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Polypharmacy and potential drug–drug interactions among Greenland’s care home residents

Nadja Albertsen¹, Tine Gjedde Sommer, Thomas Mikkel Olsen, Anna Prischl, Hans Kallerup and Stig Andersen

Abstract

Background: As lifetime expectancy in Greenland is steadily increasing, so is the proportion of elderly Greenlanders. Old age is associated with polypharmacy, and in this study, we aim to describe the prevalence and characteristics of polypharmacy among the care home residents in Greenland.

Methods: Eight care homes in Greenland were visited between 2010 and 2016. Questionnaires including information on prescribed medication and comorbidities were collected and analyzed. Drugs were categorized according to Anatomical Therapeutic Chemical (ATC) category, and potential drug–drug interactions (pDDIs) were assessed using the Danish Interaction Database. Polypharmacy was defined as five or more prescribed drugs.

Results: All 244 eligible residents were included in the study. The median number of prescribed drugs per resident was six, and women were prescribed more drugs than men (median six *versus* five). More than 60% of all residents fulfilled the criteria for polypharmacy. The residents in the polypharmacy group had a higher body mass index (26.9 *versus* 24.3) and more chronic diseases (median two *versus* one), and more often pulmonary (14% *versus* 1%) or endocrine disease (22% *versus* 2%) than in the non-polypharmacy group. The most prescribed drugs belonged to ATC category N (nervous system, 78% of the residents). Finally, pDDIs were found among 61% of the residents and were more common in the capital (77%), which also had the highest proportion of residents with polypharmacy (77%).

Conclusion: This is the first study to describe the patterns of polypharmacy and pDDIs among the elderly in care homes in Greenland. Our findings indicate that polypharmacy is as common in Greenland as elsewhere in the Western world, but there are local differences in the prevalence.

Plain Language Summary

Polypharmacy among the elderly in care homes in Greenland

The lifetime expectancy of the Greenlandic population is increasing, and so is the number of elderly Greenlanders. Previous studies have shown that the elderly have a higher risk of being treated with five drugs or more which is called polypharmacy. Polypharmacy can cause unwanted interactions and side effects. In this study, we examine the characteristics of the residents in Greenlandic care homes belonging to this group.

Using questionnaires, we gathered information from 244 residents from care homes in eight different towns and settlements in Greenland. Data included types of medication prescribed to the resident, age, gender, cause of stay, and medical history, which allowed us to compare the results between genders and towns.

We found that among 244 residents, more than half of all residents were prescribed five or more different drugs, and women were generally prescribed more drugs than men. Those prescribed five or more drugs had a higher body mass index and more diseases than those

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prescribed fewer drugs. We also found that certain types of medication, mainly painkillers, were the most prescribed. Finally, residents in the care home in Greenland's capital Nuuk were more often prescribed five or more drugs than elsewhere in Greenland, indicating local differences in Greenland.

Our results give an essential insight into the health and medication of the most fragile elderly in Greenland. Polypharmacy seems to be as common here as elsewhere in the Western world and is a point of focus.

Keywords: aging, Arctic, care homes, drugs, drug–drug interactions, elderly, Greenland, medication, polypharmacy

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Background

As life expectancy is increasing worldwide,¹ so is the number of long-term care recipients in most high-income countries.² In fact, higher age is a strong predictor for admission to long-term care facilities.³ Old age is associated with a higher risk of multimorbidity and polypharmacy,⁴ as multiple conditions often require complex medical treatments.^{5,6} Treatment with multiple drugs may, however, not always be beneficial, as polypharmacy among the elderly is associated with higher mortality,⁷ morbidity, and adverse events such as falls,⁸ hospitalizations, adverse drug reactions,^{9,10} and drug–drug interactions (DDIs).^{4,11}

The prevalence of polypharmacy defined as five or more drugs varies between Western countries. In the SHELTER study, spanning the Czech Republic, England, Finland, France, Germany, Italy, and the Netherlands, 50% of care homes residents were prescribed 5 to 9 drugs and 24% were prescribed 10 or more drugs.¹² In Spain, 77% of 326 care home residents were prescribed five drugs or more¹³ and in Sweden, 65% of nursing home residents in Gothenburg was prescribed 10 or more drugs.¹⁴ Finally, 32% of care homes residents from 147 homes in the United Kingdom were prescribed 10 or more drugs in 2017.¹⁵

In Greenland, life expectancy has increased with almost 10 to 67.5 years for men and almost 6 to 73.0 years for women during the past 42 years¹⁶ and the proportion of residents in Greenland aged 70 years or older is expected to have increased by 77% by 2050.^{17,18} Currently, approximately one in seven of the population aged 55 years or older live in an institution,¹⁹ and there are waiting lists for both care homes and houses

or apartments offering assisted living in Greenland.¹⁹

The elderly part of the population has increasingly become a point of focus in Greenland²⁰ and the authors of this article recently described the characteristics of the residents in care homes in Greenland.²¹ Here we aim to detail the prevalence and characteristics of polypharmacy and potential drug–drug interactions (pDDIs) among the residents in care homes in Greenland.

Methods

Study population

Greenland is the world's largest island and home to a population of 56,000, of which 53% are men. Almost one-third of the total population lives in the capital Nuuk, whereas the rest live in towns and settlements along the western, eastern, and southern coast of Greenland.²²

Health care is public and free for all with a permanent address in Greenland, including vaccinations and prescription medicine. The hospital in Nuuk offers specialized forms of diagnostics and care, while more advanced diagnostics or care are possible by transfer outside of Greenland. Outside the capital, all larger towns have health care centers offering some in-hospital treatment and minor surgery, and smaller towns and settlements have a health care station operated by a nurse or a health care worker.

Care homes are found in most towns and settlements in Greenland. The towns of Nuuk, Sisimiut, Ilulissat, Qaqortoq, Upernavik, Tasiilaq,

Narsaq, and Nanortalik were included in this study based on accessibility for the researchers and to represent towns of different sizes and locations.

The inclusion criterion for participation was residency in the care home at the time of visit, and there were no exclusion criteria.

Study design and questionnaires

The study was designed and conducted as described elsewhere.²¹ The inclusion criterion was residency in one of the visited care homes at the time of study and there were no exclusion criteria. Questionnaires were filled out on-site by a member of the homes' regular care staff after instruction from the visiting researchers. The residents did not participate in the filling out of questionnaires, except in one home where the resident and researcher completed the questionnaire with the care staff assisting. Questionnaires were written and filled out in Danish, and no medical records from hospitals or clinics were accessed. In accordance with the approval from the Ethics Committee for Medical Research in Greenland, informed consent from the residents was waived when they were not directly involved in the filling out of the questionnaire. When they were directly involved, verbal informed consent in Greenlandic was obtained.

Questionnaires included names of currently prescribed drugs, diagnoses, age, gender, date of birth, date and cause of admission to the care home, smoking-status, use of alcohol, height, weight, and functional level measured with the Barthel Index (BI) based on activities of daily living (ADL). The part of the questionnaire including demographical data was developed by the authors and has not been validated. The BI used in the questionnaire is a Danish version made in 2006,²³ which was obtained from the Department of Geriatrics at Aalborg University Hospital in 2001 where it is used in the everyday clinical routine. BI is a validated method to assess ADL.^{24,25} The full questionnaire can be found in Appendix 1.

The questionnaires did not provide information on cause or date of prescription, dose, or regularity of prescribed drugs. Therefore, the total number of stated medications are counted in this study.

Polypharmacy was defined as 5 or more drugs taken concurrently and excessive polypharmacy as 10 or more drugs taken concurrently. These definitions are in keeping with the literature^{10,26} and residents were grouped in a non-polypharmacy or polypharmacy group accordingly. The non-polypharmacy group includes residents prescribed zero drugs as this definition has been used in other literature concerning polypharmacy in care homes.^{12,13}

Drugs were sorted by first-level Anatomical Therapeutic Chemical (ATC) category and medication class. To determine pDDIs, all residents' lists of prescribed drugs were assessed using the Danish Interaction Database (DID),²⁷ which identifies and classifies pDDIs as minor (green), moderate (orange), or major (red). According to the DID, minor interactions are without clinical consequence, drug combinations with moderate interactions should be applied only with certain precautions, and drug combinations with major interactions should be avoided due to high risk of clinical consequences or lack of documented effect.²⁷

For analysis, age at admission was calculated as the difference between date of birth and date of admission and body mass index (BMI) was calculated using weight in kilograms divided by height in meters squared. Diagnoses and cause of admission were grouped based on affected organ system (e.g. 'cardiovascular' or 'urogenital') or by theme (e.g. 'social' or 'unknown') if the stated diagnosis was unspecific or unclear. The International Statistical Classification of Diseases and Related Health Problems (ICD) codes²⁸ were not stated in the participants' records and therefore not used.

The number of residents in a single care home ranged between 14 and 64, and to ensure anonymity of the residents when comparing locations, results were grouped by the size of the town of the care home. Consequently, towns were grouped as the 'capital' (Nuuk), 'major' towns with more than 3000 residents (Sisimiut, Qaqortoq, Ilulissat), or 'minor' towns (Upernavik, Tasiilaq, Narsaq, Nanortalik).

Statistics

Data were entered in EpiData v4.6.0.2 (EpiData Association, Odense, Denmark) and analyzed in

Table 1. ATC categories and fraction of residents prescribed at least one drug belonging to that category.

ATC category		N (% of all residents)
A:	Alimentary tract and metabolism	158 (64.8)
B:	Blood and blood-forming organs	100 (41.0)
C:	Cardiovascular system	160 (65.6)
D:	Dermatologicals	9 (3.7)
G:	Genito-urinary system and sex hormones	9 (3.7)
H:	Systemic hormonal preparations, excluding sex hormones and insulin	6 (2.5)
J:	Anti-infectives for systemic use	10 (4.1)
L:	Anti-neoplastic and immunomodulating agents	5 (2.1)
M:	Musculoskeletal system	50 (20.5)
N:	Nervous system	190 (77.9)
P:	Anti-parasitic products, insecticides, and repellents	16 (6.6)
R:	Respiratory system	36 (14.8)
S:	Sensory organs	7 (2.9)
V:	Various	4 (1.6)
ATC: Anatomical Therapeutic Chemical.		

STATA/MP16 (StataCorp LLC, College Station, TX, USA).

Prevalence rates were calculated as percentages of the total study population. Variables were tested for normality using QQ-plots. The variables were found to be nonparametric and are described using medians and interquartile ranges (IQR).

Wilcoxon rank sum (noncategorical data) and Pearson's chi-square test (categorical data) were used to test for statistical difference between two groups. A *p* value of less than 0.05 was considered statistically significant.

Results

A total of 244 residents were included in the study (100% of eligible residents). Women accounted for 62% of the study population. The median age was 77 years, and 9% of the population were 85 years or older.

The median number of prescribed drugs was six. Women were prescribed a higher number of drugs than men (a median of six *versus* five drugs, $p < 0.01$). A total of 12 residents (5%) were not prescribed any drugs, whereas 154 residents (63%) were prescribed five or more drugs. Among these, 33 residents were prescribed at least 10 drugs, corresponding to 21% of the polypharmacy and 14% of the total study population.

The most prescribed drugs were those belonging to ATC category *N* (nervous system, 78% of all residents), followed by ATC category *C* (cardiovascular system, 66%), and ATC category *A* (alimentary tract and metabolism, 65%) (Table 1).

Categorizing the study population as being either in the non-polypharmacy or the polypharmacy group, we found that the latter included 154 residents (63% of all residents) and markedly more females than the non-polypharmacy group ($p = 0.03$) (Table 2). We found no differences in

Table 2. Characteristics of residents in the nonpharmacy and the polypharmacy groups shown as fractions (%) or as median and IQR.

	Non-polypharmacy	Polypharmacy	Total
Age at time of study	76 (69–82)	77 (70–83)	77 (70–82)
Age at admission	72 (65–79)	75 (67–79)	74 (66–79)
Male (%)	42 (46)	50 (54)	92 (38)
Female (%)	48 (32)	104 (68)*	152 (62)
Number of drugs	3 (1–4)	7 (6–9)	6 (3–8)
BI	13 (7–17)	13 (5–17)	13 (6–17)
BMI	24.3 (20.6–28.3)	26.9 (21.9–32.8)*	25.6 (21.3–31.0)
Capital (%)	15 (23)	49 (77)* ^a	64 (26)
Major town (%)	44 (43)	58 (57)	102 (42)
Minor town (%)	31 (40)	47 (60)	78 (32)
Number of chronic diseases	1 (1–1)	2 (1–2)**	2 (1–2)
Smoking-status (%) N = 237			
<i>Nonsmoker</i>	17 (20)	58 (38)**	75 (32)
<i>Previous smoker</i>	13 (15)	43 (29)*	56 (24)
<i>Smoker</i>	56 (65)	50 (33)**	106 (45)
Alcohol intake, drinks/week (%) N = 234			
<i>None</i>	36 (42)	72 (48)	108 (46)
<i>0–7</i>	39 (46)	66 (44)	105 (45)
<i>More than 7</i>	10 (12)	11 (7)	21 (9)
BMI, body mass index. ^a The proportion of residents with polypharmacy in the capital compared with major and minor towns. * $p < 0.05$; ** $p < 0.01$.			

age at admission or time of study, BI score, or length of stay between the two polypharmacy groups. However, we found a higher proportion of residents with polypharmacy in the capital than in the major ($p = 0.01$) and minor ($p = 0.04$) towns (Table 2). We also found that residents with polypharmacy had a higher BMI ($p = 0.03$) and more chronic diseases ($p = 0.006$) than those without (Table 2).

The polypharmacy group included more residents with pulmonary disease ($p = 0.001$) and

endocrine disorders ($p < 0.001$) than the non-polypharmacy group (Table 3).

There were no differences between the two groups regarding causes of admission, but we found hypnotics, antihypertensives, laxatives, proton pump inhibitors (PPIs), and analgesics, including non-steroid anti-inflammatory drugs (NSAIDs), paracetamol, and morphine or morphine-like drugs (all $p < 0.001$) to be more common in the polypharmacy group than the non-polypharmacy group as detailed in Table 4.

Table 3. Causes of admission and comorbidities.

	Non-polypharmacy <i>n</i> (% of group, <i>N</i> =90)	Polypharmacy <i>n</i> (% of group, <i>N</i> =154)	Total <i>n</i> (% of all residents, <i>N</i> =244)
Cause of admission			
Dementia	28 (31)	34 (22)	62 (25)
Stroke	15 (17)	32 (21)	47 (19)
Social causes	10 (11)	17 (11)	27 (11)
Unknown/none stated	9 (10)	17 (11)	26 (11)
Musculoskeletal disease	8 (9)	15 (10)	23 (9)
Neurological disease	7 (8)	14 (9)	21 (9)
Mental illness	4 (4)	12 (8)	16 (7)
Old age	6 (7)	8 (5)	14 (6)
Comorbidities			
Stroke	22 (24)	53 (34)	75 (31)
Dementia	33 (37)	39 (25)	72 (30)
Musculoskeletal disease	20 (22)	43 (28)	63 (26)
Cardiovascular disease	21 (23)	32 (21)	53 (22)
Endocrine disorders	2 (2)	34 (22)**	36 (15)
- Diabetes	1 (1)	18 (12)**	19 (8)
- Osteoporosis	1 (1)	13 (8)*	14 (6)
Neurological disease	9 (10)	25 (16)	34 (14)
Mental illness	12 (13)	21 (14)	33 (14)
Eye disease	10 (11)	13 (8)	23 (9)
Pulmonary disease	1 (1)	21 (14)**	22 (9)
Unknown/none stated	10 (11)	10 (6)	20 (8)
Urogenital disease	6 (7)	13 (8)	19 (8)
Gastrointestinal disease	4 (4)	12 (8)	16 (7)
Cancer	2 (2)	12 (8)	14 (6)
Only groups comprising at least 5% of all residents are shown. * <i>p</i> < 0.05; ** <i>p</i> < 0.01.			

DDIs were found among 149 residents (61%), of which 127 (85%) were in the polypharmacy group. Among these, 126 residents had minor pDDIs, 98 had moderate pDDIs, and 2 had

major pDDIs. The median number of pDDIs for all residents was one (two in the polypharmacy group) and the highest number of pDDIs identified in a single prescription list was 11. The most

Table 4. Medication classes.

Medication	Non-polypharmacy <i>n</i> (% of group, <i>N</i> =90)	Polypharmacy <i>n</i> (% of group, <i>N</i> =154)	Total <i>n</i> (% of all residents, <i>N</i> =244)
Any analgesic	26 (29)	119 (77)**	145 (59)
- <i>Paracetamol</i>	24 (27)	106 (69)**	130 (53)
- <i>Morphine or morphine-like</i>	4 (4)	45 (29)**	49 (20)
- <i>NSAIDs</i>	2 (2)	18 (12)**	20 (8)
Antihypertensives	37 (41)	103 (67)**	140 (57)
- <i>Diuretics</i>	18 (20)	77 (50)**	95 (39)
Antidepressants	22 (24)	55 (36)	77 (32)
Laxatives	11 (12)	65 (42)**	76 (31)
PPI	13 (14)	61 (40)**	74 (30)
Antipsychotics	15 (17)	44 (29)	59 (24)
Hypnotics	5 (6)	39 (25)**	44 (18)
Anxiolytics	5 (6)	19 (12)	24 (10)

Only groups containing at least 5% of all residents are shown.
p* < 0.05; *p* < 0.01.

common pDDIs are shown in Table 5. The pDDIs were more common in the capital than in major ($p=0.002$) and minor towns ($p=0.02$) (Figure 1).

Discussion

This article describes prescribed drugs and pDDIs among the residents in care home in Greenland and details the residents with polypharmacy.

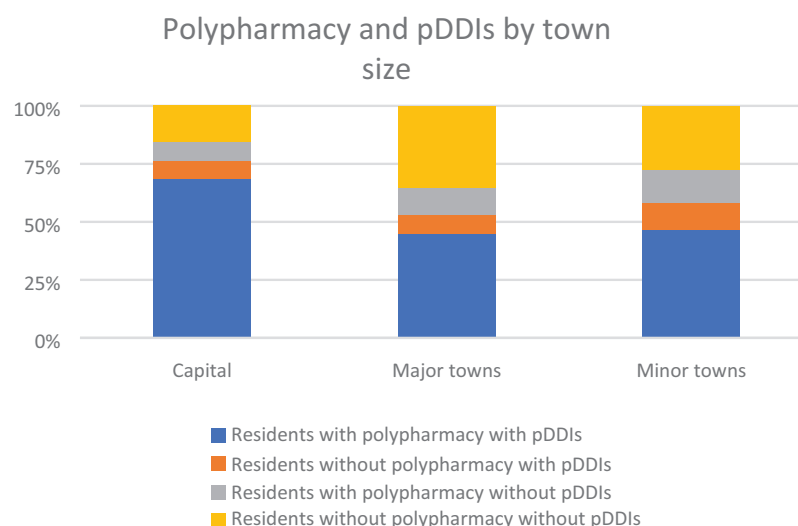
The number of prescribed drugs per care home resident were six in our study, which is in the lower range compared with other countries. A review from 2014 including 44 studies from long-term care facilities found the median number of drugs to range between 4 and 14,⁵ and a study from 2019 found a median of 10 prescribed drugs among residents in aged care facilities in Australia.²⁹ Similarly, the prevalence of both polypharmacy (63%) and excessive polypharmacy (14%) is within the middle and lower range, as an international cross-sectional study from Europe¹² and two reviews^{10,30} have found

the prevalence of polypharmacy to range from 26.3% to 91.2% and nine to 65% for excessive polypharmacy using the same definitions as us.

The reason for the relatively low number of prescribed drugs needs to be explored further. However, it may be speculated that it relates to Greenland mainly consisting of small communities with only a few doctors, as the number of prescribers has been found to have a positive association with the number of prescribed drugs among care home residents.^{14,31} In addition, recent hospital discharge^{6,13} has been found to correlate positively with the number of prescribed drugs, and as the only hospital in Greenland is located in Nuuk, care home residents outside of the capital are often treated locally by their regular physicians. It could also be speculated that residents outside of the capital may be underdiagnosed and therefore under-treated due to lack of access to advanced diagnostics, and the Charlson comorbidity index (CCI) score has been found to be positively correlated with the number of prescribed drugs.^{6,32} However,

Table 5. The most common pDDIs.

	Drugs involved (ATC code)	Prevalence among residents with pDDIs, n (%)	Possible consequence according to the DID ²⁷
Minor pDDI	1. Paracetamol (N02BE) and amlodipine (C08CA01)	1. 26 (17)	1. One review has shown reduced antihypertensive effect of amlodipine.
	2. Paracetamol (N02BE) and simvastatin (C10AA01)	2. 25 (17)	2. One reported case of hepatotoxicity.
	3. Paracetamol (N02BE) and iron with vitamin C (B03AA02)	3. 21 (14)	3. One study has shown reduced effect of paracetamol.
Moderate pDDI	1. Paracetamol (N02BE) and ibuprofen (M01AE01)	1. 18 (12)	1. One study found an increased odds of acute kidney damage among children.
	2. Enalapril (C09AA02) and bendroflumethiazide (C03AB01)	2. 17 (11)	2. Increased risk of 'Triple Whammy' and therefore kidney failure.
	3. Amlodipine (C08CA01) and simvastatin (C10AA01)	3. 12 (8)	3. Amlodipine inhibits the metabolism of simvastatin.
Major pDDI	1. Ibuprofen (M01AE01) and warfarin (B01AA03)	1. 1 (1)	1. Increased risk of gastrointestinal bleeding.
	2. Estrogen (G03CA03) and carbamazepine (N03AF01)	2. 1 (1)	2. Carbamazepine increases the clearance of estrogen.
ATC: Anatomical Therapeutic Chemical; pDDI: potential drug–drug interactions; DID: Danish Interaction Database.			

**Figure 1.** pDDIs in the non-polypharmacy and polypharmacy groups by town size.

the number of chronic diseases per resident in our study were similar to those found in the general Swedish population in 2010³³ and in the

SHELTER study including data from eight European countries,¹² and lower than among care home residents in the northern part of Denmark,

where 62% of the residents with polypharmacy have five to nine comorbidities.¹¹

Tests for associations were not applied in our study due to the limited sample size. We did, however, find that the residents in the polypharmacy group consisted mainly of women, had more chronic diseases, particularly pulmonary disease and endocrine diseases, and had a higher BMI. Chronic diseases and BMI are associated with polypharmacy in other populations,^{5,6,11,12,33,34} whereas the gender association is inconsistent.^{5,12} However, women, also in the highest age groups, are more commonly prescribed antihypertensives than men in Greenland,³⁵ as well as medication targeting chronic obstructive pulmonary disease (COPD).³⁶ It could be speculated that diagnoses are missed due to challenges in access to health care in some areas in Greenland, but a study from 2012 found that both men and women in Greenland are frequent users of the primary health care system, especially those older than 60 years.³⁷ Thus, the gender difference may relate to different patterns in disease burden causing differences in drug use.

We found a higher prevalence of pulmonary disease in the polypharmacy group (14% *versus* 1%). Polypharmacy has been found to be more common among patients with COPD than those without in other studies,^{38,39} and several diseases may impact the prevalence of pulmonary diseases in Greenland. For one, smoking, although not heavy smoking, is common in Greenland with more than half of the population being daily smokers^{40,41} and COPD seems to be underdiagnosed.³⁶ Furthermore, tuberculosis was common in Greenland in the first half of the 20th century and declined until the mid-90s when the country experienced a new rise in incidence.⁴² Tuberculosis has been shown to cause impaired lung function post-treatment in some patients,^{43,44} and this may be an underlying contributor to some of pulmonary morbidities found among the care home residents in Greenland.

It has previously been speculated that dementia may be underdiagnosed among care home residents in Greenland, as the prevalence of diagnosed dementia is lower among care home residents in Greenland than in comparable studies from Europe.²¹ We found that 25% of the residents with polypharmacy had been diagnosed with dementia *versus* 37% in the non-polypharmacy group. The difference was not statistically significant ($p=0.06$),

but other studies have found that dementia and cognitive impairment are inversely associated with polypharmacy in care facilities.^{10,12,45} However, one of these studies only found a lower prevalence of polypharmacy among residents with dementia after excluding anti-dementia medication.⁴⁵ Our study shows the same trend, although the reason for this is unclear – it could be due to residents having difficulties expressing symptoms⁴⁶ or prescribers being cautious due to the risk of side effects worsening cognitive symptoms.²⁹

Based on first-level ATC, the three most prescribed types of drugs are the same among residents with polypharmacy in Greenland as found elsewhere, namely, medication for the cardiovascular system (C), alimentary tract and metabolism (A), and the nervous system (N).^{11,46} This corresponds with cardiovascular diseases being among the most common comorbidities among the elderly in Greenland, as well as musculoskeletal diseases, which often requires pain medication included in ATC N.⁴⁷

Potential DDIs are difficult to compare across nations as the systems may differ in their assessment method and precision.^{48,49} We found a total of 226 pDDIs, most of them minor and most found in the polypharmacy group. Almost two-thirds of the entire study population had one or more pDDIs, and as adverse drug interactions have been found to increase the risk of hospitalization,⁵⁰ falls with hip fractures,⁵¹ toxicity and side effects,⁵² pDDIs are an important issue in all populations.

In our study, the findings from the capital differed slightly from those from the rest of Greenland. We found a higher percentage of residents with polypharmacy than elsewhere in Greenland, which may partly be explained by the residents in the capital having a higher number of chronic diseases when compared with major, but not minor towns. In addition, the residents in Nuuk are younger than in the rest of the country,²¹ and, although it may seem counterintuitive, age among care home residents has been found to be inversely associated with polypharmacy.¹⁰ The reason for this could be induced by deprescribing when life expectancy is limited. Furthermore, it may relate to the fact that Nuuk hosts the referral hospital for Greenland and younger patients with severe disabling disease are more likely to be transferred to Nuuk for specialized treatment and care.²²

Strengths and limitations

Strengths

The study was nationwide, included 100% of eligible participants in the visited towns, and included residents from care homes of different sizes and locations. The simple design of the study allowed us to implement it with a minimum of inconvenience and a high degree of uniformity and the questionnaires were filled out by staff who knew the residents well.

Limitations

The questionnaires were written and filled out in Danish. Danish was not the first language of all care staff members contributing to the study, but it is used in most public workplaces in Greenland. Also, the BI is not regularly used in care home settings in Greenland and some members of the care staff may not have had prior training in using the BI. However, systematic differences are not likely as similar instructions were given by the research staff in all care homes prior to filling out the questionnaires and the researchers were available for questions during the evaluations.

Furthermore, the gathered information on prescribed medication did not include indication or doses, nor if the drug was to be taken regularly, on different days or *pro re nata*. This excludes us from assessing both whether the residents were prescribed potentially inappropriate medications (PIMs) and actual consequences of pDDIs. We lacked information on medication prescribed at the time of admission, which would have allowed us to assess the incidence of polypharmacy and changes of prescriptions or prescription patterns during care homestays.

We chose not to perform adjusted analyses to identify risk factors for polypharmacy and pDDIs due to the limited sample size. This could be considered in future, larger studies.

Finally, the care homes were visited over a period of several years. Both prescribing and deprescribing habits and the characteristics of the residents may have changed since the first data collections and should be considered in future studies.

Conclusion

This study is the first to investigate the prevalence and characteristics of polypharmacy among residents in Greenlandic care homes covering two-thirds of the country. Findings are comparable with studies conducted in care facilities in Western parts of the world, suggesting that health care professionals in Greenland face similar challenging and complex tasks of prescribing and deprescribing medication to the elderly and chronically ill as in many Western countries.

Our findings need to be extended with in-depth data on whether the residents in Greenlandic care homes are provided the appropriate medical treatment for their illnesses, as polypharmacy, as well as non-polypharmacy, can be either appropriate or inappropriate. Further studies are warranted to clarify this, while our findings provide a point of focus among the elderly in Greenland.

Ethics approval and consent to participate

The study was conducted in accordance with the Helsinki Declaration. The study was approved by The Ethics Committee for Medical Research in Greenland (ID: 2009-8). In accordance with this approval, informed consent was waived when there was no direct contact to the residents. Informed consent in Greenlandic was obtained in one care home, in which direct contact to the residents was made.

Consent for publication

Not Applicable.

Author contributions

Nadja Albertsen: Formal analysis; Investigation; Writing – original draft.

Tine Gjedde Sommer: Investigation; Writing – review & editing.

Thomas Mikkelsen: Investigation; Writing – review & editing.

Anna Prischl: Investigation; Writing – review & editing.

Hans Kallerup: Investigation; Writing – review & editing.

Stig Andersen: Conceptualization; Formal analysis; Investigation; Methodology; Project administration; Resources; Supervision; Writing – review & editing.

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Conflict of interest statement

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Availability of data and materials

The data set used during the current study is available from the corresponding author on reasonable request.

Supplemental material

Supplemental material for this article is available online.

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