POLAND AND UNITED STATES COLLABORATIVE STUDY ON CARDIOVASCULAR EPIDEMIOLOGY: ALL-CAUSE AND CARDIOVASCULAR MORTALITY TRENDS - IS POLAND REPEATING THE US EXPERIENCE OF 30 YEARS AGO?

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Abstract

The objective of the study was to contrast cardiovascular mortality levels and trends between Poland and the United States across strata of gender, area and ethnicity (US only). Mortality and population data for each country were obtained from the Main Statistical Office in Poland and from the US National Center for Health Statistics Compressed Mortality File. The presented moving average rates were age standardized (WHO world population as standard) and calculated per 100,000 population. The study analyzed the national rates as well as rates for the two Polish areas covered by the Pol-MONICA Project (Warsaw and Tarnobrzeg) and for the four US economic areas covered by the ARIC Study (Minneapolis, M.N.; Jackson, M.S.; Forsyth County N.C.; and Washington County, MD), from which the trends of risk factor levels were available.

In the early 1970's age- and gender-specific all-cause, cardiovascular disease, coronary heart disease and stroke mortality rates were higher in the US than in the Polish populations. However, different trends of these rates were observed between 1970 and 1995. Mortality rates declined in the US and increased in Poland up to 1990, resulting in Polish rates which exceeded US White rates and approached or exceeded those for African American rates by 1995.

Key words: ARIC Study, Pol-MONICA Project, all cause mortality, cardiovascular mortality, coronary heart disease, stroke, international comparisons, time trends
Background

Cardiovascular diseases (CVD) are the leading cause of death in both the United States (US) and Poland. However, while the US and western European Countries have experienced declines in death rates from these diseases for nearly three decades, rates in Poland and in other Central and Eastern European countries have increased at least up to the last decade (1 - 3). The enormity of the CVD problem in both countries served as the stimulus for establishing a joint effort to study CVD epidemiology. Although the causes of international variation in CVD mortality are not well understood, temporal and cross-population variations in lifestyle, socio-environmental and medical care factors may provide a partial explanation. It should be noted that, since 1989, the Polish population has been under strong social stress as a consequence of economic transformations the country has undergone which could have influenced the mortality trends.

This report, as a part of the Poland and US Agreement on Cardiopulmonary Research (4), compares cardiovascular mortality trends in the two countries at the national level and within the areas covered by two research projects, the US ARIC Study (Atherosclerosis Risk in the Communities) (5) and the Pol-MONICA Project (Monitoring of Trends and Determinants of Cardiovascular Diseases) in Poland (6) which serve as the basis for the collaborative efforts in cardiovascular epidemiology.

An important objective was to contrast cardiovascular mortality rates and trends between the two countries across strata of gender, area and race (the latter in the US only) because the different mortality rates experienced among these subpopulations suggest that trends may also differ (7,8,9,10).

Material and Methods

National mortality and population data were obtained from the Main Statistical Office in Poland (11) and from the US National Center for Health Statistics Compressed Mortality File (12). Individual year age strata from the Polish data were aggregated to match the ten-year age strata provided for the US. The Pol-MONICA Project covers two populations, one containing residents of two districts of Warsaw, the capital of Poland, and another of residents of Tarnobrzeg voivodship, a semi-rural area in Southeastern Poland. The ARIC Study includes residents of four communities: Forsyth County, North Carolina; the city of Jackson, Mississippi; eight suburbs of Minneapolis, Minnesota, and Washington County, Maryland. Mortality rates were determined for the State Economic Areas (SEA) containing the ARIC Study communities (SEA is a US geographic unit
consisting of a single metropolitan county or a group of nonmetropolitan counties sharing similar social and economic characteristics).

The all-cause, cardiovascular disease (CVD), coronary heart disease (CHD), and stroke mortality rates and their trends were calculated separately for males and females aged 35-64 years. Stratification of the US population into African Americans and White Americans was due to the markedly different mortality experiences in the two groups (13,14). The regional mortality trends were computed for the US white populations only in order to make them comparable to the Polish samples and to eliminate race as a possible confounder.

All rates were age-standardized using weights determined previously from Segi's world population (15) and were calculated per 100,000 population.

Underlying cause of death in Poland was classified in accordance with the Eighth (1970-1979) and Ninth (1980-1996) Revisions of the International Classification of Diseases, Traumas and Causes of Death (ICD) (16,17). Underlying cause of death in the US was classified in accordance with the Eighth ICD Revision adapted for use in the United States (1968-1978) and the Ninth Revision of the ICD (1979-1994) (18,19). Deaths attributable to CVD were identified as eighth and ninth revision rubrics 390 through 459. Deaths attributable to CHD were adjusted for comparability in the coding rules between the two revisions of ICD's by including in CHD category number 410-413 for the ICD-8 and category numbers 410-414 and 402 for ICD-9 for both countries and additionally 429.2 in the US only (in Poland only 3-digit codes were recorded; however, due to the relatively very few deaths in this category the comparisons should be affected only minimally.) Deaths attributable to stroke were identified as eighth and ninth revision rubrics 430 through 438.

Mortality rates were presented as five-year moving averages (the last value shown in the tables and figures covers 4 years only). Average annual change in mortality rates presented in table 2 were evaluated by linear regression models based on standardized rates for each year and presented as annual average change. The linear trends for US populations were computed for years 1968-1995 and for 1968-1990 and 1991-1995 separately to make them comparable to the Polish data; trends for Poland were computed for years 1970-1996 and for 1970-1990 and 1991-1996 separately because mortality rates appeared to peak in 1990. Furthermore, in Poland a new administrative structure was introduced in 1976 and as a result there were no comparable data available for the analyzed areas before this year.
Results

All cause mortality rates (fig. 1)

In both genders, the all cause mortality rates at the beginning of the observation period were highest in US African Americans (AA) and lowest in Poland (fig. 1 and table 1). However, during the period included in this report, rates declined in the US but, in Poland, they increased up to 1990 in men and leveled off in women. After 1990, the all cause mortality rates declined sharply in both genders in Poland, and showed some tendencies to level off in the US populations (table 2).

The five-year moving average all cause mortality rates differed markedly at the outset of the collaborative effort in 1978. For years, mortality was highest in Warsaw, and lowest in Minneapolis. At this point in time there was relatively little difference between all cause mortality for men in Tarnobrzeg and the US areas other than Minneapolis. However, over time, rates declined in all US areas except in Jackson, while they remained relatively constant in Warsaw and increased in Tarnobrzeg. These trends over time resulted in marked excesses in the Poland areas compared with the US areas. The pattern was somewhat different for women. All cause mortality was higher in Warsaw in 1978 than in the remaining study areas in both countries and there was little difference among them. There was also little variation in levels over time.

Total cardiovascular disease mortality (fig. 2)

In the early 1970's total CVD mortality was highest in African Americans and lowest in Poland (fig. 2 and table 1). However, these rates then declined in all US populations, but increased in Poland in both genders up to 1990 after which they too declined (table 2). As a result of these time trends in mortality rates, the CVD mortality at the end of period was higher in Polish men than in either US male population. However in women these rates remained the highest in US African American followed by Polish and US white women.

For CVD mortality in men, rates for 1978 were very similar among all areas except for a lower rate in Minneapolis. However, there were marked differences in trends over time. From 1978 to 1990, there was an increase in Polish areas while rates declined in US areas. Subsequent to 1990, CVD rates declined in both Polish areas, appeared to plateau in Washington County, continued to decrease in Minneapolis and Forsyth, and increased in Jackson. The result of these trends was marked difference
in CVD mortality rates in 1994, in contrast to their similarity earlier on. In women rates were generally stable over the period of study with rates higher in Poland than the US, with little variation among areas within countries.

Coronary heart disease mortality (fig. 3)

In the early 1970's, CHD mortality was much higher in the US populations than in Poland (fig. 3 and table 1). At that time, CHD mortality of African Americans was more than 3 times higher than that of Polish men and almost 8 times higher for Polish women. Large differences were also observed between the rates of African American and White American women. The decline of CHD mortality in the US and its increase in Poland up to 1990 (table 2) resulted in Polish CHD mortality rates being higher than in White American in both genders, and approached this mortality in African American men.

At the beginning of the collaboration, CHD mortality rates in men were lower in both Polish areas than in all US areas, especially than in Washington County, where the rates were highest. However, there were marked differences in trends over time. From 1978 to 1990 the decline of rates was observed in US areas and their increase in Poland. Subsequent to 1990, CHD rates declined in both Polish areas and in Minneapolis and Forsyth, whereas in Washington County and Jackson they increase. At the end of observation highest rates were in Jackson, followed by both Polish areas. The lowest rates were in Minneapolis. Similar differences in rates by area and in their trends were observed in women. At the end of observation, the rates were higher in Washington County, Jackson, followed by Warsaw and Tarnobrzeg areas.

Stroke mortality (fig. 4)

Stroke mortality in the early 1970's was higher in African American compared with White American or Polish populations (fig. 4 and table 1). In the next years, the mortality rates declined for African American men and women and White American women and leveled off for White American men (table 2). In Polish populations, for the period 1970-1990, an increase in stroke mortality was observed both in men and in women; however, since 1990 these trends declined in Poland (table 2). At the end of the period, stroke mortality became higher in Polish men than White American men and similar to African American men, whereas in women the Polish rates were between those for White American and African American.
For the whole observation period the stroke mortality by rates were higher in both Polish areas, in men and in women, than in US areas. Over time these rates declined in US areas except in Forsyth men where some increase of rates in 1990’s was observed. In Warsaw men these rates were rather stable while in Tarnobrzeg they increased being still lower than in Warsaw. In women, there is a decline in these rates in Polish areas, while some leveling off in US areas.

**Discussion**

Cardiovascular diseases are the major cause of death in adults and in the elderly in the majority of the developed countries and in many developing countries. Cardiovascular mortality began to decrease in USA in the mid-1960’s, first in California, and somewhat later in the north-eastern states and Appalachian region of the middle Atlantic states. Since the 1970’s, decreases in CVD mortality have been observed for each gender, race and socioeconomic group (9, 20). The total age - adjusted mortality rate has also declined, providing confirmation that the decrease in heart disease (being the major cause of mortality), was both real and important and not an artifact of shifting classification of causes of death.

In Poland total and cardiovascular mortality presented quite different trends. The report of the Task Force of the European Society of Cardiology on Cardiovascular Mortality and Morbidity Statistics in Europe (2) stressed: "More recent analysis of mortality data points to a substantial increase in cardiovascular diseases in countries of Central and Eastern Europe concomitant with recent nutritional, economical and political changes". Foster and Jozan, (10) analyzing the poor health record in Eastern Europe, underline: "From the 1939-1945 war to 1964 the decrease in mortality rates in many Eastern countries was similar to that in Western Europe. This period coincided with the post war reconstruction stage, better nutrition and the effective treatment of infectious diseases. There are several reasons why this improvement in mortality rates has not been maintained. In Eastern Europe, industrial production and other factors have taken precedence over health". Furthermore, they wrote, "Less attention has been given to the health of middle aged and older people and there has been a lack of investment in health care technology".

In reference to the differences in mortality trends between Poland and USA, the statement of Hunink et al (21) should be quoted: "In a previous analysis based on a literature review that evaluated changes from 1968 to 1976, 63% of the decline in CHD mortality (in USA) was estimated to be owing
to risk factor reduction, including reduction in blood pressure and 31% owing to other medical intervention”. Goldman and Cook (22) estimated that 54% of the decline in the death rate from ischaemic heart disease was related to changes in lifestyle, while 40% could be attributed to medical interventions. These conclusions were supported by Hunink et al (21). Bots and Grobbee (23), analyzing the contribution of the observed Netherlands decline in CVD mortality of medical care and changes over time in presence of major CVD risk factors, conclude that improvements in medical care contribute only 46% to the observed decline in CHD mortality trend, whereas approximately 44% of the decline could be attributed to primary prevention efforts and changes in risk factors. National and regional US data confirm there have been changes in several of the major risk factors levels. Higgins and Thom, analysing the CHD trends in USA, (9) found a decrease in smoking prevalence both in men and women. According to the estimates 33% of men and 28% of women were current smokers in 1985. The detection, treatment and control of hypertension have also improved. Approximately 57% of hypertensives were, according to them, properly controlled. The reduction of blood total cholesterol level has been noted; the fall ranged from 9 mg/dl to 7 mg/dl in white women and men and to 2 mg/dl in Blacks of both genders. There have been also substantial changes in the American diet in recent years following the AHA dietary recommendations.

In Poland, up to mid-1980, there were no national programs devoted to the community dealing with cardiovascular prevention or health promotion. Such programs as were available were of local interest only and of research character (24). Risk factors levels were much higher in Poland than in the USA. For 1983/84, the WHO Pol-MONICA Project reported that more than 50% of middle aged men and more than 30% of women were current smokers (25), hypertension prevalence was higher in Polish than in US samples and its control was rather very poor (26), prevalence of hypercholesterolemia was close to 70% in middle aged adults of both genders (25) with no change in its level in due time. It should be also taken into account that the Polish economic situation was much worse than in the US populations and it is known that members of lower socioeconomic groups experience higher incidence and mortality rates and poorer survival rates for most major chronic diseases. Moreover the risk of morbidity and mortality consistently declines as the socioeconomic situation improves.

The presented data confirm the existing differences both in mortality rates and their trends over time between US and Poland. These differences are even more expressed while analyzing the data
from the US and Polish areas. These data confirm also the racial differences in rates and their trends in the US (8,13,14). Whereas the mortality rates in Poland were at the beginning of observation much lower than in the US, especially in African Americans, these rates at the end of observation were much higher in Poland than in US Whites and approach or even overcome the rates of African Americans. This was the result of the sharp decline in the 1980’s nad leveling off in the 1990’s of mortality rates in the US, (27,28) and an increase in 1980’s and sharp decrease in the 1990’s of these rates in Poland (2). The observed decline of Polish mortality rates is a new phenomenon. Zatonski et al (29) analyzing the possible causes of these trends stated: “Neither access to medical services nor their effectiveness has obviously improved since 1989. The health service budget did not increase after 1989”. Therefore reduction in CVD and CHD deaths in Poland cannot be explained by changes in medical service, so one should examine the population for lifestyle changes. After introducing the free food market in Poland in 1989, different low fat milk products, different fruits and vegetables, and other low fat and low calories products became available. According to Pol-MONICA Warsaw data (30), this influenced the Polish daily diet- and within the years 1984-93 a decrease of total energy and saturated fat intake was observed as well as an increase in polyunsaturated fat intake and fruit and vegetable consumption. Furthermore, the decrease of hypertension prevalence and improved hypertension control as well as decrease of smoking prevalence particularly in men was observed. However, no changes in dislipidemia nor obesity prevalences were found (25). Dobson et al (31) analyzing the change in global risk in the WHO MONICA populations between the first and second screens (in Warsaw between 1984 and 1988), found that the CHD risk of Warsaw population decreased between these screens. This improved CHD risk proceeded the decrease of CVD mortality rates. Poland, along with the Czech Republic (32), are the only countries from the previous Socialist Block, where after the political-economic transformation, a decrease in CVD mortality has been observed.
Bibliography


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Fig 1. Age standardized total mortality rates in men and women aged 35-64 years

Fig 2. Age standardized total cardiovascular disease mortality rates in men and women aged 35-64 years

Fig 3. Age standardized coronary heart disease mortality rates in men and women aged 35-64 years

Fig 4. Age standardized stroke mortality rates in men and women aged 35-64 years
Table 1. Age adjusted average mortality rates (per 100,000) by cause, area and gender, for Poland and US Whites and African Americans

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Table 2. Average annual change per 100,000 persons of mortality rates calculated from log linear models by cause for US White and African American and Polish men and women and by time period

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<td>-0.1</td>
<td>-3.7</td>
<td>-4.4</td>
<td>-0.8</td>
</tr>
</tbody>
</table>
Age standardized total mortality rates in men and women aged 35-64
(5 year moving average rates)

Men

National Differences

Regional Differences

Women

Deaths/100,000

Deaths/100,000

Deaths/100,000
Age standardized cardiovascular mortality rates in men and women aged 35-64
(5 year moving average rates)

Men

National Differences

Regional Differences

Women

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Verified references
Age standardized CHD mortality rates in men and women aged 35-64
(5 year moving average rates)

Men

National Differences

Regional Differences

Women

Deaths/100,000

Deaths/100,000

0 50 100 150 200 250 300 350 400 450 500


0 50 100 150 200 250 300 350 400 450 500


US white US Black Poland

US white US Black Poland

Minneapolis whites Jackson whites Washington whites

Forsyth whites Warsaw Tarnobrzeg
Age standardized stroke mortality rates in men and women aged 35-64
(5 year moving average rates)

Men
National Differences

Regional Differences

Women

Deaths/100,000

Deaths/100,000


0 20 40 60 80 100 120 140 160 180


0 20 40 60 80 100 120 140 160 180

 Minneapolis whites
 Jackson whites
 Washington whites
 Forsyth whites
 Warsaw
 Tarnobrzeg

US white  US Black  Poland

US white  US Black  Poland