

DENTAL HEALTH STATUS AND DEVELOPMENT TRENDS AMONG CHILDREN AND ADOLESCENTS IN GREENLAND

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ABSTRACT

Objectives. This paper describes the occurrence of dental caries in children and adolescents in Greenland and the disease pattern is analysed across districts and over time.

Study design. Cross-sectional population surveys of children aged 6, 12 and 15 years.

Methods. Data were stored in the oral health information system established for the Greenland Public Dental Health Services, recording the dental health status of children served by the programme. The participation rate is approximately 100%. In 2003, the study population counted 645 6-year-olds; 587 12-year-olds, and 488 15-year-olds. Dental caries is clinically recorded according to the criteria used by the Danish Public Dental Health Services.

Results. About 80-90% of children in all age groups were affected by dental caries. In 2003, a mean of 13.1 tooth surfaces were affected by dental caries in children aged 6 years, about 6.1 tooth surfaces in 12-year-olds, and 10.2 surfaces at age 15. At all ages, high proportions of children had severe patterns of dental caries. Extensive variations by district in dental caries indices were observed for all age groups. The dental caries experience tends to increase with time in young children, while the dental caries level remained stable for adolescents.

Conclusions. The dental caries burden is high in children in Greenland compared to Denmark and other Nordic countries. It is unrealistic to achieve international goals for oral health and, thus, the strengthening of oral health promotion and disease prevention is urgently needed.

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Keywords: dental caries prevalence, child dental health, dental caries trends over time, achievement of dental health goals, oral health promotion

INTRODUCTION

In western, industrialized societies, the prevalence of oral diseases has changed dramatically over recent decades. This evolution in the panorama of disease has been documented primarily among the child population, where evidence has shown that a growing number of children and adolescents are caries-free, and that the caries experience has systematically declined over time (1). This improved dental health is clearly demonstrated in the Nordic countries, and coincides with the development of preventive public oral health care programmes (2, 3). On the basis of information from the Recording System for the Danish Municipal Dental Health Services (SCOR), it can be ascertained that this improvement in dental health among children and adolescents in Denmark was most remarkable at the end of the 1970s and through the 1980s (4), in pace with the establishment of population-oriented preventive programmes. The enhanced control of oral diseases has been observed among children and adolescents of varying social and economic backgrounds and across regional or geographical boundaries. This altered dental health profile among children and adolescents in Denmark thus reflects, among other things, a provision of oral health care which is oriented towards systematic dental care and prevention, as well as to a strengthening of health promotion efforts at the local community level (5). The Danish municipality-based oral health care of children and adolescents currently covers almost 100% of the target group.

Earlier reports (6-9) have documented a high incidence of dental disease among both children and adolescents in Greenland. This is largely related to the particular living condi-

tions, customs and health habits prevailing here, as well as to nutritional status. Dental health care in Greenland is provided free of charge by public dental clinics, which are primarily oriented to a target group made up of schoolchildren and young people. As the public dental health service is school-based, nearly all children and adolescents eligible for dental care take part in the programme. Due to a high level of dental disease, radical interventions, such as extraction of teeth, have been in common use as treatment measures for many years. Apart from this, restorative - as opposed to preventive - dental care has been dominant. The coverage of dental care for pre-school children has been rather more limited. For adults, dental health care has primarily been oriented to the relief of pain and the treatment of symptoms. There is a major disparity in access to dental health care between cities and settlements, and across districts.

The population of Greenland is approximately 50 000, and dental services are provided by about 28 dentists, 12 Greenland dental hygienists (*kigitigssaasut*), 7 dental technicians and 63 chair-side assistants. Over time however, staffing has fluctuated; in the 1970s staffing was below 2/3 of the prescribed level, while it increased to about 90% at the turn of the millennium. The population to dentist ratio is presently 1780:1 in Greenland, 1030:1 in Denmark, 1050:1 in Sweden and 1140:1 in Norway (10, 11).

In 1999, the Greenland Home Rule and the Directorate of Health entered into a cooperative agreement with the School of Dentistry at the University of Copenhagen, with the aim of modernizing Greenland's dental health care. The overall objective of the 5-year project has been that this collaboration would contribute

to the reorientation of Greenland's dental health care towards a greater emphasis on prevention, planning and evaluation of dental health care at national and district levels, on strengthening management and staff development, on the establishment of experimental and developmental work, on the provision of evidence for dental health programmes at the district level, and on the construction of a health information system applying modern information technology. This health information system is to serve quality development, as well as health surveillance.

The objective of the present report is to give an up-to-date overview of the prevalence of dental caries in Greenland among children and adolescents at the national level and in relation to districts; likewise, the disease prevalence over time will be analyzed. Finally, it is our aim to describe the level of dental caries among children and adolescents in Greenland relative to corresponding data for Denmark and the other Nordic countries, and to assess the health status in terms of international goals for oral health.

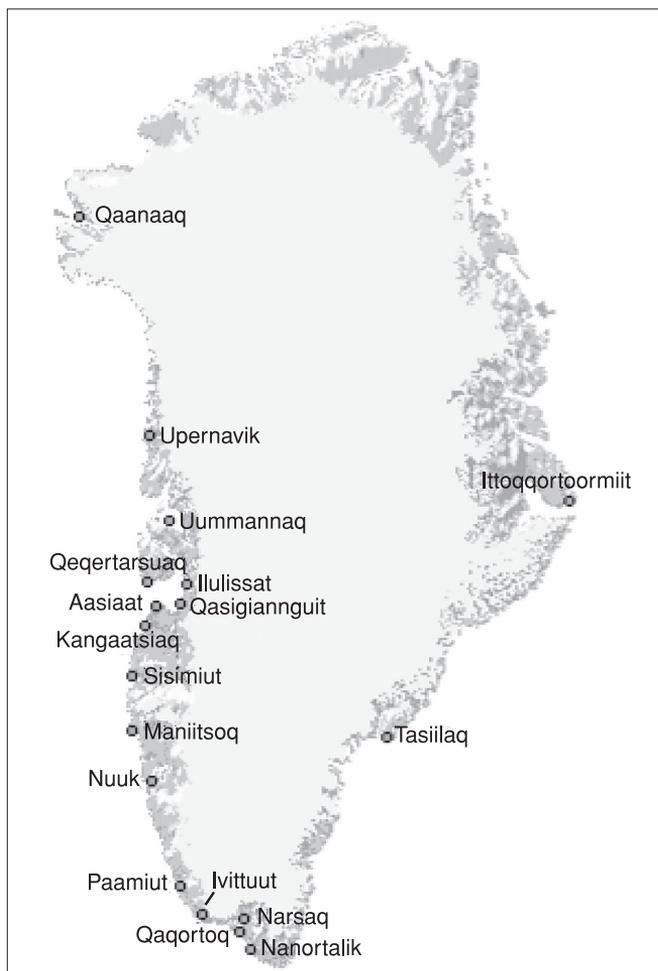


Figure 1. Map of study area.

MATERIAL AND METHODS

Epidemiological data on dental caries among children and adolescents were collected from the clinical dental examinations undertaken as part of the introduction of a modern health information system (SIS) for the Greenland Dental Health Services. This system was developed for the collection, processing and analysis of health data, and the criteria for registration of caries correspond to the Danish recording system for reporting on the prevalence of dental disease to the Danish National Board of Health (SCOR) (12). The prevalence proportion rate (PP) and the caries experience index measured at the tooth level are not sensitive enough to detect population variations if the occurrence of dental caries is high. Therefore, the tooth surface caries index has to be applied (12). The caries criteria imply the registration of caries with loss of tooth substance or cavity level (12), and calibration trials were carried out involving dentists in all districts in Greenland. Kappa statistics were at least 0.85 (13). All 16 districts in Greenland (Figure 1) have used the health information system for all children and adolescents under dental care, and the registration of children aged 6, 12 and 15 years was made mandatory for surveillance. Registration of the selected age groups took place annually during 1999-2003, and the numbers of participants for the individual groups are given in Table I. The study population includes subjects in towns and coastal settlements.

Table I. Number of children examined according to age and year of study.

Year	6-year-olds	12-year-olds	15-year-olds
1999	776	706	544
2000	663	699	509
2001	504	560	477
2002	716	748	531
2003	645	587	488

Data analysis

The Greenland dental health care information system was constructed applying the Statistical Package for the Social Sciences (SPSS) and, as part of the organisational development project, the programme was designed to calculate prevalence proportions and caries indices for primary and permanent dentitions (dmfs/t: decayed, missing due to caries and filled surfaces/teeth in the primary dentition; DMFS/T: Decayed, Missing due to caries and Filled Surfaces/Teeth for the permanent dentition). Calculation of caries index values comprises both mean values for indices of tooth surface and tooth levels. Furthermore, the children are classified according to caries severity zones as follows: Zone 1 – caries-free children, Zone 2 – children with caries on occlusal surfaces, Zone 3 – children with caries also on approximal surfaces, Zone 4 – children with caries on smooth surfaces and in front teeth (11). The data analyses in this report consist of both descriptive cross-sectional analyses, and of comparative analyses including comparisons with corresponding data from the Danish Municipal Dental Health Services (4). Statistical tests for the evaluation of parameters were not applied, as the study comprised total population groups.

RESULTS

Caries among children and adolescents

The prevalence proportion of dental caries among schoolchildren and adolescents in 2003 was about 80-90% for all age groups. Figure 2 shows the caries amount in the primary dentition of 6-year-olds expressed in terms of the average dmfs-index, while the DMFS-index is used for the 12 and 15-year-olds. The data presented are based on a cross-sectional design to effectively illustrate the burden of dental caries in different key age groups. The caries index was approx. 13 dental surfaces among 6-year-olds, and untreated caries constituted over half of the caries experience; the m-component made up about one-third of the index, whereas the f-component was approx. 10%. The caries index was approx. 6 DMFS among 12-year-olds; untreated caries constituted one-third of the caries index, and about half of the surfaces affected by caries had fillings.

Figures 3-4 show the overall caries experience (dmfs + DMFS) for 6- and 12-year-olds during the period 1999-2003. The caries experience showed a tendency to increase among the 6-year-olds, while the trend was more stable among the 12-year-old children.

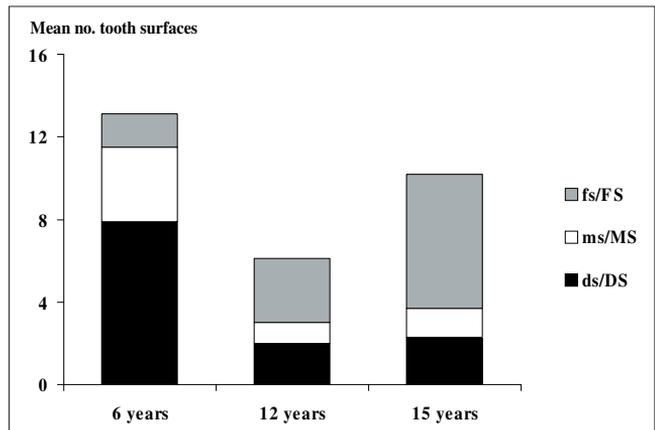


Figure 2. Dental caries experience in 6-year-olds (dmfs), and 12- and 15-year-olds (DMFS) in Greenland 2003, based on cross-sectional survey.

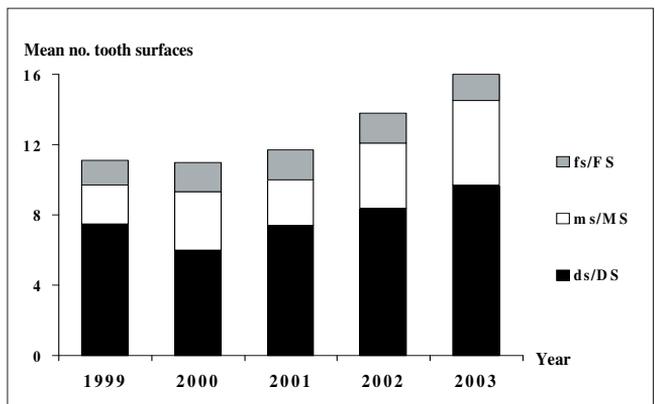


Figure 3. Time trend of total dental caries experience (dmfs + DMFS) in 6-year-olds in Greenland.

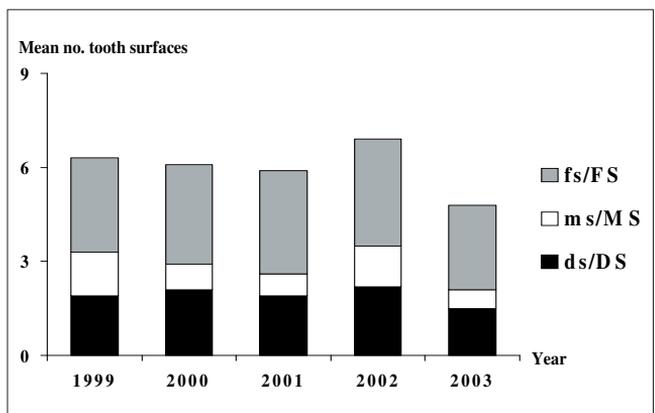


Figure 4. Time trend of total dental caries experience (dmfs + DMFS) in 12-year-olds in Greenland.

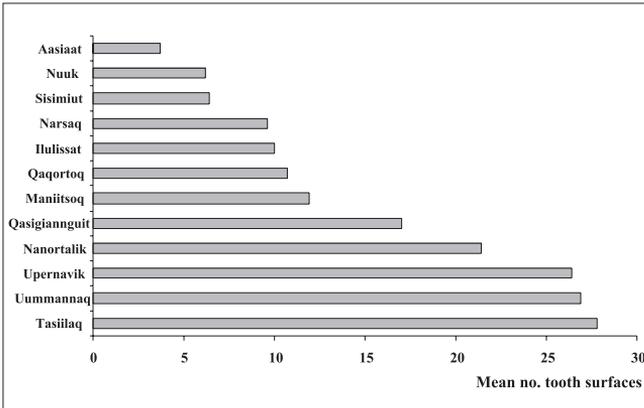


Figure 5. Dental caries experience (dmfs) of 6-year-olds in Greenland 2003.

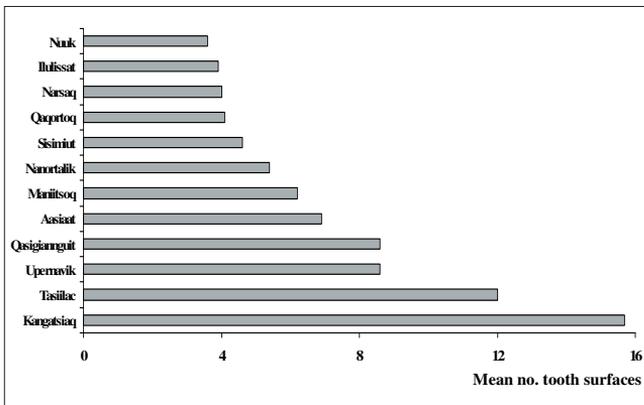


Figure 6. Dental caries experience (DMFS) of 12-year-olds in Greenland 2003.

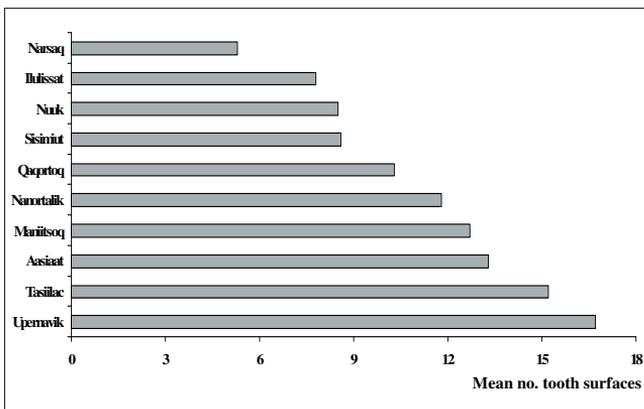


Figure 7. Dental caries experience (DMFS) of 15-year-olds in Greenland 2003.

Caries in relation to district

Figures 5-7 illustrate the caries experience during 2003 among the subject age groups of children and adolescents in relation to district. For all three age groups there was a marked variation in district averages. The figures include only those districts where there was an adequate number of children for statistical calculation of the average using the caries index.

Caries among children and adolescents in Greenland and Denmark

Figure 8 elucidates the caries prevalence among the subject age groups of children in Greenland in relation to the corresponding groups of children in Denmark (4). For children in the 6 years age group, the Greenland caries level was approx. 5 times higher than the Danish level; likewise, a marked variation could be seen in caries components. In addition to variations in the amount of caries, there were pronounced differences in the distribution of children according to caries severity zone (Figure 9). Less than 20% of the 6-year-olds in Greenland were caries-free, and approx. 60% of these children exhibited the most severe caries pattern (severity zone 4). A similar picture was observed for children aged 12 and 15.

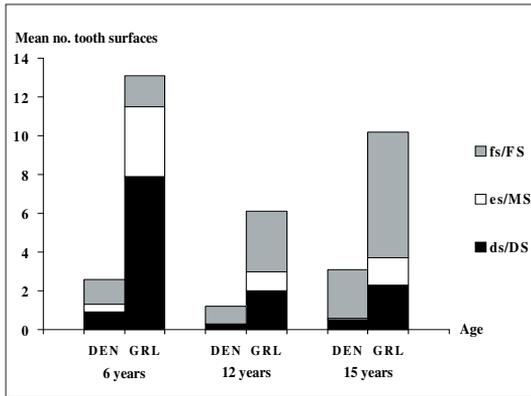


Figure 8. Dental caries experience in primary teeth of 6-year-olds (dms) and in permanent teeth of 12-year-olds (DMFS) in Greenland (GRL) and Denmark (DEN) 2003 (4).

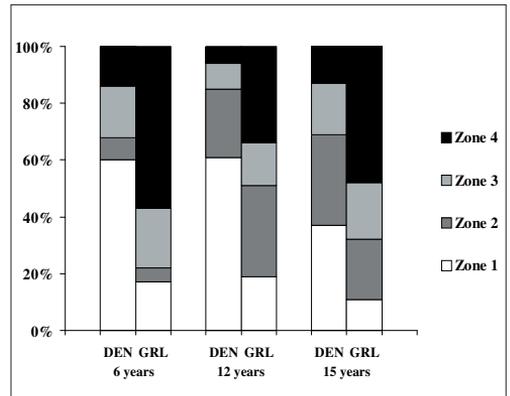


Figure 9. Distribution (pct.) of children in Greenland (GRL) and Denmark (DEN) by caries severity zones 2003 (4).

DISCUSSION

The present report is based on data collected for the newly developed health information system for Greenland. This system was designed to serve various purposes: 1) as a planning and management tool for dental health intervention programmes in relation to the target groups at national and district levels; 2) for quality development and outcome measurement; and 3) for surveillance of trends in disease and health based on selected age groups of children and adolescents. The system was designed with a view to integration with standard information technology and patient record systems for oral health.

The present surveillance data were collected on a population basis, and comprise all children and adolescents registered as part of the systematic procedure within oral health for an annual routine examination; i.e. the participation rate in the survey is approx. 100%. The application of the health information system was developed under the organizational

development project for the Greenland Dental Health Services and, at the time of the introduction of the system, calibration exercises were conducted, both in the use of technology, and in the use of criteria for the registration of dental caries. These calibrations have contributed to ensuring the reliability of the data, as a high consistency index (Kappa), comparable to that recommended by the World Health Organization (13), was achieved.

The investigation has revealed that dental caries is extremely widespread among children and adolescents in Greenland; not only does the caries disease affect almost all children and adolescents, but the extent of the disease, measured in terms of the average caries index, is also extraordinarily large. Among the youngest children, the degree of untreated caries and the number of extracted teeth/tooth surfaces is relatively higher for the primary dentition than for the permanent dentition. This picture reflects the priority given within dental health care to the treatment of disease in permanent teeth. However,

caries data for the permanent dentition also indicate that the efforts of the dental health services to control the disease through traditional care has not been entirely successful, as a significant share of the caries experience here is also untreated, and tooth extraction makes up a significant portion of the overall caries index. A similar pattern is also found among teenagers, but the filling component of the caries index is relatively higher for this age group.

The components in an epidemiological characterization of the disease prevalence in a population comprise analyses of variations in place and time. The information for the three age groups of children and adolescents unanimously show a considerable variation in the burden of disease from district to district. Detailed analyses of locality-specific data indicate that important reasons for this pattern are to be found both in differing risk profiles and in differing dental health care coverage down through the years. Meanwhile, time variations in dental resources, or access to care, cannot wholly account for the variations in dental caries levels found in the study, as outreach public health service programmes have been organized. The records for the whole Narsaq district show a low caries level, which may be attributed to the higher fluoride content in its drinking water (14). With regard to the caries prevalence among children over time, it is to be noted that the trend in caries in the primary dentitions of younger children seems to be progressing adversely, while a certain positive development can be traced in caries reduction in the permanent dentition of 12-year-old children.

Caries in children and adolescents in Greenland in a Nordic perspective

Seen in a European perspective, the prevalence of caries in Greenland is very high (15), and the prevalence of dental caries among children in Greenland is particularly high in a Nordic context. The percentage of caries-free children 6 years of age is 6-7 times lower than that of other countries in the Nordic region, and caries experience (DMFT) among 12-year-old Greenland children is about double that of children of similar age in the Nordic region (16).

Not only does a comparison of caries data for children and adolescents in Greenland with corresponding data for Denmark substantiate a significantly high caries burden among Greenland children, but the distributions of children according to caries severity zones also demonstrate a very severe disease pattern in Greenland. These differences in caries data may partly reflect disparities in dental health care coverage, and be partly due to significant variations in risk profiles and lifestyles. During the period 1994 to 2002, the WHO Regional Office for Europe conducted systematic investigations into the health and health behaviours of young people which also included Greenland and Denmark (17). The children and adolescents of Greenland exhibited a consistently lower level of regular toothbrushing and a consistently high level of intake of sugary food items, compared to those in Denmark.

Goals for oral health

In the early 1980s, the WHO put forward global goals for the oral health of children according to which, by the end of the millennium, 50% of 6-year-olds would be caries-

free, and the average DMFT of 12-year-olds would be no more than 3 (18). Moreover, the WHO Regional Office for Europe formulated a goal of no more than 2 DMFT for children 12 years of age (19). These two goals for a maximum caries amount, along with the goal that at least 50% of 6-year-old children be caries-free, were attained by Denmark and other Nordic countries several years ago. The present study shows that Greenland has far from achieved the European goals for oral health among children. The WHO has also recently set new goals for continued caries reduction and oral health by the year 2020 in Europe (20), according to which, on average, a maximum DMFT of 1.5 should be experienced in 12-year-olds, and at least 80% of 6-year-old children should be caries-free. These goals are thus very ambitious for Greenland, and it is therefore necessary to set more modest, operational goals for oral health here.

Challenges for the promotion of oral health in Greenland

It is unrealistic to seek to control the serious oral health situation in Greenland through traditional, treatment-based, oral health care. Not only would this be more resource-demanding, but it would also not contribute to the development of health in the long term. It will therefore be necessary to expand preventive and health promotion efforts, not as an isolated oral health care activity, but as an integrated part of the health sector's wider health work. Like many common chronic diseases, oral disease is related to an unhealthy diet with a high intake of sugar, unhealthy lifestyles and personal hygiene. The prevention of oral diseases in Greenland must therefore take these common risk factors in account.

This can be effectively accomplished by incorporating the prevention of oral diseases into a diet and nutrition policy, and into preventive strategies for healthy habits in children, young people and adults. The Greenland Dental Health Services can make an important contribution to health education and, using the health-promoting school as a platform, oral health promotion and preventive care can be strengthened within the local community. With an increased number of kigutigssaasut (dental hygienists), the Greenland Dental Health Services can more effectively be reoriented from the current passive prevention, towards active, outreaching health work. Reorientation of the scope of oral health care towards prevention and health promotion is highly recommended by the WHO (1). In the Greenland Dental Health Services, the chief district dentists play a central role in this reorientation process, in that it is their task to implement the overall principles and priorities for health work.

The prevalence of dental caries remains frequent, massive and constant in Greenland. Thus, new public health initiatives are imperative. In the light of the present profile of low self-care and low coverage for regular dental care for certain other age groups, it will be relevant to strengthen the prevention of dental caries through a more effective use of fluoride. The introduction of water fluoridation is not feasible in Greenland, because a central water supply system is not available. The most viable alternative here is automatic fluoridation through salt. Salt fluoridation is recommended by the WHO (21, 22) as an effective means of caries prevention in populations with a high incidence of caries, and analyses undertaken hitherto (14) speak

clearly in favour of an introduction of fluoridated salt. The WHO has prepared a manual and guidelines for the implementation of salt fluoridation, monitoring and impact assessment (22). The health information system of the Greenland Dental Health Services is designed in such a way that surveillance of the health status and measurement of the effect of salt fluoridation may be accomplished automatically.

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