Physical activity intervention in older adults: does a participating partner make a difference?

Paul Gellert · Jochen P. Ziegelmann ·
Lisa M. Warner · Ralf Schwarzer

Published online: 7 July 2011
© Springer-Verlag 2011

Abstract Social integration and social support are expected to facilitate the adoption and maintenance of physical activity. In the context of a physical activity intervention, we distinguished three partner status groups, serving as an indicator of social integration. It was hypothesized that individuals whose partner also participated in the intervention, as opposed to individuals whose partners did not participate, or individuals without an intimate partner, would benefit more in terms of their physical activity. In a second step, a differential prediction pattern of social support on physical activity for each of the three partner status groups was investigated. The study involved 302 men and women (aged 60–95 years) and included two measurement points in time: A baseline assessment with a leaflet intervention to foster physical activity, and a 4-week follow-up assessment. In participants whose partners took part in the intervention, physical activity increased substantially over time, whereas it did not change in those individuals whose partners were not involved in the intervention, and it did not change in singles. Social support was positively related to physical activity when couples participated together in the intervention, but it was negatively related in singles or when

partners did not participate. Social support appeared to be beneficial for physical activity in older adults when both partners participate in the intervention, which might reflect joint exercise or reciprocal exercise support. Singles or those with nonparticipating partners are not only less active, they might also be impeded by misguided support that could be perceived as social control.

Keywords Social support · Physical activity · Intervention

Introduction

The purpose of the present study is the identification of social factors to promote physical activity in old age. We address the roles of two different social concepts, namely *social integration* and exercise-specific *social support* in the context of an intervention to increase physical activity, as these factors were found to influence levels of physical activity, especially in older adults (Irwin et al. 2004; van Gool et al. 2006).

Physical activity and health in old age

Health benefits of physical activity for older adults are well documented in terms of reduced mortality (Chakravarty et al. 2008), better functional, physical, and psychosocial health (Taylor et al. 2004; Hughes et al. 2004), more positive affect (Netz et al. 2007), reduced risk of falling (Carter et al. 2001), better health-related quality of life (Rejeski and Mihalko 2001; Motl and McAuley 2009), and less cognitive decline (Klusmann et al. 2010). However, despite this evidence, many older adults are not sufficiently active to enjoy these health benefits (Newsom et al. 2004).

Responsible editor: D.J.H. Deeg

P. Gellert (✉) · J. P. Ziegelmann · L. M. Warner ·
R. Schwarzer
Freie Universität Berlin, Health Psychology, Habelschwerdter
Allee 45, 14195 Berlin, Germany
e-mail: paul.gellert@fu-berlin.de

J. P. Ziegelmann · L. M. Warner
German Centre of Gerontology, Berlin, Germany

R. Schwarzer
Warsaw School of Social Sciences and Humanities, Wrocław,
Poland

Only 31.5 percent of American adults aged 65 to 74 reported regular leisure-time activity (30 min of light to moderate activity on 5 or more days per week *or* 20 min of vigorous activity on 3 or more days). Of those aged 75 and older, only 17.6 percent participated in regular physical activity (USDHHS 2010). A European survey showed that two thirds of the adult population did not reach the recommended physical activity level, which was defined as at least 1 h of moderate intensity on 5 days a week in that study (Cavill et al. 2006).

Social integration and social support

To promote physical activity in older age, two important social factors have been identified in a recent review: Having an *exercise partner* and *receiving exercise-specific social support* by intimate partners, family members, or friends (van Stralen et al. 2009). In this context, support from these significant others showed to be more effective than support by health care providers (van Stralen et al. 2009), although some studies report also opposite effects (e.g., Whaley and Schrider 2005).

Social factors that influence older adults' health and quality of life can be differentiated into the concepts of social integration (such as having an exercise partner) and social support (such as being encouraged to exercise regularly). *Social integration* refers to the structure and quantity of social relationships, such as the size and density of networks, the frequency of interaction, or the existence of a partner (Berkman et al. 2000). Various aspects of social integration were found to have a protective effect on older adults' quality of life, health, and mortality (Bosworth and Schaie 1997; Cohen 2004; Pinquart and Sörensen 2000; Seeman et al. 1993). However, it is well-documented that social network size diminishes with increasing age, and that this process is partially self-motivated: Due to motivational changes in the face of constrained time left in life, having close, emotionally gratifying relationships becomes more salient than having a large social network. As people age, they tend to maintain their closer relationships, rather than focusing on a large number (Carstensen et al. 1999; Löckenhoff and Carstensen 2004). Hence, particularly in old age, the spouse or intimate partner is likely to become a relatively stronger source of social support. Therefore, among the measures of social integration, having a partner becomes especially protective for older adults, as spousal influence encourages health-promoting behaviors and deters health-compromising behaviors (Umberson 1987; Rook 1990).

Whereas social integration describes the structure and quantity of social relationships, *social support* refers to the function and quality of relationships, such as perceived availability of help or support actually received (Schwarzer

and Knoll 2007; Knoll et al. 2007b). Social support is seen as one of the key factors to successfully overcome health compromising behaviors (e.g., McAuley et al. 2003) and to cope with illnesses or functional limitations (Luszczynska et al. 2007; Knoll et al. 2007a). However, in a literature review on the effectiveness of social support interventions, Hogan et al. (2002) reported mixed results. They found some studies that reported significant effects by including supportive others into the intervention (Blanke et al. 1990; McNabb et al. 1989; Wing and Jeffrey 1999), whereas other studies found no additional effects of the presence of a significant other on health behaviors (Nyamathi et al. 1998; Wilson and Brownell 1978).

Social support for physical activity in old age

Although the evidence is somewhat inconsistent, many studies have found that favorable characteristics of social networks can have positive effects on the adoption and maintenance of *physical activity* in older adults (McAuley et al. 2003; Stevens et al. 2003). For example, social integration as reflected by marital status was found to be associated with the amount of physical activity (Garcia and King 1991; Irwin et al. 2004; van Gool et al. 2006), probably because spouses seem to be the primary source of support for many older adults (Dykstra and Fokkema 2007; Gallo et al. 2003). One mechanism of benefiting from the presence of an intimate partner could be the partner's provision of exercise-specific support (Martire and Schulz 2007; Martire 2005). However, research on marital status as well as social support for exercise has shown an inconsistent pattern. In a review by van Stralen et al. (2009), only three out of 15 studies provided evidence for social support as a determinant of physical activity maintenance, whereas all 11 studies that included social support found associations of social support with physical activity initiation. Furthermore, McAuley et al. (2003) found that social support served as a source of self-efficacy that, in turn, predicted physical activity at 6- and 18-month follow-up. Also, Ayotte et al. (2010) found in a study of middle-aged and young-old couples, in which both partners participated, that social support had an indirect effect on physical activity via self-efficacy and self-regulatory behavior. When looking for dyadic processes of social support and physical exercise, Hong et al. (2005) found that exchanges of support from one partner to another were evident when partners were similar in their physical activity level. Whereas for partners with different levels of physical activity, however, no association between one partner's provision and the other's receipt of exercise support was detected.

However, partner support was not always found to be superior to other sources of social support. Due to the ambiguous roles, the intimate partner can be a source of

social support as well as a potential source of distress (Hogan et al. 2002). It has been shown that inappropriate support can have negative consequences for motivation, self-esteem, and autonomy (Williams et al. 2006). Negative effects of partner support on health behavior might occur when social support is perceived as *social pressure*, which in turn evokes reactance under certain circumstances (Hogan et al. 2002; van Dam et al. 2005).

Hence, it remains to be clarified whether exercise-specific social support facilitates physical activity in older adults, and whether this mechanism is responsible for the link between marital status and physical activity. There is not only a lack of intervention studies that include both intimate partners, but also studies comparing different types of partner status.

Aims

In the present study, we examine the effects of social integration and exercise-specific social support on physical activity. Social integration is represented by distinguishing three groups of participants in a physical activity intervention: We compare those who have an intimate partner or spouse with those who do not. Among participants who have a partner, we compare those who participate conjointly with their partner in the physical activity intervention, against those whose partner does not take part in the intervention. We hypothesize that individuals who participate together with their partner benefit more from the physical activity intervention, as we expect them to have more social support and opportunities to exercise together. On the other hand, persons without a partner, or with a nonparticipating partner, should benefit less. Therefore, we predict the level of physical activity by exercise-specific social support within these three different groups of older adults.

Method

Participants and procedure

The intervention study on physical activity in older adults was conducted in Germany. Participants were recruited via advertisements in nationwide newspapers. All participants were asked to take part in a health promotion program that aimed at physical activity promotion in older adults. There was no control group, as the research question did not include an evaluation of the intervention package itself. Inclusion criteria were being older than 60 years and having no medical contraindication for physical activity. Individuals were allowed to take part in the study with their intimate partner, but there was no explicit request to do so. After

sending back the informed consent form, participants received a baseline questionnaire to measure social-cognitive variables as well as physical activity levels and the intervention leaflet via mail. The leaflet prompted *planning* and *self-efficacy* for physical activity. In the *planning* part, participants were requested to create detailed plans on their physical activity goals. In the *self-efficacy* part, they were stimulated to envision their former mastery experience in various life-domains. There were no components in the intervention that focused explicitly on either spousal support or dyadic exercise. As the intervention targeted persons older than 60 years, physical activity was conceptualized and addressed in the intervention as a broad scope of activities, including mild to intense sports, work in household and garden, transportation, or leisure time activities. Each participant received the same leaflet, no matter whether both partners participated in the intervention or only one of them. However, for couples in which both partners participated, a male or a female label was additionally printed on the leaflets to address the correct partner over both points in time. Four weeks later, a follow-up questionnaire was sent by mail to assess social-cognitive variables as well as physical activity levels. At Time 1, 420 participants completed the questionnaire. The follow-up questionnaire was answered by 343 participants (82% of baseline). Of those, 41 were excluded from further analyses because of missing values on the marital status variable, so that $n = 302$ participants constituted the longitudinal sample (72% of baseline). This sample comprised 145 women and 157 men. From $n = 48$ individuals participating with their partner, $n = 24$ (50%) were women. Among those participants whose partner did not take part in the intervention ($n = 170$), $n = 56$ (33%) were women. And in the group of singles ($n = 84$), $n = 65$ (77%) were women. Participants were on average 66.5 years old ($SD = 4.9$, ranging from 60 to 95 years; Table 1 gives the descriptive statistics for each partner status group separately).

Measures

Social integration was measured by *grouping the participants* according to their partner status (with or without a partner). If they had a partner, they were further split up into one of two groups, either with a participating partner or with a nonparticipating partner. Hence, three partner status groups were established: (a) Participants whose partner took part in the intervention, which means that both partners received the intervention materials; (b) participants who reported to have a partner not taking part in the intervention; and (c) participants who took part in the intervention but had no partner, that is, who were single (unmarried, widowed, without an intimate relationship).

Table 1 Means (*M*), standard deviations (*SD*), and intercorrelations for age, social support, and physical activity for individuals with a participating partner (PP, *n* = 48), those with a nonparticipating partner (NP, *n* = 170), and those without a partner (WP, *n* = 84)

	Age			Social support T2			Physical activity T1 ^a			Physical activity T2 ^a		
	PP	NP	WP	PP	NP	WP	PP	NP	WP	PP	NP	WP
Social support T2	0.13	−0.02	0.25*									
Physical activity T1	−0.09	0.14	0.04	0.02	0.07	0.15						
Physical activity T2	−0.30*	0.11	−0.14	0.15	−0.04	−0.11	0.45**	0.48**	0.48**			
<i>M</i>	65.5	65.9	68.3	3.6	3.4	2.9	2.7	2.5	2.6	4.0	2.9	2.9
<i>SD</i>	3.5	4.4	6.1	1.5	1.4	1.6	1.8	1.6	1.8	2.7	2.3	2.2
Range	60–75	60–88	60–95	1–6	1–6	1–6	1.4–9	0–8	0.2–8	0–12	0–4	0–16

Note: ** $p < 0.01$, * $p < 0.05$. T1 = Time 1, T2 = Time 2

^a In hours per day

No matter which group the participants belonged to, they all received the same intervention leaflet (except from a gender label in the joint participation group to address the correct partner). To group individuals in the participating partner group, all persons with the same address and the same last name were requested to answer whether they wanted to join the intervention together.

Physical activity was assessed at two measurement points in time, at baseline and 4 weeks after the intervention. Based on the PAQ-50+ (adopted from Huy and Schneider 2008), participants reported the frequency and duration for each of three types of physical activity over the last 7 days: work in household and garden, transportation, and exercise/sports. For the analyses, a composite score was formed. Physical activity at Time 1 averaged 2.6 h a day, *SD* = 1.7 (at Time 2: *M* = 3.1, *SD* = 2.4).

Social support for physical activity was measured at Time 2 with two items from the Friends and Family Support for Exercise Habits Scale by Sallis et al. (1987). An introduction served as a preface to the items: “Within the last three months, what have significant others (friends, partner, family) done in terms of physical activity?” We assessed these sources of support together to ensure that participants without an intimate partner could answer these items as well. The following items were (a) “These persons encouraged me to stick to my exercise program,” and (b) “These persons exercised with me.” Responses were given on six-point scale ranging from *not at all true* (1) to *exactly true* (6). The correlation coefficient indicated the partially heterogeneous content of the two items ($r = 0.40$). Hereafter, we will use the term *social support* to abbreviate *exercise-specific social support received from family and friends*.

Sociodemographic variables (gender and age) served as covariates in the analyses because of their potential influence shown in prior studies (e.g., Knoll and Schwarzer 2002; Schwarzer and Gutiérrez-Dona 2005).

Analytical procedure

ANOVA of change was conducted to examine changes in physical activity over time between the three partner status groups. To estimate the effect of social support on physical activity within each partner status group, as well as the interaction between social support and each group, the MODPROBE macro for SPSS recommended by Hayes and Matthes (2009) was used. MODPROBE is a tool that allows probing interactions with regression analytical procedures. It estimates model coefficients, standard errors, and the conditional effect of a predictor (social support) on the outcome variable (physical activity) at specific values of a moderator variable (partner status group). The interaction is represented by the product of the predictor variable and the moderator. To test the interaction, the continuous variable (social support) was mean centered (Hayes and Matthes 2009; Aiken and West 1991). Additionally, baseline physical activity, gender, and age were included as covariates in the model. Missing data—with the exception of marital status—were imputed using the expectation maximization (EM) algorithm (Enders 2001). No differences emerged between persons who dropped out and those who remained in the study in terms of gender, age, physical activity, and social support. None of these variables had more than 5 percent missing values. SPSS 17 was used for all analyses.

Results

Table 1 displays means and correlations separately for the three partner status groups. The lower part shows the mean structure of the central study constructs separated for the three partner status groups. For physical activity at baseline, there were no mean differences between the three social groups ($F(2, 299) = 0.29$, $p > 0.05$). At 1-month

Fig. 1 Time effect and interaction effect between time and participation status of the partner. Note: * $p < 0.05$ (two-tailed)

follow-up, the mean level of physical activity ($F(2, 299) = 4.39$, $p < 0.05$) as well as of social support ($F(2, 299) = 5.49$, $p < 0.01$) was higher in the group with individuals whose partners took part in the intervention, as opposed to the other two groups. Further, the correlation between Time 1 and Time 2 physical activity was constantly high and significant across the three partner status groups. Other correlations were mostly non-significant across the groups.

First, we tested mean differences in physical activity over time for each of the three social groups, controlling for gender and age with an ANOVA of change. Results are displayed in Fig. 1. There was a significant change in physical activity ($F(1, 297) = 3.84$, $p < 0.05$, $\eta = 0.01$) from Time 1 ($M = 2.56$, $SD = 1.71$) to Time 2 ($M = 3.11$, $SD = 2.33$). The significant interaction ($F(2, 297) = 3.86$, $p < 0.05$, $\eta = 0.03$) between time and group revealed a differential pattern. Participants whose partner took part in the intervention had a more substantial increase in their physical activity levels (Time 1: $M = 2.65$, $SD = 1.79$; Time 2: $M = 4.02$, $SD = 2.73$) than participants whose

partner did not take part (Time 1: $M = 2.49$, $SD = 1.62$; Time 2: $M = 2.94$, $SD = 2.28$) or those without a partner (Time 1: $M = 2.64$, $SD = 1.84$; Time 2: $M = 2.93$, $SD = 2.21$). However, there was no difference in physical activity between singles and respondents with a partner who did not participate. Therefore, the former interaction was further analyzed (cf. Fig. 1), whereas the latter was not analyzed in more depth.

In a second step, a regression analytical procedure was conducted to test the interaction between the three groups and social support as a potential explanatory mechanism. The regression model (see Table 2) explained 27.1% of the variance in physical activity at Time 2 ($F(8, 293) = 13.64$, $p < 0.001$). Gender ($\beta = -0.01$, $p > 0.05$) and age ($\beta = -0.05$, $p > 0.05$) were included in the analysis as covariates. Physical activity at Time 1 served as baseline control variable ($\beta = 0.48$, $p < 0.001$). The intervention group variable was dummy coded. A first dummy variable contrasted the combined “partner in intervention” and “partner not in intervention” groups *against* the group of singles. Then a second dummy variable contrasted the “partner in intervention” *versus* the combined singles and “partner not in intervention” group. A significant interaction between the second dummy variable and social support on physical activity emerged ($\beta = 0.10$, $p < 0.05$), which is displayed in Fig. 2.

Social support was positively related to physical activity when both partners participated in the intervention. However, support was negatively related to physical activity in singles or when partners did not take part in the intervention.

Discussion

Based on a physical activity intervention, we explored the social factors that might play a role in the performance of

Table 2 Interaction between social integration (partner in intervention vs. partner not in intervention or no partner) and social support on physical activity in $N = 302$ older adults, controlling for gender, age, and baseline physical activity

Variable	β	SE	B	SE
Constant	-0.01	0.05	2.98	1.72
Physical activity Time 1	0.48***	0.05	0.66***	0.07
Age	-0.05	0.05	-0.03	0.03
Gender	-0.01	0.06	-0.03	0.26
Partner vs. no partner ^a	0.04	0.05	0.19	0.31
Partner in the intervention vs. partner, but not in the intervention or no partner ^a	0.13**	0.05	0.81**	0.34
Social support Time 2	-0.06	0.06	-0.10	0.08
Interaction term ^b	0.10*	0.05	0.42*	0.22

Note: Dependent variable = physical activity Time 2. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (one-tailed)

^a The three partner status groups were dummy coded into two dichotomous variables

^b Interaction term is constituted by the product of “Social support Time 2” and “Partner in the Intervention vs. Partner, but not in the intervention or no partner”

Fig. 2 Exercise-specific social support is positively related to physical activity in participants whose partner took part in the intervention, but it is negatively related in participants without a partner or with one who did not participate in the study

physical activity in older adults. Two main findings emerged: a differential mean level change in physical activity (see Fig. 1) and an interactive prediction pattern (see Fig. 2). It turned out that individuals whose partner also participated in the intervention attained higher levels of physical activity after the intervention, as compared to singles and individuals whose partners did not participate. All three groups started with similar levels of physical activity at baseline. Even though there were no components in the intervention focusing on partner support for exercise or performing physical activity together with the partner, the intervention had stronger effects on jointly participating partners than on couples with one abstinent partner, or on singles.

The second main finding was the prediction of physical activity levels within each group through levels of social support. As hypothesized, higher social support was associated with more physical activity in the subsample of respondents whose partners also participated. This effect might be due to reciprocal social support for being physically active or social modeling mechanisms assumed in the social cognitive theory (Bandura 1997).

However, it was surprising that in the other two groups (i.e., singles and those whose partners did not participate) a negative association between social support and physical activity emerged. The more participants reported to receive exercise support, the less they were physically active in those two groups. This might be interpreted as misguided or mismatched support, as these participants might have felt controlled, pressured or overprotected instead of encouraged by their social networks (van Dam et al. 2005). This is in line with research on unrequested help undermining self-esteem and posing threats to autonomy (Williams et al. 2006), which is a topic of particular

relevance in older adults (Baltes et al. 1994). Future studies should assess problematic or undermining exercise-specific support for exercise in older adults as well to give further insight into which kinds of support evoke reactance and cause negative effects in health behaviors.

In contrast to other studies (e.g., Schwarzer and Gutiérrez-Dona 2005; Knoll and Schwarzer 2002), we found no gender effects. For example, Schwarzer and Gutiérrez-Dona (2005) found a significant gender effect for social support from the spouse. Men received more support from women than women did from men. In our study, however, there were 77 percent women in the group without an intimate partner, which could imply that they were widowed. But as women usually seek more support by family members and friends than men do (Schwarzer and Gutiérrez-Dona 2005), women can probably compensate the lack of spousal support to a certain extent.

Some limitations need to be addressed. Although there has been an intervention, the data were analyzed in terms of a longitudinal observation study. There was no control group without an intervention because the research question did not include an evaluation of the intervention package itself. Rather, the hypotheses targeted the sensitivity of different partner status groups to the health promotion program. We were interested in social integration and social support for physical exercise in older adults. Thus, due to the lack of randomization of the participants to groups with different participation status of their partner, we cannot make causal conclusions. Because we had only self-selected groups in our study, a desirable design for future research would be to randomize couples to a physical activity intervention condition where both partners have the possibility to take part in the intervention as compared to a condition where the partner is not allowed to take part. Furthermore, the manipulation of the supportiveness of a partner or the partner status is not possible per se.

Another point to be mentioned is the self-report nature of physical activity. However, previous research has documented that sufficient validity of such self-reports can be expected (Armitage and Conner 2001).

In terms of the short time-frame of the study, which was 4 weeks, longer follow-up periods in future studies are warranted to test long-term intervention effects. Regarding the intervention, it is clear that filling in intervention materials can only be considered a small-scale intervention, which might be augmented in future studies by offering additional telephone counseling or providing written materials over the course of the intervention study.

Future studies should also try to assess information about those partners who did not take part in the intervention, as social selection processes might have taken place: Inactive persons might have chosen inactive partners who do not encourage them to exercise, or who provide

problematic support. On the other hand, those persons who are already active might have chosen partners who are able to provide positive social support for exercise.

Finally, future studies should differentiate in detail between the types and sources of support and should try to assess social integration in more detail. This would also facilitate the investigation of potentially negative effects of partner support, as social support can also be perceived as social pressure, which in turn can evoke negative consequences such as reactance (Hogan et al. 2002). A more detailed assessment would also enable researchers to distinguish between those persons who participate with a partner and those who participate on their own, despite having a partner. This would also allow more detailed marital interaction studies (Kiecolt-Glaser and Newton 2001) in intervention research.

Conclusions and implications for practice

In sum, the present findings contribute to the literature and practice in the domain of exercise support in older adults, as we found substantial effects for increasing physical activity levels in active couples as opposed to participants with inactive partners and those who were single. Moreover, a unique prediction pattern for physical activity emerged, as social support for exercise was only positively related to physical activity in those participants whose partner also took part in the intervention, whereas singles or participants whose partner did not take part experienced negative effects of support. This confirms the assumption that social support is a double-edged sword in some samples (Revenson et al. 1991).

As outlined above, our study provided first insights into the benefits of having a partner participating in the intervention as well, as there are not many studies on that topic. Hence, it is vital to replicate these findings with more detailed measures of social support and social integration. From a public health perspective, these findings are important as they suggest intervening in a way that partners are encouraged to join, as opposed to clinical settings in which only one part of a dyad is in the intervention program. At the same time, our findings highlight the vulnerability of older single adults and their need for adequate support providers. For older adults without a partner, relatives or friends might step into the important role of a close confidant and take over the role of a support provider for health behaviors as well (Martire and Schulz 2007; Martire 2005). It has also been shown that support by health care providers might be effective for health behaviors and should therefore be incorporated into future studies (Whaley and Schrider 2005). Would our results be replicated, an implication for practice might be that

intervention programs on physical activity for older adults should try to involve the partners as well, as this may lead to better intervention outcomes. In settings that do not allow the inclusion of partners, or if they are not eligible for participation, partners should at least be informed about their significant role in providing exercise support, which is perceived as support rather than control by the recipient.

Acknowledgments This work has been supported by the German Ministry of Education and Research (BMBF) within the project “Fostering Lifelong Autonomy and Resources in Europe: Behaviour and Successful Aging: FLARE-BSA” (Project ID 01ET0801). The first author was funded by the PhD Program “Multimorbidity in Old Age” of the Robert Bosch Foundation. The content is solely the responsibility of the authors.

References

- Aiken LS, West SG (1991) Multiple regression: testing and interpreting interactions. Sage, Newbury Park
- Armitage CJ, Conner M (2001) Efficacy of the theory of planned behaviour: a meta-analytic review. *Br J Soc Psychol* 40(4):471–499. doi:[10.1348/014466601164939](https://doi.org/10.1348/014466601164939)
- Ayotte BJ, Margrett JA, Hicks-Patrick J (2010) Physical activity in middle-aged and young-old adults: the roles of self-efficacy, barriers, outcome expectancies, self-regulatory behaviors and social support. *J Health Psychol* 15(2):173–185. doi:[10.1177/1359105309342283](https://doi.org/10.1177/1359105309342283)
- Baltes MM, Neumann E-M, Zank S (1994) Maintenance and rehabilitation of independence in old age: an intervention program for staff. *Psychol Aging* 9:179–188. doi:[10.1037/0882-7974.9.2.179](https://doi.org/10.1037/0882-7974.9.2.179)
- Bandura A (1997) Self-efficacy: the exercise of control. Freeman, New York
- Berkman LF, Glass T, Brissette I, Seeman TE (2000) From social integration to health: Durkheim in the new millennium. *Soc Sci Med* 51(6):843–857. doi:[10.1016/S0277-9536\(00\)00065-4](https://doi.org/10.1016/S0277-9536(00)00065-4)
- Blanke K, Stanek K, Stacy RD (1990) Comparison of the success of nutrition education to lower dietary cholesterol and fat with and without spouse support for individuals with elevated blood cholesterol. *Health Values* 14:33–37
- Bosworth HB, Schaie KW (1997) The relationship of social environment, social networks, and health outcomes in the Seattle longitudinal study: two analytical approaches. *J Gerontol B Psychol Sci Soc Sci* 52B(5):197–205
- Carstensen LL, Isaacowitz DM, Charles ST (1999) Taking time seriously: a theory of socioemotional selectivity. *Am Psychol* 54:165–181. doi:[10.1037/0003-066X.54.3.165](https://doi.org/10.1037/0003-066X.54.3.165)
- Carter ND, Kannus P, Khan KM (2001) Exercise in the prevention of falls in older people: a systematic literature review examining the rationale and the evidence. *Sports Med* 31(6):427–438. doi:[10.2165/00007256-200131060-00003](https://doi.org/10.2165/00007256-200131060-00003)
- Cavill N, Kahlmeier S, Racioppi F (eds) (2006) Physical activity and health in Europe: evidence for action. World Health Organization, Copenhagen
- Chakravarty EF, Hubert HB, Lingala VB, Fries JF (2008) Reduced disability and mortality among aging runners. *Arch Intern Med* 168:1638–1646. doi:[10.1001/archinte.168.15.1638](https://doi.org/10.1001/archinte.168.15.1638)
- Cohen S (2004) Social relationships and health. *Am Psychol* 59(8):676–684. doi:[10.1037/0003-066X.59.8.676](https://doi.org/10.1037/0003-066X.59.8.676)
- Dykstra PA, Fokkema T (2007) Social and emotional loneliness among divorced and married men and women: comparing the

- deficit and cognitive perspectives. *Basic Appl Soc Psych* 29(1):1–12
- Enders CK (2001) A primer on maximum likelihood algorithms available for use with missing data. *Struct Equ Model* 8(1): 128–141. doi:[10.1207/S15328007SEM0801_7](https://doi.org/10.1207/S15328007SEM0801_7)
- Gallo LC, Troxel WM, Matthews KA, Kuller LH (2003) Marital status and quality in middle-aged women: associations with levels and trajectories of cardiovascular risk factors. *Health Psychol* 22(5):453–463. doi:[10.1037/0278-6133.22.5.453](https://doi.org/10.1037/0278-6133.22.5.453)
- Garcia AW, King AC (1991) Predicting long-term adherence to aerobic exercise: a comparison of two models. *J Sport Exerc Psychol* 13(4):394–410
- Hayes AF, Matthes J (2009) Computational procedures for probing interactions in OLS and logistic regression: SPSS and SAS implementations. *Behav Res Methods* 41(3):924–936. doi:[10.3758/BRM.41.3.924](https://doi.org/10.3758/BRM.41.3.924)
- Hogan BE, Linden W, Najarian B (2002) Social support interventions: do they work? *Clin Psychol Rev* 22(3):381–440. doi:[10.1016/S0272-7358\(01\)00102-7](https://doi.org/10.1016/S0272-7358(01)00102-7)
- Hong TB, Franks MM, Gonzalez R, Keteyian SJ, Franklin BA, Artinian NT (2005) A dyadic investigation of exercise support between cardiac patients and their spouses. *Health Psychol* 24(4):430–434. doi:[10.1037/0278-6133.24.4.430](https://doi.org/10.1037/0278-6133.24.4.430)
- Hughes SL, Seymour RB, Campbell R, Pollak N, Huber G, Sharma L (2004) Impact of the fit and strong intervention on older adults with osteoarthritis. *Gerontologist* 44(2):217–228
- Huy C, Schneider S (2008) Instrument für die Erfassung der physischen Aktivität bei Personen im mittleren und höheren Erwachsenenalter. Entwicklung, Prüfung und Anwendung des “German-PAQ-50+” [Instrument for the assessment of middle-aged and older adults’ physical activity: Design, reliability and application of the German-PAQ-50+]. *Z Gerontol Geriatr* 41:208–216. doi:[10.1007/s00391-007-0474-y](https://doi.org/10.1007/s00391-007-0474-y)
- Irwin ML, Tworoger SS, Yasui Y, Rajan B, McVarish L, LaCroix K, Ulrich CM, Bowen D, Schwartz RS, Potter JD, McTiernan A (2004) Influence of demographic, physiologic, and psychosocial variables on adherence to a yearlong moderate-intensity exercise trial in postmenopausal women. *Prev Med* 39(6):1080–1086. doi:[10.1016/j.ypmed.2004.04.017](https://doi.org/10.1016/j.ypmed.2004.04.017)
- Kiecolt-Glaser JK, Newton TL (2001) Marriage and Health: His and Hers. *Psychol Bull* 127:472–503. doi:[10.1037/0033-2909.127.4.472](https://doi.org/10.1037/0033-2909.127.4.472)
- King AC, Kiernan M, Oman RF, Kraemer HC, Hull M, Ahn D (1997) Can we identify who will adhere to long-term physical activity? Signal detection methodology as a potential aid to clinical decision making. *Health Psychol* 16(4):380–389. doi:[10.1037/0278-6133.16.4.380](https://doi.org/10.1037/0278-6133.16.4.380)
- Klusmann V, Evers A, Schwarzer R, Schlattmann P, Reischies FM, Heuser I, Dimeo FC (2010) Complex mental and physical activity in older women and cognitive performance: a 6-month randomized controlled trial. *J Gerontol A Biol Sci Med Sci* 65A: 680–688. doi:[10.1093/gerona/gdq053](https://doi.org/10.1093/gerona/gdq053)
- Knoll N, Schwarzer R (2002) Gender and age differences in social support: a study on East German refugees. In: Weidner G, Kopp M, Kristenson M (eds) *Heart disease: environment, stress, and gender*. NATO Science Series, Series I: Life and behavioural sciences, vol 327. IOS Press, Amsterdam, pp 198–210
- Knoll N, Kienle R, Bauer K, Pfüller B, Luszczynska A (2007a) Affect and enacted support in couples undergoing in vitro fertilization: when providing is better than receiving. *Soc Sci Med* 64: 1789–1801. doi:[10.1016/j.socscimed.2007.01.004](https://doi.org/10.1016/j.socscimed.2007.01.004)
- Knoll N, Rieckmann N, Kienle R (2007b) The other way round: health as a predictor of perceived social support. *Anxiety Stress Coping* 20:3–16. doi:[10.1080/10615800601032823](https://doi.org/10.1080/10615800601032823)
- Löckenhoff CE, Carstensen LL (2004) Socioemotional selectivity theory, aging, and health: the increasingly delicate balance between regulating emotions and making tough choices. *J Pers* 72:1395–1424. doi:[10.1111/j.1467-6494.2004.00301.x](https://doi.org/10.1111/j.1467-6494.2004.00301.x)
- Luszczynska A, Boehmer S, Knoll N, Schulz U, Schwarzer R (2007) Emotional support for men and women with cancer: do patients receive what their partners provide? *Int J Behav Med* 14(3): 156–163. doi:[10.1007/BF03000187](https://doi.org/10.1007/BF03000187)
- Martire LM (2005) The “relative” efficacy of involving family in psychosocial interventions for chronic illness: are there added benefits to patients and family members? *Fam Syst Health* 23(3): 312–328. doi:[10.1037/1091-7527.23.3.312](https://doi.org/10.1037/1091-7527.23.3.312)
- Martire LM, Schulz R (2007) Involving family in psychosocial interventions for chronic illness. *Curr Dir Psychol Sci* 16(2): 90–94
- McAuley E, Jerome GJ, Elavsky S, Marquez DX, Ramsey SN (2003) Predicting long-term maintenance of physical activity in older adults. *Prev Med* 37(2):110. doi:[10.1016/S0091-7435\(03\)00089-6](https://doi.org/10.1016/S0091-7435(03)00089-6)
- McNabb J, Der-Karabetian A, Rhoads J (1989) Family involvement and outcome in treatment of alcoholism. *Psychol Rep* 65: 1327–1330
- Motl RW, McAuley E (2009) Pathways between physical activity and quality of life in adults with multiple sclerosis. *Health Psychol* 28(6):682–689
- Netz Y, Tenenbaum G, Eklund RC (2007) Physical activity and three dimensions of psychological functioning in advanced age: cognition, affect, and self-perception. In: Tenenbaum G, Eklund RC (eds) *Handbook of sport psychology*, 3rd edn. Wiley, Hoboken, pp 492–508
- Newsom JT, Kaplan MS, Huguet N, McFarland BH (2004) Health behaviors in a representative sample of older Canadians: prevalences, reported change, motivation to change, and perceived barriers. *Gerontologist* 44(2):193–205
- Nyamathi A, Flaskerud J, Keenan C, Leake B (1998) Effectiveness of a specialized vs. traditional AIDS education program attended by homeless and drug-addicted women alone or with supportive persons. *AIDS Educ Prev* 10:433–446
- Pinquart M, Sörensen S (2000) Influences of socioeconomic status, social network, and competence on subjective well-being in later life: a meta-analysis. *Psychol Aging* 15(2):187–224. doi:[10.1037/0882-7974.15.2.187](https://doi.org/10.1037/0882-7974.15.2.187)
- Rejeski WJ, Mihalko SL (2001) Physical activity and quality of life in older adults. *J Gerontol A Biol Sci Med Sci* 56A(10): 23–35
- Revenson TA, Schiaffino KM, Majerovitz SD, Gibofsky A (1991) Social support as a double-edged sword: the relations of positive and problematic support to depression among rheumatoid arthritis patients. *Soc Sci Med* 33(7):807–813. doi:[10.1016/0277-9536\(91\)90385-P](https://doi.org/10.1016/0277-9536(91)90385-P)
- Rook KS (1990) Social networks as a source of social control in older adults’ lives. In: Giles H, Coupland N, Wiemann J (eds) *Communication health and the elderly*. University of Manchester Press, Manchester, pp 45–63
- Sallis JF, Grossman RM, Pinski RB, Patterson TL, Nader PR (1987) The development of scales to measure social support for diet and exercise behaviors. *Prev Med* 16(6):825–836. doi:[10.1016/0091-7435\(87\)90022-3](https://doi.org/10.1016/0091-7435(87)90022-3)
- Schwarzer R, Gutiérrez-Dona B (2005) More spousal support for men than for women: a comparison of sources and types of support. *Sex Roles* 52(7/8):523–532. doi:[10.1007/s11199-005-3718-6](https://doi.org/10.1007/s11199-005-3718-6)
- Schwarzer R, Knoll N (2007) Functional roles of social support within the stress and coping process: a theoretical and empirical overview. *Int J Psychol* 42(4):243–252. doi:[10.1080/00207590701396641](https://doi.org/10.1080/00207590701396641)
- Seeman TE, Berkman LF, Kohout F, Lacroix A, Glynn R, Blazer D (1993) Intercommunity variations in the association between social ties and mortality in the elderly: a comparative analysis of

- three communities. *Ann Epidemiol* 3(4):325–335. doi:[10.1016/1047-2797\(93\)90058-C](https://doi.org/10.1016/1047-2797(93)90058-C)
- Stevens M, Lemmink KAPM, van Heuvelen MJG, de Jong J, Rispen P (2003) Groningen Active Living Model (GALM): stimulating physical activity in sedentary older adults; validation of the behavioral change model. *Prev Med* 37(6):561. doi:[10.1016/j.ypmed.2003.09.012](https://doi.org/10.1016/j.ypmed.2003.09.012)
- Taylor AH, Cable NT, Faulkner G, Hillsdon M, Narici M, van der Bij AK (2004) Physical activity and older adults: a review of health benefits and the effectiveness of interventions. *J Sports Sci* 22(8):703–725. doi:[10.1080/02640410410001712421](https://doi.org/10.1080/02640410410001712421)
- Umberson D (1987) Family status and health behaviors: social control as a dimension of social integration. *J Health Soc Behav* 28:306–319. doi:[10.2307/2136848](https://doi.org/10.2307/2136848)
- USDHHS (2010) U.S. Department of Health and Human Services: summary health statistics for U.S. adults: National Health Interview Survey, 2009. DHHS Publication, Hyattsville
- van Dam HA, van der Horst FG, Knoop L, Ryckman RM, Crebolder HFJM, van den Borne BHW (2005) Social support in diabetes: a systematic review of controlled intervention studies. *Patient Educ Couns* 59(1):1–12. doi:[10.1016/j.pec.2004.11.001](https://doi.org/10.1016/j.pec.2004.11.001)
- van Gool CH, Penninx BWJH, Kempen GJM, Miller GD, van Eijk JTM, Pahor M, Messier SP (2006) Determinants of high and low attendance to diet and exercise interventions among overweight and obese older adults: results from the arthritis, diet, and activity promotion trial. *Contemp Clin Trials* 27(3):227–237. doi:[10.1016/j.cct.2005.11.002](https://doi.org/10.1016/j.cct.2005.11.002)
- van Stralen MM, De Vries H, Mudde AN, Bolman C, Lechner L (2009) Determinants of initiation and maintenance of physical activity among older adults: a literature review. *Health Psychol Rev* 3(2):147–207. doi:[10.1080/17437190903229462](https://doi.org/10.1080/17437190903229462)
- Whaley DE, Schrider AF (2005) The process of adult exercise adherence: self-perceptions and competence. *Sport Psychologist* 19(2):148
- Williams GC, Lynch MF, McGregor HA, Ryan RM, Sharp D, Deci EL (2006) Validation of the “Important Other” climate questionnaire: assessing autonomy support for health-related change. *Fam Syst Health* 24(2):179–194. doi:[10.1037/1091-7527.24.2.179](https://doi.org/10.1037/1091-7527.24.2.179)
- Wilson GT, Brownell K (1978) Behavior therapy for obesity: including family members in the treatment process. *Behav Ther* 9:943–945
- Wing RR, Jeffrey RW (1999) Benefits of recruiting participants with friends and increasing social support for weight loss and maintenance. *J Consult Clin Psychol* 67:132–138. doi:[10.1037/0022-006X.67.1.132](https://doi.org/10.1037/0022-006X.67.1.132)