Health Service Research

Synergistic effect of pain and deficits in ADL towards general practitioner visits

Karin Pieber\textsuperscript{a,}*, Tanja A Stamm\textsuperscript{b}, Kathryn Hoffmann\textsuperscript{c} and Thomas E Dorner\textsuperscript{d}

\textsuperscript{a}Department of Physical Medicine and Rehabilitation, General Hospital of Vienna, \textsuperscript{b}Division of Rheumatology, Department of Internal Medicine III, \textsuperscript{c}Department of General Practice and Family Medicine, Centre for Public Health and \textsuperscript{d}Institute of Social Medicine, Centre for Public Health, Medical University of Vienna, General Hospital of Vienna, Vienna, Austria.

\*Correspondence to Karin Pieber, Department of Physical Medicine and Rehabilitation, Medical University of Vienna, General Hospital of Vienna, Waehringer Guertel 18–20, A-1090 Vienna, Austria; E-mail: karin.pieber@meduniwien.ac.at

Abstract

Background. Pain and activities of daily living (ADLs) deficits are common problems among elderly people who visit general practitioners (GPs).

Objective. To examine whether the probability of visiting a GP is related to deficits in ADLs and pain, and whether these factors act synergistically towards GP visits.

Methods. A total of 3097 subjects aged ≥65 years from the Austrian Health Interview Survey formed the cohort. Visiting the GP in the last 4 weeks, chronic pain (CP; pain for at least 3 months) and deficits in ADLs across 11 dimensions were reported. Binary logistic regression models were applied and were stepwise controlled for possible confounders. Based on odds ratios (OR), the synergy index (SI), population attributable fraction (PAF) and relative excess risk due to interaction (RERI) were calculated.

Results. Overall, 61.0% visited their GP; 51.2% were affected by ADL deficits and 42.2% by CP. In subjects with ADL deficits, the OR for GP consultation was 1.32 (95% confidence interval [CI] 1.11–1.56) and in subjects with CP, 1.93 (95% CI 1.63–2.27) in the fully adjusted model. The OR for those affected by both was 2.56 (95% CI 2.08–3.15); SI was 1.82 (95% CI 1.04–3.18), PAF was 0.27 (95% CI 0.08–0.47) and RERI was 0.70 (95% CI 0.13–1.27).

Conclusion. There is a strong synergistic effect of CP and deficits in ADL in patients ≥65 years on visiting the GP. Prevention, screening, treatment and rehabilitation in this population should focus on both CP and ADL deficits.

Keywords: Deficits in activities of daily living, GP, pain, primary health care, synergy index.

Introduction

Chronic pain (CP) and deficits in activities of daily living (ADLs) are common problems for elderly individuals (1). Musculoskeletal diseases, as possible underlying conditions for both CP and ADL impairments, have been defined as major health priorities at international (2) and national levels (3). Stamm \textit{et al}. (4) found higher health care utilization in patients with musculoskeletal diseases, higher rates of limitations in ADLs, higher pain intensity and more frequent anxiety/depression compared with subjects without these diseases. However, they did not examine the possible synergistic effects of pain and ADL deficits. The combination of these factors could lead to a complex problem, which should be checked and treated as early as possible, as the presence of one could alter associations with the other with the probability of visiting the general practitioner (GP). The primary contact person who may perform this task will most likely be a GP in Austria (5). In Germany, 18.4% of patients visiting a GP presented with ADL deficits and CP, mostly related to musculoskeletal degenerative diseases (6). The authors reported similar results concerning CP and activity limitations, but they did not indicate a synergistic effect. A study on mental and physical disorders and their relationship with disability is the only
study that examined synergistic effects on this topic (7). The author reported that the odds of disability among those with mental and physical disorders were significantly greater than the sum of the odds of each single condition.

Statistics Austria is an institution that provides data from the Austrian economy and society. It carries out different surveys including standardized assessments of physical and mental diseases; it also reports visits to the GP and collects information concerning pain and ADL limitations in the general population. This provides the opportunity to assess the association between CP, ADL deficits and the combination of both with GP visits; it can also look for possible synergies between CP and ADL limitations on the probability of visiting a GP.

Methods
Data set
The Austrian Health Interview Survey (AT-HIS) 2006–07 database, carried out by Statistics Austria, was used (8). Face-to-face interviews were conducted by trained interviewers using a computer-assisted personal interviewing system. The questionnaire was designed based on the European Core Health Interview Survey (9) and was adapted by an Austrian expert panel. For this analysis, the data of subjects ≥65 years were used. The gross sample size was 25,130 people, 215 years, of which 24,509 were reached; 9,656 subjects were excluded (5,709 subjects refused the interview; 3,308 due to difficulties in contacting them, or because of German language deficiencies and 639 were cases with insufficient data quality). Thus, the data of 12,59 men and 1838 women were eligible for analysis.

GP visits
For primary health care utilization, participants were asked if they visited the GP in the last 4 weeks. Those who visited the GP were asked about the main reason for their last GP consultation.

Chronic pain
Participants were asked if they had ‘severe’ pain in at least one body part in the last 12 months, and if they had suffered from it for at least the last 3 months prior to the survey (10). The definition of CP that was used was in line with that of the International Association for the Study of Pain (11).

ADL deficits
We used all 11 AT-HIS ADL-related variables; these were mandatory questions and translations of the internationally used European Health Information Survey (EHIS) questionnaire by EUROSTAT and the European Commission. Thus, the same questions were used in all EHIS-based surveys within the European Union (EU). We did not have any influence on selecting and modifying those questions. The Lawton and Barthel instruments (12,13) served as the basis for those questions, and they were adapted for use in the interview survey. We are not aware of studies that have assessed the validity of this instrument. Questions on preparing food, managing shopping, using the telephone, washing clothes, doing light housework, managing financial affairs, eating, sitting down and standing, putting on or taking off clothes, going to the toilet and taking a bath or shower were asked.

Socio-demographics
Age was used in 5-year groupings. Level of education was measured in three levels: primary education (up to the age of 15 years), secondary education (apprenticeship or secondary school) and tertiary education (university or other vocational training).

Diseases
For the calculation of chronic somatic non-musculoskeletal disease, the eight diseases (allergic bronchial asthma, other forms of asthma, diabetes mellitus, hypertension, myocardial infarction, stroke, cancer and chronic bronchitis) were used. These are the most relevant chronic somatic non-musculoskeletal disease in the Austrian population according to Statistics Austria in 2006/07 (8). Chronic musculoskeletal diseases (osteoarthritis, back pain and arthritis/osteoarthritis) were not used due to their connection to pain and ADL deficits, and thus due to their possible bias. Furthermore, patients were asked about the presence of anxiety and depression.

Statistical analyses
Bivariate analyses were undertaken by means of cross-tabulations, and group differences were assessed with Pearson’s chi-square test including the z-test. Binary logistic regression models were applied with GP consultation as the dependent variable. In a first, unadjusted model, ADL deficits and CP were analyzed separately as independent variables. In a second model, sex, age and educational level were added as control variables. In a third model, chronic somatic non-musculoskeletal diseases and anxiety/depression were added as control variables. In a fourth, fully adjusted model, CP was added as a control variable for ADL deficits, and ADL deficits were the control variable for CP. The results of the logistic regression models are presented as odds ratios (OR) with 95% confidence intervals (95% CI). Additive interactions between CP and ADL deficits in relation to GP consultation are shown as the mean synergy index (SI), population attributable fraction (PAF) and relative excess risk due to interaction (RERI). These were calculated as deviations from an additive model using the following equation (14): SI = OR (CP and ADL deficits – 1)/([OR CP but no ADL deficit − 1] + [OR ADL deficit but no CP − 1]). Thus, the SI is the ratio of the observed effect (combined exposure to two risk factors) to the expected effect (independent causes operating jointly). The SI would equal 1 for causes acting independently, 0 when two causes completely neutralize each other and it would approach infinity when two causes produced no independent effect, but a measurable effect together. In addition to a crude model, the SI analyses were controlled for sex, age and education level in model 2. In model 3, additional adjustments were carried out for chronic somatic non-musculoskeletal diseases and anxiety/depression. RERI was computed as a metric of the departure from the additivity of effects, as measured by the following equation: RERI = OR (CP and ADL deficits) − OR (CP but no ADL deficit) − OR (ADL deficit but no CP) + 1. The PAF due to interactions was computed to indicate the proportion of GP consultations that would theoretically be avoided if the interaction of the two exposures was eliminated. This was calculated using the following equation: PAF = RERI/OR (CP and ADL deficits). There was no biological interaction when RERI and its attributable proportion were equal to 0. For the CIs for the SI, RERI and PAF, we used the delta method, a straightforward Taylor expansion of variance and covariance (14).

Calculations were performed using SPSS 21. SI, RERI and PAF were calculated with MS Excel.

The secondary analysis of the AT-HIS database used in this study was approved by the ethics committee of the Medical University Vienna (EC # 770/2011).
Results

GP visits

Of all subjects aged ≥65 years, 61.0% (57.5% of men and 63.4% of women, \( P = 0.001 \)) visited their GP in the last 4 weeks. The main reason for consulting a GP included drug prescription (38.3%), acute illness (28.9%) and control or follow-up visits (25.4%).

CP, ADL deficits and socio-demographic impact

A total of 51.2% (48.1% of men and 53.2% of women, \( P = 0.006 \)) were affected by ADL deficits and 42.2% (34.9% of men and 47.1% of women, \( P < 0.001 \)) by CP. As shown in Table 1, subjects who visited their GP were significantly more likely to be female, older, with a lower education level, a higher chance for chronic somatic or mental disease, ADL deficits and CP. The main reasons for GP consultations differed significantly in subjects with ADL deficits or CP. Patients were more likely to consult a GP for acute illness if they were affected with both ADL deficits and CP when compared with those with none of the conditions or with ADL deficits alone. Those with ADL deficits, but without CP, were significantly more likely to report a control or follow-up visit as the main reason for a GP consultation. Drug prescriptions were frequently the main reasons for GP consultation in subjects with ADL deficits when compared with those without. Preventive health examinations were clearly more likely the reason for a GP consultation in those who were neither affected by ADL deficits nor CP (Table 2).

Logistic regression analysis revealed that ADL deficits were associated with a double—and CP with a more than double—chance for consulting a GP among patients ≥65 years. This is mainly due to acute illnesses; in subjects with ADL deficits, it is also due to additional control or follow-up visits. The SI shows that there was a doubled chance of consulting a GP when ADL deficits and CP operated jointly, compared with independently acting factors. A total of 27% of GP consultations are solely attributable to the synergistic effect between ADL deficits and CP (PAF). The RERI tells us that those who are suffering from both conditions are 70% more likely to visit a GP than merely adding the chances of visiting a GP based on the single exposure conditions. Subjects who visited their GP were significantly more likely to be female, older, have a lower education level, a higher chance of chronic somatic or mental disease, ADL deficits and CP. The main reasons for GP consultations differed significantly in subjects with ADL deficits or CP. Patients were more likely to consult a GP for acute illness if they were affected with both ADL deficits and CP when compared with those with none of the conditions or with ADL deficits alone. Those with ADL deficits, but without CP, were significantly more likely to report a control or follow-up visit as the main reason for a GP consultation. Drug prescriptions were frequently the main reasons for GP consultation in subjects with ADL deficits when compared with those without. Preventive health examinations were clearly more likely the reason for a GP consultation in those who were neither affected by ADL deficits nor CP (Table 2).

Discussion

In our analysis, we found a significant association between CP and ADL deficits with consulting a GP among patients ≥65 years. This is mainly due to acute illnesses; in subjects with ADL deficits, it is also due to additional control or follow-up visits. The SI shows that there was a doubled chance of consulting a GP when ADL deficits and CP operated jointly, compared with independently acting factors. A total of 27% of GP consultations are solely attributable to the synergistic effect between ADL deficits and CP (PAF). The RERI tells us that those who are suffering from both conditions are 70% more likely to visit a GP than merely adding the chances of visiting a GP based on the single exposure conditions. Subjects who visited their GP were significantly more likely to be female, older, have a lower education level, a higher chance of chronic somatic or mental disease, ADL deficits and CP. The main reasons for GP consultations differed significantly in subjects with ADL deficits or CP. Patients were more likely to consult a GP for acute illness if they were affected with both ADL deficits and CP when compared with those with none of the conditions or with ADL deficits alone. Those with ADL deficits, but without CP, were significantly more likely to report a control or follow-up visit as the main reason for a GP consultation. Drug prescriptions were frequently the main reasons for GP consultation in subjects with ADL deficits when compared with those without. Preventive health examinations were clearly more likely the reason for a GP consultation in those who were neither affected by ADL deficits nor CP (Table 2).

Logistic regression analysis revealed that ADL deficits were associated with a double—and CP with a more than double—chance for visiting the GP. Stepwise adjustment for potential confounders, like socio-demographic variables and health-related variables, lowered the OR; however, even after full adjustment, ADL deficits and CP remained significantly associated with GP consultations (Table 3).

In Table 4, the synergy between ADL deficits and CP regarding the likelihood of consulting a GP within the last 4 weeks is presented. The proportion of those who were affected by both ADL deficits and CP when visiting the GP was 76.8% compared with 48.7% of those with neither ADL deficits nor CP. In those affected by both factors, the OR for consulting a GP was higher than that obtained when merely adding the ORs of those who were affected by ADL deficits or CP alone. Adjusting for socio-demographic and health variables lowered the SI; however, even in the fully adjusted model, the SI remained significantly high. The same applied for PAF and RERI.

Table 1. Characteristics of 3097 study participants from the AT-HIS 2006–07 who visited or did not visit their GP in the last 4 weeks

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Participants who visited GP in last 4 weeks</th>
<th>Participants who did not visit GP in last 4 weeks</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Sex (female)</td>
<td>1165</td>
<td>61.7</td>
<td>672</td>
</tr>
<tr>
<td>Aged ≥75 years</td>
<td>971</td>
<td>51.4</td>
<td>468</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>906</td>
<td>48.0</td>
<td>522</td>
</tr>
<tr>
<td>Secondary</td>
<td>910</td>
<td>48.2</td>
<td>602</td>
</tr>
<tr>
<td>Tertiary</td>
<td>73</td>
<td>3.9</td>
<td>84</td>
</tr>
<tr>
<td>Chronic somatic disease</td>
<td>1433</td>
<td>75.9</td>
<td>661</td>
</tr>
<tr>
<td>other than musculoskeletal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety/depression</td>
<td>261</td>
<td>13.8</td>
<td>86</td>
</tr>
<tr>
<td>Deficits in ADLs</td>
<td>1094</td>
<td>57.9</td>
<td>490</td>
</tr>
<tr>
<td>CP</td>
<td>949</td>
<td>50.2</td>
<td>357</td>
</tr>
</tbody>
</table>

Table 2. Main reasons (in %) for the most recent GP consultation among those who visited a GP within the last 4 weeks

<table>
<thead>
<tr>
<th>Reason</th>
<th>Neither ADL nor CP</th>
<th>ADL deficits but no CP</th>
<th>CP but no ADL deficits</th>
<th>ADL deficits and CP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug prescription</td>
<td>44.0(^a)</td>
<td>34.7(^b)</td>
<td>40.3(^{ab})</td>
<td>35.3(^a)</td>
</tr>
<tr>
<td>Acute illness</td>
<td>23.0(^a)</td>
<td>25.6(^{ab})</td>
<td>29.6(^a)</td>
<td>35.0(^a)</td>
</tr>
<tr>
<td>Control or follow-up visit</td>
<td>23.0(^a)</td>
<td>32.7(^a)</td>
<td>21.7(^a)</td>
<td>24.4(^a)</td>
</tr>
<tr>
<td>Health examination</td>
<td>6.1(^a)</td>
<td>3.3(^{bc})</td>
<td>4.3(^{bc})</td>
<td>1.9(^b)</td>
</tr>
<tr>
<td>Administration reason</td>
<td>1.5(^a)</td>
<td>1.0(^a)</td>
<td>2.8(^{a})</td>
<td>1.9(^b)</td>
</tr>
<tr>
<td>Accident or injury</td>
<td>1.1(^a)</td>
<td>1.5(^a)</td>
<td>0.8(^{a})</td>
<td>0.6(^{a})</td>
</tr>
<tr>
<td>Other reason</td>
<td>1.3(^a)</td>
<td>1.3(^a)</td>
<td>0.4(^a)</td>
<td>1.0(^a)</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

\(^{ab}\) The superscript letters represent a subset of the variable categories that were not significantly different at a significance level of \( P < 0.05 \) if the same superscript letter appears in the same row.
education level and they presented with a greater chance of having chronic somatic or mental illness, ADL deficits and CP. Participants with CP and ADL deficits often visited the GP due to acute illness.

Comparison with other studies

Pain in the musculoskeletal system is a primary problem when seeking consultations with a GP (15). Previous studies demonstrated a strong relationship between musculoskeletal pain and functional limitations (1,16,17), as well as back pain and ADL disability (18). In an article by Hensler et al. (6), 42.1% of patients reported severe pain and pain-related limitations during activity. Furthermore, the author reported the highest rate of CP in a 70–79-year-old age group, as well as a high rate of female sufferers. These results are in line with ours, which may be explained by the similar role played by GPs in Germany and Austria. However, our results expand upon the previous existing data by providing nationally representative results; we used a sample that included subjects of both sexes of a similar age distribution. Furthermore, the sample represents well community dwellers—men and women—with a high rate of female sufferers. These results are consistent with the results of substantial agreement by the World Health Organization; this practice has already been implemented in many countries of the EU (20). This may involve adopting holistic approaches in the complex management of patients with musculoskeletal diseases, and it may include offering multidisciplinary rehabilitation assessment and specifically targeted and integrated health care (21).

The importance of this topic increases as the population ages; it is a known fact that pain and disability are associated with increasing age (22). Although pain is the main problem associated with visiting a GP, one-quarter of patients fail to get sufficient treatment for pain in primary care (15). Rosemann et al. (23) recommended that GPs should focus more on pain and disability, as well as on providing information concerning treatment options. The new aspect of our study—examining the synergic effect of CP and ADL deficits—can greatly impact GPs’ work. It is important to incorporate skills related to the management of pain and ADL deficits into the base knowledge of GPs, so that they can determine which patients need referrals to specialists.

Strengths and limitations

This is the first study to show that CP and ADL deficits have individual effects on health care utilization. In addition, when they occur together, they have a much greater implication for GP visits when compared with the mere sum of individual effects. The strength of our study includes the large number of patients evaluated. Furthermore, the sample represents well community dwellers—therefore, the Austrian population without a selection bias—which would be possible in the clinical or rehabilitative setting. Moreover, pain and ADL deficits were evaluated comprehensively and potential confounders were considered.

The cross-sectional design and self-reported data were limitations in this study. The self-reporting of ADL deficits and the diagnosis of anxiety and depression may lead to underreporting. A recent study by Peersman et al. (24) demonstrated a substantial agreement between self-reported and registered data concerning the utilization of physician services. Common mental disorders like anxiety and

## Table 3. Crude and adjusted OR for visiting or not visiting the GP in the last 4 weeks, as related to having or not having deficits in ADLs and having or not having been affected by CP, respectively

<table>
<thead>
<tr>
<th></th>
<th>N (%) all</th>
<th>N (%) visited GP in last 4 weeks</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADL deficit</td>
<td></td>
<td></td>
<td>2.01 (1.74–2.33)</td>
<td>1.84 (1.57–2.15)</td>
<td>1.57 (1.34–1.85)</td>
<td>1.32 (1.11–1.56)</td>
</tr>
<tr>
<td>CP</td>
<td></td>
<td></td>
<td>2.40 (2.06–2.80)</td>
<td>2.33 (1.99–2.72)</td>
<td>2.07 (1.76–2.42)</td>
<td>1.93 (1.63–2.27)</td>
</tr>
</tbody>
</table>

Model 1: unadjusted. Model 2: adjusted for socio-demographics (sex, age and education). Model 3: similar to model 2; additionally adjusted for chronic somatic diseases other than musculoskeletal diseases and anxiety/depression. Model 4: similar to model 3; ADL deficit additionally adjusted for CP, and CP additionally adjusted for ADL deficit.

## Table 4. Synergistic effect of deficits in ADL and CP with regard to the likelihood of visiting the GP within the last 4 weeks in subjects aged ≥65 years

<table>
<thead>
<tr>
<th>ADL deficit</th>
<th>CP</th>
<th>GP consultation, N (%)</th>
<th>No GP consultation, N (%)</th>
<th>Model 1, OR (95% CI)</th>
<th>Model 2, OR (95% CI)</th>
<th>Model 3, OR (95% CI)</th>
<th>Model 4, OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>+</td>
<td>697 (76.8)</td>
<td>211 (23.2)</td>
<td>3.48 (2.86–4.22)</td>
<td>3.11 (2.55–3.80)</td>
<td>2.56 (2.08–3.15)</td>
<td></td>
</tr>
<tr>
<td>+</td>
<td>−</td>
<td>397 (58.6)</td>
<td>280 (41.4)</td>
<td>1.49 (1.23–1.81)</td>
<td>1.35 (1.10–1.65)</td>
<td>1.20 (0.98–1.48)</td>
<td></td>
</tr>
<tr>
<td>−</td>
<td>+</td>
<td>252 (63.2)</td>
<td>147 (36.8)</td>
<td>1.81 (1.43–2.29)</td>
<td>1.78 (1.40–2.56)</td>
<td>1.66 (1.30–2.11)</td>
<td></td>
</tr>
<tr>
<td>−</td>
<td>−</td>
<td>543 (48.7)</td>
<td>571 (51.3)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>SI</td>
<td></td>
<td>1.90 (1.25–2.89)</td>
<td>1.87 (1.18–2.97)</td>
<td>1.82 (1.04–3.18)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAF</td>
<td></td>
<td>0.34 (0.17–0.50)</td>
<td>0.32 (0.14–0.42)</td>
<td>0.27 (0.08–0.47)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RERI</td>
<td></td>
<td>1.17 (0.48–1.86)</td>
<td>0.99 (0.34–1.63)</td>
<td>0.70 (0.13–1.27)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Depression are often underdiagnosed and, hence, underreported in interview surveys (23). However, given that these diseases were used as control parameters in our study, this fact might have had only little—if any—influence on our main findings. Finally, the adapted assessment tool used for the ADL deficits may have served as a limitation. The assessment of ADL deficits is based on the EHIS and is used in all EU countries in the same way. However, data about the validity of this instrument are, to our knowledge, not currently available; we did use this instrument previously in another study (4).

Conclusions

We found a strong synergistic effect between CP and ADL deficits and GP visits among patients ≥65 years. This association exists after adjusting for potential confounders. Treatments should focus on pain management and strategies to improve ADL deficits, and the GP should play a ‘screening role’, as he or she is often the patient’s first point of contact.

Acknowledgements

We thank Journal Prep for providing English-language editing of this manuscript.

Declaration

Funding: none.

Ethical approval: ethics committee of the Medical University Vienna (EC # 770/2011).

Conflict of interest: none.

References