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REPRINTS AND REFLECTIONS

Observations throwing light on the high mortality in the county of Finnmark.

Is the high mortality today a late effect of very poor living conditions in childhood and adolescence?*

Anders Forsdahl

Ever since the beginning of the registration of county mortality approximately a hundred years ago, the mortality of the county of Finnmark has been much higher than for the rest of Norway. Men in our largest towns have a high mortality rate. However, compared to the other counties of the country, Finnmark has unfavourable mortality and the difference is still striking and considerable.

The high infant mortality in Finnmark has been the subject of several investigations,[1,2,4,5,9] but no studies are available concerning the reasons for the high general mortality in the county, even though several investigations of particular diseases such as pneumonia, lung cancer and rickets have been carried out. Cardiovascular diseases are known to be a common cause of death, but not much is known regarding the reasons for this high mortality. Therefore we do not know whether there are geographical variations within the county, whether some groups of employees are at higher risk than others, or whether there are considerable differences between the different ethnic groups.

It is important to note that the high mortality is seen for both men and women (Figures 1 and 2). These data cover the population living in villages and rural areas in the time period 1890–1967. The population distribution in Finnmark makes such a comparison most useful, since as late as 1960, only 34% of the population inhabited urban areas. But even if one compares the rural areas of Finnmark county to the mortality of the towns of Norway, Finnmark still shows an unfavourable pattern.[13] From 1960 and onwards, routine statistics make no distinction between towns and rural districts, but the tendency is the same when the comparison concerns the total mortality of the county (Figures 1 and 2).

Even though there is a lack of specific studies, several possible reasons for the higher mortality of the county today have been suggested. In particular, more widespread smoking has been mentioned in this context. Undoubtedly, smoking amongst men seems to be much more common than in the rest of the country,[8] but there is no reliable evidence that this also applies to women, and the female mortality is also considerably above country averages. Recently, the situation of fishermen and the fish industry workers under harsh climatic conditions has been mentioned. The climate itself—with polar nights, harsh cold and long winters—has also been considered a factor of importance.

In the following, I will pay attention to a possible reason for the high mortality in Finnmark which has not been discussed earlier, namely that the considerably higher mortality today is a late consequence of the adverse circumstances to which a large part of the population was exposed during their childhood and adolescence.

It follows from the literature, word-of-mouth accounts and the medical records of doctors with responsibility for public

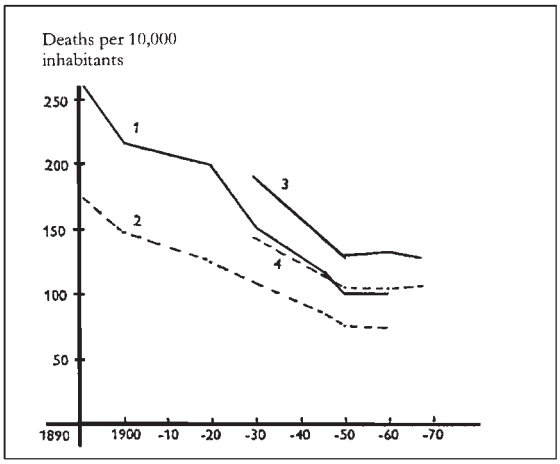

Figure 1 Total mortality among men in villages in Finnmark county and in villagers in Norway from 1890–1960, and the total mortality in Finnmark and in Norway 1930–1967. Standardized mortality per 10 000 inhabitants

1 Total mortality among men in villages in Finnmark.
2 Total mortality among men in villages in Norway. The standard population is men at the census in 1920.[13,14]
3 Total mortality among men in Finnmark.
4 Total mortality among men in Norway. The standard population is men in the country on 1/11/1960.[14,15]

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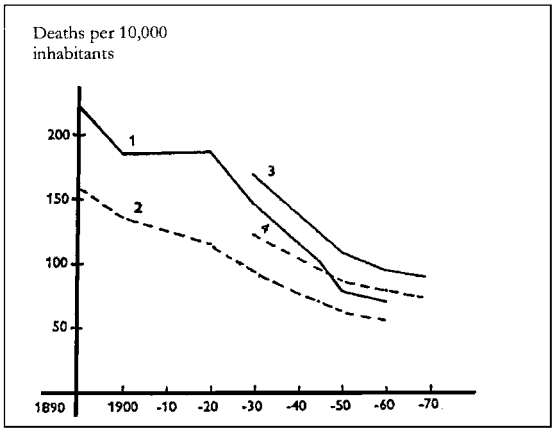

Figure 2 Total mortality among women in villages in Finnmark county and in villages in Norway 1890–1960, and the total mortality among women in Finnmark and Norway from 1930–1967. Standardized mortality per 10 000 inhabitants

1 Total mortality among women in villages in Finnmark.
2 Total mortality among women in villages in Norway. The standard mortality is women at the census 1920.[13,14]
3 Total mortality among women in Finnmark.
4 Total mortality among women in Norway. The standard population is women in the country on 1/11/1960.

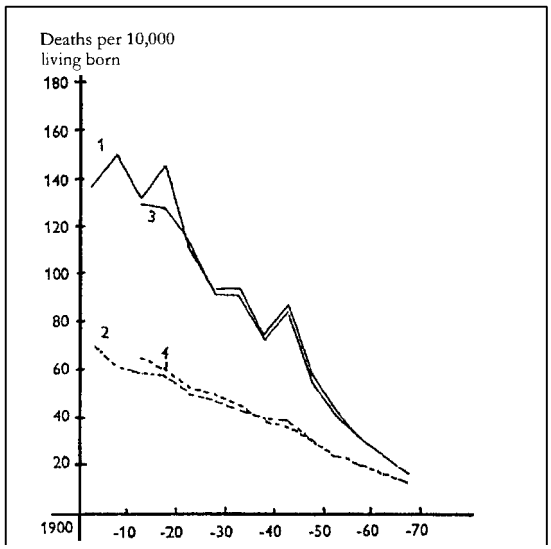

Figure 3 Infant mortality in villages in Finnmark and villages in Norway 1900–1960, and in infant mortality in Finnmark and Norway 1915–1967. Deaths at less than 1-year-old per 1000 live born

1 Infant mortality in villages in Finnmark.[13]
2 Infant mortality in villages in Norway.[13]
3 Infant mortality in Finnmark.[16]
4 Infant mortality in Norway.[16]

health,[6,12] that a large part of the population lived under very poor conditions, nutritionally, hygienically and socially. During the last century there have been periods of starvation in large segments of the population. Poverty and suffering existed until the last World War, and to a considerable part of the population, both those staying and those evacuated, the last stage of the war was a harsh time.

A major part of the population were living at a bare minimum living standard and depended upon livelihoods that were vulnerable to adverse climatic conditions and general economic circumstances. A failing fish season or a bad summer and autumn would be enough to make life difficult. A comparison to several developing countries today is apposite. Even if poor living conditions also existed in other parts of the country, these were probably not as large and long lasting as in Finnmark.

Another indicator of the bad conditions in Finnmark is that infant mortality has, until recently, been considerably above the average for the rest of the country (Figure 3). There seems to be consensus regarding infant mortality as a sensitive indicator of social conditions in the broadest sense.

Comparing mortality among men and women in the county to infant mortality, the pattern was quite similar from 1900 until around 1950. From the mid-1920s there was movement towards the country average, both for all-cause and infant mortality. While this tendency continued for infant mortality, with differences nearly disappearing by 1960, relative improvement in overall mortality seemed to end around 1950.

Poor living conditions continue to be related to overall mortality, but economic and other social conditions have gradually been improving in Finnmark, and the difference between Finnmark and other parts of the country has declined which is indicated by the declining difference in infant mortality. It is, therefore, not reasonable to assume that the higher mortality in Finnmark today is due to current poor economic or other social circumstances.

Own Studies

To elucidate the problems further, mortality in Sør-Varanger municipality is compared to mortality in Finnmark county, Norway and Finland. This municipality is different in several ways from the rest of the county, with regard to settlements, ethnic background and economic activity.

The mining industry is dominant with more than 1000 employees. Roughly the same number of people are employed in farming and forestry, a few hundred are fishermen or both fishermen and smallholders, and a few are herding reindeer.

By comparing the age-group 30–80 years for the time-periods 1949–1951, 1959–1961 and 1965–1967, we find that the mortality in Sør-Varanger municipality is considerably above the country average. For men, mortality is similar to that of Finnmark county, however for women the findings are less consistent, although there is a tendency to higher mortality than country average (Tables 1 and 2).

Comparing the infant mortality in Sør-Varanger with Finnmark county, a coherent pattern is seen (Figure 4). Medical records and word-of-mouth reports suggest that the average social conditions of this municipality were not very different from other municipalities in the county, at least not until the 1930s.

As indicated above, the economy has a different structure from other municipalities of Finnmark. There are also considerable differences in settlements and ethnic background. The area, including almost the total present municipality, became Norwegian as late as in 1826. The period from the middle of

Table 1 Deaths among men in Sør-Varanger municipality, compared to number of expected deaths according to mortality rates in the county of Finnmark and in the whole country—by age and time period

Time Period	No. of men in the age range 30–79 years	Age (years) 30–39	40–49	50–59	60–69	70–79	30–79	Mortality in the age range 30–79 years when the mortality in Norway = 100
1949–1951								
Sør-Varanger	2121	1	9	15	19	23	67	123
Finnmark		5.4	7.9	14	21.8	17.3	66.4	122
Norway		4.5	6.4	10.4	16.3	16.8	54.4	100
1959–1961								
Sør-Varanger	2517	7	11	22	32	27	99	128
Finnmark		6.7	9.1	18.5	27.8	35.5	97.6	127
Norway		4.1	7.1	14.2	21.5	30.2	77.1	100
1965–1967								
Sør-Varanger	2568	7	12	22	31	38	110	128
Finnmark		5.4	11.8	19.4	35.4	35.1	107.1	125
Norway		3.6	8	15.4	29	30	86	100

Table 2 Deaths among women in Sør-Varanger municipality, compared to number of expected deaths according to mortality rates in the county of Finnmark and in the whole country—by age and time period

Time Period	No. of women in the age range 30–79 years	Age (years) 30–39	40–49	50–59	60–69	70–79	30–79	Mortality in the age range 30–79 years when the mortality in Norway = 100
1949–1951								
Sør-Varanger	1869	3	4	7	9	24	37	100
Finnmark		4.6	6.1	9.3	12.5	16.8	49.3	134
Norway		2.6	3.8	6.3	10.6	13.6	39.6	100
1959–1961								
Sør-Varanger	2297	3	4	7	20	26	60	123
Finnmark		3.2	4.7	7.6	21.5	24.1	61.1	125
Norway		1.9	4.2	6.7	15.5	20.6	48.9	100
1965–1967								
Sør-Varanger	2367	1	2	11	21	22	57	112
Finnmark		1.4	5.1	10.5	18.5	27.2	62.7	124
Norway		1.5	3.8	7.8	14.6	23	50.7	100

the last century until 1900 was dominated by Finnish immigration, with the population consisting of about 43% Finnish, 36% Laplanders and 21% Norwegians.[17] While the Finnish immigration almost came to an end, many Norwegians immigrated to work in the ore and mining industries. They came partly from other parts of the county, and partly from the rest of Norway, and consequently the population increased from around 2000 in 1900 to almost 5000 in 1920.

Almost everyone of Finnish origin in Sør-Varanger today was born and raised in the municipality. Due to the large migration to the municipality, their percentage share of the population has markedly diminished. Furthermore, there has also been a process of assimilation with the rest of the population. By research mainly based upon personal knowledge, I have found that of the male population in the age range 30–79 years around 16% are of Finnish origin, meaning that at least one parent was Finnish. This percentage has remained stable in the population during the time period of 1949–1968 (Table 3). The pattern among women has been more difficult to discern, partly because of change of name by marriage, and the results are less certain.

The non-Finnish part of the population is more mixed with regard to ethnicity; together with Norwegians there are some Laplander elements and some of more diluted Finnish origin.

A comparison of the mortality among men of Finnish origin in the age range 30–79 for the periods 1949–1953, 1958–1962 and 1964–1968 with the mortality of the rest of the population of the county, and with country averages, shows a considerably higher mortality among those of Finnish origin (Table 4). Since the Finnish part of the population is relatively small, it has been necessary to calculate the mortality for five-year periods. The migration out of the municipality from this population group seems to be small and there is no indication of selective emigration, but within the borders of the county mobility was considerable. Most deaths among people of Finnish origin during the study period were second and third generation immigrants, only 6 persons having been born in Finland.

Infant mortality among those of Finnish origin and non-Finnish origin in the municipality is estimated by information from the archives of Sør-Varanger parish (Figure 5). They show that infant mortality among those of Finnish origin was

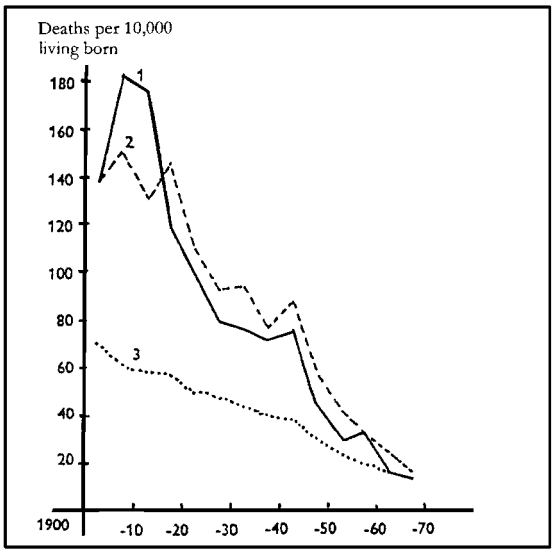

Figure 4 Infant mortality in Sør-Varanger municipality, villages in Finnmark county and villages in Norway 1901–1968. Deaths at less than 1-year-old per 1000 live born

1 Infant mortality in Sør-Varanger county.
2 Infant mortality in municipalities in Finnmark.[13]
3 Infant mortality in villages in Norway.[13]

considerably higher until the last World War, but since then infant mortality has been approximately the same. It is also seen that overall mortality among Finnish people is higher than the average for Finnmark.

Is there any reason to assume that the Finnish part of the population has been living under worse conditions than the average in the municipality? This is of course difficult to prove today. Until the end of the 19th century, this ethnic group seems, on the contrary, to have been better off than the rest of the population. However, the Finnish part of the population was in general employed in vulnerable branches such as farming and fishing. From the medical reports by doctor *Wessel*, it is evident that the population in this municipality suffered twice from famine in this century, the last time in 1921, and worst in the regions dominated by the Finnish population.[12] Furthermore, the Finnish families had more children and their dwellings were more crowded than the average of the municipality;[17] circumstances which are likely to be of importance.[5] During the last 25 years however, the social differences have diminished and such differences cannot explain the higher mortality in those of Finnish origin.

When considering the high mortality in Finland today,[11] we might imagine that the subjects of Finnish origin in Sør-Varanger are still maintaining Finnish traditions in way of life which may influence present mortality. On-going research gives so far no

Table 3 The population in Sør-Varanger municipality according to sex, ethnic group, age and time period

	Men in Sør-Varanger			Women in Sør-Varanger			Finnish men in Sør-Varanger		
Age (years)	1950	1960	1966	1950	1960	1966	1951	1959	1967
30–39	750	788	728	707	702	617	103	120	98
40–49	590	713	730	491	673	662	89	89	112
50–59	407	531	548	350	457	552	78	82	82
60–69	270	309	389	225	361	357	48	54	73
70–79	104	176	170	96	154	179	16	25	26
30–79	2121	2517	2568	1869	2297	2367	334	370	391

Table 4 Deaths among Finnish men in Sør-Varanger municipality compared to the expected number of deaths according to the mortality among non-Finnish men in Sør-Varanger municipality, and the mortality in Finnmark county and the whole country—based on age and time period

		Age (years)						
Time Period	**No. of men in the age range 30–79 years**	30–39	40–49	50–59	60–69	70–79	30–79	**Mortality in the age range 30–79 years when the mortality in Norway = 100**
1949–1951								
Finnish in Sør-Varanger	334	0	5	1	6	11	23	153
Non-Finnish in Sør-Varanger	1787	0.3	1.8	5.7	5.5	5.	18.3	122
Finnmark		1.2	2	4.5	6.5	4.5	18.7	124
Norway		1	1.6	3.3	4.8	4.3	15	100
1958–1962								
Finnish in Sør-Varanger	370	2	2	11	11	12	38	194
Non-Finnish in Sør-Varanger	2147	1.7	2.3	4.7	9	5.5	23.2	119
Finnmark		1.7	1.9	4.8	8.1	8.4	24.9	128
Norway		1	1.5	3.7	6.2	7.1	19.5	100
1964–1968								
Finnish in Sør-Varanger	391	5	5	8	17	12	47	201
Non-Finnish in Sør-Varanger	2174	1	2.7	5	8	9.3	26	111
Finnmark		1.2	3	4.9	11.1	8.9	29.1	124
Norway		0.8	2	3.8	9.1	7.7	23.4	100

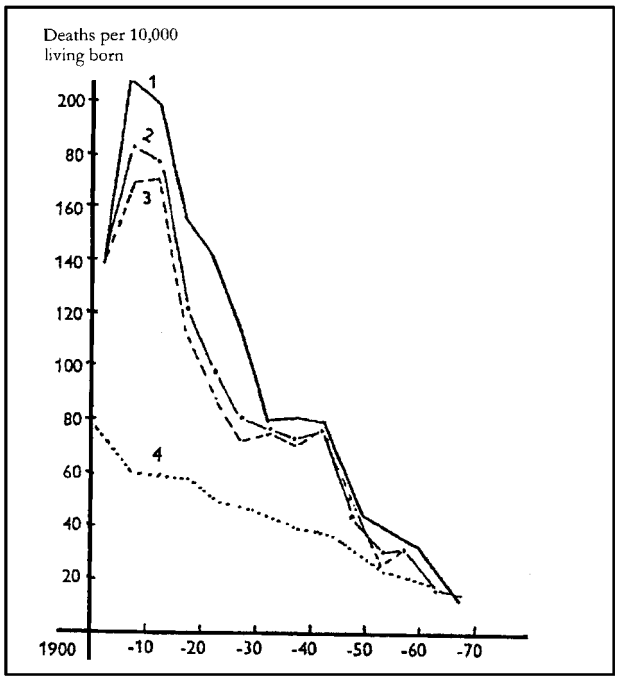

Figure 5 Infant mortality among Finnish, non-Finnish and the total population in Sør-Varanger municipality, and the villages in Norway 1901–1968. Deaths at less than 1-year-old per 1000 live born

1 Infant mortality among Finnish.
2 Infant mortality in Sør-Varanger county.
3 Infant mortality among non-Finnish.
4 Infant mortality in villages in Norway.[13]

indication of such traditions. For instance, smoking habits are not 'Finnish' but quite similar to those found among the male population in Finnmark.[8] The fat content of the diet is unfavourable, but not very different from what is usual in Norway today. A higher average blood cholesterol however, has been observed in men in some segments of the Finnish population. The only living tradition, which is actually adopted to a large part by the rest of the population, is sauna bathing. It seems, though, to be fully documented that saunas have no unfavourable effect on health.

When considering causes of death in Finnish and non-Finnish subjects in Sør-Varanger, the difference is mainly due to arteriosclerotic heart diseases (Table 5). Since the total number of deaths among Finnish people is quite small, caution should be taken in drawing inferences concerning the causes of the excess mortality of those of Finnish origin. It seems, though, (when putting aside the excess mortality from arteriosclerotic heart diseases) that there is an excess mortality from other causes of 30% among those of Finnish origin compared to the rest of the population.

Since the great difference in mortality of arteriosclerotic heart diseases between Finnish and non-Finnish people is difficult to explain by present environmental factors, it is not unreasonable to assume that poor living conditions in childhood and adolescence may be a contributing cause to such diseases.

Discussion

Since the last World War, several studies have been made regarding health deficiency as a late consequence of war and other disasters. This subject is treated by Lønnum.[7] Even though much research remains to be done on this issue, it is probable that catastrophes may cause health deficiency as a late effect. Concerning the more extreme conditions in concentration camps and in some prisoner of war camps, this association must be called an established fact.

Similar studies concerning health deficiency as a late consequence in groups of individuals that have been living under harsh conditions during their childhood and adolescence do not seem to be available.

The question arises whether the living conditions in Finnmark during the last century were bad enough to be called catastrophic conditions. In my opinion, this was the case. Even if this has not been a permanent situation, the vulnerable economy would imply that such hard conditions would often appear and might be of long duration. Such poor living conditions would result not only in increased infant mortality,

Table 5 Mortality according to cause of death and year among Finnish and non-Finnish men in Sør-Varanger municipality in the age range 30–79. Standardized rates per 100 000 inhabitants

		1950		1960		1966	
Diagnosis International Classification List 1955		Finnish	Non-Finnish	Finnish	Non-Finnish	Finnish	Non-Finnish
Tuberculosis	(001–016)	–	19	–	32	–	–
Tumours	(140–239)	347	255	348	262	432	86
Vascular lesions in the central nervous system	(330–334)	185	140	101	137	235	171
Arteriosclerotic heart disease	(420–422)	61	142	839	398	1038	431
Other heart diseases	(430–445)	114	138	97	22	51	22
Diseases in respiratory organs	(470–527)	116	53	–	48	–	169
Sudden death	(795)	61	46	107	92	178	112
Accidents	(800–962)	116	64	154	80	224	86
Other causes of death		354	151	322	122	144	202
All causes of death		1354	1008	1968	1193	2302	1279

Mortality among Finnish men is calculated from the average number of deaths in the time periods 1949–1953, 1958–1962 and 1964–1968. Mortality among non-Finnish men is calculated from the average number of deaths in the time periods 1949–1951, 1959–1961 and 1965–1967. The standard population is the population in Sør-Varanger in 1950, 1960 and 1966.

Table 6 Mortality per 1000 inhabitants. Finnish men in Sør-Varanger and men in Finland by age and time period

	Finnish men in Sør-Varanger			Finland		
Age (years)	1949–1953	1958–1962	1964–1968	1950	1960	1966
30–39	0	3.3	10.2	4.2	3.2	2.8
40–49	11.2	4.5	8.9	8	6.8	7.2
50–59	2.6	26.8	19.5	19.2	17	17.6
60–69	25	40.7	46.6	41.3	40.2	40.3
70–79	137.5	96	92.3	87.3	91.2	93.8

but children and adolescents that grew up under these harsh conditions might also have their health affected. It is not unreasonable to think that this may result in a health deficiency later in life. This might later be observed by an earlier ageing of the population, by increasing work disability and higher mortality. Besides higher mortality, Finnmark is also the county with the proportionally largest number of those registered with work disability,[10] with 8.2% (6%) of the male and 7.4% (5.8%) of the female population in the age range 18–69 receiving disability benefit.

The difference in the number of those registered with work incapacity increases from the age of 40 upwards, and in the age group 65–69 45% (28.7%) of the men and 28% (16.9%) of the women are disabled. (The numbers in parentheses represent the country average.)

Among the non-Finnish part of the population in Sør-Varanger, infant mortality has been very high (Figure 5), and we would expect to find mortality among adults in this group of the population that was above what was actually seen in the time period 1949–1968 (Table 4). But, because of the large immigration to the municipality, we find that among the non-Finnish men who died in this period, only 32% were born in Sør-Varanger. (Altogether, 50% were born in Finnmark, 33% in Troms and Nordland, 9% in the south of Norway and for 7% the place of birth was not possible to trace.) Half of the non-Finnish men were not born in Finnmark, and a considerable part of these probably did not grow up under such conditions that resulted in the high infant mortality of the county. From this we expect to find a lower mortality among adults in this group of the population compared to that shown for Finnmark, and this was also the case.

It is difficult to identify existing environmental factors that may explain the high mortality today among the adult population of Finnmark. As discussed above, the social conditions of Finnmark have radically improved, and infant mortality is at almost the same low level as the average for the country. Sør-Varanger municipality has, in spite of a different economic basis than the rest of Finnmark county, the same high mortality rate, and the difference shown between two population groups in the municipality cannot be explained by existing environmental risk factors.

To what extent climatic factors such as long winters, cold and polar nights, make a health difference, is disputable. In earlier times these factors have, without doubt, contributed to worsen an already bad social situation, among other things by forcing the population of Finnmark to a much larger extent than the rest of the country to stay inside in poor and crowded houses. Both in Norway and in Sweden mortality is highest in the northern counties, but this is not the case in Finland, where mortality is highest in North Karelia, which is in the south-eastern part of Finland.

It is apposite to compare existing data regarding those of Finnish origin in Sør-Varanger to the conditions in Finland (Table 6). The comparison shows no consistent difference in mortality, but by comparing corresponding age groups in the same periods, some excess mortality among the Finns in Sør-Varanger is found (in 10 out of 15 compared groups). If the high mortality is due to 'Finnish genes' alone, one would expect to find a lower mortality among the Finnish people in Sør-Varanger because of—an admittedly small—mix with 'Norwegian genes'.

The comparison is made against Finnish average numbers, but in Finland the variation in mortality is large between the different counties[3]. (For instance, the mortality in North Karelia [1963] was approximately 18% above average in Finland.) Also, in Finland during the last century (1900) there were regions with very poor social conditions and high infant mortality[13] where the (rising) growing generation has been exposed to large health hazards. The population has been exposed to civil war and the last World War quite differently from Norway. Besides, the living conditions and diet today may be different from those in Norway—the smoking habits are different. A comparison between the people of Finnish origin in Norway and in Finland would therefore be of low value without a thorough knowledge of social development, migration, living standards, ethnic situation, etc, in Finland.

The studies give no satisfactory answer as to what extent genetic factors may have any impact on the mortality in Finnmark. However, genetic factors alone are unlikely to explain the great difference in mortality existing between the population in Finnmark and the rest of the country.

These studies may suggest an association between very poor living conditions in childhood and adolescence and high mortality in adulthood so that the worse the living standards, the higher the later mortality. Thus, one should not expect that the difference in mortality between Finnmark and the rest of the country will disappear until the generation that grew up under these adverse conditions are gone.

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Commentary: Childhood deprivation and adult mortality

Anders Forsdahl

This investigation was undertaken in the municipality of Sør-Varanger, which is the most remote municipality in Norway, situated between the northern parts of Russia and Finland. The author was particularly qualified to do the investigations in this region because of his in-depth knowledge of the living conditions of the different ethnic groups. The author had grown up in the municipality, where his father was the district doctor, and where later, from 1963 to 1974, the author became the district doctor. According to an old Norwegian tradition the district doctor had a combined position; he was partly a private practitioner and partly the public health officer and chairman of the municipal Board of Health. This gave the author special knowledge of the population and their mode of living.

During the past 25 years several investigations have been carried out in order to find an explanation for the high mortality rates of arteriosclerotic heart disease in the municipality of Sør-Varanger and in the county of Finnmark. None of the investigations so far have weakened the main conclusion in this paper that there is an association between very poor living conditions in childhood and adolescence and high mortality in adulthood for the same cohort.

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There may be several reasons for the observed association. Various types of injury to health during infancy may add up, so as to cause an increased risk of early ageing and death. This is not in contradiction to the Darwinian doctrine of survival of the fittest. Rather, whereas the weaker of the cohort die in infancy, the more fit survive and carry with them a life-long vulnerability because of their poor living conditions in early years.

It may at first sight seem paradoxical, not that early poverty is associated with later excess mortality, but that arteriosclerotic heart disease should be a major component of this excess. However, the prerequisite is a later exposure to affluence and its consequences in the form of our present way of life. Where this latter condition is not fulfilled—as in the developing countries—the mortality rates from arteriosclerotic heart disease remain low.

The standard of living in Norway has much improved and the regional differences have practically been eliminated, as shown by the current infant mortality rates. The relatively large mortality differences in middle age that still exist can therefore hardly be attributed to the living conditions of today.

The biological mechanisms that may be involved cannot be identified from the present analyses. However, some form of permanent damage in the cardiovascular metabolism caused by a nutritional deficit may be involved.

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Commentary: Components in the interpretation of the high mortality in the county of Finnmark

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The weather in Northern Norway is severe. Anders Forsdahl describes 'polar nights, harsh cold and long winters' that force people to spend much of their time indoors. He himself, however, put his long winters to good use, reflecting on why the adult population of Finnmark, far above the Arctic Circle, has such high death rates. He quickly disposed of smoking and genes as possible explanations. He concluded that since economic and social conditions in Finnmark were similar to those in other parts of Norway, its 25% higher adult mortality rates must be a legacy of its history, of events during the childhood or adolescence of the adult population. This was the first of two platforms on which he developed his hypothesis. Like most good ideas it had occurred to others before him. Studying adult mortality in Britain before 1920, Derrick had shown that each succeeding generation displayed a lower mortality at all ages from childhood to old age.[1] He concluded that 'each generation is endowed with a vitality peculiarly its own, which persistently manifests itself through the succeeding stages of its existence'. The pre-war development of ideas about generation effects has been reviewed by Kuh and Davey Smith.[2]

To develop his hypotheses Forsdahl turned his attention to a single municipality within Finnmark, Sor-Varanger. His findings are described in this issue of the *International Journal of Epidemiology*. He established by 'research mainly based upon personal knowledge' that the population had a sizeable Finnish minority, second or third generation immigrants. Death rates among these Finnish people were much higher than those among the non-Finnish population, the excess deaths being mainly due to coronary heart disease. There were no explanations to be found in differences in adult lifestyles, but historically the Finnish population had occupations associated with poor living conditions, had lived in more crowded homes, and had been more vulnerable to periodic famine. Forsdahl estimated infant mortality from information in the archives of Sor-Varanger and found that, until the Second World War, rates were higher among Finnish than non-Finnish people. He concluded that poor living conditions in childhood and adolescence contributed to coronary heart disease. As an example of the long-term consequences of poor childhood living conditions he cited the persisting poor health of young men who survived prisoner of war camps. He recognized that, since coronary heart disease is a western disease, affluence had also to play a role. This was the second platform of his hypothesis. In his best known paper he suggested that 'great poverty in childhood and adolescence followed by prosperity is a risk factor for arteriosclerotic heart disease'.[3]

Forsdahl did not develop his ideas further. His observations did not allow him to determine whether poor living conditions were especially harmful at certain times in childhood and adolescence or to specify what aspects of poor living conditions were important. Ten years previously Geoffrey Rose had reported that siblings of patients with coronary heart disease had stillbirth and infant mortality rates that were twice as high as those of controls.[4] Rather than interpreting this as an association with poor living conditions in childhood he concluded that 'ischaemic heart disease tends to occur in individuals who come from a constitutionally weaker stock' a conclusion foreshadowing the discovery that coronary heart disease is associated with low birthweight. During this period, McCance and Widdowson, working at Cambridge University, were showing, in experimental animals, that undernutrition before or shortly after birth profoundly and permanently modifies the morphology and physiology[5,6] of the body. (In later years Widdowson readily accepted the concept that coronary heart disease may originate through undernutrition *in utero*.) Had Forsdahl been aware of these developments his work might have progressed further. It was analyses of neonatal and post-neonatal mortality in England and Wales[7] that first showed that coronary heart disease is associated with past infant mortality because it originates in poor conditions *in utero*, rather than poor conditions in childhood, though these contribute.[8] The geographical distribution of cardiovascular disease was more closely related to neonatal mortality, that is deaths in the first month after birth, than to post-neonatal deaths from one month to one year. Since, in the past, high neonatal mortality was strongly associated with low birthweight and was used as a marker of maternal undernutrition this observation suggested that low birthweight was associated with later coronary heart disease, an association that subsequent longitudinal studies have now established.[9–13]

Forsdahl's best known paper is entitled 'Are poor living conditions in childhood and adolescence an important risk factor for arteriosclerotic heart disease?'.[3] The short answer is that they are not. Questions raised by Finnish migrants in Norway are now being answered by studies of Finnish residents in Finland, using the archives in Helsinki. It has taken 8 years for Eriksson and colleagues, in collaboration with the Southampton group, to assemble a cohort of 15 000 men and women born in Helsinki whose size at birth was recorded, together with their living conditions and growth through childhood.[13] Now answers are appearing and the picture is clear. Coronary heart disease,

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hypertension and Type 2 diabetes are associated with paths of growth that are broadly similar though different in detail. Low birthweight, or shortness or thinness at birth, are followed by poor infant growth but thereafter rapid growth, so that body weight returns to around the average for all the children.[13–15] Rapid growth is generally associated with good nutrition and good living conditions. People who were small at birth remain biologically different through life because of the persisting constraints and adaptations that accompany slow early growth. Their different morphology and physiology leads them to respond differently to the biological[13] and social environments in later life.[16] Rapid postnatal growth has costs about which we know little, but examination of a sample of subjects in the Helsinki cohort may illuminate these. Thus the discontinuity in nutritional experience that leads to later disease does not seem to be primarily poor nutrition in childhood and adolescence followed by good or excess nutrition in adult life, as Forsdahl proposed. Rather it is poor nutrition *in utero* and during infancy, the so-called 'fetal' phase of endocrine control of growth,[17] followed by improved nutrition in the second phase of growth, which begins in early childhood.

In the long Norwegian evenings and the no-doubt dusty archives of Sor-Varanger, Forsdahl realized that differences in cardiovascular mortality rates are not driven by the adult environment, though this may contribute to them. This realization takes its place in a body of knowledge that is changing the way we think about the environmental causes of cardiovascular disease.[18] In the past we sought causes that acted in adult life and hastened destructive processes; the formation of atheroma, rise in blood pressure and loss of glucose tolerance. This model, however, has a limited ability to explain the ecology of coronary heart disease. What is now emerging is a new 'developmental' model. The causes to be identified act on the baby. In responding to them the baby ensures its continued survival and growth but at the cost of cardiovascular disease in later life.

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