Older Adults' Physical Activity: The Integration of Autonomous Motivation and Theory of Planned Behaviour Constructs

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Research Team Description

Dr Urska Arnautovska (general psychologist and researcher), Professor Lena Fleig (academic), Associate Professor Frances O'Callaghan (health psychologist and academic), and Dr Kyra Hamilton (health psychologist and academic); the work of all authors focuses on the application of social-cognition models to understanding health-related behaviours.

Abstract

Objective: To examine the motivational processes underpinning Australian older adults' physical activity.

Method: Adults aged 65 years and over ($N = 213$) completed a questionnaire assessing autonomous motivation and theory of planned behaviour variables (attitudes, subjective norm, and perceived behavioural control), and a 2-week follow-up of their self-reported physical activity ($n = 165$).

Results: In a structural equation model, effects of autonomous motivation on intention were mediated by attitudes and perceived behavioural control, but not subjective norm. The model explained 60% and 46% of the variance in intention and physical activity, respectively.

Conclusion: The findings add to current knowledge of motivational processes underpinning physical activity in older adults. Current results indicate that interventions where the value of regular physical activity can be internalised by offering activities that foster feelings of competence, autonomy, and relatedness may be important to consider in increasing physical activity levels of older adults, a group at risk of sedentary behaviours.

Keywords: motivation; older adults; physical activity; self-determination theory; theory of planned behaviour

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Despite a range of health benefits associated with physical activity (PA) in later life (Williams, Eastwood, Tillin, Hughes, & Chaturvedi, 2014), the majority of Australian older adults do not meet recommended levels of PA (AIHW, 2016). While it is recommended that older adults engage in a minimum of 30 minutes of at least moderate intensity PA on five or more days of the week (Department of Health, 2014), the Australian Health Survey (ABS, 2015) showed that in 2014-15, only 40% of those aged 65-75 years and 27.8% of those aged 75 years and older were sufficiently active.

While research indicates that person-related barriers, such as poor health and lack of interest, are strong predictors of older adults' PA (Gellert et al., 2015), less is known about more distal psychological processes associated with older adults' motivation for PA (Baert, Gorus, Mets, Geerts, & Bautmans, 2011). The source of an individual's motivation for PA, or lack thereof, is suggested to originate from a range of factors, including biased (overestimated) perceptions of own PA levels (Visser, Brychta, Chen, & Koster, 2014), poor awareness of health benefits associated with PA (Baert et al., 2011), and perceived competence of performing PA at their past (higher) level (Arnautovska, O'Callaghan, & Hamilton, 2017a). Older adults, in particular, may benefit from the motivation associated with a sense of autonomy (Arnautovska et al., 2017; Chang, 2012). Limited research focusing on older adults' motivational perspectives has shown that those who are autonomously motivated report higher quality of life, including less discomfort due to pain or physical state in daily activities (Ferrand, Martinet, & Bonnefoy, 2014). Despite this research indicating a diverse range of possible determinants, understanding of the nature of older adults' motivation for regular PA is limited (Duncan, Hall, Wilson, & Jenny, 2010).

Research investigating motivation for health behaviour has indicated that the nature of one's motivation, specifically autonomous motivation, impacts social cognitions and is an important driver of health behaviour (Hagger & Chatzisarantis, 2009). To advance current knowledge, researchers (Hagger & Chatzisarantis, 2014; Hamilton, Cox, & White, 2012; Hamilton, Kirkpatrick, Rebar, & Hagger, 2017) have integrated dominant social-cognitive models, such as the theory of planned behaviour (TPB; Ajzen, 1991), with complementary theories. Integrative models offer a more comprehensive articulation of the complexity of psychological processes guiding health behaviour (Hagger, 2009).

The TPB (Ajzen, 1991) proposes intention as the proximal predictor of behaviour. It is further hypothesised that intention is predicted by the three belief-based constructs: attitude (advantages/disadvantages), subjective norm (perceived social approval/disapproval), and perceived behavioural control (facilitators/barriers). In addition, it is proposed that perceived behavioural control directly predicts behaviour. The strength of intention is predicted by a person's evaluation of the target behaviour, perceptions about approval of important others for performing the behaviour, and perceptions of control and ability in relation to behavioural performance. Findings from meta-analyses support the predictive ability of attitudes and perceived behavioural control on intention, with a weaker subjective norm-intention relationship often found (Downs & Hausenblas, 2005; Hagger, Chatzisarantis, & Biddle, 2002). In line with these findings, a review of TPB-based PA studies by Hagger and colleagues (2002), including persons of all ages, indicated that attitudes and perceived behavioural control were the best predictors of intention ($\beta = 0.40$ and 0.33 , respectively), and together with subjective norm predicted 45% of variance in intention. In addition, perceived behavioural control was found to be associated with PA, and together with intention explained 27% of the variance in behaviour.

The TPB has been shown to be useful in prediction of a wide range of behaviours for individual health (McEachan, Conner, Taylor, & Lawton, 2011) and the health of others (Hamilton, Thomson, & White, 2013; Hamilton, White, Wihardjo, & Hyde, 2016; Hamilton, Spinks, White, Kavanagh, & Walsh, 2016; Spinks & Hamilton, 2016; Walsh, Hamilton, White, & Hyde, 2015), including PA (Downs & Hausenblas, 2005). Despite the vast amount of research supporting the TPB, the model has been suggested to be limited in its explanation of the processes underpinning motivational variables, which are proposed to be underpinned by specific beliefs (Hagger & Chatzisarantis, 2009). Although it is proposed in the TPB that salient beliefs underlying attitudes, subjective norm, and perceived behavioural control include behavioural, normative, and control beliefs, respectively (Ajzen, 1991), and identification such beliefs for targeted interventions have been the focus of much research in a range of health behaviours (Ashford, Edmunds & French, 2010; Cowie & Hamilton, 2014; Epton, Norman, Harris, Webb, Snowsill & Sheeran, 2014; Hamilton, White, et al., 2012; Masser, White, Hamilton & McKimmie, 2012; Vayro & Hamilton, 2016), the origins of, and reasons why specific beliefs would be pursued, are explained only in a general way. For example, it is postulated that behavioural beliefs develop through experience with the behaviour by associations with other objects, characters, and events. This explanation, however, offers only a limited opportunity to change such cognitions without the actual engagement in regular PA. Thus, for people with little or no such experience, changing cognitions towards more favourable beliefs may be difficult. To account for these motivations, self-determination theory (SDT; Deci & Ryan, 2002), an alternative theory that focuses on the quality of motivation, has been proposed to complement the TPB to provide a better understanding of the processes underpinning TPB constructs (for an explanation of this integration see Hagger and Chatzisarantis, 2009).

The SDT proposes a multidimensional conceptualisation of motivation, with amotivation, autonomous motivation, and controlled motivation representing the three main types (Deci & Ryan, 2002). It is proposed that individuals' motivation lies along a continuum (known as perceived locus of causality), ranging from completely non self-determined regulation, or amotivation, to completely self-determined regulation, or intrinsic motivation, with extrinsic motivation falling between the two. Autonomous motivation indicates that behaviour is self-determined and performed out of a person's internal will, while controlled motivation refers to behaviours which are performed with a sense of pressure that is perceived as external to the person. The most autonomous form of motivation is intrinsic motivation, which involves behaviour that is performed out of inherent interest and enjoyment. This is followed by extrinsic (controlled) motivation, which can be performed either for autonomous or more controlled reasons. The two more autonomous forms of extrinsic (controlled) motivation are identified regulation, which involves performing the behaviour because it is personally important and results in expected outcomes, and integrated regulation, which is involved in pursuit of behaviour that is congruent with one's values and has become part of one's self-identity (Deci & Ryan, 2002). The two more controlling forms of extrinsic (controlled) motivation are performed for external contingencies such as satisfying an external demand, obtaining rewards or to avoid feelings of guilt (external regulation), or to obtain feelings of worth (introjected regulation).

Studies have shown that intrinsic motivation (Hagger & Chatzisarantis, 2009), and the relatively autonomous forms of extrinsic motivation (i.e., identified and intrinsic regulation), are associated with long-term exercise adherence (Teixeira, Carraça, Markland, Silva, & Ryan, 2012) and higher frequency of PA (Duncan et al., 2010). It should be acknowledged that the study by Duncan and colleagues (2010) included young adults who exercised regularly, while the systematic review by Teixeira and colleagues (2012) included

predominantly studies with students, healthy adults, and rehabilitation patients. The use of such age groups, however, offers limited understanding of how intrinsic motivation may be helpful for PA in older adults. Limited research investigating the SDT (Deci & Ryan, 2002) in the context of PA in older adults confirms the positive effects of autonomous motivation (Ferrand et al., 2014). For example, Ferrand and colleagues (2014) reported that those aged 70 years and older, who engaged in regular exercise and were classified as “highly self-determined” reported higher PA levels compared to the “moderately introjected group”. In addition, those with higher levels of intrinsic motivation reported less discomfort and limitations due to physical or mental health, as well as less bodily pain than those with less intrinsic motivation. Cumulatively, the available evidence provides support for the exploration of the role of autonomous motivation for PA engagement in older adults.

The current research examined fundamental motivational processes impacting PA in an at-risk group for physical inactivity by investigating potential associations of older adults’ social cognitions (i.e., attitude, subjective norm, and perceived behavioural control) with more distal motivational constructs, such as the concept of autonomous motivation. Drawing on the empirical evidence supporting the integration of SDT and TPB (Hagger & Chatzisarantis, 2009; Hagger et al., 2016; Hagger, Trost, Keech, Chan, & Hamilton, 2017; Hamilton et al., 2017), we hypothesised that autonomous motivation would predict attitude, subjective norm, and perceived behavioural control (H1). In line with the TPB (Ajzen, 1991), it was further hypothesised that these belief-based cognitions would predict PA intention (H2). Following this sequence, it was expected that TPB concepts would mediate the effects of autonomous motivation on PA intention (H3). Finally, we expected that PA behaviour would be predicted by intention (H4) and perceived behavioural control (H5), consistent with the TPB.

Method

Participants

Participants were recruited through a variety of methods including advertisements in local community newsletters, face-to-face presentations at community events, and word of mouth. 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 injury or other medical reason). Moderate-intensity PA was defined according to Australian guidelines and described as activity that causes faster heartbeat and some shortness of breath, while still being able to talk comfortably (Department of Health, 2014). Participants were asked to indicate if they met the selection criteria at the beginning of the survey. If not, they were advised that they were not eligible to continue. No other eligibility criteria were considered.

At baseline, participants ($N = 215$) provided informed consent and then completed the main questionnaire. Two participants were excluded due to inability to perform PA, leaving a final sample of $N = 213$. Two weeks later, 165 participants completed the follow-up; out of these, 66.7% were female. The longitudinal sample ($N = 165$) included a diverse range of participants regarding age ($M_{\text{age}} = 73.8$, $SD = 7.0$, range = 65 – 95); education status (university = 35.4%, non-university = 64.6%); socio-economic status, as determined by the average gross weekly income (up to \$1,000 = 68%, over \$1,000 = 32%); and country of birth (Australian-born = 63.4%). About half of the participants were married or in a de-facto relationship (49.7%) and most were retired (87.3%). Participants experienced an average of two health conditions ($SD = 1.5$, range = 0 – 7), with the most common being hypertension (40%) and arthritis (37.6%). Attrition between baseline and follow-up was 22.1%, which was lower than rates observed in other previous studies (Caudroit, Stephan, & Le Scanff, 2011). Drop-out analysis indicated that participants who completed both assessments, compared to those who only completed the baseline survey, had a higher level of education ($p = .03$). No other significant differences on study measures were observed (all $p > .05$).

Procedure

Participants completed the survey either in paper form (59.2%) or online (40.8%). The paper-based surveys were distributed when presenting the study at community events. The access to an online survey was provided via email notices. The baseline survey included assessment of demographic characteristics as well as social-cognitive and motivational variables, while the follow-up survey assessed self-reported PA in the previous week. The two-week follow-up period was chosen to facilitate accuracy of recall; research has suggested that longer follow-up periods may compromise recall accuracy due to age-related declines in memory that are typically present in older adults (Hedden & Gabrieli, 2004). A unique code identifier allowed matching of questionnaires. Participants who completed both questionnaires were offered the chance to enter a prize draw to win one of five AUD20 vouchers. The University Human Research Ethics Committee approved the study.

Measures

The target behaviour, *regular physical activity*, was defined as “behaviour that is of at least moderate intensity and performed for at least 30 minutes on 5 days or more of the week” (Department of Health, 2014). Unless otherwise stated, items were rated on a 7-point scale ranging from *strongly disagree* (1) to *strongly agree* (7), with the total score for each measure being represented by the mean score of included items. Psychological constructs were measured on multi-item psychometric instruments developed using standardised guidelines (Fishbein & Ajzen, 2010) and validated in previous studies (Hamilton, Cox et al., 2012) and adapted for use with the target behaviour in the current study. Factor loadings for manifest indicators within the construct and Cronbach’s alpha for each measure are presented in Table 1.

Intention. Three items assessed intention: “It is likely that I will be regularly physically active”; “I intend to be regularly physically active”; and, “I expect that I will be regularly physically active”.

Attitude. Attitude was assessed by two, 7-point semantic differential scales, both positively scored: “For me to do regular PA would be ...” *bad* (1) to *good* (7) and *harmful* (1) to *beneficial* (7).

Subjective norm. Subjective norm was measured by four items: “People who are important to me would want me to engage in regular physical activity”; “Most people who are important to me would approve of my engaging in regular physical activity”; “People who are important to me engage in regular physical activity”; and, “People who are important to me would think that engaging in regular physical activity is a good thing to do”.

Perceived behavioural control. Two items assessed perceived behavioural control: “It is mostly up to me whether or not I engage in regular physical activity” and “I have complete control over whether I engage in regular physical activity”.

Autonomous motivation. Autonomous motivation was assessed using intrinsic and identified subscales of the Behavioural Regulation in Exercise Questionnaire (Mullan, Markland, & Ingledew, 1997). Four items measured identified regulation: “I value the benefits of regular physical activity”; “It’s important to me to do regular physical activity”; “I think it is important to make the effort to be regularly physically active”; and, “I get restless if I don’t do regular physical activity”. Four items measured intrinsic motivation: “I get pleasure and satisfaction from being regularly physically active”; “I am regularly physically active because it’s fun”; “I enjoy being regularly physically active”; and, “I find regular physical activity a pleasurable activity”. Items were scored on a 5-point scale ranging from *not true for me* (1) to *very true for me* (5). The mean of these two subscales was used to assess autonomous motivation as per Hagger and Chatzisarantis (2009).

Control variables. Participant demographic variables (i.e., sex, age, socio-economic status [SES], and multimorbidity) were entered into model analyses as control variables. These variables were selected because of their association with PA in previous studies (van Stralen, De Vries, Mudde, Bolman, & Lechner, 2009). For SES, participants' self-reported average gross household income per week was dichotomised into below average ($\leq \$1,000$) and above average ($> \$1,000$), in accordance with the Australian Bureau of Statistics (ABS, 2012). Multimorbidity was assessed by asking about the presence of 14 health conditions, following Menec (2003). A total morbidity score was calculated by summing affirmative responses.

Behaviour. Self-reported PA behaviour was measured using three 7-point single-items: "On how many days in the past week (past 7 days) have you engaged in at least 30 minutes of at least moderate-intensity PA?"; "In the previous week, how often did you engage in regular PA?"; and, "In the previous week, to what extent did you engage in regular PA?" Self-report measures of PA have proven to be valid for assessing PA against objective measures of PA (Hamilton, White, & Cuddihy, 2012).

Data Analysis

Frequency and drop-out analyses were conducted using SPSS Version 20. Attrition bias was assessed by comparing participants who did and did not complete follow-up assessment ($n = 165$, $n = 23$, respectively) on all baseline characteristics, using t -test for continuous and χ^2 test for nominal variables. The intercorrelations between the variables were calculated using Pearson correlation coefficients. Multicollinearity among the variables was not identified. The scale reliability was calculated using Cronbach's α . A principal component analysis (PCA) was conducted on the attitude and autonomous motivation items with oblique rotation. Two components had eigenvalues over Kaiser's criterion of 1, and in combination, explained 76.29% of the variance. Items clustering on component 1 referred to autonomous

motivation, whereas items clustering on component 2 referred to attitudes, supporting discriminant validity of both constructs.

The model was specified within a structural equation modelling framework and estimated direct and indirect paths (Figure 1) using Mplus 7. The hypothetical model consisted of six latent variables which were specified with manifest indicators described in the Measures section. For autonomous motivation and subjective norm, we applied parcelling to reduce the number of parameters per each construct, to improve the normality of the distributions, and to increase the stability of the parameter estimates (Little, Cunningham, Shahar, & Widaman, 2002). The model was evaluated based on recommended fit indices including the comparative fit index (CFI), the root-mean-square error of approximation (RMSEA), and the Tucker-Lewis-Index (TLI). Missing data (< 5%) were treated using the full maximum likelihood algorithm.

Results

Table 1 presents the means, standard deviations, and intercorrelations among all variables. All latent variables were positively related ($p < .01$) with PA at follow-up, with the correlations between subjective norm and PA, and PBC and PA being small to moderate, and the correlations between attitudes and PA, and autonomous motivation and PA being moderate to strong, according to Cohen's (1992) guidelines.

Structural Equation Modelling

The hypothesised model provided an adequate fit to the data (RMSEA = .04, CFI = .98, TLI = .98, $\chi^2(108) = 141.76$, $\chi^2/df = 1.31$). As hypothesised (H1), autonomous motivation was associated (all $p < .01$) with attitude ($\beta = .67$), subjective norm ($\beta = .45$), and PBC ($\beta = .34$, Figure 1). In partial support of H2, intention was predicted by attitude and PBC ($\beta = .32$, $p < .01$ and $\beta = .26$, $p < .01$, respectively), but not subjective norm ($\beta = .02$, $p > .05$). Multiple mediation analysis showed that the effects of autonomous motivation on intention were

mediated by attitude and perceived behavioural control, but not subjective norm (Table 1), which partly supported H3. In support of H4, intention predicted PA at follow-up ($\beta = .25, p < .05$); however, perceived behavioural control predicted PA only indirectly via intention ($\beta = .08, p > .05$; Figure 1), partly confirming H5. Behaviour was also directly predicted by autonomous motivation ($\beta = .46, p < .05$). Autonomous motivation, attitude, subjective norm, and perceived behavioural control cumulatively accounted for 60% of the variance in intention; the overall model explained 46% of the variance in PA.

Discussion

This study examined fundamental motivational processes impacting older adults' PA, demonstrating the importance of autonomous motivation and social cognitive factors for this important health behaviour in a group at risk for inactivity. Current findings corroborate previous studies investigating belief-based determinants of PA (Hagger & Chatzisarantis, 2014; Hamilton, Cox, et al., 2012) and add to the extant literature by demonstrating that the effects of autonomous motivation on PA are mediated by social cognitive variables in an older adult population. This contribution is important for two reasons: first, it informs the development of PA models which, as argued by Caudroit et al. (2011), should be adjusted to the unique characteristics of the target group; and, second, it provides a greater understanding of concepts that may assist in facilitating PA levels in older adults.

Current findings showed that autonomous motivation was associated with all three TPB constructs, with mediation analysis indicating that the effects of autonomous motivation on intention were mediated by attitude and perceived behavioural control, but not subjective norm. Original theoretical explanations examining the effects of autonomous motivation in the TPB did not hypothesise a path from autonomous motivation to subjective norm, based on subjective norm being defined as *controlling* (i.e., perceptions about approval of important others), rather than *autonomous* cognitions (Hagger & Chatzisarantis, 2009). Current findings

provide support for this original theorising and corroborate previous research indicating that the effect of subjective norm on intention is smaller than that of attitude and perceived behavioural control (Downs & Hausenblas, 2005). From a lifespan perspective, older adults' PA may be less dependent on perceived social approval due to a stronger need for independent decision making, which can be associated with age-related functional limitations (Arnautovska, O'Callaghan, & Hamilton, 2017b). Indeed, subjective norm has previously been found to have a small and negative effect on PA intention among retirees (Gretebeck et al., 2007).

More noteworthy are the findings of the current study that indicated those who are more autonomously motivated to engage in PA were more likely to have positive attitudes toward PA and hold beliefs that they have control over their PA. This corroborates previous research (Lawton, Conner, & McEachan, 2009) and suggests that considering strategies to improve PA attitudes and control in interventions to promote PA engagement in older adults may be useful. Current findings, therefore, illustrate the importance of prompting formation of positive attitudes about and control over PA in later life through supporting one's sense of competence, relatedness, and autonomy—the basic psychological needs—which, as proposed by SDT (Deci & Ryan, 2002), foster one's autonomous motivation. According to SDT (Deci & Ryan, 2002), the need for autonomy is particularly relevant for understanding goal-directed behaviour and can be expected to be a strong motivating force for maintaining PA, particularly in the context of age-related multimorbidity.

Although specified as a control variable in the current study, it is interesting to note that multimorbidity had a negative effect on PA, indicating that the greater the number of chronic conditions, the less PA the person was likely to do. This finding is consistent with previous research indicating debilitating effects of chronic conditions on one's physical activities (Clarke & Bennett, 2013). Of importance, however, is that the current study

underlines the need to support autonomy and competence as a means to influence social cognitions regarding PA which, in turn, could buffer against negative effects of illness on one's well-being and functional independence (De Vries et al., 2012).

Current findings are useful in better understanding older adults' PA engagement. Although older adults can gain significant health benefits from PA (Williams et al., 2014), they may lack interest in PA (Gellert et al., 2015), which may result from not perceiving it as personally valuable and beneficial. Current results have provided a more comprehensive explanation of the motivational processes that underpin older adults' PA by demonstrating that the path from autonomous motivation to intention is mediated via attitudinal and control perceptions of PA. In addition, autonomous motivation had direct effects on PA behaviour, highlighting the importance of goals that are congruent with one's personal values and perceived as being initiated out of one's free choice (Chang, 2012). It is important that health policies support a range of PA opportunities across a broader range of settings such as communities, health services and hospitals, workplaces, education programs for older adults, and residential settings. Such a multi-setting promotion of PA may not only contribute to creating a social and physical environment where older adults would feel more comfortable engaging in PA (King & King, 2010), but may also provide more opportunities for older adults to be physically active. To facilitate PA engagement, it is suggested that intervention developers provide an environment where the value of regular PA would be internalised so that the intervention effects would more likely extend beyond the duration of the program over the long term (Ryan, Patrick, Deci, & Williams, 2008).

Potential limitations and implications for future research should be considered. First, although self-report PA measures are shown to be reliable and valid for assessing PA (Hamilton, White, et al., 2012; Milton, Bull, & Bauman, 2010), the self-report measure of PA may be methodologically weaker than objective measures. Second, while adopting a

prospective design, assessing behaviour over a 2-week period precludes generalising the findings to PA maintenance or conclusions about the cause and effect nature among variables (van Stralen et al., 2009). To test whether changes in these constructs would, indeed, result in older adults changing their PA levels, an experimental design, including manipulation of these constructs, would be needed. Finally, although our analysis controlled for multimorbidity, given the nature of this age group, it might be beneficial in future studies to consider also other potential barriers to PA, such as functional ability or environmental factors.

In conclusion, given that psychologists and other health practitioners may witness an increase in the number of older clients they consult, current findings can be used to inform practice regarding motivational processes driving health behaviour in this at-risk group. Strengthening the quality of a person's motivation for PA, as suggested by the current findings, towards greater internalisation of PA (congruence with individual personal values), by healthcare professionals aiming to increase an older person's PA level may be especially useful. Such focus seems particularly important since a recent review of strategies and interventions promoting health and active lifestyles among older adults identified a lack of interventions aiming to appeal to personal motivation (Menichetti, Cipresso, Bussolin, & Graffigna, 2015). Indeed, previous evidence indicates that contact with a healthcare professional who would provide individualised PA advice may have beneficial effects for older adults' PA engagement (Hinrichs et al., 2011; Robare et al., 2011). This knowledge can also assist intervention designers to develop evidence- and theory-based behaviour change programs and, thus, enhance intervention effectiveness. Future research might benefit from identifying which strategies are most appropriate to engender behaviour change in older adults, as well as how to best deliver the strategies to enhance older adults' autonomous motivation for PA.

Key points

What is already known on this topic?

1. While PA has been associated with a range of health benefits, including reducing the risk of age-related illness and disability, older adults are at risk for engaging in insufficient PA to obtain health benefits.
2. Social cognitions have been associated with PA; however, their origins and motivational processes underlying these cognitions are not well understood.
3. Recent research has indicated that people who engage in PA for autonomous reasons are more likely to form intentions to be active and also to actively pursue PA activities.

What this topic adds?

1. Current results highlight the importance of autonomous motivations and social cognitive factors for older adults' PA.
2. Interventions where the value of regular PA can be internalised by offering activities that foster feelings of competence, autonomy, and relatedness may be important to consider in increasing PA levels of older adults.
3. Practitioners wanting to increase older adults' PA should focus on increasing autonomous motivation for PA by giving older adults a choice about the type of activity they would like to engage in, while providing relevant information about the appropriate type of PA for the individual's specific health needs.

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References

- ABS. (2012). *Australian Demographic Statistics (Catalogue No. 3101.0)*. Canberra: ABS.
- ABS (2015). *National Health Survey: First Results, 2014-15. (Catalogue No. 4364.0.55.001)*. Canberra: ABS.
- AIHW. (2016). *Australia's health 2016. Australia's health series no. 15 (Cat no AUS 199)*. Canberra: AIHW.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179-211.
- Arnautovska, U., O'Callaghan, F., & Hamilton, K. (2017a). 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., & Hamilton, K. (2017b). Applying the Integrated Behavior Change model to understanding physical activity among older adults: A qualitative study. *Journal of Sport & Exercise Psychology*, Ahead of Print. doi: <https://doi.org/10.1123/jsep.2015-0300>.
- Ashford, S., Edmunds, J., & French, D. P. (2010). What is the best way to change self-efficacy to promote lifestyle and recreational physical activity? A systematic review with meta-analysis. *British Journal of Health Psychology*, 15(2), 265-288. doi:10.1348/135910709X461752.
- Baert, V., Gorus, E., Mets, T., Geerts, C., & Bautmans, I. (2011). Motivators and barriers for physical activity in the oldest old: A systematic review. *Ageing Research Reviews*, 10(4), 464-474.
- Brown, D., Hagger, M. S., Morrissey, S., & Hamilton, K. (2018). Predicting fruit and vegetable consumption in long-haul heavy goods vehicle drivers: application of a multi-theory, dual-phase model and the contribution of past behavior. *Appetite*, 121, 326-336. <https://doi.org/10.1016/j.appet.2017.11.106>.

- Caudroit, J., Stephan, Y., & Le Scanff, C. (2011). Social cognitive determinants of physical activity among retired older individuals: An application of the health action process approach. *British Journal of Health Psychology*, 16(2), 404-417.
- Chang, L.-C. (2012). An interaction effect of leisure self-determination and leisure competence on older adults' self-rated health. *Journal of Health Psychology*, 17(3), 324-332.
- Clarke, L. H., & 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 and Society*, 33(2), 342-360.
- Cowie, E., & 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, 719-726. doi:[10.1007/s10900-013-9817-3](https://doi.org/10.1007/s10900-013-9817-3).
- De Vries, N. M., Van Ravensberg, C. D., Hobbelen, J. S. M., Olde Rikkert, M. G. M., Staal, J. B., & Nijhuis-van der Sanden, M. W. G. (2012). Effects of physical exercise therapy on mobility, physical functioning, physical activity and quality of life in community-dwelling older adults with impaired mobility, physical disability and/or multi-disability: A meta-analysis. *Ageing Research Reviews*, 11, 136-149.
- Deci, E. L., & Ryan, R. M. (2002). Overview of self-determination theory: An organismic dialectical perspective. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 3-33). New York: University of Rochester Press.
- Department of Health. (2014). Recommendations on physical activity for health for older Australians. Retrieved from <http://www.health.gov.au/internet/main/publishing.nsf/Content/phd-physical-rec-older-guidelines>

- Downs, D. S., & Hausenblas, H. A. (2005). The theories of reasoned action and planned behavior applied to exercise: A meta-analytic update. *Journal of Physical Activity and Health*, 2(1), 76-97.
- Duncan, L. R., Hall, C. R., Wilson, P. M., & Jenny, O. (2010). Exercise motivation: A cross-sectional analysis examining its relationships with frequency, intensity, and duration of exercise. *International Journal of Behavioral Nutrition and Physical Activity*, 7(7), 1-9.
- Epton, T., Norman, P., Harris, P., Webb, T., Snowsill, F. A., & Sheeran, P. (2014). Development of theory-based health messages: Three-phase programme of formative research. *Health Promotion International*, 30(3), 756-768.
- Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behavior: The reasoned action approach*. New York: Psychology Press.
- Ferrand, C., Martinent, G., & Bonnefoy, M. (2014). Exploring motivation for exercise and its relationship with health-related quality of life in adults aged 70 years and older. *Ageing and Society*, 34(3), 411-427.
- Gellert, P., Witham, M. D., Crombie, I. K., Donnan, P. T., McMurdo, M. E., & Sniehotta, F. F. (2015). The role of perceived barriers and objectively measured physical activity in adults aged 65–100. *Age and ageing*, 44(3), 384-390.
- Gretebeck, K. A., Black, D. R., Blue, C. L., Glickman, L. T., Huston, S. A., & Gretebeck, R. J. (2007). Physical activity and function in older adults: Theory of planned behavior. *American Journal of Health Behavior*, 31(2), 203-214.
- Hagger, M. S. (2009). Theoretical integration in health psychology: Unifying ideas and complementary explanations. *British Journal of Health Psychology*, 14(2), 189-194.

- Hagger, M. S., & 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., & Chatzisarantis, N. L. D. (2014). An integrated behavior change model for physical activity. *Exercise and Sport Sciences Reviews, 42*(2), 62-69.
- Hagger, M. S., Chatzisarantis, N. L. D., & Biddle, S. J. H. (2002). A meta-analytic review of the theories of reasoned action and planned behavior in physical activity: Predictive validity and the contribution of additional variables. *Journal of Sport and Exercise Psychology, 24*(1), 3-32.
- Hagger, M. S., Trost, N., Keech, J., Chan, D. K. C., & Hamilton, K. (2017). Predicting sugar consumption: Application of an integrated dual-process, dual-phase model. *Appetite, Advanced online publication*. doi:10.1016/j.appet.2017.04.032.
- Hagger, M. S., Sultan, S., Hardcastle, S., Reeve, J., Patall, E. A., Fraser, B., Hamilton, K., & Chatzisarantis, N. (2016). Applying the integrated trans-contextual model to mathematics activities in the classroom and homework behavior and attainment. *Learning and Individual Differences, 45*, 166-175. doi:10.1016/j.lindif.2015.11.017.
- Hamilton, K., Cox, S., & White, K. M. (2012). Testing a model of physical activity among mothers and fathers of young children: Integrating self-determined motivation, planning, and the theory of planned behavior. *Journal of Sport and Exercise Psychology, 34*(1), 124-145.
- Hamilton, K., White, K. M., & 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), 340-345.
- Hamilton, K., Thomson, C., & White, K.M. (2013). Promoting active lifestyles in young children: investigating mothers' decisions about their child's physical activity and

- screen time behaviour. *Maternal and Child Health Journal*, 17, 968-976.
doi:10.1007/s10995-012-1081-0.
- Hamilton, K., Kirkpatrick, A., Rebar, A., & Hagger, M. S. (2017). Child sun safety: Application of the Integrated Behaviour Change model. *Health Psychology*, 36(6), 916-926. doi:10.1037/hea0000533.
- Hamilton, K., Spinks, T., White, K. M., Kavanagh, D. J., & Walsh, A. M. (2016). A psychosocial analysis of parents' decisions for limiting their young child's screen time: An examination of attitudes, social norms and roles, and control perceptions. *British Journal of Health Psychology*, 21(2), 285-301. doi:10.1111/bjhp.12168.
- Hamilton, K., White, K. M., Young, R., Hawkes, A., Starfelt, L. C., & Leske, S. (2012). Identifying critical sun-protective beliefs among Australian adults. *Health Education Research*, 27, 834-843. doi:10.1093/her/cys093.
- Hedden, T., & Gabrieli, J. D. (2004). Insights into the ageing mind: a view from cognitive neuroscience. *Nature Reviews Neuroscience*, 5(2), 87-96.
- Hinrichs, T., Moschny, A., Klaaßen-Mielke, R., Trampisch, U., Thiem, U., & Platen, P. (2011). General practitioner advice on physical activity: Analyses in a cohort of older primary health care patients (getABI). *BioMed Central Family Practice*, 12(1), 26-37.
- King, A. C., & King, D. K. (2010). Physical activity for an aging population. *Public Health Reviews*, 32(2), 401-426.
- Lawton, R., Conner, M., & McEachan, R. (2009). Desire or reason: Predicting health behaviors from affective and cognitive attitudes. *Health Psychology*, 28(1), 56-65.
- Little, T. D., Cunningham, W. A., Shahar, G., & Widaman, K. F. (2002). To parcel or not to parcel: Exploring the question, weighing the merits. *Structural Equation Modeling*, 9(2), 151-173.

- Masser, B.M., White, K.M., Hamilton, K., & McKimmie, B. (2012). Beliefs of blood donors' intentions to donate during two phases of an avian influenza outbreak. *Transfusion and Apheresis Science*, 46, 47-52. doi:org/10.1016/j.transci.2011.11.001.
- McEachan, R. R. C., Conner, M., Taylor, N. J., & Lawton, R. J. (2011). Prospective prediction of health-related behaviours with the theory of planned behaviour: A meta-analysis. *Health Psychology Review*, 5(2), 97-144.
- Menec, V. H. (2003). The relation between everyday activities and successful aging: A 6-year longitudinal study. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 58(2), 74-82.
- Menichetti, J., Cipresso, P., Bussolin, D., & Graffigna, G. (2015). Engaging older people in healthy and active lifestyles: A systematic review. *Ageing and Society*, 36(10), 2036-2060.
- Milton, K., Bull, F., & Bauman, A. (2010). Reliability and validity testing of a single-item physical activity measure. *British Journal of Sports Medicine*, 45(3), 203-208.
- Mullan, E., Markland, D., & Ingledew, D. K. (1997). A graded conceptualisation of self-determination in the regulation of exercise behaviour: Development of a measure using confirmatory factor analytic procedures. *Personality and Individual Differences*, 23(5), 745-752.
- Robare, J. F., Bayles, C. M., Newman, A. B., Williams, K., Milas, C., Boudreau, R., . . . Kuller, L. H. (2011). The "10 Keys" to healthy aging: 24-month follow-up results from an innovative community-based prevention program. *Health Education & Behavior*, 38(4), 379-388.
- Ryan, R. M., Patrick, H., Deci, E. L., & Williams, G. C. (2008). Facilitating health behaviour change and its maintenance: Interventions based on Self-Determination Theory. *European Health Psychologist*, 10(1), 2-5.

- Sniehotta, F. F., Presseau, J., & Araújo-Soares, V. (2014). Time to retire the theory of planned behaviour. *Health Psychology Review*, 8(1), 1-7.
- Spinks, T., & Hamilton, K. (2016). Investigating mothers' decisions to give their 2-3 year old a nutritionally balanced diet. *Journal of Nutrition Education and Behavior*, 48, 250-257. doi:10.1016/j.jneb.2016.02.002
- Teixeira, P. J., Carraça, E. V., Markland, D., Silva, M. N., & Ryan, R. M. (2012). Exercise, physical activity, and self-determination theory: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 9(1), 78-86.
- van Stralen, M. M., De Vries, H., Mudde, A. N., Bolman, C., & Lechner, L. (2009). Determinants of initiation and maintenance of physical activity among older adults: a literature review. *Health Psychology Review*, 3(2), 147-207.
- Vayro, C., & Hamilton, K. (2016). Using three-phase theory-based formative research to explore healthy eating in Australian truck drivers. *Appetite*, 98, 41-48.
- Visser, M., Brychta, R. J., Chen, K. Y., & Koster, A. (2014). Self-reported adherence to the physical activity recommendation and determinants of misperception in older adults. *Journal of Aging and Physical Activity*, 22(2), 226-234.
- Walsh, A., Hamilton, K., White, K. M., & Hyde, M. (2015). Use of online health information to manage children's health care: A prospective study investigating parental decisions. *BMC Health Services Research*, 15:131. doi:10.1186/s12913-015-0793-4.
- Williams, E. D., Eastwood, S. V., Tillin, T., Hughes, A. D., & Chaturvedi, N. (2014). The effects of weight and physical activity change over 20 years on later-life objective and self-reported disability. *International Journal of Epidemiology*, 43(3), 856-865.

Table 1

Estimated Means (M), Standard Deviations (SDs), Intercorrelations, and Reliability Statistics for Latent Social Cognitive Variables and Older Adults' Physical Activity Behaviour (N = 165)

	1	2	3	4	5	6
1. Autonomous motivation T1	1.00					
2. Attitudes T1	0.76**	1.00				
3. Subjective norm T1	0.44*	0.37*	1.00			
4. PBC T1	0.34*	0.32*	0.20*	1.00		
5. Intention T1	0.67**	0.66**	0.34*	0.48**	1.00	
6. Physical activity behaviour T2	0.59*	0.49*	0.27*	0.15*	0.52**	1.00
Factor loadings for manifest indicators within construct	.89/.93	.73/.70	.83/.93	.98/.85	.96/.97/.97	.77/.88/.89
<i>M^a</i>	3.81	6.25	5.24	6.11	5.63	4.91
<i>SD^a</i>	0.97	1.32	1.32	1.25	1.56	1.38
Range	1-7	1-7	1-7	1.7	1-7	1-7
Cronbach's alpha ^a	.92	.63 ^b	.82	.84 ^b	.98	.85

Note. ^amanifest scale means, standard deviations, and internal consistency; * $p < .05$; ** $p < .01$. T1 = baseline questionnaire, T2 = 2-week follow-up questionnaire,

PBC = perceived behavioural control; ^bPearson correlation (two-item indicator).

Table 2

Summary of Results for Multiple Mediation Model for Older Adults' Physical Activity Intention

Independent variable (IV)	Dependent variable (DV)	Mediating variables (M)	Effect of IV on M	Effect of M on DV	Total effect	Direct effect	Indirect effects	Lower BC 95% CI	Higher BC 95% CI
Autonomous motivation	Intention	Attitudes	0.67**	0.32*			0.21*	0.01	0.49
		Subjective norm	0.45**	0.02	0.64**	0.32*	0.01	-0.07	0.10
		PBC	0.34**	0.26**			0.10*	0.01	0.16

Note. Reported are standardized path coefficients; $n = 162$; * $p = 0.05$; ** $p < 0.001$; PBC = perceived behavioural control, BC = bias corrected, CI =

bootstrapping confidence interval.

Figure 1. Structural model for predicting older adults' physical activity ($N = 165$). *Notes:* Sex, age, income, and multimorbidity were entered as covariates; only significant covariates ($p < .05$) are included in the Figure. $*p < .05$; $**p < .01$.