

Original Article

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Opioid dispensing in relation to arthroscopic knee surgery in Denmark from 2006 to 2018

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ABSTRACT

INTRODUCTION. In the US, opioids are commonly prescribed after arthroscopic knee surgery. We aimed to investigate opioid dispensing in relation to arthroscopic knee surgeries from 2006 to 2018 in Denmark.

METHODS. In Danish registries, we identified patients (≥ 15 years old) having arthroscopic knee surgery (anterior cruciate ligament (ACL) reconstruction; meniscal surgery; cartilage resection; synovectomy and diagnostic arthroscopy) between 1 January 2006 and 31 December 2018 and opioid dispensing (oral morphine equivalents (OMEQ)) within seven days after discharge from surgery.

RESULTS. Among 218,940 patients, 15,263 (7%) had an opioid dispensed within seven days after being discharged following surgery. The opioid dispensing incidence (per 1,000 persons/year) increased during the study period for all procedures. This trend was more pronounced for ACL reconstruction, which recorded an increase from 86 (95% confidence interval (CI): 75-99) in 2006 to 278 (95% CI: 255-301) in 2018, corresponding to 9% and 28% of ACL patients, respectively. In the same period, the average amount of opioids dispensed within the first seven days after discharge decreased (change: 70.0 OMEQ (95% CI: 12.4-127.5)). Tramadol and oxycodone were the most commonly dispensed opioids.

CONCLUSION. About 7% of patients had an opioid dispensed within the first seven days after discharge following arthroscopic knee surgery. The incidence of opioids dispensed increased for all investigated procedures from 2006 to 2018. In the same period, the average amount of opioids dispensed within the first seven days after discharge decreased.

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Opioid use in relation to surgery is considered a factor contributing to the increased and prolonged use of opioids [1]. For many persons, first-time opioid exposure is related to a surgical intervention in which opioids are prescribed to alleviate postoperative pain [1]. Opioids may be necessary for strong postoperative pain but are associated with poorer postsurgical outcomes, a risk of serious adverse events and addiction [2, 3].

In the US, as many as 80% of patients undergoing common arthroscopic knee surgeries, such as anterior cruciate ligament (ACL) reconstruction or meniscal surgery, receive opioids to manage postoperative pain [4] often in excessive amounts [5]. In Denmark, no national guidelines exist on postoperative pain management after arthroscopic knee surgical procedures, and the extent of opioid use following arthroscopic knee surgery is not well documented.

This study aimed to investigate short-term opioid dispensing in relation to the most common arthroscopic knee surgeries performed from 2006 to 2018 in Denmark.

METHODS

Data sources

Contacts with public and private hospitals in Denmark are registered in the Danish National Patient Registry. Each patient contact has a unique record number that can be used to identify administrative (i.e. discharge date, hospital, etc.) and clinical data (i.e. diagnosis, procedure and surgical date, etc.). The Danish version of the Nordic Medico-Statistical Committee Classification of Surgical Procedures has been used to code surgical procedures with a high validity since 1996 [6, 7]. All drug prescriptions redeemed by Danish citizens at pharmacies are registered in the Danish National Prescription Registry. Drugs are categorised according to the Anatomical Therapeutic Chemical (ATC) coding system. Prescription data include information on substance, brand name, date of dispensing and quantity expressed as defined daily dose (DDD) [8]. Data on age, sex, educational level, migrations and death were retrieved from the Danish Population Statistic Register, the Population Education Register and the Danish Register of Causes of Death. All data were linked at the person level using the unique personal identification number (Central Person Register (CPR) number) given to all residents in Denmark [9] and stored by Statistics Denmark; a governmental institution collecting and maintaining electronic records for research and statistical purposes. This register-based study was exempt from ethics approval, and it was approved by the University of Southern Denmark for the Danish Data Protection Agency (Reference number: 10,574).

Study population

We identified patients who had undergone arthroscopic knee surgery between 1 January 2006 and 31 December 2018 and who were aged 15 years or older at the of time surgery. To be able to identify knee surgery (yes/no) for a minimum of ten years and opioid dispensing (yes/no) for a minimum of one year prior to surgery, we excluded persons who had been observed for less than ten years prior to the surgery date. Also, persons with fewer than 30 days of observation time after their surgery were excluded. We included the most common arthroscopic knee surgical procedures (Nordic Classification of Surgical Procedure codes) and divided these procedures into five subcategories: ACL reconstruction (KNGE45* and KNGE55*); cartilage resection (KNGF31); synovectomy (KNGF01 and KNGF11); meniscal surgery (KNGD01, KNGD11, KNGD21, and KNGD91); and diagnostic arthroscopy (KNGA11*). If more than one procedure had been coded on the same date, we included only the primary surgical procedure for this study. The primary

surgical procedure was the one coded as 'V' (most important surgical procedure in the finished contact) or 'P' (most important procedure during a given surgery). For each person, only the first procedure was included in the study.

Opioid dispensing

First, opioid dispensing (yes/no) (ATC codes: N02A* and R05DA04) was identified within the first seven days (days 0-6) after discharge for all patients undergoing arthroscopic knee surgery. Then, type of opioid in the first dispensing was identified, and we calculated the total amount of opioids dispensed (mg oral morphine equivalents (OMEQ)) within the first seven (days 0-6) and 30 (days 0-29) days after discharge. OMEQ was calculated as DDD from all dispensed prescriptions multiplied by the appropriate drug-specific OMEQ conversion factor ([Supplementary table 1 <https://content.ugeskriftet.dk/sites/default/files/2023-07/a01230032-supplementary.pdf>](https://content.ugeskriftet.dk/sites/default/files/2023-07/a01230032-supplementary.pdf)) [10-13]. For combination drugs (N02AJ06 and N02AJ07), only the opioid component was included in this study. Lastly, we investigated if patients had any opioid dispensing (yes/no) in the one-year period leading up to their surgery.

Statistics

Descriptive statistics were reported as number with percentages and means with standard deviation (SD), as appropriate. The two-sided unpaired Student's t-test was used to investigate any change in the incidence of opioid dispensing and any change in the amount of opioids dispensed (OMEQ) from 2006 to 2018.

Trial registration: not relevant.

RESULTS

We included 218,940 persons who had a minimum of one arthroscopic knee surgery in the period from 2006 to 2018 ([Supplementary figure 2](#)). The mean age and sex distributions of patients undergoing arthroscopic knee surgery were similar for all the years ([Supplementary table 2](#)). The most common type of surgery was meniscal surgery (51%) followed by synovectomy (21%). Men had more procedures (55%) than women, and the average age was 43 years. In total, 15,263 patients (7%) had an opioid dispensed within the first seven days after discharge following surgery. The proportion of female and young patients was larger among patients with opioid dispensing within the first seven days after discharge than among those without opioid dispensing. Furthermore, a larger proportion of patients with opioid dispensing after surgery had opioid dispensing in the year leading up to their surgery ([Table 1](#)).

TABLE 1 Characteristics of patients with and without opioid dispensing in the first seven days after discharge following arthroscopic knee surgery in 2006-2018 in Denmark.

	No dispensing (n = 203,677)	Dispensing (n = 15,263)	All (N = 218,940)
<i>Procedure, n (%)^a</i>			
ACL reconstruction	18,280 (9)	3,894 (26)	22,174 (10)
Meniscal surgery	106,309 (52)	5,879 (39)	112,188 (51)
Cartilage resection	14,685 (7)	979 (6)	15,664 (7)
Synovectomy	41,773 (21)	3,234 (21)	45,007 (21)
Diagnostic arthroscopy	22,630 (11)	1,277 (8)	23,907 (11)
<i>Gender</i>			
Women, n (%)	91,657 (45)	7,503 (49)	99,160 (45)
<i>Age</i>			
At discharge, mean (± SD), yrs	43 (± 16)	42 (± 17)	43 (± 16)
<i>Categories, n (%)^a</i>			
15-30 yrs	46,804 (23)	4,601 (30)	51,405 (24)
31-45 yrs	60,568 (30)	4,227 (28)	64,795 (30)
46-60 yrs	67,877 (33)	4,120 (27)	71,997 (33)
61-75 yrs	25,940 (13)	2,008 (13)	27,948 (13)
> 75 yrs	2,488 (1)	307 (2)	2,795 (1)
<i>Living conditions, n (%)</i>			
Married	108,015 (53)	6,572 (43)	114,587 (52)
Living alone	53,209 (26)	5,123 (34)	58,332 (27)
<i>Highest level of education, n (%)^{a,b}</i>			
Lower secondary	54,509 (27)	4,466 (29)	58,975 (27)
Upper secondary	86,731 (43)	5,507 (36)	92,238 (42)
Post secondary	44,172 (22)	2,624 (17)	46,796 (21)
Unknown or missing	18,265 (9)	2,666 (18)	20,931 (10)
<i>Region for procedure, n (%)^a</i>			
North Denmark Region	24,976 (12)	1,674 (11)	26,650 (12)
Central Denmark Region	55,909 (27)	2,778 (18)	58,687 (27)
Region of Southern Denmark	45,759 (23)	2,111 (14)	47,870 (22)
Capital Region of Denmark	48,877 (24)	5,358 (35)	54,235 (25)
Region Zealand	28,156 (14)	3,342 (22)	31,498 (14)
Opioid dispensing in year prior to surgery, n (%)	29,590 (15)	5,038 (33)	34,628 (16)
<i>Length of hospital/clinic stay, n (%)^a</i>			
0 days	150,119 (74)	11,998 (79)	162,117 (74)
1 day	14,480 (7)	1,647 (11)	16,127 (7)
≥ 2 days	39,078 (19)	1,618 (11)	40,696 (19)

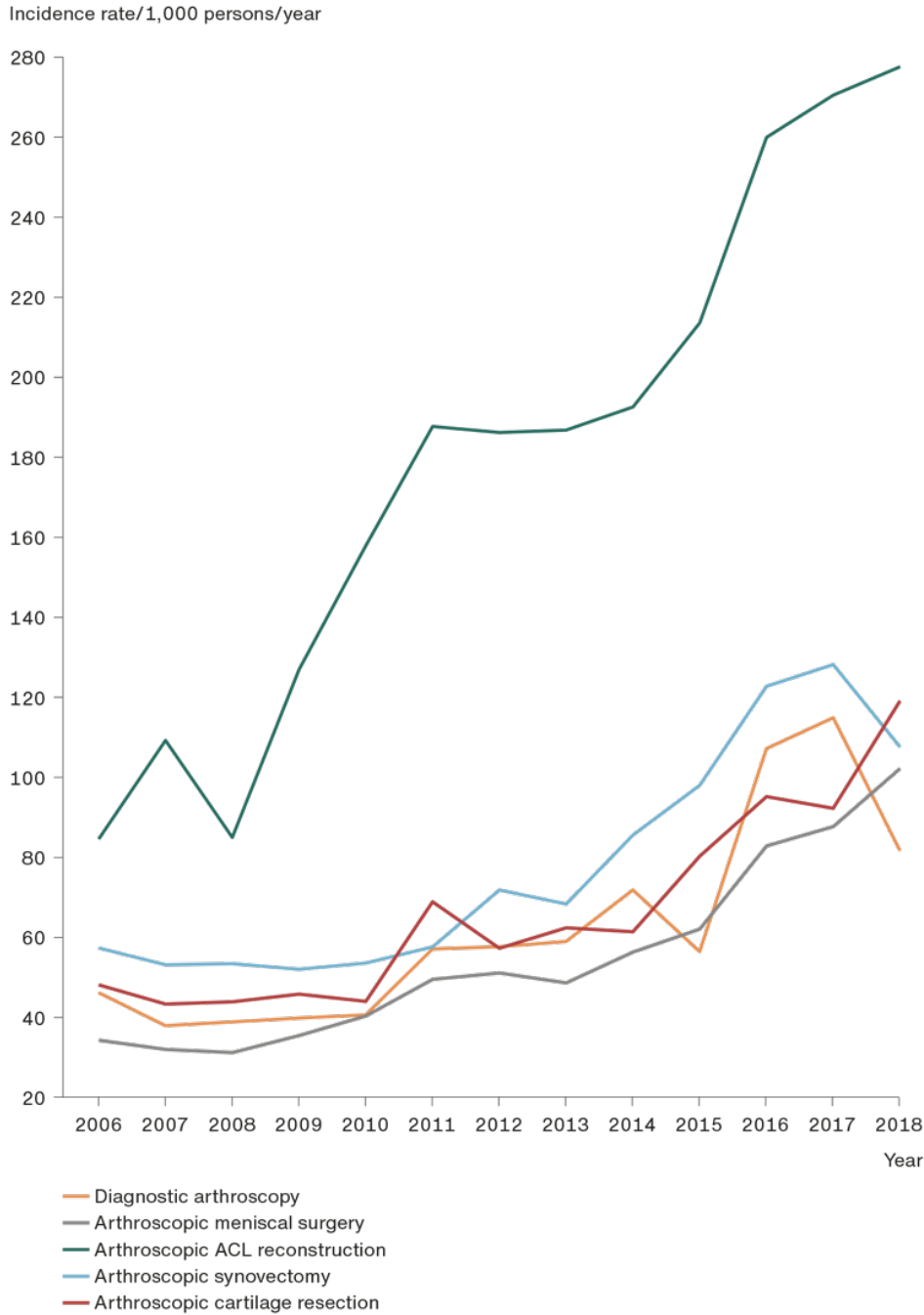
ACL = anterior cruciate ligament; SD = standard deviation.

a) Percentages may not add up to 100 due to rounding.

b) A person is characterised according to the highest completed educational level, lower secondary school is compulsory in Denmark and lasts 10 yrs.

Opioid dispensing within the first seven days after discharge following arthroscopic knee surgery was most common for patients undergoing ACL reconstruction (Table 1 and Figure 1). The proportion of ACL patients having an opioid dispensed within the first seven days after discharge rose from 9% in 2006 to 28% in 2018. The corresponding incidences (per 1,000 persons/year) were 86 (95% confidence interval (CI): 75-99) in 2006 and 278 (95% CI: 255-301) in 2018 (change: 192, 95% CI: 165-219), corresponding to a relative increase of 223%. For the remaining four surgery types, the incidence of opioid dispensing also increased from 2006 to 2018, but not to the same extent as for ACL reconstruction (Figure 1).

FIGURE 1 Incidence of opioid dispensing (per 1,000 persons/year) within the first seven days after discharge among patients having arthroscopic knee surgery in the years 2006-2018.



Most of the opioids dispensed within 30 days after discharge following arthroscopic knee surgery was dispensed within the first seven days (**Figure 2**). The average amount of opioids dispensed after discharge decreased from 2006 to 2018 (change seven days: 70.0 OMEQ (95% CI: 12.4-127.5), change 30 days: 271.3 OMEQ (95% CI: 187.8-354.8)). Among patients with opioid dispensing, the amount of opioids dispensed was higher in patients with opioid dispensing in the one-year period leading up to their surgery (**Figure 3**).

Tramadol and oxycodone accounted for the largest proportion of the total amount of opioids (i.e. OMEQ) dispensed from 2006 to 2018 ([Supplementary figure 1](#)).

FIGURE 2 Average amount oral morphine equivalents (OMEQ) dispensed within the first seven and 30 days after discharge (among patients with opioid dispensing).

Average amount of OMEQ

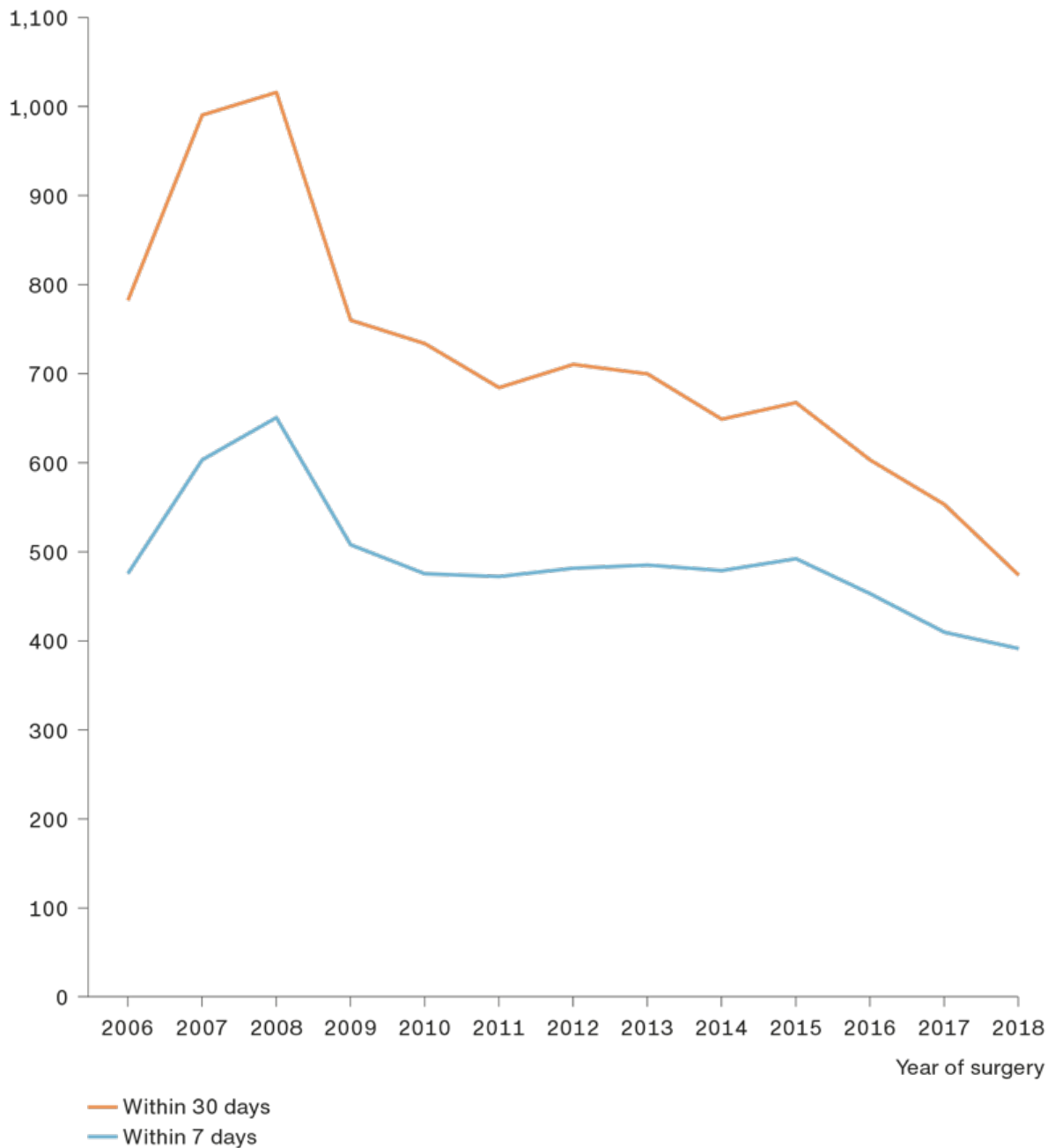
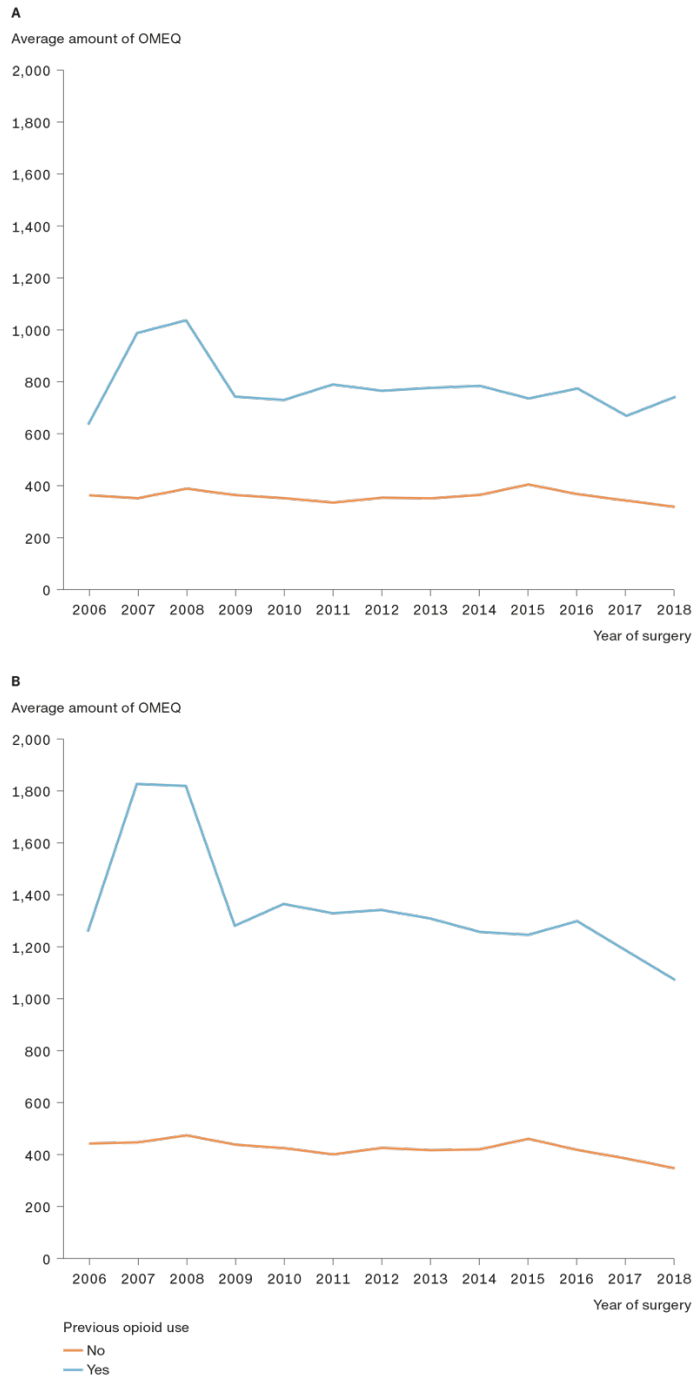


FIGURE 3 Average amount oral morphine equivalents (OMEQ) dispensed (among patients with opioid dispensing) within the first seven days (A) and 30 days of discharge (B) stratified by patients with and without opioid dispensing in the one-year period leading up to their surgery.



DISCUSSION

About 7% of patients undergoing one of the five most common arthroscopic knee procedures had an opioid dispensed within the first seven days after discharge following surgery. Opioid dispensing was most common in relation to ACL reconstruction. While the number of patients having opioids dispensed was relatively modest, a large relative increase was observed in the incidence of dispensing for all procedures

included in this study from 2006 to 2018, even though the average amount of short-term dispensing of opioids decreased in the same period.

In North America, it has been reported that up to 80% of patients undergoing knee arthroscopy procedures have opioids dispensed within the first seven days after surgery [4, 14]. From studies including patients undergoing total knee joint replacement, it is known that some opioid-naïve patients continue opioid use long after surgery [15]. In the present study, we investigated opioid dispensing in relation to the five most common arthroscopic knee surgery procedures, constituting 96% of all arthroscopic knee procedures in the study period. For some patients, this may represent their first opioid exposure [1]. Post-surgery opioid dispensing for arthroscopic knee procedures was much lower in our study than in the US [4, 14]. In Sweden, the number of patients having opioids dispensed within the first seven days after meniscectomy was 7% [14], which is comparable to the overall proportion (7%) of patients having opioids dispensed across all procedures in our study period. It is worth noting that the patients who had opioids dispensed in the year leading up to the surgery consumed larger amounts of opioids. This is likely a fact that clinicians should pay attention to as these patients may have a higher potential for long-term use and addiction.

Some differences in patient characteristics were recorded. A lower proportion of patients having opioids dispensed had a long education and a higher proportion were living alone. Both of these factors are typically linked with socio-economic status. Indicators of a poor socio-economic status have previously been associated with post-opioid dispensing for other types of surgery [16, 17]. Some geographical variation in dispensing was also observed as a higher proportion of patients having opioids dispensed were from Region Zealand and the Capital Region. Geographical variance in treatment practice is well-known, but it is often hard to determine the exact reason for such differences in practice [18].

Despite opioid-sparing strategies being promoted by leading surgeons in Denmark, the proportion of patients having opioids dispensed within the first seven days after discharge following surgery increased from about 5% to 13% (for all procedures) from 2006 to 2018 [19]. The largest increase in the incidence of opioid dispensing in relation to surgery was observed among patients having ACL reconstruction, which is a procedure that requires extensive postoperative rehabilitation. Therefore, physiotherapists may play an important role in reducing postoperative opioid use and discussing longer-term pain management with these patients. Most opioids prescribed in the 30-day period after discharge following arthroscopic knee surgery were dispensed within the first seven days. This may mean that the need for additional opioid dispensing within the first period after surgery was modest. Theoretically, this might also indicate over-prescription, meaning that pills may remain unconsumed and available for potential diversion. Such overprescribing of opioids in relation to arthroscopic knee surgery has previously been reported in the US [5]. However, in the course of the study period, the seven-day and 30-day dispensing curves (Figure 2) came closer and closer. In combination with the drop in the average amount of dispensing within both the seven-day and the 30-day period, this suggests an improved dispensing strategy in the more recent years.

Limitations

No information on the reason (i.e. diagnosis) for opioid dispensing was available in the National Danish Prescription Registry, but we assumed that opioid dispensing within the first seven days was related to the surgical procedure. As with all studies using data on dispensed drugs, it is not possible to know if the dispensed drugs were actually consumed by the patient or not. Data on drugs prescribed during the hospital stay (which may vary between hospitals and between procedures) are unavailable in the National Danish Prescription Registry. Thus, in the present study, dispensed drugs are all drugs from filled prescriptions at

pharmacies. We categorised procedures as the primary surgical procedure based on register codes. This code may not necessarily represent the most 'painful' pathology experienced by the patient at the time, which can, in any case, be hard to determine. Nevertheless, ACL reconstruction is generally considered the largest and most painful procedure among those examined in this study. In a previous study, we found that only about 1% of ACL surgeries were coded as secondary procedures [20], meaning that this error source would have had little impact on the results.

CONCLUSION

About 7% of patients undergoing arthroscopic knee procedures in Denmark had an opioid dispensed within the first seven days after discharge following surgery. Opioid dispensing was most common in relation to ACL reconstruction. Even though the number of patients having opioids dispensed was relatively modest, the proportion of patients who had opioids dispensed in relation to arthroscopic knee surgery increased from 5% to 13% from 2006 to 2018. In the same period, the average amount of opioids dispensed within the first seven days after discharge decreased. Though opioid prescribing in relation to arthroscopic knee surgeries appears modest, it is important to monitor opioid dispensing trends as the incidence increased substantially from 2006 to 2018. Future studies should focus on identifying patients at risk of long-term opioid consumption.

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Conflicts of interest Potential conflicts of interest have been declared. Disclosure forms provided by the authors are available with the article at ugeskriftet.dk/dmj

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Supplementary <https://content.ugeskriftet.dk/sites/default/files/2023-07/a01230032-supplementary.pdf>

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