Eur Respir J
1988, 1, 428–432

A scoring system on respiratory symptoms

A. Gulsvik, O.K. Refvem

A scoring system on respiratory symptoms. A. Gulsvik, O.K. Refvem.
ABSTRACT: A method for quantitative recording of psychiatric symptoms has been modified for application to respiratory symptoms such as cough, attacks of breathlessness, wheezing and dyspnoea. The method was evaluated in a survey of 193 subjects without pulmonary disorders and 186 patients with pulmonary disorders. The average time taken to obtain scores for four symptoms was six minutes. Inconsistencies were few when the subjects selected statements about symptoms. Cough score discriminated between groups of healthy persons with various smoking habits. Wheezing score distinguished healthy persons from patients with obstructive lung disease more accurately than cough, attacks of breathlessness and dyspnoea score. Regression analyses showed that per score point of dyspnoea and cough the peak expiratory flow rate decreased by almost 12 and 7% of predicted, respectively.
Eur Respir J, 1988, 1, 428–432.

Department of Thoracic Medicine, National Hospital of Norway, University Hospital, Rikshospitalet, Oslo, Norway.

Correspondence: A. Gulsvik, Department of Thoracic Medicine, University of Bergen, 5021 Bergen, Norway.

Keywords: Breathlessness; cough; peak expiratory flow rate; scoring system; wheeze.

Received: 13th July, 1987; accepted after revision 22nd December, 1987.

A correct clinical diagnosis is obtained by history-taking alone in 85% of cases in a medical out-patient clinic [1]. Symptom recording has been extensively used in surveys of pulmonary diseases [2] and in controlled clinical trials [3]. The disadvantages of symptom recording with the usual questionnaire and interview technique are the observer-dependence of the variable [4] and its grading on a discrete scale [5]. INGHAM [6, 7] developed a recording method for psychiatric symptoms and attitudes which attempts to avoid these two problems.

The aims of the present study were to examine the applicability of Ingham's method to the quantitative estimation of cough, attacks of breathlessness, dyspnoea and wheezing. How often does this method yield inconsistent answers and how time-consuming is it? Do the variables discriminate between various smoking habits in healthy persons, and do they discriminate between healthy persons and patients with obstructive lung disease? We also wanted to examine the correlation between symptom score and peak expiratory flow rate.

Methods and subjects

Theory

A brief description of Ingham's method is given for wheezing (fig. 1). A series of four statements (A, B, C and D) describes different degrees of wheezing and the statements can be ranked in order of severity. The four statements can be combined into six pairs of statements, and the midpoint between the two statements of each pair can also be uniquely ranked. The midpoint between two statements is the hypothetical point, which determines whether a given individual will choose the weaker or stronger statement as nearest to agreement with his/her wheezing. With four statements we constructed a range of six scores and with six statements a range of ten scores as previously described by FIELD [8] for cough. If a person always chooses the weaker statement his symptom score will be 1. For the pair A/B, if he chooses B and for the pair A/C chooses A, his symptom score will be 2.

Selection of statements

A series of six statements (in Norwegian) was devised, describing different degrees of cough, wheezing, attacks of breathlessness and dyspnoea. In a pilot study seven chest physicians, four nurses, four patients with lung disease and two non-medical healthy subjects were asked to rank the statements in order of severity. The patients and the non-medical subjects showed inconsistencies in the ranking of the original statements of wheezing, cough and dyspnoea. The number of statements on these three symptoms were reduced from six to four, and the precision of the wording was improved. The final statements are given in the Appendix.

The pairs of statements were printed on plain cards and the statements on each card were numbered 1 and 2.

Administration of method

Before presenting the cards a standard instruction was given to the subject, asking him/her to select the statement, from each pair, which most closely described the degree of his/her respiratory symptom. The first card given included statements roughly midway along the score scale. The cards were presented from the top of the deck and the subject's answers recorded as shown in figure 2. Two boxes on the proforma, one below the other, labelled 1 and 2,

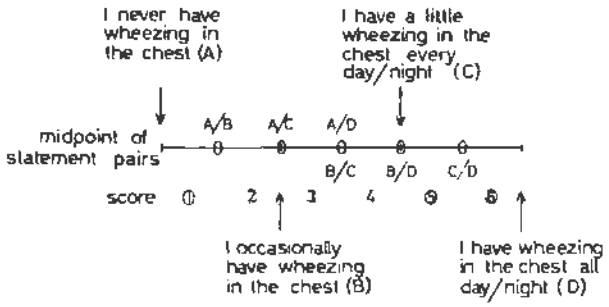

Fig. 1. Schematic presentation of a method for scoring wheezing frequency. The location of four statements (A, B, C and D) and the midpoints between pairs of statements are marked on a line with scores.

Score	1	2	3	4	5	6
Weaker statement	2	1	2	1	X	
Stronger statement	X	X	X	X	1	

Fig. 2. Proforma for recording the subject's answers. Crosses have been put in the boxes corresponding to the statements nominated by the subject. The responses shown are for a score of 5.

indicate the first and second statement chosen from each pair. The weaker statements appear on the upper line, the stronger statements on the lower line. This allows the score to be read directly from the record and also reveals immediately any inconsistent responses. The score is given by the number of the card at which the responses shift to the upper line. Only one cross-over point appears; should more than one cross-over point appear, the subject has been inconsistent in his responses. Inconsistencies in selection of statements on the same occasion were not challenged until all cards had been presented. The cards to which inconsistent responses were given were then presented without comment from a second deck. The test was administered to subsets of the population by two physicians in a random order.

Smoking habits were defined by answers given to the questionnaire approved by the British Medical Council's Committee on Research into Chronic Bronchitis [9]. The subjects were asked about their previous education. In each subject three peak expiratory flow rates (PEFR) were measured, on a Wright peak-flow meter, immediately after the interrogation. The mean of the two highest recordings was used in the analyses. For the regression analyses, the PEFR was expressed as a percentage of the predicted value from the age and height regression of a healthy urban Norwegian population [10]. Standard statistical methods were applied [11].

Subjects

The method was applied to two different populations. One hundred and ninety-five healthy subjects (113 men and 82 women; mean age 47 yrs), participated in a mass X-ray screening. The mean PEFR of these subjects was 97% of the predicted value. Two subjects were excluded after clinical examination because of obstructive lung disease. The remaining group consisted of 66% smokers or ex-smokers and 34% non-smokers.

A series of 184 in-patients (105 men and 79 women) were tested by the same method. The mean age of the patients was 52 yrs. It included 78% smokers or ex-smokers and 22% non-smokers. The mean PEFR of the patients was 68% of the predicted value. In 124 patients the clinical diagnosis was of obstructive lung disease, including chronic obstructive bronchitis (80), emphysema (12) and bronchial asthma (32) corresponding to numbers 491-493 in the International Classification of Diseases [12]. The remaining sixty patients had lung cancer, fibrosing alveolitis and pneumonia of varying severity.

Results

Altogether, for the four symptoms, inconsistent responses occurred in 8.4% (32/379) of the subjects and for 0.7% (35/379 × 18) of the statements. Two subjects had more than one inconsistency. All inconsistencies occurred in subjects with lung disease.

Statements on dyspnoea and attacks of breathlessness showed six times as many inconsistencies as statements on wheezing and cough (table 1). Subjects with only primary school education gave significantly ($p < 0.001$) more inconsistent replies (16%) than those with university education (3%). No differences in recorded symptom scores were observed between the two physicians who administered the test.

The time needed to administer the cards and record the symptom score was on average 5.8 min (range: 2–22 min). In healthy subjects the average time was 3.9 min and in subjects with lung disease 7.8 min.

In healthy subjects the distribution of symptom score for cough varied significantly ($p < 0.01$) among persons with different smoking habits (fig. 3). No smoking-related differences were observed for attacks of breathlessness, wheezing or dyspnoea. The dyspnoea score was higher ($p < 0.01$) in women than in men of identical smoking category.

The mean score for cough, wheezing, attacks of breathlessness and dyspnoea in subjects without lung

Table 1. - Inconsistencies in recording of respiratory symptoms by education

Symptoms	Primary school n=144	Secondary school n=124	University n=111	Total n=379
Cough	3	0	0	3
Dyspnoea	10	4	3	17
Attacks of breathlessness	10	3	0	13
Wheezing	0	2	0	2
Total	23	9	3	35

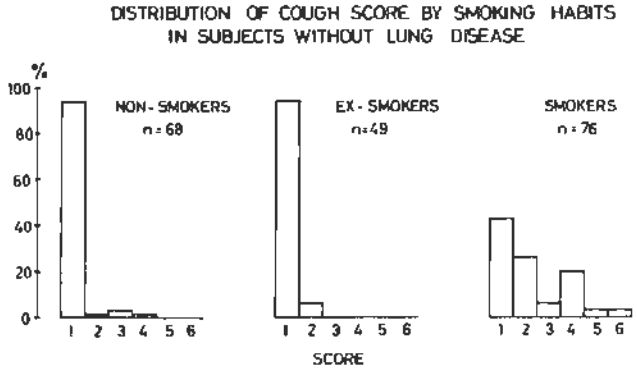

Fig. 3. Distribution of cough scores in clinically healthy subjects by smoking habits.

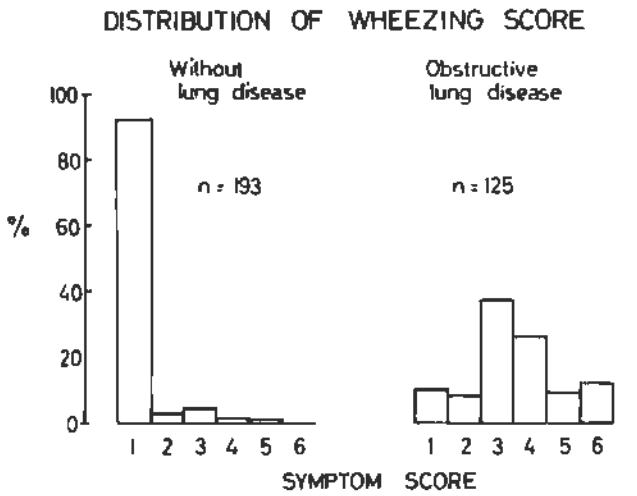

Fig. 4. Distribution of wheezing score in healthy subjects and in patients with obstructive lung disease.

disease was 1.49, 1.16, 1.08 and 1.16 and in subjects with obstructive lung disease 3.84, 3.54, 4.35 and 2.99, respectively. The distribution of the scores judged by the size of the chi-squared statistics with five degrees of freedom showed that scores of wheezing (fig.4) discriminated better between obstructive lung disease patients and healthy subjects than scores of dyspnoea, attacks of breathlessness and cough. The histograms of cough score in particular yielded large overlaps between healthy subjects and patients.

Increasing symptom score for dyspnoea, wheezing

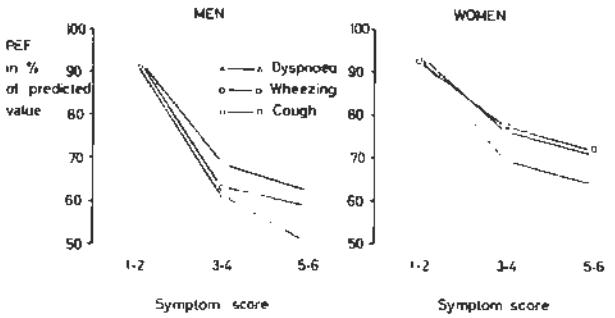

Fig. 5. Respiratory symptoms score and mean peak expiratory flow rate (PEFR) as a percentage of predicted value in men and women. Each point includes more than ten subjects.

and cough was associated with decreasing PEFR (fig. 5). Attacks of breathlessness were not associated with a further decrease in PEFR for symptom scores above 4. Simple regression analyses revealed a regression slope of PEFR for dyspnoea score twice as high as for cough (table 2). The regression slope of PEFR on wheezing was significantly higher ($p < 0.01$) in men (−9.4%) than in women (−4.7%). Multiple regression analyses did not reveal a higher multiple regression coefficient if cough, wheezing and attacks of breathlessness were added to dyspnoea as explanatory variables.

Discussion

If respiratory symptoms are recorded as a discrete variable, the progression of symptoms is not impressive in longitudinal studies of chronic obstructive lung diseases [13]. A more sensitive method for rating scores of respiratory disability is highly desirable [14]. The applicability of a new method for symptom recording in a cross-sectional survey can be judged by its consistency of answers, observer variability and agreement with objectively recorded variables. It is also reasonable to compare results of a new method with those of a well-known and validated respiratory questionnaire.

The number of inconsistent statements selected with Ingham's method was particularly small for cough and wheezing. FIELD [8] observed, in men employed in industry, ten times as many inconsistencies for cough than the present study. However, he

Table 2. - Analysis of variance (n=379) for simple linear regression: PEF (% predicted)=a+b·symptom score

Symptom	Regression intercept (a)	Regression slope (b)	Standard error of b	F-ratio	Multiple R
Cough	98.86	− 6.6	0.7	85.2	0.4293
Dyspnoea	105.27	−11.6	0.9	173.6	0.5616
Attacks of breathlessness	88.61	− 2.8	0.5	32.4	0.2813
Wheezing	98.18	− 7.5	0.8	89.3	0.4377

used six statements of cough against four statements in our study. It is, of course, easier to rank only a few statements, but with less statements the symptom scale will be less sensitive.

The statements on cough, wheezing and dyspnoea in the present study reviewed the last fourteen days, and attacks of breathlessness reviewed the last six months. A six month period for attacks of breathlessness may be too long and could account for the high number of inconsistencies for this symptom. Optimal recall period for dramatic occurrences such as motor vehicle accidents can be as short as three months [15].

The wording of the statement on dyspnoea would probably have been more precise if the statement 'I do not get more breathlessness than other people of my own age' had been changed to 'I do not get more breathless than other *healthy* people of the same age *and sex*'.

The present wording of the dyspnoea statement may be one cause for the male/female gradient of dyspnoea besides the difference in mass index [16–18]. The index weight·height^{-2} (g·cm^{-2}) is usually higher in women than in men. Another problem in grading of dyspnoea is the fact that some subjects seldom use stairs, so have not tested awareness of the symptom on stairs.

The Ingham method of symptom recording is presumably less dependent on the observer than the usual interview, but an observer is involved, so some influence cannot be excluded. Several studies [16, 19] show a large influence of interviewers on the recording of symptoms with standardized interview techniques.

In the healthy subjects cough score was the only symptom which discriminated between smokers and non-smokers. There is a unimodal distribution with peak score 1 for non-smokers, and a bimodal distribution with peak scores 1 and 4 for smokers (fig. 3). A similar distribution was observed by FIELD [8]. Several Nordic surveys [16, 17, 20] using the Medical Research Council questionnaire have reported a higher prevalence of wheezing and breathlessness in smokers than in non-smokers. Why such a gradient was not observed in the present survey with Ingham's method is unclear, but may be partly due to the small number of subjects.

Wheezing was the most discriminatory symptom between healthy subjects and patients with a physician's diagnosis of obstructive lung disease. It is frequently interpreted as a non-specific marker of airflow-obstruction due to rapid flow through severely narrowed peripheral airways [21]. Cough is a much more prevalent symptom in the general population but it does not usually imply a disease with disability.

PEFR decreased with increasing symptom score in each smoking category. Dyspnoea was more closely correlated with airflow limitation than were wheezing, cough and attacks of breathlessness, which is in agreement with previous studies [22, 23]. Score of the latter symptom was so poorly correlated with PEFR that both variables should be examined in surveys. The decrease in PEFR with increasing symptom score was more impressive than the differences in PEFR between various smoking groups.

Recording of respiratory symptoms with Ingham's method is cheap and relevant for pulmonary disorders. The method is attractive as an epidemiology research tool in occupational medicine and in clinical institutions. The agreement between this scoring technique and methods using visual analogue scales or psychophysical scaling of symptoms should be examined in the future. Its definitive value can only be determined in longitudinal studies.

Appendix

Cough frequency statements
a) I hardly ever cough
b) I cough a little occasionally
c) I cough a little every day
d) I cough a lot every day

Statements of breathlessness
a) I do not get more breathless than other people of my own age
b) I get breathless when I walk up two floors at my own pace
c) I get breathless when I walk on level ground at my own pace
d) I am nearly always breathless when at rest

Statements on frequency of attack of breathlessness
a) I never have attacks of breathlessness
b) I have attacks of breathlessness at intervals of several months
c) I have attacks of breathlessness at intervals of several weeks
d) I have an attack of breathlessness approximately every week
e) I have several attacks of breathlessness every week
f) I have attacks of breathlessness every day/night

Wheezing frequency statements
a) I never have wheezing in the chest
b) I occasionally have wheezing in the chest
c) I have a little wheezing in the chest every day/night
d) I have wheezing in the chest all day/night

References

1. Hampton JR, Harrison MJG, Mitchell JRA, Pritchard JS, Seymour C. – Relative contribution of history-taking, physical examination and laboratory investigation to diagnosis and management of medical outpatients. *Brit Med J*, 1975, 2, 486–488.
2. Fletcher CM, Oldham PD. – Diagnosis in group research. *In*: Medical surveys and clinical trials. L.J. Witts ed., Oxford University Press, Oxford, 1964, pp.25–29.
3. Turner-Warwick M. – The use of diary cards in asthma. *Brit J Dis Chest*, 1977, 71, 228–230.
4. Cochrane AL, Chapman PJ, Oldham PD. – Observers' errors in taking medical histories. *Lancet*, 1951, 1, 1007–1009.

5. Aitken RCB. – Measurements of feelings using visual analogue scale. *Proc Roy Soc Med*, 1969, 62, 989–993.
6. Ingham JG. – A method for observing symptoms and attitudes. *Brit J Soc Clin Psychol*, 1965, 4, 131–140.
7. Ingham JG. – Quantitative evaluation of subjective symptoms. *Proc Roy Soc Med*, 1969, 62, 492–494.
8. Field GB. – The application of a quantitative estimate of cough frequency to epidemiological surveys. *Int J Epidem*, 1974, 3, 135–143.
9. Medical Research Council's Committee on Research into Chronic Bronchitis. – Questionnaire on respiratory symptoms. Publication Group, Medical Research Council, 20 Park Cresent, London, W1N 4AL, 1976.
10. Gulsvik A. – Reference values: Tables and nomograms. *In*: The health of aluminium smelter operators. J.R. Vale and T. Guthe eds., European Primary Aluminium Association. Düsseldorf, 1979.
11. Armitage P. – *In:* Statistical methods in medical research. Blackwell, Oxford, 1971.
12. World Health Organization. – International Classification of Diseases. 8th version. Geneva, 1967.
13. Fletcher C, Peto R, Tinker C, Speizer FE. – *In*: The natural history of chronic bronchitis and emphysema. An eight year study of early chronic obstructive lung disease in working men in London. Oxford University Press, Oxford, 1976.
14. Kerridge DF. – Subjective rating scores for respiratory disability. *Eur J Respir Dis*, 1980, (Suppl. 110), 217–219.
15. Cash WS, Moss AJ. – Optimum recall period for reporting persons injured in motor vehicle accidents. *In*: Vital and health statistics, series 2, No. 50, National Center for Health Statistics, Rockville, Md., 1972, 10.
16. Gulsvik A. – Obstructive lung disease in an urban population, Reprografisk Industri A/S, Oslo, 1979.
17. Huhti E. – Prevalence of respiratory symptoms, chronic bronchitis and pulmonary emphysema in a Finnish rural population. *Acta Tuberc Scand*, 1965, 61 (Suppl.).
18. van der Lende R. – Epidemiology of chronic non-specific lung disease (chronic bronchitis). van Gorcum & Comp., Assen, 1969.
19. Fairbairn AS, Wood CH, Fletcher CM. – Variability in answers to a questionnaire on respiratory symptoms. *Brit J Prev Soc Med*, 1959, 13, 175–193.
20. Kujala P. – Smoking, respiratory symptoms and ventilatory capacity in young men. *Eur J Respir Dis*, 1981, (Suppl. 114), 26–29.
21. Crofton J, Douglas A. – *In*: Respiratory diseases. Blackwell, Oxford, 1975.
22. Helsing KJ, Comstock GW, Speizer FE, Ferris BG, Lebowitz MD, Tockman MS, Burrows B. – Comparison of three standardized questionnaires on respiratory symptoms. *Am Rev Respir Dis*, 1979, 20, 1221–1231.
23. Samet JM, Speizer FE, Gaensler EA. – Questionnaire reliability and validity in asbestos exposed workers. *Bull Eur Physiopathol Respir*, 1978, 14, 177–188.

RÉSUMÉ: Nous avons modifié une méthode d'enregistrement quantitatif des symptômes psychiatriques pour l'appliquer à des symptômes respiratoires comme la toux, les crises d'oppression, le sifflement respiratoire et la dyspnée. La méthode a été évaluée au cours d'une enquête chez 193 sujets sans maladie pulmonaire, et chez 186 patients avec maladie pulmonaire. Le temps moyen pour l'obtention d'un score pour les 4 symptômes fut de 6 minutes. Il y a eu peu de discordance lorsque les sujets ont sélectionné les affirmations concernant les symptômes. Le score de toux permet la discrimination entre les groupes de sujets bien portants avec diverses habitudes tabagiques. Le score de sifflements permet de distinguer les sujets sains des patients atteints de maladie pulmonaire obstructive, mieux que ne le font la toux, les crises d'oppression et la dyspnée. Les analyses de régression ont montré que le débit expiratoire de pointe diminuait respectivement de près de 12 et de 7% des valeurs prédites, respectivement, par point de score de dyspnée et de toux.