The relation between the number of symptoms and other health indicators in working men and women

IVO FOPPA, RICHARD H. NOACK *

Simple symptom counts are widely used indicators of ill-health in health survey research. However, there has only been little research aimed at a better understanding of symptom counts. The purpose of this study was to explore the number of symptoms (a summary score derived from 10 unspecific self-reported symptoms) in a 'healthy' population. We reanalysed data on a sample of 850 employed men and women (Berne Workplace Health Project). Stepwise ordinal logistic regression analysis was used to study the relation of the number of symptoms to contextual, person-related, behavioural, and health-related variables. In neither men nor women were any of the socio-demographic indicators significantly associated with the number of symptoms. Of the work-related variables, low job discretion and adverse work environment were significantly associated with the number of symptoms and there was a statistical trend for high job demands. In women, dissatisfaction with salary was the only work-related variable which was significant. The private context, on the other hand, seemed to be more influential for women than for men and there was a statistical trend for strain at home. Among the person-related factors studied, age and emotional problems were significantly associated to the number of symptoms in both men and women. Psychological ill-health and negative future orientation were significant only in men and immersion only in women. Physical inactivity in leisure time was the only behavioural variable found to be significantly associated to the number of symptoms. Among the health-related factors, poor self-rated health was significant for both gender groups, while obesity was significant only in men. Only categories of variables being hypothesized to be unfavourable in terms of health were associated with a higher number of symptoms. Most of the associations found seem to be theoretically meaningful. Despite methodological provisos, our findings support a conception of the number of symptoms as an indicator of general ill-health.

Key words: functional symptoms, health survey, multiple symptom reporting, indicators of ill-health

Simple summary scores or counts of unspecific functional symptoms are widely used in health surveys as indicators of subjective ill-health.[1] Despite the fact that such measures ignore the nature of individual symptoms and also do not allow symptom patterns to be taken into account, counts of self-reported symptoms have been shown to be strong predictors of health-related behaviour such as absenteeism, health care utilization and other health-related consequences.[2] Moreover, symptom counts are easy to assess and are therefore attractive for health survey research. However, it remains unclear what symptom counts actually measure. Can the number of symptoms an individual experiences be regarded as an indicator of 'stress'?[3] Or does it indicate a degree of general psychological ill-health? There is abundant literature on many instruments assessing unspecific physical symptoms (e.g. the psychosomatic symptom check list or the Hopkins symptom checklist). Literature on simple symptom counts is, however, virtually non-existent.[2]

In a recent study on back pain[4] we found that reporting more than 2 symptoms (other than back pain) was strongly associated with the likelihood of experiencing back pain. This association was independent from other, more specific factors predicting back pain and could therefore represent something like symptom proneness. While in the study mentioned[4] the focus was more on specific correlates of back pain, the purpose of the present study was in exploring the 'unspecific' aspect of self-reported symptoms. We were mainly interested in exploring the relation between a simple symptom count and other factors representing a variety of dimensions in a 'healthy', i.e. working, population. In addition, by calibrating this measure against a number of other health indicators we hoped to contribute to a better understanding of the meaning of simple symptom counts.

* I. Foppa[1], R.H. Noack[2]
1 Division of Health Research, Institute of Social and Preventive Medicine, University of Berne, Switzerland
2 Institute of Social Medicine, University of Graz, Austria
Correspondence: Ivo Foppa, Department of Epidemiology, Harvard School of Public Health, 677 Huntington Avenue, Boston, MA 02115, USA, tel +1 617 4321050, fax +1 617 2627485

METHODS

Sample

This study was based on data from the Berne Workplace Health Project. The aim and background of that project have been reported elsewhere.[5,6] In short, workers and

employees from 2 middle-sized enterprises were enrolled and randomized to different interventions aiming at the modification of cardiovascular risk factors. Enterprise A was a supermarket chain, while enterprise B was a municipal power distribution service.

Participation was voluntary and during working hours. The sample consisted of 80.4% of all workers and employees, with 227 women and 623 men. A more detailed description of the sample has been given elsewhere.[4]

Data and variables

Data on various dimensions of the work environment, private context, of health and health-related behaviour and on personal characteristics were collected by personal interview and questionnaire. Furthermore, the blood pressure, weight and height of the subjects were measured and venous blood samples were taken by trained nurses who also conducted the interviews. Physical symptoms were assessed in the questionnaire by using the following questions (the expressions in parentheses are used in the results section):

'How much, during the last 4 weeks, have you suffered from: back pain or lower-back pain (back pain); pain in joints or limbs (joint pain); general weakness, fatigue, lack of energy (fatigue); dyspepsia (dyspepsia); pain or feeling of pressure in the abdomen (abdominal pain); diarrhoea, constipation, or both (diarrhoea/constipation); difficulties going to sleep (insomnia 1); wakefulness during the night (insomnia 2); headache, feeling of pressure in the head, facial pain (headache); and irregular heart beat, racing heart, palpitations (palpitations)?'.

The following response categories were provided: 'not at all', 'hardly', 'moderately', and 'severely'. The number of symptoms was defined as the number of moderate or severe symptoms. For multivariate analysis, counts higher than 4 were combined into one category. Pressure in the chest and productive cough were not included in the count because both quite likely reflect manifestations of organic disease rather than mainly functional symptoms. If a subject had missing values for up to 3 symptoms, the number of symptoms was calculated by up-weighing the actual number of symptoms defined by the factor $10/(10-k)$, where k is the number of symptoms with missing values. The resulting number was then rounded to the next integer. If values were missing for more than 3 symptoms, the number of symptoms was set to missing. A detailed description of the variables has been published elsewhere.[4]

The theoretical framework for the underlying project and for this study as well was a general demand-resource model, a generalized version of the Karasek et al.'s[7] job demand model. It assumes that chronic imbalance of external and internal health-related demands, on the one hand and resources, on the other hand causes psychophysiological strain. Given a certain predisposition, this may trigger psychological or physical symptoms. This heuristic model guided the coding of the variables (dichotomizing in favourable and unfavourable categories) and the selection of variables for analysis. We assumed that factors perceived as 'unfavourable' with respect to future health outcome were positively related to the number of symptoms.

Data analysis

All statistical analyses were performed with SAS.[8,9] Data analysis included 4 steps. Firstly, prevalences of individual symptoms were computed for men and women and compared with Pearson's chi-square test. Secondly, the distribution of the number of symptoms was analysed and compared between men and women, by the Wilcoxon rank sum test (normal approximation). Thirdly, bivariate associations were carried out and tested by Wilcoxon rank sum tests. In a final step, ordinal stepwise logistic regression analysis was used to identify the variables with the strongest association to the number of symptoms if other factors were controlled for. Variables for which a p of <0.1 was obtained for the bivariate association were used for model fitting. However, variables more likely to be caused by the number of symptoms than the reverse (frequently seeing a physician, use of analgesics and use of tranquillizers) were excluded from model fitting. Moreover, history of intestinal problems and history of rheumatic disorder were not included because they may represent a similar factor as the number of symptoms. If job strain or strain at home were included in the basic model, the respective 'main effect' variables (low job discretion, high job demands; high demands at home and low control at home) were also included. However, these variables would be allowed to drop out. The inclusion and stay criterion were defined as $p<0.1$. Distinct models were fitted for men and women. Finally, to increase the power, the fitted models were applied to the whole (male and female) sample. The terms 'statistical trend' or 'borderline statistical significance' are used to refer to a p value between 0.05 and 0.1.

RESULTS

Univariate analysis

- Prevalence of symptoms

Back pain was the most common symptom among both men (32.22%) and women (44.08%). Like back pain, the following symptoms were significantly ($p<0.005$) more common among women than among men: fatigue (36.19% versus 23.33%), constipation/diarrhoea (21.43 versus 13.01%) and headache (31.75% versus 15.56%). Dyspepsia and insomnia 2 were more common among men than among women (11.92% versus 7.18% and 20.28% versus 16.75%, respectively) but these differences were not statistically significant ($p>0.5$).

- The distribution of the number of symptoms

Sixty-nine subjects had missing values for the number of symptoms and were excluded from further analysis. Most of them (94%) had missing values for all of the 10 individual symptoms.

Of the men 39.7% and of the women 31.3% were symptom free. On average, women reported significantly more symptoms than men (2.3 versus 1.8, $p=0.009$), but comparing only those reporting at least one symptom, there

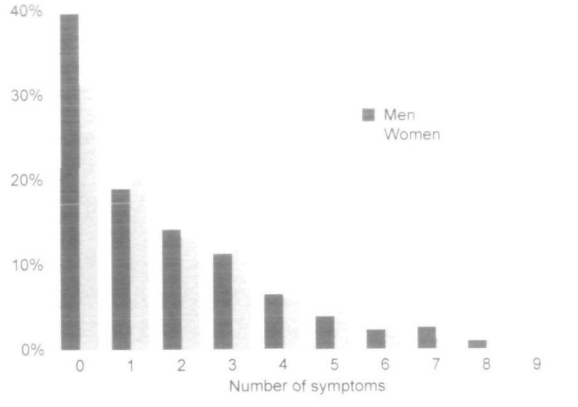

Figure The distribution of the number of symptoms among men (n=572) and women (n=210) (Berne Workplace Health Project)

was no statistically significant difference between women and men (3.1 versus 2.7, p=0.168). The distribution of the number of symptoms is shown in the *figure*.

Bivariate analysis of the number of symptoms

Table 1 explores the relation between numerous variables and the number of symptoms by comparing 'favourable' and 'unfavourable' categories of the dichotomous variables with respect to the mean number of symptoms.

- Sociodemographic factors

In neither men, nor women were any of the sociodemographic variables significantly associated with the number of symptoms.

- Work-related factors

In men, the categories of all work-related factors hypothesized to be unfavourable, with the exception of dissatisfaction with salary, high responsibility and high competition (p=0.052) were significantly associated with significantly more symptoms than the categories presumably more favourable in terms of health. Most variables significantly associated with the number of symptoms in men were also significant for women with the exception of low job discretion, low recognition, and adverse environment. Moreover, high competition and dissatisfaction with salary were significantly associated to the number of symptoms in women.

- Private context

High demands at home, strain at home and stressful life event were significantly associated with a higher number of symptoms in both genders (for men, there was only a statistical trend for the latter variable). There was a statistical trend for poor social network in men only.

- Person-related factors

In both genders, immersion, low life satisfaction, psychological ill-health, emotional problems, and negative future orientation were significantly associated with a high number of symptoms, while vigour was not.

- Behavioural factors

Frequently seeing a physician was significant for both genders. Physical inactivity in leisure time and use of tranquillizers were significantly associated with the number of symptoms in men (for the latter variable, a statistical trend was found for women).

- Health-related factors

Poor self-rated health, history of intestinal problems, history of 'rheumatism', pressure in chest, and productive cough were significantly associated with the number of symptoms in both genders. Obesity was significantly associated with the number of symptoms in men only and there was a statistical trend for hypertension. High cholesterol/HDL-cholesterol ratio was significant in women only.

Multivariate analysis

The results of the logistic regression analysis are given in *table 2*. The interpretation of odds ratio estimates from an ordinal logistic regression is similar to conventional logistic regression. However, in ordinal logistic regression analysis, odds ratio estimates refer to a comparison between any adjacent dichotomous categories defined on the ordinal outcome variable (for example, the comparison between those without any symptoms and those with at least 1 symptom or between those with less than 3 and those with more than 3 symptoms).

- Work-related factors

In men, low job discretion and adverse work environment were significantly associated with a high number of symptoms and there was a statistical trend for high job demands. In women, only dissatisfaction with salary remained significant.

- Private context

Strain at home remained in the model for women but only with borderline statistical significance. None of the private context variables remained significant in men.

- Person-related factors

Age and emotional problems were statistically significant in both genders. Psychological ill-health and negative future orientation were statistically significant only for men, while immersion was significant only in women.

- Behavioural factors

Physical inactivity in leisure time was the only behaviourally related variable which was significant in the model fitted for men. None of these variables remained in the model fitted for women.

- Health-related factors

Poor self-rated health was significant for both genders, whereas obesity was significantly associated with the number of symptoms in men only.

DISCUSSION

We have studied the relation of the number of symptoms to other health-related variables in cross-sectional data from a working population. In a cross-sectional study it is logically impossible to identify cause and effect statistically. This inherent limitation of cross-sectional studies makes the interpretation of associations difficult. For example, emotional problems that are strongly associated with the number of symptoms could generate physical (or 'psychosomatic') symptoms. However, persisting symptoms could also lead to emotional symptoms. Furthermore, and this seems the most likely mechanism, there

Table 1 The relation of sociodemographic, work-related, private context-related, person-related, behavioral, and health-related factors to the number of symptoms

	Men			Women		
Variable	Prevalence in % (absolute) [a]	Mean number of symptoms [b]	P value [c]	Prevalence in % (absolute)	Mean number of symptoms	P value
Sociodemographic factors						
Blue-collar worker	77.82 (435)	1.84 (1.67)	0.359	85.94 (165)	2.42 (1.81)	0.329
Part-time work	2.10 (12)	2.83 (1.76)	0.102	35.71 (75)	2.49 (2.14)	0.414
Basic education	15.41 (88)	1.80 (1.78)	0.885	33.33 (70)	2.46 (2.17)	0.689
Foreigner	6.32 (36)	2.03 (1.77)	0.667	4.76 (10)	2.60 (2.25)	0.368
Celibacy	32.05 (183)	1.64 (1.85)	0.239	67.62 (142)	2.22 (2.37)	0.816
Living alone	17.57 (100)	1.70 (1.81)	0.576	43.81 (92)	2.27 (2.26)	0.633
Work-related factors						
Low job discretion	28.04 (159)	2.19 (1.64)	0.002	50.73 (104)	2.38 (2.13)	0.471
High job demands	29.25 (167)	2.57 (1.46)	0.000	33.81 (71)	3.25 (1.76)	0.000
Job strain	7.79 (44)	3.09 (1.69)	0.000	15.69 (32)	3.22 (2.09)	0.012
Physically demanding job	42.43 (241)	2.21 (1.49)	0.000	35.92 (74)	2.85 (1.94)	0.01
Time pressure	40.85 (230)	2.11 (1.58)	0.005	23.65 (48)	2.83 (2.11)	0.019
High subjective work load	30.40 (173)	2.61 (1.43)	0.000	34.47 (71)	3.13 (1.84)	0.000
Low recognition through work	37.65 (215)	2.00 (1.65)	0.020	40.95 (86)	2.28 (2.26)	0.666
High competition	47.89 (273)	1.92 (1.66)	0.052	35.44 (73)	2.99 (1.87)	0.001
Low job satisfaction	35.20 (201)	2.24 (1.54)	0.000	32.38 (68)	2.76 (2.03)	0.012
Dissatisfaction with salary	38.30 (216)	1.91 (1.73)	0.192	49.76 (103)	2.68 (1.90)	0.001
Adverse work environment	34.83 (194)	2.11 (1.62)	0.011	6.86 (14)	2.50 (2.26)	0.410
High responsibility	40.36 (226)	1.85 (1.77)	0.822	6.37 (13)	2.77 (2.25)	0.317
Private context						
High demands	28.47 (162)	2.01 (1.70)	0.052	42.03 (87)	2.78 (1.88)	0.004
Low control	40.92 (232)	1.81 (1.77)	0.885	41.06 (85)	2.22 (2.29)	0.645
Strain at home	11.03 (63)	2.43 (1.70)	0.01	17.62 (37)	3.00 (2.11)	0.056
Stressful life event	7.94 (45)	2.64 (1.71)	0.008	17.62 (37)	2.78 (2.16)	0.015
Poor social network	29.45 (167)	2.04 (1.66)	0.084	31.58 (66)	2.47 (2.19)	0.215
Person-related factors						
Immersion	26.19 (149)	2.69 (1.47)	0.000	31.07 (64)	3.47 (1.75)	0.000
Low life satisfaction	36.49 (204)	2.32 (1.52)	0.000	39.11 (79)	2.91 (1.81)	0.002
Psychological ill-health	26.94 (153)	3.00 (1.35)	0.000	46.15 (96)	3.14 (1.49)	0.000
Emotional problems	29.07 (166)	2.94 (1.31)	0.000	37.02 (77)	3.65 (1.44)	0.000
Negative future orientation	25.88 (147)	2.57 (1.52)	0.000	25.84 (54)	3.22 (1.92)	0.001
Vigour	40.88 (233)	1.88 (1.72)	0.634	37.56 (77)	2.57 (2.10)	0.562
Behavioural factors						
Physical inactivity in leisure time	46.36 (261)	2.18 (1.46)	0.000	57.56 (118)	2.33 (2.10)	0.743
Current smoking	36.43 (200)	1.84 (1.75)	0.341	27.09 (55)	2.58 (2.06)	0.17
Use of tranquillizers	3.85 (22)	4.23 (1.69)	0.000	4.76 (10)	3.70 (2.20)	0.052
Frequently seeing a physician	25.22 (144)	2.64 (1.50)	0.000	38.57 (81)	2.88 (1.88)	0.002
Daily consumption of alcohol	54.82 (313)	1.73 (1.85)	0.944	21.90 (46)	2.15 (2.30)	0.801
Use of analgesics	7.71 (44)	2.61 (1.72)	0.011	7.14 (15)	3.27 (2.19)	0.119
High consumption of animal fat	35.80 (203)	1.71 (1.83)	0.228	34.76 (73)	2.37 (2.21)	0.403
Irregular meals	36.51 (207)	1.84 (1.77)	0.787	41.63 (87)	2.24 (2.30)	0.697
Health-related factors						
Poor self-rated health	10.68 (61)	3.39 (1.59)	0.000	9.05 (19)	4.89 (2.01)	0.000
History of intestinal problems	24.60 (138)	2.56 (1.52)	0.000	25.37 (52)	3.67 (1.74)	0.000
History of 'rheumatism'	21.10 (119)	2.62 (1.57)	0.000	16.35 (34)	3.26 (2.08)	0.007
Pressure in chest	8.63 (49)	4.20 (1.56)	0.000	10.00 (21)	4.71 (1.99)	0.000
Productive cough	13.93 (79)	2.85 (1.61)	0.000	10.95 (23)	3.83 (2.07)	0.001
Hypertension	15.47 (88)	2.18 (1.71)	0.095	8.57 (18)	3.17 (2.18)	0.093
High cholesterol/HDL cholesterol ratio	49.46 (275)	1.88 (1.69)	0.182	20.10 (40)	3.00 (2.13)	0.027
Obesity	12.26 (70)	2.46 (1.69)	0.004	17.62 (37)	2.70 (2.17)	0.228

a: Proportion in 'unfavourable' category
b: The figures in parentheses represent the mean number of symptoms in the 'favourable' category
c: Proportion in 'unfavourable' category

could be positive feedback loops between physical and emotional symptoms.

An even more fundamental problem is collinearity between explanatory variables which can lead to highly unstable effect estimates (e.g. odds ratios).[10] The development of methods of analysis that are more adequate for complex data structures which cannot readily be described by linear models should be a focus of future methodological research in this area. We have discussed methodological problems of this kind – that are by no means unique to this study – more thoroughly elsewhere.[4] As with most epidemiological studies on subjective health, our findings have to be interpreted with caution, in particular where they contradict established knowledge or previous results.

Keeping this proviso in mind we will now discuss our results in more detail. A surprising finding is that none of the social status variables (basic education and blue-collar worker) are associated with the number of symptoms. Although this would not be surprising in a multivariate analysis – as potential mediators of the effects of social status are included – it is, however, an unexpected finding in a bivariate analysis. Social or socioeconomic health gradients are an almost universal finding (the lower the status the poorer the health).[1,11] Insufficient power of the study to detect a difference is hardly a good explanation for this finding – at least in men where the mean number of symptoms is virtually identical for both status groups. A more plausible explanation would be the relative socioeconomic homogeneity of the sample.

The fact that women report consistently more symptoms than men is well known.[12] Some of the gender differences found for the factors associated with the number of symptoms may be attributable to differences between the male and the female proportion of the sample. For example, a considerable proportion of the women were only employed part-time, while only very few men worked part-time. For these women, the impact of the work environment on health is presumably smaller and, therefore, the influence of the private context larger than for men.

Low job discretion was strongly related to the number of symptoms reported and high job demands remained in the model fitted for men with borderline statistical significance. These 2 variables resemble the 2 dimensions of Karasek et al.'s[7] job strain model. In fact, symptom counts have been interpreted as a measure of stress.[12] Yet, job strain, which was defined according to Karasek et al.[7] was not significantly associated with the number of symptoms in the multivariate analysis. On the other hand, strain at home remained in the model fitted for women, whereas the 2 'main effect variables' did not. This is compatible with the differences between the male and female sample pointed to above.

Similarly, the fact that adverse work environment was related to the number of symptoms only in men but not in women could be attributed to such differences. Adverse environmental factors (noise, dust, handling of chemical substances and dangerous work) may also be perceived as stress, independently of job strain. Moreover, toxicological or allergic reactions could be involved.

Immersion was found to be predictive to the number of symptoms in women only. This is somewhat unexpected because, as we have seen, the health impact of the work environment is likely to be smaller in women employed part-time than in men employed full-time. A possible explanation could be that, due to their low job status, women experience more job stress than men and therefore have more problems in optimally coping with the demands of their job.

Two psychological scales were associated with the number of symptoms in both genders. Psychosocial problems such as depression and anxiety have been repeatedly shown to be associated with illness (e.g. Anehensel et al.[13]). Moreover, the functional symptoms as studied here could also be perceived as symptoms of depression and anxiety. Negative future orientation was related to the number of symptoms in men only. Again, this finding could be explained in a number of

Table 2 Stepwise logistic regression analysis of the number of symptoms on socioeconomic, work-related, private context-related, individual, behavioural and health-related variables in men and women

Variable	Men Estimated OR (95% CI)	Women Estimated OR (95% CI)
Work-related factors		
Low job discretion	1.56 (1.09–2.23)**	–[a]
High job demands	1.38 (0.96–2.00)*	–
Dissatisfaction with salary	–	2.31 (1.35–3.94)***
Adverse work environment	1.41 (1.01–1.96)***	–
Private context		
Strain at home	–	1.87 (0.94–3.70)*
Person-related factors		
Age	1.03 (1.02–1.05)****	1.03 (1.01–1.05)***
Immersion	–	2.58 (1.44–4.61)***
Psychological ill-health	2.29 (1.51–3.47)****	–
Emotional problems	2.97 (1.96–4.51)****	6.24 (3.48–11.19)****
Negative future orientation	1.51 (1.03–2.21)**	–
Behavioural factors		
Physical inactivity in leisure time	1.52 (1.10–2.09)**	–
Health-related factors		
Poor self-rated health	2.14 (1.26–3.63)***	7.04 (2.41–20.51)****
Obesity	1.70 (1.05–2.75)**	–

* p<0.1, ** p<0.05, *** p<0.01, **** p<0 001
OR: odds ratio; CI: confidence interval
a Variable not in the final model

ways, one being the small variance of this variable in women due to relative homogeneity in age, employment, salary and so on.

The association between physical inactivity in leisure time and the number of symptoms in men has several plausible interpretations. Firstly, physical activity in leisure time could reduce the risk of experiencing symptoms. The beneficial effect of physical activity is well-known.[14] Secondly, experiencing symptoms, such as back pain or joint pain, could interfere with physical activity. Finally, physical activity and symptom reporting could be manifestations of an underlying causal factor, a latent variable such as a general type of illness behaviour. It is most likely that the association is due to all these kinds of causes. The fact that this association was found in men only could again be due to characteristics of the sample.

Poor self-rated health was associated with the number of symptoms which is not surprising. However, poor self-rated health does not necessarily have to be caused by symptoms. Rather, as for physical inactivity in leisure time, alternative factors are likely to contribute to this association.

Obesity was associated with symptom reporting only among men. For example, a relation between obesity and back pain has been reported previously.[15] An association between joint pain and obesity due to mechanical factors is also plausible.

We conclude that our results confirm that the number of symptoms is an interesting concept for health research that captures information about a variety of health-related dimensions. However, not all associations found have a straightforward interpretation. Studies addressing the questions raised here more specifically are needed to develop a more comprehensive theory of the number of symptoms as an indicator of ill-health.

This study was supported by the Swiss National Science foundation (project No. 32–9290.87). We are grateful to Roland Calmonte and his co-workers whose work in the Berne Workplace Health Project made this study possible.

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Received 1 September 1994, accepted 10 August 1995