Journal of Epidemiology and Community Health, 1978, **32**, 34-37

Living conditions in childhood and subsequent development of risk factors for arteriosclerotic heart disease

The cardiovascular survey in Finnmark 1974-75

A. FORSDAHL

From the Institute of Community Medicine, University of Tromsø, Norway

SUMMARY Several studies in Norway have shown large differences in risk factors for arteriosclerotic heart disease among municipalities. Today it is difficult to show specific differences in the standard of living between the various municipalities to explain these findings. However, such differences have previously existed, and were expressed by, for example, the variations in infant mortality from one municipality to another. In this work a significant positive correlation is shown between the cholesterol values among men and women aged 35-49 years and the infant mortality rate previously present in the municipalities for the same cohort. The findings indicate that poverty in childhood and adolescence, followed by later prosperity, results in high cholesterol values. The findings are related to previous work where a significant positive correlation was shown between infant mortality rates and later mortality rates from arteriosclerotic heart disease.

Protected by copyright.

It has been shown that the considerable differences between the Norwegian counties in mortality from arteriosclerotic heart disease among men and women aged 40-69 years were strongly correlated with the infant mortality rate in the counties during the childhood and adolescence of the deceased (Forsdahl, 1977). In that paper the infant mortality rate was used as an indicator for living conditions. The findings confirmed a hypothesis that poverty during childhood—later followed by a 'high standard of living'—must be regarded as a risk factor for the development of arteriosclerotic heart disease.

The investigation could not indicate which factor or factors connected to a low standard of living might be responsible for the increased risk. It was hinted that serum cholesterol might be an intermediate risk factor.

This paper follows up the above hypothesis. It compares living conditions during childhood with a later development of risk factors for arteriosclerotic heart disease. The infant mortality rate will be used as an indicator of living conditions in this paper also.

Material and methods

Finnmark is the most northern county in Norway and it has the highest mortality rate caused by arteriosclerotic heart disease in the country (Central Bureau of Statistics of Norway, 1974). During 1974-75 a large-scale examination of the county's population was carried out, and an attempt was made to map the risk factors for arteriosclerotic heart disease. All men and women between the ages of 35 and 49 were asked to take part, and 87·5% of the population in this age group participated (Bjartveit, 1978).

Of all men and women between the ages of 35 and 49 a total of 3513 men and 2595 women still lived in the area of their birth. The risk factors for arteriosclerotic heart disease (municipal means) are compared below with the mean infant mortality rate for the municipalities from 1921-35.

Since systematic registration of the infant mortality rate in Norwegian counties started more than 100 years ago, the figures in Finnmark have topped the list. During the period 1921-35 the infant mortality rate in Finnmark was 96 per thousand,

J Epidemiol Community Health: first published as 10.1136/jech.32.1.34 on 1 March 1978. Downloaded from http://jech.bmj.com/ on May 21, 2022 by guest. Protected

while the average for the whole country was 49 per thousand (Central Bureau of Statistics of Norway, 1961). It is only during the last decade that the infant mortality rate in Finnmark has approached the same low level as the average for the country as a whole, with generally better living conditions. In 1971-75 the infant mortality rate in Finnmark had decreased to 15·9 per thousand, and the average for the country to 11·6 per thousand (Central Bureau of Statistics of Norway, 1977, personal communications).

Although in the past there was extensive poverty over the whole county, variations existed between areas. This is clearly expressed in the infant mortality rate. In the period 1921-35, it varied from 55·5 per thousand in the most prosperous municipality to 150·5 per thousand in the least prosperous. Today the difference between the municipalities has almost vanished.

The population of Finnmark consists of three different ethnic groups: Norse, Lapps, and the descendants of Finnish immigrants. There is no reliable registration of the ethnic distribution of live births or deaths in infancy. There are indications that living conditions during the period 1921-35 were better for the average Norse population than for Lapps and Finns. Also, it is likely that the Norse population born outside the county had, on average, better living conditions during childhood than the native Norse.

The infant mortality rate for the period 1921-35 in the present study has been compiled from information in church registers. During this period, the clergy was responsible for the registration. Account has been taken of changes in municipal borders. This means that the paper is concerned with 19 different municipalities.

Associations are expressed as product-moment correlation coefficients (r), and Spearman's rank correlation coefficients (r_s). Age and sex adjustment has been made by the indirect method with the examined population of Finnmark 1974-75 as standard population.

Results

Table 1 shows both the product-moment correlation, r, and the Spearman rank correlation, r_s, for the 19 municipalities between the infant mortality rates in 1921-35 and the mean values—adjusted for age—of certain physiological and anthropometric measures recorded in 1974-75. The highest correlation was found between infant mortality in 1921-35 and serum cholesterol in 1974-75; this was observed in both men and women.

The poorer the social conditions in a municipality —expressed through the infant mortality rate—the higher the cholesterol values among the men and women still living in the municipalities of their birth (Figs 1 and 2). If one were to use the infant mortality rate 1971-75 rather than 1921-35, this correlation disappears (male: r = 0·06, female: r = 0·25).

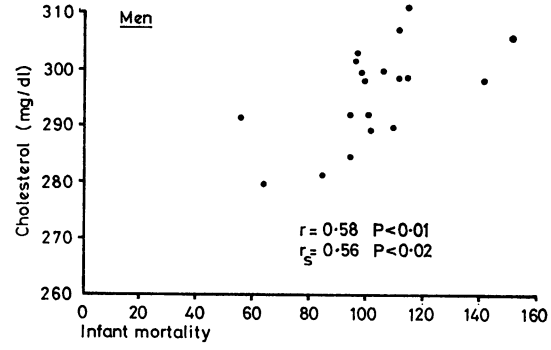

Fig. 1 *Correlation coefficients between infant mortality 1921-35 and age-adjusted means of serum cholesterol among men aged 35-49, who in 1974-75 were living in their municipalities of birth.*

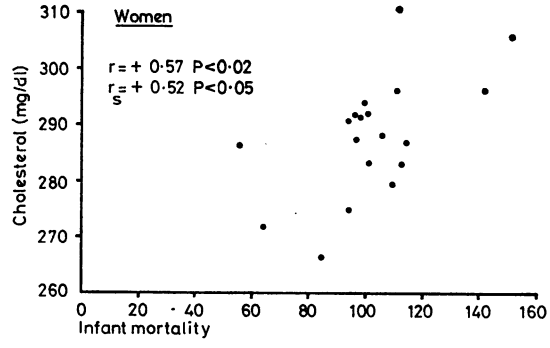

Fig. 2 *Correlation coefficients between infant mortality 1921-35 and age-adjusted means of serum cholesterol among women aged 35-49, who in 1974-75 were living in their municipalities of birth.*

There is also a positive correlation between past infant mortality and the percentage of male smokers (Table 1). Current smokers among men are more widespread in municipalities with the poorest conditions than in the more prosperous. Other Norwegian surveys seem to support these findings. Smoking among men aged 40-60 is more widespread among the less well educated, and again it is reasonable to suspect that these men have been recruited more often from families brought up in poor

J Epidemiol Community Health: first published as 10.1136/jech.32.1.34 on 1 March 1978. Downloaded from http://jech.bmj.com/ on May 21, 2022 by guest. Protected by copyright.

conditions (Bjartveit, 1977). In women there is no equivalent correlation between past infant mortality and current smoking habits (Table 1). Current smoking habits among women aged 40-60 seem to indicate that smoking habits among women have developed along different social lines than they did among the men (Bjartveit, 1977).

There is a negative correlation, although it is not statistically significant at the 5% level, between past infant mortality and adult body height (Table 1). People from the poorest municipalities seem to be shorter than those from more prosperous ones. Other analyses from the survey in Finnmark have shown that for both sexes there is a significant negative correlation between cholesterol values and body height. However, such correlation was not found among male Lapps (Westlund, 1977, personal communications).

We find no connection between living conditions in childhood and triglycerides, blood pressure, blood sugar, and obesity (height/weight relationship) (Table 1). Thus, people from the poorest municipalities do not seem to have changed their diet during later years in a way that makes them heavier than others.

Table 2 shows the risk factors for the various ethnic groups. Immigrant Norse have the lowest cholesterol values, followed by Norse born in Finnmark, and Lapps and Finnish descendants have the highest values. A similar gradient exists for smoking among men, although the variations are minor. Other variations worth noting are that Norse are taller, Finnish descendants have the highest blood pressure values, and the Finnish descendants and the Lapps are, on average, slightly heavier than the Norse.

A more detailed analysis shows that the uneven distribution of the ethnic groups in the various municipalities cannot explain the municipal correlations.

Table 1 *Correlation coefficients between infant mortality 1921-35 and the age-adjusted means for various factors in men and women aged 35-49 who, in 1974-75, were living in their municipalities of birth (19 municipalities)*

Factors examined in 1974–75	*Men*		*Women*		*Men and Women*	
	r	r_S	*r*	r_S	*r*	r_S
Cholesterol	0·58	0·56	0·57	0·52	0·60	0·64
Triglycerides	−0·01	−0·02	0·14	0·16	0·08	0·16
Serum glucose	0·09	0·12	0·09	0·38	0·10	0·24
Systolic BP	0·15	0·16	0·09	0·03	0·13	0·12
Diastolic BP	0·03	−0·05	0·12	0·19	0·10	0·12
Current smokers (%)	0·54	0·44	0·20	0·25	0·47	0·35
Height	−0·39	−0·35	−0·40	−0·40	−0·37	−0·41
Weight/height² (Daveports index)	−0·28	−0·17	0·01	0·01	−0·09	−0·15

For 19 pairs of observations the statistical significance of the correlation coefficients are:

P	0·1	0·05	0·02	0·01
*r	0·39	0·46	0·53	0·58
**r_S	0·39	0·46	0·55	0·61

*Product moment correlation
**Spearman rank correlation

Table 2 *Age-adjusted means for various factors in men and women aged 35-49 of different ethnic groups. The Norse are divided into those who were born in Finnmark and those who were born in other parts of Norway*

	*No.**	*Chol-esterol (mg/100 ml)*	*Tri-glycerides (mmol/l)*	*Glucose (mg/100 ml)*	*BP (mmHg)*		*Smokers (%)*	*Height (cm)*	*Weight (kg)*	*Weight/height²*
					Sys-tolic	*Dia-stolic*				
Men										
Born in Finnmark										
Finns	944	295·6	2·36	103·5	138·6	86·0	65·3	172·8	76·2	2·552
Lapps	699	295·9	2·31	104·4	134·5	83·2	66·7	167·0	70·2	2 517
Norse	1772	288·3	2·22	104·6	135·4	84·8	64·0	174·6	76·4	2·506
Norse born outside Finnmark	883	275·5	2·21	102·3	133·7	84·0	59·7	176·4	77·8	2·500
Women										
Born in Finnmark										
Finns	814	288·6	1·74	101·5	133·0	81·7	49·7	159·9	65·0	2·542
Lapps	686	283·6	1·77	101·2	131·1	80·6	39·0	154·0	63·7	2·686
Norse	1557	279·5	1·70	102·1	130·5	80·5	49·4	161·5	64·4	2·469
Norse born outside Finnmark	851	271·5	1·61	102·0	128·3	79·8	45·1	163·1	64·9	2·440

*No. of subjects included in the estimation of mean serum cholesterol concentration. For the other averages the number of subjects may be slightly different

J Epidemiol Community Health: first published as 10.1136/jech.32.1.34 on 1 March 1978. Downloaded from http://jech.bmj.com/ on May 21, 2022 by guest. Protected by copyright.

Discussion

This investigation shows a significant positive correlation between municipal infant mortality in childhood and later high cholesterol values among men and women aged 35-49 years. Previously we have shown a positive correlation between past infant mortality and the mortality rate from arteriosclerotic heart disease among men and women aged 40-69 years. This increases the suspicion that cholesterol is the intermediate risk factor in the chain between childhood poverty and arteriosclerotic heart disease.

Our present way of living, with a high consumption of fats, seems to cause higher cholesterol values in people who have grown up in poverty than it does in people who grew up under better social conditions. Those who have grown up in poverty may have a reduced tolerance to fats or certain types of fats. There are studies indicating that the nutrition received in infancy is important to the development of cholesterol metabolism (Fomon, 1971).

The positive correlation between smoking habits and early poor social conditions among men may explain the correlation between the death rate from lung cancer among men aged 40-69 and poor living conditions in childhood (Forsdahl, 1977). It is, however, worth noting the lack of correlation in women between poverty in childhood and the current proportion of smokers, while for both men and women a strong positive correlation between early poverty and later mortality from arteriosclerotic heart disease was found.

In registering mortality in Norway the various ethnic groups are not separated, and therefore it is not possible to draw any conclusions on what the registered variations in risk factors may mean to the mortality rates of the groups. There is a study, however, which suggests that Finnish descendants in Norway have a higher mortality rate from arteriosclerotic heart disease than indigenous Norwegians (Forsdahl, 1973).

Although there are still many unknown factors, the chances are that an increase in arteriosclerotic heart disease may be expected in the poor countries as these gradually prosper and imitate the Western way of life. In the West one may hope that the coming generation, as a result of much better social conditions in childhood, will have less arteriosclerotic heart disease than the present adult generation. One cannot be absolutely sure, however, as long as one does not know the factor or factors associated with poverty in childhood that are causing the development of arteriosclerotic heart disease in later life.

Reprints from A. Forsdahl, Institute of Community Medicine, University of Tromsø, N-9010 Åsgård sykehus, Norway.

References

Bjartveit, K. (1978). Cardiovascular studies in Norwegian counties. (In press).

Bjartveit, K. (1977). Røykevaner og utdannelse. *Bergens Tidende*, 22 January. Bergen.

Central Bureau of Statistics of Norway (1961). *Trend of Mortality and Causes of Death in Norway 1856-1955*. Central Bureau of Statistics: Oslo.

Central Bureau of Statistics of Norway (1974). *Regional Mortality 1969-1972*. Central Bureau of Statistics: Oslo.

Fomon, S. J. (1971). A pediatrician looks at early nutrition. *Bulletin of the New York Academy of Medicine*, **47**, 569-578.

Forsdahl, A. (1973). Momenter til belysning av den høye dødelighet i Finnmark fylke. *Tidsskrift for den Norske Laegeforening*, **93**, 661-667.

Forsdahl, A. (1977). Are poor living conditions in childhood and adolescence an important risk factor for arteriosclerotic heart disease? *British Journal of Preventive and Social Medicine*, **31**, 91-95.

J Epidemiol Community Health: first published as 10.1136/jech.32.1.34 on 1 March 1978. Downloaded from http://jech.bmj.com/ on May 21, 2022 by guest. Protected by copyright.