

THE RISK OF DEATH FROM CARDIOVASCULAR DISEASES IN THE MALE POPULATION OF WORKING AGE IN POLAND. II. EPIDEMIOLOGICAL OBSERVATIONS AND BASIC RESULTS

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Abstract. The objective of this work is to present the methodology and basic results of epidemiological studies, which facilitate the evaluation of risk of death from cardiovascular diseases in males of working age, exposed to risk factors related to this group of diseases, in comparison with females. The results revealed that in Poland, social and stressogenic factors determining strong negative life-styles play a significant part in shaping male mortality. These factors, acting in combination with high rates of hazards such as smoking, arterial hypertension, obesity and diabetes, significantly increase mortality from cardiovascular diseases.

INTRODUCTION

Part I of this work dealt with the plan and methods of the study intended for identifying those factors which significantly increase risk of death from cardiovascular diseases in males of working age; and among them those responsible for a considerably higher in males than in females risk of death. This work presents the progress of field studies and only those results which point to risk of death in males and females exposed to individual hazard factors.

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1. Methodology and progress of the studies

1. 1. Studies of the deceased

As was previously decided, the studies were carried out in two regions (voivodeships), Wrocław and Ciechanów. The socio-economical development and ecological conditions of these two regions are different. The Wrocław region is highly industrialised and polluted while the Ciechanów region is agricultural with a relatively low level of the environmental pollution.

Persons (20-64 years old) who, in 1987 died from cardiovascular diseases (390-459 entities, ICDICD) or from symptoms, signs and ill-defined conditions (780-799) were eligible for the study. The latter group of causes was taken into consideration because it had been assumed that they might be, to a great extent, a "mask" for cardiovascular diseases. After completing interviews with families of those who died from ill-defined conditions, those cases were only included in the study if relatives or doctors had reported a previously diagnosed cardiovascular disease or if symptoms preceding death, and described by relatives, indicated such a disease.

Data from local Health Departments was the basis for the final decision that, according to criteria pointed out earlier, 665 persons from the Wrocław region (50% sample) and 491 persons from the Ciechanów region (all eligible subjects) should be covered by the study.

Interviews were collected in cooperation with the national network of interviewers from the Institute of Philosophy and Sociology, Warsaw. Completed questionnaires were successively sent to the research team from the Institute of Occupational Medicine, Łódź. In the Institute the questionnaires were checked and coded.

During the period between June 1988 and the end of January 1989, 561 interviews in the Wrocław region and 450 in the Ciechanów region were collected (84.4% and 91.8%, respectively, of the planned number). Lack of information on deceased persons who had lived alone and change of the family address were the most frequent reasons of failed interviews. There were only a few cases of refusal (less than 5%).

Evaluation of comparability of investigated samples with the total population under study was performed separately for each region, taking into account such variables as sex, age and dwelling.

The comparison performed by means of the χ^2 test did not show significant differences between examined distributions in both regions.

1. 2. Studies of persons randomly sampled from the general population

The study covered two samples, 120 persons in each, of adult inhabitants (20-64 years old) of the Ciechanów and Wrocław regions. Necessary information, in line with the adopted plan of the study, was obtained by employing a standardised questionnaire interview. Its contents corresponded with



the questionnaire used in the study of the deceased. A questionnaire interview was the only source of information. Such sources of information as place of employment or doctor's report were given up. It was assumed that all indispensable information had been directly obtained from a respondent.

The same group of interviewers interviewed persons randomly sampled from the general population as in the deceased population.

The field study was started in September, 1988 and completed in March, 1989. Altogether 1,160 interviews (96.6%) were collected in the Ciechanow region and 1,059 (88.0%) in the Wroclaw region. Tables 1 and 2 present samples according to sex and place of residence.

TABLE 1. Response rate to the interview study in the general population from the Wroclaw and Ciechanow regions according to sex.

Sex	Wroclaw region			Ciechanow region		
	Sampled	Interviewed	S/I $\times$ 100	Sampled	Interviewed	S/I $\times$ 100
Males	600	506	84.3	600	572	95.3
Females	603	553	91.7	601	588	97.8
Total	1203	1059	88.0	1201	1160	96.6

TABLE 2. Response rate to the interview study in the general population from the Wroclaw and Ciechanow regions according to place of residence.

Place of residence	Wroclaw region			Ciechanow region		
	Sampled	Interviewed	S/I $\times$ 100	Sampled	Interviewed	S/I $\times$ 100
Urban area	600	470	78.3	600	561	93.5
Rural area	603	589	97.7	601	599	99.7
Total	1203	1059	88.0	1201	1160	96.6

Groups randomly sampled and studied according to sex, age and place of residence were compared by means of the χ^2 test. No significant differences were found.

2. Basic results of the studies

2.1. Risk factors considerably increasing risk of death from cardiovascular diseases in males of working age

This part of the analysis aimed at identifying, out of all the variables considered in the study (List I), those characteristics which, according to

relevant criteria, could be recognised as those significantly responsible for an increased risk of death from cardiovascular diseases in males 20-64 years old.

Description of the analytical methodology pointed out that the standardised mortality ratio (SMR) was used as a comparable measure of mortality. SMRs were calculated for males and females in groups of the "exposed" and "non-exposed" for each out of 24 variables, suspected risk factors. Calculated values of SMRs were left without comments since they were not the aim of the study. Attention was focussed on a thorough comparison of SMRs quotients in persons "exposed" and "non-exposed" to the factors under study, considering them as a measure of risk of death from cardiovascular diseases. In the assessment of the quotient value:

SMR of the "exposed"

SMR of the "non-exposed" in males, a group of factors was identified, for which, as was pointed out earlier, it was higher than 1 and fell within the confidence interval for $p = 0.05$. That means that the SMR for males exposed to a given factor was significantly higher than the SMR calculated for persons not exposed to this factor.

List of risk factors under study

1. Smoking
2. Arterial hypertension
3. Unbalanced nutrition
4. Obesity
5. Diabetes
6. Limited physical activity
7. "A" type personality
8. Alcohol abuse
9. Not taking care of personal health
10. Living alone
11. Education (primary or less)
12. Toxic factors — occupational exposure
13. Hot microclimate — occupational exposure
14. Noise — occupational exposure
15. Hard physical work
16. Strong mental strain at work
17. Sedentary work
18. Shift work
19. Extra work
20. Insufficient earnings (males)
Feeling of unfulfilled duty as a mother or a wife (females)
21. Bad housing
22. Marriage complications
23. Hard experiences, worries in recent years
24. Excessive concern about strains and problems



Table 3 displays quotients of individual SMRs for "exposed" and "non-exposed" males and for each of four stratified sub-groups.

TABLE 3. Quotients of death risk in "exposed" (SMR_1) and "non-exposed" males (SMR_2) of selected factors in urban and rural areas of the industrialised and agricultural regions.

Factor	Industrialised region		Agricultural region	
	urban	rural	urban	rural
	SMR_1	SMR_1	SMR_1	SMR_1
	SMR_2	SMR_2	SMR_2	SMR_2
1. Smoking	2.44*	0.52	1.33	1.14
2. Arterial hypertension	1.47*	4.00*	1.91*	2.68*
3. Unbalanced nutrition	0.86	1.13	1.02	1.12
4. Obesity	1.06	1.96*	0.55	1.95*
5. Diabetes	3.94*	2.17*	1.73*	91.38
6. Limited physical activity	1.48*	1.04	1.51	0.47
7. "A" type personality	0.77	0.64	1.20	0.93
8. Alcohol abuse	2.92*	1.71*	2.59*	1.77*
9. Not taking care of personal health	2.15*	2.97*	5.68*	2.34*
10. Living alone	2.68*	2.34	2.85*	1.60*
11. Education (primary or less)	1.99*	0.83	2.18*	0.52*
12. Toxic factors	0.85	0.96	0.59	0.35
13. Hot microclimate	2.25*	1.55	1.32	0.33
14. Noise	0.82	0.35	0.78	0.56
15. Hard physical work	1.54*	1.01	2.34*	0.72
16. Strong mental strain at work	1.20*	1.33	1.09	3.19*
17. Sedentary work	2.36*	3.87*	2.17*	3.23*
18. Shift work	1.11	0.95	0.93	0.67
19. Extra work	0.49	0.97	1.05	0.84
20. Insufficient earnings	2.81*	5.11*	7.37*	2.88*
21. Bad housing	2.19*	0.99	0.93	0.84
22. Marriage complications	2.50*	2.45*	5.92*	20.30*
23. Worries in recent years	1.37*	2.53*	1.06	1.79*
24. Reaction to problems	1.87*	0.98	0.87	1.08

* values of quotients $\frac{SMR_1}{SMR_2}$ — statistically significant

According to the analysis, the following factors considerably increase risk of death from cardiovascular diseases in males 20-64 years of age in each sub-group (in both regions, and in urban and rural areas):

- diagnosed arterial hypertension,
- alcohol abuse,
- not taking care of personal health,
- sedentary work,
- insufficient earnings,
- marriage complications.

Out of 24 factors under study, 18 significantly increased risk of death from cardiovascular diseases in male subjects, in one out of the four investigated populations, at least. Only six factors showed an insignificant impact on differences in mortality between "exposed" and "non-exposed" groups of males. They were:

- a. unbalanced nutrition (too much salt, sugar, or fat, too much food),
- b. "A" type personality,
- c. occupational exposure to toxic factors,
- d. occupational exposure to noise,
- e. shift work,
- f. extra work.

These factors were excluded from further analysis which was aimed at identification only of those which were responsible for the difference in the mortality rate in males and females.

The calculated rates of risk of death from cardiovascular diseases in males exposed to individual factors require a separate discussion. A more thorough interpretation of data in cause-effect terms is difficult at this stage of the analysis. The analysis does not embrace a combined occurrence of certain factors which, if cumulated, considerably increase the risk of death. Being aware of this fact, it was, however, found interesting to present the hierarchy of values of the death risk in males exposed to individual factors. The results showed that the following three variables differentiate most significantly male mortality: marriage complications (twentyfold difference); feeling of insufficient earnings (sevenfold difference); and not taking care of personal health (fivefold difference). These characteristics probably often act in combination with such variables as: alcohol abuse, smoking, primary education. Each of the latter ones analysed separately doubles the risk of death from cardiovascular diseases in the "exposed" males.

2. 2. Factors which significantly increase risk of death from cardiovascular diseases in the "exposed" males in comparison with females

The next phase of the analysis was focussed on identifying a group of factors which significantly differentiate risk of death from cardiovascular diseases in "exposed" males, from risk of death in females exposed to the same factors. It should be stressed that the results which confirm a significantly higher risk of death in the "exposed" males should be interpreted very carefully. They may indicate a combined action of another group of important risk factors of stronger adverse health effects. It may also be suspected that intensity of those factors is higher than in the group of females. Finally, certain genetic predispositions of males cannot be ruled out. Such a predisposition is likely to accelerate the progress of pathology leading to a higher mortality. A complex effect of factors under study on mortality in both sexes can be, at least partly, explained upon obtaining the results of a model analysis (not included in the presented work) while the role of genetic predispositions go far beyond the scope of this work.



In order to single out groups of factors responsible for higher risk of death from cardiovascular diseases in males than in females, SMRs for both sexes were compared in groups "exposed" to factors under study. Relevant quotients SMR_1/SMR_2 were constructed where SMR_1 was the measure of mortality in "exposed" males and SMR_2 in "exposed" females. The list of analysed factors was limited to 16, since only those factors were considered which had been previously recognised as responsible for a significantly higher risk of death in males (there were 18 of them). At the same time it was possible to estimate

TABLE 4. Quotients of death risk in "exposed" males (SMR_1) and "exposed" females (SMR_2) of selected factors in urban and rural areas of industrialised and agricultural regions.

Factor	Industrialised region		Agricultural region	
	urban	rural	urban	rural
	SMR_1	SMR_1	SMR_1	SMR_1
	SMR_2	SMR_2	SMR_2	SMR_2
1. Smoking	3.07*	—	—	—
2. Arterial hypertension	1.66*	5.75*	3.36*	2.66*
3. Unbalanced nutrition	—	—	—	—
4. Obesity	—	5.05*	—	4.62*
5. Diabetes	4.58*	0.14	7.34*	—
6. Limited physical activity	3.22*	—	—	—
7. "A" type personality	—	—	—	—
8. Alcohol abuse	—	—	—	—
9. Not taking care of personal health	4.75*	5.38*	4.40*	6.14*
10. Living alone	7.89*	8.23	9.22*	5.91*
11. Education (primary or less)	2.99*	—	3.67*	—
12. Toxic factors	—	—	—	—
13. Hot microclimate	1.19	—	—	—
14. Noise	—	—	—	—
15. Hard physical work	3.39*	—	9.79*	—
16. Strong mental strain at work	4.49*	—	—	—
17. Sedentary work	2.48*	—	2.90*	2.92
18. Shift work	—	—	—	—
19. Extra work	—	—	—	—
20. Insufficient earnings	4.70	1.52	8.74*	7.26*
21. Bad housing	5.12*	—	—	—
22. Marriage complications	7.02*	4.78*	17.31*	18.30*
23. Worries in recent years	4.22*	6.29*	—	4.72*
24. Reaction to problems	4.43*	—	—	—

* values of quotients $\frac{SMR_1}{SMR_2}$ — statistically significant

— — not compared with the group of females; factor does not significantly increase the risk in the group of "exposed" males.

— — not compared with the group of females; SMR was not calculated for females (too small numbers).

mortality in the group of "exposed" females (there were 16 of them; because of the limited number, SMR was not estimated for female alcohol abusers and for females working in a hot microclimate).

Table 4 presents detailed data on risk factors in four sub-groups. All factors under study were responsible for higher mortality in the group of "exposed" males in comparison with females, at least in one sub-group.

Bearing in mind differences between regions, pointed out earlier, it should be stressed that they referred only to urban inhabitants. In the industrialised regions as many as 15 out of 16 factors under study were responsible for the higher risk of death in males than in females. In the agricultural region only 8 such factors were indicated. However, the comparison of mortality rates in males and rural female inhabitants exposed to the investigated factors produced almost the same results for both regions.

It is worthy of notice that differences in mortality (SMR_1/SMR_2 quotient value), when compared: "exposed" males and "exposed" females, were considerably higher than differences in mortality between "exposed" and "non-exposed" males. Sex proved to be a stronger distinctive mark of mortality than the risk factors under study. Bearing in mind the relative risk ratio, it was found that in 10 out of all variables, mortality of "exposed" males was increased fivefold or even more in comparison with female mortality. The greatest differences referred to the following factors:

- a. marriage complications (eighteenfold difference),
- b. hard physical work, and
- c. living alone.

As pointed out earlier, these factors are most probably more intense in the group of males; furthermore, they act in a much wider combination of other risk factors increasing adverse health effects.

DISCUSSION

Numerous epidemiological studies conducted throughout the world have proved the significance of smoking (4, 13, 19, 20), arterial hypertension (12, 13, 19), high fat diet (13, 19, 25), obesity (3), lack of physical activity (8, 10, 15, 18), "A" type personality (22), alcohol abuse (5, 6, 11, 17) as risk factors in the incidence of cardiovascular diseases. The significance of these hazards has also been the subject of studies in Poland (2, 16, 21, 23). However, not so much has been written with regard to their effect on mortality from cardiovascular diseases. Because of methodological and organisational difficulties, cross-sectional analyses (comparison of frequency of individual risk factors in cardiovascular diseases in population of high and low mortality from these diseases) have been more frequent (11, 14) than cohort mortality studies (1, 24).

The results of many studies (eg. USA and Switzerland) have showed that a decline in mortality from cardiovascular diseases, observed in several countries, should be mainly attributed to the diminished extent of risk factors in those populations (9, 26). In studies conducted so far, both on incidence

and mortality, little attention was given to the role of socio-occupational and stressogenic factors.

In this work, using retrospective data, it was confirmed that as many as 18 out of 24 factors described in the literature increase risk of cardiovascular diseases. The same tendency was observed in the rate of death risk in males living in two selected regions of Poland. The following factors most strongly differentiated the risk of death in males: marriage complications, feeling of insufficient earnings, lack of care about own health, while arterial hypertension and diabetes took further places. This apparently surprising observation concerning the first three factors probably proves that this group of the population is additionally exposed to other factors acting in combination, such as smoking or alcohol abuse.

No differences were found in male mortality in relation to unbalanced nutrition, "A" type personality, occupational exposure to toxic factors and noise, extra and shift work. A negative result may be related to the application of direct measurement, based in the case of the diseased, on information obtained from relatives (rarely used by other authors) which, finally, may misclassify the subjects to the group of "exposed". In regard to extra and shift work, the desired effect would probably emerge if a group of persons, who continued such work despite symptoms of the disease, could be identified.

It is difficult to interpret the differences in rates of death risk between urban areas of the industrialised and agricultural regions, found in this study. It may only be suspected that factors characteristic of urban agglomerations, uncontrolled in our study, do exist and reinforce additionally the effect of the discussed hazards (for example air pollution in the case of smoking). Probably bad housing or everyday problems and strains are more stressogenic in urban inhabitants of the industrialised region.

In addition, it should be strongly stressed that in the case of each "verified" factor, risk of death from cardiovascular diseases was higher by several times in males than in females exposed to individual factors. For 10 out of all factors, the mortality of "exposed" males was higher by five or even more times in comparison with mortality in the group of "exposed" females. The extent of these factors is most probably much stronger in the group of males and in addition, those factors act in a much wider combination of other risk factors increasing adverse health effects. A multifactor model analysis, already prepared, will partly explain this question.

It is worth mentioning that similar results were obtained in the study of the effect of risk factors in cardiovascular diseases on the incidence rate in males and females. Thus, the Framingham study indicated a risk of cardiovascular diseases 3.5 higher in males than in females even if arterial hypertension, body weight, cholesterol, smoking and glucose in the serum had been controlled (7).

Similar observations were made in comparative studies conducted in Framingham, Honolulu and Puerto Rico. The differences observed in the incidence of ischaemic heart disease could not be explained by differences found in the extent of risk factors (measured according to standards) in those populations (13).



To sum up, it should be stressed that the cross-sectional studies, employing indirect techniques of measurement of various variables, do not produce a base for final identification of the cause of differences in mortality from cardiovascular diseases according to sex observed in Poland. The results could only serve as groundwork for constructing detailed cause-effect hypotheses.

The results, however, permit to assume that a group of given social factors which strongly determine negative health behaviour as well as stressogenic factors, characteristic for Poland, are especially responsible for such high mortality in males. Males are very frequently exposed to these factors which, in turn, interfere in their health condition. They may act in combination with well known risk factors such as smoking, arterial hypertension, obesity and diabetes increasing mortality from cardiovascular diseases.

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