Cardiovascular Mortality in the Federal Republic of Germany, 1970–79, and the Evaluation of the German Cardiovascular Prevention Study: Results from a Geographic Mortality Study

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Introduction

The German Cardiovascular Prevention Study (GCP) is a multicenter community-oriented study aiming at the primary prevention of cardiovascular diseases [1]. The analysis of the primary endpoint of this study, cardiovascular mortality, has to be based on the official mortality statistics for the study areas (Berlin Spandau, Bremen North and West, Stuttgart West and Vaihingen, County of Traunstein, known as "Kooperative Prävention" and Karlsruhe/Bruchsal/Mosbach, known as "Kommunale Prävention") as compared to that of the Federal Republic (FRG) as a whole. The difference between the "Kooperative Prävention" and the "Kommunale Prävention" primarily represents a difference in intervention concepts: In the study regions Karlsruhe/Bruchsal/Mosbach the preventive strategy is more strictly on a positive vote and the explicit support by the regional medical association, see [1] for further details. The quasi-experimental design of the study led to a decision for the FRG as a whole as a reference for the intervention regions, since single control communities are not easily found far enough from the intervention regions, whereas the study communities were selected to represent socioeconomic characteristics of the national reference, see [1]. The primary endpoint of the study consists of the mortality from
- ischemic heart disease (ICD-9 410–414)
- cerebrovascular diseases (ICD-9 430–438)
in the age group 25–69. See [1] for more details on the study design.
In order to clarify the scientific basis for this kind of approach a geographic mortality study has been carried out [2]. The aim of this paper is to report on some of the results from this study by
- describing temporal and regional trends for ischemic heart disease and cerebrovascular diseases mortality in the FRG over the period 1970–79
- providing mortality comparisons of the pool of ("Kooperative Prävention") intervention regions to the FRG.

Materials and Methods

Cause-specific mortality and population rates by five-year age groups and sex for the counties of the FRG in the time period 1970–79 were used to investigate cause-specific mortality regarding the ICD-9 categories by county:

410–414 (ischemic heart disease [IHD]),

430–438 (cerebrovascular diseases),

and the combined categories 410–414, 430–438 (primary endpoint of the GCP) for the pool of ("Kooperative Prävention") intervention regions and the FRG as a whole. Due to limitations of the data different types of aggregations had to be used, depending on the type of comparison. This limited availability of mortality data also led to different time spans being covered by this study.

Time Trends of Cardiovascular Mortality in the FRG

For the FRG as a whole, aggregation over the different counties and causes of death yielded age-, sex-, and cause-specific mortality data for the above-mentioned categories for the years 1970–79. From these data suitable rates were calculated on an annual basis. These rates were used to form age-standardized sex- and cause-specific rates, where SEGI's world-population [3], restricted to the GCP age groups 25–69, was used for direct standardization.

Geographic Variation of Cardiovascular Mortality in the FRG

Due to administrative changes the number of counties in the FRG was reduced from 471 in 1970 to 328 in 1975, the latter being the number presently existing. Because of other changes (e.g. border lines) only mortality data from the period 1977–1979 were used to calculate the aggregated (1977–1979) age-specific and standardized rates for all of the present 328 counties of the FRG. Since the change from the 8th to the 9th revision of the ICD apparently was not executed in all states of the FRG simultaneously (in 64 of the counties the use of the eighth revision was marked in the mortality data record of the year 1979), and the effect at least in the first year seemed to be small, it was decided to include the year 1979 in order to reduce the variability of the rates (the differences in size of the counties

are considerable!). This evaluation of the effect of the ICD revision is based on findings by Berg-Schorn [4], indicating an effect for the ICD group 410−414 of not more than 11%, and on our own calculations of the mortality development from 1970 to 1979. The codes used for the two groups of diseases of this study were the same for the two revisions. In order to facilitate international comparisons and comparisons with the German Cancer Atlas [5] SEGI's world population was used without restrictions on age.

Comparison of Cardiovascular Mortality in the Intervention Regions to that of the FRG

To calculate mortality rates for the pool of the intervention regions, appropriate mortality data were available for Berlin Spandau, Bremen North and West and the county of Traunstein only for the years 1974−1979. For Stuttgart West and Vaihingen, the data from the county of Stuttgart had to be used and appropriately weighted for the calculation of the rates of the pool.

In order to focus on the study population of persons aged 25−69, the standard population was restricted to this age range for the calculation of age-standardized rates. To compare mortality figures from the intervention regions and the FRG, unweighted averages of age-specific and age-standardized rates over the period 1974−1979 were used.

Results

Time Trends of Cardiovascular Mortality in the FRG

Unlike the US [6], the FRG has not experienced a sharp decline of ischemic heart disease during the time period 1970−79. (See Fig. 1.) Only for cerebrovascular diseases, a negative trend for both sexes can be observed (−20.2% for males, −21.3% for females). For the combined categories the rates remain nearly constant for males, whereas females experience a slight downward trend (−7.9%). Within the combined ICD-9 categories 410−414, 430−438, the proportion of deaths from ischemic heart disease (IHD) steadily increases for both sexes, as can be seen from Fig. 2. One can also see that the proportional mortality within this combined group is consistently higher for younger age groups in men. For women, this effect is not so pronounced, but here the mortality pattern changes much more strikingly over time.

Geographic Variation of Cardiovascular Mortality

The map, Fig. 3, of age-standardized mortality rates by quintiles of the distribution shows high geographic clustering for both causes of death in males with high rates in the Rhine-Ruhr area, which is a highly industrialized part of the FRG. Generally, IHD rates tend to be higher in the northern part of the FRG. A predominant cluster for stroke mortality is observed in the states of North Rhine-Westphalia, the Saarland,
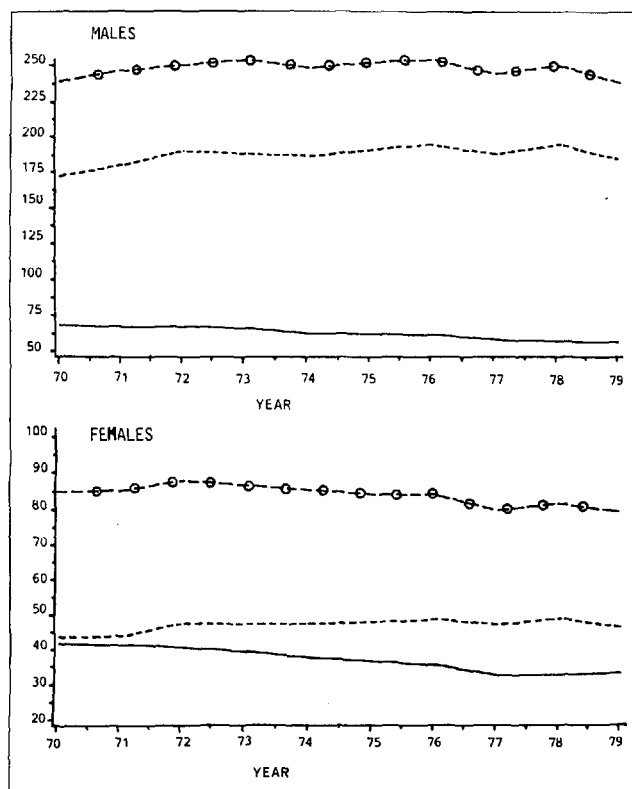

Fig. 1. Death rates for ischemic heart disease (----), cerebrovascular diseases (——) and the combined categories (—⊖—⊖—), FRG residents, aged 25−69, adjusted to SEGI's world population (per 100.000 population).
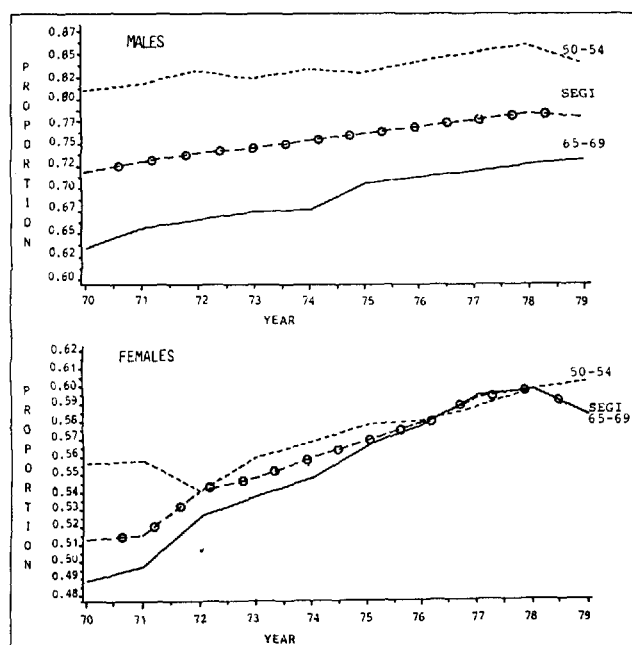

Fig. 2. Proportion of death from ischemic heart disease in the combined categories ICD 410−414, 430−438, FRG males and females, aged 50−54 (----), 65−69 (——), and adjusted to SEGI's world population 25−69 (—⊖—⊖—).
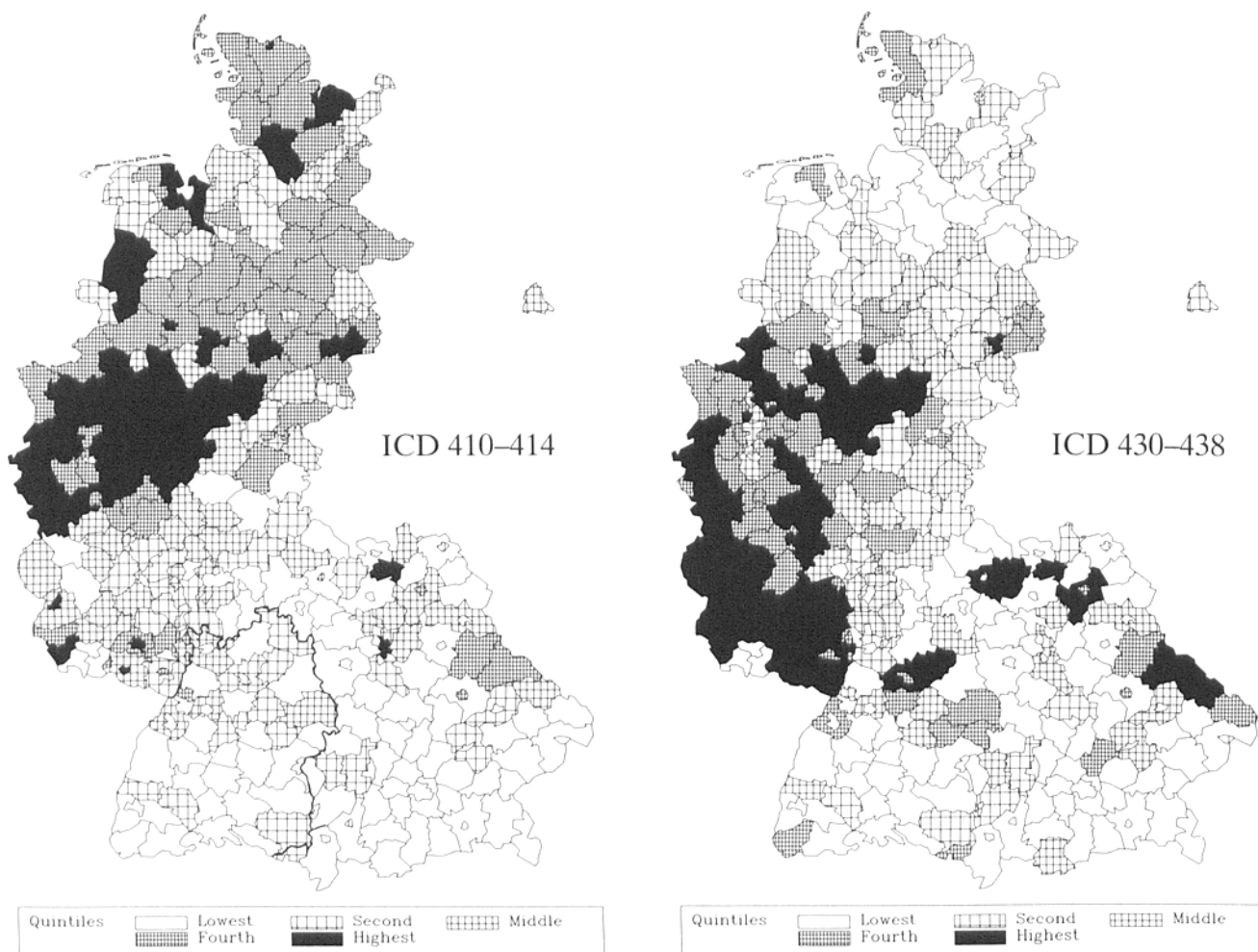
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Fig. 3. Age-adjusted mortality for FRG males, 1977–1979 (standard population = SEGI's world population) in ischemic heart disease (ICD 410–414) and cerebrovascular diseases (ICD 430–438).

Rhineland-Palatinate and in the western parts of Baden-Württemberg.

Another interesting feature are the relatively high rates in counties at the eastern border, pointing in the same direction as Zachcial's findings [7]. It is not clear whether these differences are real or whether they are due to problems in the accuracy of the population counts (which have to be based on estimates from the 1970 census). The patterns presented here only for males are similar for females. Although these geographical patterns are most probably due to a certain degree of exposure to some common risk factors (e.g. smoking, nutritional habits), they may also reflect a speciality of FRG mortality statistics: The coding of the death certificates according to the International Classification of Diseases (ICD) is performed in the statistical offices of the different states by nonmedical staff. The geographic distribution of the proportion of IHD mortality in the combined group, Fig. 4, shows a marked "state effect", which points to the limited validity of the official mortality statistics with respect to these causes of death.

Comparison of Cardiovascular Mortality in the Intervention Regions and in the FRG

The visual inspection of the age-standardized mortality rates for the three categories of death over the period 1974–1979 indicates, that the mortality pattern of the pool parallels that of the FRG. (See Fig. 5.) The absolute level of IHD, cerebrovascular mortality, separate and combined, however, is consistently lower for the intervention regions, as may be seen from Table 1. This effect is more pronounced for older age groups and stronger for cerebrovascular than for ischemic heart disease mortality. The difference in levels should not be a methodological problem if the apparent parallelism persists for future years. Otherwise the observation of different trends during the intervention period may not easily be attributed to the effect of the inter-
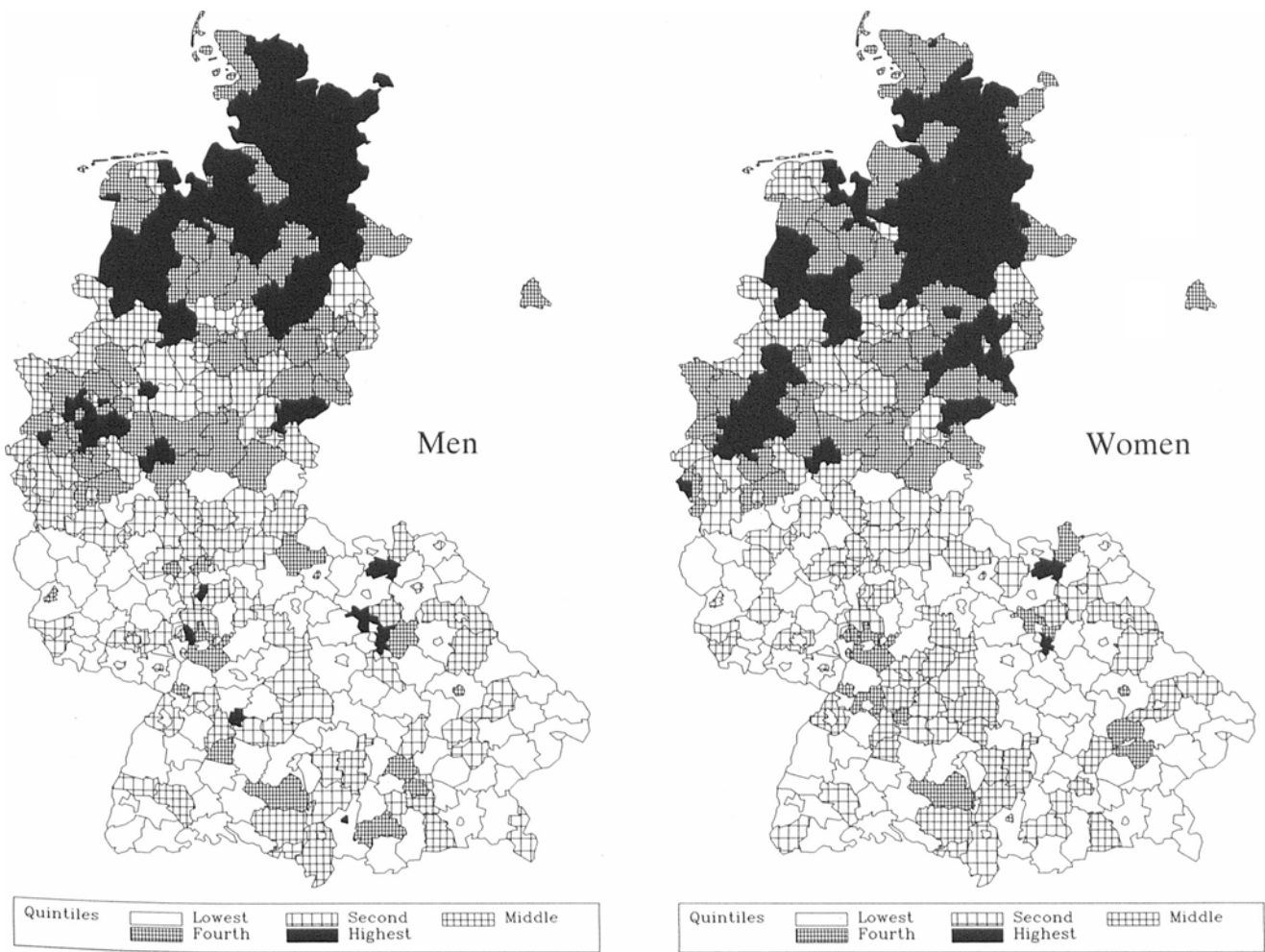
Fig. 4. Proportion of deaths from ischemic heart disease within combined categories ICD-9 410−414, 430−438 in FRG males and females 1977−1979 (adjusted for SEGI's world population).

vention. As Table 2 shows, the proportional mortality from IHD with respect to the combined categories is higher for the pool of intervention regions than for the FRG as a whole.

Tab. 1. Relation of cardiovascular mortality[1] of the pool of intervention regions to the FRG in different age groups (in %).

ICD-9 cate- gories	Age groups							
	25−69[2]		50−54		60−64		65−69	
	Males	Females	Males	Females	Males	Females	Males	Females
410−414	94.7	92.4	96.1	105.8	96.2	98.2	90.0	90.0
430−438	80.4	82.5	85.1	86.8	92.8	82.7	85.5	80.6
410−414, 430−438	92.8	88.3	94.4	98.0	95.4	92.2	88.7	86.1

Tab. 2. Proportion of mortality[1] from ischemic heart disease within the combined categories ICD 410−414, 430−438 in different age groups.

		Age groups			
		50−54	60−64	65−69	25−64[2]
M A L E S	Inter- vention regions	85.4%	77.4%	71.7%	78.1%
	FRG	83.8%	76.8%	70.7%	76.6%
F E M A L E S	Inter- vention regions	63.3%	65.2%	60.4%	60.6%
	FRG	58.6%	61.2%	57.7%	58.0%

[1] unweighted average of rates, 1974−1979
[2] adjusted for SEGI's world population

[1] unweighted average of rates, 1974−1979
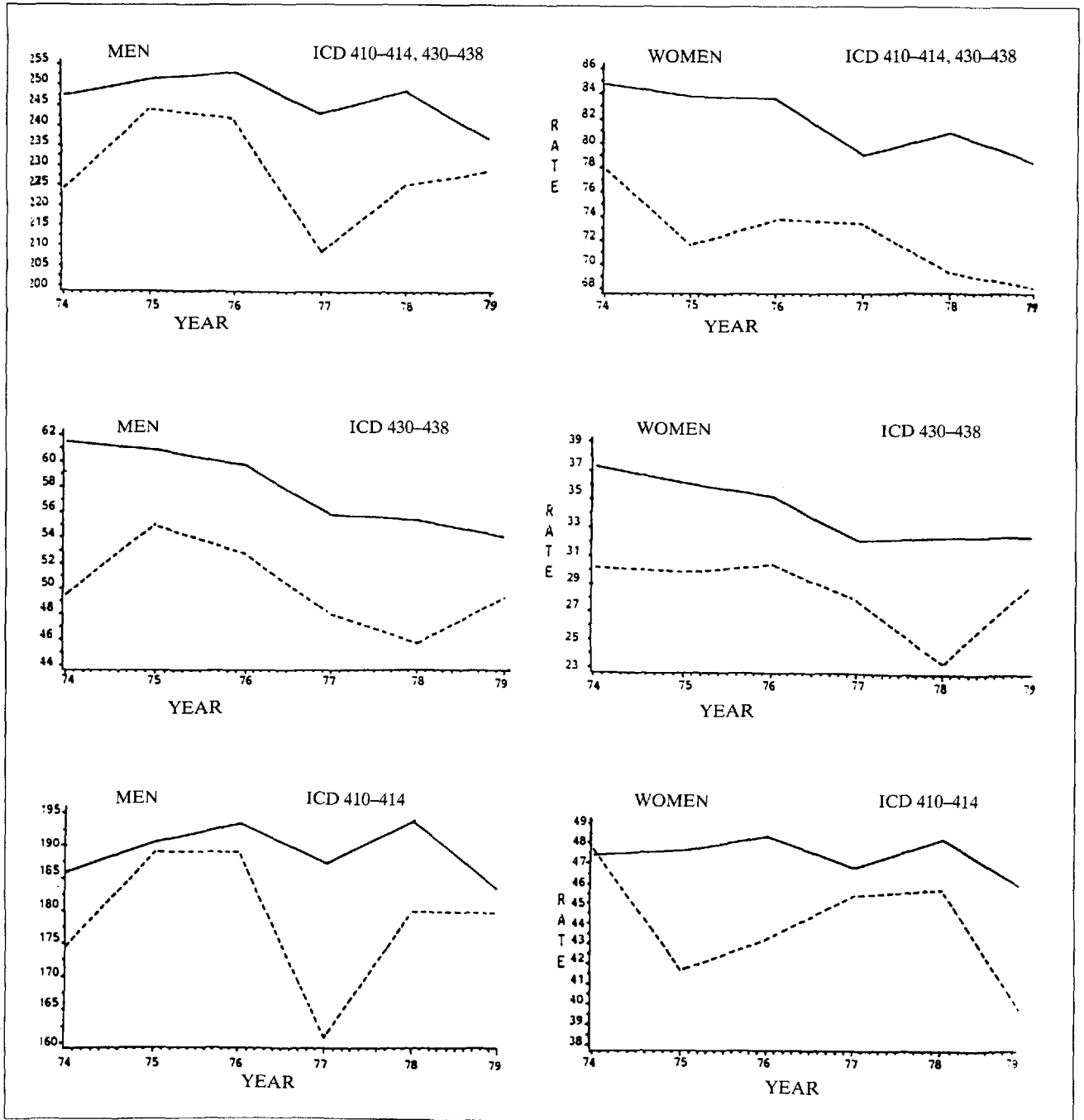[2] adjusted for SEGI's world population

Fig. 5. Comparison of cardiovascular mortality in the intervention regions (——) and the FRG (- - - -), rates in males and females aged 25—69, adjusted to SEGI's world population (per 100.000 population), 1974—1979.

Discussion

The results from the present study give rise to questions requiring further investigation concerning the validity and reliability of the mortality statistics, the impact of the numerator problem and the adequacy of certain statistical models. This is beyond the scope of this paper. The reader is referred to [2] for further details. From the comparative analysis of the pool of intervention regions and the FRG it seems obvious,

however, that relying on the reference "FRG as a whole" may pose some severe problems, if the observed parallelism turns out to be unstable for future years. As an alternative, selected counties or aggregates of counties might be considered as reference regions. Such reference regions should be comparable to the intervention regions with respect to mortality and certain sociodemographic characteristics. First steps in this direction based on mortality

information alone, have been made, and further analysis including sociodemographic variables are planned for the near future.

Summary

The primary endpoint of the German Cardiovascular Prevention Study (GCP), cardiovascular mortality, has to be based on the official mortality statistics. In the scope of a geographic mortality study trends and regional variations of ischemic heart disease (ICD-9, 410–414) and cerebrovascular disease (ICD-9, 430–438) mortality were investigated. During the study period from 1970 to 1979 a relevant decline of cerebrovascular diseases in men and women was observed, whereas ischemic heart disease mortality figures remained relatively stable. Over time the importance of ischemic heart disease mortality has increased. The geographic analysis points to relevant problems concerning the validity of mortality data due to the particularities of the German mortality statistics (separately signed in the 11 statistical offices of the 11 federal states). The mortality rates of the four intervention regions of the "Kooperative Prävention" (corresponding data of "Kommunale Prävention" not available) indicate that the intervention regions are at a considerably lower level than the FRG, the mortality patterns, however, paralleling those of the FRG. As far as mortality structures are concerned, ischemic heart diseases are more important in the intervention regions than in the FRG as a whole.

Résumé

Etude de prévention des maladies cardio-vasculaires en Allemagne Fédérale: comparaison des taux de mortalité entre les régions d'intervention et l'ensemble du pays

Les résultats obtenus pour l'étude allemande de prévention des maladies cardio-vasculaires sont mesurés à l'aide de la statistique fédérale des décès. Les causes de mortalité investiguées sont les maladies ischémiques du cœur (CIM-9 410–414) et les maladies cérébro-vasculaires (CIM-9 430–438). Pour l'Allemagne Fédérale, dans son ensemble, de 1970 à 1979, une baisse significative de la mortalité cérébro-vasculaire a été observée, alors que la mortalité cardio-vasculaire est restée plus ou moins stable. Par comparaison, dans les quatre régions d'intervention de l'étude pour lesquelles les données sont disponibles, les taux de mortalité, pour les deux groupes de décès, sont inférieurs à ceux du pays, avec des tendances temporelles comparables. Cependant, le poids relatif de la mortalité ischémique y est plus élevé. La discussion porte sur la comparabilité inter-régionale des données de mortalité en Allemagne Fédérale, où le codage des causes de décès se fait séparément dans chacun des Etats.

Zusammenfassung

Kardiovaskuläre Mortalität in der Bundesrepublik Deutschland 1970–1979 und die Evaluation der Deutschen Herz-Kreislauf-Präventionsstudie: Ergebnisse aus einer geographischen Mortalitätsstudie

In der Deutschen Herz-Kreislauf-Präventionsstudie soll die Evaluation des primären Endpunktes, der kardiovaskulären Mortalität, auf der Basis amtlicher Mortalitätsstatistiken erfolgen. Im Rahmen einer geographischen Mortalitätsstudie wurden Trends und regionale Variation der Mortalität an ischämischen Herzkrankheiten (ICD-9, 410–414) und der zerebrovaskulären Krankheiten (ICD-9, 430–438) untersucht. Im Studienzeitraum 1970 bis 1979 konnte für Männer und Frauen ein relevanter Rückgang an zerebrovaskulären Krankheiten festgestellt werden, während für ischämische Herzkrankheiten kein eindeutiger Trend festzustellen war. Es lässt sich weiterhin zeigen, dass ein Wandel der Struktur der Mortalität in der Gesamtgruppe dieser Krankheiten zugunsten der ischämischen Krankheiten stattfindet, die geographische Analyse deutet auf relevante Validitätsprobleme im Zusammenhang mit den Besonderheiten der deutschen amtlichen Statistik (Signierung jeweils in den 11 statistischen Landesämtern der 11 Länder) hin. Die Mortalitätsraten der vier Interventionsregionen der «Kooperativen Prävention» (für die «Kommunale Prävention» standen keine entsprechenden Daten zur Verfügung) zeigen, dass die Interventionsregionen im Vergleich zur Bundesrepublik auf deutlich niedrigerem Niveau liegen, die Entwicklung in den Jahren 1974 bis 1979 jedoch den Bewegungen der Raten der BRD folgt. Hinsichtlich der Struktur der Mortalität besteht in den Interventionsgebieten eine höhere Bedeutung der ischämischen Herzkrankheiten gegenüber den zerebrovaskulären Krankheiten im Vergleich zur BRD.

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