Published in final edited form as:

J Health Psychol. 2017 June ; 22(7): 834–843. doi:10.1177/1359105315616470.

Promoting walking in older adults: Perceived neighborhood walkability influences the effectiveness of motivational messages

Nanna Notthoff^a and Laura L. Carstensen^a

^aStanford University

Abstract

Positively-framed messages seem to promote walking in older adults better than negatively-framed messages. This study targeted elderly people in communities unfavorable to walking. Walking was measured with pedometers during baseline (one week) and intervention (four weeks). Participants ($n = 74$) were either informed about the *benefits* of walking or the *negative* consequences of not walking. Perceived neighborhood walkability was assessed with a modified version of the Neighborhood Walkability Scale. When perceived walkability was high positively-framed messages were more effective than negatively-framed messages in promoting walking; when perceived walkability was low negatively-framed messages were comparably effective to positively-framed messages.

Keywords

walking; health messages; positivity effect; socioemotional selectivity theory; aging

A large literature suggests that physical activity confers benefits to health and reduces all-cause mortality (Loef & Walach, 2012; Löllgen, Böckenhoff, & Knapp, 2009). Prior research has shown that even relatively small increases in activity appear to benefit health (Samitz, Egger, & Zwahlen, 2011; Wen et al., 2011) and are effective at advanced ages (Brown et al., 2011). Walking is a particularly appealing target for older adults because most people are able to engage in the activity, and it requires no special equipment (Morris & Hardman, 1997). Nevertheless, the majority of older Americans are notably inactive (King, Rejeski, & Buchner, 1998; Trost, Owen, Bauman, Sallis, Brown, 2002). This is especially evident in relatively disadvantaged segments of the population (Eyler, Eyler, Bacak, & Housemann, 2003). Furthermore, chronic physical and psychological problems may undermine beliefs about the benefits of walking and the ability to engage in the activity (Ensari, Adamson, & Motl, 2015; Galea Holmes, Weinman, & Bearne, 2015). There is growing evidence, however, that effective communications can strengthen beliefs about the beneficial effects of walking and increase engagement in the behavior (Khani Jeihooni, Hidarnia, Kaveh, Hajizadeh, & Askari, 2015; Ledford, 2012).

In two studies, Notthoff and Carstensen (2014) examined the effectiveness of motivational messages to promote walking. Post-intervention walking differed significantly as a function of message framing. Participants who received positively-framed messages walked more than participants who received negatively-framed messages. The conceptual approach was grounded in the *positivity effect*. Relative to their younger counterparts, older adults show a preference in attention and memory for positive over negative information (Mather & Carstensen, 2005; for a review, see Reed & Carstensen, 2012). The positivity effect has been observed widely across sociocultural groups in the United States as well as in other countries (Kwon, Scheibe, Samanez-Larkin, Tsai, & Carstensen, 2009). Given abundant evidence that older people process positive information more deeply than negative information (see meta-analysis by Reed, Chan & Mikels, 2014), we hypothesized that positive messages would more effectively promote walking in a diverse group of older adults.

In the studies by Notthoff and Carstensen (2014), participants lived in neighborhoods that were quite conducive to walking. Neighborhoods vary widely, of course, in their accessibility and amenability to walking. Research has shown that walking is more common in urban as compared to rural environments, for example (Van Cauwenberg et al., 2012), and a range of factors, including short blocks, mixed land use, availability of indoor walking space, access to parks and destinations like shops and restaurants all appear to promote walking (Kassavou, French, & Chamberlain, 2015; Kerr, Rosenberg, & Frank, 2012). Moreover, such factors appear to gain in importance with age (Ranchod, Diez Roux, Evenson, Sánchez, & Moore, 2013). Additionally, contextual factors seem to play a role in how walking affects psychological outcomes (Priest, 2007).

Thus, it was important to assess whether the positive messaging approach would be effective when implemented in relatively poor neighborhoods. Although walking remains arguably the best exercise option for less affluent individuals due to negligible cost, poorer neighborhoods also present barriers to walking such as relatively high crime rates, poorly lit streets, and damaged sidewalks (Ball et al., 2007; Saelens, Sallis, Black, & Chen, 2003).

Reasoning from the positivity effect, we hypothesized that positively-framed messages would more effectively increase walking than negatively-framed messages; however, we also anticipated a main effect of walkability. Namely, we expected that perceiving environmental barriers to walking would reduce the effect of the intervention in both message framing conditions.

Method

Participants

One hundred older adults between the ages of 60 and 89 years ($M = 72.81$, $SD = 7.28$) were recruited from a non-residential senior center that offered daytime services and educational opportunities in Oakland, California by posting fliers and announcing the study at the Center's adult education classes, physical activity classes, and meals. All recruitment and study procedures were approved by the Institutional Review Board of Stanford University. Although participants resided in a neighborhoods with varying walkability they all had

access to safe walking paths through the senior center. Only people who scored 23 or higher out of a possible 26 points on a telephone version of the Mini-Mental State Examination (Newkirk, et al., 2004) were included in the study. Seventy-four participants were included in the analyses. Three participants were excluded because they participated only in the first session, eleven were excluded because they did not complete all study sessions due to scheduling issues, three were excluded because they could not complete all study sessions due to worsening health issues, and eight were excluded because they did not return the pedometer log. Eleven participants were male and 63 were female. Participants had between 8 and 30 years of education ($M = 15.39$, $SD = 3.74$). About one third (36.5%) of the participants were European American, another third (35.1%) were African American, and the remaining third represented a variety of ethnicities. 12.2% of the participants had an annual household income of less than \$10,000, 20.3% of \$10,000 to \$19,999, 14.9% of \$20,000 to \$29,999, 13.5% of \$30,000 to \$39,999, 30.0% between \$40,000 and \$199,999, and 9.5% did not report their income (Table 1).

Materials and Procedure

Study procedures were similar to those in Notthoff & Carstensen (2014); in the current study, a measure of walkability was added. Participants were enrolled in the study for five weeks and completed a total of six study sessions at the senior center, one at the beginning of each week and one at the conclusion of the study. In the initial session, we obtained informed consent and collected questionnaire data. We assessed walking-related self-efficacy with a modified version of the Self-Efficacy for Exercise Questionnaire (Resnick & Jenkins, 2000) which specifically targeted walking; its internal reliability was high (Cronbach's $\alpha = .96$). Participants rated their confidence in being able to walk in the face of various obstacles on a scale from 0 = "not confident" to 10 = "very confident." Participants rated their health on two items from the Short Form 36 on scales from 1 = "excellent" to 5 = "very poor" and 1 = "much better now than one year ago" to 5 = "much worse now than one year ago", respectively (Ware & Sherbourne, 1992). Participants rated the walkability of their neighborhoods on a scale from 1 to 4, on 18 items representing a variety of facets of walkability (mixed use of the environment, public transportation infrastructure, intersection density, pedestrian infrastructure, neighborhood aesthetics, traffic safety, crime) from the Neighborhood Environment Walkability Scale – Abbreviated Version (NEWS-A) (Cerin, Saelens, Sallis, & Frank, 2006). Higher values indicate higher walkability. The reliability of the subscale was satisfactory (Cronbach's $\alpha = .81$). Participants also provided demographic information, namely educational attainment, ethnicity, and income.

Trained research assistants provided participants with a Sportline 340 pedometer to track walking and instructed participants to record the number of steps the pedometer measured on a paper log at the end of each day. The first week served as a measure of baseline walking. In subsequent weeks, research staff met with participants individually at the senior center for approximately fifteen minutes per session (sessions 2 to 5) and verbally provided participants with information about walking. Participants were randomly assigned to one of two experimental conditions, positive framing or negative framing. In the positive framing condition, participants were informed about the potential benefits of walking, and in the negative framing condition, they were told about the potential negative consequences of not

walking (for the messages, see Notthoff & Carstensen, 2014). During each session, participants completed the walking-self-efficacy scale. At the sixth and final session, participants only completed the self-efficacy questionnaire and did not receive further information about walking. They were thanked and debriefed with an explanation for the hypotheses and findings from our previous studies. Participants received a one-time payment of US \$65 for their participation and were allowed to keep the pedometer they used during the study.

Analyses

We used the Statistical Software for Social Sciences (SPSS) Versions 20 and 21 to calculate sample characteristics (demographics, health, self-efficacy, neighborhood walkability) and to examine associations among the sample characteristics and with walking.

Walking—We used hierarchical linear modeling (HLM 7; Raudenbush, Bryk, & Congdon, 2004) to examine changes in walking as a function of the message framing condition, baseline walking, and covariates. We ran two-level models for number of steps, the main outcome variable of interest. Level 1 represents repeated observations, and level 2 represents participants. The intercept represents average walking, and the slope represents changes in walking over time.

Model 1: We examined the effect of experimental condition on walking, controlling for baseline walking, health, self-efficacy, and education across the whole sample. We entered day as a level 1 predictor (first day after the first message = 1; grand-centered). For both the intercept and the time slope at level 2, we entered experimental condition as a predictor (positive framing coded as 0 and negative framing coded as 1; uncentered) and included baseline walking, health, self-efficacy, and education as covariates (grand-centered).

Model 2: We examined the role of neighborhood walkability in addition to experimental condition. This started with Model 1 and added walkability (grand-centered) and an interaction term between experimental condition and walkability as predictors.

Results

Health, Self-Efficacy, and Neighborhood Walkability

On average, participants rated their general health as very good ($M = 2.42$, $SD = .94$) and their health now as about the same as one year ago ($M = 2.95$, $SD = .70$). Participants had relatively high levels of walking-related self-efficacy. At baseline, they rated it as $M = 7.41$ on a 10-point scale ($SD = 1.90$). Walking-related self-efficacy did not change significantly throughout the study and did not differ between experimental conditions. Walking-related self-efficacy was highly and significantly correlated across sessions; for example, the correlation between self-efficacy at baseline and at the end of the intervention was $r = .59$, $p < .001$.

Perceived neighborhood walkability

On average, participants perceived their neighborhoods as walkable, though ratings varied considerably, ranging from 2.06 to 4.00, with the mean score close to the scale maximum ($M = 3.21$, $SD = .43$). Neighborhood walkability ratings did not differ between experimental groups, although they differed by ethnicity, $F(3, 68) = 2.95$, $p = .039$. Posthoc pairwise comparisons showed that, on average, African Americans perceived the walkability of their neighborhoods as significantly lower than European Americans ($Mean\ Difference = -.33$, $SE = .11$, $p = .033$). Higher perceived neighborhood walkability was associated with higher walking-related self-efficacy ($r = .32$, $p = .005$) (Table 2).

Walking

Participants walked between 20 and 20,907 steps daily during the baseline week ($M = 4,599$, $SD = 3,706$). Experimental groups did not differ in baseline walking. There was a tendency for older participants to walk fewer steps than younger participants, $r = -.22$, $p = .067$. Health ratings were unrelated to baseline walking. The higher participants' walking-related self-efficacy was, the more they walked at baseline, $r = .42$, $p < .001$ (Table 2).

On the whole, participants significantly increased the number of steps they walked per day from baseline to the last week of the intervention ($M = 599$, $SD = 2,341$, $t(73) = 2.20$, $p = .031$). Considering daily steps averaged for each week, the increase appears relatively continuous. In week 2, participants walked, on average, 4,417 steps daily ($SD = 3,874$), in week 3, 4,598 steps ($SD = 3,162$), in week 4, 4,902 steps ($SD = 3,706$), and in week 5, 5,198 steps ($SD = 4,039$). Using Hierarchical Linear Modeling, we examined the trajectories of steps walked per day more closely.

Model 1—The marginally significant time slope indicated that participants continuously increased the number of steps they walked each day throughout the intervention ($G_{10} = 51.17$, $SE = 26.04$, $t(50) = 1.97$, $p = .06$); no differences were found as a function of experimental condition. Participants who walked more at baseline also walked more, on average, during the intervention ($G_{04} = .64$, $SE = .11$, $t(50) = 5.73$, $p < .001$). Those with higher levels of walking related-self-efficacy and more years of education walked more, on average, during the intervention ($G_{03} = 278.61$, $SE = 119.62$, $t(50) = 2.33$, $p = .024$ and $G_{05} = 124.68$, $SE = 57.27$, $t(50) = 2.18$, $p = .034$, respectively); self-rated health was unrelated to walking. Unlike findings from Notthoff and Carstensen (2014), experimental groups did not differ in average steps per day during the intervention. Both groups showed gains.

Model 2—Although the senior center was in an objectively walkable neighborhood, participants lived in neighborhoods that varied in walkability. Therefore, we examined if perceived neighborhood walkability influenced the effectiveness of the intervention. The more favorably participants perceived the walkability of their neighborhood, the more effective positively-framed messages were in promoting daily walking, after controlling for baseline walking, $G_{06} = 1648.04$, $SE = 670.87$, $t(50) = 2.46$, $p = .018$. Conversely, the less favorably participants perceived the walkability of their neighborhoods, the more likely comparable yet negatively-framed messages also promoted daily walking, controlling for baseline walking, $G_{06} + G_{07} = 1648.04 + (-1842.34) = -194.30$, $SE = 893.25$, $t(50) = -2.06$,

$p = .045$ (Figure 1). The effect of walking-related self-efficacy was no longer significant, and that of education reduced to marginal significance, $G_{05} = 100.75$, $SE = 57.06$, $t(50) = 1.77$, $p = .084$).¹

Discussion

The intervention examined in this study succeeded at increasing walking in a diverse sample of older adults recruited from relatively poor neighborhoods. On average, participants walked roughly 600 steps per day more in the last week of the intervention compared to baseline, which corresponds to just over a quarter mile. Notably, increases of 600 steps per day (or approximately a quarter mile or two to three city blocks) are practically significant. The ability to walk a quarter mile is strongly associated with a delay of functional disability and reduced risk of mortality in older adults (Hardy, Kang, Studenski, & Degenholtz, 2011).

Consistent with the literature on physical activity and its promotion, participants who were more confident in their ability to walk as well as those who had more education walked more at baseline and continued to do so throughout the intervention (Lewis, Marcus, Pate, & Dunn, 2002; Sallis et al., 1986; Wolf, Gazmararian, & Baker, 2007). The pattern of change over time suggests that the increase happened continuously throughout the study period.

Unlike in a study by Notthoff & Carstensen (2014), however, positively-framed and negatively-framed messages were comparably effective. On closer examination, we observed that message effectiveness varied by perceived neighborhood walkability, which also accounted for the relationships of walking to self-efficacy and education. Specifically, positively-framed messages were more effective in promoting walking among participants who perceived their neighborhoods as relatively walkable, whereas negatively-framed messages were comparably effective among participants who perceived their neighborhoods as less walkable. A consistent pattern is emerging across studies when participants are residents of neighborhoods where walking is easily managed. Both studies by Notthoff and Carstensen (2014) generated similar findings as the present study in participants who perceived neighborhood walkability to be high. In contrast, the present findings suggest that negative messaging may be at least as effective among participants who find walking to be challenging.

One possible explanation is that walking in the face of perceived barriers demands problem solving and deliberative processing which subsequently reduces selective attention to positive material. Such an interpretation is consistent with the literature on the positivity effect. Theoretically, the positivity effect reflects goal-directed cognitive processing related to well-established age differences in goals (Reed & Carstensen, 2012). Older people are more likely to pursue goals about satisfaction and meaning whereas younger people are just as likely to pursue goals about information acquisition (Carstensen, 2006). Notably, the positivity effect is strongest in experiments where cognitive processing is unconstrained, that

¹The patterns of results for both models remain the same when the outcome variable steps is square-root transformed (and thus, normally distributed). Likewise, the patterns of results for both models remain the same when extreme values are replaced by the group mean ± 3 standard deviations, although we would argue that walking is highly variable across days and have therefore opted to report analyses on the raw data.

is, when participants are instructed to simply view or review information. In experiments where specific goals are imposed experimentally, the positivity effect is reduced or eliminated, e.g., when participants are instructed to pursue goals about learning. Löckenhoff & Carstensen (2007) explored this postulate experimentally in a study of health-related decisions. When asked to simply review information, compared to younger adults, older adults reviewed proportionately more positive than negative attributes associated with the options. When experimental instructions specifically activated information-gathering goals, however, the positivity effect was no longer evident. It is conceivable that asking older people to increase walking under difficult conditions demands a shift in goals away from a focus on satisfaction and meaning to ones that involve information seeking and subsequently reduce selective attention to positive messaging.

Strengths, Limitations, and Future Directions

Importantly, findings suggest that a simple and cost-effective intervention based on motivational messages is effective in promoting walking in older adults even when they perceive barriers to walking in their neighborhoods. To our surprise, positive and negative messages were comparably effective. On closer examination, we observed a systematic relationship between perceived walkability and message type. Those who perceived their neighborhoods as highly walkable walked more in response to positively-framed messages, as in earlier work based on more participants who lived in more affluent neighborhoods (Notthoff & Carstensen, 2014). Those who perceived their neighborhood as low in walkability, walked more in response to both positively-framed and negatively-framed messages. Goal directed cognitive processing offers one possible explanation which merits empirical testing. Specifically, future research should formally examine older adults' attention to and memory for the positively- and negatively-framed messages. In order to better understand when positively-framed and negatively-framed messages differ in their effectiveness for promoting walking in older adults and when they do not, it will be important to learn more about the mechanisms that can explain differences in message effectiveness.

The role of objectively assessed neighborhood walkability merits consideration in future studies. Although prior research has demonstrated that both subjective perceptions and objective measures of walkability predict walking (Arvidsson, Kawakami, Ohlsson, & Sundquist), participants who perceived their neighborhoods as less walkable, i.e., as more negative, may have also been more responsive to the negatively-framed messages than participants who viewed their neighborhoods more positively as relatively walkable. The possible influence of the study location on participants' perceptions of walkability may have affected the results and should be more objectively quantified in future research. Surveying participants in the senior center that was located in an *objectively* walkable neighborhood may have influenced their perceptions of their own neighborhoods.

Despite open questions about the precise mechanisms through which perceived neighborhood walkability influences the effectiveness of the messages about walking, the types of motivational messages utilized in this study have the potential to be the basis of simple and cost-effective interventions that promote physical activity even in contexts that

are unfavorable to it. The present set of findings suggests that a number of factors should be taken into consideration when implementing such an intervention. First, the sample in the present study consisted primarily of women. Theoretically, we would not expect to observe gender differences in the effectiveness of positively-framed and negatively-framed messages, and preferential processing of positive compared to negative information has been observed in both older men and older women. However, we could not explicitly test this assumption in the current study given the small number of men in the sample. Second, participants who had relatively high levels of self-efficacy about walking were especially likely to benefit from the intervention. Thus, it may be useful to consider taking additional steps to boost self-efficacy (e.g., offering a structured activity program that allows people to build up confidence about walking) prior to implementing the intervention. Third, we do not know whether participants walked near the senior center or in their neighborhoods nor do we know whether they chose to increase walking by using it more as a mode of transportation, leisure activity, or as planned exercise. Answers to such questions could greatly inform future interventions.

Conclusion

Framed motivational messages effectively promoted walking in a diverse sample of older adults drawn from relatively poor neighborhoods, even ones that were relatively unfavorable to walking. Messages about the benefits of physical activity appear to effectively increase walking in neighborhoods that differ greatly in amenability to walking and in cultural contexts. Our findings suggest that messages about the negative consequences of inactivity also may be effective in some contexts where increasing walking demands problem solving in order to overcome perceived obstacles to walking. From a practical standpoint, messages about the benefits of activity appear to offer a way to improve health in older adults.

Acknowledgments

This research was supported by grant NIA AGO R37-8816 to Laura L. Carstensen and a seed grant to Nanna Notthoff from the Center for Advancing Decision Making and Aging (NIA Roybal Center 5P30-AG024957, PI: Mary K. Goldstein). The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the United States government, the National Institute on Aging or the National Institutes of Health.

We are grateful to Ewart Thomas for his consultations on data analyses as well as his comments on earlier drafts of this manuscript. We also thank Albert Bandura, Lee Ross, and Jeanne Tsai for their comments on earlier drafts of the manuscript. We thank Emily Vogel for coordinating data collection in Oakland and Natasha Avery, Helen Bowles, Tim Feeney, Aly Lopez, Ben Lauing, and Ana-Karen Zavala-Zimmerer for their assistance with data collection and entry.

References

- Arvidsson D, Kawakami N, Ohlsson H, Sundquist K. Physical activity and concordance between objective and perceived walkability. *Medicine & Science in Sports & Exercise*. 2012; 44(2):280–287. DOI: 10.1249/MSS.0b013e31822a9289 [PubMed: 21716148]
- Ball K, Timperio A, Salmon J, Giles-Corti B, Roberts R, Crawford D. Personal, social and environmental determinants of educational inequalities in walking: a multilevel study. *Journal of Epidemiology and Community Health*. 2007; 61:108–114. DOI: 10.1136/jech.2006.048520 [PubMed: 17234868]

- Brown SC, Huang S, Perrino T, Surio P, Borges-Garcia R, Flavin K, Brown CH, Pantin H, Szapocznik J. The relationship of perceived neighborhood social climate to walking in Hispanic older adults: a longitudinal, cross-lagged panel analysis. *Journal of Aging and Health*. 2011; 23(8):1325–1351. DOI: 10.1177/0898264311418502 [PubMed: 21885705]
- Carstensen LL. The influence of a sense of time on human development. *Science*. 2006; 312:1913–1915. DOI: 10.1126/science.1127488 [PubMed: 16809530]
- Cerin E, Saelens BE, Sallis JF, Frank LD. Neighborhood Environment Walkability Scale: Validity and Development of a Short Form. *Medicine & Science in Sports & Exercise*. 2006; 38(9):1682–1691. DOI: 10.1249/01.mss.0000227639.83607.4d [PubMed: 16960531]
- Ensari I, Adamson BC, Motl W. Longitudinal association between depressive symptoms and walking impairment in people with relapsing-remitting multiple sclerosis. *Journal of Health Psychology*. 2015; doi: 10.1177/1359105315584837
- Eyler AA, Brownson RC, Bacak SJ, Housemann RA. The epidemiology of walking for physical activity in the United States. *Medicine and Science in Sports and Exercise*. 2003; :1529–1536. DOI: 10.1249/01.MSS.0000084622.39122.0C [PubMed: 12972873]
- Galea Holmes MN, Weinman JA, Bearne LM. ‘You can’t walk with a cramp!’ A qualitative exploration of individuals’ beliefs and experiences of walking as treatment for intermittent claudication. *Journal of Health Psychology*. 2015; doi: 10.1177/1359105315600238
- Hardy SE, Kang Y, Studenski SA, Degenholtz HB. Ability to walk ¼ mile predicts subsequent disability, mortality, and health care costs. *Journal of General Internal Medicine*. 2011; 26(2):130–135. DOI: 10.1007/s11606-010-1543-2 [PubMed: 20972641]
- Kassavou A, French DP, Chamberlain K. How do environmental factors influence walking in groups? A walk-along study. *Journal of Health Psychology*. 2015; 20(10):1328–1339. DOI: 10.1177/1359105313511839 [PubMed: 24296734]
- Kerr J, Rosenberg D, Frank L. The role of the built environment in healthy aging: Community design, physical activity, and health among older adults. *Journal of Planning Literature*. 2012; 27(1):43–60. DOI: 10.1177/0885412211415283
- Khani JA, Hidarnia A, Kaveh MH, Hajizadeh E, Askari A. The effect of an educational program based on health belief model and social cognitive theory in prevention of osteoporosis in women. *Journal of Health Psychology*. 2015; doi: 10.1177/1359105315603696
- King AC, Rejeski WJ, Buchner DM. Physical activity interventions targeting older adults. A critical review and recommendations. *American Journal of Preventive Medicine*. 1998; 15(4):316–333. DOI: 10.1016/S0749-3797(98)00085-3 [PubMed: 9838975]
- Kwon Y, Scheibe S, Samanez-Larkin GR, Tsai JL, Carstensen LL. Replicating the positivity effect in picture memory in Koreans: Evidence for cross-cultural generalizability. *Psychology and Aging*. 2009; 24:748–754. DOI: 10.1037/a0016054 [PubMed: 19739932]
- Ledford CJW. Exploring the interaction of patient activation and message design variables: Message frame and presentation mode influence on the walking behavior of patients with type 2 diabetes. *Journal of Health Psychology*. 2012; 17(7):989–1000. DOI: 10.1177/1359105311429204 [PubMed: 22253330]
- Lewis BA, Marcus BH, Pate RR, Dunn AL. Psychosocial mediators of physical activity behavior among adults and children. *American Journal of Preventive Medicine*. 2002; 23(2):26–35. DOI: 10.1016/S0749-3797(02)00471-3 [PubMed: 12133735]
- Löckenhoff CE, Carstensen LL. Aging, emotion, and health-related decision strategies: Motivational manipulations can reduce age differences. *Psychology and Aging*. 2007; 22:134–146. DOI: 10.1037/0882-7974.22.1.134 [PubMed: 17385990]
- Loef M, Walach H. The combined effect of healthy lifestyle behaviors on all cause mortality: A systematic review and meta-analysis. *Preventive Medicine*. 2012; 55(3):163–170. DOI: 10.1016/j.ypmed.2012.06.017 [PubMed: 22735042]
- Löllgen H, Böckenhoff A, Knapp G. Physical activity and all-cause mortality: An updated meta-analysis with different intensity categories. *International Journal of Sports Medicine*. 2009; 30(3): 213–224. DOI: 10.1055/s-0028-1128150 [PubMed: 19199202]
- Mather M, Carstensen LL. Aging and motivated cognition: the positivity effect in attention and memory. *Trends in Cognitive Science*. 2005; 9(10):496–502. DOI: 10.1016/j.tics.2005.08.005

- Morris JN, Hardman AE. Walking to health. *Sports Medicine*. 1997; 23(5):306–332. DOI: 10.2165/00007256-199723050-00004 [PubMed: 9181668]
- Newkirk LA, Kim JM, Thompson JM, Tinklenberg JR, Yesavage JA, Taylor JL. Validation of a 26-point telephone version of the Mini-Mental State Examination. *Journal of Geriatric Psychiatry and Neurology*. 2004; 17(2):81–87. DOI: 10.1177/0891988704264534 [PubMed: 15157348]
- Notthoff, Carstensen. Positive messaging promotes walking in older adults. *Psychology & Aging*. 2014; 29(2):329–341. DOI: 10.1037/a0036748 [PubMed: 24956001]
- Priest P. The healing balm effect: Using a walking group to feel better. *Journal of Health Psychology*. 2007; 12(1):36–52. DOI: 10.1177/1359105307071734 [PubMed: 17158839]
- Ranchod YK, Diez Roux AV, Evenson KR, Sánchez BN, Moore K. Longitudinal associations between neighborhood recreational facilities and change in recreational physical activity in the multi-ethnic study of atherosclerosis, 2000–2007. *American Journal of Epidemiology*. 2013; 179(3):335–343. DOI: 10.1093/aje/kwt263 [PubMed: 24227016]
- Raudenbush, SW., Bryk, AS., Congden, R. HLM 6 for Windows. Skokie, IL: Scientific Software International; 2004.
- Reed AE, Chan L, Mikels J. Meta-analysis of the age-related positivity effect: Age differences in preferences for positive over negative information. *Psychology and Aging*. 2014; 29:1–15. DOI: 10.1037/a0035194 [PubMed: 24660792]
- Reed AE, Carstensen LL. The theory behind the age-related positivity effect. *Frontiers in Psychology*. 2012; 3:1–9. DOI: 10.3389/fpsyg.2012.00339 [PubMed: 22279440]
- Resnick B, Jenkins L. Testing the reliability and validity of the self-efficacy for exercise scale. *Nursing Research*. 2000; 49:154–159. DOI: 10.1097/00006199-200005000-00007 [PubMed: 10882320]
- Saelens BE, Sallis JF, Black JB, Chen D. Neighborhood-based differences in physical activity: An environment scale evaluation. *Research and Practice*. 2003; 93(9):1552–1558.
- Sallis JF, Haskell WH, Fortmann SP, Vranzian KM, Taylor CB, Solomon DS. Predictors of adoption and maintenance of physical activity in a community sample. *Preventive Medicine*. 1986; 15(4): 331–341. DOI: 10.1016/0091-7435(86)90001-0 [PubMed: 3763558]
- Samitz G, Egger M, Zwahlen M. Domains of physical activity and all-cause mortality: systematic review and dose-response meta-analysis of cohort studies. *International Journal of Epidemiology*. 2011; 40(5):1382–1400. DOI: 10.1093/ije/dyr112 [PubMed: 22039197]
- Trost SG, Owen N, Bauman AE, Sallis JF, Brown W. Correlates of adults participation in physical activity: review and update. *Medicine and Science in Sports and Exercise*. 2002; 34(12):1996–2001. DOI: 10.1097/00005768-200212000-00020 [PubMed: 12471307]
- Van Cauwenberg J, Clarys P, De Bourdeaudhuij I, van Holle V, Verté D, de Witte N, Deforche B. Physical environmental factors related to walking and cycling in older adults: the Belgian Aging Studies. *BMC Public Health*. 2012; 12:142. doi: 10.1186/1471-2458-12-142 [PubMed: 22361255]
- Ware JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36): I. Conceptual framework and item selection. *Medical Care*. 1992; 30:473–483. DOI: 10.1097/00005650-199206000-00002 [PubMed: 1593914]
- Wen CP, Wai JPM, Tsai MK, Yang YC, Cheng TYD, Lee MC, Chan HT, Tsao CK, Tsai SP, Wu X. Minimum amount of physical activity for reduced mortality and extended life expectancy: a prospective cohort study. *The Lancet*. 2011; 378(9798):1244–1253. DOI: 10.1016/S0140-6736(11)60749-6
- Wolf MS, Gazmararian JA, Baker DW. Health literacy and health risk behaviors among older adults. *American Journal of Preventive Medicine*. 2007; 32(1):19–24. DOI: 10.1016/j.amepre.2006.08.024 [PubMed: 17184964]

Figure 1. Association between neighborhood walkability and step change in the positive and negative framing conditions.

Table 1

Sample Characteristics by Experimental Condition

	Positive Framing		Negative Framing		p
	M	SD	M	SD	
Age	73.00	7.39	72.61	7.27	n.s.
Education (years)	15.28	3.77	15.52	3.77	n.s.
General Health	2.34	0.89	2.50	1.00	n.s.
Comparative Health	3.08	0.59	2.81	0.79	n.s.
Walking-related self-efficacy (baseline)	7.55	2.09	7.27	1.67	n.s.
Walkability	3.20	0.45	3.23	0.42	n.s.
Baseline Walking	4757.02	3304.62	4432.92	4128.78	n.s.

Table 2

Correlations Among Measures

	Age	Education	Income	General Health	Comparative Health	Walking Self-Efficacy	Walkability
Education	-.12						
Income	.01	.35[*]					
General Health	-.17	-.24⁺	-.19				
Comparative Health	.05	.08	.02	.12			
Walking Self-Efficacy	-.01	.05	.09	-.26[*]	.01		
Walkability	-.17	.34^{**}	.05	-.45^{**}	-.06	.32^{**}	
Baseline Walking	-.22⁺	.20	.09	-.12	-.04	.42^{**}	.19⁺

Note.

^{**} indicates that correlation is significant at the p .01 level (two-tailed).

^{*} indicates that correlation is significant at the p .05 level (two-tailed).

⁺ indicates that correlation is marginally significant (p .1; two-tailed).