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Group-Based Physical Activity for Older Adults (GOAL) Randomized Controlled Trial: Exercise Adherence Outcomes

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Background: Despite the health benefits of regular physical activity, across the globe older adults represent the least active section of society. ***Purpose:*** The GrOup-based physical Activity for oLder adults (GOAL) trial was a three-arm parallel randomized controlled trial (RCT) that was designed to test the efficacy of two group-based exercise programs for older adults, informed by self-categorization theory (SCT), in comparison to a standard group-based exercise program. ***Methods:*** RCT conducted in Greater Vancouver, Canada, enrolled 627 older adults (M_{age} = 71.57 years, SD = 5.41; 71.0% female). Participants were randomized to similar age same gender (SASG), similar age mixed gender (SAMG), or 'standard' mixed age mixed gender (MAMG) exercise group conditions. In addition to group composition, the intervention programs operationalized principles from SCT designed to foster a sense of social connectedness among participants. The primary outcome of the trial was exercise adherence behavior over 12 and 24 weeks. ***Results:*** Analyses of variance revealed that older adults randomized to the SAMG (12-weeks d = .51, p < .001; 24-weeks d = .47, p < .001) and SASG (12-weeks d = .28, p = .012; 24-weeks d = .29, p = .016) conditions adhered to a greater extent than those in the MAMG comparison condition. There were no significant differences between the SAMG and SASG conditions. ***Conclusions:*** The results provide support for the efficacy of group-based physical activity programs informed by SCT. Furthermore, the results suggest that community group-based exercise programs should attempt to engage in age-targeting but not necessarily gender-targeting among older adults.

Keywords: physical activity, older adults, self-categorization theory, group-dynamics, intervention

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Across the globe older adults represent the least active section of society, with older adults in the Americas being less active than those in every other geographical region including Africa, Eastern Europe, South East Asia, and the Western Pacific (Hallal et al., 2012). When objective rather than self-report surveillance measures are taken into account the picture is particularly concerning. In Canada, for instance, fewer than 15% of older adults currently meet international physical activity guidelines (Colley et al., 2011). With such widespread inactivity among older adults comes an increased risk of cardiovascular disease, obesity, and arthritis,

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as well as depleted functional capacity and overall quality of life (Denys, Cankurtaran, Janssen, & Petrovic, 2009; Paterson & Warburton, 2010; Yazdanyar & Newman, 2009). When older adults do meet international guidelines, by engaging in regular (150 min/week) moderate intensity physical activity, they tend to experience substantive improvements in these health outcomes (Denys et al., 2009; Paterson & Warburton, 2010; Yazdanyar & Newman, 2009).

In light of the pervasiveness, and concomitant health implications, of inactivity among older adults in particular, recent intervention efforts have emerged that target a range of personal, social, environmental, and policy factors. This trial focused on the social context, by examining the efficacy of two theory-driven evidence-informed group-based interventions in relation to supporting older adults' physical activity adherence behaviors, as assessed by objective measures of class attendance over 12 and 24 weeks.

Within the field of behavioral medicine, the use of groups has received considerable attention as a viable means of influencing individual physical activity behavior (Estabrooks, 2008). The results of systematic and meta-analytic reviews have revealed that among adults, in general, physical activity interventions that are delivered via groups tend to be more effective than those that are delivered to individuals (Burke, Carron, Eys, Ntoumanis, & Estabrooks, 2006; Carron, Hausenblas, & Mack, 1996; Dishman & Buckworth, 1996). A recent mixed methods systematic review revealed that, among older adults in particular, community-based group-exercise interventions have the potential to not only foster social connections among program participants, but also support their long-term exercise adherence behaviors (Farrance, Tsoflio, & Clark, 2016). Interestingly, in a large scale study involving 21,684 older adults from Japan, Kanamori et al. (2016) found that when older adults exercised with others they tended to display improvements in subjective health status over and above that experienced by older adults who exercised alone. A separate systematic review and metasynthesis by Devereux-Fitzgerald, Powell, Dewhurst, and French (2016), revealed that, among older adults, interventions that emphasize social bonds between participants are more likely to be acceptable to this specific population. When taken together, there appears to be a sound empirical basis to consider group settings as a means of supporting older adult exercise adherence behaviors.

So if groups represent a viable means of intervention, how should they be optimally designed and delivered to support the sustained involvement of older adults within physical activity programs? To address this question we turned to self-categorization theory (Turner, 1985, Turner, 1987), as well as recent empirical evidence that sheds light on this issue. Self-categorization theory was developed by Turner and colleagues (Abrams & Hogg, 1990; Haslam, Jetten, Cruwys, Dingle, & Haslam, 2017; Turner, 1985, Turner, 1987) to explain the psychological processes that shape the way in which individuals see themselves and others. According to self-categorization theory, people place themselves and others into various social categories on the basis of a set of underlying attributes that are salient to them (e.g., age, gender, race, education). Those social categories are then used to make inferences about whether others are similar or dissimilar to themselves. People engage in self-categorization for two main reasons. First, this process helps to facilitate cognitive ease and reduce the demands of effortful interpretation related to multiple social interactions (Abrams & Hogg, 1990). Indeed, given the limits of people's information-processing capabilities, complementary research from the field of behavioral economics has established that people regularly use various heuristics, or shortcuts (e.g., stereotype appraisals), to guide their decision-making processes (Kahneman, 2011). Second, social categorization helps to reduce uncertainty regarding a person's place in the world (Hogg, 2000). When taken together, one of the key tenets of self-categorization theory is that people tend to feel connected to others with whom they share membership in these socially constructed categories and that this process guides individual behavioral engagement (Abrams & Hogg, 1990).

Research from the physical activity domain points to the role of *age-similarity* as a particularly salient categorizing factor. In one study by Beauchamp, Carron, McCutcheon, and Harper (2007), adults across the age spectrum were queried about their preferences to engage in group-based physical activity. The results revealed that adults displayed strong preferences for exercising in groups made up of others of their own age, but were less positive about exercising with others much younger or older than themselves. In a more recent study with a large Australian sample (n = 7,873) Burton, Kahn, and Brown (2012) found that older adults aged 60–67 in particular (i.e., when compared to those aged 42–47) had a positive preference for exercising with those of the same age. In terms of how preferences for age-congruent exercise groups translate into people's actual adherence behaviors, the results of an observational study with intact exercise groups revealed that intragroup age similarity (i.e., the more similar people were with other members of their respective groups in terms of age) was positively associated with objective measures of individual exercise adherence behavior (Dunlop & Beauchamp, 2012).

Another potential categorization factor for physical activity groups relates to intragroup *gender-congruence*. In one study by Dunlop and Beauchamp (2011), both men and women were found to report stronger preferences for same-gender rather than mixed gender group settings and this effect was found to be particularly pronounced among those who were overweight or obese. Balanced against those findings, Burton et al. (2012) did not find evidence that adults prefer to be physically active with others of the same gender. Nevertheless, research has yet to examine how gender congruence within exercise groups is related to sustained (behavioral) involvement in group-exercise settings. Additionally, when taken together, it should also be noted that the above research on exercise preferences, group composition, and exercise adherence behavior was limited by the nonexperimental nature of the designs used in those studies. As such, and in order to make causal inferences, there is a pressing need to examine the extent to which age- and gender-similarity within groups is related to sustained exercise behavior using experimental designs. With this in mind, the overall purpose of this study was to test the efficacy of two different group-based exercise programs for older adults (informed by the tenets of self-categorization theory) in comparison to a standard group-based exercise program.

The two group-based exercise programs were designed to comprise older adults only, with classes led by older adults (see Methods for full description of the programs). One of those older-adult-only programs was designed to include both men and women (i.e., similar age mixed gender; SAMG), with the other designed to include just men or just women (i.e., similar age same gender;

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SASG)[1]. The third condition operationalized in the study involved older adults taking part in 'standard exercise classes', comprised of both older adults as well as younger adults, as well as both men and women (i.e., mixed age mixed gender; MAMG). Drawing from self-categorization theory (Turner, 1985, Turner, 1987) as well as the above observational findings supporting older adults' preferences for exercising with others of the same age (Beauchamp et al., 2007), the relations between intragroup age similarity and exercise adherence (Dunlop & Beauchamp, 2012), as well as adults' preferences for same-gender exercise groups (Dunlop & Beauchamp, 2011), we sought to test the following hypotheses. Specifically, we expected that older adults randomized to a SASG condition would display improved exercise adherence behavior at both 12 and 24 weeks relative to older adults in the SAMG condition, who in turn would display improved adherence behavior than those in the standard MAMG exercise condition. These hypotheses constituted the primary research question tested within this randomized controlled trial (Beauchamp et al., 2015)[2].

Method

The study procedures were approved by the research ethics board of The University of British Columbia, with the design, conduct, and reporting of this study adhering to the Consolidated Standards of Reporting Trials (CONSORT) guidelines (Moher et al., 2010).

Study Design

Full details of the design and conduct of the GOAL (GrOup-based physical Activity for oLder adults) Trial have been published elsewhere (Beauchamp et al., 2015). In brief, the GOAL trial was a three-arm parallel randomized controlled trial (RCT) conducted in partnership with the YMCA (Young Men's Christian Association) in Greater Vancouver between March, 2014 and August, 2015. The GOAL study was registered at clinicaltrials.gov (Identifier: NCT02023632). The trial took part at three YMCA sites in the Greater Vancouver, British Columbia, Canada.

Participants and Recruitment

Participants were recruited via advertisements placed through the local media, recreation centers, health care centers, hospitals, physician general practices, shopping malls, golf courses, and online interest sites within the Lower Mainland of British Columbia. In order to manage the scope of the trial and minimize the burden on the respective YMCA sites, the trial was conducted via two cohorts, with the first cohort (n = 306) taking place between March and August 2014 and the second cohort (n = 321) taking place between March and August 2015.

After initial screening for eligibility (n = 798), and informed consent for participation was obtained, 627 of the 745 eligible adults aged 65–91 (M_{age} = 71.57 years, SD = 5.41) took part in the study (see Figure 1 for participant flow through the trial)[3]. Participants were eligible if they were 65 years of age or older and did not have any medical contraindication preventing them from engaging in moderate-to-vigorous physical activity. We initially sought to target a 50% female and 50% male composition within the overall study. Although consistent with the underrepresentation of men within previous evidence-based health promotion programs (Anderson, Seff, Batra, Bhatt, & Palmer, 2016), our sample included fewer men than women with 182 males (29.0%) and 445 (71.0%) females taking part. Overall, the sample was primarily married (50.6%), white (82.1%), and retired (79.1%; see Table 1).

Procedure and Setting

Potentially interested study individuals (n = 798) completed a prescreening process over the phone, which included the completion of the Physical Activity Readiness Questionnaire for Everyone (PARQ+) and Electronic Physical Activity Readiness Medical Examination (ePARmed-X+; Warburton, Jamnik, Bredin, & Gledhill, 2011). Prescreening was conducted either by the project coordinator (authors SMH and SAW) or a trained research assistant using a prescreening script for consistency. If the ePAR-medX+ highlighted that physician approval was required prior to joining the program, the respective individual was informed that physician approval was required before s/he then could enroll in the study. All prescreening measures took place in January and February (2014 for cohort 1 and 2015 for cohort 2). Following the initial screening process for inclusion/exclusion, informed consent was obtained. Participants then completed baseline measures (related to demographic and background variables, physical activity, general health status), and were block randomized by the project coordinator (SMH, SAW) to one of three study arms (SASG, SAMG, and MAMG), with the sequence of randomization blinded to the other investigators. The programs ran between the beginning of March and end of August within each of the respective years (24 weeks in total). In return for study participation, participants did not incur any costs associated with exercising at the respective YMCAs (i.e., exercise membership fees were waived). No other forms of remuneration were provided.

Measures

Demographic information including age, marital status, household income, health status, smoking status was collected at base-

[1] We are/were acutely cognizant of the differences between contemporary conceptions of sex (as a biological construct) and gender (as a socially constructed construct; Canadian Institutes of Health Research, 2014). As an individual difference variable, at the point of baseline assessment, participants were asked to report whether they identify as male or female (as part of one of the demographic questions). As such, other than by randomization, individual assignment to conditions was made on the basis of gender (i.e., self-identification as being male or female); hence, our reference to a 'similar age same gender' condition rather than 'similar age same sex condition'. The same conceptualizations regarding our use of the term 'gender' also apply to the other two experimental conditions ('similar age mixed gender'; 'mixed age mixed gender').

[2] None of the secondary outcomes assessed in the trial (see Beauchamp et al., 2015) are reported in the current paper.

[3] The initial sample reported in our protocol paper (Beauchamp et al., 2015) was specified as n = 634 (with 805 assessed for eligibility). However, after trial completion, and following comprehensive data cleaning (Van den Broeck, Cunningham, Eeckels, & Herbst, 2005), we observed that five participants who enrolled in the first cohort also surreptitiously managed to enroll in the second cohort. As such, we only used data from their first enrollment. In addition, a typographical error meant that two fewer participants were enrolled in the MAMG condition than were reported in our protocol paper. In sum, the study sample involved seven fewer participants (n = 798 assessed for eligibility; n = 627 randomized and analyzed; see Figure 1) than were reported in our protocol paper.

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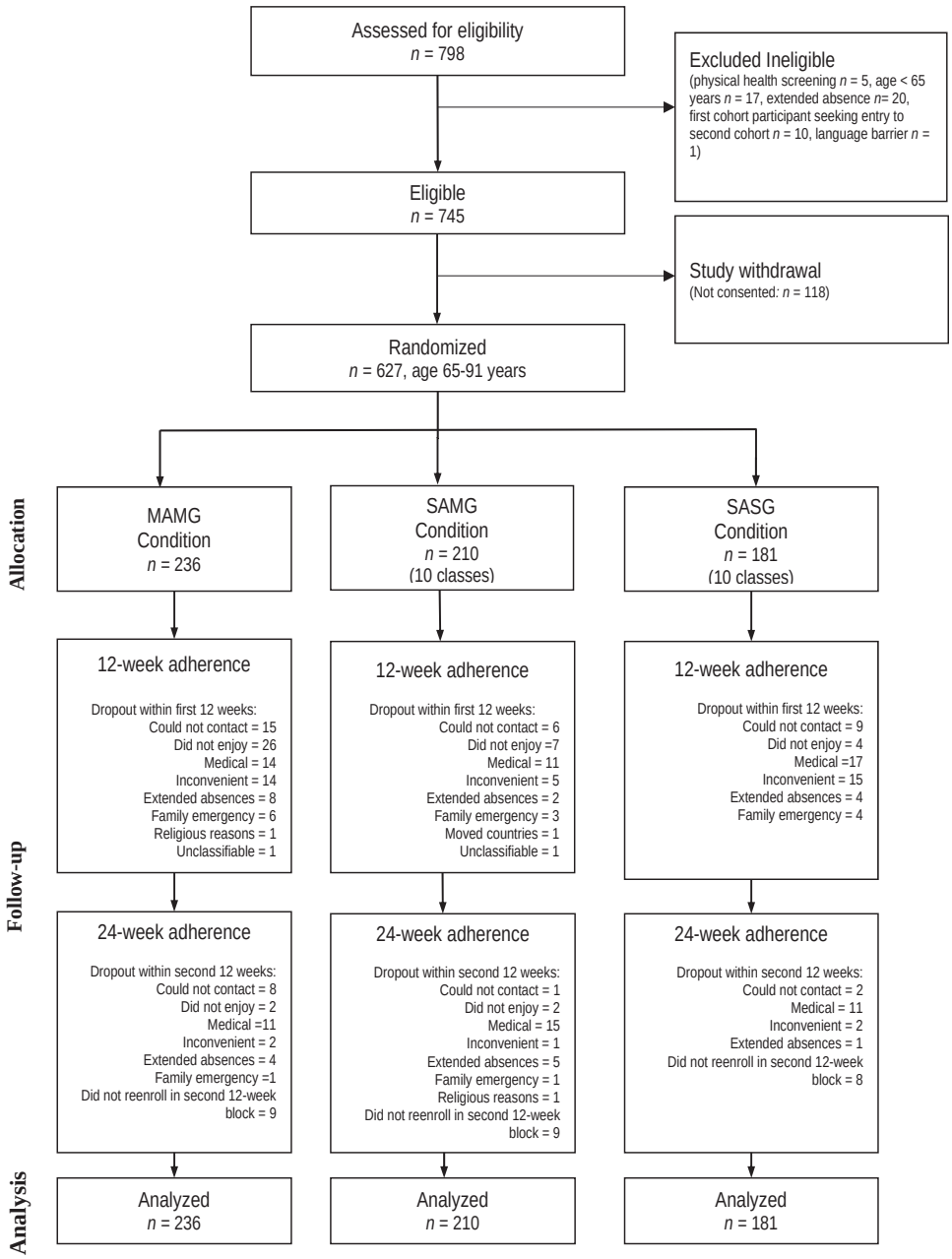

Figure 1. Participant flow.

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line (see Table 1). The primary outcome measure for the trial corresponded to objective measures of class attendance over the course of the program that were derived via reports generated by the use of participants' electronic access cards (providing date and time stamped data). Self-reported physical activity at baseline was also assessed using the Godin's Leisure Time Exercise Questionnaire (LTEQ; Godin, 2011), whereby moderate-to-vigorous physical activity (MVPA) was measured using a modified version of the Leisure Score Index (LSI; Courneya, Jones, Rhodes, & Blanchard, 2004) that has been applied to the LTEQ. This assessment involved participants reporting the average number of times in the previous seven days that they engaged in strenuous (heart-beats rapidly, sweating), moderate (not exhausting, light perspiration), and mild (minimal effort, no perspiration) physical activity. They also specified the average duration of exercise bouts (minimum of 10 min per bout) for each of the three levels of intensity. Although the primary interest was in exercise at moderate-to-vigorous (i.e., health enhancing) intensities, the mild-intensity category was included so that participants did not "bump up" their mild-intensity exercise into the moderate intensity category (Courneya et al., 2004). MVPA at baseline was calculated by multiplying the frequency of exercise bouts (for the moderate and strenuous categories) by the average duration of an exercise bout for the given intensity category. The reliability and validity of measures

Table 1
Participant Demographic Information

	MAMG	SAMG	SASG	Total
Age [*M* (*SD*)]	71.19 (4.68)	71.49 (5.46)	72.19 (6.16)	71.57 (5.41)
Range	65–87	65–92	65–90	
Gender [*n*(%)]				
Male	36 (15.3%)	80 (38.1%)	66 (36.5%)	182 (29.0%)
Female	200 (84.7%)	130 (61.9%)	115 (63.5%)	445 (71.0%)
Dwelling Arrangements [*n* (%)]				
Own	163 (81.1%)	161 (84.7%)	123 (80.4%)	447 (82.2%)
Rent	38 (18.9%)	29 (15.3%)	30 (19.6%)	97 (17.8%)
Marital Status [*n* (%)]				
Married	92 (42.8%)	104 (54.2%)	81 (52.6%)	277 (50.6%)
Divorced	36 (17.9%)	25 (13.0%)	18 (11.7%)	79 (14.4%)
Widowed	23 (11.4%)	23 (12.0%)	29 (18.8%)	75 (13.6%)
Single	33 (16.4%)	21 (10.9%)	14 (9.1%)	68 (12.4%)
Living common-law	12 (6.0%)	10 (5.2%)	7 (4.5%)	29 (5.3%)
Separated	5 (2.5%)	9 (4.7%)	5 (3.2%)	19 (3.5%)
Ethnicity [*n* (%)]				
White	167 (81.9%)	157 (84.0%)	122 (80.3%)	446 (82.1%)
Chinese	14 (6.9%)	12 (6.4%)	15 (9.9%)	41 (7.6%)
South Asian	2 (1.0%)	4 (2.1%)	3 (2.0%)	9 (1.7%)
Japanese	4 (2.0%)	2 (1.1%)	2 (1.3%)	8 (1.5%)
Korean	4 (2.0%)	0 (.0%)	1 (.7%)	5 (.9%)
Latin American	4 (2.0%)	0 (.0%)	1 (.7%)	5 (.9%)
Other	9 (4.4%)	12 (6.4%)	8 (5.3%)	29 (5.3%)
Level of Education [*n* (%)]				
Eighth Grade or less	1 (.5%)	0 (.0%)	1 (.7%)	2 (.4%)
Some high school	7 (3.4%)	6 (3.1%)	13 (8.5%)	26 (4.7%)
High school diploma	17 (8.3%)	36 (18.8%)	18 (11.8%)	71 (12.9%)
Vocational school or some college	57 (27.9%)	55 (28.6%)	42 (27.5%)	154 (28.1%)
College/ University degree	64 (31.4%)	54 (28.1%)	44 (28.1%)	161 (29.3%)
Professional or graduate degree	58 (28.4%)	41 (21.4%)	36 (23.5%)	135 (24.6%)
Household Income [*n* (%)]				
$0–20000	14 (8.3%)	14 (8.3%)	13 (9.4%)	41 (8.6%)
$20001–40,000	44 (26.5%)	48 (28.6%)	34 (23.0%)	124 (26.2%)
$40001–60000	27 (16.2%)	32 (19.0%)	22 (15.8%)	81 (17.1%)
$60001–80000	44 (26.3%)	34 (20.2%)	34 (24.5%)	112 (23.6%)
$80001–100000	20 (12.0%)	27 (16.1%)	19 (13.7%)	66 (13.9%)
$100001–120000	0 (.0%)	0 (.0%)	0 (.0%)	0 (.0%)
$120001–140000	9 (5.4%)	5 (3.0%)	7 (5.0%)	21 (4.4%)
$140001–160000	6 (3.6%)	4 (2.4%)	5 (3.6%)	15 (3.2%)
$160001 or above	3 (1.8%)	4 (2.4%)	7 (5.0%)	14 (3.0%)
Employment Status [*n* (%)]				
Retired	149 (75.3%)	151 (80.3%)	127 (82.5%)	427 (79.1%)
Part-time employed	25 (12.6%)	10 (5.3%)	6 (3.9%)	41 (7.6%)
Self-employed	6 (3.0%)	16 (8.5%)	7 (4.5%)	29 (5.4%)
Homemaker	6 (3.0%)	8 (4.3%)	9 (5.8%)	23 (4.3%)
Full-time employment	10 (5.1%)	1 (.5%)	3 (1.9%)	14 (2.6%)
Unemployed more than 1 yr.	2 (1.0%)	1 (.5%)	0 (.0%)	3 (.6%)
Unemployed less than 1 yr.	0 (.0%)	1 (.5%)	2 (1.3%)	3 (.6%)
Disabled and unable to work	0 (.0%)	0 (.0%)	1 (.6%)	0 (.0%)
Smoking Status [*n* (%)]				
Do not smoke	132 (64.4%)	113 (59.2%)	101 (65.6%)	346 (62.9%)
Ex-smoker	71 (34.0%)	76 (39.8%)	50 (32.5%)	197 (35.8%)
Currently smoke	2 (1.0%)	2 (1.0%)	3 (1.9%)	7 (1.3%)
General Health Status [*n* (%)]				
Poor	0 (.0%)	0 (.0%)	1 (.6%)	1 (.2%)
Fair	20 (9.9%)	19 (10.1%)	16 (10.4%)	55 (10.1%)
Good	87 (43.1%)	80 (42.3%)	80 (51.9%)	247 (45.3%)
Very good	76 (37.6%)	67 (35.4%)	43 (27.3%)	185 (33.9%)
Excellent	19 (9.4%)	23 (12.2%)	15 (9.7%)	57 (10.5%)
Minutes of Baseline MVPA [*M* (*SD*)]	124.88 (167.61)	105.12 (148.23)	119.93 (175.55)	116.50 (162.97)
[Median]	67.50	45.00	60.00	60.00

Note. MAMG = Mixed Age Mixed Gender; SAMG = Same Age Mixed Gender; SASG = Same Age Same Gender. The total data available for each of the demographic variables: $n = 627$ for Gender, $n = 573$ for Age, $n = 524$ for Dwelling Arrangements, $n = 497$ for Marital Status, $n = 543$ for Ethnicity, $n = 549$ for Education, $n = 445$ Household Income, $n = 540$ Employment Status, $n = 550$ for Smoking Status, $n = 545$ for General Health Status, $n = 533$ for baseline MVPA; 75 participants did not provide demographic information at baseline.

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derived from the LSI have been independently evaluated and found to compare well to nine other measures of objective and self-reported physical activity (Jacobs, Ainsworth, Hartman, & Leon, 1993).

Study Interventions

Participants were randomized 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 min. Thus, if participants fully attended their respective exercise programs they were considered to be meeting Canada's physical activity guidelines for older adults engaging (i.e., ≥150 min of moderate-to-vigorous physical activity per week; Canadian Society for Exercise Physiology, 2017).

Development of the SASG physical activity program was directly informed by self-categorization theory (Abrams & Hogg, 1990; Turner, 1985, Turner, 1987) as well as the results of a previous case study that involved a highly efficacious physical activity program for older adult males (Dunlop & Beauchamp, 2013). Specifically, classes were restricted to older adults (aged 65+) of the same gender (i.e., older adult women-only classes, older adult men only). Classes were also led by instructors, who were themselves older adults of the same gender as the study participants, rather than instructors employed by the community fitness center. In addition to alignment with the tenets of self-categorization theory (Abrams & Hogg, 1990; Turner, 1985, Turner, 1987), this approach aligns with principles from social–cognitive theory, whereby 'similar models' are considered important sources of role modeling and verbal persuasion (Bandura, 1997). In addition, the SASG condition also harnessed several strategies specifically designed to foster group identity. These included providing participants with t-shirts to foster a sense of 'distinctiveness', and encouraging postworkout gatherings (e.g., coffee and other refreshments) to enable participants to socially connect (Carron & Spink, 1993).

The SAMG physical activity condition was designed to mirror the SASG group condition in every respect (e.g., restricted to older adults ≥65 years), but was open to both older adult men and women (i.e., mixed gender). As with the SASG condition, the same strategies informed by self-categorization theory were utilized (e.g., t-shirts, opportunities to socialize after classes), with classes also offered on three days per week. Similarly, older adults were recruited to be instructors for the group classes (≥65 years), with both males and females invited to occupy these instructional roles.

Instructors for both the SASG and SAMG conditions were recruited via the local media, flyers at the partnering YMCA, and word of mouth. They were provided training (up to 45 hr of instruction/training were available to instructors), through three modules, that related to 'Program Basics and Guidelines', 'Tailoring the Program,' and 'Instructor Mastery' (for full details see Beauchamp et al., 2015). Class instructors were directed to ensure that classes included a warm-up component, moderate intensity exercises as the core component of the class, and a cool-down. Instructors were provided with autonomy-support (Mageau & Vallerand, 2003, whereby they could choose the exercises to be included in each class; however, to ensure sufficient support, instructors were provided with six unique sequences of recommended exercises that they could mix and match to suit their needs. The six sequences included themes related to: a full-body, basic class ("All Over Burn") as well as classes emphasizing gluteal and back muscles ("Spectacular Backsides"), abdominal muscles ("ABsolutely Intense"), upper body ("Superhuman Strength"), agility and balance moves ("Adios Arthritis and Balance Bodies"). A website (http://goal.kin.educ.ubc.ca/videos) was developed to provide instructors (and class participants) with audio, written, and visual (i.e., videos) tutorials, involving older adult male and female models (cf. Bandura, 1997), for completing exercises that were performed in the sessions. Exercise instructors were also provided with music playlists that had the appropriate beats per minute (BPM) to align with warm-up/cool-down (120–134 BPM) and moderate intensity (135–160 BPM) components of the physical activity programs.

Finally, the MAMG exercise condition was operationalized to reflect the 'standard' (or typical) group-based exercise program that one sees in physical activity centers in North America. Specifically, older adult participants who were randomized to the MAMG condition took part in regular group-based exercise classes that were run by the respective YMCAs. These classes were not restricted to participants on the basis of age or gender, and as such older adults in this condition participated in groups comprised of people younger than themselves as well as those of both men and women. Participants randomized to this condition had the opportunity to exercise three times per week (50–60 mins per class) within any of the standard group-based exercise programs offered by the respective YMCA (i.e., identical in frequency and duration as the SASG and SAMG conditions). Although these classes involved regular YMCA class members, only the older adults who were recruited to the GOAL Trial provided data for subsequent analyses.

Analyses

Power Analysis

To address each of the research questions examined in this trial several sample size parameters were considered. First, for our primary outcome measure (physical activity adherence behavior), 211 participants were required across the three centers to detect a medium effect size $f = .25$ (difference between the SASG and both SAMG and MAMG conditions) based on a 2 (Gender) × 3 (Conditions) ANCOVA with the percentage of classes attended over three and six months specified as dependent variable (while controlling for baseline levels of physical activity), with power $(1 - \beta)$ set at .80, and alpha set at .05. (Faul, Erdfelder, Lang, & Buchner, 2007). In addition to this primary research question, secondary research questions addressed in this trial (but not reported in this paper) trial involved multigroup (men, women) cross-panel modeling on the relations between psychological variables (e.g., group cohesion, enjoyment) and behavioral measures of physical activity, that required a minimum sample of $n = 540$ (for full details see Beauchamp et al., 2015).

Data Analyses

Statistical analyses were conducted using SPSS Version 20. All statistical tests were two-tailed, with 95% confidence intervals

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reported in the analysis. Intervention evaluations were performed on the basis of intent-to-treat principles (Moher et al., 2010; Ruiz-Canela, Martinez-Gonzáles, & de Irala-Estévez, 2000) using all of the data that were collected from randomized participants. Intraclass correlations (ICCs) for the adherence measures were as follows: SAMG ICC = .028, SASG ICC = .023. An ICC could not be calculated for the MAMG condition as we did not collect data from those (younger/other) group members who were otherwise enrolled in their regular YMCA classes, but were not the older adults enrolled as part of the GOAL Trial. Regardless, the ICCs for the experimental conditions revealed that less than 3% of the variance in the dependent variable (class attendance) was explained by clustering effects (i.e., differences between classes). To ascertain whether class clustering required modeling in the main analyses, design effects were calculated (Hox, 2010). The design effect is a function of the intraclass correlation and the average cluster size, and can be calculated using the equation: design effect = 1 + (average cluster size − 1) ∗ intraclass correlation (Muthen & Satorra, 1995, equation 35). In this study the design effects were $SAMG_{deff}$ = 1.560 and $SASG_{deff}$ = 1.391. Using Monte Carlo simulation Muthen and Satorra (1995) revealed that when design effects are <2 the estimation of standard errors of regression parameter estimates is not affected by clustering effects; however, when design effects of >2 exist clustering needs to be taken into account during model estimation (e.g., multilevel modeling). In light of the ICCs and design effects displayed in this study multilevel modeling was not required (Muthen & Satorra, 1995).

Prior to conducting the main analyses, we examined if there were any differences in baseline levels of moderate-to-vigorous physical activity behavior either with respect to experimental condition or participant gender. Seven outliers were detected through the examination of box-plots and Z-scores. Participants with a Z-score of +/− 3.29 (n = 7) were identified as potential univariate outliers (Tabachnick & Fidell, 2001). These participants were removed because their responses appeared to be atypical (e.g., participants reported between ≥1200 min of MVPA at baseline). Even after these outliers were removed, the self-reported MVPA data were found to display significant skewness (skew = 2.15, SE = .11) and kurtosis (kurtosis = 6.03, SE = .21), which even after conducting different (logarithmic) transformations, precluded subsequent parametric data analysis. As a result, we conducted nonparametric analyses of variance, which revealed that there were no significant differences between the three conditions (Kruskal-Wallis test: $H(2)$ = 1.247, p = .563) or men versus women (Mann–Whitney U test: U = 1.425, p = .148) in terms of baseline physical activity.

Our initial data analysis plan involved conducting two 2 (Gender) × 3 (Condition) ANCOVAs with baseline (self-reported) physical activity specified as a covariate, and objective measures of adherence at 12 and 24 specified as dependent variables in each model. However, due to missing baseline (self-report) physical activity measures from 94 participants (along with the 7 outliers), we also examined the *pattern* of missing baseline self-report data. The results revealed that those participants who did not provide self-report baseline physical activity data differed significantly from those who provided those baseline measures (i.e., those who provided self-report baseline physical activity measures displayed greater objective measures of adherence at both 12 and 24 weeks than those who did not, p < .001). As a result, for the main analyses we conducted two 2 (Gender) × 3 (Condition) ANOVAs, given that (a) such analyses involve data from the full sample (16.11% of study participants would be excluded by conducting the ANCOVAs), (b) it would be inappropriate to conduct the planned ANCOVAs given the pattern of missing data for the covariate was not missing at random, and (c) there were no differences (based on n = 526) in baseline physical activity between conditions and genders (based on the Kruskall-Wallis and Mann–Whitney U tests).

Results

The results of the 2 (Gender) × 3 (Condition) ANOVA, based on physical activity adherence over 12 weeks, revealed a main effect for Condition, $F(2, 624) = 8.95$, $p < .001$, $\eta_p^2 = .03$, no effect for Gender $F(1, 625) = 0.06$, $p = .812$, $\eta_p^2 = .00$, and a nonsignificant Condition × Gender interaction $F(2, 624) = 0.40$, $p = .668$, $\eta_p^2 < .01$ (see Figure 2). Post hoc comparisons, using confidence intervals, and a Bonferroni correction to alpha (p < .017), based on mean differences between conditions, indicated those randomized to the SAMG condition (M = 19.85, SE = 0.86) participated in significantly more exercise classes (d = 0.51, p < .001, CI [3.16, 8.64]) compared to the MAMG condition (M = 13.95, SE = 1.10). Older adults randomized to the SASG condition (M = 17.57, SE = 0.94), participated in significantly more exercise classes (d = 0.28, p = .012, CI [0.79, 6.46]), compared to the MAMG condition. There was no significant difference between those randomized to the SASG and SAMG conditions (d = 0.22, p = .074, CI [−0. 22, 4.78]).

The results of the 2 (Gender) × 3 (Condition) ANOVA, based on physical activity adherence over 24 weeks, revealed a main effect for Condition, $F(2, 624) = 6.86$, $p = .001$, $\eta_p^2 = .02$, no effect for Gender $F(1, 625) = 0.45$, $p = .502$, $\eta_p^2 < .01$, and a nonsignificant Condition × Gender interaction $F(2, 624) = 0.27$, $p = .767$, $\eta_p^2 < .01$ (see Figure 3). Post hoc comparisons, using confidence intervals, again with a Bonferroni correction to alpha (p < .017), based on mean differences between conditions, indicated those randomized to the SAMG condition (M = 33.76, SE =

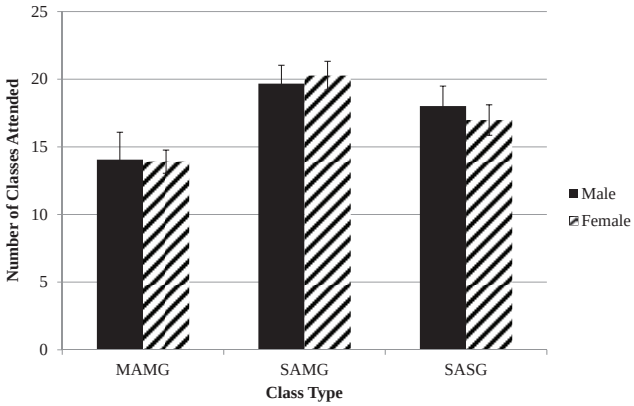

Figure 2. The effect of the group exercise class age and gender composition on the number of classes attended after 12 weeks in the program. MAMG = Mixed Age Mixed Gender, SAMG = Similar Age Mixed Gender, SASG = Similar Age Same Gender. Error bars represent standard errors.

1.58) participated in significantly more exercise classes ($d = 0.47$, $p < .001$, CI [4.43, 14.49]) compared to the MAMG condition ($M = 24.30$, $SE = 2.01$). Older adults randomized to the SASG condition ($M = 30.67$, $SE = 1.72$), participated in significantly more exercise classes ($d = 0.29$, $p = .016$, CI [1.18, 11.57]), compared to the MAMG condition. There was no significant difference between those randomized to the SASG and SAMG conditions ($d = 0.16$, $p = .187$, [−1.50, 7.66]).

Discussion

The overall purpose of this study was to test the efficacy of two group-based exercise programs for older adults that were informed by the tenets of self-categorization theory (Abrams & Hogg, 1990; Haslam et al., 2017; Turner, 1985, Turner, 1987), in comparison to a standard group-based exercise program. The results revealed that older adults who were randomized to the two group-based programs comprised solely of older adults (aged 65+) adhered to a greater extent than those older adults who took part in standard group-based exercise programs that were made up of older and younger adults alike. Previous research suggests that older adults display a preference for exercising in age-congruent settings (Beauchamp et al., 2007). The current study extends those findings by providing experimental evidence that when older adults do exercise in an age-matched environment they also adhere to a greater extent. Contrary to expectations, however, there were no significant differences in adherence between those randomized to the SASG and SAMG conditions. That is, while previous research on exercise preferences suggest that people may report a greater preference for same-gender settings (Dunlop & Beauchamp, 2011), when people take part in such exercise they do not respond with improved adherence when compared to exercising within mixed gender classes.

Several points are worthy of note. First, the patterns of findings were identical for both the 12 week and 24 week model, which gives confidence in the robustness of the observed effects. Furthermore, within each condition, and indeed between conditions, the effects for men and women were directly comparable. Second, it is noteworthy that even after utilizing conservative intent-to-treat analytic procedures (Ruiz-Canela et al., 2000) the differences in adherence between the SAMG and standard MAMG condition over both 12 and 24 weeks were in the medium effect size range and the differences between the SASG and MAMG within the same timeframes were in the small-to-medium effect size range (cf. Cohen, 1988). Of note, when one considers the differences between the SAMG and MAMG conditions over 24 weeks the differences in adherence equated to an average of 9.46 more classes taken in the SAMG program than the "standard" MAMG program.

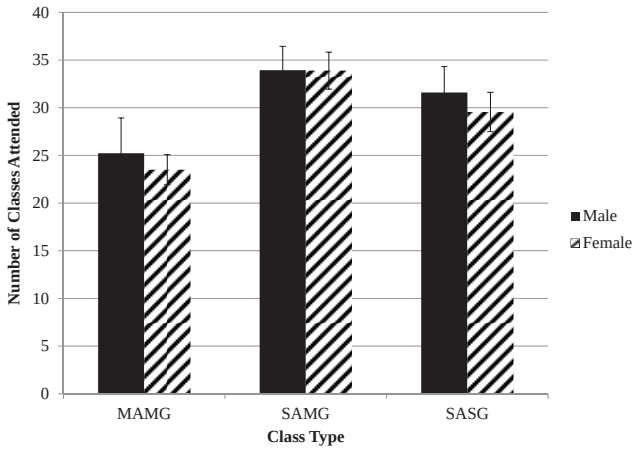

Figure 3. The effect of the group exercise class age and gender composition on the number of classes attended after 24 weeks in the program. MAMG = Mixed Age Mixed Gender, SAMG = Similar Age Mixed Gender, SASG = Similar Age Same Gender. Error bars represent standard errors.

In this study, we did not assess caloric expenditure during the classes and so were unable to determine how this improved adherence converts to energy expenditure (i.e., kcal) or metabolic equivalents. However, the results of previous systematic reviews point to a curvilinear dose-response relationship between physical activity and health outcomes (e.g., Rhodes, Bredin, Janssen, Warburton, & Bauman, 2017; Warburton, Charlesworth, Ivey, Nettlefold, & Bredin, 2010), in which the health benefits tend to be greatest as physically inactive people become more physically active. When one considers that the participants in this study were highly inactive at baseline (median self-reported MVPA = 60 mins/week), this represent a population most likely to benefit from even small increases in physical activity. As Warburton and Bredin (2016) note "relatively minor increases in PA (or fitness) in inactive individuals will lead to marked reductions in the risk for chronic disease and mortality" (p. 497). In terms of how specific (increased) doses/bandwidths of physical activity translate to specific health/medical benefits, this represents an ongoing (and unresolved) question within the field of behavioral medicine (Warburton & Bredin, 2016). From a public health perspective, the most recent epidemiological evidence points to the fact that "every bit [of physical activity] counts—but more is even better" (Warburton & Bredin, 2016, p. 500). When taken together, the findings from this study suggest that when older adults are provided an opportunity to exercise with other older adults, in classes led by older adults, and that utilize simple cost-effective strategies (e.g., group t-shirts, postexercise coffee gatherings), they tend to sustain their involvement in that program to a greater extent than in typical group-based exercise classes. Furthermore, given that there were no additional benefits of delimiting classes of older adults to those of the same gender, from an applied perspective, the results further suggest that community group-based exercise programs should engage in age-targeting but not necessarily gender-targeting among older adults.

Although the results of this study provide experimental evidence for the utility of age-matched group-based physical activity programs (informed by self-categorization theory; Abrams & Hogg, 1990; Haslam et al., 2017; Turner, 1985, Turner, 1987) for supporting physical activity adherence, it should be noted that these findings provide evidence for the *efficacy*, but not necessarily the *effectiveness*, of such interventions. An efficacy trial involves examination of an intervention under highly controlled circumstances, whereas an effectiveness study refers to an examination of an intervention under 'real-world' conditions (Glasgow, Lichtenstein, & Marcus, 2003). In the current study, participants were randomized to one of the three experimental conditions (i.e.,

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absence of choice), and while such a design allows researchers to ascertain causality, and maximize internal validity, they do not provide any insights into certain aspects of generalizability (i.e., external validity). Specifically, as it relates to the current research, the question remains concerning the extent to which older adults will naturally *choose* to enroll in same or mixed gender exercise classes as well as similar age or mixed age classes, as well as the concomitant effects of those choices on their adherence behavior. While such questions represent important considerations and directions for future research (i.e., effectiveness trials typically follow efficacy trials), some evidence that emerged after the trial concluded points to the uptake of such age-matched programs within the 'real world' (i.e., ecological validity). That is, after the trial had ended, participants in the two older adult conditions (SAMG and SASG) petitioned the community partner organization (YMCA) to request that their older-adult 'GOAL classes' be continued (Ellis, 2016).

While strengths of the study included the use of a RCT design as well as objective measures of physical activity adherence (i.e., data derived from electronic swipe cards), limitations to the study should also be acknowledged. First, although the results of the study do provide evidence for the efficacy of two group-based physical activity programs for older adults, the length of the exercise programs (24 weeks) would still be considered fairly short-term in nature. Indeed, in future, the effects of those programs over a longer period of time (1 to 5 years) should be examined. Parenthetically, the case study that directly informed the development and delivery of the GOAL trial involved a group-based exercise program for older adult males, and as reported by Dunlop and Beauchamp (2013), that program resulted in very high levels of adherence with over 70% of older adult participants sustaining their involvement for more than 5 years. Nevertheless, that study involved a qualitative case study design and, so in future, research is clearly warranted that examines the efficacy (and effectiveness) of group-based exercise programs using experimental designs, with older adults, over a longer period of time.

A second limitation corresponds to our inability to ascertain the full gender and age composition of the participants in the standard YMCA classes that constituted the MAMG condition, beyond the older adults that were part of this trial. Specifically, study participants in this condition took part in classes made up of other men and women across the age spectrum; however, due to the fact that those other class members were not part of this study, we were unable to collect data on these people (for ethical reasons). As such, while we can indicate that study participants in the MAMG condition were involved in standard classes offered by the YMCA (and thus would be representative of typical community-based exercise classes), we were unable to ascertain the exact gender or age mixes of those classes; thus precluding us from examining how such intragroup variability with regard to age or gender affected older adults' sustained class participation.

A final limitation of this study relates to the relative underrepresentation of men, when compared to women, in this study. Although older women tend to be more forthcoming in their involvement in evidence-based health promotion programs than their male contemporaries (Anderson et al., 2016), we still sought to actively target males to ensure an even representation across genders. Unfortunately, we were not successful in that endeavor. Nevertheless, given that the same patterns of findings emerged for males and females, in what was a large sample size, and involved a RCT design, gives confidence in the robustness of the effects observed, both between conditions and between men and women.

Conclusions

In conclusion, the results of this study provide support for the efficacy of group-based physical activity programs informed by self-categorization theory. Specifically, the results support the viability group-based physical activity programs for older adults, whose members are made up solely of other older adults. There was no advantage to also delimiting groups to those of the same gender, with mixed gender groups made up of older adults displaying significantly improved adherence (in the medium effect size range) relative to mixed age mixed gender classes. From a knowledge translation perspective, attending to group composition within exercise classes is an easy and sustainable way to influence older adults' physical activity behaviors. Indeed, exercise classes that are (a) made up of older adult men and women, (b) led by an older adult instructor, that (c) use basic strategies informed by self-categorization theory (e.g., group t-shirt, postexercise coffee gatherings), would be easy to translate to a variety of physical activity settings including community-centers, standard fitness clubs, and retirement communities.

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