehearse, as well as tools to self-monitor their behaviour (*e.g.* Fitbit, daily recording sheet). While habits are conceptualised as automatic cue–response behaviours, their formation is subject to conscious cognitive processes (Gardner 2015). Thus, through the facilitation of the repetition of a specific activity, by demonstrating the behaviour and providing means to monitor an individual's subsequent performance, such a combination of strategies may assist in strengthening the automaticity towards behavioural performance leading to maintenance of PA engagement. Indeed, recent research emphasises targeting multiple cognitive processes, eliciting behaviour change both through a conscious and non-conscious pathway (Rebar *et al.* 2016), when promoting PA.

Strengths and limitations

Some limitations of this study should be noted. First, while the mixed-method approach allowed for triangulation of data, the extent to which participants' understanding of the descriptions of techniques in the survey may have

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

affected their responses in unclear. To improve understanding of the techniques, the survey was prepared following feedback from four pilot participants, who provided detailed feedback about understanding of all BCTs. Nevertheless, interpretation of quantitative data should be conducted in combination with qualitative findings which provide a more rich understanding of survey responses. Second, the questions asked participants about the usefulness of techniques in a hypothetical situation (*e.g.* if something interfered with their PA plans), which may be different to what an individual would do in a real-life situation. Thus, assessing the actual feasibility of a theory-based PA intervention for older adults (Fleig *et al.* 2016) could not be fully explored. Third, although the interview started with an open question about potentially useful techniques to facilitate regular PA behaviour, not all participants were able to verbalise their preferences about what they would want from a PA intervention. This was demonstrated by very short or off-the-topic answers. It might, therefore, be useful to try alternative procedures, such as thought listing (Rhodes and Mistry 2016), to triangulate the results further. In addition, it would be beneficial to validate the findings on a larger sample size, given that a relatively small sample size in both groups may have limited the ability to obtain any other, additional ideas that older adults may have about facilitating PA behaviour.

Despite these limitations, the current study is unique in exploring the usefulness of theory-based BCTs for promotion of PA by eliciting from the target population (older adults) what strategies they would consider useful in a PA intervention. This knowledge is especially important considering the limited effectiveness of existing PA interventions targeting older adults (Chase 2015), as well as inconsistent evidence regarding the use of self-regulatory strategies (*e.g.* planning) in PA interventions targeting older adults (Warner *et al.* 2016). The findings of this study have important practical implications because they may assist intervention developers in designing theory-based PA programmes targeted at older adults.

Overall, this study was able to match theory-based influences on behaviour from multiple decision-making processes with relevant BCTs, and using a mixed-method approach, to provide insight into specific techniques within each of these processes considered to be useful in increasing PA among community-dwelling older adults. Unfortunately, this step within the process of developing health interventions is often missed (Lloyd *et al.* 2011). In addition, the findings highlighted commonly considered appropriate strategies for delivering a PA intervention for this population group (*i.e.* face-to-face, followed up with other material, low cost, of age-appropriate activity level and individualised). This study extends prior research on the factors moderating the effectiveness of PA interventions (Chase 2015) by providing insight into aspects of programme delivery that may either

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

contribute towards or undermine the effectiveness of interventions designed to increase PA in older adults across a wide range of settings. For instance, older adults' preferences regarding delivery of a PA intervention may be important to consider when contemplating the use of non-face-to-face methods (Müller and Khoo 2014), by means of advanced technologies such as eHealth (Muellmann *et al.* 2016).

Given that tailoring PA programmes to the preferences and needs of the target group is likely to improve intervention effectiveness (Noar, Benac and Harris 2007), such a formative approach to developing and implementing PA programmes may also need to be applied to other sub-groups, such as older adults with physical disabilities and those from culturally diverse backgrounds. Future PA research may benefit from translating older adults' voices and specific needs regarding regular PA into a theory-based intervention that includes a combination of BCTs, targeting key factors within both conscious and non-conscious processes (Sheeran *et al.* 2016*b*) and deliver them in an autonomy-supportive and individualised approach. Overall, it is recommended that strategies directed at older adults, their care-givers, health professionals and other relevant community members consider older adults' circumstances and preferences regarding PA engagement, in order to increase their potential for regular PA participation and, thus, create healthier societies.

Acknowledgements

This research is supported by the Griffith University International Postgraduate Research Scholarship, awarded to the first author, UA. The funding body played no role in designing and carrying out this research. Ethical approval was obtained from the University Human Research Ethics Committee and all participants provided written consent. All authors were involved with the discussions on the purpose and focus of the manuscript; UA designed the study and study materials, collected and analysed data, and wrote the first draft of the manuscript; FO and KH commented on subsequent drafts of the manuscript. The authors disclose no conflict of interest.

NOTE

1 The full list of BCTs included and additional quotes supporting the identified themes are available upon request from the first author.

References

Addy, C. L., Wilson, D. K., Kirtland, K. A., Ainsworth, B. E., Sharpe, P. and Kimsey, D. 2004. Associations of perceived social and physical environmental supports with physical activity and walking behavior. *American Journal of Public Health*, **94**, 3, 440–3.

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

Ajzen, I. 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, **50**, 2, 179–11.
Allom, V., Mullan, B., Cowie, E. and Hamilton, K. 2016. Physical activity and transitioning to college: the importance of intentions and habits. *American Journal of Health Behavior*, **40**, 2, 280–90.
Arnautovska, U., Fleig, L., O'Callaghan, F. and Hamilton, K. 2017. A longitudinal investigation of older adults' physical activity: testing an integrated dual-process model. *Psychology & Health*, **32**, 2, 166–85.
Arnautovska, U., O'Callaghan, F. and Hamilton, K. 2017*a*. Older adults' perceptions of physical activity within the process of ageing. *Health Behavior and Policy Research*, **4**, 1, 76–86.
Arnautovska, U., O'Callaghan, F. and Hamilton, K. 2017*b*. Applying the Integrated Behaviour Change model to understanding physical activity among older adults: a qualitative study. *Journal of Sport & Exercise Psychology*. Advance online publication. doi.org/10.1123/jsep.2015-0300.
Baert, V., Gorus, E., Mets, T., Geerts, C. and Bautmans, I. 2011. Motivators and barriers for physical activity in the oldest old: a systematic review. *Ageing Research Reviews*, **10**, 4, 464–74.
Barnett, I., Guell, C. and Ogilvie, D. 2012. The experience of physical activity and the transition to retirement: a systematic review and integrative synthesis of qualitative and quantitative evidence. *International Journal of Behavioral Nutrition and Physical Activity*, **9**, 1, 97–06.
Brunet, J. and Sabiston, C. M. 2011. Exploring motivation for physical activity across the adult lifespan. *Psychology of Sport and Exercise*, **12**, 2, 99–05.
Chase, J. A. 2015. Interventions to increase physical activity among older adults: a meta-analysis. *The Gerontologist*, **55**, 4, 706–18.
Clarke, L. H. and Bennett, E. 2013. 'You learn to live with all the things that are wrong with you': gender and the experience of multiple chronic conditions in later life. *Ageing & Society*, **33**, 2, 342–60.
Courtney, M., Edwards, H., Chang, A., Parker, A., Finlayson, K. and Hamilton, K. 2009. Fewer emergency readmissions and better quality of life for older adults at risk of hospital readmission: a randomized controlled trial to determine the effectiveness of a 24-week exercise and telephone follow-up program. *Journal of the American Geriatrics Society*, **57**, 3, 395–402.
Cowie, E. and Hamilton, K. 2014. Key beliefs related to decisions for physical activity engagement among first-in-family students transitioning to university. *Journal of Community Health*, **39**, 4, 719–26.
Darker, C., French, D., Eves, F. and Sniehotta, F. 2010. An intervention to promote walking amongst the general population based on an 'extended' theory of planned behaviour: a waiting list randomised controlled trial. *Psychology and Health*, **25**, 1, 71–88.
Day, L., Trotter, M. J., Donaldson, A., Hill, K. D. and Finch, C. F. 2016. Key factors influencing implementation of falls prevention exercise programs in the community. *Journal of Ageing and Physical Activity*, **24**, 1, 45–52.
Deci, E. L. and Ryan, R. M. 2008. Self-determination theory: a macrotheory of human motivation, development, and health. *Canadian Psychology*, **49**, 3, 182–5.
Department of Health 2014. *Recommendations on Physical Activity for Health for Older Australians*. Available online at http://www.health.gov.au/internet/main/publishing.nsf/Content/phd-physical-rec-older-guidelines [Accessed 5 March 2017].
Dionigi, R. A., Horton, S. and Baker, J. 2013. How do older masters athletes account for their performance preservation? A qualitative analysis. *Ageing & Society*, **33**, 2, 297–19.

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

Emile, M., Chalabaev, A., Stephan, Y., Corrion, K. and d'Arripe-Longueville, F. 2014. Aging stereotypes and active lifestyle: personal correlates of stereotype internalization and relationships with level of physical activity among older adults. *Psychology of Sport and Exercise*, **15**, 2, 198–204.

Epton, T., Norman, P., Harris, P., Webb, T., Snowsill, F. A. and Sheeran, P. 2014. Development of theory-based health messages: three-phase programme of formative research. *Health Promotion International*, **30**, 3, 756–68.

Ferrand, C., Martinent, G. and Bonnefoy, M. 2014. Exploring motivation for exercise and its relationship with health-related quality of life in adults aged 70 years and older. *Ageing & Society*, **34**, 3, 411–27.

Fitbit 2017. *Fitbit Inc.* Available online at https://www.fitbit.com/au/store?gclid=CP-9zqO2w9ICFYYsvQodEUMH8Q [Accessed 7 March 2017].

Fleig, L., McAllister, M. M., Chen, P., Iverson, J., Milne, K., McKay, H. A., Clemson, L. and Ashe, M. C. 2016. Health behaviour change theory meets falls prevention: feasibility of a habit-based balance and strength exercise intervention for older adults. *Psychology of Sport and Exercise*, **22**, 1, 114–22.

Fleig, L., Pomp, S., Schwarzer, R. and Lippke, S. 2013. Promoting exercise maintenance: how interventions with booster sessions improve long-term rehabilitation outcomes. *Rehabilitation Psychology*, **58**, 4, 323–33.

French, D. P., Olander, E. K., Chisholm, A. and Mc Sharry, J. 2014. Which behaviour change techniques are most effective at increasing older adults' self-efficacy and physical activity behaviour? A systematic review. *Annals of Behavioral Medicine*, **48**, 2, 225–34.

French, S. D., Green, S. E., O'Connor, D. A., McKenzie, J. E., Francis, J. J., Michie, S., Buchbinder, R., Schattner, P., Spike, N. and Grimshaw, J. M. 2012. Developing theory-informed behaviour change interventions to implement evidence into practice: a systematic approach using the Theoretical Domains Framework. *Implementation Science*, **7**, 1, 38–46.

Gale, N. K., Heath, G., Cameron, E., Rashid, S. and Redwood, S. 2013. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Medical Research Methodology*, **13**, 1, 117–29.

Gardner, B. 2015. A review and analysis of the use of 'habit' in understanding, predicting and influencing health-related behaviour. *Health Psychology Review*, **9**, 3, 277–95.

Hagger, M. S. 2010. Current issues and new directions in psychology and health: physical activity research showcasing theory into practice. *Psychology & Health*, **25**, 1, 1–5.

Hagger, M. S. and Chatzisarantis, N. L. D. 2009. Integrating the theory of planned behaviour and self-determination theory in health behaviour: a meta-analysis. *British Journal of Health Psychology*, **14**, 2, 275–302.

Hagger, M. S. and Chatzisarantis, N. L. D. 2014. An integrated behavior change model for physical activity. *Exercise and Sport Sciences Reviews*, **42**, 2, 62–9.

Hagger, M. S. and Luszczynska, A. 2014. Implementation intention and action planning interventions in health contexts: state of the research and proposals for the way forward. *Applied Psychology: Health and Well-being*, **6**, 1, 1–47.

Hagger, M. S., Luszczynska, A., de Wit, J., Benyamini, Y., Burkert, S., Chamberland, P.-E., Chater, A., Dombrowski, S. U., van Dongen, A., French, D. P., Gauchet, A., Hankonen, N., Karekla, M., Kinney, A. Y., Kwasnicka, D., Lo, S. H., López-Roig, S., Meslot, C., Moreira Marques, M., Neter, E., Plass, A. M., Potthoff, S., Rennie, L., Scholz, U., Stadler, G., Stolte, E., ten Hoor, G., Verhoeven, A., Wagner, M., Oettingen, G., Sheeran, P. and Gollwitzer, P. M. 2016. Implementation intention and planning interventions in health psychology:

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

recommendations from the Synergy expert group for research and practice. *Psychology & Health*, **31**, 7, 814–39.
Hagger, M. S., Trost, N., Keech, J., Chan, D. K. C. and Hamilton, K. 2017. Predicting sugar consumption: application of an integrated dual-process, dual-phase model. *Appetite*, **116**, 9, 147–56.
Hamilton, K., Cox, S. and White, K. M. 2012. Testing a model of physical activity among mothers and fathers of young children: integrating autonomous motivation, planning, and the theory of planned behavior. *Journal of Sport and Exercise Psychology*, **34**, 1, 124–45.
Hamilton, K. and Hagger, M. S. 2014. The 'health' of health psychology in Australia: behavioural approaches and interventions. *Australian Psychologist*, **49**, 2, 63–5.
Hamilton, K., Kirkpatrick, A., Rebar, A. and Hagger, M. S. 2017. Child sun safety: application of the Integrated Behaviour Change model. *Health Psychology*. Advanced online publication. doi:10.1037/hea0000533.
Hamilton, K. and White, K. M. 2012. Social influences and the physical activity intentions of parents of young-children families: an extended theory of planned behavior approach. *Journal of Family Issues*, **33**, 10, 1351–72.
Hamilton, K. and White, K. M. 2014. Strategies for developing and delivering a parental physical activity intervention: answers to the what and how. *Journal of Physical Activity and Health*, **11**, 1, 152–64.
Hamilton, K., White, K. M. and Cuddihy, T. 2012. Using a single-item physical activity measure to describe and validate parents' physical activity patterns. *Research Quarterly for Exercise and Sport*, **83**, 2, 340–45.
Hill, A., McPhail, S., Hoffman, T., Hill, K., Oliver, D., Beer, C., Brauer, S. and Haines, T. P. 2009. A randomised trial comparing digital video disc with written delivery of falls prevention education for older patients in hospital. *Journal of the American Geriatrics Society*, **57**, 8, 1458–63.
Hobbs, N., Godfrey, A., Lara, J., Errington, L., Meyer, T. D., Rochester, L., White, M., Mathers, J. C. and Sniehotta, F. F. 2013. Are behavioral interventions effective in increasing physical activity at 12 to 36 months in adults aged 55 to 70 years? A systematic review and meta-analysis. *BioMed Central Medicine*, **11**, 1, 75–86.
King, A. C. and King, D. K. 2010. Physical activity for an aging population. *Public Health Reviews*, **32**, 2, 401–26.
Kok, G., Gottlieb, N. H., Peters, G.-J. Y., Mullen, P. D., Parcel, G. S., Ruiter, R. A., Fernandez, M. E., Markham, C. and Bartholomew, L. K. 2015. A taxonomy of behaviour change methods: an Intervention Mapping approach. *Health Psychology Review*, **10**, 3, 297–12.
Kosma, M. 2014. Self-determination for physical activity among adults with physical disabilities. *Research Quarterly for Exercise and Sport*, **85**, 1, 31–31.
Kwasnicka, D., Presseau, J., White, M. and Sniehotta, F. F. 2013. Does planning how to cope with anticipated barriers facilitate health-related behaviour change? A systematic review. *Health Psychology Review*, **7**, 2, 129–45.
Lally, P. and Gardner, B. 2013. Promoting habit formation. *Health Psychology Review*, **7**, 1, 137–58.
Lawton, R., Conner, M. and McEachan, R. 2009. Desire or reason: predicting health behaviors from affective and cognitive attitudes. *Health Psychology*, **28**, 1, 56–65.
Lloyd, J. J., Logan, S., Greaves, C. J. and Wyatt, K. M. 2011. Evidence, theory and context-using intervention mapping to develop a school-based intervention to prevent obesity in children. *International Journal of Behavioral Nutrition and Physical Activity*, **8**, 1, 73–87.
Lord, S. R., Tiedemann, A., Chapman, K., Munro, B., Murray, S. M. and Sherrington, C. 2005. The effect of an individualized fall prevention program

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

on fall risk and falls in older people: a randomized, controlled trial. *Journal of the American Geriatrics Society*, **53**, 8, 1296–304.
Maher, J. P. and Conroy, D. E. 2015. Habit strength moderates the effects of daily action planning prompts on physical activity but not sedentary behavior. *Journal of Sport and Exercise Psychology*, **37**, 1, 97–107.
Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, W., Eccles, M. P., Cane, J. and Wood, C. E. 2013. The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: building an international consensus for the reporting of behavior change interventions. *Annals of Behavioral Medicine*, **46**, 1, 81–95.
Muellmann, S., Forberger, S., Möllers, T., Zeeb, H. and Pischke, C. R. 2016. Effectiveness of eHealth interventions for the promotion of physical activity in older adults: a systematic review protocol. *Systematic Reviews*, **5**, 1, 47–51.
Mullan, B., Henderson, J., Kothe, E., Allom, V., Orbell, S. and Hamilton, K. 2016. The role of habit and perceived control on health behaviour among pregnant women. *American Journal of Health Behavior*, **40**, 3, 291–301.
Müller, A. M. and Khoo, S. 2014. Non-face-to-face physical activity interventions in older adults: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, **11**, 1, 35–45.
Müller-Riemenschneider, F., Reinhold, T., Nocon, M. and Willich, S. N. 2008. Long-term effectiveness of interventions promoting physical activity: a systematic review. *Preventive Medicine*, **47**, 4, 354–68.
Noar, S. M., Benac, C. N. and Harris, M. S. 2007. Does tailoring matter? Meta-analytic review of tailored print health behavior change interventions. *Psychological Bulletin*, **13**, 34, 673–93.
Orbell, S. and Sheeran, P. 1998. 'Inclined abstainers': a problem for predicting health-related behaviour. *British Journal of Social Psychology*, **37**, 2, 151–65.
Ory, M., Hoffman, M. K., Hawkins, M., Sanner, B. and Mockenhaupt, R. 2003. Challenging aging stereotypes: strategies for creating a more active society. *American Journal of Preventive Medicine*, **25**, 3, 164–71.
Pereira, C., Baptista, F. and Cruz-Ferreira, A. 2016. Role of physical activity, physical fitness, and chronic health conditions on the physical independence of community-dwelling older adults over a 5-year period. *Archives of Gerontology and Geriatrics*, **65**, 4, 45–53.
Phoenix, C and Orr, N. 2014. Pleasure: a forgotten dimension of physical activity in older adults. *Social Science and Medicine*, **115**, 8, 94–2.
Prestwich, A., Webb, T. L. and Conner, M. 2015. Using theory to develop and test interventions to promote changes in health behaviour: evidence, issues, and recommendations. *Current Opinion in Psychology*, **5**, 1–5. Available online at https://doi.org/10.1016/j.copsyc.2015.02.011.
Rebar, A. L., Dimmock, J. A., Jackson, B., Rhodes, R. E., Kates, A., Starling, J. and Vandelanotte, C. 2016. A systematic review of the effects of non-conscious regulatory processes in physical activity. *Health Psychology Review*, **10**, 4, 395–407.
Reyes Fernández, B., Knoll, N., Hamilton, K. and Schwarzer, R. 2016. Social-cognitive antecedents of hand washing: action control bridges the planning–behavior gap. *Psychology & Health*, **31**, 8, 993–1004.
Rhodes, R. E. and Courneya, K. S. 2003. Investigating multiple components of attitude, subjective norm, and perceived control: an examination of the theory of planned behaviour in the exercise domain. *British Journal of Social Psychology*, **42**, 1, 129–46.
Rhodes, R. E. and de Bruijn, G. J. 2013. How big is the physical activity intention–behaviour gap? A meta-analysis using the action control framework. *British Journal of Health Psychology*, **18**, 2, 296–309.

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

Rhodes, R. E. and Mistry, C. D. 2016. Understanding the reasons behind anticipated regret for missing regular physical activity. *Frontiers in Psychology*, **67**, 8, 282–7.
Schwarzer, R. 2008. Modeling health behavior change: how to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology*, **57**, 1, 1–29.
Sheeran, P., Bosch, J. A., Crombez, G., Hall, P. A., Harris, J. L., Papies, E. K. and Wiers, R. W. 2016*b*. Implicit processes in health psychology: diversity and promise. *Health Psychology*, **35**, 8, 761–6.
Sheeran, P., Maki, A., Monanaro, E., Avishai-Yitshak, A., Bryan, A., Klein, W. P., Miles, E. and Rothman, A. J. 2016*a*. The impact of changing attitudes, norms, and self-efficacy on health-related intentions and behavior: a meta-analysis. *Journal of Health Psychology*, **35**, 11, 1178–88.
Sherrington, C., Tiedemann, A., Fairhall, N., Close, J. C. T. and Lord, S. R. 2011. Exercise to prevent falls in older adults: an updated meta-analysis and best practice recommendations. *New South Wales Public Health Bulletin*, **22**, 4, 78–83.
Sims, J., Birrell, C. L., Hunt, S., Browning, C., Burns, R. A. and Mitchell, P. 2014. Prevalence of physical activity behaviour in older people: findings from the Dynamic Analyses to Optimise Ageing (DYNOPTA) project and Australian national survey data. *Australasian Journal on Ageing*, **33**, 2, 105–13.
Sims, J., Hill, K., Hunt, S., Haralambus, B., Brown, A., Engel., L., Huang, N., Kerse, N. and Ory, M. 2016. Physical activity recommendations for older Australians. Discussion document, Australian Government Department of Health and Ageing, Canberra.
Sniehotta, F. F., Schwarzer, R., Scholz, U. and Schüz, B. 2005. Action planning and coping planning for long-term lifestyle change: theory and assessment. *European Journal of Social Psychology*, **35**, 4, 565–76.
Sun, F., Norman, I. J. and While, A. E. 2013. Physical activity in older people: a systematic review. *BioMed Central Public Health*, **13**, 1, 449–61.
Thøgersen-Ntoumani, C., Shepherd, S. O., Ntoumanis, N., Wagenmakers, A. J. and Shaw, C. S. 2016. Intrinsic motivation in two exercise interventions: associations with fitness and body composition. *Health Psychology*, **35**, 2, 195–8.
Verplanken, B. and Melkevik, O. 2008. Predicting habit: the case of physical exercise. *Psychology of Sport and Exercise*, **9**, 1, 15–26.
Warner, L. M., Wolff, J. K., Ziegelmann, J. P., Schwarzer, R. and Wurm, S. 2016. Revisiting self-regulatory techniques to promote physical activity in older adults: null-findings from a randomised controlled trial. *Psychology & Health*, **31**, 10, 1145–65.
Warner, L. M., Ziegelmann, J. P., Schüz, B., Wurm, S. and Schwarzer, R. 2011. Synergistic effect of social support and self-efficacy on physical exercise in older adults. *Journal of Aging and Physical Activity*, **19**, 3, 249–61.
Welmer, A. K., Morck, A. and Dahlin-Ivanoff, S. 2012. Physical activity in people age 80 years and older as a means of counteracting disability, balanced in relation to frailty. *Journal of Aging and Physical Activity*, **20**, 3, 317–31.
Williams, S. L., Michie, S., Dale, J., Stallard, N. and French, D. P. 2015. The effects of a brief intervention to promote walking on theory of planned behavior constructs: a cluster randomized controlled trial in general practice. *Patient Education and Counseling*, **98**, 5, 651–9.
Wolff, J. K., Warner, L. M., Ziegelmann, J. P., Wurm, S. and Kliegel, M. 2016. Translating good intentions into physical activity: older adults with low prospective memory ability profit from planning. *Journal of Behavioral Medicine*, **39**, 3, 472–82.
Zhou, G., Gan, Y., Miao, M., Hamilton, K., Knoll, N. and Schwarzer, R. 2015*a*. The role of action control and action planning on fruit and vegetable consumption. *Appetite*, **91**, 1, 64–8.

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press

Zhou, G., Sun, C., Knoll, N., Hamilton, K. and Schwarzer, R. 2015*b*. Self-efficacy, planning, and action control in an oral self-care intervention. *Health Education Research*, **30**, 4, 671–81.
Ziegelmann, J. P. and Knoll, N. 2015. Future directions in the study of health behavior among older adults. *Gerontology*, **61**, 5, 469–76.

Accepted 11 June 2017; first published online 3 October 2017

Address for correspondence:

Urska Arnautovska,
Griffith University,
Health and Psychology Innovations (HaPI) Research Lab,
Building M24 Psychology, 176 Messines Ridge Road,
Mt Gravatt, QLD 4122, Australia

E-mail: urska.arnautovska@griffithuni.edu.au

https://doi.org/10.1017/S0144686X17001027 Published online by Cambridge University Press