

ORIGINAL PAPERS

SICKNESS ABSENTEEISM AS A TEST FOR THE POPULATION'S HEALTH STATUS

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Abstract: The aim of the present study was to determine the correlation between health status of workers and their sickness absenteeism. Information was collected about 5132 randomly chosen textile industry workers in Lodz, which concerns their state of health determined on the basis of medical examination and sickness absenteeism during the two years preceding this study. Absenteeism caused by a given disease served as a test for evaluating the state of health. Certain parameters of test validity, such as sensitivity, specificity, positive and negative predictive value and relative risk were adopted for the purpose of the analysis.

The aim of the present study was to demonstrate the relation between the state of health of employees and their sickness absenteeism. Data were collected concerning 5132 randomly chosen employees of the textile industry in Lodz. The data refer to their state of health, determined on the basis of medical examinations performed by general practitioners of the industrial health service and registered in the standard medical examination records (3), as well as to sickness absenteeism reported during the two years preceding the study.

Preliminary results of the analysis, which referred to the frequency of some chronic diseases and which were arrived at on the basis of medical examination and documents concerning sickness absenteeism (4), proved that data on sickness absenteeism, acquired during the two-year period, rendered it possible to assess the incidence rate of central nervous system diseases, heart diseases, chronic bronchitis, gastric or duodenal ulcers, diseases of the liver, gallbladder and pancreas in the population of textile workers.

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METHOD OF STUDY

In the present analysis which refers to sickness absenteeism as crucial for determining the health conditions of the workers, absenteeism due to a given disease was found to be a test for the evaluation of the state of health. All persons from the studied group in whom physicians had diagnosed a specific disease were isolated, as well as the persons who did not suffer from this disease. For these two groups, sickness absenteeism caused both by the disease found by practitioners and by other diseases, was determined.

The analysis was based on detailed study results, classified in four-fold contingency tables according to the diagnosis of a particular disease group and absenteeism resulting from these diseases. The tables helped to calculate both sensitivity and specificity of sickness absenteeism and also the relative risk of absenteeism due to a particular cause in the group of persons with a given diagnosis, as related to the group of patients without such a diagnosis. Such parameters of the test validity as positive predictive value (PP) and negative predictive value (NP) (2)¹ were also applied in the analysis.

RESULTS

Among the examined textile industry workers, the most numerous group was that of persons with circulatory system-diseases which were reported in 1476 persons, i.e. in 29% of the studied sample. 15% of these patients did not show sickness absenteeism in the two-year period, while absenteeism due to circulatory system diseases was observed in 35%.

Out of the total number of workers with circulatory system diseases, 396 persons suffered from heart diseases (7.8% of the general population of the analysis). About 32% of these people showed absenteeism. Hypertensive disease was diagnosed in 424 persons (8.3%) and the absenteeism

¹ Parameters mentioned were calculated using the following formulae:

$$\text{Sensitivity} = \frac{a}{a+c}, \quad \text{Specificity} = \frac{d}{b+d}, \quad \text{PP} = \frac{a}{a+b}, \quad \text{NP} = \frac{d}{c+d},$$

$$\text{Relative risk} = \frac{a \cdot d}{b \cdot c}$$

where: a,b,c,d are the number of persons in the following four-fold table:

Absenteeism due to a disease xD	Diagnosis of a disease xD		Total
	+	—	
+	a	b	a+b
—	c	d	c+d
Total	a+c	b+d	a+b+c+d



in this case was shown by 46% of the workers. In 923 persons, diseases of blood vessels, the lymphatic system and other diseases of the circulatory system were reported; in 824 members of this group (16% of the studied population) varicose veins in the lower extremities were found. Absenteeism due to diseases of the blood vessels was noted in 8% of persons with this diagnosis, while absenteeism caused by the presence of varicose veins was reported in only 2.4%.

The proportions recorded of persons showing absenteeism due to diseases corresponding to those diagnosed medically determine the sensitivity of absenteeism as a test for the evaluation of health status (Table 1). The highest sensitivity can be observed in hypertensive disease

TABLE 1. Validity of Sickness Absenteeism as a Test for the State of Health due to Diseases of the Circulatory System; Relative Risk of Absence in Persons with a Diagnosis of Chronic Disease

Diagnosis	Sensitivity	Specificity	PP	NP	Relative risk *
Diseases of the circulatory system (390-459)	0.32	0.90	0.57	0.77	4.37
— heart diseases (390—398, 410—429)	0.32	0.94	0.32	0.94	7.63
— hypertensive disease (401—405)	0.46	0.97	0.61	0.95	30.10
— diseases of blood vessels, lymphatic system and other diseases of the circulatory system (430—459)	0.08	0.98	0.43	0.83	3.69
— varicose veins of lower extremities (454)	0.02	0.996	0.54	0.84	6.28

* all values are significant at $\alpha = 0.05$ (1)

and in heart diseases, while a very low sensitivity can be found for the group absent due to the presence of varicose veins of the lower extremities. Validity of absenteeism as a test for the correct diagnosis of hypertensive disease, heart diseases and circulatory system diseases in general is not too high either. For instance, sensitivity = 46% in the case of hypertension which indicates that in more than 50% of persons hypertension did not result in the inability to work. Very low sensitivity for blood vessels and lymphatic system diseases, and especially for varicose veins of the lower extremities, makes the application of absenteeism as a test for the evaluation of the health status impossible as regards these diseases.

In the group of circulatory system diseases, absenteeism specific-

ity ranges from 90 to 99.6%, which indicates that persons in whom none of these diseases was diagnosed can present a medical certificate of temporary work disability specifying these diseases as the ones causing absenteeism at work only in rare cases.

The predictive value of positive results, also called a positive predictive value, for circulatory system diseases ranges from 32% (heart diseases) to 61% (hypertension). The latter value, for instance, demonstrates that in 61% of persons unable to work due to hypertension, the diagnosis of hypertensive disease was reported in their medical records. The predictive value of negative results i.e. the negative predictive value, is higher and ranges from 77% (circulatory system diseases in general) to 95% (hypertension), which means that in 77—95% of persons who did not show absenteeism due to this group of diseases, this chronic disorder was not observed during a medical investigation.

The relation between the numerical PP value and sensitivity proves that the possibility of predicting the percentage of patients on the basis of the percentage of persons absent due to a given disease does exist. Thus, similar values of these measures for heart disease (sensitivity = PP = 0.32) prove that the number of persons absent due to heart diseases may help to calculate the number of patients suffering chronically from these diseases, with a permissible error.

The relative risk is the measure which determines the possibility of the occurrence of absenteeism caused by a given disease encountered in patients suffering from this disease, in relation to healthy persons (i.e. those in whom such a chronic disease has not been diagnosed). Numbers presented in the last column of Table 1 show, for instance, that persons with a diagnosed hypertensive disease face a 30 times higher risk of absenteeism due to this disorder, than other employees, while the risk of absenteeism among persons with chronic circulatory or lymphatic system diseases is 3.7 times higher than among healthy persons.

Diseases of the musculoskeletal system were diagnosed in 1214 persons, i.e. in about 24% of the studied group of textile industry workers. 87% of persons suffering from these diseases were unable to work due to poor health in the 2-year period of the study, and 33% — due to musculoskeletal system diseases. More than 50% of patients in whom musculoskeletal system diseases had been diagnosed, are persons with arthropathies and similar diseases (656 persons) and 394 persons suffered from rheumatoid diseases of the spine.

Absenteeism sensitivity (Table 2) is highest for the whole group of musculoskeletal system diseases and amounts to 33%, which means that in one out of three patients the degree of intensification of ailments



TABLE 2. Validity of Sickness Absenteeism as a Test for Health Status due to Diseases of the Musculoskeletal System and Connective Tissue; Relative Risk Absence in Persons with a Diagnosis of Chronic Disease

Diagnosis	Sensitivity	Specificity	PP	NP	Relative risk *
Diseases of the musculoskeletal system and connective tissue (710—739)	0.33	0.90	0.52	0.81	4.65
— arthropathies and related disorders (710—719)	0.26	0.94	0.41	0.90	5.98
— dorsopathies (720—724)	0.30	0.96	0.40	0.94	10.88

* all values are significant at $\alpha = 0.05$

resulted in disability to work. For more specific disease groups, absenteeism sensitivity is still lower. Out of the total number of persons suffering from rheumatoid diseases of the spine, 30% were absent from work, and from among patients with chronic arthropathies, 26% of persons got medical certificates for this reason.

The absenteeism specificity of musculoskeletal system diseases remained at a level of 90—96%, and was the lowest for the whole group of diseases, which is connected with the fact that most "accidental" certificates of temporary disability to work (i.e. those which do not concern chronically ill patients, but rather those with temporary acute conditions) are attributed to different syndromes related to a given system and not to a given disease.

The predictive value of positive results is the highest for diseases of the musculoskeletal system in general, which brought about chronic states diagnosed in 52% of persons who held sickness certificates of temporary work disability.

Like sensitivity, the predictive value of negative results is the lowest for all diseases of the discussed system in general — in 19% of employees among whom no absence due to musculoskeletal system diseases was reported during 2 years, practitioners found, however, chronic diseases of this system.

The highest risk of temporary incapability to work, due to reasons consistent with a diagnosed chronic disease, can be observed in patients suffering from rheumatoid diseases of the spine. The risk is almost 11 times higher than in healthy persons.

The presented absenteeism parameters, referring to diseases of the musculoskeletal system, indicate a rather limited usefulness of absenteeism as a test for health status, which results mainly from the remarkable numerical difference between sensitivity and positive predictive value. This is

a result of the significant proportion of medical certificates of temporary work disability due to acute ailments which are not consistent with diagnoses of chronic diseases.

Digestive system diseases were diagnosed in 782 persons (15.2%) and in 45% of persons, this group of diseases brought about sickness absenteeism. Gastric and duodenal ulcers (240 patients), hepatopathy, gallbladder and pancreas diseases (309 patients) dominated. Among patients afflicted with peptic ulcers, 57% of persons made use of medical certificates of temporary inability to work due to this reason; in the other diseases group this proportion amounted to 26%.

Absenteeism specificity for peptic ulcers, liver, gallbladder and pancreas diseases is high and equals 98% and 96%, respectively. Taking into account the detailed investigation necessary to diagnose these cases, it is easy to explain the apparently lower specificity (82%) for the whole group of digestive system diseases. Disability to work due to these diseases is related to all cases which were not diagnosed specifically.

For the same reason, the predictive values of both positive and negative results are high for gastric or duodenal ulcers. Among patients possessing sickness certificates due to ulcers, 63% of patients had such a diagnosis stated in their health records. On the other hand, almost all the workers (98%), who were not absent due to this reason, were not given such a diagnosis. Lower values of these parameters for the two groups of diseases listed in Table 3 do not need to be discussed.

In the evaluation of health status the accuracy of absenteeism due to ulcers can be reflected by a very high relative risk (relative risk of absenteeism for this reason is more than 80 times higher in sick than in healthy persons). Therefore, absenteeism from gastric or duodenal

TABLE 3. Validity of Sickness Absenteeism as a Test for Health Status due to Diseases of the Musculoskeletal System and Connective Tissue; Relative Risk of Absence in Persons with a Diagnosis of Chronic Disease

Diagnosis	Sensitivity	Specificity	PP	NP	Relative risk *
Diseases of the digestive system (005, 009, 520—579)	0.45	0.82	0.31	0.89	3.72
— gastric ulcer, duodenal ulcer, peptic ulcer and gastrojejunal ulcer (531—534)	0.57	0.98	0.63	0.98	80.36
— diseases of the liver, gallbladder and pancreas (570—577)	0.26	0.96	0.30	0.95	8.62

* all values are significant at $\alpha = 0.05$



ulcers may well be looked upon as a measure of the spread of this disease in the population. Relatively high, yet similar PP and sensitivity values render it possible to assess the number of persons suffering from peptic ulcer disease as approaching the number of persons with absenteeism due to this reason, laying aside the risk of making significant errors. A similar situation is observable in the case of diseases of the liver, gallbladder and pancreas, although sensitivity and positive predictive values are lower.

TABLE 4. Validity of Sickness Absenteeism as a Test for Health Status due to Diseases of the Respiratory System; Relative Risk of Absence in Persons with a Diagnosis of Chronic Disease

Diagnosis	Sensitivity	Specificity	PP	NP	Relative risk *
Diseases of the respiratory system (460—519)	0.73	0.37	0.10	0.94	1.54
— chronic diseases of the respiratory system (470—478, 490—496, 500—508, 515, 518, 519)	0.32	0.93	0.31	0.94	6.58
— — chronic obstructive pulmonary diseases and allied conditions (490—496)	0.45	0.95	0.34	0.97	15.30
— — — chronic bronchitis (491)	0.41	0.98	0.49	0.98	39.49

* all values are significant at $\alpha = 0.05$

Respiratory system diseases, which dominate among the reasons for sickness absenteeism, were diagnosed in only 432 examined patients of textile industry plants, as in the medical records only the diagnoses of chronic diseases were mentioned. As many as 3291 persons were absent from work due to this reason (only 4314 cases were diagnosed).

As a result, the parameters of validity of absenteeism as a test for the state of health (except for the negative predictive value) represent the different values from analogous parameters for the diseases of other systems, and even for specific diseases of the respiratory system (Table 4).

A very high sensitivity in this case is only apparent, since absenteeism mainly from acute diseases "detects" 73% of chronic diseases, which is confirmed by the very low predictive value of positive results (only 10% of persons absent due to respiratory system diseases suffer from chronic diseases).

Absenteeism due to respiratory system diseases is not a specific test for health status. Only 37% of healthy persons (i.e. those among whom no chronic diseases were diagnosed) did not get certificates of temporary



disability to work justified by the diagnoses of respiratory system disease. It is obvious that the majority of the rest (67%) are workers who fell sick with colds during the course of the study. All this results in a 1.5-fold higher risk of absenteeism in sick persons than in healthy ones.

More detailed specification of a given diagnosis stops the absenteeism specificity from being so artificially overestimated. It amounts to 32% for chronic non-specific diseases of the respiratory system, 41% for chronic bronchitis and 45% for bronchitis, pulmonary emphysema and bronchial asthma. The other parameters rise as the diagnosis becomes more detailed, so they are lowest for chronic non-specific diseases of the respiratory system and highest for chronic bronchitis. In all the cases, specificity and negative predictive value exceed the value of 90%, which proves that healthy persons are rarely absent due to the reasons mentioned and that in other (not absent) persons these diseases are encountered very rarely. The relation between sensitivity and positive predictive value indicates that the percentage of patients can be assessed on the basis of the proportion of individuals absent only due to chronic non-specific diseases of the respiratory system. On the other hand, for bronchitis, pulmonary emphysema and bronchial asthma this proportion would result in a significant underestimation, while in the case of chronic bronchitis in the overestimation of the number of patients.

CONCLUSIONS

The use of statistical measures which characterize absenteeism as a test of the state of health, i.e. sensitivity, specificity, positive and negative predictive values and relative risk of absenteeism, rendered it possible to record the following conclusions:

1. Absenteeism is not a sensitive measure of health status — the highest sensitivity can be observed in the case of absenteeism due to gastric or duodenal ulcers (57%), chronic hypertensive disease (46%) and chronic obstructive pulmonary disease (45%).
2. Sickness absenteeism is a specific measure of the state of health, as among those considered to be healthy, people who do not show absenteeism due to a given disease prevail (82—99.6%).
3. The apparently high sensitivity (73%) and low specificity (37%) of absenteeism due to respiratory system diseases in general results from its being dominated by acute conditions.
4. In such diagnoses as heart diseases, gastric or duodenal ulcers, diseases of the liver, gallbladder and pancreas, and chronic non-specific diseases of the respiratory system, absenteeism sensitivity and positive

predictive value are similar, which proves that on the basis of the percentage of individuals with absenteeism, the proportion of sick persons can be assessed.

5. The highest relative risk of absenteeism is characteristic of persons suffering from gastric or duodenal ulcers (80.36), chronic bronchitis (39.49), and chronic hypertensive disease (30.10). The relative risk value is statistically significant in all the analysed disease groups.

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REFERENCES

1. Breslow N. E. and Day N. E.: Statistical methods in cancer research. Vol. 1. — The analysis of case-control studies. IARC, Lyon 1980. — 2. MacMahon B. and Pugh T. F.: Epidemiology. Principles and methods. Little, Brown and Comp. Boston, 1970. 3. Starzyński Z. (et al): Investigations on the health state of textile industry workers in the city of Lodz. Part I. Organization and methods of studies. *Zdrowie Publ*, 93, 10, 1982 (in Polish). — 4. Szubert Z., Wilczyńska U. and Szeszenia-Dąbrowska N.: Morbidity of textile industry workers according to a cross-sectional study and sickness absenteeism data. *Med Pracy*, 1, 71, 1988 (in Polish).

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