Determinants of prescription opioid use: population-based evidence from Finland

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ABSTRACT

Background and aims   Previous studies have shown that prescription opioid use is more common in socio-economically disadvantaged communities in the United States. This study examined the area and individual-level determinants of prescription opioid use in Finland during the period 1995–2016. **Design**   Logistic regression analysis using nation-wide data on filled opioid-related prescriptions dispensed at Finnish pharmacies and covered by National Health Insurance. Opioid consumption was linked, using personal identification codes, to population-based data maintained by Statistics Finland, which records individual background and area-level characteristics. **Setting and participants**   Working-age population aged between 15 and 64 years in Finland during the periods 1995–2007 ($n = 4\,315\,409$) and 2009–16 ($n = 4\,116\,992$). **Measurements**   Annual prescription opioid use was measured using defined daily doses (DDD) and whether people used opioids during a year. **Findings**   Prescription opioid use increased in Finland from 1995 to 2016 (from less than 1 to 7%), but the increase was explained by the change in the treatment of codeine-based opioids in National Health Insurance. The area-level unemployment rate was positively correlated with the share of opioid users at the municipal level ($r = 0.36$; $P < 0.001$). In comparison with being employed, being outside the labour force was associated with increased opioid use in 1995–2007 [odds ratio (OR) = 2.22, 95% confidence interval (CI) = 2.10–2.36] and non-codeine opioid use in 2009–16 (OR = 2.16, 95% CI = 2.06–2.27), but not with codeine opioid use in 2009–16. **Conclusions**   Prescription opioid use in Finland appears to be more common among low socio-economic status people, similar to the United States and the United Kingdom.

Keywords   Codeine, Finland, opioid use, opioids, population-based, prescription drugs, prevalence, socio-economic status.

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INTRODUCTION

The use of prescription opioids has increased dramatically in the United States during the past few decades and has currently reached epidemic proportions. Although the prevalence of opioid prescriptions has decreased in the United States since 2010 [1], the misuse and non-medical use of opioids remain a major public health and policy concern [2,3]. While the use of opioids has also increased in many European countries [4,5], a similar trend has not been observed in the Scandinavian countries where the use of opioids has remained stable or decreased [6–8]. Recent analyses suggest that, in the United States,

prescriptions of opioids and prescription opioid overdoses are more common among socio-economically disadvantaged communities that suffer from higher rates of unemployment, lower educational attainment and high levels of uninsured people [1,9]. While studies from the United Kingdom present a similar picture [10,11], a recent study from Sweden suggests that older women, especially those living alone, have higher rates of prescription opioid use [12]. However, there is a lack of population-based studies which investigate these issues combining both individual and area-level information.

In the present study, we examined how demographic and socio-economic factors were related to prescription

opioid use among the working-age population in Finland during the period 1995–2016. We used nation-wide population-based data to document the individual-level patterns of prescription opioid use and characteristics of the regions where patients live. This information is useful in order to better select demographic characteristics and geographic areas for possible policy intervention. From the prescription opioids, we differentiated codeine-based opioids from other opioids, as they were included in 2008 in our data, which contain opioids covered by National Health Insurance (NHI).

METHODS

Data

The primary administrative data were from the Social Insurance Institution containing filled opioid-related prescriptions dispensed at Finnish pharmacies during the period 1995–2016. Opioids cover the World Health Organization (WHO)'s anatomical therapeutic chemical (ATC) classification system codes beginning with 'N02A' (strong opiate-type analgesics and analgesics with similar structure or action). The data contained patient-level prescriptions reimbursed under NHI. People may have reimbursed opioid prescriptions multiple times within the same year.

The prescription register (PR) was linked using personal identification codes to population-based data, maintained by Statistics Finland, to obtain information on individual background characteristics, including education level, labour market status and parental socio-economic status (SES) during the period 1995–2016. The analysis of opioid use was restricted to the working-age population aged between 15 and 64 years. The data covered approximately 3.3–3.5 million people annually.

Individual-level measures

In the analysis, opioid use was primarily defined as whether an individual was using prescription opioids during the year (i.e. at least one reimbursed opioid prescription). Additionally, prescription opioid use was measured as defined daily doses (DDD) [13]. It provides a fixed unit of measurement that accounts for the differences in package size and strength, making comparisons possible between population groups.

The models included the following individual-level covariates. Age, gender and marital status (indicating whether an individual is married or in a registered partnership) were obtained from Statistics Finland's longitudinal census files. Annual employment status (employed, unemployed or outside the labour force, including students, pensioners and housewives and house-husbands, measured during the last week of each year) originates from the Finnish longitudinal employment statistics. The highest completed education for both the individual and parents is based on the Register of Completed Education and Degrees, which is also maintained by Statistics Finland. Parental education was included as an additional measure of the individual's SES, because parental SES may differ considerably from the individual's own SES (measured by education and labour market status).

Area-level measures

The municipal-level unemployment rate (the number of municipalities = 313) was computed as the ratio of unemployed people (during the last week of each year) to the labour force aged between 15 and 64 years in each municipality.

Statistical analyses

The present study analyses were not pre-registered, and thus the findings should be considered exploratory. The preliminary analysis of the annual data from the PR indicated that there was a noticeable increase in prescription opioid use in 2008. The reason for this was that codeine-based medicines (most popular brand name: Panacod) were added to the list of reimbursed medicines covered by the NHI in 2008 (ATC codes: N02AA59 and N02AJ06). Therefore, we conducted all analyses separately for 1995–2007 (n = 4 315 409) and 2009–16 (n = 4 116 992) and examined the use of codeine and other opioids separately.

The associations between prescription opioid use and individual-level characteristics were examined using logistic regression models. The results were reported as odds ratios (ORs) with 95% confidence intervals (CIs). CIs were based on standard errors that have been clustered at the municipality level. Descriptive patterns at the regional level were investigated by aggregating individual-level data to the municipality level, and then calculating the annual share of people with opioid prescriptions for each municipality. As there were very few missing data (fewer than 1%), all people with missing data were omitted from the analyses. Stata version 15.1 (Stata Corp, College Station, TX, USA) was used for all analyses.

RESULTS

Although prescription opioid use increased in Finland during the period 1995–2016 (from less than 1 to 7%), this increase was explained by the inclusion of codeine-based opioids to the list of reimbursed medicines (Supporting information, Fig. S1). The use of other opioids than codeine remained stable. In codeine use, there was even a slight decrease between 2012 and 2016.

Table 1 Descriptive statistics of the study samples.

	1995–2007		2009–16				Change between periods		
	(1) Group share,[a] %	(2) Opioid users,[b] %	(3) Group share, %	(4) Opioid users, %	(5) Codeine users, %	(6) Non-codeine opioid users,[c] %	(7) = (4)–(2) Opioid users, % points	(8) = (5) Codeine users,[d] % points	(9) = (6)–(2) Non-codeine opioid users, % points
Demographic variables									
15–24 years	20.6	0.3	20.5	3.3	2.9	0.6	3.0	2.9	0.2
25–34 years	19.3	0.9	19.7	6.3	5.3	1.4	5.4	5.3	0.6
35–44 years	21.9	1.4	19.0	8.0	6.5	2.1	6.6	6.5	0.7
45–54 years	22.6	2.0	21.2	9.3	7.4	2.7	7.4	7.4	0.8
55–64 years	15.6	2.5	19.6	10.1	7.7	3.3	7.6	7.7	0.7
Male	50.5	1.4	50.5	7.2	5.7	2.1	5.8	5.7	0.7
Female	49.5	1.3	49.3	7.6	6.3	2.0	6.3	6.3	0.6
Marital status									
Married	46.3	1.6	41.8	8.4	6.8	2.3	6.8	6.8	0.7
Not married	53.7	1.2	58.2	6.6	5.4	1.8	5.5	5.4	0.6
Employment status									
Working	62.7	1.1	65.0	7.5	6.3	1.7	6.3	6.3	0.5
Unemployed	9.7	1.3	9.0	7.7	6.0	2.4	6.4	6.0	1.1
Outside labour force	27.6	1.9	26.0	7.1	5.1	2.7	5.2	5.1	0.8
Highest education									
Only compulsory education	34.4	1.6	25.2	7.0	5.5	2.2	5.4	5.5	0.6
Vocational upper secondary	30.8	1.6	34.1	8.9	7.1	2.5	7.3	7.1	0.9
High school	8.6	0.6	8.7	5.0	4.3	1.0	4.4	4.3	0.5
Tertiary	26.2	1.1	32.1	6.7	5.6	1.6	5.7	5.6	0.5
Parents' highest education									
Missing parental information	20.3	2.0	9.6	5.7	4.4	1.7	3.7	4.4	−0.3
Only compulsory education	38.8	1.6	31.8	9.6	7.5	2.9	8.0	7.5	1.3
Vocational upper secondary	21.3	1.0	27.7	7.4	6.0	1.9	6.4	6.0	1.0
High school or more	19.7	0.7	30.9	5.7	4.8	1.3	5.0	4.8	0.6
Municipal-level unemployment rate	0.136		0.122						
Using opioids (%)		1.4		7.4	6.0	2.1	6.0	6.0	0.8
Mean opioids DDD[e] for users		51.7		53.1	41.9	70.6	1.4	41.9	19.0

(*Continues*)

Table 1. (Continued)

	1995–2007		2009–16				Change between periods		
	(1) Group share,[a] %	(2) Opioid users,[b] %	(3) Group share, %	(4) Opioid users, %	(5) Codeine users, %	(6) Non-codeine opioid users,[c] %	(7) = (4)–(2) Opioid users, % points	(8) = (5) Codeine users,[d] % points	(9) = (6)–(2) Non-codeine opioid users, % points
Number of people	4 315 409		4 116 992						
Number of person-year observations	45 124 593		28 059 740						

[a]Average annual group share during the observation period; [b]average annual share of opioid users (%) within the subsample of people during the observation period; [c]non-codeine opioid users may also use codeine, and *vice versa*, and therefore columns (5) and (6) do not sum to (4); [d]the share of prescription codeine users is negligible during the first period 1995–2007; [e]defined daily dose (DDD) is defined by the World Health Organization as the assumed average maintenance dose per day for a drug used for its main indication in adults [13].

Descriptive statistics of the study participants for the periods 1995–2007 and 2009–16, together with the changes between periods, are reported in Table 1. Five important patterns stand out. First, the share of users increases notably with age, which was largest for those aged 55–64 years (10.1% in 2009–16). Secondly, the share of codeine users was larger among employed people (6.3%) than people outside the labour force (5.1%), whereas the opposite was found for non-codeine opioid use (1.7 versus 2.7%). Thirdly, prescription opioid use was most common among those with vocational upper secondary education (8.9%). Fourthly, the share of users in terms of parental background was largest among those with only compulsory education (9.6%). The increase in the use of opioids between the two periods was also highest among this group. Lastly, codeine use was more common among women (6.3%) than men (5.7%) in 2009–16.

Next, we examined the potential regional variation in prescription opioid use in 2016. We noted two observations. First, there was substantial variation in prescription opioid use among the municipalities, and the use of opioids was not concentrated in urban areas in Finland (Supporting information, Fig. S2). Secondly, there was a positive correlation ($r = 0.36$; $P < 0.001$) between the unemployment rate and the share of users at the municipal level (Supporting information, Fig. S3) indicating that, on an average, municipalities with a higher unemployment rate had more people with opioid prescriptions. A similar positive correlation was also found for codeine use ($r = 0.29$; $P < 0.001$) and non-codeine opioid use ($r = 0.34$; $P < 0.001$).

The associations between background characteristics with prescription opioid use are reported in Table 2. We found four important patterns. First, in comparison to employed people, being outside the labour force was associated with increased opioid use in 1995–2007 (OR = 2.22, 95% CI = 2.10–2.36) and with non-codeine opioid use in 2009–16 (OR = 2.16, 95% CI = 2.06–2.27). A similar association was not found for codeine opioid use in 2009–16 (OR = 0.98, 95% CI = 0.94–1.03). Secondly, high parental SES (high school or more) was associated with lower odds of opioid use in 1995–2007 (OR = 0.87, 95% CI = 0.85–0.89) and with lower odds of non-codeine opioid use in 2009–16 (OR = 0.90, 95% CI = 0.88–0.92). A similar, but weaker, association was also found for codeine opioid use in 2009–16 (OR = 0.96, 95% CI = 0.95–0.97). Thirdly, codeine opioid use was negatively associated with age (lowest odds at ages 15–24, OR = 0.41, 95% CI = 0.38–0.43; highest odds at ages 55–64, OR = 1.19, 95% CI = 1.16–1.22 in 2009–16). Fourthly, once we adjusted the individual-level background characteristics and region and time fixed effects, the municipal-level unemployment rate was no longer significantly associated with opioid use in any of the four models.

DISCUSSION

The present study, using nation-wide population-based data from Finland, shows that prescription opioid use was most common among people aged 55–64 years or those who had parents with low SES. Non-codeine opioid use was more common among those people who were outside the labour force compared to the employed, whereas the opposite was found for codeine use. These findings indicate that there are socio-economic differences between non-codeine and codeine opioid use. The area-level unemployment rate was positively correlated with the share of opioid users at the municipal level.

These patterns are in accordance with analyses from the United States and United Kingdom, where the use of opioids is much higher in more socio-economically deprived areas [1,9,11], and with a Swedish study

Table 2 The association between background characteristics and prescription opioid use.

	1995–2007, any opioid	2009–16, any opioid	2009–16, codeine	2009–16, non-codeine opioids
	(1) OR (95% CI)	*(2) OR (95% CI)*	*(3) OR (95% CI)*	*(4) OR (95% CI)*
Demographic variables				
15–24 years	0.15 (0.14–0.16)	0.35 (0.32–0.38)	0.41 (0.38–0.43)	0.16 (0.15–0.17)
25–34 years	0.62 (0.61–0.64)	0.77 (0.76–0.78)	0.80 (0.79–0.81)	0.64 (0.62–0.66)
35–44 years	Ref	Ref	Ref	Ref
45–54 years	1.29 (1.25–1.32)	1.15 (1.13–1.16)	1.12 (1.10–1.13)	1.23 (1.20–1.26)
55–64 years	1.14 (1.03–1.26)	1.21 (1.17–1.25)	1.19 (1.16–1.22)	1.19 (1.12–1.27)
Male	1.08 (1.03–1.13)	0.91 (0.89–0.92)	0.87 (0.86–0.89)	1.02 (1.00–1.04)
Female	Ref	Ref	Ref	Ref
Marital status				
Married	1.01 (0.97–1.07)	1.02 (1.01–1.03)	1.02 (1.01–1.04)	1.02 (1.00–1.04)
Not married	Ref	Ref	Ref	Ref
Employment status				
Working	Ref	Ref	Ref	Ref
Unemployed	1.16 (1.09–1.23)	1.01 (0.99–1.02)	0.94 (0.92–0.95)	1.34 (1.31–1.37)
Outside labour force	2.22 (2.10–2.36)	1.17 (1.11–1.23)	0.98 (0.94–1.03)	2.16 (2.06–2.27)
Highest education				
Only compulsory education	Ref	Ref	Ref	Ref
Vocational upper secondary	1.00 (0.98–1.02)	1.04 (1.03–1.04)	1.04 (1.03–1.05)	0.97 (0.96–0.99)
High school	0.68 (0.66–0.70)	0.82 (0.79–0.84)	0.84 (0.82–0.87)	0.66 (0.63–0.69)
Tertiary	0.68 (0.64–0.73)	0.71 (0.70–0.73)	0.73 (0.72–0.74)	0.61 (0.60–0.63)
Parents' highest education				
Missing parental information	1.08 (1.00–1.15)	0.67 (0.63–0.71)	0.67 (0.63–0.71)	0.65 (0.60–0.70)
Only compulsory education	Ref	Ref	Ref	Ref
Vocational upper secondary	0.99 (0.98–1.00)	1.04 (1.03–1.04)	1.03 (1.03–1.04)	1.05 (1.04–1.07)
High school or more	0.87 (0.85–0.89)	0.95 (0.94–0.95)	0.96 (0.95–0.97)	0.90 (0.88–0.92)
Area-level measure				
Municipal-level unemployment rate	1.07 (0.67–1.73)	1.23 (0.71–2.14)	1.34 (0.75–2.38)	0.97 (0.47–2.00)
Number of people	4 315 409	4 116 992	4 108 510	4 092 048
Number of person-year observations	45 124 593	28 059 740	27 656 333	26 551 859

Ref = reference group; OR = odds ratio; CI = confidence interval, which is based on standard errors that have been clustered at the municipality level; results are based on logistic regression models that account for region fixed effects (20 regions) and year fixed effects.

demonstrating socio-economic differences in opioid use [12]. Women have been reported to use more opioids in the United States [14], which is in accordance with our finding that codeine use was more common among women. Although an increase in opioid use in Europe has also been shown [4,5], our results are in line with other Scandinavian countries where the use of opioids has remained somewhat stable or even decreased in the 2010s [6–8]. To the best of our knowledge, the present study is the first to show how socio-economic factors are partially differently related to codeine and non-codeine opioid use in a Scandinavian country.

Limitations

The main limitation of the present study is that the administrative data included filled prescriptions that were purchased from Finnish pharmacies and were covered by NHI. Thus, the present results did not cover all instances of opioid use. In particular, we did not assess illicit opioid use. Secondly, we used information on filled prescriptions, but there is a possibility that some patients may not consume their medication as implied by filled prescriptions. Thirdly, adults older than 64 years were not included in the present study. Thus, the present results are not generalizable to older adults. Recent reports from the United States have demonstrated high opioid use among older adults [3]. It remains

unclear whether the situation is similar in Finland. Fourthly, our register data do not contain information on cancer or non-cancer pain, which probably affects opioid use.

CONCLUSIONS

In Finland, prescription opioid use increased from 1995 to 2016, but the increase was explained by the change in the treatment of codeine-based opioids in NHI. Prescription opioid use was more common among low socio-economic status people. Thus, opioid use in Finland resembles the patterns in the United States and United Kingdom, with a concentration of use in socio-economically disadvantaged groups. These patterns prevail, despite the fact that the United States and United Kingdom have different health care systems from that in Finland.

Declaration of interests

None.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Figure S1 The share of people with opioid prescriptions annually in 1995–2016. Sample: Working-age population aged between 15 and 64 years. Notes: Dashed line indicates the share of population using codeine-based medicines, and dotted line indicates the share of population using non-codeine opioids during the given year. Solid line indicates the share of population using any opioids during the given year.

Figure S2 The share of people with opioid prescriptions by municipality in 2016. Notes: Population aged between 15 and 64 years. Data are shown in eight intervals.

Figure S3 The share of people with opioid prescriptions by municipality and the unemployment rate by municipality in 2016. Notes: Pearson's correlation coefficient $r = 0.36$ ($P < 0.001$). The corresponding correlation coefficient for codeine use is 0.29 ($P < 0.001$) and for non-codeine opioid use 0.34 ($P < 0.001$), respectively.