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Medicine use in people with intellectual disabilities: a Finnish nationwide register study

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Abstract

Background People with intellectual disability (ID) are a vulnerable group in our society; many of them depend on other people for assistance in their everyday lives. Compared with the general population, people with ID have poorer general health and, therefore, need more healthcare services and use more medicines. The aim of this study is to define the population of all Finnish people with ID using administrative data and to compare their medicine use and expenditure on medicines to those of the age-matched and sex-matched controls.

Methods People with ID and their age-matched and sex-matched controls (1:1) were extracted from nationwide healthcare and social allowance registers. Administrative register data on all prescription medicine purchases in 2019 were used to determine the prevalence of medicine use in both groups on a general level and by medicine categories. The differences in the prevalence of medicine use between the two groups were analysed using the logistic regression model. In addition, we studied the total expenditure on reimbursable medicine purchases covered by the National Health Insurance between people with ID and control group.

Results The subpopulation of people with ID consisted 37 196 individuals, of whom 82.7% purchased prescription medicines in 2019. The corresponding share of individuals purchasing prescription medicines in the control group was 70.3%. The differences in the prevalence of medicine use between the two populations were highest in the younger age groups (0–6, 7–12 and 13–17). In the study population, 28.1% (OR = 12.28; 95% CI: 11.54–13.07) of the people used antipsychotics, making it the most used medicine category in people with ID. In the control group, 3.3% of people used antipsychotics. Compared with the control group, the use of antiepileptics, drugs for constipation, mineral supplements and anxiolytics was four to seven times higher among people with ID. Furthermore, the median expenditure on medicine use among people with ID was four times higher than in the control group.

Conclusions Compared with the control group, people with ID used more medicines, especially

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psychotropics, and their expenditure on medicine use was higher.

Keywords Health inequalities, Intellectual disability, Pharmacotherapy, Prevalence of medication, Psychotropic medication

Introduction

People with ID are a vulnerable group in our society; many of them depend on the assistance of other people, sometimes throughout their lives.

Compared with the general population, people with intellectual disability (ID) have poorer general health (Jansen *et al.* 2004; Emerson *et al.* 2016; Hughes-McCormack *et al.* 2017; McMahon & Hatton 2021), and they are more likely to suffer from epilepsy, constipation, mental health disorders and behavioural problems (Straetmans *et al.* 2007; Folch *et al.* 2019; Hughes-McCormack *et al.* 2018). In addition, people with ID use more medicines than the general population (Straetmans *et al.* 2007; Hove *et al.* 2019; McMahon *et al.* 2020), and medicines affecting the nervous system are significantly more common among people with ID (Doan *et al.* 2013; Hove *et al.* 2019; McMahon *et al.* 2020). However, previous evidence is mostly based on relatively small sample size studies or regional population.

People with ID are entitled to the highest attainable standard of health without discrimination on the basis of disability (United Nations 2006, article 25), and States Parties undertake to collect appropriate information, including statistical and research data (United Nations 2006, article 31). Identifying the patterns of medicine use in people with ID and comparing them to people without ID is essential in estimating whether the pharmacotherapies of people with ID are rational, that is effective, safe, of high quality, cost-effective and equal (Ministry of Social Affairs and Health 2022). Furthermore, the patterns of medicine use and the distribution of medicine expenditure provide information on the functionality of the national reimbursement system, especially with people highly dependent on the National Health Insurance (NHI) scheme.

The aim of this study was twofold. First, we defined nationwide Finnish population of people with ID by linking five national registers containing information on the use of health and social care service as well as allowances. Second, we used the population of people with ID and their age-matched and sex-matched controls to compare the prevalence of medicine use between the groups. We used comprehensive individual-level register data on prescription medicines in general and by medicine categories to make the comparison. In addition to the prevalence of medicine use, we studied the expenditure on medicine use in compared populations.

Methods

Setting

In Finland, most of the medicines are prescribed in outpatient setting, and the prescription and purchases of these medicines are registered in Kanta Prescription Centre. All permanent residents are entitled to reimbursements from the NHI scheme, to outpatient medicines assessed as reimbursable based on national criteria. Approximately 80% of all outpatient prescription medicine purchases were entitled to reimbursement in 2019 (Kari & Rättö 2020).

According to statistics, the number of people with ID living in institutional setting was 1697 in 2019. Of them, 451 were long-term residents, and 1246 individuals were living in institutional setting for short term (Sotkanet 2022). Medicine use in the institutional settings is not centrally registered, and this study concerns medicine purchases in outpatient setting, regardless of institutional status.

NHI reimburses medicines, clinical nutrients and emollient creams prescribed for the treatment of an illness. There are three reimbursement categories: basic rate of reimbursement (40% of retail price), lower special rate of reimbursement (65% of retail price) and higher special rate of reimbursement (100% of retail price, a co-payment of €4.50 per purchase and per medicine applies). The special rates of reimbursement are granted to patients based on a doctor's certificate. However, reimbursements are provided only after meeting the initial annual deductible of €50 (people under the age of 18 are exempt, deductible €0). After meeting the initial deductible, the patient's payments count towards the annual maximum limit on out-of-pocket costs (€572 in 2019). After exceeding the annual maximum limit,

the cost of each reimbursable medicine is €2.50 per purchase (Kela 2022).

Data

In this study, we used five national registers containing information on the use of social and healthcare services as well as allowances and two registers containing information on medicines dispensed in community pharmacies (Fig. 1).

The Register of the Disability Allowance and Register of the Disability Pension, maintained by the Social Insurance Institution of Finland (Kela), hold information on the beneficiaries of disability allowance and disability pension. In addition, the registers contain information on the beneficiaries' diagnoses and the start and end dates of the allowances. The Finnish Institute for Health and Welfare (THL) maintains the Care Registers for Health and Social Care containing records of inpatient and outpatient healthcare and social care. These registers hold data on, for example, dates of healthcare appointments, diagnoses related to the appointments and, in some cases, diagnoses of chronic conditions.

Kanta Prescription Centre contains records of all medicines dispensed in community pharmacies. These data were used to study prevalence of medicine use. Dispensations reimbursable under the NHI scheme register, maintained by Kela, contains the details on all reimbursable medicine dispensations in community pharmacies, including information on the retail price (tax included) of the medicines and the amount of reimbursement covered by the NHI scheme. These data were used to study pharmaceutical expenditures.

Furthermore, we used a register from the Digital and Population Data Services Agency to define the age-matched and sex-matched control group.

Ethics statement

The Health and Social Data Permit Authority Findata issued permits for the use of the data. The data used in the study were fully pseudonymised prior to accessing them, and all data preparation and linkage in the study were done with pseudo-identifiers. The data were processed and stored in a secure provided environment (Kapseli). According to Finnish legislation, no ethical review was required because the study only utilised register data.

Study population

We used the diagnoses included in Register of the Disability Allowance, Register of the Disability Pension, Care Register for Health Care, Register of Primary Health Care and Care Register for Social Welfare to form the study population of people with ID (Fig. 1). These registers represent the benefits and healthcare services likely used by people with ID.

To form the study population of people with ID, we first collected all individuals with at least one diagnosis indicating ID during 2017–2019 from the registers. In all registers, diagnosis codes F70, F71, F72, F73, F79 and Q90 of the ICD-10 classification were included. In addition, diagnosis codes 317 and 319 of the ICD-9 were also included in the Disability Allowance and the Disability Pension registers. When forming the study population, we used a 3-year period (2017–2019) because all individuals might not use services every year, and, thus, might not be included in the annual registries. Additionally, only individuals who were alive at the end of 2019 were included in the study population. All individuals were assigned a unique identification number, and even though some individuals may appear in several registers, all included individuals were gathered to the study population only once.

The age-matched and sex-matched control subjects (1:1) were collected for the study population of people with ID from the population register maintained by the Digital and Population Data Services Agency. The population register was also used to define the ages of the individuals in the study population at the end of 2019.

Measures of medicine use

In this study, we define medicine use in terms of purchased outpatient medicines: The proportion of people using medicines is defined as proportion of people purchasing medicines from community pharmacies at least once in 2019.

We compared the prevalence of medicine use and the reimbursement expenditure between people with ID and control subjects in 2019. First, we studied the prevalence of medicine use on a general level. The data on medicine use were collected from the national Kanta Prescription Centre, which contains records of all prescriptions dispensed in outpatient setting

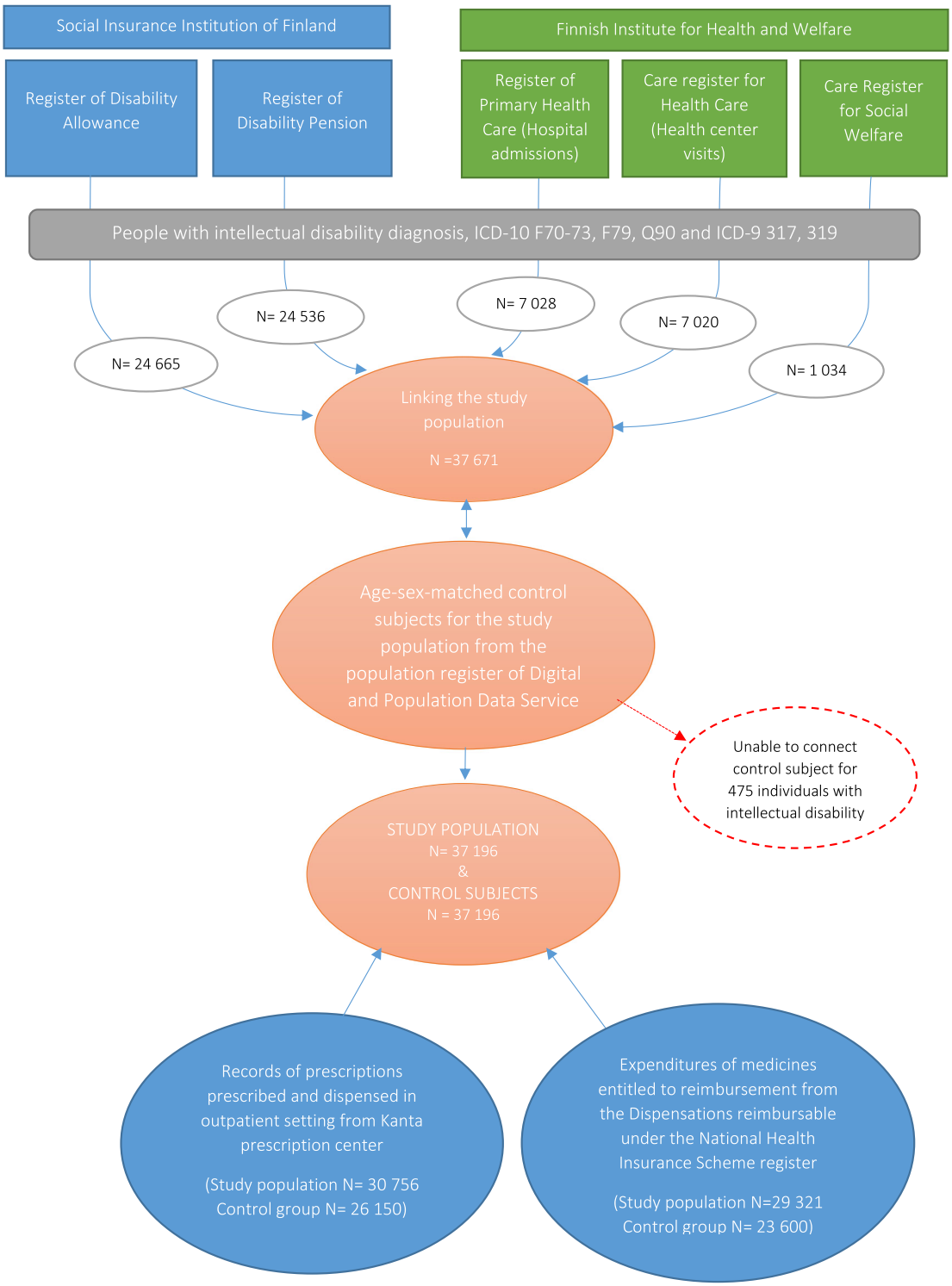

Figure 1. Formation of the study population of people with ID and their control subjects.

categorised by the Anatomical Therapeutic Classification (ATC) (WHO 2022).

In the second phase, we examined the 35 most used ATC categories and studied their prevalence in people with ID and the control group. One of the ATC categories was studied on the first ATC level (consists of one digit indicating the anatomical main group), 25 ATC categories were studied on the second level (consists of three digits indicating therapeutic subgroups), and nine ATC categories were studied on the third level (consists of four digits indicating pharmacological subgroups).

In third phase, we studied the expenditures of medicine use in people with ID and their control group. We collected the data on the 2019 medicine expenditure from the Dispensations reimbursable under the NHI scheme register. The register contains the details of each reimbursable medicine purchase, including information on the total cost (in euros, tax included) and the amount of reimbursement (in euros).

Statistical analysis

We first assessed the frequency statistics of medicine use in people with ID and the control group and then examined the prevalence of medicine use by sex and age groups. We used eight stages of life to define the age groups: early childhood (0–6), childhood (7–12), adolescence (13–17), young adulthood (18–29), middle adulthood (30–45), late adulthood (46–64), retirement (65–74) and old age (75+).

In each studied ATC subcategory, we used logistic regression models to compare the medicine use between study population and control group, controlling for the age and sex of the individual. The results are expressed in terms of odds ratios (OR) with 95% confidence interval.

In addition, medicine expenditures were studied with statistical mean and median values of costs.

Data management and statistical analysis were conducted with R version 4.0.3.

Results

The subpopulation of people with ID consisted of 37 196 individuals (42.6% female, 57.4% male) with at least one recorded diagnosis indicating ID during 2017–2019. The subpopulation of people with ID represents 0.7% of the Finnish population at the end of 2019 (5.52 million).

Medicine use

Overall, medicine use was more common in people with ID than in the control group. In 2019, the share of individuals who purchased medicines was 82.7% among people with ID and 70.3% in the control group. The difference in the prevalence of medicine use was especially high in children and adolescents with ID (Table 1). In people with ID, females purchased more medicines than males in all age groups. In the control group, however, the share of males did purchasing medicines exceeded that of females' in two age groups: early childhood (0–6) and childhood (7–12) (Fig. 2).

Medicine use in ATC categories

The prevalence of medicine use in 35 ATC subcategories is presented in Table 2. Table 3 presents the 10 most used medicine groups in terms of prevalence and the share of individuals using medicines in each age group.

In 27 ATC categories, the prevalence was higher in people with ID than in the control group. In the study population, antipsychotics (N05A) was the most used medicine group and among the three most used medicine groups in all age groups starting from childhood (7–12) (Table 3). The difference in the use of antipsychotics between the studied populations was larger than with any other medicine group, as 28.3% of people with ID

Table 1 Number people who purchased medicines from community pharmacies at least once in 2019

	Individuals buying medicines in 2019				
Age group	Individuals	ID	%	Control	%
0–6	1112	894	80.4	651	58.5
7–12	3131	2315	73.9	1448	46.2
13–17	3226	2362	73.2	1653	51.2
18–29	8349	6410	76.8	5235	62.7
30–45	7755	6470	83.4	5506	71.0
46–64	9735	8639	88.7	8110	83.3
65–74	3069	2874	93.6	2763	90.0
75+	819	792	96.7	784	95.7
Total	37 196	30 756	82.7	26 150	70.3

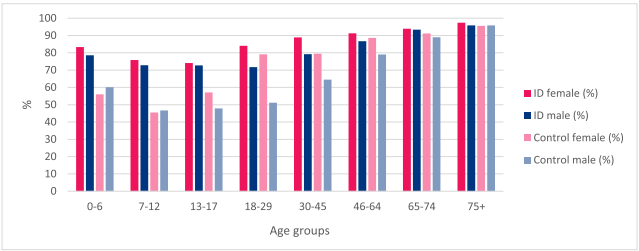

Figure 2. The share (%) of individuals with intellectual disabilities and their control group buying medicines in 2019 divided by sex.

and only 3.3% of the control group used antipsychotics (OR = 12.28; 95% CI: 11.54–13.07) (Table 2).

People with ID used nervous system medicines (ATC category N) more often than the control group. The prevalence of all subcategory N medicines (N05A antipsychotics, N03 antiepileptics, N05B anxiolytics, N06B psychostimulants, agents used for ADHD and nootropics and N05C hypnotics and sedatives) was higher in people with ID, except for analgesics (N02, including paracetamol, opioids and antimigraine preparations), which were commonly used in the control group as well (Table 2). The high prevalence of nervous system medicines in people with ID can be identified already in early childhood (0–6), and it is the highest in young adulthood (18–29) and adulthood (30–45) (Table 3).

In the control group, the prevalence of analgesics use is high in all age groups, and prevalence of antidepressants reaches among the most used medicines among young adults (18–29) and adults (30–45). In the older age groups, the prevalence of nervous system medicine use did not differ highly between people with ID and the control group (Table 3.)

In addition, people with ID had a higher prevalence in the use of drugs for constipation (A06), mineral supplements (A12), diuretics (C03) and thyroid therapy (H03) compared with the control group. In nasal preparations (R01) and angiotensin II receptor blockers (C09C, D), the prevalence of medicine use was lower in people with ID than in the control group. Furthermore, people with ID had a tendency for lower prevalence in the use of sex hormones and modulators of the genital system (G03), immunostimulants (L03) and endocrine therapy (L02) (Table 2.)

In the control group, the most used medicine group (25.1%) was anti-inflammatory and antirheumatic products (M01). The prevalence of use among people with ID was significantly lower (16.4%) (OR = 0.58 95% CI: 0.56–0.60) (Table 2). The difference in the prevalence of anti-inflammatory and antirheumatic products between the populations increased in the older age groups.

Late adulthood (46–64) appears to be a turning point for both populations, as cardiovascular medicines (ATC category C) became common (Table 3). Prevalence in the use of diuretics (C03), beta blocking agents (C07), calcium channel blockers (C08), ACE inhibitors, plain and combinations (C09A, B) and lipid-modifying agents (C10) was higher in people with ID than in the control group. Only the prevalence of angiotensin II receptor blockers (C09C, D) was higher in the control group than in people with ID (Table 2).

Medicine expenditure

The share of people who received reimbursement for their medicine purchases in 2019 was 78.8% (N = 29 321) among people with ID and 63.4% (N = 23 600) in the control group (Table 4). The medicine purchases entitled to reimbursement covered approximately 80% of all prescribed medicine purchases in both groups. In 2019, the total costs of reimbursed medicine purchases were €30.1 million in people with ID and €11.8 million in the control group. The total reimbursement expenditure was €23.5 million and €8.6 million, respectively. The share covered by the NHI scheme was 78.1% in people with ID and 72.5% in the control group. People with ID paid more for their pharmacotherapies than the control subjects did, that is, the annual out-of-pocket costs were higher for people with ID than for control subjects.

Expenditure of all medicine purchases in 2019 was aggregated for each individual (Table 4). The mean annual cost of reimbursed medicine purchases in 2019 was €1026.69 for people with ID and €500.94

Table 2 Prevalence of medicine use in people with intellectual disabilities and control group categorised by ATC

ATC		Users of medication Individuals with Intellectual disability (%)	Control subjects (%)	Odds Ratio (95% CI)
Drugs for acid-related disorders	A02	13.97	10.06	1.49 (1.43–1.56)
Drugs for constipation	A06	10.28	1.77	6.54 (6.01–7.12)
Anti-diarrhoeals, intestinal anti-inflammatory/ anti-infective agents	A07	2.37	2.02	1.18 (1.07–1.30)
Insulins and analogues	A10A	3.40	1.93	1.80 (1.64–1.98)
Blood glucose-lowering drugs, excl. insulins	A10B	7.65	4.18	2.02 (1.89–2.16)
Mineral supplements	A12	10.52	2.33	5.47 (5.07–5.91)
Antithrombotic agents	B01	5.96	4.16	1.53 (1.43–1.64)
Diuretics	C03	6.01	2.41	2.89 (2.66–3.14)
Beta blocking agents	C07	12.41	9.19	1.47 (1.40–1.55)
Calcium channel blockers	C08	6.26	5.16	1.26 (1.18–1.35)
ACE inhibitors, plain and combinations	C09A,B	7.00	4.25	1.79 (1.67–1.91)
Angiotensin II receptor blockers (ARBs), plain and combinations	C09C, D	6.74	9.05	0.69 (0.65–0.73)
Lipid-modifying agents	C10	11.13	9.32	1.28 (1.22–1.35)
Dermatologicals	D	16.15	11.51	1.48 (1.42–1.55)
Sex hormones and modulators of the genital system	G03	9.15	10.58	0.83 (0.79–0.88)
Urologicals	G04	6.08	5.39	1.16 (1.08–1.24)
Corticosteroids for systemic use	H02	3.12	3.30	0.94 (0.87–1.02)
Thyroid therapy	H03	11.16	4.44	2.83 (2.66–3.00)
Antibacterials for systemic use	J01	27.09	23.60	1.21 (1.17–1.25)
Antineoplastic agents	L01	0.20	0.24	0.81 (0.60–1.11)
Endocrine therapy	L02	0.37	0.48	0.77 (0.62–0.97)
Immunostimulants	L03	0.07	0.13	0.57 (0.36–0.92)
Immunosuppressants	L04	1.35	1.42	0.94 (0.84–1.07)
Anti-inflammatory and antirheumatic products	M01	16.35	25.08	0.58 (0.56–0.60)
Analgetics	N02	20.20	17.54	1.20 (1.16–1.25)
Antiepileptics	N03	24.08	3.13	9.92 (9.31–10.56)
Antipsychotics	N05A	28.25	3.28	12.28 (11.54–13.07)
Anxiolytics	N05B	16.76	3.87	5.11 (4.82–5.43)
Hypnotics and sedatives	N05C	14.51	5.70	2.82 (2.67–2.97)
Antidepressants	N06A	19.42	9.71	2.32 (2.22–2.42)
Psychostimulants, agents used for ADHD and nootropics	N06B	3.49	0.99	3.77 (3.35–4.25)
Nasal preparations	R01	7.00	12.50	0.53 (0.50–0.55)
Drugs for obstructive airway diseases	R03	10.90	10.71	1.02 (0.97–1.07)
Antihistamines for systemic use	R06	11.52	9.06	1.31 (1.25–1.37)
Ophthalmologicals	S01	12.44	10.36	1.23 (1.18–1.29)

for the control subjects. The median annual cost of reimbursed medicine purchases was €412.79 for people with ID and €100.52 for control group.

Discussion

In this study, we showed that the prevalence of overall medicine use is higher in people with ID than in the age-matched and sex-matched control group without ID. The difference in the prevalence of medicine use between the two groups is higher in children and adolescents than in the older age groups, where the difference is smaller. In people with ID, females use more medicines than males in all age groups. More than one-fourth of the people with ID used antipsychotic medicines. The

Table 3 Ten most used medicine groups by prevalence for all age groups and the share of medicine users

	Age group 0–6			Age group 7–12					
TOP 10	ID	%	Control	%	ID	%	Control	%
1	J01 Antibacterials for systemic use	42.36	J01 Antibacterials for systemic use	29.41	J01 Antibacterials for systemic use	25.55	J01 Antibacterials for systemic use	18.24
2	S01 Ophthalmologicals	26.89	S01 Ophthalmologicals	18.53	N03 Antiepileptics	17.02	R06 Antihistamines for systemic use	8.62
3	R03 Drugs for obstructive airway diseases	23.74	M01 Anti-inflammatory and antirheumatic products	14.75	N05C Hypnotics and sedatives	16.07	S01 Ophthalmologicals	8.50
4	M01 Anti-inflammatory and antirheumatic products	23.11	D Dermatologicals	13.49	S01 Ophthalmologicals	14.72	R03 Drugs for obstructive airway diseases	8.43
5	N03 Antiepileptics	20.14	R03 Drugs for obstructive airway diseases	11.60	N06B Psychostimulants, agents used for ADHD and nootropics	14.24	D Dermatologicals	7.82
6	N05C Hypnotics and sedatives	16.82	R06 Antihistamines for systemic use	9.89	M01 Anti-inflammatory and antirheumatic products	14.08	M01 Anti-inflammatory and antirheumatic products	7.51
7	D Dermatologicals	15.11	N02 Analgetics	7.91	R03 Drugs for obstructive airway diseases	12.33	R01 Nasal preparations	6.45
8	N02 Analgetics	13.13	A07 Antidiarrhoeals, intestinal anti-inflammatory/anti-infective agents	5.49	D Dermatologicals	12.20	N02 Analgetics	5.08
9	A06 Drugs for constipation	12.23	R01 Nasal preparations	5.49	N05A Antipsychotics	11.50	N06B Psychostimulants, agents used for ADHD and nootropics	3.23
10	N05B Anxiolytics	11.51	A06 Drugs for constipation	1.89	R06 Antihistamines for systemic use	9.84	A07 Antidiarrhoeals, intestinal anti-inflammatory/anti-infective agents	2.24
	Age group 13–17				Age group 18–29			
Top 10	ID	%	Control	%	ID	%	Control	%
1	J01 Antibacterials for systemic use	21.82	J01 Antibacterials for systemic use	18.01	J01 Antibacterials for systemic use	24.05	J01 Antibacterials for systemic use	23.12
2	N05A Antipsychotics	18.44	D Dermatologicals	10.88	N05A Antipsychotics	23.94	M01 Anti-inflammatory and antirheumatic products	20.48
3	N03 Antiepileptics	17.89	M01 Anti-inflammatory and antirheumatic products	10.69	N03 Antiepileptics	22.90	G03 Sex hormones and modulators of the genital system	15.68
4	N05C Hypnotics and sedatives	17.33	R06 Antihistamines for systemic use	10.04	N06A Antidepressants	16.29	N02 Analgetics	12.15

Table 3. *(Continued)*

	Age group 0–6				Age group 7–12			
TOP 10	ID	%	Control	%	ID	%	Control	%
5	D Dermatologicals	13.24	R01 Nasal preparations	9.30	D Dermatologicals	15.81	D Dermatologicals	11.16
6	M01 Anti-inflammatory and antirheumatic products	12.59	R03 Drugs for obstructive airway diseases	8.31	M01 Anti-inflammatory and antirheumatic products	15.65	R01 Nasal preparations	11.09
7	N06B Psychostimulants, agents used for ADHD and nootropics	12.03	S01 Ophthalmologicals	7.69	N05C Hypnotics and sedatives	14.49	N06A Antidepressants	8.67
8	R06 Antihistamines for systemic use	10.73	N02 Analgetics	6.14	N05B Anxiolytics	13.87	R03 Drugs for obstructive airway diseases	7.97
9	S01 Ophthalmologicals	10.01	G03 Sex hormones and modulators of the genital system	4.62	N02 Analgetics	13.27	R06 Antihistamines for systemic use	7.95
10	R03 Drugs for obstructive airway diseases	9.27	N06A Antidepressants	3.04	R06 Antihistamines for systemic use	12.55	S01 Ophthalmologicals	6.77
	Age group 30–45				Age group 46–64			
TOP 10	ID	%	Control	%	ID	%	Control	%
1	N05A Antipsychotics	29.76	M01 Anti-inflammatory and antirheumatic products	30.32	N05A Antipsychotics	36.35	M01 Anti-inflammatory and antirheumatic products	36.46
2	N03 Antiepileptics	27.83	J01 Antibacterials for systemic use	23.89	N02 Analgetics	27.67	J01 Antibacterials for systemic use	25.75
3	J01 Antibacterials for systemic use	25.42	N02 Analgetics	18.57	J01 Antibacterials for systemic use	27.64	N02 Analgetics	24.76
4	N06A Antidepressants	24.68	R01 Nasal preparations	15.45	N06A Antidepressants	27.11	C09C,D Angiotensin II receptor blockers, plain and combinations	19.47
5	N05B Anxiolytics	18.65	N06A Antidepressants	12.42	N03 Antiepileptics	26.83	C10 Lipid-modifying agents	17.64
6	N02 Analgetics	17.73	D Dermatologicals	10.12	C10 Lipid-modifying agents	22.86	A02 Drugs for acid-related disorders	17.20
7	M01 Anti-inflammatory and antirheumatic products	16.87	R03 Drugs for obstructive airway diseases	9.81	N05B Anxiolytics	22.26	R01 Nasal preparations	16.01
8	D Dermatologicals	16.75	G03 Sex hormones and modulators of the genital system	9.54	C07 Beta blocking agents	21.55	C07 Beta blocking agents	15.34
9	R06 Antihistamines for systemic use	14.40	A02 Drugs for acid-related disorders	9.48	A02 Drugs for acid-related disorders	21.37	R03 Drugs for obstructive airway diseases	13.42
10	N05C Hypnotics and sedatives	13.81		9.40		18.18	N06A Antidepressants	13.41

Table 3. *(Continued)*

	Age group 0–6			Age group 7–12					
TOP 10	**ID**	**%**	**Control**	**%**	**ID**	**%**	**Control**	**%**
	Age group 65–74		R06 Antihistamines for systemic use		M01 Anti-inflammatory and antirheumatic products Age group 75+			
TOP 10	ID	%	Control	%	ID	%	Control	%
1	N05A Antipsychotics	42.49	C10 Lipid-modifying agents	38.16	N02 Analgetics	57.14	C10 Lipid-modifying agents	47.74
2	N02 Analgetics	38.81	C07 Beta blocking agents	29.29	J01 Antibacterials for systemic use	44.93	C07 Beta blocking agents	45.05
3	C10 Lipid-modifying agents	36.69	C09C,D Angiotensin II receptor blockers, plain and combinations	28.32	N05A Antipsychotics	43.35	N02 Analgetics	44.81
4	J01 Antibacterials for systemic use	34.67	N02 Analgetics	27.63	C07 Beta blocking agents	41.27	C09C,D Angiotensin II receptor blockers, plain and combinations	35.16
5	C07 Beta blocking agents	33.43	M01 Anti-inflammatory and antirheumatic products	26.62	C03 Diuretics	38.71	B01 Antithrombotic agents	34.68
6	N06A Antidepressants	29.06	J01 Antibacterials for systemic use	25.38	A12 Mineral supplements	35.29	C08 Calcium channel blockers	31.75
7	A02 Drugs for acid-related disorders	29.00	A02 Drugs for acid-related disorders	22.39	A02 Drugs for acid-related disorders	34.68	A02 Drugs for acid-related disorders	29.06
8	A12 Mineral supplements	26.88	C08 Calcium channel blockers	18.57	B01 Antithrombotic agents	32.72	J01 Antibacterials for systemic use	28.33
9	N03 Antiepileptics	26.30	G04 Urologicals	17.11	C10 Lipid-modifying agents	31.01	S01 Ophthalmologicals	25.40
10	B01 Antithrombotic agents	22.97	C09A,B ACE inhibitors, plain and combinations	16.72	A06 Drugs for constipation	26.62	G04 Urologicals	23.81

corresponding number in the control group was 3.3%, suggesting an eightfold use of antipsychotics among people with ID. Overall, psychotropics were more used in people with ID than in the control group. Certain somatic medicine groups, such as anti-inflammatory and antirheumatic products, nasal preparations and angiotensin II receptor blockers, appeared to be less used among people with ID than in the control group. In addition, people with ID paid more of their pharmacotherapies than the control subjects.

The observed prevalence of medicine use among people with ID (82.7%) aligns with previous findings of high prevalence of medicine use among people with ID. In previous studies, the prevalence of medicine use among people with ID has been from approximately 60% (Hove *et al.* 2019) to approximately 80% (Straetmans *et al.* 2007; Folch *et al.* 2019; McMahon *et al.* 2020). However, making comparisons between studies is difficult because of different research frames.

The unexpected outcome of our study, that is, children and adolescents with ID use relatively more medicines than old people with ID, may be explained by a common dilemma occurring with cross-sectional studies: People with ID form a heterogeneous group of people, and, in terms of ID aetiology, the age groups were probably not homogeneous. The underlying cause of the impairment and the prevalence of comorbidities may differ between people with ID. Due to the differences in life expectancy, people with severe or profound ID diagnoses may be over-represented in the younger age groups, and a majority of people in the older age groups might have milder, non-specific forms of ID.

When categorising the subjects by their sex, our results suggest a difference in the overall use of medicines between people with ID and control subjects in young children and children. In people with ID, females use more medicines than males in all age groups. In the control group, however, males use more medicines than females in early childhood (0–6) and childhood (7–12). Additional research is needed to investigate the gender-specific differences in children's medicine use.

In comparison with the control group, the overall prevalence of medicine use is higher, and the use of nervous system medicines is significantly higher in people with ID. Poorer general health among people with ID may partially explain the difference in the prevalence of medicine use (Jansen *et al.* 2004; Emerson *et al.* 2016; Hughes-McCormack *et al.* 2017; Hughes-McCormack *et al.* 2018; McMahon & Hatton 2021). Straetmans *et al.* (2007) have shown that the high number of prescriptions to people with intellectual disabilities is a consequence of more frequent contacts with GPs, even though people with ID are less likely to receive a prescription during a doctor's appointment. Another reason possibly explaining the differences in the use of medicines between people with ID and the control group is that people with ID are less likely to assess or decide for themselves whether they want to take the medicines prescribed to them (Flood & Henman 2021). Because register data do not provide an answer, further research on the subject is needed.

The high prevalence of psychotropic medicines in people with ID can be explicated by the high prevalence of diagnosed mental health disorders among the population (Doan *et al.* 2013; Hughes-McCormack *et al.* 2017; Folch *et al.* 2019;

Table 4 Aggregated annual costs of reimbursed medication in 2019

		Costs (€)	Reimbursements (€)	Share of reimbursement per purchase (%)
People with intellectual disability	Total	30 103 482.20	23,516,395.41	78.1
	Median	412.79	195.05	
	Mean (*n* = 29 321)	1026.69	802.03	
Control group	Total	11 822 185.99	8 569 223.98	72.5
	Median	100.52	24.16	
	Mean (*n* = 23 600)	500.94	363.10	

McMahon & Hatton 2021). However, previous studies have indicated that even though people with ID have more diagnosed mental health disorders and behavioural problems, the amount of prescribed psychotropics is larger than the number of diagnosed mental health problems suggests (Doan *et al.* 2013; McMahon *et al.* 2020). This is in accordance with our recent Finnish study. Those with antiepileptic medication had been diagnosed as suffering from an epilepsy syndrome, but those with on psychotropics did not have a mental health diagnosis (Arvio *et al.* 2021). In this study, we were not able to verify the mental health diagnoses of the people on psychotropic medication, and, thus, we were not able to verify the indication of the medication.

We found high use of antiepileptics, thyroid hormones, mineral supplements and medicines for constipation in people with ID. Compared with the general population, epilepsy is more common among people with ID (Straetmans *et al.* 2007; Robertson *et al.* 2015). However, antiepileptics have a negative effect on the endocrine system, including thyroid function and bone health (Jasien *et al.* 2012; Svalheim *et al.* 2015), which means that the use of antiepileptics is a risk factor for low bone mass density (Jasien *et al.* 2012; Winterhalder *et al.* 2022), deficiency of vitamin D (Winterhalder *et al.* 2022) and the prevalence of thyroid dysfunction (Svalheim *et al.* 2015). In addition, Down syndrome predisposes to hypothyroidism (Carroll *et al.* 2008). In addition to anti-epilepsy medication, immobility is a risk factor for osteoporosis (Srikanth *et al.* 2011) and for constipation (Robertson *et al.* 2018); thus, mobility limitations may contribute to the high prevalence of drugs for constipation and mineral supplements, especially calcium.

Non-steroidal anti-inflammatory medicines for pain relief were less used among people with ID than in the control group. Nevertheless, people with ID experience acute and chronic pain with at least the same frequency as the rest of the population (Barney *et al.* 2020). Due to limited communication abilities, people with ID face challenges in self-reporting their pain (Doody & Bailey 2017), and, therefore, their pain may go unrecognised and undertreated (McGuire *et al.* 2010). Pain may also convey as changes in the behaviour (Kyrkou 2005), which may be treated with antipsychotic medicines (Sheehan *et al.* 2015).

Our results indicate that people with ID use less sex hormones and modulators of the genital system. However, further study is needed to establish whether people with ID use long-term products, which may cause the low annual prevalence in the use of sex hormones. Long-term products do not have to be purchased every year; thus, the use of sex hormones and modulators of the genital system may not occur in the 2019 data. Furthermore, long-term products may be easier to use, because people with ID might not be responsible for taking their medicines themselves.

It is noteworthy that the medicines that were less used among people with ID, the angiotensin II receptor blockers (C09C, D) are more expensive than other cardiovascular medicines, and antineoplastic agents are considerably expensive. There is evidence of more expensive medicines being prescribed in the private sector compared with the public sector (Aaltonen *et al.* 2018). The lower use of above-mentioned medicines may indicate a higher use of public services; people with ID generally require specialised medical care, which is a public service in Finland.

The mean costs being higher than the median costs indicate that a few people with particularly high expenditures skew the deviation of costs (Saastamoinen & Verho 2013). Among people with ID, the mean cost of medicine use was two and a half times higher than the median cost, although the difference in the control group was five times higher. This indicates that the costs of medicine use were more evenly distributed in the control group than in people with ID, that is, there were relatively more individuals with high expenditures in people with ID than in the control group. In addition, despite having a larger share of their medicine costs reimbursed, people with ID had a larger out-of-pocket cost compared with the control group. Diseases related to ID partially explain the high use of psychotropic medicines, but a certain risk of overuse exists. Future research should also investigate whether there is some underuse of certain somatic medicines. Furthermore, people with ID often need varying housing facilities, and the form of living may affect the received care, including but not limited to pharmacological care. The effects of the form of living on medicine use among people with ID should also be addressed in future studies. People with ID are a vulnerable population, and there might be a risk of overusing or

underusing medicines or other types of drug related problems. Attention should be paid to ensure rational prescribing of medicines and rational medicine use to people with ID.

Strengths and limitations

To the best of our knowledge, this is the first nationwide study on the prevalence of medicine use in people with ID based on registers and including medicine use in general as well as by medicine categories. The main strength of this study is the comprehensive study population that includes all individuals with ID who have used healthcare services and the services of social security.

In this study, the number of people with ID was identified based on the diagnoses coded in administrative registers of the use of health and social care services as well as receipt of allowances during 2017–2019. Some individuals who meet the diagnostic criteria for ID may be excluded from the study group or appear in the control group due to not having an ID diagnosis recorded in the registers. Overall, the diagnostics of ID is ambiguous, especially in mild cases.

The registers of medicine use hold information on prescribed medicines purchased in community pharmacies. The registers do not include information on the indication for the purchased medicine, and therefore, we were not able to evaluate whether the medicine use was appropriate. In addition, we cannot observe if the purchased medicines are used appropriately or used at all. This may also vary by ATC groups. The data do not include information on inpatient medicine use or over-the-counter medicine purchases, so the medicine use of residents of inpatient institutions is under-represented. So medicine treatments for people with ID nor their control subjects implemented in hospitals were not included in the data. However, the number of units with institutional status is low. Most care homes for people with ID are not regarded as units with institutional status. Medicine use in care homes should be further studied in register-based settings. Furthermore, we were not able to take into account the severity of ID.

Finally, the data on medicine costs is only available in the register of medicine reimbursement (Finnish Prescription Registry), and it does not include medicine purchases that are not reimbursable. However, in line with previous estimates (Kari & Rättö 2020), in our study population, approximately 80% of all medicine purchases were reimbursable in both ID and control groups.

Conclusions

Compared with the control group, people with ID used more medicines, especially psychotropics, and their expenditure on medicine use was higher. In addition, people with ID paid more of their pharmacotherapies out of pocket than the control subjects.

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This research did not receive any specific grant.

Conflict of interest

The authors have no conflicts of interest to declare.

Ethics approval statement

According to Finnish legislation, no ethical review was required because the study only utilised register data. The Health and Social Data Permit Authority Findata issued permits for the use of the data. The data used in the study were fully pseudonymised prior to accessing them, and all data preparation and linkage in the study were done with pseudo-identifiers. The data were processed and stored in a secure provided environment (Kapseli).

Data availability statement

Due to data protection regulations of the secondary use of administrative, individual-level register data in Finland, the authors do not have the permission to make the data supporting the current findings available. Interested parties may however apply for permission to access the data from the centralised data permit authority Findata (https://www.findata.fi/en/), info@findata.fi, tel. +358295246500.

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