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# Subjective health complaints, health-related quality of life and physician visits: results of the Study of Health in Pomerania (SHIP)

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**Summary**

**Objectives:** To investigate the relationship between subjective health complaints (SHCs), health-related quality of life and physician visits.
**Method:** 3'773 participants of the **S**tudy of **H**ealth **i**n **P**omerania (SHIP) filled questionnaires and were interviewed. Data consisted of 1) 38 statements concerning SHCs, 2) the SF12, and 3) statements concerning visits to 11 different groups of physicians. Factor analysis was done on the SHC data, with a subsequent varimax rotation. Relationships between resulting factors and remaining variables were analysed using 1) the cumulative logit model for the first SF12 item (overall health evaluation), 2) linear regression for the physical and mental sum scores of the SF12, and 3) logistic regression for physician visits.
**Results:** Eight factors have eigenvalues greater than one and together explain 54.2 % of total variance. Varimax rotated factors can be interpreted easily. Altogether, these factors, sex and age significantly affect the first SF12 item (Nagelkerke's $R^2$ = 0.27), both sum scores (physical: $R^2$adj. = 0.40; mental: $R^2$adj. = 0.36), and all physician visits (Nagelkerke's $R^2$ between 0.03 and 0.23).
**Conclusions:** Subjective health complaints are important. Total sum scores of typical SHC questionnaires do not reflect all relevant aspects of SHCs.

**Keywords: Subjective health complaints – Health-related quality of life – Physician visits – Factor analysis.**

The health status diagnosed by the physician is not necessarily identical with health as experienced by the patient. On the one hand, the medical parameters determined by the physician can be alarming even though the patient feels fine. On the other hand, the patient may suffer from certain complaints for which the physician is unable to find any somatic cause. These complaints that are primarily experienced by the patient are often referred to as subjective health complaints (SHC). They are assumed to play an important role in the patient's feelings and actions. More specifically, they are assumed to affect the patient's health-related quality of life (HRQoL) and his or her utilisation of medical care. This assumption, which is at least implicitly made by most researchers concerned with SHCs, is presumably the most important reason why SHCs have become a major topic of research in their own right in the last four decades.

Research into SHCs has looked into various issues. First of all, several attempts have been made to produce appropriate questionnaires. In most cases, a sample of items has been selected which is meant to be representative of the whole spectrum of SHCs. The best-known German-language questionnaires constructed using this approach are the Freiburg Complaint Checklist (Freiburger Beschwerdeliste) by Fahrenberg, (1975, 1994, 1995), the Complaints List (Beschwerdeliste) by von Zerssen & Köller (1976), the Giessen Subjective Complaints List (Giessener Beschwerdebogen) by Brähler (1978) and Brähler & Scheer (1995), and the second subscale of the SOMS, a screening procedure for somatoform disorders (Rief et al. 1997; Rief et al. 1992). Typical SHC questionnaires in languages other than German are the Health Complaints Scale by Denollet (1994; Pedersen & Denollet, 2002), the list of Subjective Health Complaints by Eriksen et al. (1999), and the Health Behavior in School-aged Children Symptom Checklist (HBSC-SCL) by Haugland et al. (2001).
The above-mentioned questionnaires have been used in a considerable amount of research. Part of this research has been concerned with the questionnaires themselves (Koloska et al. 1989; Piel et al. 1991; Roth, 1999). However, by far the largest part of the research uses these questionnaires as re-

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search instruments: e. g. they have been applied for assessing the distribution of SHCs in certain well-defined populations (Brähler et al. 2003; Brähler et al. 2000; Fahrenberg, 1995; Gunzelmann et al. 1996, 2002; Haugland et al. 2001; Hessel et al. 2002; Ihlebæk et al. 2002; Schumacher & Brähler, 1999), for studying the effects of therapeutic and/or organisational interventions (Buddeberg-Fischer et al. 1998; Eriksen et al. 2002; Lupke et al. 1996; Schienle et al. 1997) and for investigating the relationship with other health-related variables (Angermeyer et al. 2001; Beutel et al. 2004; Halbgewachs & Aschoff, 1992; Myrtek et al.1997; Torsheim et al. 2001).

Although SHCs have attracted a great deal of research interest, there has only been very little research into the question as to whether and how typical SHC questionnaires actually relate to HRQoL and to the utilisation of medical care. To our knowledge, there is only one study which is relevant to the first question (Hinz et al. 2005) and only two which are relevant to the second (Hessel et al. 2005; Laubach & Brähler, 2001).

Hinz et al. (2005) investigate the relationship between six different questionnaires. One of these questionnaires, the Giessen Subjective Complaints List, is a typical SHC questionnaire, whereas two, the NHP (Nottingham Health Profile) and the EORTC-QLQ C30 (European Organisation for Research and Treatment of Cancer – Quality of Life Questionnaire, Core Questionnaire, 30 Items), refer to HRQoL in a narrower sense. The correlations of the Giessen Subjective Complaints List with the NHP and the EORTC-QLQ C30 are 0.61 and 0.63 respectively.

Laubach and Brähler determined correlation coefficients between the different subscales of the Giessen Subjective Complaints List and a questionnaire assessing whether subjects would visit a general practitioner if they displayed certain clinical symptoms. In other words, this questionnaire does not assess the actual, unconditional utilisation of the general practitioner but only the hypothetical behaviour conditional to the existence of a complaint. The sum score of this questionnaire correlates significantly with only one of the four subscales of the Giessen Subjective Complaints List, the subscale "exhaustion", and the size of this correlation is only 0.06.

Hessel et al. (2005) investigated a subgroup of a representative sample of the German population. This subgroup consisted of persons who had experienced at least one disorder within the preceding two years for which three conditions were fulfilled: 1) The subject suffered from this disorder; 2) physicians had no unique explanation for this disorder; and 3) the disorder occurred in combination with one or more stressing events. Within this subgroup the authors investigated the prevalence of different aspects of physician utilisation. The authors did not compare the prevalence within this group with the prevalence within a group without SHCs. Hence, this study gives no critical information about the impact of SHCs on the utilisation of physicians.

Altogether, still very little is known about the effect of SHCs on HRQoL and on the utilisation of physicians. Hence, it is to a large extent unclear to what extent SHCs as assessed by a typical SHC-questionnaire actually play the important role they are implicitly presupposed to play. This investigation aims to clarify that role. More specifically, it is concerned with the following two research questions:

1) Are SHCs actually related to HRQoL and the utilisation of physicians?
2) Is this relationship different for different kinds of SHCs?

## Methods

Data collected in the context of the **S**tudy of **H**ealth **I**n **P**omerania (SHIP) were analysed. This study was performed from October 1997 to May 2001 in Western Pomerania (Vorpommern), which is the north-eastern-most region of Germany, situated on the Baltic coast. SHIP was designed to provide a comprehensive picture of the state of health as well as the health-related behaviour and living conditions of the population in Western Pomerania. In the following, those aspects of SHIP are presented which are relevant for the analyses performed here, as well as the statistics applied to perform these analyses. For further details of SHIP see John, Greiner, Hensel et al. (2001).

## Materials

Different instruments for gathering data were applied within SHIP. The subjects completed a rather comprehensive questionnaire and performed an interview, the answers to which were recorded by the interviewer. The questionnaire contained questions concerning SHCs and HRQoL, whereas the interview posed a number of questions concerning the utilisation of physicians.

The questions concerning SHCs were mainly adopted from the Complaints List by von Zerssen & Köller (1976) and from the Giessen Subjective Complaints List by Brähler (1978) and Brähler & Scheer (1995). To meet the specific needs of the different researchers involved in SHIP, some of the items of the original questionnaires were omitted and some new items were added. The resulting list contains 38 questions which refer to more or less the same complaints that are considered in most of the questionnaires mentioned above. Each question addresses the degree of suffering produced by the respective complaint (see Table 2). The response categories are "not at all" (gar nicht), "hardly" (kaum), "moderately" (mäßig), and "strongly" (stark).

HRQoL was assessed using the SF12 (Ware et al. 1996), which is a 12-item sub-sample of the SF36. Three variables defined on the basis of this questionnaire were taken as indicators of HRQoL. The first of these three variables is the first SF12-item. This item is concerned with the overall evaluation of the present health status and can thus be seen to reflect the core meaning of the HRQoL concept. The response categories for this item are "excellent" (ausgezeichnet), "very good" (sehr gut), "good" (gut), "fair" (weniger gut), and "poor" (schlecht). The other two variables are the physical and the mental sum scores. These scores are both derived from all twelve SF12 items by means of linear regression equations which are reported in the manual of the German version of the SF36 (Bullinger & Kirchberger, 1998).

Utilisation of physicians was assessed using questions referring to thirteen different groups of physicians. The subject was asked whether he or she had visited a physician from the respective group within the preceding year. Of these thirteen different groups, two groups were excluded from the analysis: the gynaecologists and the works, company or industrial doctors. The gynaecologists were excluded because usually only women visit this group of doctors; the works, company or industrial doctors were excluded because this group of doctors is only available to persons who have a regular job or who are in vocational training. The analyses presented below refer to the remaining 11 groups of doctors (see Table 5).

*Sample studied*

The sample studied is the result of a multistage selection process. First, 32 localities were selected from the 112 localities in the region of Western Pomerania. All towns with more than 1 500 inhabitants were included, 15 in total. Of the remaining 97 localities, which have fewer than 1 500 inhabitants, 17 were chosen randomly. Subsequently, a stratified sample of residents was randomly chosen from the population registers of the selected localities. The stratification variables were sex and age. An age range from 20 to 79 segmented into 12 five-year intervals was considered. For each combination of sex and five-year interval, 292 persons of German nationality were selected, totalling 7 008 (John, Greiner, Hensel et al, 2001). Of these, it was possible to contact 6 267. The remaining 741 persons had either moved or died. Of the persons contacted, 4 310 (68.8 % of 6 267) participated in the study, 4 286 filled in the questionnaire and 3 773 answered all 38 SHC questions. The data of these 3 773 persons were analysed. Within this sample, 1 886 persons were male and 1 887 female. The mean age at the time of questioning was 49.4 (std.: 16.4; min.: 20; max.: 81). The final study sample had a larger age range than the sample drawn from the population registers because the study extended over three years.

*Statistics*

To check whether the 38 SHC items actually refer to qualitatively different kinds of SHCs and to represent these different kinds of SHCs in an adequate manner, the SHC items were submitted to a factor analysis with a subsequent orthogonal varimax rotation of those factors with an eigenvalue greater than one. To provide an interpretation of the resulting factors, an item was assigned to a factor if the item loading was at least 0.5. To check the stability of the orthogonal varimax rotation, an oblique promax rotation was also performed. This type of rotation uses the same rotation criteria as varimax except that the factors are no longer forced to be orthogonal (Fahrmeir et al. 1996). The factor scores determined within the factor analysis with varimax rotation are applied in the further statistical analyses. Each of these scores is a sum of the z-transformed items weighted with the item loadings for the corresponding factor. In the following, the sets of factor scores belonging to the same factor will be referred to as SHC-factors. These factors represent the information contained in the 38 original items in a very parsimonious way. Moreover, these factors are orthogonal. Hence, the influence of each factor on HRQoL and physician visits can be investigated independently by means of multiple regression equations, without any problems due to multicollinearity.

The relationship between the SHC-factors and the first item of the SF12 was investigated by means of the cumulative logit model (CLM). The CLM was chosen because the distances between the response categories of the HRQoL-item cannot be assumed to be equal, and because the CLM is specially designed for criterion variables with exactly these characteristics (Andreß et al. 1997). The CLM presupposes that the $m$-category ordinal criterion variable is represented by $m$-1 different binary variables. Each of these binary variables refers to a different dividing point between the ordinal categories of the criterion variable. The first binary variable refers to the dividing point between the highest category and all the remaining categories. It is coded as one if the subject has chosen the highest category. Otherwise it is coded as zero. The second binary variable refers to the dividing point between the two highest and all the remaining categories. It is coded as one if the subject has chosen either the highest or the second highest category. Otherwise it is coded as zero. The remaining binary variables are constructed correspondingly. An analysis according to the CLM consists of computing logistic regressions for all $m$-1 binary variables with the constraint that the

multiplicative weights for the predictor variables do not vary between the resulting *m*-1 regression equations. The additive parameters, in contrast, are allowed to vary. After multiplying them by minus one, each of these additive parameters represents the boundary between the categories separated by the corresponding binary variable.

The difference between the higher and the lower boundary of a category is the width of the category. If the widths of different categories are different then the CLM provides more valid estimates of the multiplicative weights of the predictor variables than, for example, a simple linear regression model. To check whether the category widths differ significantly, the CLM was compared with a model in which – all other features being equal – the category widths of the criterion variable were set to be equal. The total influence of all SHC-factors on the HRQoL item was checked by means of the pseudo $R^2$ of McFadden ($R^2_M$) and Nagelkerke ($R^2_N$). In both statistics, the model in which the boundaries between the criterion variable categories are estimated without reference to the predictor variables was taken as the initial model. In the following, this model will be referred to as the boundary model.

The relationship between the SHC-factors and the two SF12 sum scores was analysed using linear regression. The relationship between the SHC-factors and physician visits was analysed by means of ordinary logistic regression. The total influence of all SHC-factors on physician visits was checked using $R^2_M$ and $R^2_N$. In contrast to the analyses with the CLM and in line with common practice in ordinary logistic regression, the mean, i. e. the percentage of persons visiting the respective type of physician, was taken as the initial model for both statistics.

All regression analyses were performed both for each sex separately and for both sexes together. In the sex-specific models, the SHC-factors, age and interactions between age and SHC-factors were taken as independent variables. In the integrated models, sex, interaction between sex and age, interactions between sex and SHC-factors, as well as interactions between sex, age and SHC-factors were added to these. In the cumulative logit model also the interactions between category boundaries and sex were included. In all analyses, age was dichotomised into the categories "< 50" and "> 50". The effects of the SHC-factors on the different criterion variables were statistically tested both within the integrated and within the sex-specific models. Sex differences in the effects of SHC-factors were statistically tested by means of the interactions between sex and SHC-factors in the integrated models.

For all regression models, predictions were computed for different hypothetical response patterns of the 38 item SHC-questionnaire to demonstrate the differential influence of the different SHC-factors. Pairs of response patterns were constructed so that two conditions were fulfilled: 1) the sum scores of both patterns were identical, and 2) one pattern only involved complaints for items that load high on SHC-factors with large regression weights, whereas the other pattern only involved complaints for items loading low on these factors.

## Results

*Factor analysis*

The principal component factor analysis yielded eight factors with an eigenvalue greater than one. Together these eight factors explain 54.19 % of the total item variance. The first of these factors already explains 28.56 %, the second 5.77 % (see Table 1). The orthogonal varimax rotation yielded the following eight factors: 1) anxiety/depression (seven items), 2) exhaustion (six items), 3) difficulty in breathing (three items), 4) pain (four items), 5) disturbance of sensations in the extremities (three items), 6) digestive trouble (three items), 7) nausea/weight loss (two items), and 8) sensitivity to temperature (two items) (see Table 2). With the assignment criterion applied here, eight of the 38 items could not be assigned to any of the eight factors. The promax rotation only yielded minor changes. In contrast to the varimax rotation, it was possible to assign the item "heart trouble" to the first factor, the items "lack of concentration" and "feeling of faintness" could not be assigned to any factor, and the item "trembling" could be assigned to the factor "nausea/weight loss".

*Relation to health-related quality of life*

The CLM fits the data significantly better than the model in which the widths for the first item of the SF12 are set to

| | Factor | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Eigenvalue | 10.85 | 2.19 | 1.72 | 1.43 | 1.18 | 1.12 | 1.06 | 1.03 |
| Percentage of explained variance | 28.56 | 5.77 | 4.53 | 3.77 | 3.11 | 2.94 | 2.80 | 2.71 |
| Cumulative percentage of explained variance | 28.56 | 34.33 | 38.86 | 42.63 | 45.74 | 48.68 | 51.48 | 54.19 |

**Table 1** Factor analysis of SHC items without rotation: factors with eigenvalues greater than one

**Table 2** Factor analysis of SHC items with orthogonal varimax rotation

| Item[b] | Factor[a] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1) Anxiety/depression | | | | | | | | |
| Inner restlessness (8), Z | **0.72** | 0.27 | 0.04 | 0.15 | 0.10 | 0.16 | 0.07 | 0.06 |
| Dejection, depression (24) | **0.67** | 0.29 | 0.11 | 0.09 | 0.11 | 0.05 | 0.09 | 0.08 |
| Feelings of anxiety (18), Z | **0.66** | 0.09 | 0.27 | 0.16 | 0.09 | 0.10 | 0.23 | 0.02 |
| Brooding (31), Z | **0.65** | 0.25 | –0.02 | 0.08 | 0.07 | 0.05 | 0.13 | 0.17 |
| Inner tension (22), Z | **0.62** | 0.38 | 0.06 | 0.06 | 0.00 | 0.13 | 0.02 | 0.19 |
| Irritability (7), Z | **0.53** | 0.35 | –0.03 | 0.09 | –0.03 | 0.23 | –0.00 | 0.19 |
| Insomnia (10), Z, B | **0.50** | 0.03 | 0.09 | 0.25 | 0.29 | 0.10 | 0.07 | 0.01 |
| 2) Exhaustion | | | | | | | | |
| Tiredness (12), Z, B | 0.22 | **0.70** | 0.09 | 0.21 | 0.07 | 0.09 | 0.14 | 0.03 |
| Excessive need of sleep (35), Z, B | 0.10 | **0.67** | 0.07 | 0.11 | 0.04 | 0.06 | 0.16 | 0.30 |
| A lack of energy (20), Z | 0.39 | **0.63** | 0.13 | 0.05 | 0.12 | 0.12 | 0.04 | 0.06 |
| Fatigue (5), Z, B | 0.34 | **0.63** | 0.14 | 0.16 | 0.13 | 0.20 | 0.06 | –0.02 |
| Diminished ability to concentrate (21), Z | 0.40 | **0.54** | 0.11 | 0.06 | 0.15 | 0.10 | 0.04 | 0.14 |
| A feeling of weakness (3), Z, B | 0.32 | **0.51** | 0.26 | 0.21 | 0.25 | 0.12 | 0.12 | –0.11 |
| 3) Difficulty in breathing | | | | | | | | |
| Attacks of breathlessness (15), Z, B | 0.07 | 0.12 | **0.81** | 0.07 | 0.14 | 0.04 | –0.02 | 0.02 |
| A feeling of suffocation (16), Z | 0.09 | 0.09 | **0.72** | 0.02 | 0.00 | 0.11 | 0.05 | 0.07 |
| Shortness of breath (27), Z | 0.13 | 0.12 | **0.69** | 0.09 | 0.19 | 0.09 | 0.02 | 0.16 |
| 4) Pain | | | | | | | | |
| Back pain or lumbago (1), Z, B | 0.11 | 0.11 | 0.07 | **0.73** | 0.17 | 0.06 | –0.04 | 0.11 |
| Pain in the neck and the shoulders (37), Z, B | 0.16 | 0.17 | 0.01 | **0.72** | 0.09 | 0.12 | 0.10 | 0.17 |
| Pain in joints or limbs (2), Z, B | 0.13 | 0.03 | 0.14 | **0.57** | 0.43 | 0.08 | –0.12 | 0.12 |
| Headache, pressure in the head or pain in the face (13), Z | 0.15 | 0.24 | 0.01 | **0.52** | –0.06 | 0.20 | 0.32 | –0.10 |
| 5) Disturbance of sensations in the extremities | | | | | | | | |
| Restless feeling in the legs (32), Z | 0.18 | 0.04 | 0.10 | 0.11 | **0.77** | 0.14 | 0.13 | 0.11 |
| A sensation of heaviness or fatigue in the legs (9), Z, B | 0.14 | 0.20 | 0.14 | 0.26 | **0.68** | 0.15 | 0.08 | 0.05 |
| A sensation of numbness (or of burning or itching) in the hands and/or feet (25), Z, B | 0.11 | 0.11 | 0.11 | 0.23 | **0.57** | 0.20 | 0.18 | 0.15 |
| 6) Digestive trouble | | | | | | | | |
| Heartburn or belching due to stomach acidity (6), Z, B | 0.07 | 0.05 | 0.04 | 0.04 | 0.16 | **0.69** | –0.08 | 0.08 |
| A sensation of pressure or excessive fullness in the stomach (4), Z, B | 0.21 | 0.22 | 0.08 | 0.11 | 0.16 | **0.66** | –0.01 | 0.02 |
| Stomach-aches or abdominal discomfort (19), Z | 0.16 | 0.19 | 0.08 | 0.21 | 0.07 | **0.58** | 0.25 | –0.06 |
| 7) Nausea/weight loss | | | | | | | | |
| Weight loss (38), Z, B | 0.04 | 0.10 | –0.08 | –0.01 | 0.15 | –0.13 | **0.58** | 0.21 |
| Nausea (30), Z, B | 0.19 | 0.16 | 0.12 | 0.13 | 0.03 | 0.34 | **0.58** | 0.03 |
| 8) Sensitivity to temperature | | | | | | | | |
| Extreme sensitivity to cold (34), Z, B | 0.12 | 0.32 | 0.03 | 0.21 | 0.18 | 0.00 | 0.13 | **0.56** |
| Extreme sensitivity to heat (33), Z, B | 0.25 | 0.08 | 0.16 | 0.11 | 0.21 | 0.02 | 0.02 | **0.53** |
| Not assigned to any of the factors | | | | | | | | |
| A feeling of dizziness or light-headedness (11), Z, B | 0.25 | 0.27 | 0.25 | 0.36 | 0.20 | 0.10 | 0.31 | –0.18 |
| Difficulty in hearing (14) | –0.03 | 0.18 | 0.32 | –0.01 | 0.31 | –0.10 | –0.05 | –0.03 |
| Palpitation or throbbing of the heart, or skipping of heart beats (17), Z, B | 0.49 | 0.00 | 0.38 | 0.26 | 0.18 | 0.06 | 0.18 | –0.01 |
| Sensitivity to the weather (23) | 0.25 | 0.17 | 0.20 | 0.40 | 0.22 | 0.02 | –0.04 | 0.23 |
| A feeling of having a lump or constriction in the throat, or of choking (26), Z, B | 0.18 | 0.01 | 0.34 | 0.12 | –0.03 | 0.39 | 0.27 | 0.42 |
| Difficulty in swallowing (28), Z, B | 0.09 | 0.01 | 0.37 | 0.09 | –0.05 | 0.37 | 0.29 | 0.41 |
| Stabbing pains, twinges or aching in the chest (29), Z, B | 0.29 | 0.01 | 0.34 | 0.27 | 0.09 | 0.17 | 0.32 | 0.02 |
| Trembling (36), Z, B | 0.28 | 0.14 | 0.22 | –0.05 | 0.25 | 0.01 | 0.46 | 0.01 |
| Eigenvalue | 4.27 | 3.35 | 2.76 | 2.63 | 2.35 | 2.10 | 1.70 | 1.43 |
| Percentage of explained variance | 11.23 | 8.82 | 7.25 | 6.93 | 6.17 | 5.54 | 4.48 | 3.77 |
| Cumulative percentage of explained variance | 11.23 | 20.05 | 27.30 | 34.23 | 40.40 | 45.94 | 50.42 | 54.19 |

[a] Factors are: 1) anxiety/depression, 2) exhaustion, 3) difficulty in breathing, 4) pain, 5) disturbance of sensations in the extremities, 6) digestive trouble, 7) nausea/weight loss, 8) sensitivity to temperature. [b] Numbers in parentheses reflect the order of the items in the questionnaire. Z means: also contained in von Zerssen's complaint list (one of two parallel forms). B means: also contained in Braehler's Giessen Subjective Complaint List (57-item version).

be equal (likelihood ratio test statistics: integrated model: 107.65, df = 5, $p < 0.001$; women: 54.71, df = 2, $p < 0.001$; men: 51.76, df = 2, $p < 0.001$). The better fit of the integrated CLM is mainly caused by the main effects of the category boundaries. No interaction between boundaries and sex differs significantly from zero. According to the integrated model, the category "good" is the widest and the category "very good" the smallest (see Table 3).

The $R^2_M$ with the boundary model as the initial model are 0.22 for the total sample, 0.24 for women and 0.20 for men. The corresponding $R^2_N$ are 0.27, 0.29 and 0,25. For all statistics, the difference from zero is highly significant ($p < 0.001$). There

**Table 3** Category boundaries of the first SF-12 item

| Category | Upper boundary | Lower boundary | Width | p of average person[a] | Relative frequencies[b] |
|---|---|---|---|---|---|
| excellent | --- | 4.568 | --- | 0.010 | 0.021 |
| very good | 4.568 | 2.038 | 2.459 | 0.105 | 0.152 |
| good | 2.038 | –2.066 | 4.175 | 0.772 | 0.626 |
| fair | –2.066 | –4.989 | 2.852 | 0.106 | 0.172 |
| poor | –4.989 | --- | --- | 0.007 | 0.019 |

[a] Category probabilities of a person with average values (i.e. zero values) on all eight SHC-factors; no differentiation with respect to sex or age.
[b] Actual relative frequencies of the categories in the whole sample.

**Table 4** Regression coefficients for relationships between SHC-factors and SF12 variables[a]

| Factor | First item[b] | Sum scores[c] | |
|---|---|---|---|
| | | Physical | Mental |
| Total sample | | | |
| Anxiety/depression | –0.505*** (0.604) | –0.065*** | –0.480*** |
| Exhaustion | –0.406*** (0.667) | –0.151*** | –0.255*** |
| Difficulty in breathing | –0.542*** (0.582) | –0.230*** | –0.094*** |
| Pain | –0.694*** (0.499) | –0.349*** | –0.058*** |
| Disturbance of sensations in the extremities | –0.686*** (0.504) | –0.284*** | –0.022 |
| Digestive trouble | –0.067* (0.935) | –0.032* | –0.021 |
| Nausea/weight loss | –0.190*** (0.827) | –0.048** | –0.122*** |
| Sensitivity to temperature | –0.093*** (0.911) | –0.053*** | –0.010 |
| Women | | | |
| Anxiety/depression | –0.544*** (0.581) | –0.068*** | –0.490*** |
| Exhaustion | –0.421*** (0.656) | –0.175*** | –0.267*** |
| Difficulty in breathing | –0.521*** (0.594) | –0.231*** | –0.056**+ |
| Pain | –0.706*** (0.494) | –0.331*** | –0.073*** |
| Disturbance of sensations in the extremities | –0.660*** (0.517) | –0.300*** | –0.053*+ |
| Digestive trouble | –0.079 (0.924) | –0.037* | –0.027 |
| Nausea/weight loss | –0.195*** (0.823) | –0.032 | –0.145*** |
| Sensitivity to temperature | –0.137** (0.911) | –0.086***+ | –0.019 |
| Men | | | |
| Anxiety/depression | –0.465*** (0.628) | –0.061** | –0.475*** |
| Exhaustion | –0.390*** (0.677) | –0.127*** | –0.249*** |
| Difficulty in breathing | –0.563*** (0.570) | –0.227*** | –0.141***+ |
| Pain | –0.682*** (0.505) | –0.343*** | –0.038 |
| Disturbance of sensations in the extremities | –0.711*** (0.491) | –0.265*** | –0.009+ |
| Digestive trouble | –0.055 (0.947) | –0.028 | –0.014 |
| Nausea/weight loss | –0.185*** (0.831) | –0.062*** | –0.102*** |
| Sensitivity to temperature | –0.049 (0.952) | –0.022+ | –0.001 |

[a] Significance levels are indicated as follows: for deviation of regression coefficients from zero: * = p<0.05, ** = p<0.01, *** = p<0.001; for deviation from the corresponding statistic for the opposite sex: + = p<0.05, ++ = p<0.01, +++ = p<0.001.
[b] Regression coefficients within a cumulative logit model; coefficients refer to z-transformed predictors; odds-ratios in brackets.
[c] Standard regression coefficients within a linear regression model.

are no sex differences in the effects of the SHC-factors on the first item of the SF12. All factors have a highly significant influence. The extent of the influence is different for the different factors. It is greatest for pain, second greatest for the disturbance of sensations in the extremities, and third greatest for difficulty in breathing. It is minimal for nausea/weight loss, sensitivity to temperature and digestive trouble (see Table 4).

The adjusted multiple $R^2$ for the linear regression of the physical sum score on the eight SHC-factors are 0.40 for the total sample, 0.40 for women and 0.39 for men. The corresponding statistics for the mental sum score are 0.36, 0.36 and 0.32. There are slight sex differences in the effects of the SHC-factors on both sum scores. Sensitivity to temperature affects the physical sum score of women but not of men. Difficulty in breathing effects the mental sum score of men more than the corresponding score in women. Disturbance of sensations in the extremities affects the mental sum score of women but not that of men. Apart from this, the patterns for both sexes are very similar. For both sexes, the pattern of relationships with the individual SHC-factors differs between the two sum scores. The physical sum score is mainly determined by pain, disturbance of sensations in the extremities and difficulty breathing, the mental sum score mainly by anxiety/depression and exhaustion (see Table 4).

The fact that the different factors have such a different effect implies that very different values of the HRQoL variables are predicted for certain patterns of complaints with the same sum score. This holds true for the probabilities of the first SF12 item as well as the two SF12 sum scores (see Table 5).

*Relation to physician visits*

In the total sample, the integrated effect of all model variables on physician visits is statistically significant for all eleven groups of doctors (see Table 6). However, $R^2_M$ and $R^2_N$ are rather low. They range from 0.02 to 0.21 and from 0.03 to 0.23 respectively (see Table 6). In the female subgroup, all model variables together show a statistically significant effect, except for surgeons; in the male group the exception is skin specialists. The $R^2_M$ range from 0.02 to 0.15 in the female subgroup and from 0.03 to 0.28 in the male subgroup. The $R^2_N$ range from 0.03 to 0.21 and from 0.02 to 0.30 respectively (see Table 6).

There are only few sex differences with respect to the effects of the SHC-factors. Anxiety/depression induces only women to visit their general practitioner, but not men. In contrast, the same factor induces men more than women to see a psychotherapist or psychiatrist. Exhaustion affects the tendency of men to visit a urologist but not that of women. Disturbance of the sensations in the extremities affects men's tendency to visit an unspecified other physician but not the corresponding tendency of women. Women's tendency to visit their general practitioner decreases with digestive trouble whereas men's tendency increases. However, both tendencies do not differ significantly from no tendency at all. Sensitivity to temperature affects women's tendency to visit internists and other physicians, whereas it has no such effect in men (see Table 6). However, since 88 interactions between SHC-factors and sex were tested and only 7 were found to be significant, all differences between the sexes can still be explained by statistical error.

In the total sample, the physician visits which are determined most by the model's variables are those to the psychotherapist/psychiatrist ($R^2_M = 0.21$; $R^2_N = 0.23$), to the orthopaedist ($R^2_M = 0.13$; $R^2_N = 0.19$) and to the urologist ($R^2_M = 0.13$; $R^2_N = 0.19$). The eight SHC-factors have very different effects on the visits to the different groups of physicians (see Table 6). Anxiety/depression and exhaustion mostly influence visiting

**Table 5** Predicted values for SF12 variables[a]

| Pattern[b] | Pattern sum_score | Probabilities for categories of the first SF12 item | | | | | SF12 sum scores[c] | |
|---|---|---|---|---|---|---|---|---|
| | | excellent | very good | good | fair | poor | physical | mental |
| 1 | 30 | 0.00 | 0.00 | 0.23 | 0.62 | 0.15 | –3.74 | 1.94 |
| 2 | 30 | 0.01 | 0.10 | 0.77 | 0.11 | 0.01 | –0.09 | 0.45 |
| 3 | 21 | 0.05 | 0.34 | 0.59 | 0.02 | 0.00 | 2.73 | –2.72 |
| 4 | 21 | 0.00 | 0.03 | 0.62 | 0.33 | 0.03 | –2.04 | 2.01 |

[a] Without differentiation with respect to sex or age.
[b] Pattern 1: Strong complaints for items belonging to the factors difficulty in breathing, pain, and disturbance of sensations in the extremities; no complaints at all for all other items.
Pattern 2: Strong complaints for items not assigned to any factor or assigned to sensitivity to temperature; no complaints at all for all other items.
Pattern 3: Strong complaints for items belonging to anxiety/depression; no complaints at all for all other items.
Pattern 4: Strong complaints for items belonging to the factors pain and disturbance of sensations in the extremities; no complaints at all for all other items.
[c] Z-transformed predicted values. Standard deviations of the original predicted values are 0.54 for the physical and 0.57 for the mental sum score.

**Table 6** Relationship between SHC-factors and physician visits

| | Total impact (pseudo-$R^2$)[a] | | Impact of individual factors (odds-ratios)[b] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $R^2_M$ | $R^2_N$ | Anxiety/ depression | Exhaustion | Difficulty in breathing | Pain | Disturbance of the sensations in the extremities | Digestive trouble | Nausea/ weight loss | Sensitivity to temperature |
| Total sample | | | | | | | | | | |
| General practitioner | **0.03** | **0.05** | 1.12** | 0.95 | 1.10* | 1.21** | 1.14** | 1.01 | 1.02 | 0.98 |
| Internist | **0.10** | **0.16** | 1.24** | 1.06 | 1.32** | 1.22** | 1.17** | 1.23** | 0.97 | 1.07 |
| Surgeon | **0.02** | **0.03** | 1.07 | 0.89* | 1.04 | 1.16** | 1.16** | 0.99 | 1.08 | 1.06 |
| Orthopaedist | **0.13** | **0.19** | 1.15** | 1.03 | 1.10* | 2.03** | 1.40** | 0.97 | 0.92 | 1.12* |
| Urologist | **0.13** | **0.19** | 1.11 | 1.06 | 1.17** | 1.32* | 1.17* | 1.00 | 1.08 | 1.05 |
| Ear, nose & throat specialist | **0.03** | **0.05** | 1.06 | 1.17** | 1.15** | 1.19** | 1.00 | 1.01 | 1.06 | 0.99 |
| Eye specialist | **0.07** | **0.11** | 1.06 | 1.00 | 1.14** | 1.27** | 1.16** | 1.05 | 1.00 | 1.02 |
| Skin specialist | **0.03** | **0.04** | 1.12** | 1.04 | 0.99 | 1.13** | 0.98 | 1.07 | 0.99 | 1.02 |
| Neurologist | **0.09** | **0.12** | 1.51** | 1.36** | 1.09 | 1.30** | 1.24** | 1.02 | 1.15* | 0.96 |
| Psychotherapist/psychiatrist | **0.21** | **0.23** | 2.91** | 1.35** | 0.95 | 0.95 | 0.92 | 0.99 | 1.46** | 0.97 |
| Other physician | **0.06** | **0.07** | 1.09 | 1.17* | 1.05 | 1.33** | 1.04 | 1.02 | 1.14* | 1.01 |
| Women | | | | | | | | | | |
| General practitioner | **0.07** | **0.11** | **1.34**** + | 0.93 | 1.07 | 1.28** | 1.05 | **0.93**+ | 1.06 | 1.03 |
| Internist | **0.09** | **0.14** | 1.20** | 1.05 | 1.36** | 1.22** | 1.14* | 1.24** | 1.02 | **1.18**** + |
| Surgeon | 0.02 | 0.03 | 1.13 | 0.90 | 0.97 | 1.14* | 1.11 | 1.06 | 1.05 | 1.09 |
| Orthopaedist | **0.14** | **0.21** | 1.12 | 1.06 | 1.13* | 1.89** | 1.49** | 1.04 | 0.91 | 1.21** |
| Urologist | **0.04** | **0.06** | 1.08 | **0.94**+ | 1.22* | 1.37** | 1.22* | 1.04 | 1.08 | 1.04 |
| Ear, nose & throat specialist | **0.02** | **0.04** | 1.09 | 1.16** | 1.13* | 1.14* | 1.02 | 0.98 | 1.07 | 1.05 |
| Eye specialist | **0.08** | **0.13** | 1.06 | 0.95 | 1.14* | 1.22** | 1.14* | 1.12* | 1.04 | 1.06 |
| Skin specialist | **0.02** | **0.03** | 1.15** | 1.04 | 1.00 | 1.12 | 0.92 | 1.12* | 0.94 | 0.94 |
| Neurologist | **0.09** | **0.12** | 1.60** | 1.31** | 1.03 | 1.21* | 1.27** | 0.98 | 1.17* | 1.03 |
| Psychotherapist/psychiatrist | **0.15** | **0.17** | **2.28**** + | 1.41** | 0.97 | 0.99 | 0.78 | 0.98 | 1.25* | 1.00 |
| Other physician | **0.08** | **0.04** | 1.25* | 1.13 | 1.00 | 1.51** | 0.83++ | 1.04 | 1.23* | 1.24*++ |
| Men | | | | | | | | | | |
| General practitioner | **0.03** | **0.05** | **1.01**+ | 0.99 | 1.13* | 1.14* | 1.23** | **1.10**+ | 0.98 | 0.94 |
| Internist | **0.11** | **0.17** | 1.29** | 1.07 | 1.28** | 1.22** | 1.19* | 1.22** | 0.93 | **0.96**+ |
| Surgeon | **0.02** | **0.03** | 1.01 | 0.88 | 1.12 | 1.18* | 1.20** | 0.92 | 1.10 | 1.04 |
| Orthopaedist | **0.10** | **0.15** | 1.18* | 1.01 | 1.07 | 2.18** | 1.30** | 0.90 | 0.92 | 1.05 |
| Urologist | **0.13** | **0.20** | 1.13 | **1.19**** + | 1.12 | 1.27** | 1.13 | 0.97 | 1.08 | 1.05 |
| Ear, nose & throat specialist | **0.04** | **0.06** | 1.03 | 1.19* | 1.17** | 1.24** | 0.98 | 1.04 | 1.05 | 0.93 |
| Eye specialist | **0.05** | **0.09** | 1.06 | 1.05 | 1.15* | 1.32** | 1.17* | 0.99 | 0.97 | 0.98 |
| Skin specialist | **0.02** | **0.02** | 1.10 | 1.04 | 0.99 | 1.15 | 1.03 | 1.02 | 1.05 | 1.10 |
| Neurologist | **0.08** | **0.10** | 1.43** | 1.42** | 1.16 | 1.41** | 1.21 | 1.06 | 1.13 | 0.90 |
| Psychotherapist/psychiatrist | **0.28** | **0.30** | **3.73**** + | 1.28 | 0.93 | 0.91 | 1.08 | 1.00 | 1.71** | 0.95 |
| Other physician | **0.04** | **0.05** | 0.95 | 1.21 | 1.11 | 1.18 | **1.32**++ | 0.99 | 1.06 | **0.82**++ |

[a] Statistics which differ significantly from zero are written in bold figures.

[b] Odds-ratios refer to changes of one standard deviation. Significance tests are reported as follows: For deviation of odds-ratio from one (two-sided): * = $p<0.05$ and ** for $p<0.01$ (at least); for deviation from the corresponding value of the opposite sex + = $p<0.05$ and ++ = $p<0.01$ (at least). Values which deviate significantly from the corresponding value of the opposite sex are also written in bold figures.

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the psychotherapist/psychiatrist and the neurologist. Pain and disturbances of the sensations in the extremities have the greatest effect on visiting the orthopaedist. Moreover, these two factors also have the greatest total influence on all physician visits. Except for the psychotherapist/psychiatrist, pain affects visits to all physicians; disturbance of the sensations in the extremities still affects the visits to 7 of the 11 groups of physicians. The factors with the smallest effects on physician visits are digestive trouble and sensitivity to temperature. Each of these factors affects visits to only one group of physicians. Again, the fact that the different SHC-factors have such a different effect implies that SHC patterns with the same sum scores can be related in very different ways to the probabilities of physician visits (see Table 7).

## Discussion

As announced at the outset, the analyses presented here were performed in order to answer two questions:

1) Are SHCs actually related to HRQoL and the utilisation of physicians?
2) Is this relationship different for different kinds of SHCs?

In the following, these two questions will be discussed on the basis of the results just presented. For each question, we will first elaborate the consequences for the specific questionnaire considered here, and subsequently for typical SHC questionnaires in general.

The first question can, at least for the questionnaire considered here, easily be answered affirmatively, i.e. SHCs as assessed by this questionnaire are indeed related to HRQoL. This finding is simply an empirical confirmation of the assumption which was presumably made when this questionnaire was constructed. Hence, this statement provides justification for applying the results of this questionnaire in further analyses. Because this questionnaire consists of a selection of items which is quite typical of other SHC questionnaires, these questionnaires will most probably also be related to HRQoL and physician visits. The findings of Hinz et al. (2005) already support this assumption with respect to HRQoL.

The second question, i.e. whether different kinds of SHCs relate in different ways to HRQoL and the utilisation of physicians, requires a more extensive discussion. The answer to this question depends first of all upon the results of the unrotated factor analysis. These results have two features. On the one hand, the first factor already explains a considerable proportion of the total variance. On the other hand, a considerable proportion of the total variance remains unexplained and a substantial part of this can be explained by the next seven factors. The first feature can be interpreted as an argument against the existence of different kinds of SHCs, the second facet as an argument for the opposite. In our opinion, the first factor of the unrotated analysis represents a general tendency to suffer and the eight factors of the rotated analysis, i.e. the SHC-factors, tendencies to suffer from clusters of interrelated complaints. This interpretation implies that there are different kinds of SHCs. This interpretation is supported by the finding that the different SHC-factors relate very differently to HRQoL as well as to the utilisation of physicians. This finding also directly implies an affirmative answer to the second research question. Because the questionnaire applied is fairly typical of SHC questionnaires in general, this affirmative answer can more or less be generalised to SHCs in their entirety.

The fact that there are different kinds of SHCs which relate in different ways to HRQoL and the utilisation of physicians implies that the sum scores of typical SHC questionnaires do not represent all the information contained in their items sufficiently well. Two individuals with the same sum score but different item patterns can have very different expected values of

**Table 7** Relationship between SHC patterns and predicted probabilities of physician visits

| Group of physicians | Patterns[a] (sum scores in brackets) | | | |
|---|---|---|---|---|
| | 1 (30) | 2 (30) | 3 (21) | 4 (21) |
| General practitioner | 0.84 | 0.75 | 0.74 | 0.81 |
| Internist | 0.52 | 0.28 | 0.30 | 0.23 |
| Surgeon | 0.22 | 0.18 | 0.11 | 0.23 |
| Orthopaedist | 0.56 | 0.09 | 0.04 | 0.58 |
| Urologist | 0.30 | 0.16 | 0.07 | 0.20 |
| Ear, nose and throat specialist | 0.33 | 0.17 | 0.10 | 0.19 |
| Eye specialist | 0.60 | 0.34 | 0.22 | 0.48 |
| Skin specialist | 0.13 | 0.13 | 0.22 | 0.16 |
| Neurologist | 0.05 | 0.03 | 0.08 | 0.07 |
| Psychotherapist/psychiatrist | 0.00 | 0.01 | 0.58 | 0.00 |
| Other physician | 0.07 | 0.05 | 0.02 | 0.08 |

[a] Definitions see Table 5.

HRQoL and physician visits. Hence, for more differentiated analyses not the sum scores of these questionnaires should be applied, but only the sum scores of selected subgroups of items, or factor scores. For the questionnaire used here, the results of the factor analysis indicate which items should be grouped together. For other questionnaires new analyses may be necessary. If research into SHCs is to be intensified, a more general approach might be sensible. This approach would consist of developing a classification system for SHCs by means of which the selection of items for SHC questionnaires as well as the grouping of the selected items could be determined theoretically.

The conclusion described above contrasts with that reached by Hinz et al. (2005). On the basis of their results, these authors argue that the calculation of sum scores is useful and justified from a statistical perspective. They arrive at this conclusion because in their data the correlation coefficients between individual subscales concerning the same kind of SHCs are smaller than the correlation coefficients between individual subscales and non-specific sum-scores. In our opinion this effect is due to the fact that the answer to each SHC item is affected by two components: 1) the extent to which the subject actually suffers from the specific complaint and 2) the subject's general tendency to suffer. Aggregating conceptually different SHC items will produce a reliable and valid measure of the general tendency to suffer. Yet, the more the aggregated complaints differ, the less information the aggregated measure contains about specific complaints. Hence, whether sum scores or scores of subgroups are more appropriate depends upon the purpose for which the resulting measure is needed. If a general class of behaviour is to be predicted, e. g. visits to physicians in general, then an overall sum score will be the best choice. If, however, more specific behaviour is to be predicted , e. g. visits to a psychotherapist in contrast to visits to an orthopaedist, then scores based upon specific subgroups of SHC are more promising.

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*Conflict of interest*

There is no conflict of interest.

**Zusammenfassung**

**Subjektive Gesundheitsbeschwerden, gesundheitsbezogene Lebensqualität und Arztbesuche: Ergebnisse der Study of Health in Pomerania (SHIP)**

**Ziel:** Der Zusammenhang von subjektiven Gesundheitsbeschwerden mit gesundheitsbezogener Lebensqualität und Arztbesuchen soll untersucht werden.

**Methode:** Die Probanden waren 3'773 Teilnehmer an der **S**tudy of **H**ealth in **P**omerania (SHIP). Die Daten waren 1) 38 Aussagen zu subjektiven Gesundheitsbeschwerden, 2) die SF12 und 3) Aussagen zu den Besuchen von 11 unterschiedlichen Arztgruppen. Die Daten zu den subjektiven Gesundheitsbeschwerden wurden einer Faktorenanalyse mit anschließender Varimaxrotation unterzogen. Die Beziehungen der resultierenden Faktoren zum ersten SF12-Item (zusammenfassende Gesundheitsbewertung) wurden mit dem kumulativen Logitmodell, die Beziehungen zum physischen und mentalen Summenscore des SF12 mit linearer Regression und die Beziehungen zu den Arztbesuchen mit logistischer Regression analysiert.

**Ergebnisse:** Acht Faktoren haben Eigenwerte von größer als eins und erklären insgesamt 54.2 % der Gesamtvarianz. Die Ergebnisse der Varimaxrotation sind gut interpretierbar. Alle Faktoren zusammen mit Geschlecht und Alter beeinflussen das erste SF12-Item (Nagelkerke's $R^2$ = 0.27), beide SF12-Summenscores (physisch: $R^2$adj. = 0.40; mental: $R^2$adj. = 0.36), und alle Arztbesuche (Nagelkerke's $R^2$ zwischen 0.03 und 0.23) statistisch signifikant. Verschiedene Faktoren beeinflussen die Kriterienvariablen in unterschiedlicher Weise.

**Schlussfolgerungen:** Subjektive Gesundheitsbeschwerden sind wichtig. Summenwerte typischer Fragebögen zu Gesundheitsbeschwerden spiegeln nicht alle relevanten Aspekte der Beschwerden wider.

**Résumé**

**Santé subjective, qualité de vie et visites médicales: résultats de l'Etude sur la santé en Poméranie**

**Objectifs :** Etudier les relations existant entre les plaintes concernant la santé subjective, la qualité de vie en lien avec la santé et les visites médicales.

**Méthodes :** Les réponses de 3'773 personnes ont été obtenues (questionnaires & interviews) dans le cadre de l'Etude sur la santé en Poméranie. Une analyse factorielle a été effectuée sur les données en lien avec les plaintes concernant la santé subjective avec une rotation varimax. Les relations entre les facteurs en résultant et les variables restantes ont été analysées au moyen d'un modèle logit cumulé pour la première question du SF12 (évaluation globale de la santé), au moyen de la régression linéaire pour les scores physiques et mentaux du SF12 et enfin au moyen de la régression logistique pour les visites médicales.

**Résultats :** Huit facteurs ont obtenu des eigenvalues >1; ensemble, elles expliquent 54.2 % de la variance totale. Ces facteurs, avec le sexe et l'âge, influencent significativement la première question du SF12 ($R^2$ de Nagelkerke = 0.27), les deux scores totaux (physique: $R^2$adj. = 0.40; mental : $R^2$adj. = 0.36), ainsi que toutes les visites médicales ($R^2$ de Nagelkerke entre 0.03 et 0.23).

**Conclusions :** Les plaintes concernant la santé subjective sont importantes. Les scores totaux des questions sur la santé subjective ne reflètent par tous les aspects pertinents de ces plaintes

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