On the importance of a positive view on ageing for physical exercise among middle-aged and older adults: Cross-sectional and longitudinal findings

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On the importance of a positive view on ageing for physical exercise among middle-aged and older adults: Cross-sectional and longitudinal findings

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Physical activity is one of the most important health behaviours associated with the prevention and management of chronic diseases in older adults, but this potential is often insufficiently used. The present study examined for the first time whether a positive view on ageing (PVA) may contribute to a higher level of physical activity. Analyses were based on the German Ageing Survey, a longitudinal population-based survey (N = 4034) on middle-aged and older adults (40–85 years) conducted in the years 1996 and 2002. As hypothesised, middle-aged adults with a PVA not only engaged in physical activity in the form of sports more frequently; they even increased this activity provided that they were healthy enough to do so. For older adults, PVA was particularly associated with more regular walking and increases of walking over time. Because walking is often still recommended in spite of health problems, it was remarkable that even older people with worse health walked just as regularly as those with good health, provided that they had a positive view on ageing. The results shed some light on recent findings about the importance of PVA for health and longevity and point to a partial mediation between PVA and health by physical exercise.

Keywords: positive view on ageing; physical activity; exercise; health; longitudinal survey

Introduction

Physical activity continues to be a key factor for the prevention and management of many risk factors, chronic diseases and functional disabilities associated with ageing up to old age (e.g. Blumenthal & Gullette, 2002; Paterson, Govindasamy, Vidmar, Cunningham, & Koval, 2004). Moreover, physical activity may lead to a shorter period of disability at the end of life (Hubert, Bloch, & Oehlert, 2002) and to a lower risk of premature mortality, even in the case of activities of low – or moderate intensity (Fried et al., 1998; Landi et al., 2004; Paffenbarger et al., 1994). However, a large number of people remain sedentary. Already from early adulthood this portion grows steadily, meaning that older persons are the most sedentary segment of the adult population (European Opinion Research Group EEIG, 2003; U.S. Department of Health and Human Services, 1996). In contrast to
younger people, who often name lack of time as a main cause for a sedentary lifestyle, older people often report health problems as the main barrier to physical exercise (for a review: Schutzer & Graves, 2004).

Both moderate and vigorous exercise is favoured in physical activity recommendations (e.g. World Health Organization, 1997). Because middle-aged adults have both fewer health problems and higher physical activity than older adults, recommendations for middle-aged adults usually refer to activities with higher energy expenditure; these are particularly important for weight regulation and cardiovascular health. Although, these health goals are also important for older adults (e.g. Goldberg & King, 2007), moderate physical activities have the highest priority in the recommendations for older age groups. This is due both to the high prevalence of a sedentary lifestyle and to a higher prevalence of chronic diseases and disabilities (DiPietro, 2001). Even moderate physical activity can yield important health benefits for maintaining functional ability and independence (DiPietro, 2001). By contrast, vigorous physical activities such as fast cycling or tennis are not always indicated for individuals with cardiovascular or musculoskeletal disorders, in particular if these are caused by decades of sedentary living habits and a progressive loss of musculoskeletal function (Blair, Kohl, Gordon, & Paffenbarger, 1992).

Since it has been shown that health behaviour is beneficial up to old age, there is growing interest not only in the determinants of physical exercise for younger age groups but for older people as well (Morley & Flaherty, 2002). Population-based studies indicate that demographic variables such as gender (with less physical exercise among women), socio-economic status and education (with less physical exercise among people with lower educational levels, or incomes), and social support by friends or spouses influence the prevalence of physical exercise throughout the lifespan (e.g. DiPietro, 2001).

Moreover, mechanisms of self-regulation, such as goal setting, self-monitoring and relapse-prevention training and in particular functional optimism (which includes both positive outcome expectancies and self-efficacy beliefs; Schwarzer, 1994), have been shown to be important psychological factors for the adoption and maintenance of physical exercise. Most of these findings were based on intervention studies (e.g. King, 2001; McAuley, Jerome, Elavsky, Marquez, & Ramsey, 2003), while large population-based surveys rarely examine psychological factors (Newsom, Kaplan, Huguet, & McFarland, 2004). However, people who take part in an intervention programme generally already possess a basic motivation for health behaviour change, that is, these people are at least in a ‘contemplation stage’ (Prochaska & Velicer, 1997) and thus differ from the general population. We, therefore, still know little about psychological factors involved in the promotion of regular exercise among older adults in everyday life, apart from intervention programmes (e.g. Lachman et al., 1997). What is it then that motivates older people to be physically active or even to increase their activity, independent of intervention programmes? The purpose of the present study is to address one of these possible motivators by examining whether a positive view on ageing (PVA) might promote physical exercise; this is explained in more detail below.

In recent years, several longitudinal studies have shown that older people who have a more PVA maintain better physical and functional health than those with a more negative view (Levy, Slade, & Kasl, 2002; Wurm, Tesch-Römer, & Tomasik, 2007). Moreover, a PVA has repeatedly been shown to be an important determinant for longevity (e.g. Levy & Myers, 2005). The underlying mechanisms that make a PVA a health protective factor have barely been empirically examined. However, one recent study indicates that a PVA may in fact contribute substantially to general preventive health behaviour
(Levy & Myers, 2004), and therefore suggests that analysing this association with respect to physical exercise is worthwhile.

In the present study, a PVA refers to the view that ageing is accompanied by further developmental gains. A gain-related view on ageing cannot be taken for granted because younger as well as older individuals tend to view ageing as accompanied by a decrease in gains and an increase in losses (Heckhausen, Dixon, & Baltes, 1989). Regarding ageing as accompanied by further gains implies that the personal future still has a positive meaning and that a person continues to perceive an ample time frame in his or her life for setting goals and making plans. Having goals and a positive future outlook might make it worth engaging in health behaviour such as physical exercise because the pursuit of certain goals (e.g. improving skills, caring for grandchildren) requires sufficiently good health. Thus, people with a PVA are presumably more motivated to engage in preventive health behaviour such as physical exercise because they experience that it is still worth doing something for their own health.

By contrast, a less positive view on ageing, which includes a shorter subjective time perspective and a stronger focus on the present, might prevent beneficial health behaviour because the consequences of this behaviour lie behind the individually perceived time horizon (Rakowski, 1986). It is known that, even in the case of young adults, a short-time perspective focusing on the present is negatively associated with healthy behavioural practices (Hall & Fong, 2003). For older people, whose lifetime is more limited, it is even harder to maintain a strong positive future outlook and to believe in the future benefits of positive health behaviour.

The present study investigates the importance of a PVA for physical activity in middle and later adulthood. Are people who view their ageing in a positive way physically more active than those with a less positive view on their ageing process? And does this association still persist when the socio-demographic, socio-economic and psychological variables important for physical exercise are controlled for in the analyses?

Ageing comes with increasing physical and social losses, and middle age seems to be the turning point in the ratio of gains and losses (Baltes, Lindenberger, & Staudinger, 1998). In line with this turning point, we included in the present study people as from midlife. The analysis of both middle-aged and older adults goes beyond comparable previous studies on physical activity in later adulthood that have primarily focused on people aged 60 or 65 years and above (e.g. Burton, Shapiro, & German, 1999; McAuley et al., 2003). Studies on physical activity of older adults have often examined low to moderate-intensity physical activity such as walking, stair climbing or housework (e.g. Newsom et al., 2004) and therefore have allowed for the fact that the vast majority of older people do not engage in sporting activity. Due to the broadening of the perspective to middle-aged adults in the present study, we considered not only moderate exercise (i.e. walking) but sporting activity as well. Walking ranks more among the light to moderate activities and can usually be performed despite chronic diseases and disabilities (DiPietro, 2001). Sporting activities, however, predominantly rank among moderate to vigorous activities and thus require a sufficiently good state of health (cf. Blair et al., 1992). In the present study, we included both walking and sporting activities as outcome variables in order to analyse a broad range of physical activities. However, these two indicators probably have a different validity for the different age groups. Walking may not be an adequate indicator for strenuous physical activity in middle-aged adults and sporting activities are likely to overburden the physical capacities of many in old age. In the following hypotheses we thus expected more distinct results for middle-aged adults with regard to sporting activities and for old-aged adults with regard to walking.
Generally, we expected that a PVA would contribute to overcoming motivational barriers to physical activity. More specifically, we hypothesised on a cross-sectional level of analysis that a PVA would be related to higher physical activity (Hypothesis 1). Based on the fact that physical activity declines with increasing age, we hypothesised on a longitudinal level of analysis that a PVA would prevent a strong decrease in physical activity; that is, we expected individuals with a more PVA to have a lower decrease in their physical activity over time (Hypothesis 2). Finally, we expected a PVA to contribute particularly to a lower decrease or even stability of physical activity should individual health status so allow. For the cross-sectional and the longitudinal model, we therefore additionally tested whether health serves as a moderator of a PVA in the prediction of physical activity (Hypothesis 3).

Method

Participants and procedure

The analyses were based on data of the German Ageing Survey. This survey is an ongoing nationwide and population-based study on middle-aged and older adults (cf. Engstler & Wurm, 2006). First, the baseline sample (age 40 to 85 years) was drawn in 1996 by means of a national probability sampling technique with stratified sampling by age, gender, and place of residence (Eastern or Western Germany). About 50% of the persons contacted agreed to an interview ($N = 4838$) and 83.4% of them additionally completed a questionnaire ($N = 4034$). The response rate corresponds to that of other large survey studies in Germany (Neller, 2005). In the present study we used data assessed within the questionnaire, which is why we only refer to the sample of $N = 4034$.

This baseline sample was on average 60.1 years old, 49% ($n = 2065$) of whom were women and 66% ($n = 2668$) lived in Western Germany. Detailed sample characteristics are shown in Table 1, broken down in the groups of middle-aged (40–64 years) and older adults (65–85 years). The age limits correspond to a common distinction between middle adulthood and third age (e.g. Schaie & Willis, 2002) and, furthermore, reflects the legal transition age into retirement. All analyses were computed for both age groups separately because middle-aged and older adults differ considerably in their physical activity. According to the baseline sample ($N = 4034$), middle-aged adults reported higher sporting activity ($t(4032) = 11.86, p < 0.001$) and lower frequency of walking ($t(4032) = 8.56, p < 0.001$) than older adults.

Second, in 1996 the participants of the baseline sample were asked whether they were willing in principle to participate again at a later point of time and 61% ($N = 2972$) agreed to this. The addresses of the other participants were deleted in accordance with the regulations of the German data protection law. Six years after the first interview, 16.3% of the 2972 respondents had died or moved to unknown addresses, which reduced the sample that could be contacted for a second time to $N = 2478$. A total of 63.8% of persons from this reduced sample were in fact re-interviewed, while 36.2% refused (due to illness, or without giving any reason). Considering again only those people who completed both interview and questionnaire, the longitudinal sample consisted of $N = 1286$ participants. Compared to the baseline sample, the longitudinal sample was about 3 years younger ($M_{AgeT1} = 57.07; SD = 10.81$), but hardly differed in gender (52% male; $n = 675$) and the place of residence (63% from Western Germany; $n = 816$).

Independent sample $t$-tests were computed to assess the differences in the baseline scores between participants of the longitudinal sample and those who dropped out after
the first interview. Both groups differed significantly \( p < 0.01 \) in all variables described in Table 1, except for gender, place of residence and frequency of walking. On average, follow-up participants had higher socio-economic status (education, income, prestige), more often a partner, and rated their health better. Moreover, follow-up participants had significantly higher optimism (hope), a more PVA and higher sporting activity. As can be seen in Table 1, the selective attrition applies more to the older adult group than to middle-aged adults. This reflects the established fact of selective attrition in longitudinal research on ageing (e.g. Baltes, Schaie, & Nardi, 1971; Norris, 1985). We get back to the implications of sample selectivity in the discussion section.

**Measures**

*Physical exercise*

Participants were asked for their frequency of walking and doing sports (‘How often do you go for walks?’; ‘How often do you do sports, i.e. hiking, football, callisthenics or swimming?’). Both questions could be answered on a 6-point scale ranging from ‘never’ to ‘daily’. The two variables on physical exercise were the only variables assessed at two measurement occasions while all other variables pertain to the first measurement occasion only (cf. Table 1).

*Positive view on ageing (PVA)*

In order to assess a PVA we used a scale on the ageing-related cognition of ongoing development; this scale has been shown to be important for physical health over time.
(Wurm et al., 2007). The scale refers to the view of ageing as a time of personal growth and development and was assessed by the four items ‘Ageing means to me that I continue to make plans’, ‘Ageing means to me that my capabilities are increasing’, ‘Ageing means to me that I can still learn new things’, and ‘Ageing means to me that I can still put my ideas into practice’. Item wordings and scale development originate from Dittmann-Kohli and her colleagues (e.g. Steverink, Westerhof, Bode, & Dittmann-Kohli, 2001). Participants could endorse the items on a 4-point scale ranging from ‘definitely false’ to ‘definitely true’.

In the present study, the scale itself was obtained by calculating the latent variable score from a congeneric measurement model with two error terms allowed to correlate. This model fitted the data very well both at baseline ($\chi^2 (1) = 1.96, p = 0.16, \text{RMSEA} = 0.015, \text{NNFI} = 1.00, \text{SRMR} = 0.003$) and the longitudinal sample ($\chi^2 (1) = 0.92, p = 0.34, \text{RMSEA} = 0.000, \text{NNFI} = 1.00, \text{SRMR} = 0.004$). In the baseline sample, the factor loadings ranged between 0.52 and 0.78 (longitudinal sample: 0.43–0.77) resulting in a reliability of $\rho = 0.74$ (longitudinal sample: $\rho = 0.67$) according to Raykov (2004).

**Physical health**

Respondents reported whether they had any of the 11 health problems in question (e.g. cardiovascular diseases, circulatory problems, back or joint diseases, diabetes, gastrointestinal diseases, respiratory diseases). For each person we counted a sum score based on the absolute number of reported illnesses. We recoded this score subsequently so that a high score means a low morbidity and scores near to zero mean that a person has a high number of coexistent diseases (multimorbidity). The sum score was chosen due to the lack of medical checkups and to various advantages compared to single self-reported illnesses. Katz and colleagues (Katz, Chang, Sangha, Fossel, & Bates, 1996) have shown that the best accordance between medical reports and self-reports are achieved when summary scores are used. Moreover, global scores of self-reported illnesses are considered as better proxies for (at least some) functional disability compared to single illnesses (Neugarten, 1996). Due to the large age range of the sample (40–85 years) we did not use an indicator that directly assesses functional disability because the vast majority of persons reported no general functional limitation.

**Hope**

The Dispositional Hope Scale (8 items; Snyder et al., 1991) was used to assess functional optimism and served as a control variable in the following analyses. According to Snyder and colleagues, hope is fuelled by the expectation of successful outcomes (‘agency’ facet; e.g. ‘I energetically pursue my goals’) and self-efficacy (‘pathways’ facet; e.g. ‘I can think of many ways to get out of a jam’). The items could be answered on a 4-point scale ranging from ‘definitely false’ to ‘definitely true’. A latent measurement model was set up in order to compute the latent variable scores (baseline: $\chi^2 (2) = 11.83, p = 0.003, \text{RMSEA} = 0.035, \text{NNFI} = 1.00, \text{SRMR} = 0.006$; longitudinal sample: $\chi^2 (2) = 0.91, p = 0.63, \text{RMSEA} = 0.000, \text{NNFI} = 1.00, \text{SRMR} = 0.003$). Scale reliability was computed according to Raykov (2004) and was found to be satisfactory in the baseline ($\rho = 0.87$), and longitudinal sample ($\rho = 0.86$). The Hope scale was correlated with PVA to a medium extent ($r = 0.53$ in the baseline sample and $r = 0.46$ in the longitudinal sample; cf. Table 2), which makes it a strong control variable.
Table 2. Correlations among the indicators for the baseline sample \((N = 4034)\) and longitudinal sample \((N = 1286)\).

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PVA</td>
<td>–</td>
<td>0.16**</td>
<td>0.46**</td>
<td>0.05</td>
<td>–0.07*</td>
<td>0.12**</td>
<td>0.15**</td>
<td>0.17**</td>
<td>0.09**</td>
<td>–0.25**</td>
<td>0.10**</td>
</tr>
<tr>
<td>2</td>
<td>Physical health</td>
<td>0.25**</td>
<td>–</td>
<td>0.15**</td>
<td>0.00</td>
<td>–0.02</td>
<td>0.07**</td>
<td>0.18**</td>
<td>0.11**</td>
<td>0.13**</td>
<td>–0.38**</td>
<td>0.10**</td>
</tr>
<tr>
<td>3</td>
<td>Hope</td>
<td>0.53**</td>
<td>0.16**</td>
<td>–</td>
<td>–0.06*</td>
<td>–0.01</td>
<td>0.07**</td>
<td>0.01</td>
<td>0.10**</td>
<td>0.02</td>
<td>0.01</td>
<td>0.00</td>
</tr>
<tr>
<td>4</td>
<td>Gender</td>
<td>0.02</td>
<td>0.00</td>
<td>–0.07**</td>
<td>–</td>
<td>0.03</td>
<td>–0.18**</td>
<td>–0.03</td>
<td>–0.05</td>
<td>0.00</td>
<td>–0.05</td>
<td>0.06*</td>
</tr>
<tr>
<td>5</td>
<td>Place of residence</td>
<td>–0.06**</td>
<td>–0.04**</td>
<td>–0.04*</td>
<td>0.01</td>
<td>–</td>
<td>–0.04</td>
<td>–0.02</td>
<td>–0.27**</td>
<td>–0.04</td>
<td>0.06*</td>
<td>–0.22**</td>
</tr>
<tr>
<td>6</td>
<td>Partner</td>
<td>0.17**</td>
<td>0.13**</td>
<td>0.12**</td>
<td>–0.22**</td>
<td>–0.04**</td>
<td>–</td>
<td>0.05</td>
<td>0.05</td>
<td>0.06*</td>
<td>–0.20**</td>
<td>0.05</td>
</tr>
<tr>
<td>7</td>
<td>Education</td>
<td>0.19**</td>
<td>0.17**</td>
<td>0.07**</td>
<td>–0.06**</td>
<td>0.01</td>
<td>0.07**</td>
<td>–</td>
<td>0.35**</td>
<td>0.51**</td>
<td>–0.24**</td>
<td>0.15**</td>
</tr>
<tr>
<td>8</td>
<td>Income</td>
<td>0.18**</td>
<td>0.12**</td>
<td>0.16**</td>
<td>–0.06**</td>
<td>–0.21**</td>
<td>0.09**</td>
<td>0.34**</td>
<td>–</td>
<td>0.35**</td>
<td>–0.10**</td>
<td>0.17**</td>
</tr>
<tr>
<td>9</td>
<td>Prestige</td>
<td>0.18**</td>
<td>0.13**</td>
<td>0.11**</td>
<td>0.00</td>
<td>0.01</td>
<td>0.11**</td>
<td>0.51**</td>
<td>0.35**</td>
<td>–</td>
<td>–0.09**</td>
<td>0.17**</td>
</tr>
<tr>
<td>10</td>
<td>Age</td>
<td>–0.37**</td>
<td>–0.41**</td>
<td>–0.08**</td>
<td>–0.01</td>
<td>0.03</td>
<td>–0.28**</td>
<td>–0.25**</td>
<td>–0.13**</td>
<td>–0.13**</td>
<td>–</td>
<td>–0.15**</td>
</tr>
<tr>
<td>11</td>
<td>Sports</td>
<td>0.20**</td>
<td>0.13**</td>
<td>0.10**</td>
<td>0.01</td>
<td>–0.14**</td>
<td>0.11**</td>
<td>0.22**</td>
<td>0.20**</td>
<td>0.24**</td>
<td>–0.22**</td>
<td>–</td>
</tr>
<tr>
<td>12</td>
<td>Walking</td>
<td>0.03</td>
<td>–0.03*</td>
<td>0.07**</td>
<td>0.02</td>
<td>–0.05**</td>
<td>–0.04*</td>
<td>–0.03*</td>
<td>–0.01</td>
<td>0.02</td>
<td>0.16**</td>
<td>0.10**</td>
</tr>
</tbody>
</table>

Notes: Values for the baseline sample are below the diagonal; values for the longitudinal sample are above the diagonal. PVA = positive view on aging. *\(p < 0.05\); **\(p < 0.01\).
Socio-demographic characteristics (SDC)

Besides the Hope scale, socio-demographic indicators were also considered as control variables to allow for the above mentioned impact of SDC on physical exercise. These are variables on gender, living arrangement (with or without partner), place of residence (Eastern or Western Germany), and level of education (1 = low education, at most 9 years school education, 2 = medium education, secondary school, 3 = high education, qualifying for university admission). Additionally, we considered the equivalent household income (a scale of the Organisation for Economic Co-operation and Development, OECD, on net household income, weighted by the number of people sharing the household, cf. Piachaud, 1992) and a measure of occupational prestige (Treiman, 1977) that ranges from 18.1 (e.g. sub workers) to 78.9 (e.g. physicians).

Age

Finally, we also included chronological age (in years) as control variable to consider additionally the close relation between physical exercise and age.

Data analysis

Pearson product moment correlations were used to examine the interrelationship between the study variables (Table 2). Descriptive data analysis and data screening revealed significant skewness for physical activity of older adults; to exemplify, 63.2% of participants aged 65 to 85 reported never doing sports while 39.3% of this age group reported walking daily in the baseline sample. We, therefore, transformed both variables for sports and walking logarithmically (log transformation) which yielded a more satisfactory distribution. Single missing values of the longitudinal as well as the baseline sample were supplemented by data imputation with expectation maximization method, which offers the advantage that there will be no systematic losses of participants who missed single items (Dempster, Laird, & Rubin, 1977).

We analysed the data with LISREL 8.5 (Jöreskog & Sörbom, 1996) as our computer programme; maximum likelihood was used as estimation method. First, we computed latent variable scores and scale reliabilities reported above with structural equation modelling (SEM). This approach offers the possibility of accounting for measurement errors in the manifest indicators (observed measures) and testing the assumed measurement model empirically. Subsequently, we computed path models using the latent variable scores to predict physical exercise (i.e. walking or sports) both without and with adjustment for the control variables health, hope, socio-demographic characteristics (gender, living arrangement, place of residence, level of education, income, prestige) and, age. The longitudinal analyses, with physical exercise at Time 2 as dependent variable, were additionally adjusted for physical exercise at Time 1. We preferred path analyses using latent variable scores to SEM because of the known theoretical and practical limitations of SEM with non-linear or interaction effects (Bollen, 1989). In particular, significance tests and model fit statistics are considered inappropriate for models involving interaction terms (Hu, Bentler, & Kano, 1992). Simulation studies show that this problem mainly occurs when the number of manifest indicators is four or less (Jaccard & Wan, 1995), as was the case in the present study. For the path models, the goodness of fit statistics are not described because the fit is perfect.
Results

Cross-sectional analyses

The cross-sectional analyses investigated the question of whether a PVA is associated with more regular physical exercise (Hypothesis 1). The results are summarised in Table 3. In line with the hypotheses, the models on the sporting activity of middle-aged and older adults showed that a PVA significantly predicted the frequency of doing sports both for middle-aged ($\beta_{MA} = 0.14$) and older adults ($\beta_{OA} = 0.20, \ p < 0.001$). These findings remained significant after adjusting the control variables health, hope, six socio-demographic variables and age ($\beta_{MA} = 0.08; \beta_{OA} = 0.12; \ p < 0.01$). Hence, people with a more PVA do sports more frequently than those with a less PVA. We additionally computed a multi-group model to analyse whether PVA differs in its impact on sporting activity between middle-aged and older adults; this turned out not to be the case ($\Delta\chi^2(1) = 0.40, \ p = 0.54$).

Next, we computed the same path model but predicted walking instead of sporting activity. As expected, for middle-aged adults, PVA was only slightly associated with more frequent walking ($\beta_{MA} = 0.04, \ p < 0.05$; cf. Table 3), and became non-significant after adjusting the analysis for all control variables ($\beta_{MA} = 0.03, \ p = 0.17$). By contrast, PVA was associated with more frequent walking in older adults ($\beta_{OA} = 0.15, \ p < 0.001$; cf. Table 3), even after the adjustment of all control variables ($\beta_{OA} = 0.11, \ p < 0.01$), which was also in line with the hypothesis. Again, we additionally computed a multi-group model to analyse whether both age groups differ significantly from each other. In fact, PVA showed a significantly higher impact on walking for older adults than for middle-aged adults ($\Delta\chi^2(1) = 3.53, \ p < 0.05$, one-tailed). Together, these results corroborated our first hypothesis that PVA would be significantly related to sporting activity among middle-aged and older adults as well as to doing sports and walking among older adults.

Table 3. Prediction of sports and walking at time 1 by PVA in unadjusted models and covariate-adjusted models.a

<table>
<thead>
<tr>
<th>Predictors at baseline</th>
<th>Sports</th>
<th>Walking</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Middle-aged</td>
<td>Older</td>
</tr>
<tr>
<td></td>
<td>adults</td>
<td>adults</td>
</tr>
<tr>
<td></td>
<td>$\beta$</td>
<td>$R^2$</td>
</tr>
<tr>
<td>Model 1: Unadjusted</td>
<td>0.14***</td>
<td>0.02***</td>
</tr>
<tr>
<td>Positive view on ageing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 2: + Health</td>
<td>0.13***</td>
<td>0.02**</td>
</tr>
<tr>
<td>Positive view on ageing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 3: + Hope</td>
<td>0.15***</td>
<td>0.02</td>
</tr>
<tr>
<td>Positive view on ageing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 4: + SES</td>
<td>0.09***</td>
<td>0.11***</td>
</tr>
<tr>
<td>Positive view on ageing</td>
<td></td>
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<tr>
<td>Model 5: + Age</td>
<td>0.08**</td>
<td>0.12***</td>
</tr>
<tr>
<td>Positive view on ageing</td>
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</tbody>
</table>

Note: aBaseline sample, $N = 4034$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. 
Longitudinal analyses

By means of the longitudinal sample we subsequently examined whether PVA can predict an increase in physical exercise over time (Hypothesis 2). For this, we performed the same path models as before, except that we used physical exercise at T2 as dependent variable while controlling for physical exercise at T1. The temporal stability for doing sports for middle-aged adults and walking for older adults was of medium extent ($r_{sports\ T1-T2} = 0.44$, $r_{walking\ T1-T2} = 0.34$; $p's < 0.001$). Contrary to our hypothesis, PVA could not predict a lower decrease in sporting activity either for middle-aged adults ($\beta_{MA} = 0.05$, $p = 0.07$) or for older adults ($\beta_{OA} = 0.08$, $p = 0.12$; cf. Table 4); the additional multi-group model did not show significant differences in this association between the age groups ($\Delta \chi^2 (1) = 0.07$, $p = 0.79$).

As expected and in line with the findings for the cross-sectional model, PVA could predict a lower decrease in walking for older adults ($\beta_{OA} = 0.11$, $p < 0.05$; adjusted for all control variables: $\beta_{OA} = 0.19$, $p < 0.01$), but not for middle-aged adults ($\beta_{MA} = 0.00$, $p = 0.92$). Here, the age groups differed significantly in the multi-group model ($\Delta \chi^2 (1) = 6.85$, $p < 0.01$).

Moderator analyses

Finally we explored whether health serves as a moderator in the relation between PVA and physical activity, i.e. sporting activity in middle-aged adults as well as sporting activity and walking in older adults (Hypothesis 3). For this, we computed the same path models as before, but this time we added the PVA $\times$ health interaction in each model.

We first added this interaction term in the cross-sectional analyses. In contrast to our expectations, the interaction term was not significant for doing sports, either for

<table>
<thead>
<tr>
<th>Predictors at baseline</th>
<th>Sports</th>
<th>Walking</th>
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<tbody>
<tr>
<td></td>
<td>Middle-aged adults</td>
<td>Older adults</td>
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<tr>
<td>Model 1: Adjusted for physical Activity T1 (sports/walking)</td>
<td>$0.20^{***}$</td>
<td>$0.19^{***}$</td>
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<td>$0.08$</td>
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<td>Model 4: + SES</td>
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<td>$0.21^*$</td>
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<td>$0.26^{***}$</td>
</tr>
<tr>
<td>Positive view on ageing</td>
<td>$0.02$</td>
<td>$0.01$</td>
</tr>
</tbody>
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Note: $^a$Longitudinal sample, $N = 1286$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
middle-aged ($\beta_{MA} = -0.10, p = 0.33$) or for older adults ($\beta_{OA} = 0.07, p = 0.44$). As expected, the PVA × health interaction turned out to be significant for the frequency of walking for older adults ($\beta_{OA} = -0.19, p < 0.05$; adjusted for all control variables: $\beta_{OA} = -0.20, p < 0.05$). The direction of this interaction effect was, however, unexpected. Figure 1 reveals that older people with a more PVA are more likely to walk regularly when they are in worse health. By contrast, people with a less PVA not only tend to be less active in general, but also walk most rarely when they additionally have worse health.

Second, we additionally tested the interaction term of PVA × health in the longitudinal model. Following our hypothesis, we again expected a significant interaction for decreases in sporting activity for both middle-aged and older adults and in walking for older adults. As expected, the interaction effect was significant for decreases in sporting activity for middle-aged adults ($\beta_{MA} = 0.31, p < 0.05$; adjusted for all control variables: $\beta_{MA} = 0.31, p < 0.05$); for older adults, the PVA × health interaction could not predict a lower decrease in sporting activities which is probably due to the overall high sporting inactivity of older adults ($\beta_{OA} = 0.18, p = 0.31$). The significant interaction for middle-aged adults is illustrated in Figure 2. The figure reveals that those people who have good health and additionally high PVA do not only have a lower decrease in sporting activity but even an increase over time. In contrast, middle-aged adults with good health but a less positive view on ageing, maintain their low level of physical exercise. Individuals with bad health reduce their physical activity, regardless of their view on ageing.

**Discussion**

The present study provides evidence that a PVA may in fact contribute to a higher level of physical exercise. This finding is in line with a previous study on general health behaviour (Levy & Myers, 2004). To the best of our knowledge, this is the first study to examine the importance of PVA for physical exercise. Moreover, the study considered not only older adults but middle-aged adults as well. Thus we could analyse whether PVA is already
important for physical exercise at the beginning of a time in which people become more aware of their own ageing (Whitbourne, 2001), which was in fact the case.

The complementary analyses on doing sports and walking suggest that PVA may counteract motivational barriers against physical exercise (Schutzer & Graves, 2004). PVA was not related to walking in middle-aged adults. This was in line with the hypothesis that the motivational barrier against walking would be rather low in middle adulthood because functional disabilities which impede walking are not very common at this age. However, middle-aged adults with high PVA not only did sports more frequently (cross-sectional level), they even increased their sporting activity provided that they were healthy enough to do so (longitudinal level). Thus, a PVA emerged as important for physical activities with higher energy expenditure; these are highly recommended in midlife to promote weight regulation and cardiovascular health. While middle-aged adults with high PVA and good health increased their sporting activity over time, those with worse health reduced this activity independent of their view on ageing (cf. Figure 2). This finding could reflect the uncertainty of individuals with health problems about whether (and how much) physical activity is still beneficial in the light of their diseases.

Risk factors such as a sedentary lifestyle are often difficult to change and changes are moderate even in patients who have enrolled in psychoeducational programmes (e.g. Dusseldorp, van Elderen, Maes, Meilman, & Kraaij, 1999). In contrast to healthy individuals who decide to change their behaviour, patients are told to change their sedentary lifestyle but may not be convinced of the need (Johnston, 1999). The present findings suggest that attitudes towards health behaviour change differ between individuals with a more or less positive view on ageing. Individuals with a more PVA not only have higher functional optimism (cf. Table 2), they additionally have further plans and goals for the future. These might make it worth engaging in health behaviour because the pursuit of goals (e.g. travelling, hobbies, caring for grandchildren) requires sufficiently good health. This is in line with studies on the importance of hoped-for selves on health behaviour.

Figure 2. Longitudinal interaction effect of a PVA × health on changes of sporting activity in middle-aged adults (database: longitudinal sample). Note: The figure depicts the values for the frequency of doing sports at T2 as predicted by overall mean frequency of sporting activity at T1, a PVA, health and the interaction between a PVA and health. Both a PVA (low vs. high) and health (good vs. bad) were separated by median split for reasons of visual clarity.
In the light of their impact on motivation towards health behaviour change, conceptions and misconceptions about ageing should be considered in the context of rehabilitation and intervention programmes.

Also in line with our hypotheses was the finding that for older adults, PVA was associated with higher physical activity, that is, doing sports and walking (cross-sectional level). It was a remarkable result that even those older people with worse health walked just as regularly as those with good health, provided that they had a PVA (cf. Figure 1). This finding exceeded our expectations and emphasises the importance of a positive view on ageing. Regular walking is often still recommended in spite of health problems, ailments or frailty. This means, it is normally a more adaptive behaviour than a sedentary lifestyle, even for ill or frail older people (Landi et al., 2004; WHO, 1997). Moreover, PVA could predict an increase in the frequency of walking (longitudinal level). Hence, for older adults, PVA was particularly associated with more regular walking. Moderate activities such as walking are often considered to have top priority for older adults because they promote functional ability and are even possible in cases of chronic disease and disabilities (DiPietro, 2001). Taken together, the findings for middle-aged and older adults in the present study support the assumption that PVA contributes to physical exercise in later adulthood.

The findings can be incorporated in the larger theoretical context of self-regulation which places special emphasis on the importance of optimism and goal setting (e.g. De Ridder & De Wit, 2006). Studies on optimism have repeatedly shown that people with a more favourable expectation about the future have more beneficial health behaviour, and are able to adapt better to negative conditions (e.g. Aspinwall, Richter, & Hoffman, 2001; Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000). However, favourable beliefs about the future do not necessarily imply that people have gain-related goals. An optimistic view of the future may also mean that a person is confident of maintaining his or her skills or social relationships, or that a person is confident of successfully coping with losses. Moreover, the present study did not focus on health goals but rather on the expectation that ageing is accompanied by further development.

Thus, the finding is striking that such a PVA could predict physical exercise even if the analyses were controlled for hope, that is, for functional optimism. This reveals that a PVA cannot be equated with optimism and emphasises that gain-related goals continue to be important up to old age. We have to keep in mind that the striving for personal development mainly characterises the goal orientation of younger adults, while already from middle adulthood there is a motivational shift toward conservation and loss-prevention (Heckhausen, 1997). Substantial reasons for this shift are the age-related increase in physical and social losses and the shorter future time perspective (Carstensen, Issacowitz, & Charles, 1999), but also the fact that older adults are more likely to have already achieved their personal goals than younger adults. Hence the finding that a PVA can motivate older people to physical exercise suggests that it remains important up to old age to see the gains in life – regardless of the age-related shift from striving for gains to balancing losses.

**Limitations**

We would like to point to some limitations concerning the generalisation of the present study. First, all data used here are based on self-reports and thus might be biased. It would...
be preferable to have additional data about physical exercise, although there is evidence for the validity of self-reports on physical activity (Miller, Freedson, & Kline, 1994). Second, sporting activity and walking were measured with single-item questions only. Several studies point to a sufficient validity of single-item measures of physical activity (e.g. Schechtman, Bazlai, Rost, & Fisher, 1991); however, the reliability of these measures cannot be estimated and thus is questionable. Moreover, the present study used only a short-term recall for the frequency of physical exercise. However, it has been shown that the regularity of physical exercise is more important (Pate et al., 1995) and easier to promote (Schwarzer, 2004) than the intensity. Finally, it would have been desirable to have additional medical data; but self-reported health indicators turned out to conform to a great extent with the health status evaluated by a physician (Bush, Miller, Golden & Hale, 1989; Kehoe, Wu, Leske, & Chylack, 1994).

A second limitation refers to the sample attrition of the longitudinal sample. Compared to the original population-based survey, the longitudinal sample was selected in favour of healthier and better-educated people who exercised more often (cf. Method section). Even though we cannot rule out the possibility that the longitudinal findings are in part due to the biased sample, two findings suggest that the findings can be generalised. First, the present study has shown converging findings for the original survey sample and the longitudinal sample which consistently point to the impact of a PVA on physical exercise in later adulthood. Second, several ageing studies have examined the question of how much the findings differ between a selected longitudinal sample and the corresponding original baseline sample with estimated follow-up data for those people who dropped out (Kempen & van Sonderen, 2002; Wurm, et al., 2007). These studies also report converging findings between the different samples, and suggest that attrition not always seems a serious problem when associations between variables (and not descriptive outcomes) are in the focus.

Finally, the variance explained in the regression models at baseline and follow-up was relatively small. This could qualify the importance of a PVA for physical activity. First of all, however, one should consider the 6-year period between baseline and follow-up. Any changes in physical activity predicted by a PVA are, therefore, probably sustainable so that cumulative benefits are very likely. Most importantly, we should bear in mind that the small effects in physical activity as predicted by a PVA might be sufficient to cause a substantial improvement in physical health. Numerous studies demonstrate the benefits of even small increases in physical activity for health and longevity (Myers, et al., 2002; Pate et al., 1995). Based on recent studies, Warburton, Nicol and Bredin (2006, p. 801) therefore conclude that ‘...an increase in energy expenditure from physical activity of 1000 kcal (4200 kJ) or an increase in physical fitness of 1 MET (metabolic equivalent) per week was associated with a mortality benefit of about 20%’. The effect of physical activity is graded, that is, even small improvements in physical activity are associated with a significant risk reduction. For example, an intervention study for patients with diabetes showed that patients who walked at least 2 h a week had a 39% lower mortality rate compared with inactive individuals (Gregg, Gerzoff, Caspersen, Williamson, & Narayan, 2003). These findings show that even small effects can result in important health benefits.

Conclusions and future directions

Besides these limitations, further aspects should be addressed in future studies. One issue concerns the number of and the time interval between follow-up surveys. While intervention studies are often limited to a short follow-up period of less than half a
year, the present study referred to a time interval of 6 years. The fact that a PVA predicted physical exercise over this long time interval is remarkable. But in future studies it would be desirable to have more information about physical activity at more regular intervals. This would also allow testing physical exercise as mediator between PVA and health. Concerning the contribution of a PVA on health behaviour, future studies should also extend their focus additionally to other health behaviour such as the use of preventive medical checkups. The enhancement of health by physical exercise implies a value placed on prospective gains, while illness-detection implies a value placed in avoiding losses (Bailis, Fleming, & Segall, 2005). It has been shown that subjective risk factors cannot predict physical exercise (Schwarzer, 2004). But for medical checkups and other health behaviour aimed at averting losses, perceiving potential risks could be more beneficial than having a positive view on ageing; an optimistically biased risk perception could prevent this kind of health behaviour, which is also termed as ‘defensive optimism’ (Schwarzer, 1994). The question of whether a PVA also promotes other aspects of a healthy lifestyle should therefore be examined in future studies. But at least with regard to physical exercise interventions and related public health programmes, it seems to be worthwhile to consider a PVA as an additional motivator. In this context we have to keep in mind that such a positive view cannot be taken for granted, not only because of the age-related losses but also due to prevailing ageism and age stereotypes.

References


