Health, Medical Risk Factors and Bicycle Use in Everyday Life in the over-50 Population

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Abstract

Few middle-aged and elderly people get enough exercise from sports or leisure-time physical activity. Therefore, the impact of everyday physical activity on health is a matter of interest. The main objective of this study was to establish whether bicycle use in everyday life is positively associated with health. 982 randomly selected men and 1,020 women aged 50 to 70 were asked in a computer-assisted telephone interview to provide information including a self-assessment of their health and physical activity. Self-assessed health correlates positively with bicycle use in everyday life (OR=1.257; 95%-CI: 1.031 to 1.532). Likewise, people who regularly cycle for transport are less likely to have medical risk factors (OR=0.794; 95%-CI: 0.652 to 0.967). This negative correlation is not diminished when sporting activity is controlled for. This indicates that positive effects of physical activity on risk factors can be also achieved solely by integrating more physical activity into routine everyday life.

Key Words: physical activity, bicycling, health, risk assessment, cross-sectional studies, interviews, regression analysis, aged
The major importance of physical activity for the prevention and rehabilitation of chronic diseases is undisputed. Most studies to date focus on the effects of systematic sporting activity on health, and show that moderate endurance sports are cardioprotective (Hu et al., 2007; Wannamethee & Shaper, 2001). Further, physical endurance training impacts positively on individual risk factors for cardiovascular disease, such as hypertension and blood lipid levels (Boardley, Fahlman, Topp, Morgan, & McNevin, 2007; Kokkinos, Narayan, & Papademetriou, 2001; Panagiotakos et al., 2003; Pescatello et al., 2004). Finally, moderate endurance activity counteracts obesity and diabetes, conditions whose prevalence is increasing in western industrialized nations (Chen & Mao, 2006; Sullivan, Morrato, Ghushchyan, Wyatt, & Hill, 2005; Vatten, Nilsen, Romundstad, Droyvold, & Holmen, 2006; Villegas et al., 2006).

Physical activity is also of key importance in the prevention and treatment of orthopedic diseases (Winett & Carpinelli, 2001). Systematic buildup of muscles by appropriate exercising is the main element here. People with an active lifestyle are less likely to develop chronic back pain (Hartvigsen & Christensen, 2007) and osteoarthritis (Mayer, Schmitt, & Dickhuth, 2003). Physical activity also helps to prevent osteoporosis-related fractures (Augestad, Schei, Forsmo, Langhammer, & Flanders, 2004; Cosman, 2005; Gass & Dawson-Hughes, 2006) and significantly enhances mobility in the elderly (Brach, Simonsick, Kritchevsky, Yaffe, & Newman, 2004; Patel et al., 2006).

In Germany, depending on the age group, more than 30% of the adult population are totally inactive and almost 50% do not engage in sports (Mensink, 1999). Older adults in particular may be very reluctant to engage in regular sporting activity. Accordingly, few people in this age group are physically active to an extent sufficient to have protective effects (Allender, Peto, Scarborough, Boxer, & Rayner, 2006; U.S. Department of Health and Human Services, 1996). Against this background, investigation of the health impact of physical activity is of signal importance. That is because not only sports training per se, but overall activity helps to reduce health risks – cardiovascular risks in particular. E. g. going for walks on a regular basis is enough to have a positive impact on health (Hakim et al., 1999; Manson et al., 1999).

Previous studies on physical activity and health, mainly within younger age groups, have shown an inverse association between cycling to and from work and the risk for coronary heart disease and all-cause mortality (Andersen, Schnohr, Schroll, & Hein, 2000; Hu et al., 2007). Other epidemiological studies have documented significant relationships between greater active commuting frequency and positive health indicators, including body mass index, blood lipid profiles, and blood pressure (Sallis, Frank, Saelens, & Kraft, 2004). However, the
database on sports, leisure-time physical activity and active transportation in middle-aged and older adults in Germany is incomplete. In particular, there is a lack of representative studies that correlate physical activity with health parameters in this age group.

Looking at the mobility patterns in Germany, 60% of everyday trips are done using individual motorized transport; 23% on foot; 9% by bicycle, and 8% by public transport. 37% of bicycle trips are for leisure pursuits, 23% are for shopping, and 21% are job-related. 47% of German citizens rarely or never use a bicycle; this percentage is much lower in rural areas (Institute for Applied Social Sciences & German Institute for Economic Research, 2004).

This paper looks at the relation between health and everyday physical activity in the form of bicycle use as a means of everyday transport in an elderly population. The purpose of this study was to analyze if there is an association between bicycle use in everyday life and health – irrespective of sporting activity. Alongside an estimation of general wellbeing, the paper takes a closer look at orthopedic and cardiovascular diseases and the pertinent risk factors.

Methods

Participants

The empirical basis for this investigation is data from the study “Living an Active Life – Age and Aging in Baden-Wuerttemberg”. This cross-sectional study is a source of contemporary and retrospective data on health, activity, and lifestyle among the elderly population in Southern Germany. The survey is representative for the federal state of Baden-Wuerttemberg; a corresponding level of representativeness is likely for similar federal states. 982 men and 1,020 women aged 50 to 70 (mean: 59.86) took part in the study. They were randomly selected from the total Baden-Wuerttemberg population. 95% of study subjects were German nationals.

Instrumentation

Wherever possible, the construction of the questionnaire was based on already validated instruments – such as the German National Health Survey 1998 (Bellach, Knopf, & Thefeld, 1998). In some cases, validated questions required minor modification or addition in accordance with the specific research interest. In this instance, additional experts for the particular specialist area were consulted and asked to evaluate and optimize the questions developed.
Demographics

Sociodemographic and socioeconomic variables were documented in a standardized part of the survey (Working Committee of the German Institutes for Marketing and Social Research, Working Group of the Socioscientific Institutes, & German Federal Statistical Office, 2004).

Bicycle Use

Everyday-life physical activity was investigated first of all on the basis of a dichotomous reply variable: “The next part is about bicycling for transport, using a bicycle for shopping, going to work, or similar. Did you perform this activity regularly over the past 12 months?” Regularly was defined as at least once a week. The next step was to determine the number of hours per week spent cycling for practical everyday life purposes. There were two questions: Subjects were asked to think of a typical week in summer and winter and differentiate according to season, as bicycle use fluctuates between seasons. The mean of the two seasonal values was then calculated.

As a control variable, subjects were also asked about the nature, duration, frequency and intensity of sporting activity.

Health

Subjects were asked to rate their general health on a scale from 1 (very good) to 5 (very poor). To investigate diseases and risk factors, subjects were asked: “Did a doctor ever diagnose you with any of the following diseases?” There followed a list of cardiovascular and orthopedic diseases: arteriosclerosis, coronary artery disease, angina pectoris, heart attack, heart failure, disorders of heart rhythm, aortic aneurysm, stroke, peripheral arterial occlusive disease, osteoarthritis of the hip or knee joints, rheumatoid arthritis of the joints or spine, osteoporosis and chronic back pain. Hypertension, dyslipidemia, diabetes, and degree of overweight (the latter rated according to WHO criteria) were documented as medical risk factors.

Procedures

The approval of the ethics committee of the Medical Faculty of Heidelberg was attained and all participants consented to take part in the study. At the beginning of the interview, the subjects were told about the purpose of the survey, the voluntary nature of
participation, and the anonymity of the processed data. Data was collected in an anonymous way without disclosing the subject’s identity, and transferred blinded to the authors.

Data was generated by an external university phone lab in the period from May to October 2006. All interviews were computer-assisted. The questionnaire employed was integrated in “The Survey System” software (Creative Research Systems Petaluma, CA 94952, USA), which enabled simultaneous data acquisition and storage, hence precluding transfer errors.

Data was collected from a random sample of telephone numbers which were sampled on the basis of the Gabler-Häder method (Gabler & Häder, 1997). The target subjects were then identified on the basis of a two-stage selection process. A telephone number was selected from the number pool on the basis of a random algorithm, and the household thus selected was contacted by phone. The target subject was defined as the 50- to 70-year-old person whose birthday was most recent.

A comparison of the data from the present study with the data of the Microcensus 2004 from the German Federal Statistical Office for the 50- to 70-year-old population of Baden-Wuerttemberg revealed differences – in some cases major – with respect to the variables of age, gender and education. To ensure that the study was representative, a weighting factor was determined in cooperation with ZUMA1 and the dataset was weighted prior to performance of the statistical analyses. This was done in two steps. First, a design weighting was conducted as a function of the number of phone connections and target persons per household. Subsequently, adaptation weighting was done on the basis of German Microcensus 2004 data according to the variables of age, gender and education. Following weighting of the data, the frequency distributions for age, gender and education corresponded to the Microcensus data for this age group in Baden-Wuerttemberg, Germany (Table 1).

Detailed information on the methods and procedures of the study “Living an Active Life – Age and Aging in Baden-Wuerttemberg” is published in Becker et al. (2007).

Statistical Analyses

The association between cycling in everyday life and general health, presence of medical risk factors, and medically diagnosed cardiovascular and orthopedic diseases were determined first on a bivariate basis using chi-squared testing. In the case of significant outcomes, logistic regression analysis was used to investigate the relation between cycling and the health variables, controlling for central covariates such as age, gender, education and

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sporting activity. This was intended to examine the extent to which cycling in everyday life in itself is a determining parameter for the dependent variable, or whether individual associations disappear when other variables are included and held constant.

Several models were calculated for the regression. Model 1 represents the correlation between the dependent variable and cycling for transport, while controlling for age, gender and education. Model 2 controls for these factors and for sporting activity too. To identify any gender-specific connections, a third model was calculated separately for men and women.

Following standard procedure, bi- and multivariate analyses were only done on full datasets. All tests were two-tailed at a level of significance of \( p \leq 0.05 \). The analyses were conducted using the statistical program SAS, Version 9.02 (SAS Institute Inc. Cary, NC 27513, USA).

Results

1,408 subjects (70.3%) said their health was good to very good. 44.6% of respondents said they used a bicycle for everyday errands. Further univariate analyses showed that 63% of the 50- to 70-year-old subjects had at least one medical risk factor. The prevalence of medically diagnosed cardiovascular and orthopedic diseases was 15.1% and 28.4%, respectively.

Bivariate analyses did not identify any associations between bicycle use in everyday life and medically diagnosed cardiovascular or orthopedic diseases. The same applies to the logistic regression analyses, while controlling for the variables of age, gender, education and sporting activity.

However, the bivariate analyses disclosed a highly significant difference in the self-assessment of general health and the use of cycling as a means of transport \( (X^2=5.960; \ p=0.0146) \). With respect to the prevalence of risk factors, it was also shown that subjects who use a bicycle regularly are significantly less likely to present any of the defined medical risk factors \( (X^2=5.276; \ p=0.0216) \). These differences concerning the self-assessment of health and the presence of risk factors do not depend on the extent of daily bicycle use (measured in hours per week).

Bicycle Use in Everyday Life and Subjective Health

Logistic regression analysis showed that the observed correlation between cycling for transport and subjective health remained in evidence when the sociodemographic variables of
age, gender and education are controlled for. 50- to 70-year-old men and women who used a bicycle for transport were 1.3 times more likely to rate their health as being good or very good versus subjects who did not use a bicycle on a regular basis (Table 2, Model 1). However, this correlation loses importance when sporting activity is included in the model as a control variable (Table 2, Model 2).

In the gender-specific analysis, for men, a correlation between cycling and subjective health was no longer apparent when the variables of age, education and sporting activity were controlled for. In contrast, women using a bicycle on a regular basis were almost 1.6 times more likely to rate their health as being good or very good (Table 2, Model 3).

**Bicycle Use in Everyday Life and Medical Risk Factors**

The correlation between bicycle use and medical risk factors remained even when the covariates were controlled for. Subjects who regularly use a bicycle for transport had a 20% lower risk of presenting one of the defined medical risk factors than subjects in the reference population who did not use a bicycle for transport on a regular basis (Table 3, Model 1). This correlation persisted even when sporting activity was held constant (Table 3, Model 2).

In the gender-specific analysis, a significant correlation between cycling for transport and the presence of medical risk factors was evident only for men when the variables of age, education and sporting activity were controlled for. Men who used a bicycle for everyday transport were less likely to present any of the risk factors investigated here than men who did not say they used a bicycle for transport on a regular basis. For the female population, no correlation between cycling for transport and presence of medical risk factors was in evidence when the covariates were controlled for (Table 3, Model 3).

**Discussion**

This study is the first to present representative data on physical activity in relation to health and risk factor profiles among older adults in Southern Germany. Physical activity is associated with a more positive subjective self-rating of a person’s general health (Norman, Bellocco, Vaida, & Wolk, 2002). This observation is confirmed in our study on bicycle use in everyday life. Our analysis also shows, however, that, when sporting activity is controlled for, this correlation applies only in the female subset of the sample population. Hence, in elderly women, everyday physical activity markedly enhances subjective health. In the male subset of the sample, a correlation was no longer apparent when sporting activity was controlled for.
This is probably partly attributable to the fact that people who use a bicycle for transport are also likely to engage in more sporting activity in general ($r=0.205$, $p<0.01$). It is also probable that women view daily bicycle use as symbolic of an active lifestyle and a balanced diet, whereas, among the male population, any improvement in their self-assessment of their general health would be more likely to be perceived as related to the pursuit of classical sports.

In contrast to previous studies (Barengo et al., 2004; Wennberg et al., 2006), this study did not identify any correlation between cycling for transport and cardiovascular diseases. In the age group studied here, this might be because the subjects integrated cycling in their everyday life in an effort to counteract existing disease, either on their own initiative or acting upon medical advice. However, irrespective of the presence or absence of existing disease, the present study – in agreement with earlier studies (Dannenberg, Keller, Wilson, & Castelli, 1989; Hu et al., 2003) – identified a particularly meaningful association between everyday mobility and incidence of risk factors. The finding of our study is all the more significant because the negative correlation between bicycle use in everyday life and the occurrence of risk factors is not diminished when sporting activity is controlled for. This indicates that positive effects of physical activity on hypertension, dyslipidemia, diabetes and obesity – the main risk factors both for the development of cardiovascular disease and for an unfavorable prognosis – can be achieved solely by integrating more physical activity into routine everyday life.

Due to the cross-sectional design of the study, the observed associations do not apply causation. It might also be possible that poor health could cause inactivity, and inactivity could cause a low self-rating of health. To address this issue, importance was attached to the subjective assessment of health, which is recognized as a reliable predictor of general health (Fayers & Sprangers, 2002; Ferraro, 1980). Another limitation based on the nature of the study is that the data generated reflect information elicited from the subjects themselves. As such, social desirability may be an issue (Latenschlager & Flaherty, 1990). To avoid having study subjects overestimate their activities or unwittingly falsify their medical history, the interviews accentuated the regularity of physical activity and explicitly asked for medically diagnosed diseases and risk factors.

The limitations of the self-information process are offset by the many advantages of the telephone interview. These reside first of all in the representativeness of the data for the overall population in the age group studied. Unlike many other studies on the impact of physical activity on physical diseases and risk factors, this study is not based on one patient cohort only. The use of previously validated measuring tools (Bellach et al., 1998) produced
results which agree with those of other studies to a large extent (Chen & Mao, 2006; Heidrich et al., 2003; Mokdad et al., 2003). Another advantage of the study approach is that it enabled the analysis of correlations between health, sports and everyday activities in a large sample size.

Given the macroeconomic importance of cardiovascular diseases coupled with the reluctance of many middle-aged and elderly people to engage in regular sporting activity, systematic encouragement of everyday physical activity should be a major healthcare policy goal. Advertising campaigns presenting bicycle use in everyday life as a symbol of a healthy lifestyle might be useful here, in addition to increasing the number of cycling lanes in cities. In view of the huge importance of an explicit recommendation from the primary care physician in encouraging regular physical activity (Schneider & Becker, 2005), medical advice will play a major role in any effort to increase the percentage of those who use a bicycle for everyday transport, based on the argument that it is good for their health.

Acknowledgments

“Living an Active Life – Age and Aging in Baden-Wuerttemberg” is a representative general survey of physical/sporting activity in middle-aged and older adults in Southern Germany. The survey as a whole centered on the sports and health biography, health behavior and lifestyle of this age group. The study was supported by the Landesstiftung Baden-Wuerttemberg, with funding in place for the period from September 2005 to August 2007. Project contributors are: Prof. Dr. Klaus-Peter Brinkhoff, University of Stuttgart; Prof. Dr. Ansgar Thiel, University of Tuebingen; Prof. Dr. Thomas Klein, University of Heidelberg; Dr. Uwe Gomolinsky, University of Stuttgart; Dr. Monique Zimmermann-Stenzel, University of Heidelberg; Christina Huy, University of Stuttgart; Simone Becker, University of Heidelberg, Germany.
References


Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion.


Table 1

*Sociodemographic Characteristics of the Total Sample and Prevalence of Selected Risk Factors and Diseases*

<table>
<thead>
<tr>
<th></th>
<th>Unweighted observations (n)</th>
<th>Unweighted data (%)</th>
<th>Weighted data (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age group</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-59 years</td>
<td>1,049</td>
<td>54.75</td>
<td>52.80</td>
</tr>
<tr>
<td>60-70 years</td>
<td>876</td>
<td>45.25</td>
<td>47.20</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>847</td>
<td>42.33</td>
<td>49.00</td>
</tr>
<tr>
<td>Female</td>
<td>1,154</td>
<td>57.67</td>
<td>51.00</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hauptschule (junior high)</td>
<td>747</td>
<td>38.76</td>
<td>63.39</td>
</tr>
<tr>
<td>Realschule (middle school)</td>
<td>571</td>
<td>29.63</td>
<td>17.60</td>
</tr>
<tr>
<td>Gymnasium (high school)</td>
<td>609</td>
<td>31.61</td>
<td>19.01</td>
</tr>
<tr>
<td><strong>Medical risk factor present</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1,175</td>
<td>58.72</td>
<td>63.04</td>
</tr>
<tr>
<td>No</td>
<td>826</td>
<td>41.28</td>
<td>36.96</td>
</tr>
<tr>
<td><strong>Cardiovascular disease</strong>&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>314</td>
<td>15.69</td>
<td>15.13</td>
</tr>
<tr>
<td>No</td>
<td>1,687</td>
<td>84.31</td>
<td>84.87</td>
</tr>
<tr>
<td><strong>Orthopedic disease</strong>&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>596</td>
<td>29.79</td>
<td>28.44</td>
</tr>
<tr>
<td>No</td>
<td>1,405</td>
<td>70.21</td>
<td>71.56</td>
</tr>
</tbody>
</table>

<sup>a</sup>: High cholesterol, high blood pressure, diabetes, overweight.

<sup>b</sup>: Arteriosclerosis, coronary artery disease, angina pectoris, myocardial infarction, heart failure, cardiac dysrhythmia, aortic aneurysm, stroke/transient ischemic attacks, peripheral arterial occlusive disease.

<sup>c</sup>: Osteoarthritis of the hip or knee joints, arthritis of the joints or spine, osteoporosis, back pain (>=3 months).
Table 2

Relation between Bicycle Use in Everyday Life and Subjective Health, Controlled for Age, Gender, Education and Sporting Activity (Logistic Regression)

<table>
<thead>
<tr>
<th>Subjective health&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Overall</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Cycling&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Odds ratio</td>
<td>1.257</td>
<td>1.170</td>
<td>0.847</td>
</tr>
<tr>
<td>95%-CI</td>
<td>[1.031, 1.532]&lt;sup&gt;*&lt;/sup&gt;</td>
<td>[0.954, 1.436]</td>
<td>[0.630, 1.139]</td>
</tr>
<tr>
<td>Constant</td>
<td>2.148***</td>
<td>2.005***</td>
<td>2.506***</td>
</tr>
<tr>
<td>R²</td>
<td>0.039</td>
<td>0.045</td>
<td>0.048</td>
</tr>
<tr>
<td>n</td>
<td>1,909</td>
<td>1,909</td>
<td>811</td>
</tr>
</tbody>
</table>

<sup>a</sup>: Dichotomous variable; Coding: 1=bicycle is used in everyday routine; 0=bicycle is not used.

<sup>b</sup>: Dichotomous variable; based on the question “How would you rate your general health? Is it very good (1), good (2), middling (3), poor (4) or very poor (5)?” Coding: 1=categories 1 and 2; 0=categories 3 to 5.

CI: Confidence interval.

R²: Explained variance.

n: Number of subjects.

Model 1: Controlled for age, gender and education.

Model 2: Controlled for age, gender, education and sporting activity.

Model 3: Controlled for age, education and sporting activity.

* p<0.05; ** p<0.01; *** p<0.001.
### Table 3

Relation between Bicycle Use in Everyday Life and the Presence of Medical Risk Factors, Controlled for Age, Gender, Education and Sporting Activity (Logistic Regression)

<table>
<thead>
<tr>
<th>Medical risk factors&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Overall</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Cycling&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Odds ratio</td>
<td>0.794</td>
<td>0.815</td>
<td>0.623</td>
</tr>
<tr>
<td>95%-CI</td>
<td>[0.652, 0.967]&lt;sup&gt;*&lt;/sup&gt;</td>
<td>[0.665, 0.998]&lt;sup&gt;*&lt;/sup&gt;</td>
<td>[0.455, 0.852]&lt;sup&gt;**&lt;/sup&gt;</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.471***</td>
<td>-2.416***</td>
<td>-2.870***</td>
</tr>
<tr>
<td>R&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.108</td>
<td>0.108</td>
<td>0.094</td>
</tr>
<tr>
<td>n</td>
<td>1,913</td>
<td>1,913</td>
<td>793</td>
</tr>
</tbody>
</table>

<sup>a</sup>: Dichotomous variable; Coding: 1=bicycle is used in everyday routine; 0=bicycle is not used.

<sup>b</sup>: Dichotomous variable; Coding: 1=one or more risk factors; 0=no risk factor; Hypertension, disorders of lipid metabolism, diabetes, overweight.

CI: Confidence interval.

R<sup>2</sup>: Explained variance.

n: Number of subjects.

Model 1: Controlled for age, gender and education.

Model 2: Controlled for age, gender, education and sporting activity.

Model 3: Controlled for age, education and sporting activity.

* p≤0.05; ** p≤0.01; *** p≤0.001.