

# Effects of Group-Based Exercise on Flourishing and Stigma Consciousness among Older Adults: Findings from a Randomised Controlled Trial

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**Background:** To examine the extent to which group-based exercise programs, informed by self-categorisation theory, result in improvements in psychological flourishing and reductions in age- and gender-related stigma consciousness among older adults. **Methods:** In the study, older adults ( $N = 485$ ,  $\geq 65$  years) were randomised to similar age same gender (SASG), similar age mixed gender (SAMG), or “standard” mixed age mixed gender (MAMG) group-based exercise programs. Flourishing and stigma consciousness were assessed on six occasions during the 24-week intervention and represented secondary trial outcomes. Multilevel growth models examined the effects of the interventions on flourishing and stigma consciousness over time. **Results:** Participants in the SASG and SAMG conditions demonstrated, on average, higher levels of flourishing, relative to the MAMG condition, over the course of the 24 weeks ( $p < .05$ ). Additionally, participants

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demonstrated lower levels of age- and gender-related stigma consciousness in both the SASG and SAMG conditions relative to the MAMG condition ( $p < .05$ ). No time by group interaction effects were observed for either flourishing or stigma consciousness. **Conclusions:** The results provide some support for the utility of group exercise programs, informed by self-categorisation theory, to enhance psychological flourishing and reduce stigma consciousness among older adults.

Keywords: flourishing, intervention, self-categorisation theory, stigma consciousness, successful aging

## INTRODUCTION

A growing body of research suggests that physical activity is a critical factor in *successful aging* (Gopinath, Kifley, Flood, & Mitchell, 2018; Kelley, Kelley, Hootman, & Jones, 2009; Netz, Wu, Becker, & Tenenbaum, 2005; Paterson & Warburton, 2010). Successful aging is not merely the absence of disease but is also inclusive of social connectedness, psychological health, and a lack of physical functional limitations (Bowling & Dieppe, 2005; Rowe & Kahn, 1987). Despite the physiological and psychological benefits of being physically active, globally, older adults are the least active segment of the population (Sallis et al., 2016). For example, the most recent estimates suggest that as few as 12 per cent of older adults in Canada meet current guidelines of 150 minutes of moderate-to-vigorous intensity physical activity per week (Public Health Agency of Canada, 2016; Sallis et al., 2016). Accordingly, it is imperative to develop and implement efficacious cost- and time-effective interventions to bolster physical activity levels in this population.

Group-based exercise programs appear to be particularly effective for improving physical activity adherence among older adults (Beauchamp, 2019). For example, a recent systematic review demonstrated that, among older adults, group-based exercise interventions were more likely to be enjoyed and adhered to by program participants (Devereux-Fitzgerald, Powell, Dewhurst, & French, 2016). Further, such group-based exercise programs have been found to support a myriad of positive effects for older adults including fostering social relatedness among program participants and improving health status (Farrance, Tsofliou, & Clark, 2016; Kanamori et al., 2016).

## THE PRESENT STUDY

In this study, we sought to examine the effects of two theoretically driven, evidence-informed group exercise programs for older adults on psychological markers of healthy aging. These two group exercise programs were compared to a standard group exercise program as part of a three-arm parallel randomised

controlled trial (RCT), entitled the GrOup based physical Activity for oLder adults (GOAL) trial (Beauchamp et al., 2015). Specifically, older adults ( $\geq 65$  years,  $n = 627$ ) were randomised to similar age same gender (SASG), similar age mixed gender (SAMG), or “standard” mixed aged mixed gender (MAMG) exercise conditions. The SASG and SAMG conditions were informed by the tenets of self-categorisation theory (Haslam, Jetten, Cruwys, Dingle, & Haslam, 2018; Turner, Hogg, Oakes, Reicher, & Wetherell, 1987; Turner, Oakes, Haslam, & McGarty, 1994) which posits that people are more likely to feel socially connected to others with whom they consider themselves to be similar on the basis of salient sociodemographic categorisations, such as age and gender. Previous observational research has found that people prefer to exercise with people the same age (Beauchamp, Carron, McCutcheon, & Harper, 2007) and gender (Dunlop & Beauchamp, 2011); as such, the two intervention conditions enabled an experimental examination of whether intra-group age similarity and gender similarity are salient factors in supporting adherence to the group. Those SASG and SAMG programs also had older adult instructors (with instructors in the SASG condition matched to the gender of group participants), and further sought to foster group distinctiveness, via group T-shirts, and encouraging post-exercise gatherings (see Methods; Beauchamp et al., 2015, 2018). The MAMG condition involved men and women across the age spectrum and was designed to reflect standard group exercise programs that are typically delivered in community centers (Heath et al., 2012).

The primary outcome for the GOAL trial was adherence to the exercise program (Beauchamp et al., 2015). The results revealed that older adults randomised to the SAMG ( $d = 0.47$ ,  $p < .001$ ) and SASG ( $d = .29$ ,  $p = .016$ ) conditions adhered to their respective exercise programs more than those in the MAMG condition over the course of the 24-week programs (Beauchamp et al., 2018). There were no significant differences in adherence between the SAMG and SASG conditions (Beauchamp et al., 2018). When taken together, these findings suggest that group-based programs made up of older adults, and supported by the tenets of self-categorisation theory, are able to better support older adults’ exercise adherence behaviours than typical (i.e. standard) group exercise classes. The present study is concerned with examining the effects of the intervention programs (when compared to the MAMG control condition) in relation to two psychological measures of successful aging, namely *psychological flourishing* and *stigma consciousness*. These measures represented secondary outcomes within the GOAL trial (see Beauchamp et al., 2015).

Psychological flourishing represents an overall assessment of well-being (VanderWeele, 2017), which includes aspects such as having positive relationships, feelings of competence, and having meaning and purpose in life (Diener et al., 2010). It has been posited to represent an important indicator of health in its broadest sense, and also represents a particularly viable target for intervention (VanderWeele, 2017). Although flourishing represents an important target for its

own sake, it is also noteworthy that the absence of flourishing is associated with increased all-cause mortality for men and women across the adult age spectrum, after adjustment for known causes of death (Keyes & Simoes, 2012). In the context of the current study, it is noteworthy that having more social support and social participation is related to better subjective and psychological well-being (Turner, 1981). For example, among older adults, informal social activities with friends have been found to promote subjective well-being beyond the effects observed from having family social connections (Huxhold, Miche, & Schuz, 2014). Of note, mitigating social isolation, and fostering social connectedness, has recently been suggested to be a critical public health priority, as meta-analytic evidence demonstrates that both loneliness and social isolation are associated with increased mortality risk (Holt-Lunstad, Robles, & Sbarra, 2017; Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015). On the basis of the adherence findings in the main trial, it was hypothesised that when older adults take part in exercise classes, where individuals exercise with, and are led by, group members of the same age (i.e. SASG and SAMG conditions), they would demonstrate improvements (i.e. *changes*) in psychological flourishing from week 2 to week 24 of the intervention, relative to the standard MAMG group exercise condition (*Hypothesis 1*).

Stigma consciousness represents the extent to which individuals tend to expect or perceive negative stereotypes in their daily lives (Pinel, 1999). Meta-analytic evidence suggests that perceptions of being stigmatised are associated with diminished psychological well-being (Schmitt, Postmes, Branscombe, & Garcia, 2014). What is particularly notable is that these perceptions are also associated with compromised physical health (Major & Schmader, 2018; Pachankis et al., 2018; Pascoe & Richman, 2009). For instance, research regarding stigma consciousness suggests that individuals of stigmatised groups (such as older adults) who are more sensitive to stigmas than others, are less likely to participate in activities in which their group is stigmatised, such as physical activity (Schmalz, 2010; Schmalz, Kerstetter, & Anderson, 2008). The influence on physical and psychological health of being stigmatised is particularly salient for older adults. For example, it has been suggested that among older adults, perceptions of stigma can be embodied such that it influences their perceptions of aging that, in turn, serve as self-fulfilling prophecies that impair their physical functioning and health (Levy, 2009; Levy, Slade, Murphy, & Gill, 2012). However, there is also evidence to suggest that physical activity (Clément-Guillotin, Radel, & Chalabaev, 2015; Emile, Chalabaev, Stephan, Corrion, & D'Arripe-Longueville, 2014; Emile, D'Arripe-Longueville, Cheval, Amato, & Chalabaev, 2015; Meisner, Weir, & Baker, 2013), generally, and being surrounded by (role) models of successful aging (Jopp, Jung, Damarin, Mirpuri, & Spini, 2017), specifically, may help ameliorate the impact of stigma consciousness.

In the present study, two types of stigma consciousness were examined, namely, *age-related* and *gender-related* stigma consciousness. These two types of stigma consciousness were examined separately as it has been previously demonstrated that stigma consciousness is a domain-specific construct. That is, people's stigma consciousness levels with respect to one salient sociodemographic categorisation (e.g. gender) may not necessarily correspond with their stigma consciousness levels associated with other sociodemographic categorisations (e.g. age; Pinel, 1999). In this study, we hypothesised that when older adults take part in exercise classes, where individuals exercise with, and are led by, group members of the same age (i.e. SASG and SAMG conditions), they would demonstrate reductions in *age-related* stigma consciousness from week 2 to week 24 of the intervention, relative to the standard MAMG group exercise class (*Hypothesis 2*). It was further hypothesised that older adults randomised to the SASG condition would demonstrate reductions in *gender-related* stigma consciousness, compared to the MAMG condition, whereas the older adults in the SAMG class would not demonstrate reductions in gender-related stigma consciousness relative to the MAMG condition (*Hypothesis 3*).

## METHOD

The data reported in the current study were part of a larger program of research designed to examine the effects of interventions informed by self-categorisation theory on bolstering physical activity adherence in older adults (Beauchamp et al., 2015). Findings related to the behavioural effects of this intervention (physical activity adherence) were previously reported in Beauchamp et al. (2018).

### Participants

Participants in this study represent a subgroup of the participants from the larger trial (Beauchamp et al., 2018) aged 65–91 ( $M_{\text{age}} = 71.40$  years,  $SD = 5.46$ ) who completed flourishing and/or stigma consciousness measures. Participants were eligible if they were 65 years of age or older and did not have any medical contraindications preventing them from engaging in moderate-to-vigorous physical activity. Overall, 485 of 627 participants (77.11%) completed at least one assessment of flourishing and/or stigma consciousness, of which 71.69 per cent were women, and 28.31 per cent were men. There were no significant differences in either the age or gender composition of participants in this study relative to the proportions in the larger study;  $F(1, 551) = 0.12$ ,  $p = .73$  for age, and  $\chi^2(1) = 0.40$ ,  $p = .53$  for gender. Participant demographic information relevant to this study is presented in Table 1. A description of the detailed demographic characteristics of the entire trial sample ( $n = 627$ ) is published elsewhere (Beauchamp et al., 2018).

TABLE 1  
Participant Demographic Information ( $N = 485$ )

	SASG	SAMG	MAMG	Total
Participants	141	189	155	485
Age [ $M(SD)$ ]	72.28 (6.36)	71.21 (5.36)	70.83 (4.57)	71.40 (5.46)
Gender [ $n(\%)$ ]				
Male	47 (33.3%)	69 (36.7%)	21 (13.5%)	137 (28.3%)
Female	94 (66.7%)	119 (63.3%)	134 (86.5%)	347 (71.7%)
Health Status [ $M(SD)$ ]	3.33 (0.82)	3.48 (0.83)	3.53 (0.80)	3.45 (0.82)

## Procedure

The GrOup-based physical Activity for oLder adults (GOAL) trial was a three-arm parallel RCT conducted in partnership with the YMCA (Young Men's Christian Association) in Greater Vancouver between March 2014 and August 2015 (clinicaltrials.gov; NCT02023632). The study procedures were approved by the research ethics board of the University of British Columbia. Full details of the design and procedures of the GOAL trial have been published elsewhere (Beauchamp et al., 2015; Beauchamp et al., 2018). The trial was delivered via two cohorts, in which group-based classes ran between the beginning of March and end of August in 2014 and 2015, respectively, with programs running for 24 weeks in total. Participants were randomised to similar age same gender (SASG), similar age mixed gender (SAMG), or mixed age mixed gender (MAMG) conditions. Each program involved group-based exercise classes taking place three days per week, with classes lasting 50–60 minutes. This dosage (150–180 mins/week) is consistent with Canada's physical activity guidelines (Warburton, Charlesworth, Ivey, Nettlefold, & Bredin, 2010). Once the classes had started, early program measures of flourishing and stigma consciousness were obtained at the end of week 2. However, considering the potential for flourishing and stigma consciousness to change throughout the intervention, additional measures of these outcome variables were collected at the end of weeks 7, 12, 14, 19, and 24 in order to assess whether the effects changed over time.

## Study Interventions

The development of the SASG and SAMG group-based exercise classes were directly informed by self-categorisation theory (Turner, 1985; see Beauchamp et al., 2015, 2018 for details). Of note, SASG classes were restricted to older adults ( $\geq 65$  years) of the same gender (i.e. older adult women-only classes, older adult men-only classes). Further, older adult instructors who led the classes were the same gender as the study participants. The SAMG condition matched

the SASG group condition (e.g. restricted to  $\geq 65$  years), but included both men and women within each of the classes. Similarly, in the SAMG condition, older adults instructed classes; however, the peer instructor in this condition could be either male or female. Additionally, for both the SASG and SAMG conditions, following recommendations by Carron and Spink (1993), participants were given program T-shirts and were provided with opportunities to socially connect after class (coffee and other refreshments) to foster group distinctiveness. Participants randomised to the MAMG condition attended group-based exercise classes that were run by the respective YMCAs, representing typical group-based exercise classes (Heath et al., 2012). Specifically, these classes were not restricted to participants based on age or gender. Accordingly, study participants in this condition attended classes comprising people younger than themselves as well as including both men and women.<sup>1</sup>

## Measures

*Demographic Measures.* Demographic information including age, gender, and general health status was collected at baseline prior to randomisation (see Table 1). General health status was assessed with a single-item self-report measure where participants answered the question, “In general, compared to other persons your age, how would you rate your health?” on a scale ranging from 1 (*poor*) to 5 (*excellent*) (Ware, Snow, Kosinski, & Gandek, 1993).

*Flourishing.* The Flourishing Scale (FS) is a brief eight-item summary measure of global well-being, including aspects such as positive relationships, feelings of competence, and having meaning and purpose in life (Diener et al., 2010). Participants indicated the extent to which they agreed with each item on a scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). All items were phrased in a positive direction, to provide a total score range of 8–56, with higher scores signifying higher levels of flourishing. An exemplar item included, “My social relationships are supportive and rewarding.” In this study, the responses to the FS demonstrated acceptable reliability, with Cronbach’s alphas ranging from 0.92 to 0.97 across the six time points.

*Stigma Consciousness.* The Stigma Consciousness Questionnaire (SCQ) is a brief 10-item summary measure of perceptions of being stereotyped (Pinel, 1999). In the present study, five items were adapted from the SCQ that tapped into both gender and age stigma consciousness related to participating in a group

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<sup>1</sup> We were unable to collect data from those (younger/other) group members who were enrolled in their regular YMCA classes, but were not enrolled as part of the GOAL Trial. Therefore, we are unable to report the age and gender composition of the MAMG groups, other than those older adults that participated as part of the trial.



exercise program. Participants were asked to consider, “When working out with my exercise group” and then indicated the extent to which they agreed with each item on a scale ranging from 0 (*strongly disagree*) to 6 (*strongly agree*) with five items related to age-related stigma consciousness and five items measuring gender-related stigma consciousness. An exemplar age-related stigma consciousness item included, “My age does not influence how other group members act with me.” A gender-related stigma consciousness item included, “My being a [fe]-male does not influence how other group members act with me.” Three of the five items were reversed scored, with all five items summed to produce a total score.

In this study, the responses to the age- and gender-related SCQ demonstrated low reliability, with Cronbach’s alphas ( $\alpha$ ) ranging from 0.53 to 0.68 for age-related stigma consciousness and 0.45 to 0.63 for gender-related stigma consciousness across the six time points. Closer examination revealed that data derived from the scale items were not normally distributed (cf. McNeish, 2018), and violated tau equivalence, thus rendering the use of Cronbach’s alpha inappropriate. Accordingly, ordinal omega total was calculated (which is conceptually similar to Cronbach’s alpha and interpreted in the same way; McNeish, 2018). Further, when examining the factor structure of the items, it was ascertained that the unidimensional structure of the separate age- and gender-related SCQ measures was not observed. Specifically, a two-factor model was observed (for both age- and gender-related stigma consciousness) whereby the three reverse scored items (after reverse scoring) loaded onto a separate factor to the two positively worded items, pointing to a response bias whereby participants differentially responded to the positively and negatively worded items. Based on the lack of unidimensionality of the two five-item measures, two three-item measures based on the negatively worded items (i.e. for age- and gender-related stigma consciousness) were utilised for the subsequent analysis. The responses to the age- and gender-related SCQ using the three-item measures demonstrated acceptable reliability, with Ordinal Omega Total ( $\omega$ ) ranging from 0.72 to 0.82 for age-related stigma consciousness and 0.70 to 0.83 for gender-related stigma consciousness across the six time points.

## DATA ANALYSES

Data were prepared, and preliminary analyses were conducted to examine whether any patterns of missing data existed for each of the outcome variables (i.e. psychological flourishing, age- and gender-related stigma consciousness). Overall, there were small amounts of missing data (< 5% missingness across variables). Furthermore, on the basis that the covariates (i.e. health status, age, gender; see Data Analysis section) and other demographic variables collected (see Beauchamp et al., 2018) in the study were significantly correlated with the



outcome variables, the missing data were assumed to be missing at random (MAR) (Sterne et al., 2009; Yang & Maxwell, 2014).

The nature of the missing data (i.e. MAR) made multiple imputation (MI) appropriate (Sterne et al., 2009). MI is preferred over traditional approaches to missing data analysis (e.g. listwise deletion), as it allows for the entire sample to be maintained and it allows for uncertainty in the data by creating several plausible datasets (Sterne et al., 2009). We imputed 10 complete datasets using the *Amelia* package in R, which uses a bootstrapped EM algorithm (Honaker, King, & Blackwell, 2015). All study variables (including flourishing and stigma consciousness outcome measures as well as covariates), in addition to other variables thought to inform the imputation (including additional demographic variables), were included in the imputation. Analyses were conducted with all 10 datasets, and parameter estimates were pooled using the *lmerModList* function from *merTools* R package. This function allows one to apply multilevel models via the *lme4* R package (Bates, Mächler, Bolker, & Walker, 2015) and extract results from multiple imputed datasets.

Following multiple imputation, separate two-level linear growth models (Singer & Willett, 2003) were conducted for each of the outcome variables in relation to psychological flourishing, as well as age- and gender-related stigma consciousness. First, to determine whether inter-individual clustering was required for modelling in the main analyses, ICCs and design effects were calculated. Design effects were calculated based on: design effect =  $1 + (\text{average cluster size} - 1) * \text{intraclass correlation}$  (Muthén & Satorra, 1995, equation 35). If design effects are  $> 2$ , Muthén and Satorra (1995) indicate that the clustering should be taken into account (i.e. the estimation of standard errors of regression parameter estimates is affected by clustering effects). The growth models were conducted using the *lme4* R package (Bates et al., 2015) in R where: (a) level-1 was the intra-individual level, and (b) level-2 is the inter-individual level. For each of the growth models, due to the non-equal intervals between time measurements, time was coded continuously with week 2 measurements coded as 0 (i.e. 0, 5, 10, 12, 17, 22 weeks). For all analyses, REML was used to test model comparisons.

Prior to conducting the main analyses, we examined if there were any differences in baseline levels of the covariates used in the present study with respect to the experimental conditions. Results of these analyses demonstrated that there were no significant differences in any of the baseline characteristics across the three conditions, except for gender  $\chi^2(2) = 24.69, p < .001$ , whereby in the MAMG condition had a smaller proportion of men than the other two conditions. Accordingly, gender was controlled for as a time-invariant covariate in all subsequent analyses. To address our first research question (*Hypothesis 1*), in the level-2 model, SASG and SAMG conditions were coded as dummy variables in relation to the referent MAMG condition. In addition, participants' self-reported

health status (*Health*) and gender were included as time-invariant covariates. Gender was dummy coded, so the referent condition was female (i.e. males were coded as 1 and females were coded as 0). Participants' subjective health status was included as a covariate, based on the relationship that exists between physical health and subjective well-being (Ngamaba, Panagioti, & Armitage, 2017).

To address our second research question (Hypotheses 2 and 3) in the level-2 models, SASG and SAMG conditions were again coded as dummy variables in relation to the referent MAMG condition. In addition to the dummy variables, for the age-related stigma consciousness analysis participants' gender and mean-centered age were included as time-invariant covariates. For gender-related stigma consciousness, the participants' gender was included as a time-invariant covariate. Comparison between models was done using Akaike's Information Criterion (AIC; Akaike, 1973), as it has been demonstrated to be an appropriate approach for model selection with multiple imputed datasets (Schomaker & Heumann, 2014). Pseudo  $R^2$  values were also calculated as an estimate of effect size (Singer & Willett, 2003). Additionally, following procedures suggested by Feingold (2009, 2013, 2017) the unstandardised coefficients ( $b$ ) for the differences between the SAMG and MAMG, and the SASG and MAMG groups, were converted into a standardised mean difference effect size (i.e. a Cohen's  $d$  equivalent for multilevel models). The final models were also examined for multivariate and univariate outliers, as well as for violations of normality, linearity, and homogeneity of variance.

## Sensitivity Analyses

In order to evaluate the robustness of our findings, three sets of sensitivity analyses were conducted for each outcome to examine the extent to which results of the present study were affected by changes in model variables and measures (cf. Thabane et al., 2013). First, following recommendations by Simmons, Nelson, and Simonsohn (2011), models were run for each of the outcome variables of interest (i.e. flourishing, age-related stigma consciousness, and gender-related stigma consciousness) that included the randomised conditions as the independent variable, but without the covariates described in the main analyses. Second, models were run that included the randomised conditions and gender (without other covariates), as gender was the only baseline demographic characteristic that demonstrated statistically significant differences at baseline across the three conditions. Finally, models were run using the five-item age- and gender-related stigma consciousness measures (in contrast to the three-item measures used in the main analyses). The results of each of these supplementary analyses demonstrated no substantive changes to the main study findings (see Data S1).

## RESULTS

### Hypothesis 1: Psychological Flourishing

*Unconditional Means Model.* Results for the unconditional means model (i.e. empty model) are presented in Table 2. The intraclass correlation (ICC) for the flourishing was 0.54, indicating that 54 per cent of the variance in psychological flourishing scores was attributable to inter-individual differences. For flourishing, the design effect was 2.89, which indicated that clustering needed to be considered during model estimation (Muthén & Satorra, 1995).

*Unconditional Growth Model.* Overall, the unconditional growth model accounted for more variation compared to the unconditional means model, as demonstrated by lower AIC values (Table 2). Pseudo  $R^2$  results indicated that including time in the model accounted for an 8.16 per cent reduction in variance at the inter-individual level, and a 2.32 per cent reduction in the random variation of the intercept. However, the results revealed that the main effect of the slope of time was not significant ( $b = 0.014$ ,  $SE = 0.014$ ,  $p > .05$ ).

*Conditional Growth Model.* The conditional growth model evaluated the effects of the two dummy coded condition variables (SASG, SAMG) on flourishing, and in comparison to the referent MAMG condition, after controlling for health status and gender (see Table 2). Two conditional growth models were fit. The first model included only the main effects of time and condition (i.e. SASG and SAMG) and the second model included time by condition interactions in addition to the main effects. As the results of the second model did not explain additional variance (as demonstrated by higher AIC levels compared to the conditional growth model with only main effects) and no significant time by condition interactions were observed, we report below the findings from the more parsimonious model, which included only main effects, and no time by condition interactions (Table 2).

Overall, the model explained more variance in flourishing scores, compared to the unconditional growth model, as demonstrated by lower AIC values. Pseudo  $R^2$  values indicated that the model explained 6.79 per cent of the variation in the random intercept, but did not explain any variation in the random slope or at the inter-individual level. A main effect of SASG condition was observed ( $M = 50.61$ ,  $SD = 5.00$ ), with participants reporting higher flourishing scores than the MAMG condition ( $M = 49.39$ ,  $SD = 6.38$ ), controlling for all other factors ( $b = 1.33$ ,  $SE = 0.54$ ,  $p < .05$ ), constituting a small effect ( $d = 0.24$ ). Similarly, participants in the SAMG condition ( $M = 50.37$ ,  $SD = 5.76$ ) reported statistically significantly higher flourishing scores compared to the MAMG condition ( $b = 1.16$ ,  $SE = 0.51$ ,  $p < .05$ ), constituting a small effect ( $d = 0.21$ ).

TABLE 2  
Fixed Effects Estimates with Robust Standard Errors (Top) and Variance-Covariance Estimates (Bottom) for Models of the Predictors of Older Adults' Self-Reported Flourishing

Fixed effects	Unconditional Means Model			Unconditional Growth Model			Conditional Growth Model		
	Parameter Estimates	SE	t	Parameter Estimates	SE	t	Parameter Estimates	SE	t
For Intercept	50.03	0.22	231.98***	49.91	0.24	209.13***	45.08	1.01	44.59***
Intercept							1.33	0.54	2.45*
SASG							1.16	0.51	2.30*
SAMG							1.20	0.25	4.82***
Health							-0.42	0.47	-0.90
Male									
For time slope									
Intercept				0.014	0.014	0.99	0.013	0.014	0.95
<i>Random effects</i>									
	Variance Component			Variance Component			Variance Component		
Level-1: $\sigma^2$			15.46			14.20			14.24
Level-2: $\tau_0^2$			18.41			17.99			16.77
$\tau_1^2$						0.022			0.022
$\tau_{10}$						-0.14			-0.15
AIC			12948.2			12936.7			12916.1

\*\*\*  $p < .001$

\*\*  $p < .01$

\*  $p < .05$ .

## Hypothesis 2: Age-Related Stigma Consciousness

*Unconditional Means Model.* Results from the unconditional means model (empty model) are presented in Table 3. The ICC for age-related stigma consciousness was 0.48, indicating that 48 per cent of the variance in stigma consciousness scores was attributable to inter-individual differences. For age-related stigma consciousness, the design effect was 2.66, thus indicating that clustering needs to be considered during model estimation (Muthén & Satorra, 1995).

*Unconditional Growth Model.* Overall, the model did not account for additional variation compared to the unconditional means model, as demonstrated by a slight increase in AIC (see Table 3). Pseudo  $R^2$  results indicated that including time in the model accounted for a 1.32 per cent reduction in variance at the inter-individual level, and a 3.33 per cent reduction in the random variation of the intercept. However, the results revealed that the main effect of time slope was not significant ( $b = -0.01$ ,  $SE = 0.01$ ,  $p > .05$ ).

*Conditional Growth Model.* The conditional growth model evaluated the effects of the two dummy coded condition variables (SASG, SAMG) on the age-related stigma consciousness scores when compared to the referent MAMG condition, after controlling for age and gender (see Table 3). Two conditional growth models were fit. The first model included only the main effects of time and condition (i.e. SASG and SAMG) and the second model included time by condition interactions in addition to the main effects. As the results of the second model did not explain additional variance (as demonstrated by higher AIC levels compared to the conditional growth model with only main effects) and no significant time by condition interactions were observed, we report below the findings from the more parsimonious model, which included only main effects, and no time by condition interactions (Table 3).

Overall, the conditional growth model explained more variance in age-related stigma consciousness scores, compared to the unconditional growth and unconditional means models, as demonstrated by smaller AIC values (Table 3). Pseudo  $R^2$  values indicated that the model explained 9.48 per cent of the variation in the random intercept and 9.30 per cent of the variation in the random slope. However, the model did not explain any additional variation at the inter-individual level. A medium-sized main effect of SASG condition ( $M = 6.72$ ,  $SD = 3.51$ ) was observed, with participants reporting lower age-related stigma consciousness scores than the MAMG referent condition ( $M = 8.89$ ,  $SD = 4.11$ ), controlling for all other factors ( $b = -2.02$ ,  $SE = 0.36$ ,  $p < .001$ ,  $d = 0.53$ ). Additionally, a medium-sized main effect of SAMG condition ( $M = 7.28$ ,  $SD = 3.73$ ) was observed, with participants reporting lower age-related stigma consciousness scores than the MAMG condition, controlling for all other factors ( $b = -1.64$ ,  $SE = 0.33$ ,  $p < .001$ ,  $d = 0.43$ ).

TABLE 3  
Fixed Effects Estimates with Robust Standard Errors (Top) and Variance-Covariance Estimates (Bottom) for Models of the Predictors of Older Adults' Self-Reported Age-Related Stigma Consciousness

Fixed effects	Unconditional Means Model			Unconditional Growth Model			Conditional Growth Model		
	Parameter Estimates	SE	t	Parameter Estimates	SE	t	Parameter Estimates	SE	t
For Intercept	7.76	0.14	54.89***	7.85	0.16	48.52***	7.92	2.05	3.86***
Intercept							-2.02	0.36	-5.68***
SASG							-1.64	0.33	-4.94***
SAMG							0.017	0.025	0.68
Age							-0.20	0.31	-0.66
Male									
For time slope									
Intercept				-0.009	0.009	-0.99	-0.009	0.009	-0.95
<i>Random effects</i>	<i>Variance Component</i>			<i>Variance Component</i>			<i>Variance Component</i>		
Level-1: $\sigma^2$			8.20			8.09			8.10
Level-2: $\tau_0^2$			7.52			7.27			6.58
$\tau_1^2$						0.0018			0.0016
$\tau_{10}$						0.069			0.12
AIC			11474			11485			11460

\*\*\*  $p < .001$   
 \*\*  $p < .01$   
 \*  $p < .05$ .

### Hypothesis 3: Gender-Related Stigma Consciousness

*Unconditional Means Model.* Results from the unconditional means model (empty model) are presented in Table 4. The ICC for gender-related stigma consciousness was 0.28, indicating that 28 per cent of the variance in gender-related stigma consciousness scores was attributable to inter-individual differences. For gender-related stigma consciousness, the design effect was 1.98, which suggests that clustering needs to be considered during model estimation (Muthén & Sartorra, 1995).

*Unconditional Growth Model.* Overall, the unconditional growth model accounted for more variation compared to the unconditional means model, as demonstrated by a reduction in the AIC statistic (see Table 4). Pseudo  $R^2$  results indicated that including time in the model accounted for a 6.40 per cent reduction in variance at the inter-individual level, and a 9.03 per cent reduction in the random variation of the intercept. Further, the results revealed that the time slope was significant such that stigma consciousness increased over time across conditions ( $b = 0.06$ ,  $SE = 0.01$ ,  $p < .001$ ).

*Conditional Growth Model.* The conditional growth model evaluated the effects of the two dummy coded condition variables (SASG, SAMG) on the gender-related stigma consciousness scores in relation to the MAMG condition, after controlling for gender (see Table 4). Two conditional growth models were fit. The first model included only the main effects of time and condition (i.e. SASG and SAMG) and the second model included time by condition interactions in addition to the main effects. As the results of the second model did not explain additional variance (as demonstrated by higher AIC levels compared to the conditional growth model with only main effects) and no significant time by condition interactions were observed, we report below the findings from the more parsimonious model, which included only main effects, and no time by condition interactions (Table 4).

Overall, the conditional growth model explained more variation in gender-related stigma consciousness scores, compared to the unconditional growth model, as demonstrated by a decrease in AIC values (Table 4). Pseudo  $R^2$  values indicated that the model explained 1.47 per cent of the variation in the random intercept, but did not explain any additional variation in the random slope or at the inter-individual level. The time slope was significant, such that stigma consciousness increased over time across conditions ( $b = 0.06$ ,  $SE = 0.01$ ,  $p < .001$ ). However, a small main effect of SASG condition ( $M = 6.86$ ,  $SD = 3.86$ ) was observed, with participants reporting lower gender-related stigma consciousness scores than the MAMG condition ( $M = 8.11$ ,  $SD = 3.92$ ), controlling for all other factors ( $b = -1.08$ ,  $SE = 0.32$ ,  $p < .001$ ,  $d = 0.28$ ).



TABLE 4  
Fixed Effects Estimates with Robust Standard Errors (Top) and Variance-Covariance Estimates (Bottom) for Models of the Predictors of Older Adults' Self-Reported Gender-Related Stigma Consciousness

<i>Fixed effects</i>	<i>Unconditional Means Model</i>			<i>Unconditional Growth Model</i>			<i>Conditional Growth Model</i>		
	<i>Parameter Estimates</i>	<i>SE</i>	<i>t</i>	<i>Parameter Estimates</i>	<i>SE</i>	<i>t</i>	<i>Parameter Estimates</i>	<i>SE</i>	<i>t</i>
For Intercept									
Intercept	7.50	0.12	60.30***	6.91	0.15	45.07***	7.51	0.24	31.80***
SASG							-1.08	0.32	-3.40***
SAMG							-0.77	0.30	-2.59***
Male							0.02	0.28	0.07
For Time slope									
Intercept				0.062	0.011	5.59***	0.063	0.01	5.58***
<i>Random effects</i>									
Level-1: $\sigma^2$		11.63				10.88			10.88
Level-2: $\tau_0^2$		4.58				4.17			4.11
$\tau_1^2$						0.0084			0.0090
$\tau_{10}$						-0.067			-0.122
AIC		11945.7				11908.3			11907.1

\*\*\*  $p < .001$

\*\*  $p < .01$

\*  $p < .05$ .

Additionally, a small main effect of SAMG condition ( $M = 7.31$ ,  $SD = 4.08$ ) was observed, with participants reporting lower gender-related stigma consciousness scores than the MAMG condition, controlling for all other factors ( $b = -0.77$ ,  $SE = 0.30$ ,  $p < .01$ ,  $d = 0.20$ ).

## DISCUSSION

The purpose of this study was to examine the extent to which participation in group-based exercise programs, underpinned by the tenets of self-categorisation theory, had an effect on psychological indices of successful aging among older adults. It was anticipated that both experimental conditions (i.e. the SASG and SAMG conditions) would demonstrate increasing levels of psychological flourishing and reductions in age-related stigma consciousness over time. That is, we initially expected that these psychological states would gradually improve (i.e. *change*) over time in the intervention conditions from week 2 to week 24 relative to the MAMG control condition. It was also expected that the condition whereby older adults were exercising with similar aged and same gender peers (i.e. SASG) would experience reductions in gender-related stigma consciousness relative to the MAMG condition, whereas older adults assigned to a similar age mixed gender condition (i.e. SAMG) would not see the same reductions in gender-related stigma consciousness. Results of the study provide partial support for these hypotheses.

With respect to our first hypothesis, the results revealed that older adults randomised to either the SASG or SAMG conditions displayed higher average levels of psychological flourishing when compared to a standard MAMG exercise class (in the small effect size range; Cohen, 1992), after controlling for health status and gender. Nevertheless, it should also be noted that the flourishing scores appeared to be invariant over time, which meant that we were precluded from examining the time by condition interaction effects, which would have provided evidence of differences in the respective rates of change over time. When taken together, this suggests that participants in the two experimental conditions displayed higher estimated average levels of flourishing than the comparison control condition, and that participant levels of flourishing did not continue to increase from early assessments onwards. However, nor did these benefits seem to dissipate over time. Moreover, although the main effects of the intervention conditions were small, we view this as meaningful, given that we utilised a global measure of flourishing (Diener et al., 2010), rather than simply a domain-specific measure of psychological well-being (e.g. well-being experienced just in exercise contexts).

The same pattern of results emerged in relation to both age- and gender-related stigma consciousness. Specifically, for our second hypothesis, participation in either the SASG or the SAMG condition was associated with lower overall levels of age-related stigma consciousness compared to the MAMG comparison

condition after controlling for age and gender (in the medium effect size range). As with the flourishing data, the age-related stigma consciousness scores appeared to be invariant over time. However, with respect to our third hypothesis, there was a small significant overall time effect, whereby gender-related stigma consciousness scores (across conditions) increased over time. Despite this small increase across conditions, it is notable that, as with the age-related stigma consciousness results, participants in the SASG and SAMG conditions displayed, on average, lower levels of gender-related stigma consciousness when compared to a standard MAMG exercise condition. Contrary to our expectations, participants in the SAMG condition displayed lower levels of gender-related stigma consciousness when compared to the MAMG condition (we only expected this effect/difference to emerge between the SASG and MAMG conditions). It is possible that the lower levels of age-related stigma consciousness in the SAMG had a “spillover effect” by also lowering gender-related stigma consciousness among older adults in the SAMG condition. Indeed, some evidence exists for identity spillover effects with various stigmatised groups (Chaney, Sanchez, & Remedios, 2016). Nevertheless, as this was not expected, we note that considerable caution should be exercised in interpreting this latter finding. It should also be noted that the main effects observed for both the SASG and SAMG conditions were smaller for gender-related stigma consciousness when compared to age-related stigma consciousness.

Previous research points to the beneficial effects of physical activity in relation to older adults’ subjective well-being (e.g. Netz et al., 2005). The results of this study suggest that when older adults take part in group-based exercise programs informed by the tenets of self-categorisation theory, whereby older adults exercise in the company of other older adults, are instructed by other older adults, and receive additional supports designed to foster a sense of togetherness (e.g. program T-shirts), this may yield additional psychological benefits when compared to exercising in typical group-based classes. The findings in this study were consistent across all three dependent measures, and appear congruent with the behavioural results of the GOAL trial (Beauchamp et al., 2018), whereby participants displayed improved adherence to the 24-week group-based exercise programs in the SAMG and SASG conditions relative to the MAMG condition (with no differences between men and women). Accordingly, community-based group exercise programs that are informed by the tenets of self-categorisation theory have the potential to influence psychological markers of successful aging, and offer opportunities for wide-scale and cost-effective dissemination (VanderWeele, McNeely, & Koh, 2019).

Although we collected data at multiple time points over the course of the respective exercise programs (i.e. six occasions from week 2 to week 24), a notable limitation of the study was that we did not collect data on flourishing or stigma consciousness at baseline (prior to randomisation). It should be noted, however, that we were unable to examine conceptions of stigma consciousness

(in relation to the group) prior to group formation as participants would not have any frame of reference for those judgments at baseline (i.e. prior to randomisation). Furthermore, by virtue of the design (i.e. RCT) and as there were no significant differences in baseline characteristics across the three conditions (except for gender, which was controlled for in the analyses for all three outcomes), there was no reason to anticipate that there would be differences in the study's dependent measures at baseline. Nevertheless, we were limited in being unable to ascertain the extent to which flourishing or stigma consciousness (as expressed during the programs) differed from participants' psychological states prior to randomisation.

In light of the main effects for condition for all three of the study outcomes, that were invariant over time, it is entirely conceivable that participants in the intervention conditions (SAMG, SASG) displayed improvements in flourishing and reductions in age- and gender-related stigma consciousness that happened within the first 2 weeks, and that these improved psychological states simply persisted over the course of the programs (differences in intercepts), but did not continue to further improve (no differences in slopes). Such a perspective is consistent with previous work in social psychology related to the "minimal groups" paradigm (Tajfel, Billig, Bundy, & Flament, 1971), which found that people's perception of, and behaviours towards, other "ingroup" or "outgroup" members were affected shortly after assignment to new social groups (see also Otten, 2016). Some prior work in the physical activity domain points to the stability of facets of group cohesion over time immediately following assignment to an exercise group (Dunlop, Falk, & Beauchamp, 2013). In a similar regard, it is possible that the effects on flourishing and stigma consciousness with respect to group assignment happen in the first 2 weeks of the program, but thereafter do not continue to change. That is, *ceteris paribus*, if a person joins a new exercise program that they immensely enjoy in the first week or two, provided the program remains the same, it is likely that they would continue to enjoy that program to the same extent (and display higher levels of psychological flourishing and so forth), but perhaps no more than during these initial weeks. Such a possibility represents an important direction to test within future research.

A second limitation of the study corresponds to our stigma consciousness measures. Specifically, although the items measuring age- and gender-related stigma consciousness were adapted from a previously published instrument with sound reliability and validity evidence (Pinel, 1999), the five items that we used for each measure displayed sub-optimal internal consistency. When we examined the distribution of the data derived from these measures, as well as unidimensionality, we found that the data were not normally distributed and items loaded on to separate factors (for both age- and gender-related stigma measures) on the basis of the directionality of item wording. As such, we utilised three-item measures for both age- and gender-stigma consciousness that demonstrated good internal consistency. Of note, when we conducted sensitivity analyses with the

five-item measures (for both age- and gender-related stigma consciousness), a similar pattern of results emerged (as with the three-item measures), which lends some support for the robustness of the stigma consciousness findings.

Balanced against these limitations, the study also had several strengths. From a methodological perspective, these included the use of multiple assessments of the study's dependent measures within the context of a pre-registered RCT design, testing the effects of two complementary theory-driven evidence-informed interventions, and using robust statistical analyses for examining change over time and for handling missing data. In terms of the results of the study, it is also notable that similar patterns of findings emerged across the three dependent measures. That is, participants randomised to the two intervention conditions (informed by self-categorisation theory) displayed better psychological functioning than those in the comparison control condition, as reflected in higher levels of flourishing and lower age- and gender-related stigma consciousness.

## CONCLUSION

In summary, results of the study suggest that the two exercise programs informed by self-categorisation theory resulted in higher levels of psychological flourishing and lower stigma consciousness, compared to standard exercise programs that were not delimited on the basis of age. The benefits were evident by 2 weeks and remained consistent over time. Tailoring group-based exercise programs for older adults based on the tenets of self-categorisation theory represents a scalable means of bolstering psychological markers of successful aging. It remains to be seen how these psychological processes change over time (from prior to condition assignment to during program assessments).

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

**Data S1.** Results of the sensitivity analyses.