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Effects of 'doctor shopping' behaviour on prescription of addictive drugs in Sweden

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ABSTRACT

Free choice of health care providers is aimed to improve the quality of health care by increasing both access to it and the competition between providers. However, it may also give patients possibilities for doctor shopping (DS) behaviour, i.e., visiting different providers to receive illicit drug prescriptions. Abuse of prescribed addictive drugs is a growing problem worldwide and is associated with increased mortality, lower quality of life and other problems on both the individual and societal level. We study DS behaviour for three categories of addictive drugs – opioid painkillers, benzodiazepine anxiolytics, and z-hypnotic sleeping drugs, in the outpatient care sector in Västerbotten County, Sweden. Our dataset contains all drug prescriptions purchased by the residents of Västerbotten in the period from January 2014 to April 2016 (approximately 160,000 observations). To identify signs of addictive prescription drugs abuse by DS, we analyse overlapping prescriptions. We use 'Defined Daily Doses' (DDDs), which is the average treatment dose of a specific drug per day for adults, as a proxy for the treatment duration. To control for medically legitimate overlaps, we compare overlapping prescriptions within a clinic with overlapping prescriptions between different clinics. Our empirical results suggest that there is a significant and positive relationship between the number of overlapping doses and the number of unique providers in the overlap. More specifically, we find that visiting different providers on average gives patients up to three additional DDDs per day. This is three times higher than the standard treatment dose. We discuss policy implications in the concluding discussion.

1. Introduction

Addictive drugs are used to treat various health conditions, e.g. pain, sleeping disorder, panic, stress, anxiety and attention deficit disorder. Abuse of such drugs is a growing problem for both developed and developing countries and may be associated with job loss, lower productivity, reduced life quality and life expectancy, risky behaviour, domestic violence and crime (Bhatt, 1998; Rudd et al., 2016; UNODC, 2010). People misuse and become addicted to drugs for several reasons. For example, inadequate knowledge may lead people to believe that medically prescribed drugs are safer and less addictive than drugs acquired on the street (Abraham et al., 2021). Moreover, patients may self-increase the dose prescribed by a doctor or start medication by using left-overs from previous prescriptions. They may also share their drugs with others or even sell them (Garnier et al., 2010).

It may be challenging to detect misuse of prescription drugs and to prevent it. One way of doing this is based on the analysis of prescription register data. The aim of such analysis is to identify 'doctor shopping' (DS) behaviour. The definition of DS varies among studies and health care settings, but generally, it refers to visiting multiple health care providers to get more help or prescriptions of drugs during a specific illness episode (Sansone and Sansone, 2012). This is a type of behaviour that patients with the demand for addictive drugs are likely to be involved in. Even though DS most often refers to addictive drugs, this phenomenon is also observed for other conditions and drug types. For example, Wang and Lin (2010) defined DS as visiting multiple providers during a single treatment episode and found the DS rate to be 6.3 per cent for patients with upper respiratory infections. In a Canadian study by Macpherson et al. (2001), the DS (visiting at least three providers) rate was estimated as 18 per cent for children with various acute symptoms.

The level of DS is closely related to the structure of the health care market. One reason for this is that the health care market is characterised by both incomplete and asymmetrically distributed information. Patients often have incomplete information about the addictiveness and the effectiveness of drugs, while doctors may find it difficult to

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understand how addicted the patient is or how severe the associated condition (e.g., pain, anxiety or sleeping disorder) is. This means that patients can use DS as a strategy to get more drugs to satisfy an addiction, but also that there is a risk that uninformed patients become addicted if they use DS as a strategy to get more help. Another important issue is the moral hazard, which arises when a patient's expenses are covered by insurance (public or private). When the competition between providers is high, and their income depends on the number of visits and registered patients, providers may be willing to comply with patients' demand for drugs. Moreover, when the choice of provider is unrestricted, and there is no gatekeeping function of primary care, it is easier for patients to get involved in DS. All the problems mentioned above are exacerbated when physicians have incomplete information about the patient's prescription history or when acquiring such information is costly.

In order to find better incentives aimed to limit drug abuse by DS, it is important to study DS in different market settings. Most previous studies on DS and misuse of addictive drugs on prescription register data are from the US and focus on estimating the frequency of DS (Cepeda et al., 2012, 2013a; McDonald and Carlson, 2013; Simeone, 2017). A few studies have also been done in France (Soeiro et al., 2020, 2021), Australia (Adewumi et al., 2020) and Norway (Winther and Bramness, 2009). These studies have contributed with important insights on DS behaviour. For example, according to one of the studies on the US data (Cepeda et al., 2013a), 0.3% of subjects exposed to opioids exhibited DS behaviour. In other studies from the US, it was found that the risk of DS was higher for oxycodone than tapentadol (which has lower abuse potential) (Cepeda et al., 2013b) and that shoppers had longer travel distances and higher opioid consumption rates compared to nonshoppers (Cepeda et al., 2013c, 2015; Schneberk et al., 2020) [18–20]. The studies on French data (Soeiro et al., 2020, 2021) focused on single drug consumption and characterised shoppers by their socio-demographic characteristics. For example, they found that the number of shoppers for oxycodone has increased by 197% from 2010 to 2016 (Soeiro et al., 2021) and that subjects with heavy DS behaviour for methylphenidate were significantly older than subjects with light DS behaviour (Soeiro et al., 2020). The study from Australia (Adewumi et al., 2020) found that patients with higher opioid consumption are more likely to visit several prescribers during a certain period of time. The Norwegian study (Winther and Bramness, 2009) compared addictive to non-addictive drugs users and found that the latter use multiple providers less frequently.

In this study, we measure the relationship between DS behaviour and the amount of addictive drugs consumed by patients using data on outpatient prescriptions from Västerbotten County, Sweden. Our analysis is based on the three most significant categories of addictive drugs by their treatment indication: opioid painkillers, benzodiazepine anxiolytics, and z-hypnotic sleeping drugs. Most previous research on the relationship between DS and drug use to a large extent rely on the use of descriptive statistics to identify individuals with signs of DS behaviour in order to find the frequency of DS (Cepeda et al., 2012, 2013b; Simeone, 2017; Soeiro et al., 2021; Winther and Bramness, 2009). We make use of the panel structure in the data and estimate multivariate regression models to measure the effect of the number of providers involved in DS and the amount of drugs used by shoppers, where we control for unobserved individual effects.

To the best of our knowledge, there is only one study by Schneberk et al. (2020) using a similar approach. This study found that shoppers had higher aggregated opioid consumption than nonshoppers. However, nonshoppers may systematically differ from shoppers due to less severe diseases/conditions and hence have lower demand for drugs and, by default, lower consumption level. To solve this problem, Schneberk et al. (2020) used a sub-sample of patients with consumption above a certain level in the group of nonshoppers. However, there are no formal criteria for choosing this level. As a consequence, the selection can create a bias which leads to inaccurate and misleading estimations. Moreover, Schneberk et al. (2020) do not make full use of the information in register data and define DS as having prescriptions from different providers during a certain period. However, visiting different providers to get a prescription of addictive drugs is not necessarily a sign of drug abuse and may be legitimate, e.g. if a permanent prescriber is currently unavailable. The use of prescription databases allows, to some extent, distinguishing between the legitimate use of drugs from DS. To do this, we base our study on identifying overlapping prescriptions in the data. This approach can identify if drugs supplied by different prescribers have been consumed simultaneously. Usually, having overlapping prescriptions from at least two different prescribers is considered to be a sign of DS behaviour (Lu et al., 2015).

A common problem for studies using register data on prescriptions is that these registers rarely include information about the intended treatment duration or the length of the supply period for a specific prescription. This makes it difficult to identify overlapping prescriptions. To overcome this problem, researchers have to make assumptions about a prescription length based on the type and amount of drug as well as on treatment guidelines (Pottegård et al., 2017). The most used (Sinnott et al., 2016) and preferred (Merlo et al., 1996) proxy for treatment duration is based on the number of defined daily doses (DDDs).

The DDD has been established in order to compare the consumption of different drugs from the same therapeutic class and is an average maintenance dose for adults when used for the main indication of the drug (WHO, 2021). However, the use of DDDs to calculate treatment duration has limitations. For example, according to Nielsen et al. (2017), DDD does not accurately reflect the actual consumption of opioids in the treatment of chronic pain. The use of DDDs may be especially problematic when there is a high variation in diagnoses, weight, type of drug used, and other individual patient-prescriber characteristics. This may result in an inaccurate estimation of the overlaps. Moreover, some overlaps may occur when a patient changes provider or visits a new provider to renew a prescription a few days prior to the expiration of the old one given by a temporary unavailable permanent prescriber. Therefore, even when prescriptions from different providers overlap, this overlap may be medically legitimate. To overcome this problem, we focus solely on episodes when an overlap occurred and test if individuals with overlapping prescriptions from different providers have access to more addictive drugs than individuals with overlapping prescriptions from the same provider.

Thus, the main difference of our study from previous research is that we do not give patients initial attributes based on their participation in DS (which may be inaccurately defined) but attempt to distinguish between legitimate use of drugs and DS. We analyse only events when an overlap happened, which allows us to exclude cases when patients consume drugs sporadically and in low or standard doses. Moreover, we analyse the effect of DS on drug consumption at every single day of the overlap, rather than on aggregated consumption level.

Another important contribution of our study is that we analyse all types of drugs within a given drug category (by treatment indication) together. According to medical guidelines (Handal et al., 2012; Helsedirektoratet, 2021), different types of drugs within a given category (opioid painkillers, benzodiazepine anxiolytics, and z-hypnotic sleeping drugs) should not be used together. However, overlaps between different drugs do occur. In some cases, overlaps within a drug category can indicate legitimate use, e.g. if one type of opioid has been substituted by another in a treatment regimen. However, within-category overlaps can also indicate drug abuse. All previous studies analyse DS behaviour mainly for a single drug. Our approach allows us to retrieve more information that may indicate drug abuse.

Finally, Sweden represents an interesting case itself. All prescriptions of addictive drugs purchased by patients are included in the data, while, for example, in the US, there is no universal electronic registration system and mandatory registration of prescriptions, and where many physicians are unwilling to spend extra time and effort checking the history of drug overuse by a patient (Alogaili et al., 2020). No studies with similar methodology and research question have been done for the countries with health care settings similar to the Swedish. On the one hand, it is a relatively regulated health market in terms of rules for drug prescriptions and health care services. On the other hand, the Swedish health care market is relatively liberal because patients can freely choose and switch between different healthcare providers.

2. The Swedish health care setting

In Sweden, patients can get prescriptions for addictive drugs via three channels in the outpatient care sector: primary care, outpatient specialist care and after-hours care (Mossialos et al., 2020).

The primary care sector is coordinated on the municipal level and is provided by health care centres. These centres are team-based practices, including general practitioners (GPs), nurses, gynaecologists, midwives, psychologists, social workers, and physiotherapists (Anell et al., 2012). On average, there are 4–5 GPs in a primary care centre (Mossialos et al., 2020). GPs are paid a salary that depends on the region, provider, experience and professional abilities (Sánchez-Sagrado, 2016). Centres are reimbursed with a mixture of capitation (60–95%), fee-for-service (5%–38%) and performance-based payments (0–3%) (Mossialos et al., 2020).

The Swedish primary care market is relatively competitive (Mossialos et al., 2020). Although all primary health care centres are publicly funded, they can be both publicly and privately owned. Patients are free to choose their primary care provider and can change it as often as they want. There is no registration required in order to visit a specific provider (1177 Vårdguiden, 2021a). Patients register with a specific centre rather than a GP, and the centres should accept all new patients but may pose temporary restrictions on their number. There is no regulation prohibiting medical practitioners from having a private practice outside the primary care centre or public hospitals (for those who are specialists) unless the employer has established such rules (Mossialos et al., 2020).

All Swedish residents are covered by mandatory and uniform health insurance, which includes pharmaceutical insurance. Those who are over 20 have to pay a consultation fee (co-payment) which is about €20 in Västerbotten (1177 Vårdguiden, 2021b). Patients are required to cover parts of their health care costs up to a limit of out-pocket payments, which is about €115 for outpatient care (1177 Vårdguiden, 2021c) and €200 for prescribed medications (1177 Vårdguiden, 2021d) in Västerbotten per year. After the limit has been reached, all further costs are covered by the health insurance with some exceptions. For example, specific drugs may not be included in the benefit scheme, while some drugs may always be free of charge for the patient (Ministry of Health and Social Affairs, 2002).

GPs are usually the first point of contact, but they do not have a formal gatekeeping function. Patients may visit outpatient specialist care without any referral and are free to choose a specialist. These departments are usually located at the hospitals, and the physicians are salaried. To limit overuse of outpatient specialist care, patients have to pay a fee that is three times higher than for visiting a GP at a health care centre. However, this rule is valid only until a patient has reached the annual limit of out-pocket payments (Mossialos et al., 2020). Specialist care visits with the referral from a GP are free of charge.

After-hours care is provided by primary care providers. Primary care centres collaborate with each other in order to organise such services. The co-payment rate for such consultations is the same as for visits to primary care centres during regular hours. To reduce the load on emergency care in hospitals, urgent care centres may be open during the day time as well (Mossialos et al., 2020).

Electronic records about prescriptions are held in both inpatient and outpatient care, and medical practitioners may see the prescriptions made by other prescribers (Mossialos et al., 2020). The electronic registration of all prescriptions is unified and mandatory all over the country. The doctor who prescribes addictive drugs must carefully examine whether the patient already has a prescription for these drugs. If the patient does not allow access to this information, the new prescription should not be given (Region Västerbotten, 2021). The risk of dependence in an individual patient must be assessed before starting treatment and the doctor who initiates a treatment must ensure that a treatment plan exists and is followed. Moreover, the doctor who prescribes addictive drugs should pay special attention to the size of the pack and the recommended duration of treatment (Heilig and Håkansson, 2017).

Table 1
Classification of the drugs included in the analysis.

Drug category by treatment indication	ATC (Anatomical Therapeutic Chemical) classification
Opioid painkillers	Opioids, N02A (all, excluding Oripavine derivatives, N02AE and Diphenylpropylamide derivatives, N02AC)
Z-hypnotic sleeping drugs	Hypnotics and sedatives, N05C (Benzodiazepine related drugs, N05CF)
Benzodiazepine anxiolytics	Anxiolytics, N05B (Benzodiazepine derivatives, N05BA)

3. Methods

3.1. Data

We use data about prescriptions made by Swedish health care providers to the residents of Västerbotten County from August 2012, purchased by them in Swedish pharmacies and billed in a period from January 2014 to April 2016. The dataset consists of approximately 160 thousand observations. Prescriptions made at the inpatient setting of hospitals and nursing homes are not included in the data (National Board of Health and Welfare, 2021). Each line in the data contains information about the date of prescription and purchase, ID and name of the prescriber's workplace (at the department level for outpatient specialist care within hospitals), and ID of the patient (anonymised), age, gender. Finally, we have information about the prescribed drug, such as the Anatomical Therapeutic Chemical (ATC) classification code and the number of DDDs prescribed. The data does not contain information on the dispensing pharmacy or information about diagnoses.

In the data about prescriptions, we have removed prescriptions without ATC code and prescriptions without patient ID. We have created three datasets according to the category of addictive drug by its treatment indication and according to the ATC code. Table 1 presents addictive drugs used in outpatient care in Sweden, which we have taken to the analysis divided by their medical indication, such as opioid painkillers, z-hypnotic sleeping drugs and benzodiazepine anxiolytics. Further, in the text we will use the names of the drug categories shortened to painkillers, sleeping drugs and anxiolytics.

3.2. Calculation of the overlaps

We identify the overlaps between prescriptions in the following steps. First, we use the date of purchase in combination with the number of DDDs in a prescription to calculate the periods of consumption/supply for each prescription. We thereafter create a panel dataset for each drug category, where each observation represents one day of supply of a specific drug by ATC5 (refers to the last level of the ATC classification, where the ATC code contains 7 digits) for a single patient and single clinic. For each day of supply, the number of DDDs given by one prescription is 1. In the third step, we aggregate the data over each consumption day for each patient to calculate the total number of DDDs and the number of unique providers in an overlap. We combine this data with patient information, such as gender, age and municipality. We also include information about the number of unique drug types according to the ATC5 code for each consumption day because patients might

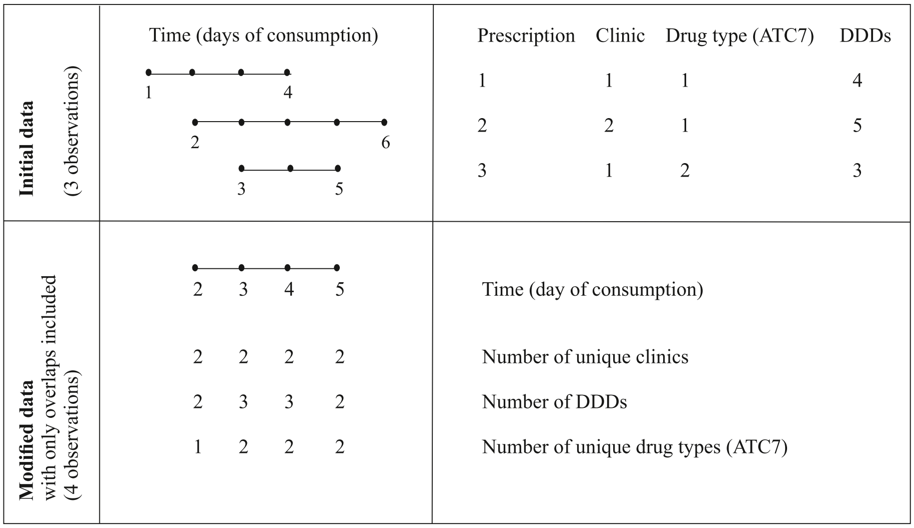

Fig. 1. Calculation of the overlaps (example). Three prescriptions (1, 2, and 3) for the same individual from the initial dataset have purchase dates 1, 2 and 3, respectively. Given the number of DDDs prescribed (4, 5 and 3, respectively), the consumption period has been calculated for each of the prescriptions, such that the end of consumption dates are equal to and 4, 6 and 5, for prescriptions 1, 2 and 3, respectively. The modified dataset consists of information about four days of consumption (2, 3, 4 and 5) – days when at least two prescriptions overlap.

consume different types of drugs in each category from Table 1 simultaneously or switch drugs in time. These drugs types are presented further in the descriptive statistics. This procedure gives us three datasets: 1) painkillers, 2) anxiolytics, and 3) sleeping drugs. Each dataset only contains days with overlaps between different prescriptions (DDDs >1). The illustration of the overlaps and an example of data modifications are presented in Fig. 1.

It should be noted that some of the prescriptions in the original dataset (prescriptions of a single drug (based on ATC5) made on the same day in the same clinic for the same patient) are represented by several transactions. These repeated transactions constitute 4.7%, 1.5% and 0.2% of all observations for painkillers, anxiolytics and sleeping drugs, respectively, and might happen due to, e.g. different formulations prescribed, brand names of the purchased packages, prices or co-payment rates. However, according to the personal communication with GPs in Västerbotten, this is unlikely to happen due to visiting multiple prescribers in the same clinic. We treat such repeated observations as one and use the sum of the DDDs to calculate the length of the prescription.

Table 2
Incidence of doctor shopping behaviour.

	(1) Number of subjects exposed to the drug			(2) Number (%) of subjects with doctor shopping behaviour[4]			(3) Percentage of days with doctor shopping behaviour for shoppers		
	P[1]	A[2]	S[3]	P	A	S	P	A	S
Total	20,473	4503	14,586	777 (3.8)	94 (2.09)	623 (4.27)	7.93	14.30	10.59
Gender									
Men	9207	1684	5126	361 (3.9)	43 (2.6)	266 (5.2)	8.16	12.10	8.16
Women	11,266	2819	9460	416 (3.7)	51 (1.8)	357 (3.8)	7.74	16.80	7.74
Age									
<18	220	82	35	1 (0.45)	1 (1.22)	1 (2.86)	15.20	6.94	15.20
18-25	1349	177	563	21 (1.56)	4 (2.26)	13 (2.31)	6.04	11.00	6.04
26-35	1941	358	1141	71 (3.36)	11 (3.07)	29 (2.54)	6.88	27.40	6.88
36-45	2371	416	1459	83 (3.50)	10 (2.40)	58 (3.98)	5.02	13.60	5.02
46-55	3319	541	2067	130 (3.92)	15 (2.77)	81 (3.92)	7.87	19.40	7.87
56-65	3698	674	2714	145 (3.92)	11 (1.63)	130 (4.79)	8.25	11.60	8.25
66-75	3846	857	3289	174 (4.52)	20 (2.23)	173 (5.26)	9.19	7.93	9.19
76-85	2910	926	3040	115 (3.95)	14 (1.51)	114 (3.75)	9.96	12.30	9.96
86+	1583	656	1477	50 (3.16)	8 (1.22)	32 (2.17)	4.70	13.40	4.70
Municipality									
Nordmaling	654	119	427	31 (4.74)	4 (3.36)	13 (3.04)	7.02	15.30	7.02
Bjurholm	214	63	153	9 (4.21)	1 (1.59)	9 (5.88)	8.41	14.30	8.41
Vindeln	480	104	404	17 (3.54)	4 (3.85)	17 (4.21)	8.55	7.88	8.55
Robertsfors	595	90	377	21 (3.53)	0 (0.00)	13 (3.45)	9.30	–	9.30
Norsjö	360	90	255	12 (3.33)	1 (1.11)	8 (3.14)	7.25	12.90	7.25
Malå	400	67	234	18 (4.50)	1 (1.49)	11 (4.70)	6.62	2.87	6.62
Storuman	689	128	319	32 (4.64)	5 (3.91)	15 (4.70)	7.29	23.80	7.29
Sorsele	340	75	204	11 (3.24)	3 (4.00)	10 (4.90)	7.43	25.80	7.43
Vilhelmina	739	181	431	28 (3.79)	3 (1.66)	20 (4.64)	9.01	29.30	9.01
Dorotea	300	71	153	15 (5.00)	1 (1.41)	6 (3.92)	9.95	5.88	9.95
Vännäs	700	111	425	23 (3.29)	0 (0.00)	14 (3.29)	7.15	–	7.15
Åsele	285	81	171	16 (5.61)	2 (2.47)	2 (1.17)	4.13	1.96	4.13
Umeå	7652	1805	6230	261 (3.41)	41 (2.27)	283 (4.54)	6.65	8.43	6.65
Lycksele	1282	289	689	56 (4.37)	4 (1.38)	24 (3.48)	9.19	28.50	9.19
Skellefteå	5876	1253	4209	229 (3.90)	24 (1.92)	178 (4.23)	9.36	18.40	9.36

Notes: 1 – P refers to painkillers, 2 – A refers to anxiolytics, 3 – S refers to sleeping drugs. 4 – doctor shopping behaviour is defined as having overlapping prescriptions from at least two different prescribers.

Table 3
Drugs used by shoppers and non-shoppers.

Drug (ATC5)	(1) Number of subjects exposed to the drug	(2) Number (%) of subjects exposed[1] to the drug with doctor shopping behaviour[2] observed	(3) Number (%) of subjects exposed[3] to the drug with the overlapping prescriptions from the same prescriber
Painkillers	20,473	456 (2.23)	1316 (6.43)
Ketobemidone (N02AB01)	76	0 (0.00)	2 (2.63)
Fentanyl (N02AB03)	929	55 (5.92)	254 (27.34)
Morphine (N02AA01)	1841	30 (1.63)	117 (6.36)
Morphine + antispasmodics (N02AG01)	111	0 (0.00)	1 (0.90)
Tramadol (N02AX02)	7060	104 (1.47)	463 (6.56)
Tapentadol (N02AX06)	10	0 (0.00)	0 (0.00)
Oxycodone (N02AA05)	7561	225 (2.98)	383 (5.07)
Oxycodone + naloxone (N02AA55)	105	3 (2.86)	8 (7.62)
Codeine (N02AA59)	6164	90 (1.46)	380 (6.16)
Anxyolitics	4503	40 (0.89)	271 (6.02)
Diazepam (N05BA01)	876	10 (1.14)	64 (7.31)
Oxazepam (N05BA04)	3142	16 (0.51)	80 (2.55)
Lorazepam (N05BA06)	131	2 (1.53)	9 (6.87)
Alprazolam (N05BA12)	564	16 (2.84)	139 (24.65)
Sleeping drugs	14,586	272 (1.86)	1317 (9.03)
Zopiklon (N05CF01)	8551	122 (1.43)	659 (7.71)
Zolpidem (N05CF02)	6952	162 (2.33)	737 (10.60)

Notes: 1 – exposure during doctor shopping; 2 – doctor shopping behaviour is defined as having overlapping prescriptions from at least two different prescribers; 3 – exposure during the overlap between prescriptions from the same prescriber.

3.3. Empirical specification

Our aim is to test if DS behaviour is associated with drug misuse, i.e. if overlapping prescriptions to the same person from different health prescribers result in a higher number of DDDs than overlaps within one prescriber. To do this, we estimate a model where we regress the number of unique prescribers (starting from one) in an overlap on the number of DDDs consumed on a single day. We carry out our analysis on each drug category separately. Since the number of DDDs consumed may vary systematically with age and gender, we include controls for these characteristics. We also include patient municipality in the model because the choice of and access to health care providers may depend on patient location. To control for potential differences between different types of drugs (by ATC5) within a drug category and other non-observable confounders, we estimate the model using individual-specific effects and year fixed effects. In addition, to deal with the fact that some drugs within a category (according to their treatment indication) may be used simultaneously, we include the number of unique drugs by ATC5 in the overlap as an explanatory variable. Our estimation model is represented by equation (1).

$$DDDs_i = F(\alpha + \sum_{n=2}^{N} \gamma_n Number\ of\ unique\ prescribers\ involved_{ni} + \sum_{l=2}^{L} \delta_l Number\ of\ unique\ drugs\ by\ ATC5_{li} + \beta_1 Age_i + \beta_2 Age^2{}_i + \beta_3 Women_i + \sum_{m=2}^{15} \theta_m Municipality_{mi} + \sum_{y=2}^{3} \mu_y Year_{yi} + \varepsilon_i). \quad (1)$$

4. Results

4.1. Descriptive statistics

We present the incidence of DS, measured as the frequency of overlaps caused by multiple prescribers (more than one), in Table 2.

As can be seen in the table, shoppers constitute between 2 and 4 per cent of people exposed to addictive drugs, depending on the drug category (first row, panel 2). More women than men consume addictive drugs, but a lower share of these women are shoppers in comparison to men. The number of subjects using addictive drugs increases with age up to a certain limit from 66 to 85 (depending on the drug category) and thereafter decreases. The number of shoppers displays a similar pattern. However, the age pattern for the share of individuals with DS behaviour is less clear. For individuals using anxiolytics, DS is most common among relatively young people (age group from 26 to 35). The incidence of DS varies across municipalities. However, these differences do not appear to be systematically related to how urban or rural the municipality is or the number of providers in a municipality.

Table 3 shows the types of drugs by ATC5 classification present in the data and the incidence of their use. Oxycodone and Tramadol are the most prescribed painkillers in the general population and among shoppers, while Ketobemidone and Tapentadol are rarely used. However, strong opioids such as Fentanyl and Oxycodone are more frequently associated with DS compared to weak opioids such as Tramadol and Codeine (column 2).

For anxiolytics drugs, Table 3 shows that Diazepam and Oxazepam are most used in the general population, while Alprazolam and Lorazepam, which have the highest abuse potential (Schmitz, 2016), are to a greater extent associated with DS. Column 2 and 3 show the numbers and percentage of patients who have overlaps between prescriptions. As shown in the two columns, it is more common to have overlapping prescriptions from the same provider (column 3) than to have overlapping prescriptions from different providers (column 2), regardless of the prescribed drug. Although the distribution of drugs is not identical between shoppers and patients with overlapping prescriptions from the same provider, there does not appear to be a systematic difference in the type of drugs used.

In Table 4, we present the descriptive statistics for datasets 1, 2 and 3. As shown in the table, the mean number of overlapping DDDs in our data is 2.33 for painkillers, 2.79 for anxiolytics, and 2.2 for sleeping drugs (panel 3). The mean number of overlapping doses grows with the number of unique drugs in the overlap for painkillers and sleeping drugs. The maximum number of overlapping DDDs are 15, 14, and 12 for painkillers, anxiolytics and sleeping drugs, respectively (panel 4). Patients may have up to four unique prescribers in an overlap. There appears to be a positive correlation between the number of unique prescribers and the mean number of overlapping DDDs. Overlaps between prescriptions from the same prescriber constitute a majority of observations, and the number of overlapping days decreases significantly with the number of providers involved. Most patients consume just one type of drug at a specific point in time. Simultaneous consumption of different types of drugs within a drug category constitutes

Table 4
Descriptive statistics for datasets 1, 2 and 3.

	(1) Number of observations			(2) Min number of DDDs per day with the overlap			(3) Mean (SD) number of DDDs per day with the overlap			(4) Max number of DDDs per day with the overlap		
	P[1]	A[2]	S[3]	P	A	S	P	A	S	P	A	S
Total	146,091	72,205	296,211	2	2	2	2.33 (0.81)	2.79 (1.40)	2.20 (0.61)	15	14	12
Gender												
Men	66,329	33,075	113,450	2	2	2	2.31 (0.72)	2.84 (1.42)	2.16 (0.45)	9	12	7
Women	79,699	39,130	182,761	2	2	2	2.34 (0.89)	2.76 (1.39)	2.22 (0.70)	15	14	12
Age												
<18	20	36	98	2	2	2	2.00 (0.00)	2.00 (0.00)	2.00 (0.00)	2	2	2
18-25	1308	1857	3950	2	2	2	2.12 (0.38)	2.55 (0.62)	2.16 (0.50)	5	4	5
26-35	7616	9979	15,482	2	2	2	2.22 (0.56)	2.97 (1.45)	2.38 (0.89)	10	10	8
36-45	22,349	10,520	22,841	2	2	2	2.44 (0.83)	3.02 (1.56)	2.23 (0.85)	8	10	12
46-55	32,558	14,874	42,422	2	2	2	2.45 (1.17)	2.70 (1.20)	2.21 (0.62)	15	12	12
56-65	30,950	15,713	67,835	2	2	2	2.29 (0.65)	2.79 (1.61)	2.20 (0.61)	7	14	8
66-75	26,791	11,673	69,350	2	2	2	2.25 (0.65)	2.94 (1.51)	2.19 (0.56)	9	10	8
76-85	15,434	6016	51,082	2	2	2	2.23 (0.58)	2.29 (0.72)	2.10 (0.34)	7	6	5
86+	9065	1537	23,151	2	2	2	2.25 (0.58)	2.15 (0.36)	2.25 (0.719)	5	4	9
Municipality												
Nordmaling	3914	2060	10,723	2	2	2	2.15 (0.42)	2.40 (0.83)	2.14 (0.42)	6	7	6
Bjurholm	703	260	1951	2	2	2	2.07 (0.26)	2.00 (0.00)	2.01 (0.10)	4	2	3
Vindeln	1918	1595	8795	2	2	2	2.09 (0.31)	2.82 (1.04)	2.13 (0.40)	4	7	4
Robertsfors	3376	410	7200	2	2	2	2.18 (0.52)	2.02 (0.15)	2.15 (0.40)	6	3	4
Norsjö	3601	171	4657	2	2	2	2.27 (0.65)	2.00 (0.00)	2.11 (0.58)	6	2	7
Malå	4272	103	3113	2	2	2	2.14 (0.41)	2.00 (0.00)	2.06 (0.25)	5	2	4
Storuman	8221	1607	5251	2	2	2	2.34 (0.71)	3.31 (2.34)	2.20 (0.47)	6	12	5
Sorsele	1979	484	3457	2	2	2	2.24 (0.57)	2.66 (1.00)	2.06 (0.25)	5	5	3
Vilhelmina	6177	2586	10,318	2	2	2	2.21 (0.53)	3.05 (1.26)	2.09 (0.33)	6	7	5
Dorotea	2201	323	1911	2	2	2	2.44 (0.78)	2.07 (0.26)	2.12 (0.37)	6	3	4
Vännäs	3959	2621	7510	2	2	2	2.12 (0.25)	3.11 (1.96)	2.05 (0.21)	5	10	4
Åsele	3322	595	3085	2	2	2	2.80 (2.13)	2.39 (0.52)	2.25 (0.43)	14	4	3
Umeå	49,316	39,739	144,227	2	2	2	2.35 (0.86)	2.72 (1.38)	2.20 (0.60)	15	14	9
Lycksele	15,250	5685	14,042	2	2	2	2.58 (0.94)	3.38 (1.49)	2.37 (1.00)	10	9	8
Skellefteå	37,882	13,966	69,971	2	2	2	2.26 (0.66)	2.74 (1.27)	2.22 (0.72)	9	10	12
Number of unique drugs by ATC5												
1	131,714	69,712	282,441	2	2	2	2.29 (0.78)	2.80 (1.42)	2.19 (0.61)	15	14	12
2	14,256	2446	13,770	2	2	2	2.63 (0.99)	2.76 (1.02)	2.31 (0.65)	12	7	6
3	121	47	–	3	3	–	3.24 (0.48)	3.79 (0.95)	–	5	5	–
Nr of unique prescribers involved												
1	132,124	68,575	266,540	2	2	2	2.31 (0.79)	2.74 (1.34)	2.17 (0.56)	15	14	12
2	13,779	3510	28,511	2	2	2	2.48 (0.93)	2.71 (2.07)	2.41 (0.89)	9	12	8
3	174	120	1138	3	3	3	4.62 (1.39)	4.47 (1.24)	3.95 (0.90)	8	6	7
4	14	–	22	4	–	4	4.07 (0.27)	–	5.41 (0.59)	5	–	6

Notes: 1 – P refers to painkillers, 2 – A refers to anxiolytics, 3 – S refers to sleeping drugs.

about 5–11 per cent of the observations (panel 1).

The distribution of the overlapping DDDs varies slightly between gender, age and municipalities. Women, in general, have a slightly higher number of overlapping doses for all drug categories. Age groups 36–45 and 46–55 on average have more overlapping doses of painkillers than the general population, while for anxiolytics, these age groups 26–45 and 66–75. Age group 26–35 has the highest mean number of overlapping doses of sleeping drugs. This number for the age groups 36–55 and 86+ is also higher than average. Åsele, Lycksele and Storuman, which are all sparsely populated inland municipalities, have the highest mean number of overlapping DDDs for painkillers, anxiolytics and sleeping drugs, respectively. However, most of the overlapping consumption days occur in the most populated and urban municipalities, Umeå and Skellefteå.

4.2. Model estimation

We present the main results of our empirical analysis in Table 5. Column 1 presents the estimated coefficients and standard errors emanating from a Generalised Least Square (GLS) regression with random patient effects for painkillers. Column 2 and 3 present the corresponding results for anxiolytics and sleeping drugs, respectively. According to the Hausman test, a fixed-effects model is preferable to a random-effects approach. However, the results for time-variant explanatory variables are robust to the difference in the estimation method. Therefore, since the fixed-effect model does not estimate the effect of the time-invariant control variables, we only present the results for the random-effects model here. The estimation results for models with patient fixed effects and separate equations for men and women are available in the online appendix in Table A1 and Tables A2-A3, respectively.

Table 5 shows that the number of DDDs per day increases significantly with the number of unique prescribers involved in the overlap for all categories of addictive drugs. Overlaps in prescriptions from the same prescriber are associated with on average 1.31 (painkillers), 2.74 (anxiolytics) and 2.17 (sleeping drugs) DDDs per day, which are unconditional means calculated from the data. Having two providers involved in the overlap (compared to the overlap between prescriptions made by the same prescriber) is associated with an increase in DDDs by 0.242, 0.429 and 0.153 units for painkillers, anxiolytics and sleeping drugs, respectively, which corresponds to a percentage increase of 7%–18% depending on the drug category. A relatively small increase in the number of DDDs when two unique providers are involved in the overlap may sign that most of the overlaps with just one additional provider are legitimate and do not relate to DS.

However, if more than two unique prescribers are involved in the overlap, the differences are disproportionally higher. With three different providers, patients have access to about 1.197–1.593 more DDDs. When four different providers are involved, this number increases to 2.117 for painkillers and 2.868 for sleeping drugs (there are no cases

Table 5
Model (1) estimation results. GLS with random patient effects.

	Dependent variable:		
	DDDs		
	Painkillers (1)	Anxiolytics (2)	Sleeping drugs (3)
Number of unique prescribers involved			
2	0.242*** (0.007)	0.429*** (0.026)	0.153*** (0.004)
3	1.593*** (0.047)	1.197*** (0.097)	1.314*** (0.016)
4	2.117*** (0.161)		2.868*** (0.090)
Number of unique drugs by ATC5			
2	0.390*** (0.008)	0.225*** (0.031)	0.201*** (0.006)
3	1.300*** (0.064)	0.792*** (0.159)	
Age	−0.0004 (0.003)	−0.091*** (0.010)	0.003 (0.002)
Age²	−0.00001 (0.00003)	0.001*** (0.0001)	−0.00004** (0.00002)
Women	0.003 (0.021)	−0.127* (0.071)	0.011 (0.014)
Municipality			
Bjurholm	0.014 (0.132)	0.167 (0.388)	−0.095* (0.057)
Vindeln	0.026 (0.091)	0.261 (0.278)	0.012 (0.050)
Robertsfors	0.005 (0.083)	0.141 (0.325)	0.099** (0.050)
Norsjö	−0.108 (0.079)	0.050 (0.395)	0.089* (0.051)
Malå	0.195** (0.078)	−0.074 (0.451)	−0.002 (0.067)
Storuman	0.089 (0.069)	2.306*** (0.224)	0.007 (0.057)
Sorsele	0.091 (0.085)	0.298 (0.388)	0.013 (0.060)
Vilhelmina	0.087 (0.069)	0.066 (0.256)	0.017 (0.049)
Dorotea	0.050 (0.095)	−0.122 (0.333)	0.032 (0.081)
Vännäs	0.033 (0.072)	0.463* (0.273)	−0.003 (0.050)
Åsele	0.131 (0.085)	0.255 (0.343)	0.076 (0.079)
Umeå	0.013 (0.056)	0.203 (0.177)	0.017 (0.037)
Lycksele	0.132** (0.063)	−0.621*** (0.211)	0.032 (0.044)
Skellefteå	0.060 (0.057)	0.219 (0.191)	−0.002 (0.038)
Year			
2015	0.021*** (0.004)	0.159*** (0.010)	0.021*** (0.002)
2016	0.001 (0.006)	0.565*** (0.014)	0.061*** (0.003)
2017		−1.443*** (0.037)	
Constant	1.969*** (0.109)	4.658*** (0.332)	1.952*** (0.075)
Observations	146,091	72,205	296,211
R^2	0.115	0.080	0.110
Adjusted R^2	0.115	0.080	0.109
F Statistic	5885.604***	5380.405***	12,144.660***

Notes: *p < 0.1; **p < 0.05; ***p < 0.01; Numbers in parentheses are standard errors.

with four providers for anxiolytics). Thus, depending on the drug category, the increase in the number of DDDs corresponds to a percentage increase of 44%–122%, 132%–161% for two and three additional providers, respectively. However, according to Table 4, the number of overlapping events with more than two providers involved is relatively small for all drugs.

Similarly to the results above, the number of DDDs per day grows with the number of unique drugs by ATC5 in the overlap. Age does not appear to have a significant effect on the number of DDDs for painkillers and sleeping drugs. For anxiolytics, the number of DDDs increases slightly up to the age of 91 and decreases thereafter. The estimation results do not show any significant difference between men and women in the number of DDDs per day for painkillers and sleeping drugs.

5. Discussion and conclusions

Abuse of addictive prescription drugs is a growing problem worldwide. The structure of the health care market, such as the degree of competition, the way providers are compensated, and access to the free choice of provider, can facilitate drug abuse via increased possibilities for DS. Both informed and uninformed patients may engage in DS. Some patients may already be addicted, while others may seek help and be unaware of the effects of drugs and the consequences of consumption. If patients are free to choose their provider and if the providers are uninformed about patients' needs or addiction and have financial incentives to please patients, the problem of drug misuse by DS may be exaggerated.

This paper analyses DS in the Västerbotten County of Sweden for the time period 2014–2016. The main difference between our study and previous research is that we test the effects of DS on drug consumption by identifying overlapping prescriptions, which may be a sign of drug misuse. We identify overlaps between prescriptions from three major categories of addictive drugs (opioid pain-killers benzodiazepine anxiolytics, and z-hypnotic sleeping drugs) and test if the number of different providers affects the DDDs available to the patient. This approach allows us to, at least to some extent, differentiate between DS and medically legitimate overlaps.

To the best of our knowledge, this is the first study on prescription drug abuse in Sweden. Sweden is known for having a fairly regulated health care market. Most of the prescribers are salaried, while the choice of the provider is limited by the small number of providers. For example, most of the municipalities in Västerbotten have one or two primary care centres (with 4–5 GPs on average), while the largest municipality Umeå has 13. All drug prescriptions are monitored and registered electronically all over the country. However, potential DS events (overlapping prescriptions from at least two different providers) still occur. The share of people involved in such events was about 2–4 per cent, depending on the drug category. Although the prevalence of DS is relatively low, the results of our study show that the problem of DS for addictive drugs may still be relevant in this setting. Our estimation results suggest that the number of overlapping prescriptions grows with the number of unique prescribers in the overlap. Having different providers involved in the overlap may increase the number of DDDs by up to three units, which is three times higher than the standard treatment dose of one DDD in adults.

A common limitation for the studies on prescribed drug registers is that is it problematic to distinguish between drug abuse by DS and medically legitimate use. Our approach attempts to address this problem by comparing the overlaps where several prescribers are involved with overlaps between prescriptions by the same prescriber. The model for painkillers is most vulnerable to the issue mentioned above. Opioids may be prescribed for treatment of pain associated with different diagnoses and manipulations, e.g. cancer, injuries, surgery. Therefore, the type of opioid, treatment regimen, form of the substance and doses may differ a lot from prescription to prescription. Our results may, therefore, partly be caused by legitimate use of opioid painkillers. However, we find very similar results for anxiolytics and sleeping drugs. The medically prescribed dose and usage of these drugs are much more homogenous, and it is therefore unlikely that we falsely interpret DS as a sign of misuse.

Even though prescriptions from the same provider may theoretically be unnecessary and even illicit, the latter is unlikely in the settings of Västerbotten County with the small number of providers and control and monitoring of the prescriptions (Hammar et al., 2014; WHO, 2017). Moreover, if the irresponsible prescription is detected or reported, the consequences for the physician may be serious, including loss of the authorisation.

On many markets, increased competition improves efficiency by reducing prices and increasing the availability and quality of valued services. However, in the health care market, increased competition in terms of free choice of health care providers can potentially lead to increased DS. Our analysis suggests that it can. The following policy instruments can be used to address this problem. One way to reduce drug abuse caused by DS is to set an upper limit on how many times patients can switch between different providers. Some countries have introduced such measures. For example, in Norway, patients may only change their GP twice per year (Helsenorge, 2021). However, it is important to mention, that (in contrast to Norway) in Sweden primary care physicians are organised in group practices and patients register with the practice, rather than specific physician. This allows to minimise the number of options patients have for DS and may serve as a policy instrument to minimise DS. Another important instrument to consider is the gatekeeping function of primary care. More possibilities for DS are available when patients are allowed to visit specialists without a referral from a GP. Moreover, to avoid the over-prescription of drugs, it may be important to rely on more targeted policy mechanisms. One of them is electronic monitoring of the prescriptions when a prescriber has control over prescriptions made by others. For example, such monitoring programs have become an efficient policy solution to the opioid epidemic in the US (Haffajee et al., 2018). However, our analysis suggests that electronic monitoring systems may not be enough. The prescribers in our dataset have access to such systems but still hand out overlapping prescriptions.

Even though we found some evidence about DS in Västerbotten, we do not have sufficient information to evaluate the size of the problem. The actual DS attempts may be far higher than those potential DS events observed in the data. To figure this out, more data about actual visits to physicians requires. Moreover, to understand what policy instruments are efficient it is important to conduct comparative analysis between countries with different market structures or to evaluate the effects of different reforms or structural changes within the country.

Author statement

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Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2022.114739.

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