Kobe University Repository : Kernel

PDF issue: 2026-11-01

Social Interaction in Walking Groups and Affective Responses Among Japanese Older Adults

Harada, Kazuhiro ; Masumoto, Kouhei ; Fukuzawa, Ai ; Touyama, Michiko ; Sato, Koji ; Kondo, Narihiko ; Okada, Shuichi

(Citation)
Journal of Aging and Physical Activity,28(2):287-293

(Issue Date)
2020-04

(Resource Type)
journal article

(Version)
Accepted Manuscript

(Rights)
Accepted author manuscript version reprinted, by permission, from [Journal of Aging and Physical Activity, 2020, 28(2): pp287-pp293, http://dx.doi.org/10.1123/japa.2018-0412 © Human Kinetics, Inc.

(URL)
https://hdl.handle.net/20.500.14094/90007176

Social Interaction in Walking Groups and Affective Responses Among Japanese Older Adults

Kazuhiro Harada, Kouhei Masumoto, Ai Fukuzawa, Michiko Touyama,

Koji Sato, Narihiko Kondo, Shuichi Okada

Kobe University

Author Note

Kazuhiro Harada, Active Aging Research Hub, Graduate School of Human Development and Environment, Kobe University, 3-11, Tsurukabuto, Nada, Kobe City, Hyogo 657-8501, Japan; Kouhei Masumoto, Active Aging Research Hub, Graduate School of Human Development and Environment, Kobe University, 3-11, Tsurukabuto, Nada, Kobe City, Hyogo 657-8501, Japan; Ai Fukuzawa, Active Aging Research Hab, Graduate School of Human Development and Environment, Kobe University, 3-11, Tsurukabuto, Nada, Kobe City, Hyogo 657-8501, Japan; Michiko Touyama, Active Aging Research Hub, Graduate School of Human Development and Environment, Kobe University, 3-11, Tsurukabuto, Nada, Kobe City, Hyogo 657-8501, Japan; Koji Sato, Active Aging Research Hub, Graduate School of Human Development and Environment, Kobe University, 3-11, Tsurukabuto, Nada, Kobe City, Hyogo 657-8501, Japan; Narihiko Kondo, Active Aging Research Hub, Graduate School of Human Development and Environment, Kobe University, 3-11, Tsurukabuto, Nada, Kobe City, Hyogo 657-8501, Japan; Shuichi Okada, Active Aging Research Hub, Graduate School of Human Development and Environment, Kobe University, 3-11, Tsurukabuto, Nada, Kobe City, Hyogo 657-8501, Japan.

Correspondence concerning this article should be addressed to Kazuhiro Harada, Active Aging Research Hub, Graduate School of Human Development and Environment, Kobe University, 3-11, Tsurukabuto, Nada, Kobe City, Hyogo 657-8501, Japan. Tel: +81-78-803-7886. E-mail address: harada@harbor.kobe-u.ac.jp

This work was supported by a Grant-in-Aid for Scientific Research B (15KT0006) and a Grant-in-Aid for Young Scientists A (17H04757), Japan Society for the Promotion of Science, and a Grant from Community Development Partnership between Kobe University and Nada ward, Kobe city.

Social Interaction in Walking Groups and Affective Responses Among Japanese Older Adults

Abstract

This study examined whether satisfaction with social interactions and the number of people interacted with during walking groups are associated with affective responses among older adults. Twenty-six older adults were asked to participate in 5 walking group sessions. The participants walked together for 40 to 50 minutes. In every session, participants reported their affective responses to walking (positive engagement, tranquility, and negative affect), their level of satisfaction with the social interactions experienced, and the number of people interacted with during the walk. The available data were from 107 person-sessions. Multilevel models revealed that while a higher number of people interacted with was not significantly associated with improvements in any affective responses, higher satisfaction with the interactions was significantly associated with improvements in positive engagement at both the within- and between-person levels. This study found that higher satisfaction with the interactions was associated with desirable affective responses among older adults.

Keywords: communication, emotions, exercise, healthy aging, social support

Social Interaction in Walking Groups and Affective Responses Among Japanese Older Adults

The health benefits of physical activity among older adults are well established. Current physical activity guidelines recommend that older adults engage in physical activity to promote their health (Nelson et al., 2007; World Health Organization, 2010). However, physical activity levels are lower in older adults than in younger and middle-aged adults (Inoue et al., 2011). Thus, the development of effective strategies to promote physical activity among older adults is a public health priority.

Experiencing favorable feelings during physical activity is effective for promoting physical activity behavior change. It is well known that a single session of physical activity can induce desirable affective states (Ensari, Greenlee, Motl, & Petruzzello, 2015). Such affective responses to physical activity can promote long-term changes to physical activity behavior (Rhodes & Kates, 2015). These beneficial associations have been reported in various age groups, including older adults (Ekkekakis, Backhouse, Gray, & Lind, 2008; McAuley, Jerome, Elavsky, et al., 2003; McAuley, Jerome, Marquez, et al., 2003).

The most common form of physical activity among older adults is walking (Simpson et al., 2003). Previous studies have shown that walking induces favorable affective responses (Ekkekakis et al., 2008) and that affective responses to walking are associated with further changes in physical activity behavior among older adults (McAuley, Jerome, Elavsky, et al., 2003; McAuley, Jerome, Marquez, et al., 2003).

Walking groups can be an effective way of promoting desirable affective responses to walking among older adults. Group walking has become a popular form of physical activity. For example, Walking for Health (2017), a network of health walk schemes in England, conducts approximately 1,800 walking group events per year, with approximately 82,000 individuals participating in at least one event. The American Volkssport Association (2012) conducts more than 3,000 walking group events annually, and approximately 400,000 people

took part in the events over a two-year period. A meta-analysis found that participation in walking groups is effective for promoting physical activity, especially among older adults (Kassavou, Turner, & French, 2013). Affective responses to walking are determined by the social setting, as well as the physiological conditions, such as the intensity and duration of walking (Reed, & Ones, 2006), and the environmental settings, such as indoors on a treadmill or outdoors and off-road (Dasilva et al., 2011; Johansson, Hartig, & Staats, 2011). Previous studies have revealed that walking in a group can induce more salient affective responses than can walking alone (McAuley, Blissmer, Katula, & Duncan, 2000) and that people feel more exhaustion while walking alone than when they walk with a friend (Johansson, et al., 2011).

However, as Masumoto et al. (2017) showed that the levels of social interaction among older adults during the free time before exercise sessions vary across participants and sessions, the levels of social interactions during a walking group may vary similarly. For example, it is reasonable to expect that while some individuals interact with many people, others interact with only a few people during a walking group. This variation in social interaction might cause different affective responses to walking groups. Nonetheless, previous studies examining affective responses to walking groups (Johansson et al., 2011; McAuley et al., 2000) have overlooked such variation. By examining the associations between the level of social interaction and affective responses, we can find the optimal conditions of social interaction to elicit the most desirable affective responses. Although one experimental study (Rogerson, Gladwell, Gallagher, & Barton, 2016) showed that the length of time spent on social interaction predicts the intention to undertake a future exercise behavior, it had several limitations because of the experimental setting. In Rogerson et al. (2016), the participants interacted with only one other participant and did not freely select their partner for the interaction. It remains unclear whether interacting with a larger number of people can induce more positive affective responses. Moreover, the authors (Rogerson et al., 2016) did not

measure participants' satisfaction with the social interaction. In the field of gerontology, satisfaction with social relationships has been emphasized. Socioemotional selectivity theory, a psychological theory concerning older adults, proposes that preferences for social relationships change as people grow older, and that older adults prioritize their satisfaction with social relationships and reduce the volume of their social network by discarding those on the peripheries (Carstensen, Isaacowitz, & Charles, 1999). Previous studies (Antonocci, Fuhrer, & Dartigues, 1997; Chi & Chou, 2001; Fuller-Iglesias, 2015) have indicated that satisfaction with social relationships would have more of an influence on mental health than the quantitative size of the social network. According to gerontological studies, satisfaction with the social interactions experienced during a walking group might be more important for inducing desirable affective responses to walking groups than the number of people with whom a participant interacted.

This study examined whether the number of people interacted with during walking groups and the level of satisfaction with those social interactions were associated with affective responses to walking groups among older adults.

Method

Participants and Procedures

The present study was conducted as part of a larger community intervention project implemented by our university to increase neighborhood social networks. Detailed information about our project was provided in another article (Xxxxxx et al., 2018 [deleted for blinded review process]). Our project targeted the Xxxxxxxxxx community [deleted for blinded review process], where our university is located. This community (0.6 km^2) is a part of Xxxx ward, Xxxx city, Japan. In this community, there are about 1,500 older people aged 60 years and above. We coordinated various community programs for the project, including musical entertainment events, recreational calisthenics classes, and gardening classes. The

walking group in the present study was one such program. Similar to the recruitment process for other programs, flyers advertising a walking group were posted to all houses in the Xxxxxxxxxx community. We also advertised the program via the residents' association and our university's homepage. Eligibility criteria for participation were that individuals 1) were aged 60 years or above, 2) were able to walk for 40 to 50 minutes, 3) had no serious health problems, and 4) were willing to participate in all sessions of the program. While 28 individuals applied, two withdrew their participation: one due to a health problem and the other for an unknown reason. Thus, the present study analyzed data from 26 individuals.

Originally, we planned to conduct walking sessions every Tuesday from May 31 to July 5, 2016 (six sessions in total). However, owing to inclement weather, one session (June 7, 2016) was canceled; thus, five sessions were conducted overall. In each session, after a short lecture on general knowledge about physical activity and health, which was the incentive for study participation, the participants walked together for 40 to 50 minutes at their preferred pace (moderate intensity was recommended), mainly on the campus of our university. They were encouraged to talk to each other. Four staff members walked with the attendants to direct them, protect them from traffic accidents, and be prepared for any emergency events (no emergency events occurred during the study). Mostly, the staff simply walked along with the group. When they were addressed by the participants, they talked with them naturally. The walks started between 9:35 and 9:45 a.m. and finished between 10:15 and 10:30 a.m. Before and after each session, participants answered questionnaires to measure their affective responses to the walking group and their satisfaction with the social interactions experienced while walking.

Written informed consent was obtained from all participants. The present study received prior approval (No. 193) from the Ethical Committee of the Graduate School of Xxxxx Xxxxxxxxxx xxx Xxxxxxxxx, Xxxx University. All procedures were carried out in

accordance with the Helsinki Declaration.

Measures

Affective responses to the walking group. Before and after each session, the Waseda Affect Scale of Exercise and Durable Activity (WASEDA: Arai, Takenaka, & Oka, 2003) was used to measure affective responses to walking. The WASEDA (Arai et al., 2003) was developed to measure exercise-induced affect in Japan and consists of 12 items with three subscales: positive engagement (four items: energetic, engrossed, hopeful, cheerful), tranquility (four items: relieved, comfortable, peaceful, relaxed), and negative affect (four items: depressed, unpleasant, guilty, upset). Participants were asked to indicate the extent to which each word described their current feelings, using a five-point Likert scale ranging from 1 (*do not feel*) to 5 (*feel strongly*). Following Arai et al. (2003), the scores of items for each subscale were summed (range: 4–20 for each subscale). For each subscale, in each session, the change in score from before to after walking was regarded as the affective response to the walking group.

Cronbach's alphas of the WASEDA subscales in a previous study (Arai et al., 2003) were .78 for positive engagement, .79 for tranquility, and .91 for negative affect. Construct validity of the WASEDA using confirmatory factor analysis [goodness of fit index (GFI) = .95, adjusted goodness of fit index (AGFI) = .93, root mean square error of approximation (RMSEA) = .05] and factorial validity using simultaneous confirmatory factor analysis across age groups (GFI = .92, AGFI = .88, RMSEA = .04) and genders (GFI = .92, AGFI = .89, RMSEA = .04) were confirmed (Arai, Matsumoto & Takenaka, 2004).

Satisfaction with social interactions during walking groups. Satisfaction with social interactions during walking groups was measured using a self-report questionnaire. After each walking session, the participants were asked to answer a question about their social interactions: "Did you feel satisfied by talking to others while walking?" A five-point Likert

scale ranging from 1 (*not satisfied*) to 5 (*very satisfied*) was used to respond to this question.

The number of people interacted with during walking groups. An item that measured the number of people interacted with during the walking group session was added to the questionnaire about satisfaction with social interactions. The question was "How many people did you talk to during walking?" for which participants indicated the specific number of people. The total number of participants of each walking session ranged from 19 (the last session) to 26 (the first session).

Analyses

Cronbach's alphas were calculated for each WASEDA subscale using the pre-walk data from the first walking session. To examine whether each walking session induced desirable affective responses, paired t-tests were conducted with pre- and post-walk WASEDA subscale scores as dependent variables. Pearson's correlation coefficients were calculated between the average change in WASEDA subscale scores, the average level of satisfaction with social interactions, and average number of people with whom participants interacted.

Then, multilevel models were used to examine the associations of the social interaction variables with the change in WASEDA subscale scores at both within- and between-person levels. The dependent variables were the change in WASEDA subscale scores for each session. The independent variables were sex; age; number of sessions attended; WASEDA subscale scores at pre-walk for one session; social interaction variables for one session (within-person level); overall WASEDA subscale scores at pre-walk; and overall values of social interaction variables (between-person level). The intercepts of the individual differences were considered a random effect. All continuous variables were mean-centered prior to the analyses. Restricted maximum likelihood estimation was used to fit the model. As in previous studies (Conroy, Maher, Elavsky, Hyde, & Doerksen, 2013; Maher & Conroy, 2017), overall variables (between-person level) were calculated as the mean value of each

variable across the five sessions for each participant, and variables in one session (within-person level) were calculated as the differences between each person's overall mean and their values for each session. Thus, overall variables represented the individual differences, whereas variables in one session represented each session's difference within one person.

Statistical significance was set at $p < .05$. Multilevel models were performed using the mixed command of Stata version 14 (StataCorp LLC, College Station, Texas, the United States). SPSS for Windows 21.0 was used to perform other analyses.

Results

Participant Characteristics and Affective Responses to Walking Groups

Among the respondents ($N = 26$), there were 12 men and 14 women. The mean age was 74.5 ($SD = 4.79$, range: 64–82). The participation rates were 100% ($n = 26$) in the first session, 88.5% ($n = 23$) in the second, 96.2% ($n = 25$) in the third, 88.5% ($n = 23$) in the fourth, and 73.1% ($n = 19$) in the second, third, fourth, and the last sessions, respectively.

Analyzing the pre-walk data of the first walking session, Cronbach's alphas were .73 for positive engagement, .73 for tranquility, and .95 for negative affect. Table 1 represents the affective response to each walking session. Positive engagement significantly increased after the first, second, third, and fourth sessions. Significant increases in tranquility were observed after the first and second sessions. Negative affect significantly decreased after the first session. Averaging the scores, all affective factors showed desirable changes after the walking sessions.

Association of Social Interactions in Walking Groups With Affective Responses to Walking Groups

As shown in Table 2, higher satisfaction with interactions was significantly and positively correlated with positive engagement ($r = .59$, $p = .001$), and the number of people interacted with was negatively correlated with negative affect ($r = –0.41$, $p = .038$).

Table 3 shows the results of multilevel models. Of the 116 person-sessions (total number of sessions attended by all participants), 107 were analyzed in the multilevel model; 9 person-sessions with missing data were excluded. At both within- and between-person levels, higher satisfaction with the interactions was significantly associated with improvements in positive engagement (within-person level: estimated coefficient = 0.56, $p = .019$; between-person level: estimated coefficient = 2.71, $p < .001$). At the between-person level, higher satisfaction was also associated with improvements in tranquility (estimated coefficient = 1.56, $p = .014$). However, although no significant association was revealed at the within-person level, higher numbers of people interacted with were associated with a decrease in positive engagement (estimated coefficient = –0.78, $p < .0001$) at the between-person level.

Discussion

The major finding of the study was that higher satisfaction with social interactions during the walk was associated with improved positive engagement at both the within- and between-person levels. However, in the multilevel models, the number of people interacted with was not favorably associated with affective responses. These findings indicate that higher satisfaction with the interactions during a walking group influences desirable affective responses, but that interacting with a larger number of people has only a limited influence on desirable affective responses among older adults. Although previous studies (Johansson, et al., 2011; McAuley et al., 2000) have indicated that walking with others could induce better affective responses than walking alone, they have not addressed the variation in the levels of these interactions. In demonstrating that such variation can cause different affective responses, the present study provides new insights into the optimal conditions of social interactions for inducing the most desirable affective responses from older adults. From our findings, satisfaction with social interactions in walking groups might be more important than the number of people interacted with for inducing such responses. It would be reasonable to

accept this relative importance, as it is supported by the findings of other studies. Previous studies (Chan & Lee, 2006; Chi & Chou, 2001; Fuller-Iglesias, 2015; Webster, Antonucci, Ajrouch, Abdulrahim, & Al, 2015) have found that satisfaction with social relationships, rather than the size of social network, is more closely related to mental health among older adults.

The present study found that higher numbers of people interacted with were associated with decreases in positive engagement at the between-person level. We note that these associations were not robust: the associations were not revealed at the within-person level and the Pearson's correlation coefficient between the average number of people interacted with and the average change in positive engagement was not significant. These findings should be interpreted carefully. Nonetheless, they imply that those who interact with a smaller number of people in walking groups might experience better affective changes than those who interact with a larger number. One potential explanation is that, while the necessity or desire to change interaction partner would be low when the interaction was comfortable, they might need to change partners frequently if they felt negative experiences in the interactions. It is possible that such negative experiences might cause an increase in the total number of people interacted with and a decrease in positive engagement. It has been reported that negative experiences of social interaction in a day reduce daily well-being (Birditt, 2014) and elevate daily stress levels (Birditt, Tighe, Nevitt, & Zarit, 2018) and that this effect is more pronounced among older adults than younger adults. However, because the present study was not able to estimate the degree of negative experiences, and few studies are available to support this speculation, further examinations are warranted to adequately clarify this relationship.

Among three indices of affective changes, while positive engagement was associated with satisfaction with social interactions at both the within- and between-person levels,

tranquility and negative affect were not significantly associated with it at either level. As shown in Table 1, significant increases in positive engagement were seen in more sessions than those in the other two indices. There is a possibility that positive engagement is more sensitive to group walking and is influenced more easily by the social interaction variables among older adults. However, because our understanding of the relative importance of the subdomains of affective responses among older adults is not established, further studies would be necessary to confirm the differences between the subdomains of the affective responses.

The strength of the present study was that the effects of social interaction variables were examined at both the within- and between-person levels by multilevel models. The robustness of these findings is strengthened by the fact that the findings at both levels concur. The present study contributes to a better understanding of affective responses to walking groups. However, there were some limitations. First, the most serious limitation of the present study was the small sample size. It was not based on a statistical power analysis; as the walking group in the present study was organized as one of the community programs our university has implemented (Xxxxxx et al., 2018), it was unsuitable for us to conduct more extensive recruitment. Second, owing to the voluntary recruitment of participants, a sampling bias exists in our examination. It is unclear whether our findings are generalizable to older adults with a lower motivation for group walking. Third, because we implemented walking groups in practical settings, the present study did not rigorously control the conditions of the walking sessions, such as temperature, heart rate monitoring, or the exact duration of walking. To weaken the potential influences of the absence of rigorous controls, the present study included the number of the session as a fixed effects variable and the intercepts of the individual differences as random effects in the multilevel models. Forth, instead of a single question for overall satisfaction with social interaction, more sophisticated questions would be necessary to assess satisfaction more accurately. Fifth, because the present study examined

only five sessions, long-term changes are unclear.

In conclusion, the present study found that satisfaction with social interactions in walking groups was associated with improvements in positive engagement, but that the number of people interacted with was not associated with improvements in any affective responses among older adults. As for practical implications, promoting higher satisfaction with social interactions in walking groups might contribute to inducing and increasing feelings of positive engagement among older adults. For example, providing opportunities to get know each other before walking might be one supportive way to promote higher satisfaction with them. On the other hand, in order to induce such feelings, encouraging individuals to interact with larger numbers of people may be ineffective. Further well-designed studies are needed to clarify the mechanisms of the beneficial effects of walking groups.

Acknowledgements:

This work was supported by XXXXX. (Delated for blind review process)

References

American Volkssport Association (2012). American Volkssport Association Facts & Figures. Retrieved from http://www2.ava.org/What_We_Are_About/AVA_Facts_and_Figures.pdf

Antonucci, T. C., Fuhrer, R., & Dartigues, J. F. (1997). Social relations and depressive symptomatology in a sample of community-dwelling French older adults. *Psychology and Aging*, *12*(1), 189–195. doi:10.1037/0882-7974.12.1.189

Arai, H., Takenaka, K., & Oka, K. (2003). Affect scale for acute exercise: Scale development and examination of the exercise-induced affects. *The Japanese Journal of Health Psychology, 16*(1), 1–10. (in Japanese). doi:10.11560/jahp.16.1_1

Arai, H., Matsumoto, H., & Takenaka, K. (2004). Examination of the construct and factorial validity of the Waseda Affect Scale of Exercise and Durable Activity (WASEDA). *Japan Journal of Test and Evaluation of Physical Education and Sports, 4*, 7–11. (in Japanese). Retrieved from http://www.shobix.co.jp/hpm/contents2/2004402.pdf

Birditt, K. S. (2014). Age differences in emotional reactions to daily negative social encounters. *Journals of Gerontology - Series B Psychological Sciences and Social Sciences*, *69*(4), 557–566. doi:10.1093/geronb/gbt045

Birditt, K. S., Tighe, L. A., Nevitt, M. R., & Zarit, S. H. (2018). Daily Social Interactions and the Biological Stress Response: Are There Age Differences in Links between Social Interactions and Alpha-Amylase? *Gerontologist*, *58*(6), 1114–1125. doi:10.1093/geront/gnx168

Carstensen, L. L., Isaacowitz, D. M., & Charles, S. T. (1999). Taking time seriously. A theory of socioemotional selectivity. *The American Psychologist*, *54*(3), 165–81. doi:10.1037/0003-066X.54.3.165

Chan, Y. K., & Lee, R. P. L. (2006). Network Size, Social Support and Happiness in Later

Life: A Comparative Study of Beijing and Hong Kong. *Journal of Happiness Studies*, *7*(1), 87–112. doi:10.1007/s10902-005-1915-1

Chi, I., & Chou, K. L. (2001). Social support and depression among elderly Chinese people in Hong Kong. *International Journal of Aging & Human Development*, *52*(3), 231–52. doi:10.2190/V5K8-CNMG-G2UP-37QV

Conroy, D. E., Maher, J. P., Elavsky, S., Hyde, A. L., & Doerksen, S. E. (2013). Sedentary behavior as a daily process regulated by habits and intentions. *Health Psychology*, *32*(11), 1149–1157. doi:10.1037/a0031629

Dasilva, S. G., Guidetti, L., Buzzachera, C. F., Elsangedy, H. M., Krinski, K., De Campos, W., … Baldari, C. (2011). Psychophysiological responses to self-paced treadmill and overground exercise. *Medicine and Science in Sports and Exercise*, *43*(6), 1114–1124. doi:10.1249/MSS.0b013e318205874c

Ekkekakis, P., Backhouse, S. H., Gray, C., & Lind, E. (2008). Walking is popular among adults but is it pleasant? A framework for clarifying the link between walking and affect as illustrated in two studies. *Psychology of Sport and Exercise*, *9*(3), 246–264. doi:10.1016/j.psychsport.2007.04.004

Ensari, I., Greenlee, T. A., Motl, R. W., & Petruzzello, S. J. (2015). Meta-analysis of acute exercise effects on state anxiety: An update of randomized controlled trial over the past 25 years. *Depression and Anxiety*, *32*(8), 624–634. doi:10.1002/da.22370

Fuller-Iglesias, H. R. (2015). Social ties and psychological well-being in late life: the mediating role of relationship satisfaction. *Aging & Mental Health*, *19*(12), 1103–12. doi:10.1080/13607863.2014.1003285

noue, S., Ohya, Y., Tudor-Locke, C., Tanaka, S., Yoshiike, N., & Shimomitsu, T. (2011). Time trends for step-determined physical activity among Japanese adults. *Medicine and Science in Sports and Exercise*, *43*(10), 1913–9. doi:10.1249/MSS.0b013e31821a5225

Johansson, M., Hartig, T., & Staats, H. (2011). Psychological Benefits of Walking: Moderation by Company and Outdoor Environment. *Applied Psychology: Health and Well-Being*, *3*(3), 261–280. doi:10.1111/j.1758-0854.2011.01051.x

Kassavou, A., Turner, A., & French, D. P. (2013). Do interventions to promote walking in groups increase physical activity? A meta-analysis. *The International Journal of Behavioral Nutrition and Physical Activity*, *10*(1), 18. doi:10.1186/1479-5868-10-18

Maher, J. P., & Conroy, D. E. (2017). Daily Life Satisfaction in Older Adults as a Function of (In)Activity. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, *72*(4), 593–602. doi:10.1093/geronb/gbv086

Masumoto, K., Yaguchi, T., Matsuda, H., Tani, H., Tozuka, K., Kondo, N., & Okada, S. (2017). Measurement and visualization of face-to-face interaction among community-dwelling older adults using wearable sensors. *Geriatrics & Gerontology International*, *17*(10), 1752–1758. doi:10.1111/ggi.12933

McAuley, E., Blissmer, B., Katula, J., & Duncan, T. E. (2000). Exercise environment, self-efficacy, and affective responses to acute exercise in older adults. *Psychology & Health*, *15*(3), 341–355. doi:10.1080/08870440008401997

McAuley, E., Jerome, G. J., Elavsky, S., Marquez, D. X., & Ramsey, S. N. (2003). Predicting long-term maintenance of physical activity in older adults. *Preventive Medicine*, *37*(2), 110–118. doi:10.1016/S0091-7435(03)00089-6

McAuley, E., Jerome, G. J., Marquez, D. X., Elavsky, S., & Blissmer, B. (2003). Exercise self-efficacy in older adults: Social, affective, and behavioral influences. *Annals of Behavioral Medicine*, *25*(1), 1–7. doi:10.1207/S15324796ABM2501_01

Nelson, M. E., Rejeski, W. J., Blair, S. N., Duncan, P. W., Judge, J. O., King, A. C., … Castaneda-Sceppa, C. (2007). Physical activity and public health in older adults:

recommendation from the American College of Sports Medicine and the American Heart Association. *Medicine and Science in Sports and Exercise*, *39*(8), 1435–45. doi:10.1249/mss.0b013e3180616aa2

Reed, J., & Ones, D. S. (2006). The effect of acute aerobic exercise on positive activated affect: A meta-analysis. *Psychology of Sport and Exercise*, *7*(5), 477–514. doi:10.1016/j.psychsport.2005.11.003

Rogerson, M., Gladwell, V. F., Gallagher, D. J., & Barton, J. L. (2016). Influences of Green Outdoors versus Indoors Environmental Settings on Psychological and Social Outcomes of Controlled Exercise. *International Journal of Environmental Research and Public Health*, *13*(4), 363. doi:10.3390/ijerph13040363

Rhodes, R. E., & Kates, A. (2015). Can the Affective Response to Exercise Predict Future Motives and Physical Activity Behavior? A Systematic Review of Published Evidence. *Annals of Behavioral Medicine*, *49*(5), 715–731. doi:10.1007/s12160-015-9704-5

Simpson, M. E., Serdula, M., Galuska, D. A., Gillespie, C., Donehoo, R., Macera, C., & Mack, K. (2003). Walking trends among U.S. adults: The Behavioral Risk Factor Surveillance System, 1987-2000. *American Journal of Preventive Medicine*, *25*(2), 95–100. doi:10.1016/S0749-3797(03)00112-0

Walking for Health. (2017). *Walking for Health Annual Overview in the 2016/17 financial year.* Retrieved from https://www.walkingforhealth.org.uk/sites/default/files/Infographic%202017%205.pdf?utm_source=Scheme+coordinators+Autumn+2017&utm_campaign=0ac129d4b4-Scheme+coordinator+newsletter+-+Sept+2017&utm_medium=email&utm_term=0_bd65075e71-0ac129d4b4-421387193

Webster, N. J., Antonucci, T. C., Ajrouch, K. J., Abdulrahim, S., & Al, W. E. T. (2015). Social

Networks and Health Among Older Adults in Lebanon: The Mediating Role of Support and Trust. *Journals of Gerontology, Series B: Psychological Science and Social Sciences*, *70*(1), 155–166. doi:10.1093/geronb/gbu149

World Health Organization. (2010). *Global recommendations on physical activity for health.* Retrieved from http://whqlibdoc.who.int/publications/2010/9789241599979_eng.pdf.

Xxxxxx, X., et al. (2018). Deleted for blinded review process.

Table 1.

Affective Response to Walking Group in Each Session

	Positive engagement						Tranquility						Negative affect					
	Pre-walk		Post-walk				Pre-walk		Post-walk				Pre-walk		Post-walk			
	M	SD	M	SD	p-value[a]	Cohen's d	M	SD	M	SD	p-value[a]	Cohen's d	M	SD	M	SD	p-value[a]	Cohen's d
Session number																		
First	12.7	2.5	14.1	2.2	**0.041**	**0.57**	13.2	2.5	14.5	1.9	**0.014**	**0.59**	8.2	4.3	6.2	2.4	**0.010**	**0.59**
Second	12.0	2.0	13.5	2.3	**0.009**	**0.70**	12.5	2.6	14.0	1.9	**0.018**	**0.64**	8.9	2.8	7.7	3.1	0.050	0.42
Third	12.0	1.9	13.8	2.8	**0.001**	**0.73**	13.3	2.0	14.0	2.3	0.189	0.33	8.3	2.8	7.8	3.0	0.350	0.19
Fourth	12.3	2.3	13.4	2.7	**0.022**	**0.46**	12.9	2.3	13.8	1.9	**0.036**	**0.42**	8.1	3.3	7.3	3.3	0.118	0.22
Fifth	12.6	2.7	13.0	2.7	0.404	0.16	13.1	1.8	13.1	2.7	0.970	0.01	7.5	3.2	7.3	3.9	0.636	0.06
Average scores [b]	12.3	1.9	13.8	2.1	**<0.001**	**0.74**	13.1	1.8	14.0	1.6	**0.010**	**0.52**	8.1	2.6	7.0	2.7	**<0.001**	**0.39**

M: mean; SD: standard deviation.

[a] paired t-tests.

[b] Average scores before and after each session were calculated for each participant.

Scores ranged from 4 to 20 points.

Table 2.

Pearson's Correlations among Social Interaction Factors in Walking Groups and Affective Responses

	M	SD	Range	1		2		3		4	
Affective response to walking group											
1 Average changes in positive engagement (score)	1.4	1.7	-2.6, 5.0	—							
2 Average changes in tranquility (score)	0.9	1.6	-2.0, 5.6	**0.43**	**(0.030)**	—					
3 Average changes in negative affect (score)	-1.0	1.3	-4.3, 1.6	-0.02	(0.924)	-0.22	(0.276)	—			
Social interaction in walking group											
4 Average satisfaction with interactions (score)	3.1	0.5	2.2, 4.3	**0.59**	**(0.001)**	0.11	(0.584)	-0.22	(0.289)	—	
5 Average number of people interacted with (numbers)	3.4	1.2	1.5, 5.6	-0.36	(0.074)	-0.18	(0.386)	**-0.41**	**(0.038)**	0.26	(0.201)

Each value represents Pearson's correlation coefficient (p-value).

Table 3.

Multilevel Models for Associations of Social Interaction in Walking Group with Affective Response to Walking Group

	Changes in positive engagement		Changes in tranquility		Changes in negative affect	
	Estimated (95%CI)	p-value	Estimated (95% CI)	p-value	Estimated (95% CI)	p-value
Fixed Effects, within-person level						
Session number (reference, first session)						
Second	-0.19 (-1.23, 0.85)	0.718	-0.55 (-1.53, 0.42)	0.266	**1.21 (0.11, 2.31)**	**0.031**
Third	-0.34 (-1.43, 0.75)	0.545	-0.47 (-1.48, 0.54)	0.361	**1.70 (0.53, 2.86)**	**0.004**
Fourth	-0.65 (-1.69, 0.39)	0.217	-0.59 (-1.57, 0.38)	0.234	**1.24 (0.11, 2.36)**	**0.031**
Fifth	**-1.40 (-2.61, -0.19)**	**0.023**	**-1.26 (-2.40, -0.12)**	**0.031**	1.33 (0.00, 2.66)	0.050
Affective states[a] at pre-walk in one session	**-0.74 (-0.99, -0.50)**	**<0.001**	**-1.08 (-1.29, -0.87)**	**<0.001**	**-0.95 (-1.12, -0.78)**	**<0.001**
Satisfaction with interactions in one session	**0.56 (0.09, 1.02)**	**0.019**	0.34 (-0.09, 0.78)	0.125	-0.24 (-0.74, 0.26)	0.350
Number of people interacted with in one session	0.27 (-0.05, 0.60)	0.098	0.01 (-0.30, 0.31)	0.966	-0.18 (-0.53, 0.17)	0.316
Fixed Effects, between-person level						
Gender: women (reference, men)	-0.20 (-1.40, 1.00)	0.746	**-1.87 (-3.41, -0.34)**	**0.017**	-0.74 (-2.11, 0.64)	0.295
Age	-0.09 (-0.24, 0.06)	0.244	**-0.22 (-0.37, -0.06)**	**0.008**	0.00 (-0.16, 0.17)	0.985

Overall affective states[a] at pre-walk	-0.12 (-0.43, 0.18)	0.428	**-0.63 (-0.98, -0.28)**	**<0.001**	-0.12 (-0.34, 0.11)	0.306
Overall satisfaction with interactions	**2.71 (1.74, 3.67)**	**<0.001**	**1.57 (0.32, 2.82)**	**0.014**	-0.16 (-1.41, 1.09)	0.798
Overall number of people interacted with	**-0.78 (-1.17, -0.40)**	**<0.001**	-0.19 (-0.68, 0.30)	0.450	-0.37 (-0.83, 0.09)	0.118
Fixed Effects, Intercept	**3.15 (1.02, 5.29)**	**0.004**	**4.74 (2.04, 7.44)**	**0.001**	-0.98 (-3.54, 1.58)	0.452
Random effects						
Intercept	0.42 (0.07, 2.30)	—	1.17 (0.44, 3.10)	—	0.72 (0.19, 2.79)	—
Residual	2.77 (2.01, 3.82)	—	2.43 (1.76, 3.36)	—	3.24 (2.35, 4.46)	—

Totally, 107 sessions (on average, 4.11 sessions for each individual) were analyzed.

[a]Score of WASEDA subscale (positive engagement, tranquility, or negative affect)