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To cite this article: Lasse Christian Nielsen, Kristian Schultz Hansen & Ulla Ringgren Nielsen (2004) Burden of mortality in Greenland - today and tomorrow, International Journal of Circumpolar Health, 63:sup2, 86-92, DOI: [10.3402/ijch.v63i0.17822](https://doi.org/10.3402/ijch.v63i0.17822)

To link to this article: <https://doi.org/10.3402/ijch.v63i0.17822>



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Published online: 01 Sep 2004.



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# Burden of mortality in Greenland - today and tomorrow

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## ABSTRACT

**Objectives.** Investigation of the relative impact of three factors expected to influence the future mortality burden in Greenland: demographic change, epidemiological transition and behavioural patterns. **Study design.** To identify general trends in public health status, evaluating the effect of public health campaigns and providing the basis for making predictions of future trends in the mortality burden data from the Greenlandic Death Causes Register to estimate Years of Life Lost (YLL) in the period 1976 – 1998 has been used. **Methods.** YLL were estimated according to the Burden of Disease Method. Age standardised death rates were calculated per 10,000 person years. Regression analysis (ordinary least squares) using time as the explanatory variable was applied to project the time series 1976 – 1998 into the prediction period 1999 - 2028. **Results.** The projections indicate that the demographic component in combination with behavioural patterns will have a dominant effect in the expected increase in the future burden of mortality. Relative to these two components, epidemiological transition will constitute a relatively insignificant impact on the future mortality burden in Greenland. **Conclusion.** Concerted multi-sectoral approaches and broad holistic health strategies related to health promotion and prevention today will strategically improve the capability of the Greenlandic society to manage the future disease burden from ageing via its health care sector and the institutional sector for care of the elderly.

**Keywords:** Behaviour, demographic transition, health strategy, monitoring and evaluation, burden of mortality, projections.

## INTRODUCTION

During the 1990s the health care sector was one of the fastest growing public sectors in the Greenlandic economy, with a per capita health care expenditure of 1,642 Euros measured on average in the 10-year period 1985-1995. Greenland thereby became one of the top spenders per capita on health care in Scandinavia and probably in the world (1). In this period of rising expenditure on health care the Greenlandic economy experienced a non-growth business cycle. The need for setting priorities and restructuring the health care system to meet the present and future challenges came to the fore. Public debate about the current problems in the health sector therefore focused on issues re-

lated to the rising health expenditure as well as health outcomes and quality in health services.

On this background the former Minister of Health, Alfred Jakobsen, initiated the Greenlandic Health Sector Reform in 1999, the year marking the 20-year anniversary of the establishment of the Greenlandic Home Rule. The reform package took a multi-stringed approach, with the formation of six working groups dealing with problem solution on various subjects identified in previous reports and analysis. One of the working groups, "Health and Health Demands", consisting of medical professionals, health planners and economists working in the health sector at various levels undertook evaluation of health outcomes in the

period 1985 – 1999. Various evaluation techniques were applied, notably the Burden of Disease approach, developed by the WHO and the World Bank (2,3). Evaluation analyses were mainly on the burden of premature mortality expressed in Years of Life Lost (YLL). Technical assistance was provided by WHO, Geneva (4,5). As an outcome of this work a database was established consisting of estimated time series on standardised YLL and deaths distributed on causes and sex for the period 1976 - 1998.

## **MATERIAL AND METHODS**

Data from the Greenlandic Death Register has been applied to evaluate developments in the Greenlandic mortality burden in the period 1976 – 1998. Validity of the register data on death causes has been evaluated and found qualitatively appropriate for purposes related to monitoring, scientific research and evaluation (6,7). However, according to the evaluations data validity was highest for death causes in age groups below 65 years of age. Based on regression analysis (ordinary least squares) of trends in 11 disease groups projections have been estimated for the period 1999-2028.

The method applied to calculate the trends and projections of the mortality burden of the Greenlandic society is the Burden of Disease approach (Years of Life Lost) per 10,000 person years. For a more comprehensive introduction to this methodology and its potential application in Greenlandic health planning, see the methodological study conducted in connection with the working group "Health and Health Demands"(7).

Projections of Years of Life Lost for the period 1999-2028 were based on probable changes in the cause of death patterns as well as expected changes in population size and composition by age and sex. Three steps were followed to generate the projection data:

First, all deaths by year in the period 1976-1998 were divided into eleven main causes of death groups and fourteen age and sex groups. Using population data for the same period, age-,

sex- and cause-specific mortality rates were calculated for every year. Based on these historic mortality rates, an attempt was made to derive a trend for each of these groups by the application of regression analysis (ordinary least squares) using time as the explanatory variable. In different age-, sex- and cause-groups, this method consequently indicated an increasing, decreasing or unchanged level of mortality rates for the period 1976-1998. The equations estimated from the historic mortality rates were subsequently used to project mortality rates for the coming thirty years (1999-2028).

Secondly, projection estimates of population size by age and sex developed by Statistics Greenland (8) were utilised for calculating the absolute number of deaths for the projection period 1999-2028 by applying the mortality rates derived as described above. In order to separate the effects of the estimated changes in cause of death pattern and population changes, the number of deaths in each of the thirty years in the projection period were also calculated under the assumption that the population size and allocation by age and sex corresponded to the 1998 population.

Finally, the total number of life years lost (YLL) was calculated by multiplying the estimated number of deaths in each age and sex group by the individual life years lost in the relevant age and sex group. However, contrary to the general burden of disease methodology (2), the present study has neither discounted future life years nor applied unequal age weighting, except for international comparison purposes; see related methodological studies for discussions on these aspects (7,9).

## **RESULTS**

### **Projections of future mortality burden**

Recent studies have indicated that the current burden of disease in Greenland is influenced by three main components: 1) demographic change, 2) development in behaviour and lifestyle and 3) epidemiological transition (4, 9). With the purpose of investigating the relative future effects from

demographic change, epidemiological transition, and behaviour on both sexes, statistical regression was performed on 11 aggregated disease groups from 1976 to 1998, see Figures 1 and 2. By projecting on fixed 1998 population structure future demographic changes are excluded and mainly the impact of the trends in the 1976-1998 period will appear.

When projecting the mortality burden with fixed 1998 population structure the rate of increase of the mortality burden between 1998 and 2028 will be respectively 0 and 9 per cent for females and males. When including population change total mortality burden will increase by 45% and 37% for females and males, respectively, cf. Figures 1 and 2 below.

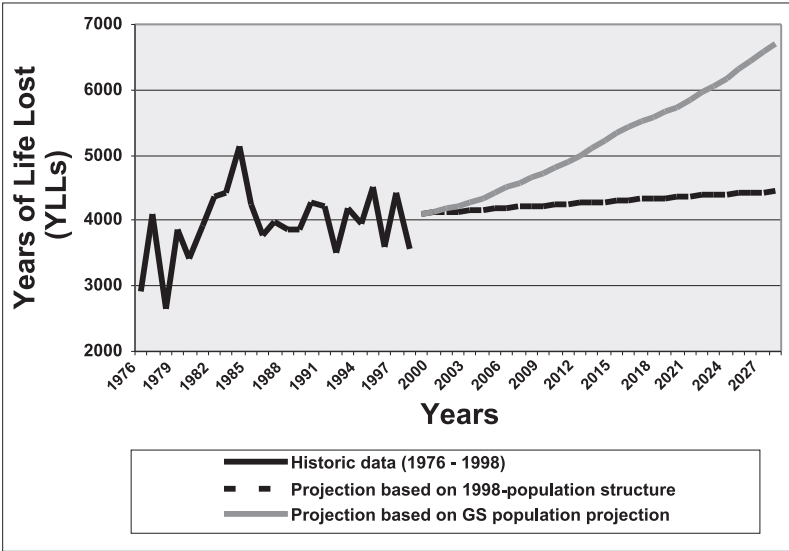


Figure 1. Projection of mortality burden (YLL) 1999 – 2028, Greenlandic females. Comparison of projections under two assumptions: Fixed 1998 population structure and GS population projection.

Figure 3 shows the projected future effects (1999-2028) on the Greenlandic mortality burden for both sexes due to demographic change compared with a 1998 level. The highest increase in Years of Life Lost is expected for the female mortality burden with a total of 28,025 YLL compared with a 27,419 YLL increase in male burden during the entire projection period.

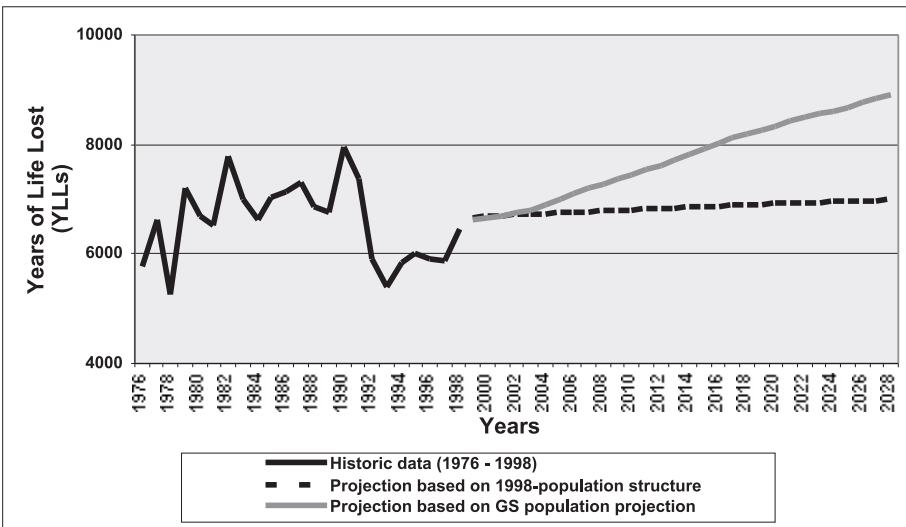


Figure 2. Projection of mortality burden (YLLs) 1999 – 2028, Greenlandic males. Comparison of projections under two assumptions: Fixed 1998 population structure and GS population projection.

The projected future excess related mortality burden due to demographic change indicates thereby close to a fifty-fifty share between the sexes (51% for females and 49% for males). In 2028 an expected "excess" mortality burden of 4,287 Years of Life Lost is expected compared to the 1998 level due to demographic change.

### Projections on mortality burden and amenability to intervention types

The approach of measuring and monitoring the quality of health intervention ex-post by distributing the mortality burden according to amenability to curative and preventive interventions has been recommended by WHO (10). By categorising and distributing YLL according to the approach of avoidable

deaths the quality of different intervention types can be measured through a given time period (11-13). The approach applied in this study follows the specification of amenable causes on curative and preventive causes made in accordance with the working group "Health and Health Demands" under the Greenlandic Health Care Reform (7). Preliminary results of this work were presented at the Nuna Med 2000 Conference in Nuuk (9). Figure 4 shows 5-year average levels in estimated female mortality burden amenable to primary prevention and curative treatment ex-post (1976 – 1998) and projected (1999–2028). The burden from preventable diseases and injuries adju-

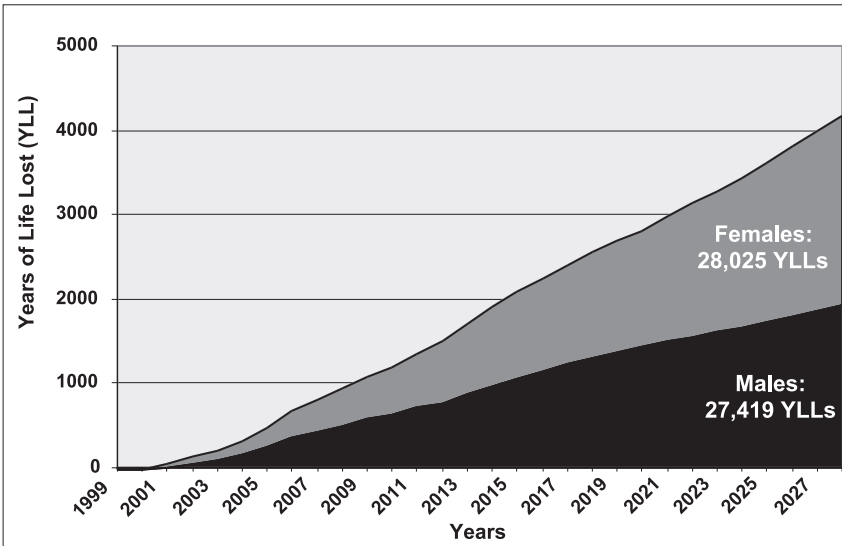


Figure 3. "Excess" mortality burden due to population change, base year: 1998 and Projection period: 1999 – 2028. Difference between projection on fixed 1998-population structure and projection on GS population projection. Greenlandic males and females.

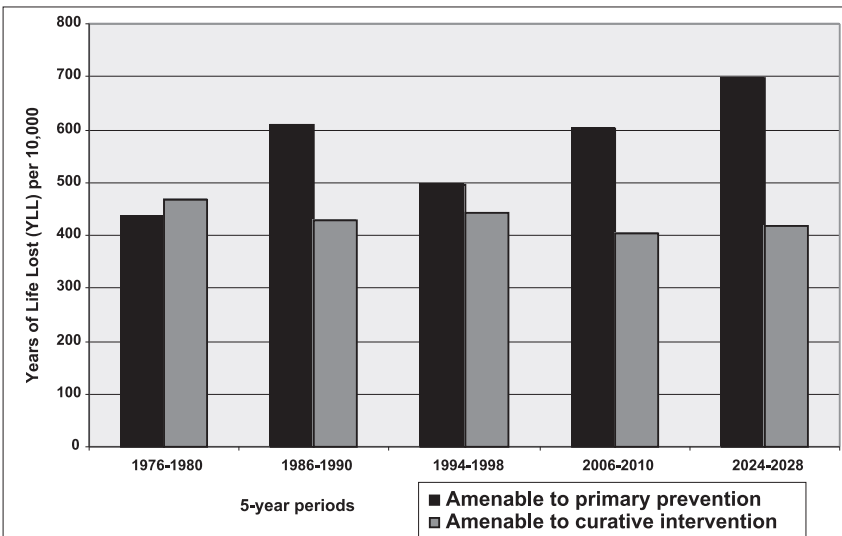


Figure 4. Historic and projected mortality burden 1976 – 2028. Greenlandic Females. Years of Life Lost distributed on amenability to intervention type.

ted for population size is generally larger than the burden amenable to curative health care, except in the 5-year period 1976-1980. Further, the burden amenable to primary prevention is expected to increase from 1998 and onwards, while the burden amenable to curative interventions is expected to stabilise around the 1986-1990 level due to the stable level in the historic period 1976–1998, probably a factor connected to the vast distances in Greenland and geography-related barriers for health care provision related to reproductive health.

Figure 5 shows the mortality burden amenable to primary prevention for males and females estimated on historic data from 1976 to 1998 and projected from 1999 to 2028 including population change. The figure reveals two trends: firstly, the mortality burden amenable to primary prevention for males is projected to decrease during the projection period. Secondly, the mortality burden amenable to primary prevention for females is projected to increase during the projection period. The decreasing trend for men is mainly due to expected further reduction and stabilisation in alcohol related deaths. This is indicated in Figure 5 by the development in YLL levels from the 5-year period 1986-1990, when alcohol consumption was at a peak, to the 5-year period 1994 –1998, when alcohol consumption decreased by nearly 40 percent to a level of 13 litres pure alcohol per capita per year for those aged 14 years and above (4).

On the other hand, the increasing trend in women’s mortality burden amenable to primary prevention is mainly due to an in-

creasingly higher burden of tobacco-related YLL, experienced from the historic data. Alcohol-related deaths constitute a significantly smaller share of total mortality burden for women than for men. That is why reduction in general alcohol consumption for women will have a relatively smaller impact for women than for men (4).

## DISCUSSION

Due to the relative difference in vulnerability between men and women to the risk factor of alcohol the inverse trends on preventable mortality burden for males and females in Figure 7 indicate that the level of mortality burden amenable to primary prevention will eventually level out at the end of the projection period. However, this result should be taken with caution, since the mechanical projected data do not allow taking into account more complex epidemiological processes. For example, the projections do not add in that a large share of the life saved due to further future reductions in alcohol consumption will in all probability be lost due to increased levels of YLL related to the tobacco epidemic. Because of relatively higher alcohol consumption among men, this factor will be more significant for men than for women when judging the future mortality burden, thereby questioning the projected tendency

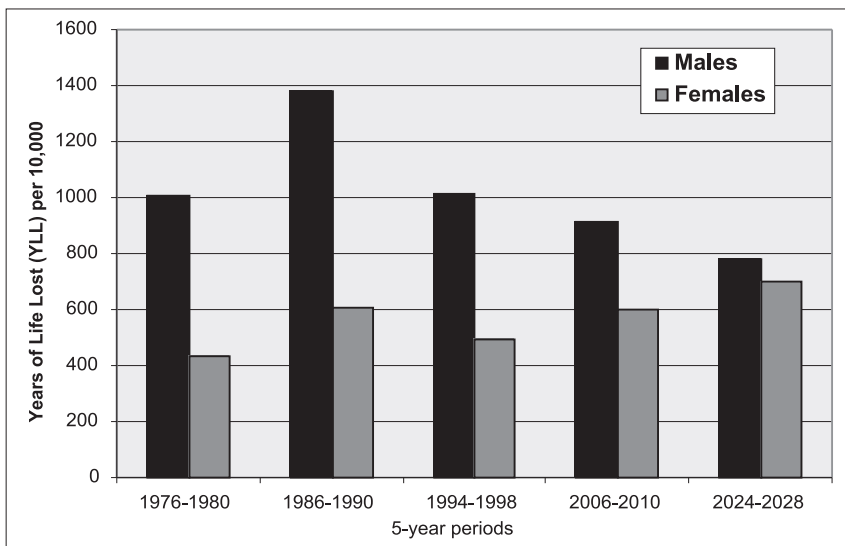


Figure 5. Mortality Burden amenable to primary prevention 1976 – 2028. Greenlandic females and males. Prediction with GS population projection.

to decrease in preventable mortality burden for men. Women's mortality burden due to lung cancer is expected to increase 240 per cent from the 1998 level to 2028, thereby providing a good predictor for the expected increase in men's mortality burden due to lung cancer, which is expected to increase by "only" 124 per cent, indicating a significant underestimate of the future development in total burden amenable to primary prevention for men.

In general, the projections indicate that the demographic component in combination with behavioural patterns will have a dominant effect in the expected increase in the future burden of mortality for both sexes. Relative to these two components, epidemiological transition will constitute a rather insignificant impact on the future mortality burden in Greenland. The future increase in mortality burden due to ageing of the population is found to be parallel to projections on the related future burden on the health care system, indicating significant increases in hospital admissions and average length of stay due to ageing (4).

Health authorities in Greenland have described the present status as below potential level due to national income level, indicating a significant health-gain potential (14). Strategies to improve public health in Greenland therefore aim at identifying risk factors that have a special impact on the population. Tentatively, explanatory factors for the low rating in public health outcome mentioned a high level of accidents and suicides, increase in tobacco-related deaths and lack of adequate resources in the Greenlandic health care system. However, this area needs further investigation (14).

Greenland is today allocating a comparatively high share of its national income to health care services and prevention, and recent reports have indicated that total health expenditure is approaching a level beyond sustainability, not least because Greenlandic population is still relatively young and therefore awaits the burden related to ageing (1, 4). Considerations of simply allocating more resources to health seem therefore to be subordinated evaluations on better resource use and application of evidence-based intervention schemes identified according to value-for-money criteria. A first step in

such a process will be identifying the right balance between preventive and curative interventions that provide maximum health for the allocated resources, taking into consideration current and future needs. This process should ideally take cost-effectiveness into consideration as one guiding tool in Greenlandic health planning (15).

## CONCLUSION

The identified indications of positive health outcomes due to reduced alcohol consumption provide promising perspectives for policies aiming to reduce further the preventable disease burden in Greenland. Additional reductions in avoidable deaths from alcohol-related injuries and homicides depend crucially on the ability of the Greenlandic Government to reduce the consumption level further. Other strategic components in the Greenlandic preventable disease burden are reduction of risk factors related to tobacco and psychosocial factors which also imply holistic policy approaches and multi-sectoral concerted actions. In future, ageing of the population will be an additional and prominent challenge for the Greenlandic health care sector, which constitutes a pressing need for reduction in the avoidable disease burden. Mortality burden as well as the need of health care services is projected to increase significantly due to population change.

The projections indicate that the demographic component in combination with behavioural factor burden will have a dominant effect on the future development in projected mortality. The component due to epidemiological transition will apparently constitute a relatively insignificant impact on the future mortality burden. The expected increase in future mortality burden will be shared equally between the sexes. However, recent improvements in public health status seem to have a higher effect on men than on women, who show a stagnant and even deteriorating tendency. This tendency should be a concern for future investigations.

The strategic implication of the future challenge of ageing for the Greenland society will be the initiation of cost-effective interventions today



to reduce the disease burden amenable to preventable diseases and injuries of tomorrow. Preventive interventions focusing on behaviour change by reducing risk factors like tobacco smoking, alcohol consumption and obesity will be effective countermeasures to mitigate the future disease burden related to population change. Increased current focus on reduction of risk factors leading to preventable diseases and injuries will thereby alleviate the significant increases in future health expenditures from the burden of disease component due to ageing in the Greenlandic population. In particular, the projected trends in the preventable mortality burden for females indicate significant increases due to smoking-related mortality, although the impact for men is probably significantly underestimated due to the relatively high mortality burden from violent deaths among men.

Concerted multi-sectoral approaches and broad holistic health strategies related to health promotion and prevention today will strategically improve the future capability of the Greenlandic society to manage the disease burden from population ageing.

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