Annals of Epidemiology 98 (2024) 1–7

Contents lists available at ScienceDirect

Annals of Epidemiology

journal homepage: www.sciencedirect.com/journal/annals-of-epidemiology

Comparison of sociodemographic factors, healthcare utilisation by general practitioner visits, somatic hospital admissions, and medication use in Norway, Sweden, and Denmark

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ARTICLE INFO

Keywords:
Scandinavia
Pharmacoepidemiology
Data pooling
Healthcare utilisation
Medication use

ABSTRACT

Purpose: The healthcare systems in Scandinavia inform nationwide registers and the Scandinavian populations are increasingly combined in research. We aimed to compare Norway (NO), Sweden (SE), and Denmark (DK) regarding sociodemographic factors and healthcare.
Methods: In this cross-sectional study, we analyzed aggregated data from the nationwide Scandinavian registers. We calculated country-specific statistics on sociodemographic factors and healthcare use (general practitioner visits, admissions to somatic hospitals, and use of medicines).
Results: In 2018, population were 5295,619 (NO), 10,120,242 (SE), and 5781,190 (DK). The populations were comparable regarding sex, age, education, and income distribution. Overall, medication use was comparable, while there was more variation in hospital admissions and general practitioner visits. For example, per 1000 inhabitants, 703 (NO), 665 (SE), and 711 (DK) individuals redeemed a prescription, whereas there were 215 (NO), 134 (SE), and 228 (DK) somatic hospital admissions per 1000 inhabitants. General practitioner contacts per 1000 inhabitants were 7082 in DK and 5773 in NO (-data from SE).
Conclusion: The Scandinavian countries are comparable regarding aggregate-level sociodemographic factors and medication use. Variations are noted in healthcare utilisation as measured by visits to general practitioners and admissions to hospitals. This variation should be considered when comparing data from the Scandinavian countries.

Background

The Scandinavian countries – Norway, Sweden, and Denmark – are often referred to as comparable regarding sociodemographic factors, social welfare, and the structure of their healthcare systems. All countries hold comprehensive nationwide registers, which include detailed individual-level information on healthcare utilisation and medication use, social and living conditions, education, and income [1–5]. The healthcare systems and the individual registers have been described in detail [5]. In short, they are characterised as welfare states with healthcare as an important element with free and easy access to health care as an essential component [6]. In epidemiological research, the

Abbreviations: ATC, Anatomical Therapeutic Chemical; CV, Coefficients of Variation; DK, Denmark; GP, General practitioner; ICD-10, International Classification of Diseases; ISCED, International Standard Classification of Education; NO, Norway; PPS/Euro, Purchasing Power Standards in Euro.

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https://doi.org/10.1016/j.annepidem.2024.07.004
Received 14 December 2023; Received in revised form 27 June 2024; Accepted 8 July 2024
Available online 9 July 2024

Scandinavian populations are often pooled to increase study size and statistical power [5,7–11] or compared in cross-national studies on e.g. drug utilization or disease prevalence [12,13]. Although the countries have similarities in economy and welfare, they also display differences in culture and lifestyle [14]. However, there are currently no direct comparisons of sociodemographic factors, healthcare utilisation, and medication use between the Scandinavian countries. Such comparisons can support generalizability or conversely highlight areas where comparability of the Scandinavian populations cannot be assumed.

To strengthen the foundation of epidemiological research in health care in Scandinavia, we aimed to compare publicly available aggregated data from Norway, Sweden, and Denmark derived from the respective national registers on sociodemographic factors, healthcare utilisation, and medication use.

Material and methods

Setting

We performed a cross-sectional descriptive study of the three Scandinavian populations and their healthcare utilisation including medicine use in the year 2018. Denmark, Sweden, and Norway are all welfare states with tax-funded healthcare and educational systems with limited (15–20 %) or no additional payment from the citizen [5]. A welfare state is defined by a state that is committed to provide basic economic security for its citizen by protecting them from market risks associated with old age, unemployment, accidents, and sickness [15]. In the Scandinavian context, this has evolved into a nordic welfare model based on income taxation with comprehensive public-sector responsibility for basic welfare tasks including social security, social services, health and education [16]. In all three countries, the national healthcare services are divided into three administrative levels: state, region, and municipality. They also have similar administrative organisations with the state government framing the overall regulatory and supervisory functions in healthcare services [17–21]. Generally, the healthcare systems in each country are operationally subdivided into a primary and a secondary healthcare sector. The primary healthcare sector includes general practitioners (GPs) and various other specialists such as psychologists and physiotherapists, many are private practising specialists partly reimbursed by tax funding. The secondary healthcare sector comprises all hospitals, including emergency and psychiatric care [17,18,22]. In all three countries, secondary healthcare and specialist contacts (e.g. gynaecologists and neurologists) are primarily facilitated through referral by GPs only (except for emergency contacts and a few other specialities). However, it is possible to self-refer to some degree across countries and, most pronounced Swedes are offered more direct access to specialists although with variation between regions. Although administrative responsibilities are similarly structured across the three countries, with central governments setting frameworks and local entities managing service delivery, there are unique national approaches that effect the Scandinavian healthcare model within each country. For details regarding country-specific organisation of the healthcare system, see elsewhere [5,17,18,21,22]. The countries use the same classification system regarding healthcare use (diagnoses, surgical procedures) and medications, see below for details.

Data sources

The study was based on publicly available aggregated data derived from the national registers. We retrieved data on sociodemographic characteristics from the Nordic Statistics Database[23], a collection of comparative Nordic Statistics funded by the Nordic Council of Ministers to inform Nordic governments and parliaments. Information on migration was collected from the Nordic Health & Welfare Statistics under the Nordic Council of Ministers[24].

Healthcare utilisation data were obtained from the following online sources: Statistikkbanken hosted by Statistics Norway [4], Statistikdatabas [25] hosted by the Swedish National Board of Health and Welfare (Socialstyrelsen) [26], and StatBank Denmark [27] hosted by Statistics Denmark [2].

Information on medication use was retrieved from national official online sources in each country: the Norwegian Prescription Database [28], the Swedish Statistikdatabas för läkemedel [25], and the Danish Medstat.dk [29]. Each database holds aggregated data on medication dispensed at pharmacies to outpatients and number of users. Medications prescribed for nursing home residents are not included in the Norwegian Prescription Database, unlike in Sweden and Denmark [10]. The registration in each of these data sources is linked to reimbursement and is considered complete [30]. Due to the nature of the population-based registers in the countries entailing all individuals with residency, the data sourcesrepresent data on nationwide unselected populations [10]. All individuals are given a unique personal identification number at birth or upon first immigration, which enables linkage between registers [10].

Definitions

The definition of all variables chosen for characterizing each country is based on the definitions provided by the respective sources, unless stated otherwise.

Sociodemographic characteristics

We grouped age into 10-year intervals. We reported population density as the number of inhabitants divided by area in square kilometres (km^2). Urbanisation was defined as the percentage of the total population living in cities (densely populated areas), towns or suburbs (intermediate densely populated areas) as defined by Eurostat [31]. We reported net migration (the number of immigrants minus the number of emigrants) by 1000 inhabitants by country [32]. Educational level was divided into three categories according to the International Standard Classification of Education (ISCED) [33]: 1) primary and lower secondary education (ISCED levels 0–2), 2) upper and post-secondary non-tertiary education (ISCED levels 3 and 4), and 3) tertiary education (ISCED levels 5–8: short, medium and long-time higher education). We reported educational level as the proportion of the total number of inhabitants aged 20–69 years. Income was reported as mean and median equalised net income. Equalised net income was defined as a household's total income (including social transfers) after country specific tax and other deductions available for spending or saving. Household members were equalised or made equivalent by weighting each according to their age, using the so-called modified OECD equivalence scale. The currency was converted from national currency to euro in Purchasing Power Standards (PPS/Euro), eliminating the impact of differences in price levels among the Nordic countries [23].

Gini coefficients were estimated as a measure of inequality by income distribution across the population in each country. The coefficients range between 0 and 1 reflecting complete equality and complete inequality, respectively [34]. The unemployment rate was defined as the proportion of unemployed individuals of the total labour force aged 15–64 years [23].

Healthcare utilization

Utilisation of the primary healthcare sector was estimated using the annual number of GP contacts per 1000 inhabitants (only available for Norway and Denmark). Utilisation of the secondary healthcare sector was estimated by the overall annual number of somatic hospital admissions (inpatient contacts) per 1000 inhabitants. This was reported by somatic diagnosis groups according to the International Classification of Diseases (ICD-10, first level) [35]. The aggregated data do not provide information on admissions for psychiatric disorders in Norway and Denmark, thus the overall admissions for all three countries are reported for somatic hospital admissions only.

Medication use

We reported the annual number of individuals redeeming at least one prescription per 1000 inhabitants overall and by main Anatomical Therapeutic Chemical (ATC) group (ATC, 1 level) [36].

Analysis

We obtained aggregated data from Norway, Sweden, and Denmark in 2018, and results were presented by country. We showed sociodemographic characteristics in total numbers and per 100 inhabitants for all three countries. Healthcare utilisation and medication use were presented per 1000 inhabitants. For all analyses, means and Coefficients of Variation (CV) (standard deviations divided by the means) were computed to express the extent of variation between the countries relative to the mean, higher CV indicating higher variation. To be noted, the CV is a relative measure of variability, meaning that it is sensitive to both the level of absolute variability (its numerator) and the mean (average) against which absolute variability takes place (its denominator). Preference for absolute or relative variability measures depends on the setting and research question. Here, expressing variability in hospital admissions (which is in the order of 10 s per 1000) and drug prescriptions (in the order of 100 s per 1000) in a relative fashion (by the CV) is considered more instructive because hospital admissions and redeemed medication prescriptions are very different phenomena. As a post hoc analysis, we calculated the proportion of somatic hospital admissions by diagnosis groups (%). This was done because the total number of hospital admissions varied considerably between countries.

The data are publicly accessible in aggregated form in each country, and approval from any ethical committee or data protection agency is not required. Due to the nature of the data, informed consent was not required. We used the STROBE cross sectional reporting guidelines.[37].

Results

Sociodemographic characteristics

In 2018, Norway, Sweden, and Denmark had a total of 21,197,051 inhabitants, with 5295,619 inhabitants in Norway, 10,120,242 in Sweden, and 5781,190 in Denmark (Table 1). The female-to-male ratio was similar across Scandinavian countries (CV=0.007). The mean age was 40 in Norway and 41 in Sweden and Denmark (CV=0.018). The distribution of inhabitants by 10-year age intervals was similar in all countries (Figure 1).

Denmark was the most densely populated country, with 135 inhabitants/km^2, followed by Sweden with 23 inhabitants/km^2 and Norway with 16 inhabitants/km^2 (CV=1.150) (Table 1). Most inhabitants resided in urban areas ranging between 59 % in Norway to 65 % in Sweden (CV=0.055). All countries had a positive net migration, i.e. having more immigrants than emigrants. Sweden had the highest net migration in 2018, with 8.4/1 000 inhabitants, followed by Norway (3.4/1 000) and Denmark (3.2/1000) (CV=0.589).

The proportion of individuals with the highest attainable educational level was higher in Norway and Sweden, where 40 % of inhabitants had a tertiary education compared to 35 % in Denmark (CV=0.075) (Table 1). In Sweden, only 15 % had a primary or lower secondary education, followed by Norway (17 %) and Denmark (20 %) (CV=0.145).

Household income varied with Norway showing the highest equivalised net income with a median of 26,296 euros (PPS/Euro), followed by Denmark and Sweden with 21,641 and 20,429 euros (PPS/Euro), respectively. Inequality in income was low within each country and comparable across countries (Gini coefficients 0.25 (NO), O.27 (SE) and 0.28 (DK)) (Table 1).

The unemployment rate among 15 to 64-year-olds was lowest in Norway (3.9 %), followed by Denmark (5.3 %) and Sweden (6.5 %) (CV=0.249) (Table 1).

Table 1
Sociodemographic characteristics across Scandinavia in 2018.

		Norway	Sweden	Denmark	CV
Total population size		5295,619	10,120,242	5781,190	0.376
Sex (%)*	Women	2627,248 (50)	5037,580 (50)	2904,717 (50)	0.007
	Men	2668,371 (50)	5082,662 (50)	2876,473 (50)	0.007
Mean age, years	Total	40	41	41	0.018
	Women	40	42	42	0.019
	Men	39	40	40	0.017
Population density, (inhab/sq.km)		16	23	135	1.150
Urbanization %*	Urban	59	65	61	0.055
Net migration, per 1000		3.4	8.4	3.2	0.589
Income (PPS/Euro)†	Annual mean	28,144	22,143	24,275	0.122
	Annual median	26,296	20,429	21,641	0.136
	Gini	0.25	0.27	0.28	0.057
Unemployment rate, %*		3.9	6.5	5.3	0.249
Educational level, %*	ISCED levels 0-2	17	15	20	0.145
	ISCED levels 3-4	42	45	43	0.035
	ISCED levels 5-8	40	40	35	0.075

CV: Coefficient of Variation
ISCED: International Standard Classification of Education
* Indicates CV calculated based on percentages
† Purchasing Power Standards in Euros [PPS/Euro]. Mean equivalised net income: The total income (including social transfers) of a household, after tax and other deductions that is available for spending or saving, divided by the number of household members converted into equalised adults.

Healthcare utilisation

GP contacts per 1000 inhabitants were 7082 in Denmark and 5773 in Norway (CV=0.144) (data unavailable for Sweden). Looking at the secondary healthcare sector, overall somatic hospital admissions ranged between 228/1000 in Denmark, 215/1000 in Norway, and 134/1000 in Sweden (CV=0.265) (Table 2). Sweden consistently had a lower number of somatic hospital admissions per 1000 inhabitants than Norway and Denmark across all diagnosis groups. Diseases of the circulatory system were the most common causes for hospital admission within all three countries (Norway: 24/1000, Sweden: 20/1000, Denmark: 23/1000) (CV 0.112). (Table 2). When looking at proportion of total somatic hospital admissions by diagnosis groups, differences between countries were attenuated. However, some variation remained e.g. the proportion of admissions related to the respiratory system, were 10 % in Denmark compared to 7–8 % in Norway and Sweden, and Sweden had a higher proportion of admissions related to pregnancy and childbirth (10 %) compared to 6 % in Norway and Denmark. Most pronounced variation in somatic diagnosis groups was found in categories that contained more unspecific disorders such as ICD10 codes R00-R99 covering "symptoms, signs and abnormal clinical findings and laboratory findings, not elsewhere classified". For details of hospital admissions by ICD-10 disease groups, see Table 2 and Figure 2. Sweden had the highest number of bed days, 737/ 1000 inhabitants, followed by Denmark (674/1000) and Norway (637/1000) (CV=0.074).

Medication use

The number of individuals redeeming at least one prescription of any

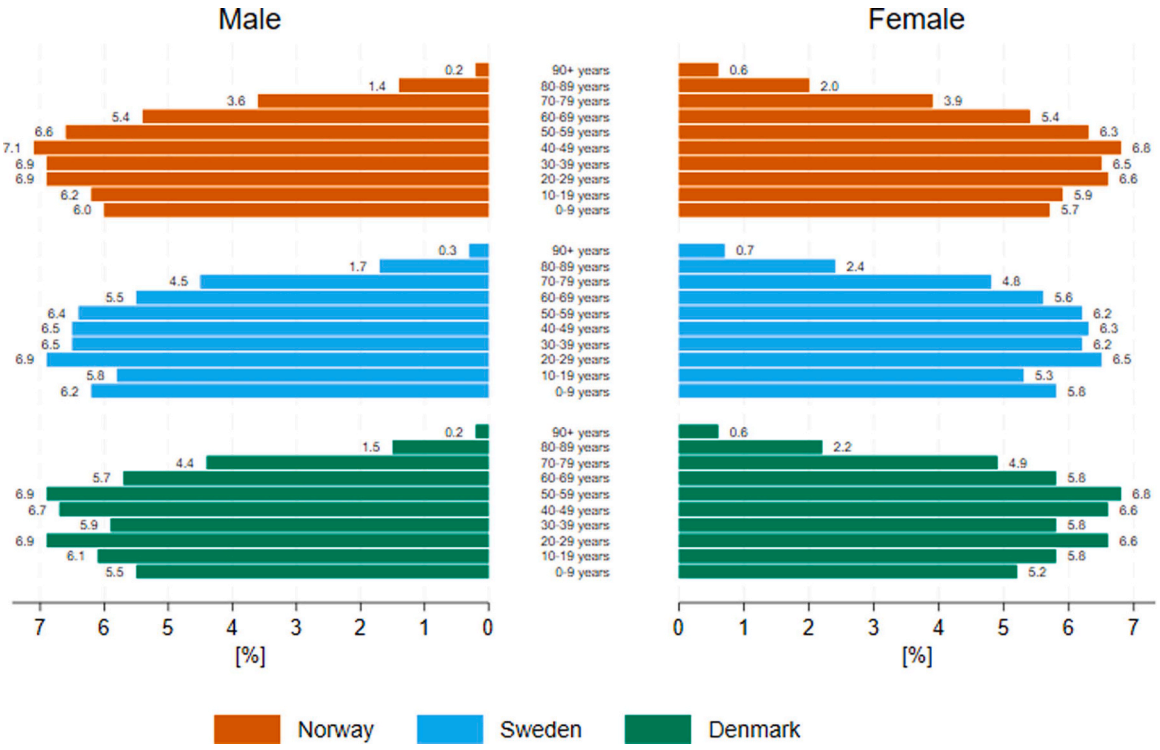

Fig. 1. The proportion of inhabitants by 10-year age categories and sex in Norway, Sweden, and Denmark (2018).

Table 2
Secondary health care utilisation overall and by disease groups, admissions per 1000 inhabitants in Norway, Sweden, and Denmark (2018).

	Norway	Sweden	Denmark	CV	Mean
	n/1000 admissions (%†)				
Secondary healthcare sector*					
All somatic admissions	215	134	228	0.265	192
Diseases of the circulatory system (I00-I99) (%)	24 (11)	20 (15)	23 (10)	0.112	22
Others (Z00-Z99, U00-U99) (%)	22 (10)	5.1 (3.8)	7.6 (3.3)	0.783	12
Injury, poisoning and certain other consequences of external causes (S00-T98, X60-99, Y00-Y09) (%)	21 (9.8)	14 (10)	19 (8.3)	0.184	18
Neoplasms (C00-D48) (%)	19 (8.8)	10 (7.5)	12 (5.3)	0.336	14
Diseases of the nervous system and the sensory organs (G00-H95) (%)	18 (8.4)	5.5 (4.1)	6.6 (2.9)	0.700	10
Diseases of the digestive system (K00-K93) (%)	17 (7.9)	12 (9.0)	18 (7.9)	0.226	15
Diseases of the musculoskeletal system and connective tissue (M00-M99, E282) (%)	17 (7.9)	8.6 (6.4)	10 (4.4)	0.376	12
Diseases of the genitourinary system (N00-N99, D070) (%)	16 (7.4)	7.5 (5.6)	11 (4.8)	0.380	12
Diseases of the respiratory system (J00-J99) (%)	16 (7.4)	11 (8.2)	23 (10)	0.359	17
Symptoms, signs and abnormal clinical findings and laboratory findings, not elsewhere classified (R00-R99) (%)	15 (7.0)	13 (9.7)	50 (22)	0.811	26
Pregnancy, childbirth, and the puerperium (O00-O99, N96) (%)	13 (6.1)	14 (10)	23 (10)	0.319	17
Endocrine, nutritional, and metabolic diseases (E00-90) (%)	4.0 (1.9)	3.1 (2.3)	7.2 (3.1)	0.452	4.8
Infections and parasitic diseases (A00-B99, Z21) (%)	3.9 (1.8)	4.5 (3.4)	9.2 (4.0)	0.495	5.9
Diseases of the skin and the subcutaneous tissue (L00-L99) (%)	2.9 (1.4)	1.2 (0.9)	2.7 (1.2)	0.410	2.3
Diseases of the blood and blood forming organs and certain disorders involving the immune system (D50-D89) (%)	1.8 (0.8)	1.3 (1.0)	2.1 (0.9)	0.233	1.7
Congenital malformations, deformations, and chromosomal abnormalities (Q00-Q99) (%)	1.8 (0.8)	0.9 (0.7)	1.4 (0.6)	0.330	1.4
Certain conditions originating in the perinatal period (P00-P96) (%)	1.4 (0.7)	1.8 (1.3)	2.0 (0.9)	0.176	1.7
Somatic bed-days	637	593	667	0.059	633

CV: Coefficient of Variation
* Numbers of admissions per 1000 inhabitants
† Percent are proportions of total hospital admissions

medication in 2018 ranged between 665/1000 inhabitants in Sweden, 703/1000 in Norway and 711/1000 in Denmark (CV=0.035) (Supplementary Table 1). Medication related to the nervous system (ATC N) were most redeemed in all countries, with a prevalence of 277/1000 inhabitants in Norway, 270/1000 in Sweden, and 287/1000 in Denmark (CV=0.030) (Figure 3 and Supplementary Table 1). Among other commonly used drug classes, there was minor variation in use, with 263/1000 individuals in Norway redeeming medication for respiratory disorders (ATC R) as opposed to 214 in Sweden and 173 in Denmark (CV=0.207). The equivalent numbers for antibiotics for systemic use (ATC J) were 219 (Norway), 194 (Sweden) and 267 (Denmark) per 1000 individuals (CV=0.163).

Discussion

The Scandinavian countries are found to be overall comparable regarding sociodemography and medication use, while variation in healthcare utilisation was more notable.

The primary strength of our study is the use of data based on each country's nationwide population, thus with minimal risk of selection

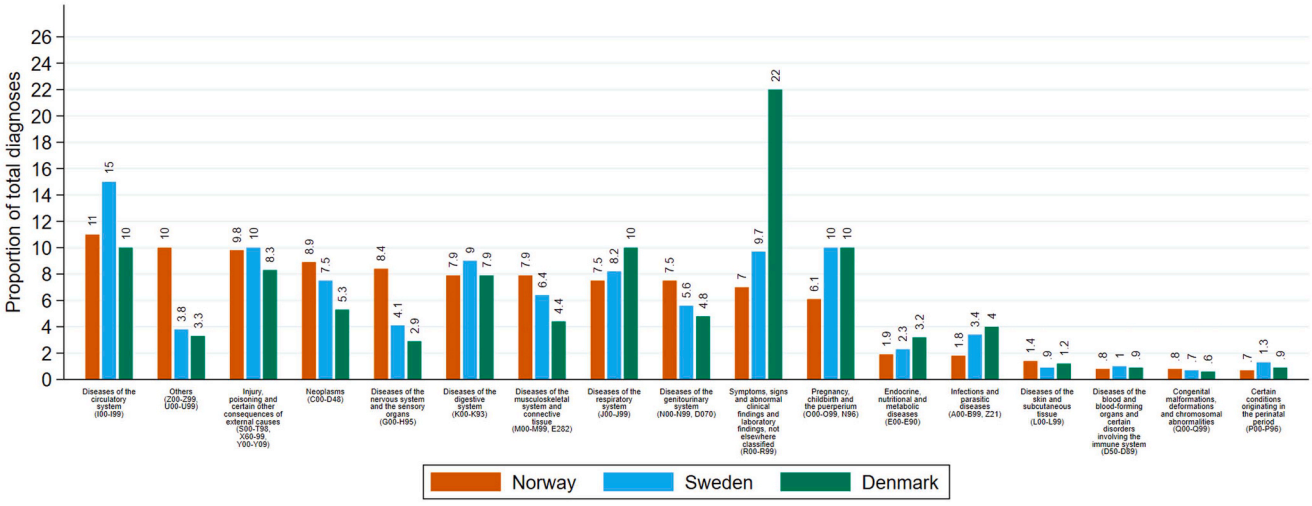

Fig. 2. Proportion of total hospital diagnoses by diagnosis groups (ICD10 first level) in Norway, Sweden, and Denmark (2018).

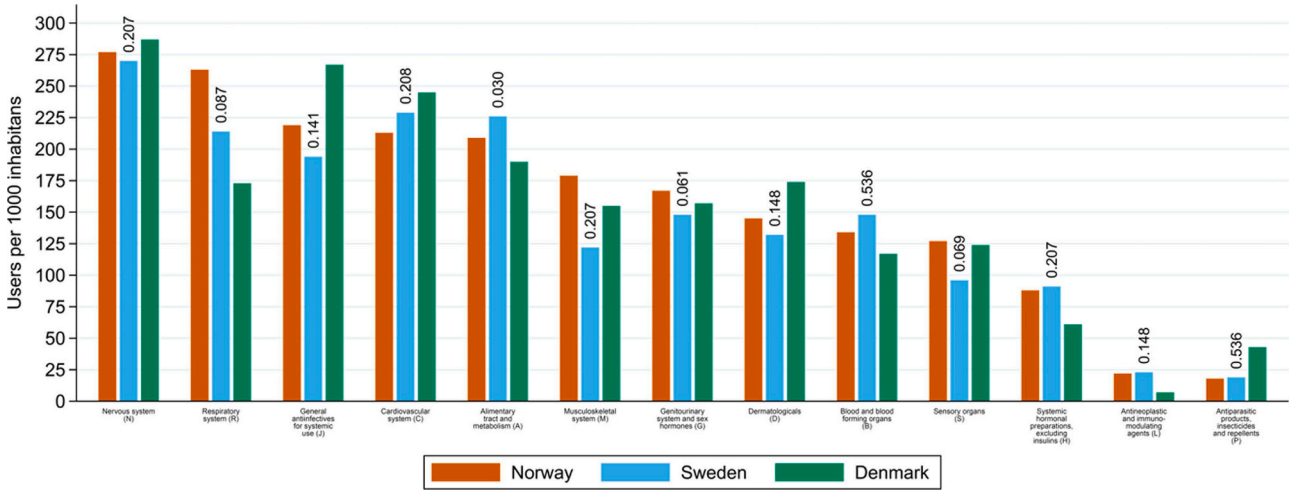

Fig. 3. The annual number of persons redeeming a prescription per 1000 inhabitants by main ATC groups (first level) in Norway, Sweden, and Denmark in 2018. The number above each main ATC group represents the Coefficient of Variance.

bias. Individuals living unregistered in the countries are not accounted for, however they are considered to be relatively few. The aggregate nature of data hinders a more detailed exploration of variations which was outside the scope of this paper. We were not able to include a comparison on psychiatric admissions due to lack of information on Norwegian and Danish data. Similarly, we did not have GP data from Sweden. For inclusion of these data, access for individual-level data from the National registers within each of the three countries would be required. Due to the relative measurement of variability, the coefficients of variation should be interpreted with caution when the overall mean is low. Finally, this study is a cross sectional descriptive study and we cannot draw any causal conclusions.

The Scandinavian populations were similar regarding sociodemographic characteristics, noting however higher immigration in Sweden than in Denmark and Norway. Income was slightly higher in Norway than in Sweden and Denmark but the Gini coefficients indicated a similar distribution of income within each country, displaying a high degree of income equality in Scandinavia compared to other countries worldwide [38]. The three countries had equal distributions of educational status, with 35–40 % of the adult populations having a top educational (tertiary) level. The population densities were very different, with low density in Norway and Sweden reflecting the size of these countries compared to Denmark. Urbanisation was rather similar, ranging between 59 % and 65 %.

We noted variations between the Scandinavian countries concerning healthcare utilisation. Within the primary healthcare sector, Danish individuals had 19 % more contacts to GPs than Norwegians. Both countries have free access to primary healthcare although organisational factors including waiting time and differences in general health among inhabitants may affect the use. Importantly, GP holds the responsibility for patients in nursing homes in Denmark which is not the case in Norway. This may potentially explain a considerable part of the variation found.

Looking at secondary healthcare utilisation, Sweden had 38–41 % fewer admissions to somatic hospitals compared to Norway and Denmark, although Sweden had more in-hospital bed-days per 1000 inhabitants. However, according to a different data source, Nordic Statistics from 2016 (latest update) [23], the number of bed-days in Sweden per 100,000 inhabitants were slightly higher (233) compared to Denmark, (221) while Norway in comparison had substantially more bed-days with 332 per 100 000 inhabitants. Thus, extraction of data might vary between data sources and numbers should be interpreted with caution. Overall, Denmark has the highest utilization of general practitioners and somatic hospital admissions registered. This could be

related to more morbidity attributable to alcohol use and smoking in Danes and the slightly lower life expectancy compared to Norwegians and Swedes [14]. I could also be explained by the differences in infrastructure and registration rules.

We find variation between countries in hospital admission frequency by diagnosis groups, especially for neoplasms, respiratory and musculoskeletal diseases (and unspecific causes), which could rely on differences in registration and coding practices feeding into the national registries. Further, variation in hospital admissions does not directly translate to variation in disease prevalence, since coding practices, screening programs, and treatment regimens may differ. This is supported by proportions by diagnosis groups according to total number of admissions, which overall shows an equal distribution although variation persists. As per our findings, medication use – also within psychotropic medication - was similar between the three countries and also appears likely less influenced by healthcare structure. It is therefore likely that the variation noted in hospital admissions and diagnoses is to some extent due to administrative differences rather than true differences in disease prevalence. However, future studies using other data sources should clarify this further.

While we generally find the three Scandinavian countries to be similar, it is important to emphasize that limited variation in overall categories does not necessarily translate to limited variation in more refined sub-categories such as individual diseases or drug groups. Therefore, researchers aiming to compare or pool data from the Scandinavian countries should always investigate the between-country variation for the factors specific to their research question. Thus, the decision of whether or not to pool data should be decided on a case-by-case basis based on a thorough review of the raw data within each country and during the data preparation process merging the registers across countries. Any differences found in this paper should be considered as confounders in studies that use data from across these countries.

Conclusion

The Scandinavian countries are comparable regarding sociodemographic factors and medication use on an aggregate level. Variation was noted in healthcare utilisation, especially in the secondary healthcare sector and when looking at specific disease categories. This variation may reflect differences in infrastructure and access to hospitals and needs to be considered when pooling results or when interpreting differences in e.g., medication use or disease prevalence, between the Scandinavian countries.

Authors contributions

Mette Bliddal, Emma Bjørn and Lotte Rasmussen conceptualised the study design. Material preparation, data collection and analysis were performed by Emma Bjørk and Mette Bliddal. The first draft of the manuscript was written by Mette Bliddal and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

CRediT authorship contribution statement

Mette Bliddal: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Lotte Rasmussen:** Writing – review & editing, Methodology, Conceptualization. **Anton Pottegård:** Writing – review & editing, Conceptualization. **Maarten Wensink:** Writing – review & editing, Methodology. **Rune Lindahl-Jacobsen:** Writing – review & editing, Methodology. **Jonas Wastesson:** Writing – review & editing, Data curation. **Rikke Wesselhoeft:** Writing – review & editing, Conceptualization. **Emma Bjørk:** Writing – review & editing, Writing – original draft, Visualization, Validation, Investigation, Formal analysis, Data curation. **Øystein Kalstad:** Writing – review & editing, Data curation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The authors would like to thank Professor Kari Furu from the Norwegian Institute of Public Health for her invaluable insights and constructive comments on the manuscript.

Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.annepidem.2024.07.004.

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