

## Original Article

# Paediatric patient referrals from Greenland to the National University Hospital, Rigshospitalet, Denmark

Johan Skov Bundgaard<sup>1, 2</sup>, Uka Wilhelm Geisler<sup>1</sup>, Hanne Rex<sup>1</sup>, Julie D. Voss<sup>2</sup>, Katharina M. Main<sup>3, 4, 5</sup> & Marianne Skov<sup>6</sup>

1) Department of Internal Medicine, Queen Ingrid's Hospital, Nuuk, Greenland, 2) Department of Cardiology, Copenhagen University Hospital – Rigshospitalet, 3) Department of Growth and Reproduction, Copenhagen University Hospital – Rigshospitalet, 4) International Centre for Research and Research Training in Endocrine Disruption of Male Reproduction and Child Health (EDMaRC), Copenhagen University Hospital – Rigshospitalet, 5) Department of Clinical Medicine, University of Copenhagen, 6) Department of Paediatrics, Copenhagen University Hospital – Rigshospitalet, Denmark

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## ABSTRACT

**INTRODUCTION.** Greenlandic patients may be referred to Denmark for specialised diagnostics and treatment. The main collaborator for these activities is the National University Hospital, Rigshospitalet, Copenhagen. We aimed to investigate the referral pattern of Greenlandic paediatric patients to Rigshospitalet.

**METHODS.** This was an observational quality assurance project comprising all Greenlandic patients below 18 years who received healthcare services at Rigshospitalet in the 2017-2021 period. This period was chosen to obtain the most updated, available and coherent data possible. Unique patients and disease courses were stratified by paediatric subspecialties and procedures.

**RESULTS.** During the five-year period, a total of 310 unique patients were referred to Rigshospitalet, resulting in a total of 676 disease courses and yielding an average 62 annual referrals of paediatric Greenlandic patients. This represents around 0.5% of all Greenlandic children. Age groups were distributed as 28% aged 0-1 years, 23% 2-4 years, 13% 5-9 years, 21% 10-14 years and 16% 15-17 years. During the study period, the number of disease courses increased by 89% with most patients being managed as outpatients. The subspecialties with most referrals were ophthalmology (17%), oto-rhino-laryngology (16%) and cardiovascular diseases (10%).

**CONCLUSIONS.** Approximately 0.5% of Greenlandic children were referred annually to Rigshospitalet with a marked increase being observed during the five-year study period. We observed a shift towards an increasing proportion of outpatient treatments at Rigshospitalet.

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**TRIAL REGISTRATION.** Not relevant.

Citizens below 18 years of age constitute 23% (n = 13,100) of the Greenlandic population totalling 56,421 inhabitants [1]. To support tertiary-level healthcare across all specialities, a population size of 200,000-250,000 inhabitants or more is required [2-4]. Hence, a longstanding collaboration on referrals for diagnostic work-up and treatment exists between Greenlandic healthcare and Rigshospitalet, a tertiary national university hospital in Denmark for children and adults [5, 6].

In Greenland, paediatric disease patterns, including specialised care, are sparsely investigated, but a review

found that Greenlandic children have a disease profile similar to other Western societies [7]. A study from 2016 reviewed medical records of a subgroup of children (n = 311) aged 6-10 years residing in Nuuk or Ilulissat, identified respiratory (pneumonia, acute bronchiolitis), eye (conjunctivitis), ear (otitis media) and dermatologic (rash) diseases as the most common causes of inpatient and outpatient contacts [8]. Additionally, the study described an annual 10% incidence of hospital admission and a mean hospitalisation duration of 4.6 days. Compared with children in Denmark, Greenlandic children had fewer primary care contacts, but more frequent and longer hospitalisations, although this may reflect organisational factors such as transport logistics [8].

The national hospital in Greenland is Queen Ingrid's Hospital in Nuuk, which comprises a paediatric department with capabilities to perform imaging (ultrasound scanning, CT and MRI) and the majority of blood and microbiology analyses [9]. The collaboration between Greenlandic healthcare and Rigshospitalet includes courier services covering selected advanced blood tests and microbiological along with pathological analyses to Denmark for analysis and interpretation, telemedicine conferences between local physicians and experts at Rigshospitalet, regular specialist visits to Greenland and, ultimately, air transport of patients from Greenland to Rigshospitalet.

Our primary aim was to establish a knowledge base on paediatric patient referrals by investigating referral patterns from Greenland to Rigshospitalet within a quality assurance project. The ultimate goal is to optimise future care for Greenlandic children. To the best of our knowledge, the collaboration between Greenlandic and Danish healthcare for Greenlandic children has not previously been investigated.

## METHODS

### Study design and population

We used unique personal identification numbers of Greenlandic residents to access information on patient referrals to Rigshospitalet, Denmark. From 1 January 2017 to 31 December 2021, all diagnostic (International Classification of Diseases (ICD)-10) and procedure codes of Greenlandic children and adolescents aged 0-17 years were obtained from the administrative system at Rigshospitalet. This period was chosen to obtain updated data but was limited due to data management changes. We grouped diagnostic codes into medical specialities and found the three most common diagnoses across each subspecialty. Procedure codes were classified into treatment-related and examination-related codes and, thereafter, sub-areas. In a sub-analysis, we estimated the proportion of diagnoses for unique patients that were congenital or genetic rather than acquired.

Patients were categorised by unique patients and number of disease courses, which we defined as one or more contacts/visits for a patient within a 30-day period, reflecting a Greenlandic patient coming to Denmark for diagnostic work-up and/or treatment as patients can have one or multiple contacts/visits during a disease course. Patient referrals across hospital departments within Rigshospitalet were considered separate contacts/visits, except for diagnostic centre services. Patients with contacts/visits more than 30 days apart, either because of outpatient visits or hospitalisation, were categorised as having two disease courses, as these patients may have returned to Greenland in the interval. Disease courses per patient may therefore be utilised as an estimate for the number of travels per patient. This estimate, however, carries a margin of error as a small percentage of patients may travel to Rigshospitalet twice within 30 days. We investigated the duration of hospitalisation in the 2019-2021 period as data were not obtainable for the full period due to data management changes in 2019.

### Statistical analysis and approval

Continuous variables are presented as means with standard deviation. Categorical variables are presented as frequencies and percentages. Paediatric patients were stratified into five age groups (0-1, 2-4, 5-9, 10-14 and 15-17

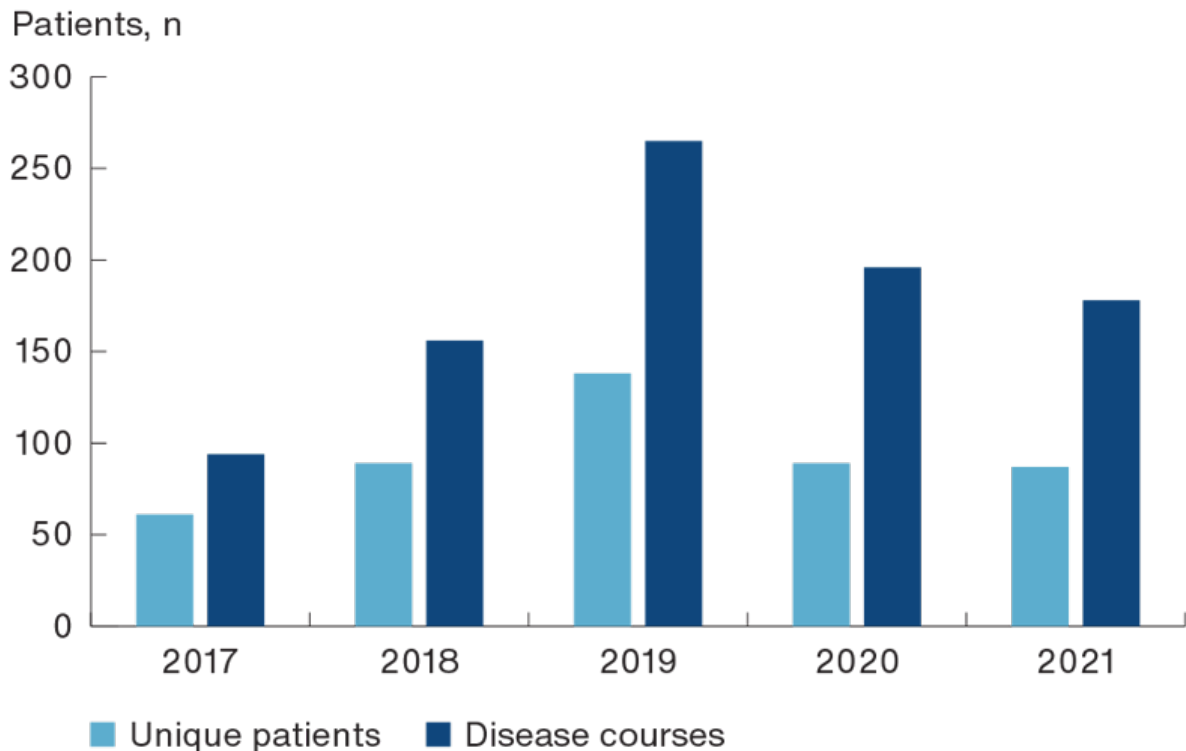
years) and by paediatric subspeciality. The Board of Directors at Rigshospitalet approved this study as a quality assurance project.

*Trial registration:* not relevant.

## RESULTS

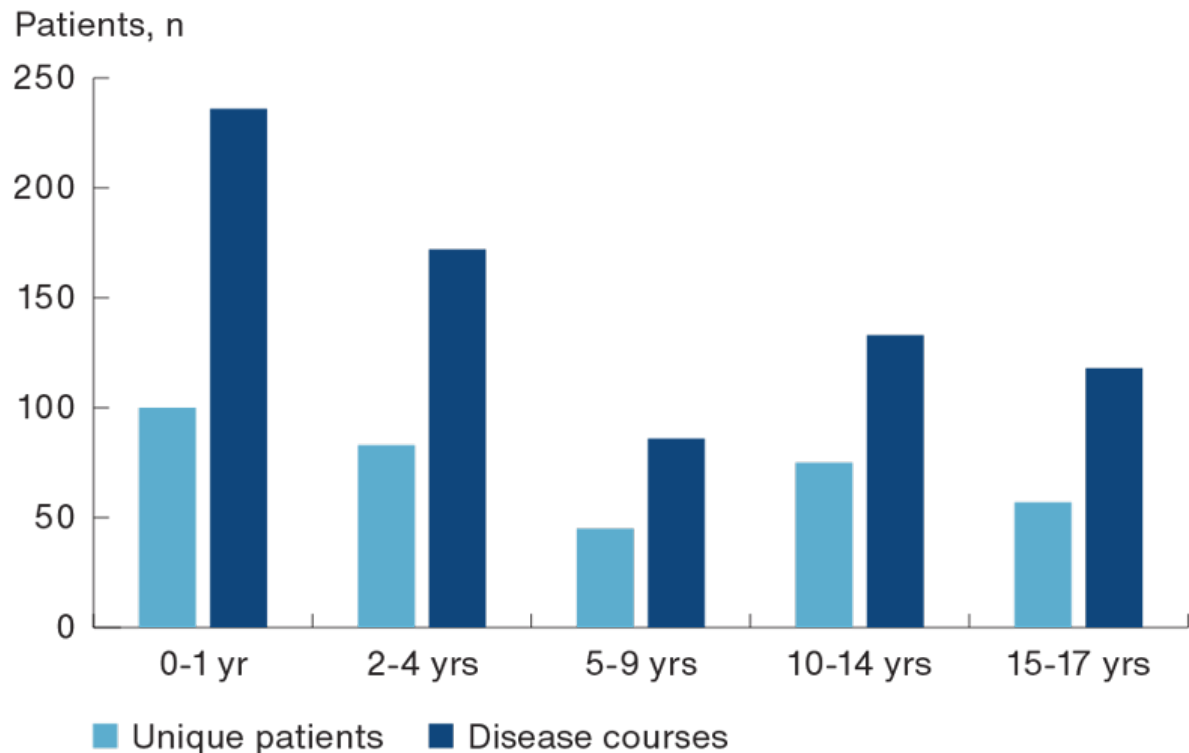
In the 2017-2021 period, a total of 310 unique paediatric patients were referred to Rigshospitalet, resulting in a total of 676 disease courses and 2,042 visits or contacts. The mean annual number of referred patients was 62, representing approximately 0.5% of the 13,100 Greenlandic citizens  $\leq$  18 years of age. We observed an overall 89% increase in disease courses (from 94 in 2017 to 178 in 2021) despite a slight decrease from 2019 to 2021 (Figure 1). Among the referred children, girls represented 43% (Supplementary Figure 1) and the mean age was 7.0 years, with half of the patients being less than five years old. Age groups were distributed as follows: 100 (28%) patients were 0-1 years old, 83 (23%) 2-4 years, 45 (13%) 5-9 years, 75 (21%) 10-14 years and 57 (16%) 15-17 years (Figure 2). Half of the paediatric patients (48%) had only one disease course at Rigshospitalet, 23% had two, 13% had three, 9% had four, and the remaining 7% had five or more disease courses. See Supplementary Figure 2 for seasonal variation of disease courses.

**FIGURE 1** Annual number of disease courses comprising paediatric patients referred from Greenland to Rigshospitalet<sup>a</sup>.



a) Referrals are measured as number of disease courses and include hospitalisations and outpatient visits.

**FIGURE 2** Age distribution of referred patients<sup>a</sup>.



a) The total number of unique patients is 310, but summing across the age groups yields a higher number as each patient may have had several visits in the five-year period and hence be included in more than one age group.

Paediatric patients were increasingly managed as outpatients, with an outpatient/hospitalisation ratio of 1.4 in 2017 and 3.6 in 2021 ([Supplementary Figure 3](#)). The number of hospital admissions declined by 28%, and the number of outpatient visits increased by 86%. In 2019, the mean length of hospitalisation was 4.6 days, increasing to 5.9 days in 2020 and 6.4 days in 2021, yielding an overall mean duration of 5.4 days (median 2.0 days) in the 2019-2021 period.

#### Distribution by subspecialties

The majority of patients' diagnoses were within the area of ophthalmology (17%), followed by oto-rhino-laryngology (16%), cardiovascular disease (10%), neurology (9%) and orthopaedics (9%) ([Table 1](#)). Congenital or genetic diseases represented 26% of referrals. Among the congenital or genetic diseases, 25% were within oto-rhino-laryngology, 20% within cardiovascular diseases, around 10% each within neurology, orthopaedics and urology, and 7% within ophthalmology ([Supplementary Figure 4](#)). Cardiology causes had the highest proportion of congenital or genetic diagnoses at 69%.

**TABLE 1** Overview of diseases by speciality.

Speciality <sup>a</sup>	Unique patients, n (%)	3 most common diagnoses, in order of frequency <sup>b</sup>
Ophthalmology	79 (17)	Congenital cataract Hypermetropia Convergent concomitant strabismus
Oto-rhino-laryngology	78 (16)	Perceptive hearing loss Unilateral cleft lip and palate Soft and hard palate cleft
Cardiology	48 (10)	Ventricular septum defect Atrial septum defect Steno-Fallot tetralogy
Neurology	46 (9)	Epilepsy Spina bifida Seizure
Orthopaedics	43 (9)	Talipes equinovarus Idiopathic scoliosis Juvenil deformed hip osteochondrosis
Gastroenterology	43 (9)	Inguinal hernia Gastroschisis Obstipation
Urology	42 (9)	Cystitis Neuromuscular bladder dysfunction Cryptorchidism
Oncology	19 (4)	Acute lymphoblastic leukaemia Benign connective tissue tumour Benign bone tumour
Pulmonology	17 (4)	Acute respiratory insufficiency Cystic fibrosis Asthma

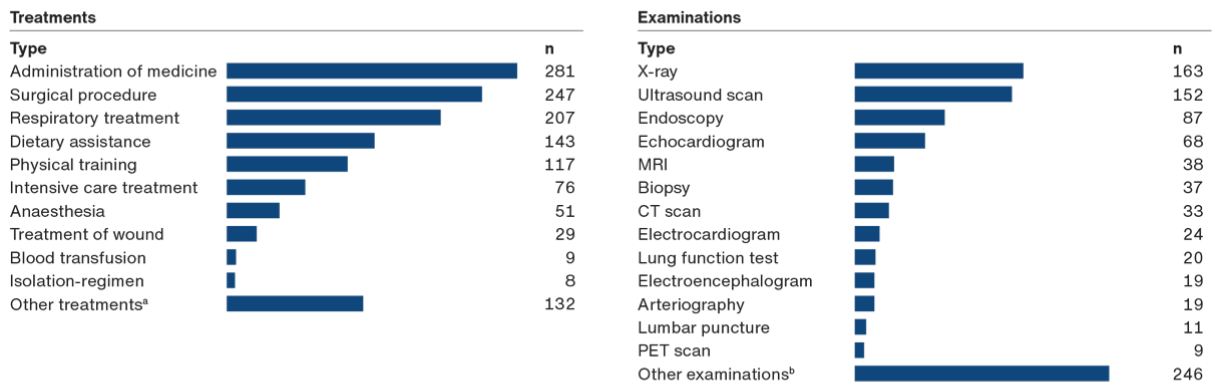
a) The remaining speciality areas (13%) comprised diseases within dermatology, infectious diseases, endocrinology, nephrology, hepatology, rheumatology, haematology, gynaecology and immunology.

b) Diagnostic names are provided according to registry data.

## Treatments and examinations

Paediatric patients from Greenland received a wide variety of treatments and examinations. The most common treatment-related procedures were various advanced administrations of medicine, followed by various surgical procedures and respiratory treatments. The surgical procedures (n = 247) were within areas: cardiovascular (n = 51), ear-nose-throat (n = 48), gastroenterological (n = 42), orthopaedic (n = 27), ophthalmologic (n = 23), urologic (n = 18) and other surgical procedures (n = 38). The most frequent examination-related codes were X-rays (n = 163), ultrasound scans (n = 152) and various endoscopy examinations (Figure 3).

**FIGURE 3** Overview of treatments and examinations at Rigshospitalet, by procedure codes in 2017-2021.



a) Includes: cast treatment, hearing aid, bandaging, phototherapy, prosthetic treatment, removal of foreign body, fluid therapy, cardiac resuscitation.

b) Includes: electrocochleography, adrenocorticotrophic hormone stimulation test, Schirmer's test, genetic test, DEXA scan, visual field examination, intracranial pressure measurement, optical coherence tomography.

## DISCUSSION

An average of 62 paediatric Greenlandic patients were referred annually to Rigshospitalet for specialised diagnostics and care, representing 0.5% of all Greenlandic children. A previous study showed that one in ten Greenlandic children aged 6-10 years are hospitalised, corresponding to approximately 1,300 annual admissions (Kløvgaard et al. [8]). In comparison, around 6% of children in Denmark are hospitalised annually [10]. Hence, the vast majority of estimated paediatric hospitalisations are managed in Greenland, supported by specialist visits and telemedicine. Thus, around 5% (62 of 1,300) of paediatric hospitalisations are referred to Rigshospitalet. Our data revealed a subtle seasonal fluctuation in referrals with reduced activity from December to April ([Supplementary Figure 2](#)), potentially influenced by logistical challenges, variation in resources and seasonal disease patterns. However, our data are not sufficient to draw conclusive interpretations regarding seasonal fluctuations.

A notable increase in referrals from Greenland to Rigshospitalet was observed in the 2017-2021 study period. Considering the limited number of absolute referrals, year-on-year fluctuations may have a considerable impact. A study on adult referrals from Greenland to Rigshospitalet, over the same period, found that the number of referrals increased by 52% for adults as compared to 89% for the paediatric patients of our study [11]. The increase in referrals may be rooted in an overall strengthened focus on specialisation, which may challenge Greenlandic healthcare [2-4]. Hence, subspecialties and advanced diagnostic capabilities at Rigshospitalet may be requested more than was previously the case. Furthermore, a strong collaboration between Greenlandic healthcare and Rigshospitalet may influence ease of referrals. The observed increase in referrals appears more pronounced for paediatric patients than adults. We interpret that this discrepancy is due to limited patient numbers rather than genuine differences, but potential factors may include areas such as specialized care for congenital or genetic diseases, exemplified by the recent first case of cystic fibrosis in Greenland found by neonatal screening, requiring specialised care and therefore, possibly, referral [12]. Understanding the intricate dynamics driving this trend requires further exploration.

In line with the general shift from inpatient to outpatient management, we found a decreasing number of hospitalisations, although a simultaneous, slight increase in hospitalisation duration was recorded [13, 14]. We hypothesise that the increase in average hospitalisation duration may be explained by a shift from inpatient to outpatient management, leading to more severe morbidity being managed at the hospital. As the estimated

population size needed to support high-level expertise across all medical specialities is 4-5 times larger than the current Greenlandic population, we do not anticipate decreasing referral rates in the coming years [4].

According to the study by Kløvgaard et al. [8], the most frequent causes of paediatric hospitalisations in Greenland were pneumonia, acute bronchiolitis and febrile convulsions, which are managed locally and rarely result in referrals to Rigshospitalet, according to our data. A considerable number of referrals were related to elective surgery (e.g. cleft palate) or more acute diseases requiring specialised care (e.g. ventricular septum defect). Kløvgaard et al. [8] estimated that 40% of hospitalisations in Denmark were due to congenital or genetic disorders. In our study, 26% of diagnostic codes were related to congenital or genetic causes, which is slightly lower, but categorization can be challenging. A recent study among children and young adults found that the risk of congenital heart disease was higher among individuals of Inuit/mixed ethnicity [15]. Our findings also suggest that cardiovascular aetiologies were common among congenital or genetic referrals, but further exploration into the comparison of absolute incidence rates of congenital heart diseases was not within our scope. Another common disease referral cause was cleft diseases, although the overall incidence rates of cleft lip and palate are lower in Greenland than in Denmark [16]. The lower referral rate in the 5-9-year age group remains unknown as it is not explained by annual Greenlandic birth rates [1, 17].

A recent study investigating disease patterns of adult Greenlanders being referred to Rigshospitalet found that 900 unique adult patients are referred annually, representing 1.2% of the population, as compared with 62 paediatric referrals, representing 0.5% of the paediatric age group [11]. Hence, a larger proportion of adults than children is referred. However, this was not standardised for hospitalisation patterns across age groups. Adult Greenlandic patients were mainly referred to Rigshospitalet due to eye diseases, cardiac diseases and oncological conditions [11]. This aligns well with the case mix seen in paediatric patients except for the lower paediatric proportion of oncological conditions and more oto-rhino-laryngology among paediatric referrals.

Our findings can be used as a data foundation to improve the management of paediatric patients in Greenland who need assistance from Rigshospitalet and to focus on specialities with high referral rates to reinforce collaboration in these critical domains. In the future, more contacts may potentially be converted to telemedicine and video-based consultations to minimise the number of physical referrals. The notable increase in outpatient care at Rigshospitalet highlights the important role of the Greenlandic Patient Home.

Our findings should be interpreted with the following limitations. First, the study period overlapped with the COVID-19 pandemic, which may partially explain the decline in the number of referrals in 2020-2021. Second, while most overseas Greenlandic patient referrals are to Rigshospitalet, some acute patients from East Greenland are referred to Iceland, and a limited number of conditions, such as diabetes and dermatology, are referred to other hospitals in Denmark. Finally, providing a clear stratification of patients by congenital or genetic causes proved challenging for some conditions, including cancer and hearing loss.

## CONCLUSIONS

An average annual of 62 paediatric Greenlandic patients, representing around 0.5% of Greenlandic children, are referred to Rigshospitalet in Denmark. A marked increase in referrals was observed from 2017 to 2021. Single referrals for diagnostics and surgery accounted for around 50%, and paediatric patients were increasingly managed as outpatients. Expert care within ophthalmology, oto-rhino-laryngology and cardiovascular diseases were the main reasons for referrals.

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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](https://ugeskriftet.dk/dmj)

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<https://content.ugeskriftet.dk/sites/default/files/2024-06/a07230466-supplementary.pdf>

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