

Original Article

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Patient referrals from Greenland to Rigshospitalet in Denmark

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ABSTRACT

INTRODUCTION. Patients from Greenland are transferred overseas for highly specialised treatment, mainly to the National University Hospital, Rigshospitalet, Denmark. We aimed to investigate the pattern of transfers from Greenland to Denmark, focusing on cardiology.

METHODS. This descriptive quality assurance study included all Greenlandic citizens receiving healthcare services at Rigshospitalet from 2017-2021. Unique patients and disease courses were accounted for and patients were stratified across specialties.

RESULTS. A total of 3,201 unique patients (56% males, mean age 51.0 years, 325 were 18 years or younger) from Greenland received healthcare services at Rigshospitalet. As some patients were seen two or more times, this corresponds to almost 900 patients (approximately 1,500 disease courses) or 1.2% of the entire Greenlandic population being referred annually. The referrals increased by 52% during the period. The Centre of Head and Orthopaedics received most referrals, followed by the Heart Centre. A modest increase in referrals due to heart diseases was observed with ischaemic heart disease being the more prevalent diagnosis. Coronary artery revascularisation rates in Greenlandic citizens aged 55-74 years were at least as high as in the same age-group for all Danes.

CONCLUSION. During the past five years, a 52% increase has been observed in the referral rate from Greenland to Rigshospitalet for diagnostics and treatment. In cardiology, ischaemic heart disease represented the largest share with a high revascularisation rate being observed in older Greenlandic citizens.

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A long-standing collaboration exists between the Greenlandic healthcare system and Rigshospitalet, Denmark's largest tertiary national university hospital for diagnostics and treatment of Greenlandic citizens [1]. Estimates suggest a required population size of 200,000-250,000 inhabitants to maintain tertiary-level expertise across all specialties, and overseas transfer is therefore needed for the Greenlandic population of 56,421 inhabitants [2, 3].

Queen Ingrid's Hospital in Nuuk is the main national hospital and comprises departments of surgery, intensive

care, internal medicine and psychiatry, counting a total of 108 beds and an additional 70 patient hotel beds. Queen Ingrid's Hospital has capacity to perform a wide range of blood and microbiology tests and imaging (ultrasound, computed tomography (CT) and magnetic resonance imaging (MRI)). Selected advanced samples are conducted and/or interpreted in Denmark. The collaboration includes both patient transfers from specialties that are not covered in Greenland and patients from specialties that are present in Greenland, but which require more specialised care. The collaboration also includes 24-hour telemedical support (e.g., common in ophthalmology), systematic telemedical conferences, Danish physicians travelling to Queen Ingrid's Hospital in Nuuk (e.g., haematologic, paediatric or cardiac device controls on established recurrent arrangements) and educational activities. Waiting time for procedures, follow-up or available transport back to Greenland may be spent at the Greenlandic Patient Home in Copenhagen (72 beds).

Disease patterns in Greenland have changed since the 1950s with infectious diseases having markedly decreased which has been followed by a rise in chronic diseases and cancer [4, 5]. A previously assumed lower cardiovascular disease prevalence among Greenlandic citizens has recently been questioned [6, 7]. Today, cardiovascular disease is a major public health issue in indigenous populations in the Arctic with similar incidences of coronary heart disease and a higher incidence of cerebrovascular disease among Inuit than among Western populations [6]. The Greenlandic population has gradually changed to a more Western lifestyle and is prone to several cardiovascular risk factors including an increase in obesity, diabetes and hypertension, as well as population aging, genetic susceptibility, high rates of smoking and decreasing physical activity levels, potentially causing an increase in cardiovascular diseases and subsequent increased referral rates to Rigshospitalet [6-9]. Our aim was to quantitate and characterise the transfer of patients from Greenland to Rigshospitalet and to investigate trends in disease patterns with a special focus on cardiovascular diseases due to the considerable attention to the prevalence of cardiovascular diseases in Greenlanders, while keeping in mind that patients with cardiovascular diseases represent a substantial proportion of all referrals from Greenland.

METHODS

Study design and subjects

All Danish and Greenlandic residents are assigned a unique personal identification number, which was used to access information of patients transferred from Greenland to Rigshospitalet in Denmark. Diagnostic and procedure codes for persons living in Greenland who were referred to Rigshospitalet from 1 January 2017 to 31 December 2021 were obtained from the administrative system at Rigshospitalet.

Unique patients and disease courses

We assessed a) number of unique patients and b) number of disease courses. Unique patients included residents from Greenland who had been assigned a unique personal identification number. Unique patients could have more than one disease course. If a patient was referred to another clinic/department, this was considered a separate disease course. It was also considered a new disease course if more than 30 days passed between admittances at Rigshospitalet (both hospitalisations and outpatient visits). Organisational changes at Rigshospitalet have been accounted for, and figures are given only for the present organisational structure.

Statistical analysis and approval

Categorical variables are presented as frequencies and percentages, whereas continuous variables are presented as means with standard deviation (SD). This was a quality assurance study and was approved by the Board at Rigshospitalet. Approvals are not required from an ethics committee or from the Data Protection Agency for quality assurance studies.

Trial registration: not relevant.

RESULTS

From 1 January 2017 to 31 December 2021, a total of 3,201 unique patients (56% males, mean age 51 years (SD: \pm 20 years), 325 (10%), of whom were below 18 years of age, were referred from Greenland to Rigshospitalet for diagnostics, treatment and/or follow-up. As some patients were seen several times, this corresponds to an annual referral of almost 900 patients (approximately 1,500 disease courses) or 1.2% of the Greenlandic population (Supplementary Figure 1 and Supplementary Figure 2A and 2B for age and gender distribution of all patients <https://content.ugeskriftet.dk/sites/default/files/2023-04/a10220585%20-%20supplementary.pdf>). The number of referrals measured by disease courses increased by 52% during the five-year study period (Figure 1), and the number of unique patients increased by 27% during the period. The Centre of Head and Orthopaedics managed the largest proportion of disease courses (37%) followed by the Heart Centre (23%) and the Centre for Cancer and Organ Diseases (23%) (Figure 2, overview of centres and departments Supplementary Figure S3). During a disease course, the majority of patients (60%) were admitted only once, 20% twice and 9% three times, whereas 11% were admitted more than three times. After discharge, follow-up is mainly managed locally in Greenland.

FIGURE 1 Referrals (disease courses) from Greenland to Rigshospitalet from 2017 to 2021. The values include disease courses with mixed hospitalisation and outpatient clinic disease courses. Virtual contacts are not included.

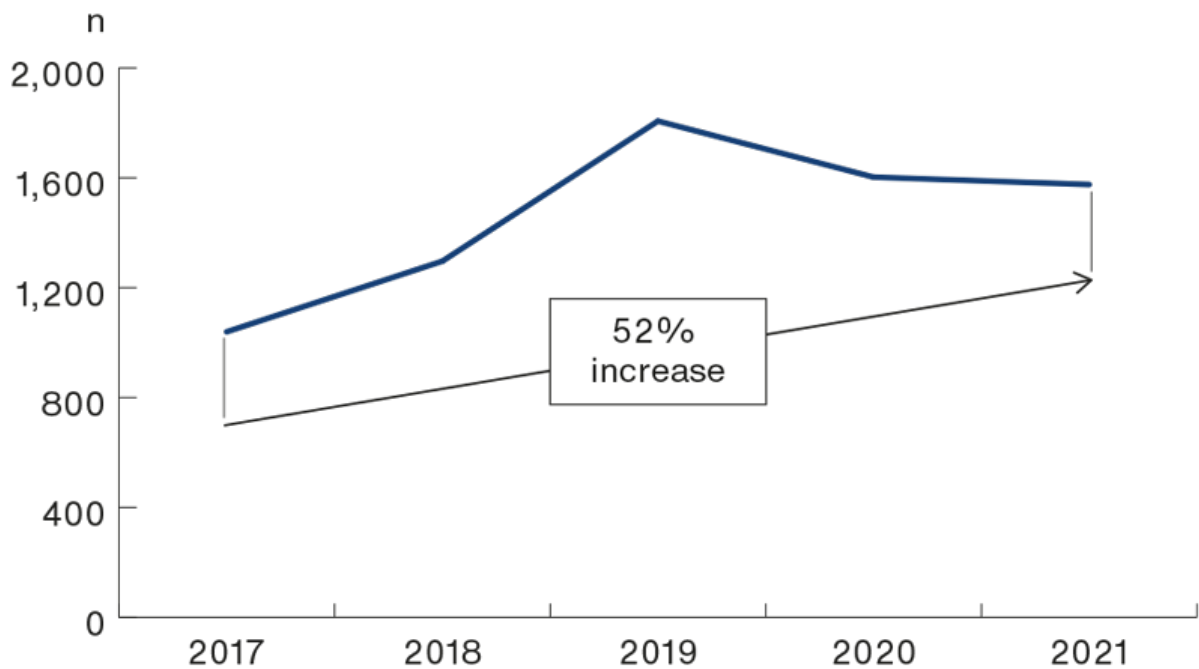
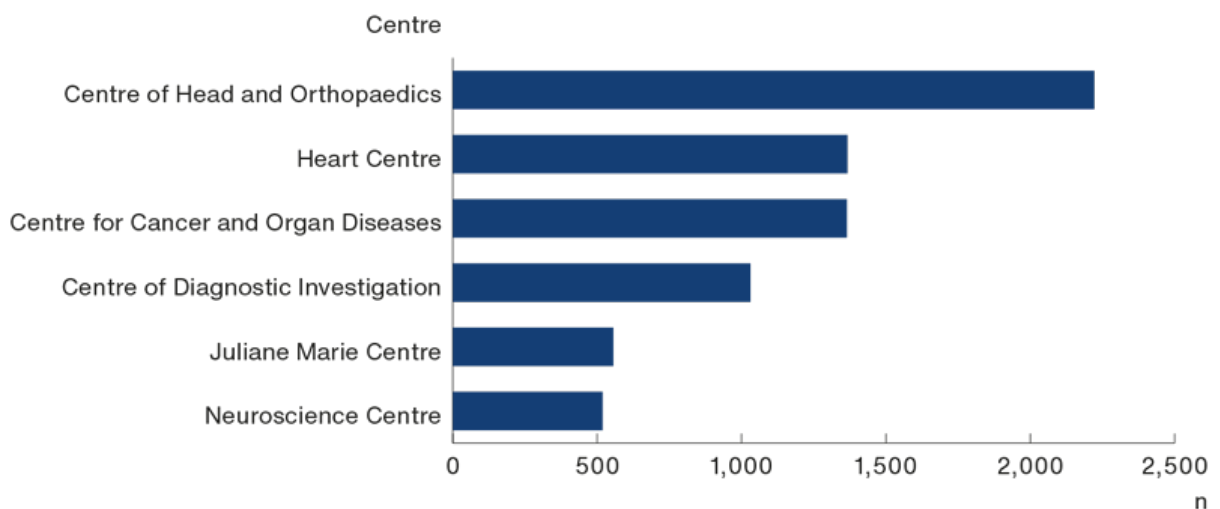


FIGURE 2 Referrals (disease courses) from Greenland to Rigshospitalet from 2017 to 2021, by centre. As per 1 January 2019, the Finsen Centre and Abdominal Centre merged into the Centre for Cancer and Organ Diseases. The Finsen Centre consisted of the Department of Haematology, the Department of Oncology and the Department of Infectious Diseases. The Abdominal Centre consisted of the Department of Vascular Surgery. At the same time, the Department of Infectious Diseases and the Department of Vascular Surgery merged to form the Heart Centre [10]. All data are presented within the present organisation of the centres. It should be noted that the referred patients may be seen by more than one speciality (see methods). Patients seen in the Diagnostic Centre are presented here but are not registered as having an independent disease course in this centre, but only in the clinical centre at which the patient was also seen.

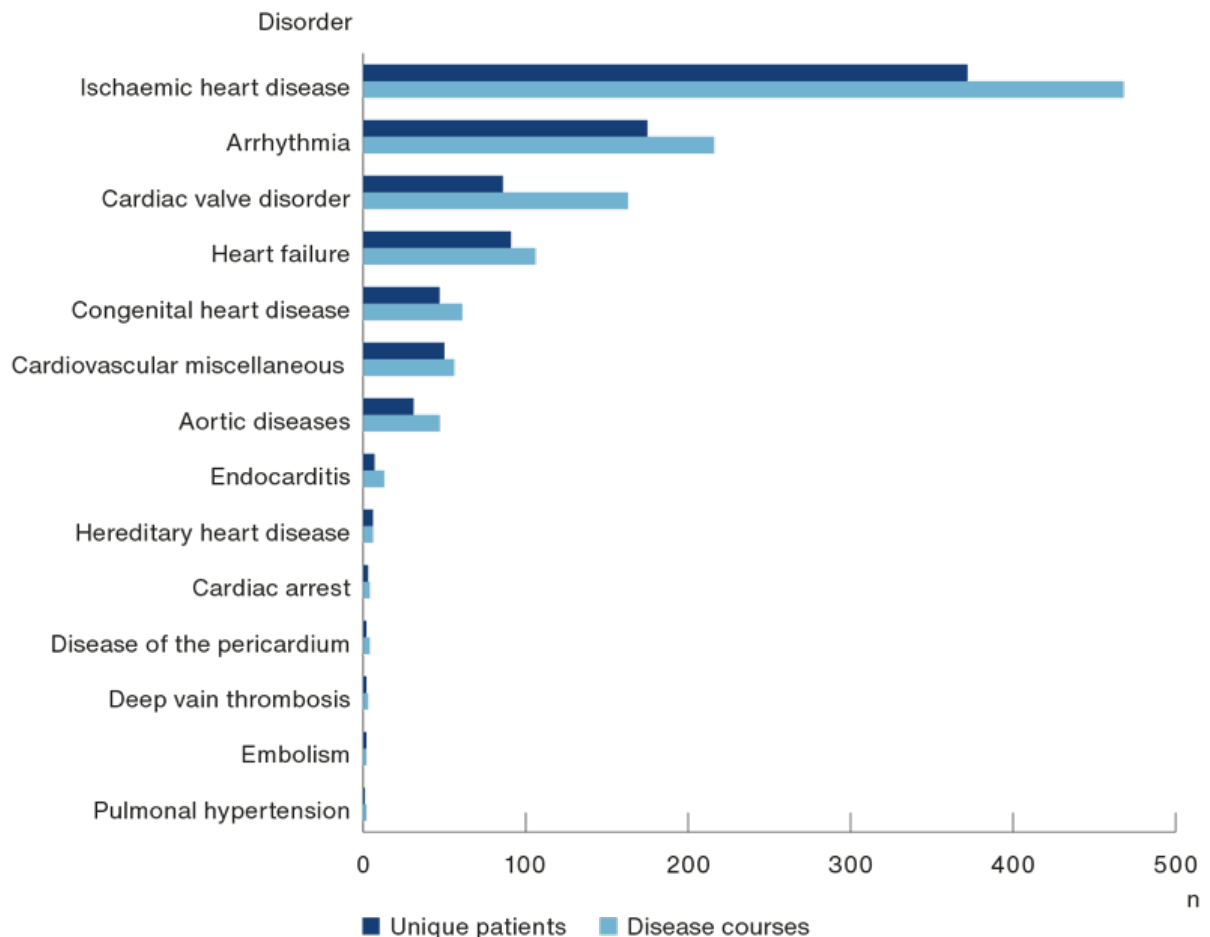


Approximately 60% of the patients stayed partially or only overnight at the Greenlandic Patient Home in Copenhagen (approx. 22,000 annual overnight stays (manager Birtha Bianco, personal communication)) or in private accommodation and were seen only as out-patients at Rigshospitalet. Outpatient management increased during the period ([Supplementary Figure S1](#)), whereas hospital admittances remained stable during the period. The ratio of patients handled as outpatients in comparison to hospitalised was 1.5 (789 outpatient/513 hospitalised) in 2017, which increased to 2.5 in 2021 (1,332 outpatient/539 hospitalised).

Referrals to The Heart Centre

Referrals to The Heart Centre remained largely stable during the period with approximately 300 annual disease courses corresponding to approximately 220 patients per year (68% males, mean age 58 years (SD: ± 15 years)). During the period, a modest increase (19%) was observed in referrals due to heart diseases ([Supplementary Figure S4](#)). Diagnostic distribution for the 1,057 disease courses managed at the Heart Centre during the period due to heart diseases is presented in [Figure 3](#). At 45%, ischaemic heart disease comprised the largest group (see [Supplementary Figure S5 for age and sex distribution](#)), followed by arrhythmia at 21%, cardiac valve disease at 16%, heart failure at 10% and congenital heart disease at 6%.

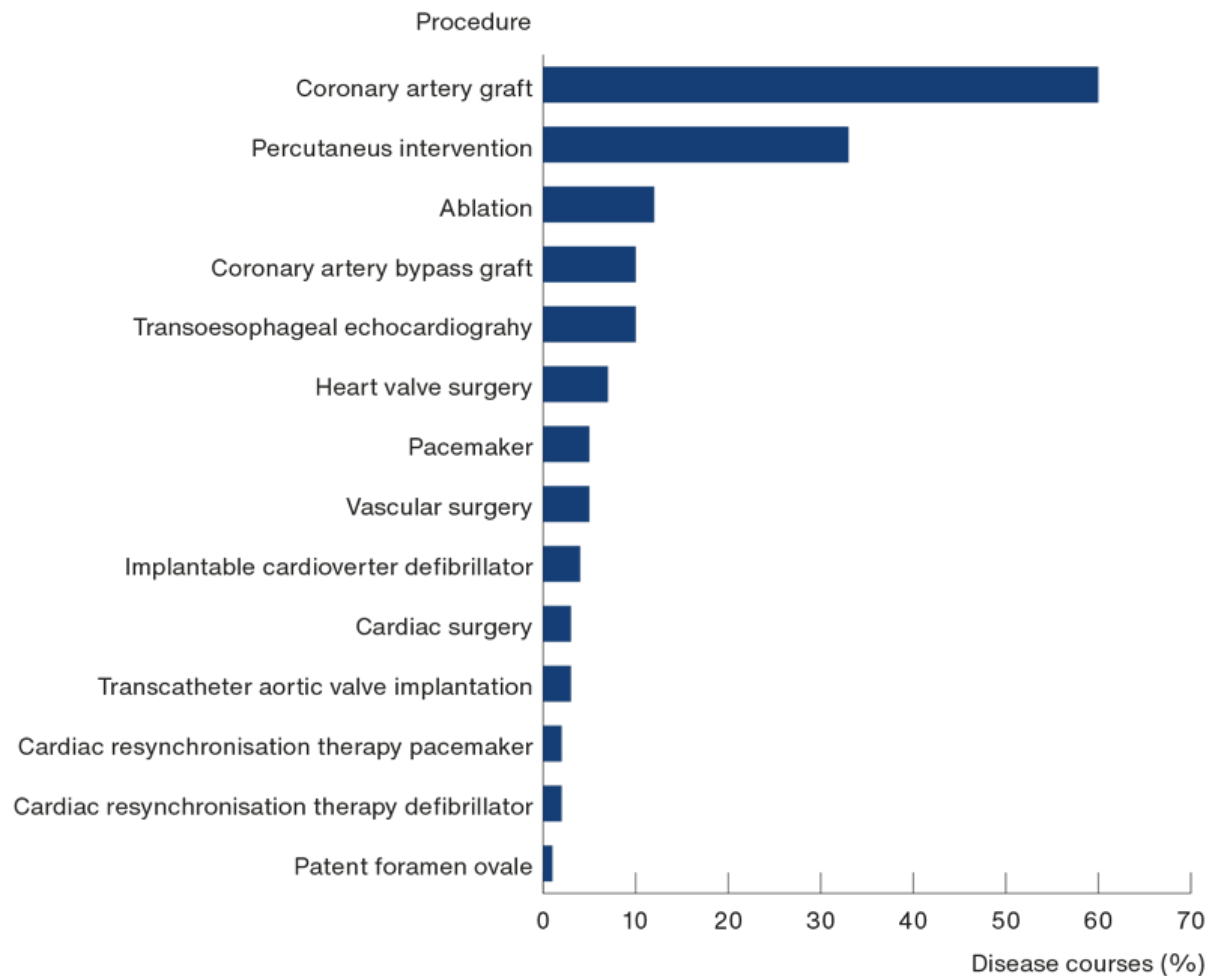
FIGURE 3 Distribution of diagnoses in patients referred from Greenland to the Heart Centre, Rigshospitalet (disease courses and patients), from 2017 to 2021. The three most common causes of referrals from Greenland to the Heart Centre were ischaemic heart disease, arrhythmia and cardiac valve disorders, corresponding to around 75% of all disease courses.



Treatment of patients with heart diseases

The most frequently performed procedure at Rigshospitalet for Greenlandic citizens was coronary angiography (CAG), which was performed in 60% of the disease courses (459 patients, 78% males, mean age 62 (SD: ± 9) years), followed by percutaneous coronary artery intervention (PCI) at 33% (83% males, mean age 62 (SD: ± 9) years), device implantation (pacemaker (P), implantable cardioverter defibrillator (ICD), cardiac resynchronisation therapy (CRT)-P, CRT defibrillator (D)) at 13% (79% males, mean age 63 (SD: ± 11) years), ablation for arrhythmia at 12% (64% males, mean age 50 (SD: ± 15) years), coronary artery bypass grafting (CABG) at 10% (91% males, mean age 63 (SD: ± 7) years), and heart valve surgery at 7% (73% males, mean age 61 (SD: ± 10) years) (Figure 4).

FIGURE 4 Procedures performed in patients referred from Greenland to the Heart Centre, Rigshospitalet (disease courses), from 2017 to 2021. The array of possible procedures and subtypes performed at the Heart Centre is lengthy. However, the most common procedures performed in patients referred from Greenland were coronary artery graft, percutaneous coronary interventions and ablations.



During the period, the annual number of CAG procedures at Rigshospitalet remained relatively stable ([Supplementary Fig S6](#)). The number of CT-CAGs conducted at Queen Ingrid's Hospital increased by 23% in the same period, from 2017-2021 ([Supplementary Figure S7](#)). During the period, the number of revascularisation procedures increased. This was related to an increase in PCI procedures, whereas the number of CABG procedures remained stable ([Supplementary Figure S8](#)). The age-specific revascularisation rates (CABG and PCI) in the age groups 55-64 years and 65-74 years were 440 and 800 per 100,000 per year, respectively ([Supplementary Figure S9](#)). Greenlandic citizens with an ICD (n = 28), CRT-P (n = 17) or CRT-D (n = 14) device are included in the home monitoring system of Rigshospitalet, which enables automated digitalised transfer of data from the inserted device to cardiologists at Rigshospitalet.

DISCUSSION

The size of the Greenlandic population does not underpin the presence of a healthcare organisation with all

specialised levels of diagnostics and treatments in Greenland, leading to a well-established collaboration with Rigshospitalet. We found that around 900 Greenlandic citizens are annually referred to Rigshospitalet. The number of referrals and the number of referred unique patients increased by 52% and 27%, respectively, from 2017 to 2021, with a stable number of hospital admittances but an increase in outpatient management. The Centre of Head and Orthopaedics received the highest proportion of referrals followed by The Heart Centre with ischaemic heart disease as the main cause.

The approximately 400 patients referred due to ischaemic heart disease from 2017-2022 corresponds to an annual mean of approximately 135 per 100,000 Greenlandic citizens. It is reasonable to consider the vast majority of referrals from Greenland with ischaemic heart disease as incident cases. However, the incidence of ischaemic heart disease as measured by referrals may not reflect the true incidence of ischaemic heart disease in Greenland as not all patients with suspected or confirmed ischaemic heart disease may be referred to Rigshospitalet. It deserves mention that the proportion of elderly patients in Greenland is lower than the corresponding proportions in most European countries, which is of importance as the risk of developing ischaemic heart disease increases with age. Thus, the proportion of Danish citizens above 66 years of age is 19% as compared with 8% in Greenland [3, 11]. Notably, the average life expectancy in Greenland is nine years shorter than in Denmark [2]. Furthermore, the likelihood of receiving a diagnostic work-up may be lower for Greenlandic citizens living in small and remote locations. From 2017 until 2021, the mean annual revascularisation rates in Greenland were approximately 440 and 800 per 100,000 in the age groups 55-64 years and 65-74, respectively, compared with approximately 425 and 640 per 100,000 in Denmark in total in 2018 [12]. Thus, the revascularisation rates in these age groups were at least as high among Greenlandic citizens as among Danish citizens overall. We also found an increase in the number of CT-CAGs conducted at Queen Ingrid's Hospital in Greenland in the period from 2008 to 2021 ([Supplementary Figure 7](#)), possibly reflecting a rise in the ischaemic heart disease burden and technological improvements in Greenland, limiting referrals to Rigshospitalet. In summary, it is likely that the overall burden of ischaemic heart disease is at least as high in the Greenlandic population as in the general Danish population.

Our findings are aligned with newer research that has questioned the previous notion that ischaemic heart disease was rare among the Inuit in late 20th century [6, 7, 12]. Evidence suggests a similar incidence of coronary heart disease among Inuit and Western populations [6, 11]. This may relate to a number of changes in the Greenlandic living conditions [13], but also the recent finding of a high genetic predisposition to increased levels of low-density lipoprotein cholesterol in Inuit [14]. Current challenges include an increasing prevalence of obesity (27% of adults in 2018), an increase in consumption of sugar and saturated fat, a high prevalence of smokers (52% in 2018), increases in the prevalence of patients with hypertension and diabetes and decreasing physical activity levels [6, 8, 14, 15].

Multiple factors may lead to adjustments in the well-established collaboration. First, we note a marked increase in Greenlandic patients treated as outpatients at Rigshospitalet. A general tendency in healthcare is a shift from inpatient to outpatient care with the latter having almost doubled for Greenlandic citizens referred to Rigshospitalet during the study period. Second, technology was a focus area in the national Greenlandic healthcare strategy 2014-2017, and telemedicine may reduce the number of referrals, travelling costs and logistic challenges associated with changes in weather conditions [16]. Third, healthcare costs attributable to referrals are of considerable importance and we see several apparent ways of reducing costs associated with joint patient care between Greenland and Denmark. These may include increasing the use of tele-medicine, expanding services provided in Greenland and increasing outpatient treatment at Rigshospitalet and – in the long term – focusing on cost-effective prophylactic initiatives may reduce costs.

Several chronic diseases are underdiagnosed in Greenland [8, 17] and many prophylactic interventions for

chronic diseases, e.g., diabetes [18] and dyslipidaemia [19] are cost-effective. Moreover, the establishment of the Steno Diabetes Centre in Greenland may play an important role within this domain, including their focus on diagnostics and treatment of many chronic diseases in addition to diabetes. One important limitation when aiming to reduce referrals to Denmark is the demand for increasingly specialised healthcare treatment worldwide as estimates suggest that a population size of 200,000-250,000 inhabitants or more is required to maintain high-level expertise across all specialties [2].

This study has several limitations. First, the majority of patients from Greenland treated in Denmark are transferred to Rigshospitalet. However, some patients from East Greenland are transported to Iceland and patients with, e.g., dermatological or psychiatric diseases are referred to other hospitals in Denmark [1]. Second, the study period included the COVID pandemic, which may have had an impact on referrals, and we believe that it is the most plausible explanation for the observed reduction in the number of referrals observed after 2019. A major strength of the study is that we had almost complete nationwide data on tertiary referrals covering a long period.

CONCLUSION

A well-established collaboration between the Greenlandic healthcare and Rigshospitalet in Denmark exists. During the past five years, approximately two patients per day have been referred from Greenland to Rigshospitalet in Denmark for diagnostics and/or treatment with an increase of 52% in disease courses over the five-year period. A large proportion was referred due to cardiac diseases mainly ischaemic heart disease.

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Conflicts of interest Potential conflicts of interest have been declared. Disclosure forms provided by the authors are available with the article at ugeskriftet.dk/dmj

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REFERENCES

1. Naalakkersuisut. Redegørelse af hvilke sygdomstyper som medfører at en patient henvises til sundhedsydelse i Danmark samt muligheden for at nedbringe antallet af patienter, der er nødt til at forlade landet kortvarigt eller på ubestemt tid. 2019. www.naalakkersuisut.gl
2. Noahsen P, Hansen HL. Health and healthcare in Greenland. *Ugeskr Læger*. 2020;182:V12190693.
3. Grønland i tal 2021. Grønlands Statistik, 2021. https://stat.gl/publ/da/GF/2021/pdf/Grønland_i_tal_2021.pdf (14 Jul 2022).
4. Iburg KM, Brønnum-Hansen H, Bjerregaard P. Health expectancy in Greenland. *Scand J Public Health*. 2001;29(1):5-12. doi: 10.1177/14034948010290010501.
5. Bjerregaard P, Larsen CVL. Three lifestyle-related issues of major significance for public health among the Inuit in contemporary Greenland: a review of adverse childhood conditions, obesity, and smoking in a period of social transition. *Public Health Rev*. 2018;39(1):5. doi: 10.1186/s40985-018-0085-8.
6. Tvermosegaard M, Dahl-Petersen IK, Nielsen NO et al. Cardiovascular disease susceptibility and resistance in circumpolar Inuit populations. *Can J Cardiol*. 2015;31(9):1116-23. doi: 10.1016/j.cjca.2015.06.002.
7. Bjerregaard P, Young TK, Hegele RA. Low incidence of cardiovascular disease among the Inuit - what is the evidence? *Atherosclerosis*. 2003;166(2):351-7. doi: 10.1016/S0021-9150(02)00364-7.
8. Dahl-Petersen IK, Larsen CVL, Nielsen NO et al. *Befolkningsundersøgelsen i Grønland 2014*. Copenhagen: National Institute

- of Public Health, 2016. www.sdu.dk/da/sif/rapporter/2016/befolkningsundersoegelsen_i_groenland_2014 (14 Oct 2021).
9. Bundgaard JS, Jørgensen ME, Andersen K et al. Dyslipidemia and the preventive potential in the Greenlandic population. *Atheroscler Plus*. 2023;51:22-7. doi: 10.1016/j.athplu.2022.12.003.
 10. To centre på Rigshospitalet bliver til ét. Rigshospitalet, 2018. www.rigshospitalet.dk/presse-og-nyt/nyheder/nyheder/Sider/2018/december/to-centre-paa-rigshospitalet-bliver-til-et.aspx (25 Aug 2022).
 11. Jørgensen ME, Bjerregaard P, Kjærgaard JJ, Borch-Johnsen K. High prevalence of markers of coronary heart disease among Greenland Inuit. *Atherosclerosis*. 2008;196(2):772-8. doi: 10.1016/j.atherosclerosis.2007.01.008.
 12. Fodor JG, Helis E, Yazdekhasi N, Vohnout B. "Fishing" for the origins of the "Eskimos and heart disease" story: facts or wishful thinking? *Can J Cardiol*. 2014;30(8):864-8. doi: 10.1016/j.cjca.2014.04.007.
 13. Backer V, Bjerregaard P, Friberg JT et al. Greenland – a changing disease pattern. *Ugeskr Læger*. 2005;167:1389.
 14. Jørsboe E, Andersen MK, Skotte L et al. An LDLR missense variant poses high risk of familial hypercholesterolemia in 30% of Greenlanders and offers potential of early cardiovascular disease intervention. *HGG Adv*. 2022;3(4):100118. doi: 10.1016/j.xhgg.2022.100118.
 15. Jeppesen C, Bjerregaard P. Consumption of traditional food and adherence to nutrition recommendations in Greenland. *Scand J Public Health*. 2012;40(5):475-81. doi: 10.1177/1403494812454467.
 16. Bundgaard JS, Petersen AJ, Geisler UW et al. Clinical management of haematology in Greenland. *Ugeskr Læger*. 2022;184:V01220002.
 17. Albertsen N, Olsen TM, Sommer TG et al. Who lives in care homes in Greenland? A nationwide survey of demographics, functional level, medication use and comorbidities. *BMC Geriatr*. 2021;21(1):500. doi: 10.1186/s12877-021-02442-0.
 18. Li R, Zhang P, Barker LE et al. Cost-effectiveness of interventions to prevent and control diabetes mellitus: a systematic review. *Diabetes Care*. 2010;33(8):1872-94. doi: 10.2337/dc10-0843.
 19. Mitchell AP, Simpson RJ. Statin cost effectiveness in primary prevention: a systematic review of the recent cost-effectiveness literature in the United States. *BMC Res Notes*. 2012;5:373. doi: 10.1186/1756-0500-5-373.