ABSTRACT

Objectives. To describe the health care system and health care delivery in Greenland.
Study design and method. This was a literature study that included literature and articles searched in PubMed published from 1989 to 2009 about health care in Greenland.
Results. The health care system is a publicly financed governmental responsibility. Its major challenges are limited economic resources, Greenland’s demographic structure, rapid epidemiological changes, increased public demand for specialized treatment, difficulty in recruiting professionals and the economic burden imposed by around-the-clock maintenance of specialized staff in sparsely populated areas. To meet these challenges, a public health program focusing on health promotion and prevention, educational initiatives to improve recruitment and a system reorientation moving towards larger health care regions is proposed to be gradually implemented from 2010. One fundamental component of this plan is tying the system together with a telemedicine system and in the future also with a joint electronic patient file system. The importance of better surveillance and monitoring of health has been recognized, while securing best clinical practice and implementing better steering instruments on resource allocation and quality are areas needing focus in the future.
Conclusion. Many of the challenges for the Greenlandic health care system are being addressed with promising strategies, but only the future will show whether they are successful.

Keywords: health care, health care delivery, epidemiologic transition, recruitment, telemedicine, Greenland, public health
INTRODUCTION

The countries with populations in the Arctic region are facing a common challenge in establishing an efficient and competent health system for a sparsely populated region, although this challenge has been met very differently by the various Arctic governments. The aim of this paper is to describe the health care system and health care delivery in Greenland.

Greenland from colony to self-governance

Greenland is the largest island in the world, covering 2.2 million km$^2$, of which 90% is covered by ice. Only the narrow strip of land along the 4,000 km long coastline is inhabited. The 17 small towns and 60 villages in the country are isolated from one another and can be reached only by boat or plane. The majority of the approximately 56,000 inhabitants live on the south and central west coast. The largest town is the capital, Nuuk, with 15,000 inhabitants. About 20% of the population lives in villages with between 3 and 500 inhabitants. Approximately 90% of the population is of Inuit origin and the rest are mostly Danes. The Inuit culture is distinct, although influenced by several hundred years of cultural exchanges with Danish, European and global societies. Language and diet are central markers of Greenlandic culture (1).

Greenland is a former Danish colony. A Home Rule Government with extensive powers did govern for 30 years until 2009, when Greenland gained the right to self-governance. The future goal is to attain full independence. Today, Denmark subsidizes more than one-quarter of the national budget. To create economic growth centres, Greenland has recently moved away from highly subsidized transportation, electricity, water and the supply of basic foods in rural areas. This policy, along with the global economic slowdown and fewer opportunities to live solely on traditional occupations such as small-scale fishing and hunting, which are the most common ways of life in rural areas, has increased socio-economic inequity in favour of towns and the capital (2).

The government and the municipalities share responsibility for the society’s needs regarding services and funding. Health care, infrastructure, building schools and institutions, most transportation and care for the disabled are currently the responsibility of the government, while the municipalities provide social services, operate day care institutions and schools, provide basic education, secure funding for local cultural and sports activities and manage the local environment. In 2009, a new municipal structure reduced the number of municipalities to only 4 from the former 18. The larger municipalities are slated to take over more public service responsibilities from the government. In the near future, these will include treatment of alcohol and drug abuse and services to the disabled.

Because of their small size and isolation, towns and villages in Greenland often need to be self-sufficient and are very vulnerable to external factors. Substantial differences are found between the capital, the larger towns along the west coast, and the more remote, often sparsely populated towns and villages in the south, north and east regarding lifestyle, living conditions, occupational structure, educational achievement, economic status and access to cultural and shopping facilities (3–6). The economic conditions in a village are often less favourable than those found in the nearest town (2).
MATERIAL AND METHODS

The aim was to include literature about public health, the health care system and health care delivery in Greenland. The literature includes reviews (5,7,8), books (1), theses (3), reports from health surveys (4,9), official statistics (2,10–12), governmental reports (6,13–19) and a literature search in the scientific database on medical journals, PubMed.

In PubMed, a broad search on “Greenland” and “health care” was made on 28 September 2009. Articles published after 1989 were selected. This search produced 139 hits. After screening the titles, 74 articles were left. Duplicates and articles that were not from peer-reviewed journals were excluded, leaving 60 articles. The literature was categorized by topic. Articles with only a narrow clinical focus that did not fulfil the aim were excluded, leaving 43 articles (Table I).

RESULTS AND DISCUSSION

The ecosystem and the societal context have a decisive influence on the health of the individual, and most of the fundamentals for health and well-being are created outside the health sector (20). In the last 50 to 100 years, Greenlandic society as well as other Indigenous Arctic societies have undergone rapid changes that have influenced all aspects of their way of life. These societal changes have been paralleled by an epidemiological transition (1,6,7).

Earlier on, perinatal complications, acute and chronic infectious diseases and injuries dominated as causes of morbidity (1,3,5,7). Today, chronic and lifestyle-induced diseases and disabilities dominate morbidity despite the fact that the “old” diseases have not dropped to the low levels found in most Western countries (1,3,5,6,11). In addition, the burden of poor health related to social conditions does not appear to be decreasing (1,21).

| Subject                                | Number of articles | Prescription | Other | General | Clinical |
|----------------------------------------|--------------------|--------------|-------|---------|----------|
| Health care delivery (37,41,56–60)     | 7                  | 3            | 4     |         |          |
| Health care quality (22,32,34,48,53–55,61) | 8                  |              | 3     | 5       |          |
| Recruitment (42)                       | 1                  |              |       |         |          |
| eHealth and telemedicine (43–46)       | 4                  |              |       |         |          |
| General health and health transition (62–66) | 5                  |              |       |         |          |
| Mental health (23,29–31)               | 4                  |              |       |         |          |
| Infectious diseases (24,67–69)         | 4                  |              |       |         |          |
| Non-infectious diseases (26,27,70,71)  | 4                  |              |       |         |          |
| Health research (49,50,52,72)          | 4                  |              |       |         |          |
| Diet contamination (35,36)             | 2                  |              |       |         |          |
The leading causes of mortality and morbidity in Greenland are all high compared to Denmark and the other Nordic countries. These include a high infant mortality rate (11,22); high death rates due to unnatural causes, especially suicides and accidents (11,14,23), which results in a low mean lifetime expectancy (11); high rates of infectious diseases (tuberculosis, hepatitis B, Helicobacter pylori, meningitis) (11,24,25); increasing rates of diabetes (26,27), cardiovascular diseases (6,7) and cancers, often connected to smoking and other lifestyle factors (11), along with stressors to mental health such as unstable family relationships, abuse and domestic violence often connected to alcohol and cannabis abuse (28–31). Lack of parenting skills is a growing concern (28). Low oral health, (3,16,32) the high rate of legal abortions (11,33,34), the prevalence of lifestyles with potential negative effects on health (1,3,4,6,9) and the effects of contamination of the traditional diet (8,35,36) are other areas of concern.

Public health and prevention

In 1992, Greenland took over responsibility for the health care system for its population from Denmark. The organization of the health care system is comparable to its organization in other Nordic social democracies. It is distinguished by its emphasis on universal social policies rather than a reliance on targeted or selective policies. Health care, including dental care and prescribed medicine, are public expenses (19,37).

In 2007 after years of preparation, the first public health program, Inuuneritta (“let us have a good life”) (17), was proposed. The program aims to meet the challenges arising from socially related health issues and the increase in lifestyle-related diseases. Inuuneritta points to the joint responsibility for health between the individual and society, and puts emphasis on prevention and health promotion. Its focus areas are alcohol and drug abuse, violence, diet, physical activity, smoking and sexual health. It also includes programs on suicide prevention (14), early interventions for the health and development of children and dental health (16).

Public health is surveilled by the Office of the Chief Medical Officer. All children are offered prophylactic health and dental examinations from birth until they finish Grade 10 (15). At present, the child immunization program includes vaccinations for tuberculosis (Bacille Calmette Guérin, BCG), whooping cough, diphtheria, tetanus, polio, Haemophilus influenzae B (HiB), Mumps, Measles, Rubella (MMR) and HPV for girls (11). Vaccinations against hepatitis B and pneumococcal pneumonia (13-valent) are included in 2010. The immunization coverage is reported to be high, between 85% and 95% (11,38,39). Screening for cervical cancer is offered to all women from 18 to 65 years of age every third year, and seniors above 64 years of age are offered vaccination against seasonal influenza.

Health care expenditures and financing

It has been found that the health of the population does not reflect the amount of money spent on health care, and the gap is attributed primarily to diseases related to lifestyle (10). In 2006, health care cost 938 million Danish kronor (1 DKK=$5.5 U.S.) corresponding to 2,219 euros per capita; of this, only 9 euros/capita were privately financed. Expenditure on health care as a percentage of GDP did
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The amount spent on pharmaceuticals is very low compared to the other Nordic countries, standing at about 108 euros/capita/year (12). In 2009, the budget for health care expenditures had increased to 1.11 billion DKK. Health care thereby accounts for more than 18% of the total governmental expenses. Of this amount, approximately 47% is spent in the health districts, while the national hospital in Nuuk, Queen Ingrid's Hospital, accounts for about 28%. Just below 2% of the expenses are used on preventive efforts and surveillance. More than 12% of the budget is allocated to treatments outside Greenland, and about one-quarter of this amount is spent on diagnosing or treating serious criminal offenders in specialized psychiatric wards. More than 6% of the total budget, about 70 million DKK, is used to transport patients with acute injuries or illnesses to treatments either within or outside Greenland (40). In recent years, the proportion of expenses used at the national hospital and, for example, telecommunication, has increased at the expense of the health districts. This is seen as a consequence of development towards more specialized treatments (19).

No private providers of health care services exist in Greenland, but private dental care, physiotherapy, psychotherapy and treatment for alcohol and drug abuse are available in Nuuk. Since private providers and private health care insurance have become more common in Denmark, more companies in Greenland have made health insurance available for their employees. Ordinary citizens have also begun to purchase health insurance coverage.

Organization and delivery of health care services

The objective of the health care system is to meet health care needs at the lowest relevant level of specialization. The health care system is obligated to deliver equal care to all citizens regardless of their place of residence (13). Still, the available daily service ranges from consulting a health worker with very limited formal health training in the smaller villages to consulting a specialist at the national hospital in Nuuk (37).

The primary and the secondary health care systems are only divided in Nuuk where the national hospital also serves as the local hospital for the population. Queen Ingrid's Hospital in Nuuk has 185 beds, along with units for surgery (abdominal, orthopaedic and gynaecology), medicine, psychiatry, anaesthesiology/ intensive care and radiology.

Of the former 18 municipalities, 16 are still autonomous units when it comes to health care, and are known as health districts. One of the 1–10 doctors in the district is the chief medical officer, and he/she is responsible for health care delivery in the district as a whole. Each district has a hospital in the town and health clinics in every village. The local hospitals are staffed according to the district's population, which varies from less than 600 up to approximately 15,000 inhabitants. Besides doctors, the staff includes nurses/nurse assistants and might also include lab technicians, physiotherapists and other professionals. The village clinics are also staffed according to the population size. The largest clinics have a nurse as the head while in the smallest, a local health worker without formal health education is responsible for the village's medicine chest (1). According to regulations, all village clinics fall from 11.3% in 1995 to 9.2% in 2006, and in 2006 Greenland had the lowest expenditure per capita of the Nordic countries (12).
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are visited regularly by doctors, midwives and other health care staff.

District medical officers are often educated as general practitioners (GPs). Patients needing elective specialized treatment are either seen by a visiting specialist or referred to the national hospital. Today, except during specialist visits elective surgery, despite being minor surgery, generally only takes place at the national hospital in Nuuk. Also, many acute patients needing surgery and other specialized treatments are transferred to Nuuk. Because of the new perinatal guidelines from 2002, more deliveries also take place in Nuuk (41).

One of the advantages of the Greenlandic health care system is the close contact which takes place between the permanent health care staff and the patients. Many staff members are a part of the local communities they serve and usually know their patients personally. This knowledge has been key to a holistic view of the patient, optimizing treatment, prophylaxis and collaboration with other community services such as the local school, the social system and the police. During recent years, the recruitment of health care personnel has become even more difficult, especially for the more remote areas (42), despite great and costly efforts. Today, the lack of staff on all professional levels and their rapid turnover is a threat to the health care system, especially to continuity in care, the surveillance of health and services and preventive or health promotion efforts (3).

**Human resources management**

Despite an internationally recognized nursing education, for many more years to come the health care system will be dependent on recruiting nurses from outside Greenland along with doctors, physiotherapists, midwives, laboratory technicians, pharmacists and other specialized health staff.

Overcoming the challenges of recruiting this diverse list of professionals has been prioritized. To meet the immediate need, staff have also been recruited outside the Nordic countries. A long-term investment has been made to intensify the education of local staff. Initiatives have included new locally recognized programs based on previous Greenlandic-specific programs, including nurse assistant training to meet standards set by internationally recognized programs. New short programs are also offered, such as psychiatric nurse assistant education, paramedic education and training for nurse assistants working in sexual health clinics; courses are provided as well for village health workers, among others. The new shorter Greenlandic programs upgrade nurse assistants or untrained staff to provide certain kinds of specialized care. They are not comparable to Nordic or international programs but are designed to cover the needs in Greenland’s health care system.

To attract students, nursing education has recently been extended to include a university-based bachelor’s degree, and a collaboration agreement Greenland’s government made with universities in Denmark concerning medical students’ clinical education introduces them to working in Greenland early in their career. Newly educated doctors are offered basic clinical training, the first years of specialization in surgery, medicine and psychiatry, as well as the possibility for full specialization as general practitioners.

To meet the need for high quality health care in the rural areas, a specialized training program to qualify nurses to work without direct supervision by a doctor is planned, and
doctors are now offered a one-year specialization in Arctic health, which equips them with the broad range of abilities needed and makes them more confident to work in rural areas. Generally, all the implemented educational initiatives have had high participation rates and have been successful both retaining local staff and recruiting doctors to educational positions as general practitioners.

The future: regionalization and telemedicine

The structure of the health care system is the same today as it was when it was designed in the 1920s, despite the advantages provided by modern transportation and a well-developed telecommunication system. The increasing public demand for a health care system that can provide specialized treatment, the difficult recruitment of professionals, the economic burden of round-the-clock maintenance of staff on duty or stand by and the new municipal structure are all areas that point to the need for a new structure in the health care system.

In 2008, a plan to reorganize the health care system was proposed. It includes 5 regions, each with a regional hospital, hospitals or health care centres in towns and health clinics in villages (18). The new structure aims at easing access to health care for the population as a whole, but also to give staff more immediate access to consulting a more specialized or experienced professional. One of the foundations of the regionalization is providing better communication by tying all parts of the health care system together with telemedicine and, in the future, with a new electronic patient file system. The new structure will be implemented in 2010 in 2 regions, the Disco Bay area and mid-western Greenland, and in 2011 in other regions.

Telemedicine is the use of information technology for electronic transmission of health information, pictures, sound and other health-related data that is needed to develop appropriate diagnoses and treatment plans (18). Telemedicine (43–45) and eHealth (46) have a rather long history in Greenland. Telepsychiatry, teledermatology, teleradiology and telecardiology have also been established. Still, the planned regionalization of the health care system calls for easy access on a large scale, with a highly developed and integrated telemedicine system that reaches from the settlements to the national hospital. A national telemedicine project did receive an infusion of more than 8 million euros in 2008–2010 to secure the implementation of advanced equipment throughout Greenland. As a result, today all hospitals and clinics in villages with more than 50 inhabitants have a “Pipaluk.” This is a telemedicine console with sophisticated monitoring and diagnostic equipment that can share the information it gathers with more than 70 other identical consoles in all parts of the health care system.

The future: improving data and securing quality

The rapid changes in morbidity patterns make the surveillance and monitoring of health at the local, regional and national levels even more important than it is in other developed countries. Data on core indicators of all aspects of health, health care and influencing factors are a necessary instrument for monitoring the outcomes of health and welfare policies. Regarding child health, the World Health Organization (WHO) has stated that the existing data are often “inaccurate, incomplete or inconsistent” (47). In Greenland, the state-
ment can be expanded to health and health care in general. A coherent strategy for the improvement, protection and monitoring of health and health care is urgently needed. To improve its success, the strategy should be focused on highly relevant issues, must be designed collaboratively by policymakers and clinicians and must provide relevant feedback for the clinical setting.

In response to the need for better documentation, public health indicators in the focus areas in Inuuneritta (the public health program) are developed as a part of the evaluation of the program. The increase in chronic and lifestyle-related diseases seen in the clinical setting calls for both centrally initiated and local initiatives to improve quality of care and determine best practice. National clinical guidelines on best practice for the use of pharmaceuticals, especially antibiotics, as well as prophylactic child health examinations (15), treatment of sexually transmitted diseases and guidelines from the departments of surgery, medicine and psychiatry already exist along with national programs on perinatal care (41) and recently for type 2 diabetes (48). Experts plan to transfer the positive experiences from these initiatives to other areas in the future, especially regarding chronic diseases.

Research is central to health and health care. For a long time health research has been a high priority, and it will be even more important in the future, as the bachelor of education in nursing science must be scientifically based. Most research is still epidemiological (31,49,50) including public health or living conditions; some includes other Arctic (Inuit) populations as well. These studies have been designed to accommodate the specific need for culturally sensitive research in Greenland and across the Arctic, as described in the present research strategy (51). To a lesser degree, health research has included projects on quality, encompassing large, international collaborative projects such as the International Polar Year project on infectious disease surveillance covering the whole Arctic region (52), but also Nordic (53), national (48,54,55) and local (56,57) projects on aspects of quality in care. To improve the health care system, more research is needed on health care management, including topics such as culturally sensitive implementation of health care, evaluation of best practice, cost-benefit analysis of resource allocation, as well as clinical quality and how it can be facilitated.

Conclusion
The major challenges for the health care system are limited economic resources, Greenland’s demographic structure, rapid epidemiological change, increased public demand for a health care system that can provide specialized treatments, the difficulty of recruiting professionals (especially to serve more remote areas) and the economic burden imposed by specialized staff who are on duty or on call around the clock in sparsely populated areas. The challenges are being addressed by a public health program focusing on health promotion and prevention, by educational initiatives to upgrade local staff qualifications and improve recruitment and by the reorganization of the structure to establish larger health care regions starting in 2010. A fundamental component of the structural reorganization is tying all parts of the health care system together through telemedicine.
and in the future with a joint electronic patient file. The rapid epidemiological changes make surveillance and monitoring of health particularly important, and data on core indicators of health and health care are urgently needed. Furthermore, better steering instruments on resource allocation and quality, and securing best clinical practice are areas where focus in the future is needed.

It might be concluded that many of the challenges for the Greenlandic health care system will be met by these current initiatives, but only the future will show whether they are successful, and before the outcome can be evaluated, many more global and local changes, outside the influence of the health care system, might have influenced the process.

Conflict of interest
Birgit Niclasen (MD, Ph.D.) is currently a Medical Adviser for the government of Greenland. She has worked for many years as a GP in Nuuk. Dr. Gert Mulvad, MD is GP at the Health Care Center in Nuuk, Greenland.

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