ORIGINAL ARTICLES

Comparison of Responses to Two Standardized Respiratory Questionnaires

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Abstract: Two standardized respiratory questionnaires in a Japanese version were given to 460 subjects randomly selected from male, middle-aged inhabitants of 15 villages in the Kashima district of Ibaraki Prefecture, Japan. One half of the men were given the questionnaire developed by the British Medical Research Council first and the questionnaire developed by the American Thoracic Society after an interval of about 2 weeks. The other half were given the questionnaires in reverse sequence.

For questions with similar wording, the two questionnaires yielded very similar results, and in terms of the over-all prevalence of symptoms, no important differences were found between the two questionnaires. However, there were not a few subjects whose individual responses to similar questions in the two questionnaires were not the same. The results seemed to be partly explained by unstable responses of subjects who complained of a symptom to only a slight extent.

Key words: Standardized questionnaire—Respiratory symptom—Prevalence rate—Population study—Epidemiology—BMRC questionnaire—ATS questionnaire

INTRODUCTION

Subjective symptoms are important findings in an epidemiologic investigation on the health effect of hazardous pollutants in occupational and general environments. In such studies, it is important that the questionnaires used and techniques of inquiry be standardized.¹⁾

As to respiratory questionnaires, two types of standardized questionnaire are now available: the British Medical Research Council questionnaire (BMRC-Q) and the American Thoracic Society questionnaire (ATS-Q). The former was originally developed by the British Medical Research Council in 1960²⁾ and introduced to Japan a few years later.³⁾ It has been widely used in clinical and epidemiological investigations since then. The latter was developed by the American Thoracic Society in 1978⁴⁾ especially for epidemiological use.

Although the BMRC-Q and the ATS-Q include nearly identical questions with similar wording to some extent, they also have different characteristics which could be advantages or disadvantages according to the purpose of the study in which they are used. Therefore, it is important to use them properly according to the purpose and design of the study. Accordingly, the comparability of the results obtained by the two standardized questionnaires should be determined. Although several studies have considered this point,^{5,6)} a comparison of the responses elicited by them in a Japanese version seems to be insufficient.

In this study, the BMRC-Q and the ATS-Q were administered to the same population by telephone interviews and the responses elicited were compared.

SUBJECTS AND METHODS

1. *Study population*

The study population was drawn from persons living in 15 villages in the Kashima district of Ibaraki Prefecture, Japan. This district has traditionally been a farming area where almost no manufacturing industries were located. In accordance with the industrial development plan begun in the 1960's, however, many modern factories were located in groups in this area. They have been in operation since the early 1970's. In each factory, modern pollution control techniques were introduced at the beginning, so the concentration of pollutants in the environmental air has been regulated and is maintained at low levels.⁷⁾

All males who were between the ages of 40 and 59 and had lived in the study area for at least 5 years on April 1, 1979, were listed. From this population, 460 males were randomly selected for the investigation.

2. *Questionnaire Study*

The version of the BMRC-Q used in this study was essentially identical with the Japanese version of the 1974 BMRC-Q⁸⁾ and the ATS-Q used in this study was essentially identical with the translation of the original ATS-Q except for minor modifications.

The 460 subjects, stratified by area of residence, were randomly divided into two groups. All subjects were interviewed twice by the same interviewer by telephone at an interval of about 2 weeks. One group was given the BMRC-Q at the first interview and the ATS-Q at the second interview, and the other group was given the questionnaires in reverse sequence.

Interviews were conducted by three interviewers. One of them was a skilled epidemiologist with much experience in respiratory symptom questionnaire administration. The other two were trained in interview procedures for at least a week, according to the standard guidelines with a minor modification. Allocation of subjects to the interviewers was randomized.

A telephone call for the interview was preceded by an introductory letter stat-

ing the purpose of the investigation. To persons who did not respond to the first call, a second attempt to contact them by telephone was made on another day. However, those with whom no contact could be made within 1 week from the first call were excluded from further survey. When subjects obviously could not take part in the survey for such reasons as moving to another district, travelling during the study period, suffering from serious illnesses, etc., they also were excluded from further survey. The study was begun in October 1979 and was completed in November 1979.

3. Response rate

The response rate of the study is summarized in Table 1. Group A includes

Table 1. Study population and response rate

		Group A	Group B
Total subjects	(1)	230	230
Respondents to both interviews	(2)	197	195
Non-respondents		33 (9)*	35 (9)*
Unavoidable reasons†	(3)	16	19
Other reasons or refusal		17	16
Response rate			
(2)/(1) %		85.7	84.8
(2)/(1)-(3) %		92.1	92.4

For definition of groups, see text.

* Number of subjects who answered in the first interview but not in the second.

† For details, see text.

Table 2. General characteristics of the respondents

	Group A (n=197)	Group B (n=195)
Age (years) : 40-49	110 (55.8)*	119 (61.0)
50-59	87 (44.2)	76 (39.0)
Smoking habit† : Non-smoker	28 (14.2)	27 (13.8)
Ex-smoker	25 (12.7)	24 (12.3)
Current smoker	144 (73.1)	144 (73.9)
Interviewer allocation : 1. SA	61 (31.0)	65 (31.3)
2. TN	67 (34.0)	64 (32.8)
3. KS	69 (35.0)	66 (33.8)
Interview interval (days) : -11	1 (0.5)	0
12	53 (26.9)	55 (28.1)
13	67 (34.0)	81 (41.5)
14	39 (19.8)	32 (16.4)
15	18 (9.1)	9 (4.6)
16	7 (3.6)	7 (3.6)
17-	12 (6.1)	11 (5.6)

For definition of groups, see text.

* Number of subjects. The percentage is shown in parentheses.

† Classified by the answer to ATS-Q.

the subjects for whom the ATS-Q was used first and group B is the BMRC-Q-first group. Seventeen subjects in group A and 16 in group B did not answer the ATS-Q or the BMRC-Q because of refusal or unknown reasons, and 16 in group A and 19 in group B did not do so for unavoidable reasons which included suffering from non-respiratory illnesses, moving or travelling and death. As a result, 197 subjects in group A and 195 subjects in group B participated in both interviews of the two questionnaires; their rates to the original number of subjects were 85.7% in group A and 84.8% in group B. When persons who did not respond for unavoidable reasons were excluded, the response rate was 92.1% in group A and 92.4% in group B. No statistically significant difference in response rate was found between the two groups.

Table 3. Rate of prevalence of respiratory symptoms by questionnaire and group

Symptom and past history	Questionnaire	Code*	Group A (n = 197)	Group B (n = 195)	Total (n = 392)
Cough	ATS	7C	14.2	11.3	12.7
morning in winter	BMRC	1	9.6	9.2	9.4
Cough	ATS	7D	15.2	6.7	11.0
day/night in winter	BMRC	2	9.1	8.7	8.9
Persistent cough	ATS	7E	7.1	4.6	5.9
	BMRC	3	7.1	6.2	6.6
Phlegm	ATS	8C	19.2	16.9	18.1
morning in winter	BMRC	4	15.7	24.1	19.9
Phlegm	ATS	8D	16.2	10.3	13.3
day/night in winter	BMRC	5	12.7	9.2	11.0
Persistent phlegm	ATS	8E	11.7	9.2	10.5
	BMRC	6	9.6	11.8	10.7
Exacerbation	ATS	9A	6.6	6.2	6.4
	BMRC	7a	5.6	8.2	6.9
Wheezing	ATS	10A-1/2	40.6	34.9	37.7
	BMRC	9a	14.2	12.8	13.5
Breathlessness	ATS	13A	26.9	19.5	23.2
	BMRC	8a	27.3	23.0	25.2
Chest illness	ATS	15C	4.6	5.1	4.8
	BMRC	11b	4.6	2.6	3.6
Persistent cough and phlegm	ATS	7E & 8E	4.1	1.5	2.8
	BMRC	3 & 6	4.6	2.1	3.3
Bronchitis	ATS	1B	13.2	12.3	12.8
	BMRC	12c	7.6	12.3	9.9
Pneumonia	ATS	2B	13.2	9.7	11.5
	BMRC	12d	12.2	9.7	11.0
Tuberculosis	ATS	—	10.7	8.7	9.7
	BMRC	12e/f	8.6	10.3	9.5
Bronchial asthma	ATS	20C	7.6	2.6	5.1
	BMRC	12g	7.6	4.6	6.1

For definition of groups, see text.

* Code number of original questionnaire⁽⁴⁾⁽⁸⁾.

4. Analysis

The analysis was restricted to those who were interviewed twice. Answers to important, prevalent, and comparable questions requiring "yes" or "no" answers were analyzed and in the case of "persistent cough and phlegm," the subjects were classified under dichotomous categories ("yes" or "no") by combining answers to the question of "persistent cough" and "persistent phlegm."

As to smoking habit, the subjects were classified under three categories: non-smoker, ex-smoker, and current smoker. When a subject smoked another form of tobacco, the amount consumed was converted into cigarette consumption.

Initially, the results were analyzed by each interviewer to reveal the difference among interviewers, but no important difference among the interviewers could be found. Therefore, the results by each interviewer are omitted and only the over-all results are presented in this paper.

RESULTS

The general characteristics of the subjects are shown in Table 2. Because of random allocation, it was difficult to obtain an exact balance in terms of age distribution between groups. As a result, the subjects in group A were slightly

Fig. 1. Rate of prevalence of persistent phlegm by smoking habit

older than those in group B, but the difference is not statistically significant. There was no gross difference between groups in occupation, interviewer allocation, smoking habit, and the interval between the two interviews. Therefore, the difference in those characteristics between groups was unlikely to have any gross effect on a following comparison.

The frequencies of important symptoms elicited by the two questionnaires are shown in Table 3. Although no statistically significant difference was found in the frequency of any symptom between the two questionnaires, the subjects had a tendency to complain more frequently in the first interview than in the second one irrespective of the type of questionnaire.

Figure 1 shows the rate of prevalence of persistent phlegm by smoking habit. Two subjects who did not give consistent answers to the two questionnaires as to smoking habit were excluded from the figure. Both questionnaires revealed a dose-related prevalence of persistent phlegm.

To reveal whether an individual subject responded in the same way in each interview, individual subjects were classified according to their responses. The results are shown in Table 4. In the case of symptoms, the concordance rate, which means the proportion of subjects who gave consistent replies to each of the questionnaires, was nearly always more than 80%. There seemed to be little variation among different symptoms in terms of the concordance rate, apart from a comparatively low value for the question about wheezing in which wording of the questions was somewhat different in the two questionnaires. As to past history, the concordance rate was more than 90%, showing better concordance than in the case of symptoms. As to smoking habit, there was a high degree of concordance between the results of the two questionnaires. As far as the category in terms of non-smoker, ex-smoker, and current smoker is concerned, only two out of the 392 subjects gave inconsistent answers and 99.5% of the subjects were placed in the same category in both questionnaires.

The concordance rate may not be a good index for concordance in a question in which there is less prevalence because it is highly dependent on the prevalence rate since it includes the results for the majority of asymptomatic subjects. Accordingly, the ratio of subjects who gave affirmative responses in both questionnaires to those who did so in only one questionnaire was calculated. For respiratory symptoms, those ratios were always less than 1.0 and often between 0.5 and 0.75. For past history of illnesses, however, they were often more than 1.0, showing better concordance than for symptoms.

It is well known that a person who has a cough tends to have phlegm and vice versa. To further analyze the state of concordance in cough and phlegm questions, the subjects were divided into two categories according to the answers to a question on persistent cough or persistent phlegm; one category included those who claimed to have persistent cough (or persistent phlegm) in at least one questionnaire and the other included those who did not reveal that symptom in

Table 4. Percentage of the subjects classified by individual response to each questionnaire

Symptom and past history	Response to each questionnaire						Concordance ratio†	Concordance ratio†	McNemar's χ^2
	ATS yes BMRC yes	ATS no BMRC yes	ATS yes BMRC no	ATS no BMRC no	ATS yes BMRC no	ATS no BMRC no			
Cough, morning in winter	5.4	4.1	7.4	83.2	88.5	0.47	3.20		
Cough, day/night in winter	4.8	4.1	6.1	84.9	89.8	0.48	1.23		
Persistent cough	3.8	2.8	2.0	91.1	95.1	0.79	0.21		
Phlegm, morning in winter	11.5	8.4	6.6	73.5	85.0	0.76	0.61		
Phlegm, day/night in winter	6.1	4.8	7.1	81.9	88.0	0.51	1.36		
Persistent phlegm	5.6	5.1	4.8	83.4	89.9	0.56	0		
Exacerbation	3.1	3.8	3.3	89.8	92.9	0.43	0.04		
Wheezing	11.2	2.3	26.5	59.9	71.2	0.39	78.19*		
Breathlessness	9.9	11.5	8.7	69.9	79.8	0.49	1.27		
Chest illness	2.8	3.1	2.0	91.6	94.9	0.55	0.45		
Persistent cough & phlegm	1.3	2.0	1.5	93.9	96.1	0.36	0.07		
Bronchitis	6.6	3.3	6.1	83.9	90.6	0.70	2.70		
Pneumonia	7.9	3.1	3.6	85.5	93.4	1.19	0.04		
Tuberculosis	7.7	1.8	2.0	88.5	96.2	2.00	0		
Bronchial asthma	4.3	1.8	0.8	93.1	97.4	1.70	0.90		

† For definition, see text.

* $p < 0.01$

Table 5. Concordance status of cough and phlegm questions

Symptom	Category									
	Persistent cough (+)*					Persistent cough (-)*				
	ATS yes BMRC yes	ATS no BMRC yes	ATS yes BMRC no	ATS no BMRC no		ATS yes BMRC yes	ATS no BMRC yes	ATS yes BMRC no	ATS no BMRC no	
Phlegm, morning in winter	14†	7	1	12		30	26	25	286	
Phlegm, day/night in winter	10	3	6	15		14	16	22	305	
Persistent phlegm	7	7	7	12		15	12	13	314	

Symptom	Category									
	Persistent Phlegm (+)*					Persistent phlegm (-)*				
	ATS yes BMRC yes	ATS no BMRC yes	ATS yes BMRC no	ATS no BMRC no		ATS yes BMRC yes	ATS no BMRC yes	ATS yes BMRC no	ATS no BMRC no	
Cough, morning in winter	15	7	6	33		6	9	22	290	
Cough, day/night in winter	8	4	6	43		10	12	18	287	
Persistent cough	11	5	5	40		4	5	3	314	

* For definition of categories, see text.
† Number of subjects.

either questionnaire. In other words, subjects in the former category were expected to have more definite phlegm (or cough), and those in the latter were expected to have the symptom to only a slight extent if at all. As shown in Table 5, the former subjects showed a higher value not only for the prevalence rate but also for the concordance ratio than the latter subjects. Therefore it was suggested that those who have a symptom to a slight extent might have a tendency to respond in a different way in repeated questionnaire interviews.

DISCUSSION

In this study, the rates of prevalence of symptoms elicited by two types of questionnaire, BMRC-Q and ATS-Q, were comparable and there was a dose-related relationship between the prevalence of persistent phlegm and smoking habit in both questionnaires. These findings may support the comparability of the results obtained by the two types of standardized questionnaires.

However, the finding does not always mean that an individual subject responded to both questionnaires in the same way. For almost all of the symptoms, indeed, the concordance rate was higher than 80%, which is compatible with the results of Lebowitz and Burrows⁹⁾ and Comstock *et al.*⁶⁾ However, the values seemed to be dependent on the prevalence rate. When the subjects who responded "yes" in both questionnaires were compared with those who did so in only one questionnaire, the ratios of the number of these subjects were between 0.5 and 0.75 for almost all symptoms, indicating poorer concordance than found by Comstock *et al.*⁶⁾

To further analyze the above findings, four possibilities should be considered: (1) inadequacy (lack of skill) of the interviewers, (2) unreliable response of the subjects, (3) difference in the composition or wording of the questionnaires, and (4) unstable response of the subjects who complain of a symptom only slightly.

Although three interviewers were trained in a standard way, the experience of an actual interview differed among them. However, no statistically significant difference was seen in the prevalence rate of concordance among the results of the three interviewers.

On the other hand, it was shown that there was a dose-related prevalence of persistent phlegm by smoking habit, and that there was better concordance in past history than in symptoms. Furthermore, there were only two subjects whose current smoking status was discordantly classified by the two questionnaires. These results seem to contradict the possibility that lack of skill of the interviewers or unreliable responses of the subjects could be a principal reason for discordance in individual responses. Moreover, there was no tendency for one questionnaire to show a higher prevalence rate than the other when questions with nearly identical wording were compared.

As a result, the possibility of an unstable response by a slightly symptomatic

person is left and the results shown in Table 5 gives support to this possibility although it only deals with the case of cough and phlegm. In the study on comparison of BMRC-Q and ATS-Q, Comstock *et al.*⁶⁾ reported better concordant results than this study. This could be partly explained by the fact that the proportion of definitely symptomatic subjects is higher in the U.S.A. than in Japan, as well as by the higher rate of prevalence of respiratory symptoms per se in their country.

Another possibility may be the difference in the interval between the two interviews. In the study of Comstock *et al.*, BMRC-Q and ATS-Q interviews were carried out on the same day. In this study, on the other hand, the second interview was conducted about 2 weeks after the first interview. It is reasonable that with a shorter interval a more concordant result can be obtained. On the contrary, it is rather surprising that more than 5% of the subjects gave discordant answers even if the interviews were repeated on the same day. In this respect, Lebowitz and Burrows⁹⁾ reported that about 10% of the subjects might give discordant responses in repeated interviews on the same day. These results show that unstable responses are unavoidable in an interview study.

In conclusion, BMRC-Q and ATS-Q can produce comparable results in terms of the over-all prevalence rate. However, unstable responses by slightly symptomatic subjects can not be avoided and apparently discordant results may be obtained when the proportion of symptomatic subjects in the population is relatively small and slightly symptomatic subjects are dominant among them.

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