INTRODUCTION

In pharmacoepidemiology studies, information on medication exposure is typically sourced from databases either on prescribing, dispensations or pharmacy claims.[1] For example, dispensation and claims databases covering the entire nations in the Nordic countries have been extensively used to provide new knowledge on utilization, effectiveness, and safety of medicines in real-world settings.[2]

In Finland, the main data source for pharmacoepidemiology research is the Finnish Prescription Register (FPR), a national pharmacy claims database maintained by the Social Insurance Institution of Finland (SII) since 1994.[2-4] The FPR has provided data not only for numerous studies on medication use and its effects in the Finnish population[2] but also for international collaborative studies, for example, on trends of methylphenidate use[5] and safety of selective serotonin reuptake inhibitors during pregnancy.[6,7] The FPR includes reimbursed dispensations of prescription medicines only, having no information on non-reimbursable prescription medicines, such as contraceptive pills, and medicines purchased over-the-counter.[2-4] This limits research on use and effects of non-reimbursable medicines, including medicines with changing reimbursement status such as direct oral anticoagulants (DOACs, see Supplementary Table 1). Furthermore, there has been no nationwide database on prescriptions. Therefore, studies on prescribing in Finland have required an ad hoc data collection from medical records.[8,9] Lack of a national prescription database is one reason why primary non-adherence (i.e., not initiating a prescribed medicine)[10] has not been studied in Finland.

Electronic prescribing was first introduced in a restricted geographical region of Finland in 2010.[11,12] Community pharmacies were required by law to be able to dispense electronic prescriptions by spring 2012. In public health care, electronic prescribing became mandatory in 2013, followed by private sector in 2015 and all settings on January 1, 2017. Paper prescriptions, which now are allowed only under exceptional circumstances, are entered into the electronic prescription database when dispensed in the pharmacy. Prescriptions issued prior to January 1, 2016 were valid up to 1 year and those issued thereafter up to 2 years since the prescription date (except for prescriptions for narcotics or central nervous system medicines).

Electronic prescriptions and dispensations are stored in the Prescription Centre in the Kanta database (hereafter referred to as Kanta).[13] In terms of dispensations, the coverage of Kanta has steadily increased since its implementation. The numbers of medicine dispensations identified through Kanta and the FPR since the introduction of electronic dispensing are shown in Figure 1.[14,15] Kanta data include all dispensations of medicines prescribed electronically regardless of whether they were reimbursed or not. Conversely, the FPR data include all reimbursed dispensations of medicines prescribed electronically or using a paper format.

The aim of this paper is to describe the contents of the Kanta database and compare its coverage to the FPR, using prescribing and dispensation of oral anticoagulants (OACs) as an example.

METHODS

The Context

The National Health Insurance Scheme, run by the SII, provides prescription medicine coverage for all ~5.5 million residents living in community, independent of individual's income.[4] Only products confirmed as reimbursable by the Pharmaceuticals Pricing Board are reimbursed. Medicines may be reimbursed at basic (40% since 2016), lower special (65%) or higher special (100%) reimbursement rates graded on medical grounds. Since 2016, adult residents have received reimbursement for their medicines after they have met an annual deductible of 50 euros. Generally, all medicines belong to the basic reimbursement category. However, the basic reimbursement status of some medicines is restricted, meaning that they are reimbursed only when prescribed for specified indications. Then the patient needs an entitlement for reimbursement granted by the SII, or in some cases, an additional note on the prescription is sufficient. Special reimbursements are always indication-specific and require entitlement from the SII. Patients may obtain an entitlement to restricted basic or special reimbursement after evaluation for eligibility according to an application and a medical certificate from the treating physician. Entitlements granted by the SII are recorded as indication-specific or medicine- and indication-specific reimbursement codes.

OACs marketed in Finland include warfarin, dabigatran, rivaroxaban, apixaban, and edoxaban. Of DOACs, dabigatran and rivaroxaban entered the market in the European Union (EU), including Finland, in 2008.[16] Dabigatran was the first DOAC granted an extension of marketing approval to include non-valvular atrial fibrillation (AF) (August 2011 in the

EU),[17] quickly followed by rivaroxaban and apixaban (both in 2012).[18,19] AF was included in the approval of edoxaban in 2015 when it entered the market.[20]

Reimbursements for oral anticoagulants (OACs)

All warfarin products belong to the basic reimbursement category while the reimbursement of DOACs is restricted.[21] The reimbursement status of DOACs and the criteria for entitlements to reimbursement for them have changed during the 2010's (Supplementary Table 1).[22] At the end of 2018, in short-term treatment (i.e., in case of cardioversion, joint replacement surgery, treatment of deep venous thrombosis [DVT] or pulmonary embolism [PE]), DOACs were reimbursed at the basic rate; however, an additional note on the prescription including a procedure or an event and its date is required. In long-term prevention of recurrent DVT and PE, DOACs are reimbursed at the basic rate only if the patient has been granted an entitlement to reimbursement by the SII. The treating physician has to justify the need for DOACs in a treatment plan included in the application for this entitlement. In AF, DOACs are reimbursed at the lower special rate. Entitlement to this reimbursement can nowadays be granted to patients with non-valvular AF and a CHA_2DS_2-VASc score of at least 1.

Study data

Data on all OAC prescriptions, dispensations, and their cancellations and corrections recorded in Kanta were retrieved for the period 2012–2016, using Anatomical Therapeutic Chemical (ATC) codes. The ATC codes included B01AA03 (warfarin), B01AE07 (dabigatran), B01AF01 and B01AX06 (rivaroxaban), B01AF02 (apixaban) and B01AF03 (edoxaban).

For every prescription issued using the Kanta system the date of prescribing, prescriber's identifier, specialty and organization, patient's identifier and date of birth, and details of the prescribed medicine, its indication and instructions for administration are saved in Kanta (Table 1).[23] When a prescription is dispensed, dispensation data including the date of dispensation, dispensed medicine and its strength, package details and number of packages, total price, the name of the pharmacist and pharmacy, and comments by the pharmacist if there are any are saved in Kanta. Conversely, reimbursed dispensations are recorded in the FPR. The FPR data include patient and prescriber information and details of the dispensed medicine, reimbursements and copayments.

To access the services provided by Kanta, physicians and pharmacists are required to verify their identity.[12] Both physicians and pharmacists can cancel prescriptions and make corrections to the Kanta data.[24] Both cancellations and corrections need to be accompanied by a reason. Prescribers can make corrections affecting treatments (e.g., change dosage instructions) to the prescriptions they have issued. Without the consent of the prescriber, pharmacists can make only technical corrections. Physicians can cancel prescriptions if, for example, treatment is changed or discontinued. Physicians can cancel prescriptions without patient's consent only if the cancellation is made for a technical (i.e., not treatment-related) reason or if the physicians was forced to issue the prescription or patient gave false information intentionally. Pharmacists are allowed to cancel prescriptions only in mutual understanding with the patient. Pharmacists can also cancel dispensations recorded in Kanta, for example, on patient request or if a patient is not able to pay for the medication.[23]

Each prescription has its own identifier in Kanta (Table 1).[23] With this identifier, a prescription can be linked to dispensations which also have their own identifiers. Corrections and cancellations are linked to prescriptions and dispensations through these identifiers. After a prescription or a dispensation is corrected or cancelled, a new version with a new identifier is generated.

First, the OAC prescriptions are described in greater detail for the year 2016. We first determined the numbers of all prescriptions, prescriptions that were not cancelled (valid) and recipients of these prescriptions (patients). For valid prescriptions, we identified corrections made by Dec 31, 2016. Indications were sought from 3 free-text data fields: dosage instructions, indications, and additional notes on the prescription. Indications were divided to 3 categories: definite, probable or possible. The definitions for indications are listed in Supplementary Table 2. The definitions and classifications were verified by a clinical expert (RH). Dosage instructions were sought for DOACs as their dosing is typically fixed. The dosing of warfarin is individual and depends on patient's international normalized ratio (INR) values, and the instructions are typically not written on the prescription but given directly to the patient or the care giver. For identifying prescribers, indications, and dosages, only valid prescriptions were considered. For the corrected prescriptions, the first dispensed version was applied since it is possible to correct a prescription after it has been dispensed. For prescriptions never dispensed during 2016, the latest corrected version was applied.

For the years 2012–2016, annual numbers of valid OAC dispensations and their recipients obtained from Kanta were compared to the numbers of reimbursed OAC dispensations and

their recipients available in the FPR. In both databases, users were defined as individuals who were dispensed an OAC at least once during a calendar year.

The permission for using the Kanta data was obtained from the National Institute of Health and Welfare.[13] However, the SII is the data custodian and provided the study data. For reimbursed dispensations, only publicly available data was used.[15]

RESULTS

In 2016, the total number of electronic prescriptions for OACs identified in Kanta was 257 751 (Table 2). The number of patients with at least 1 OAC prescription was 202 584. Of the prescriptions, 8 612 (3.3%) were cancelled. All cancellations were done on the same date as the original prescription was issued. 225 prescriptions were corrected before being cancelled. After excluding cancelled prescriptions, the total number of patients issued an OAC prescription was 199 630. Of valid prescriptions (n=249 139), the majority (69.9%) were for warfarin. The most widely prescribed DOAC was rivaroxaban (16.6%), followed by dabigatran (7.2%), apixaban (6.3%), and edoxaban (<1%). Valid OAC prescriptions were issued by 13 797 different physicians (1–399 prescriptions per physician). Of valid prescriptions, 2.3% were corrected, DOAC prescriptions more commonly than warfarin prescriptions (Supplementary Table 3). The number of corrections per prescription varied between 1 and 11.

Of all OAC prescriptions, 28.3% had no data in the free-text data field where indication should be recorded. When using data from all 3 free-text data fields (indication, dosage instructions and additional notes), a definite, probable or possible indication could be

identified for 44.7% of OAC prescriptions (Table 3). For the majority (76.1%) of these 111 378 prescriptions, indication could be identified using the indication field, followed by the dosage instructions field (21.6%) and the field containing additional notes on the prescription (13.6%). The most common indication identified was AF/flutter (26.9% of warfarin and 46.1% of DOAC prescriptions). Similarly to all identified indications, 75.5% of definite AF/flutter cases (n=51 480) could be found using the indication field, 21.9% from the dosage instructions field, and 11.1% from the additional notes on the prescription. Conversely, 57.6% of definite joint replacement surgery cases (n=6 716) were identified using information from the additional notes on the prescription, 46.0% from dosage instructions and 7.9% from the indication field. Warfarin prescriptions lacked more commonly information on indication than DOAC prescriptions (66.4% vs. 29.4%).

Dosing instructions could be identified in almost all (99.5%) of 74 924 valid DOAC prescriptions (Table 4), typical daily doses being 1 unit (51.1%) or 2 units (47.2%) per day. In 91.2% of prescriptions, rivaroxaban was prescribed to be taken once a day. This was true for all edoxaban prescriptions. In about 95% of dabigatran and apixaban prescriptions, the dosing frequency was twice a day.

In 2016, the total number of OAC dispensations recorded in Kanta was 786 597 of which 765 745 (97.3%) were valid (Table 2). All cancellations were done on the same date as the original dispensation. The proportion of cancelled dispensations was higher for DOACs compared to warfarin. After exclusion of cancelled dispensations, OACs were dispensed to 215 980 persons with warfarin being the most commonly used OAC. Of valid dispensations,

6 609 (0.9%) were corrected (1.2% of DOAC dispensations vs. 0.7% of warfarin dispensations). These dispensations were corrected up to 4 times.

The total number of OAC dispensations was higher in the FPR during the period 2012–2014 after which more dispensations were identified from Kanta (Figure 2A). However, the number of warfarin dispensations remained higher in the FPR for the whole observation period. During the years 2012–2015, more OAC users were identified in the FPR than in Kanta while the opposite was true for 2016 (Figure 2B). The number of warfarin users was higher in the FPR compared to Kanta each year. Starting 2014, more DOAC users and dispensations were identified using Kanta than the FPR.

DISCUSSION

Almost 250 000 valid OAC prescriptions issued in 2016 were found in Kanta. About 30% of the prescriptions were for DOACs. An indication was identified for less than 50% of all OAC prescriptions, twice more commonly for DOACs (71%) than for warfarin (34%). The daily dosage could be determined for almost all DOAC prescriptions. When compared to the FPR, more DOAC users and dispensations were identified in Kanta since 2014. However, more warfarin users and dispensations were identified in the FPR each year during 2012–2016.

Although the indication of medication is a mandatory field in electronic prescriptions,[25] almost 30% of OAC prescriptions lacked this information completely. In a recent pharmacy-based study in Finland, 7.2% of dispensed electronic prescriptions were reported to include an anomaly and, of them, 28.4% missed information on indication.[26] Specifically, in this current study, it was observed that the text in the indication field could point to

anticoagulation but did not reveal the reason why the patient needed it. The information is addressed to the patient for whom the underlying specific reason for anticoagulation may be clear, such as prevention of stroke in AF or treatment of DVT, and there is no need to state it in the prescription. Consequently, the future studies aiming to compare effectiveness and safety of various OACs in specific indications cannot solely rely on the information from Kanta when defining their study populations. This is likely to be true for other medication classes, too.

In these data, DOAC prescriptions included more commonly information on indication than did warfarin prescriptions. One likely reason for this is that the reimbursement for DOACs is restricted, requiring an additional note on the prescription or patient's entitlement to reimbursement granted by the SII. For example, joint replacement surgeries were often identified from the additional note which is required for basic reimbursement. In many DOAC prescriptions with AF identified as the indication, it was mentioned that the patient fulfilled the medical criteria for entitlement to reimbursement, although this information needs to be sent to the SII in a separate medical certificate.[4] On the other hand, warfarin treatment is regularly monitored, and patients receive separate instructions for their individual dosing. As patients on warfarin are in a regular contact with the healthcare system, physicians may consider it unnecessary to record the indication on prescriptions.

The number of warfarin dispensations remained higher in the FPR than in Kanta for the whole period 2012–2016 although the difference was getting smaller as the implementation of electronic prescribing expanded. This difference was probably due to long-term users of warfarin who still had paper prescriptions that were renewed. Because of no restrictions on

reimbursement, recording of warfarin dispensations in the FPR is likely to be complete. Conversely, due to reimbursement restrictions, more DOAC users and dispensations could be identified from Kanta than FPR since 2014. Based on Kanta, the estimated proportion of DOAC users of all OAC users in 2016 was 25% compared to 21% based on the FPR.

All cancelled OAC prescriptions were cancelled on the same date as they were originally issued. This suggests that prescriptions are not cancelled unless there is an immediate need for cancellation. A previous Finnish study reported that physicians perceive cancelling of electronic prescriptions difficult and prescriptions are not cancelled in Kanta even if the treatment is changed or discontinued and a prescription is no more needed.[27] That is, physicians do not seem to use the opportunity to manage patient's medication regimen through Kanta. This may lead to inappropriate use of medicines at the patient level. In addition, the applicability of Kanta for creating an up-to-date list of patients' medication seems limited as discontinued treatments still appear in the data. Pharmacists and researchers may also erroneously deem a patient non-adherent as the patient does not fill prescriptions for treatment that was in fact discontinued by the prescriber. Furthermore, unnecessary, uncancelled prescriptions can lead to false conclusions about treatment patterns and treatment prevalence estimated using prescription data.

While Kanta includes new, important variables for pharmacoepidemiology research, it lacks information on many. For example, information on copayment and reimbursement codes are not available. Therefore, for most research questions, the data from Kanta needs to be supplemented with data from the FPR and other sources. Examples of often used data sources are the Care Register for Health Care maintained by the National Institute for Health

and Welfare including data on inpatient care, and the SII Special Reimbursement Register including patients' reimbursement codes (often used for identifying comorbidities).[28] In the future, other Kanta services, such as the Patient Data Repository and the Client Data Archive for Social Welfare Services, may offer new data for research.[12,29]

Despite of offering new important information, many new Kanta variables are in free-text form (e.g., dosage instructions and indication). Transforming the data into a structured form can be challenging and time-consuming and would benefit from text-mining methods.[30] Regarding the usability of prescription and dispensation data, one must bear in mind that cancelling and correcting always generates a new identifier. Therefore, a cancellation may not be directly linkable to the original prescription or dispensation if they have been corrected prior cancellation, or, similarly, a dispensation to the original prescription if the prescription has been corrected prior to dispensation.

Furthermore, the quality of some Kanta variables is questionable. When examining OAC prescriptions in 2016 marked as "treatment initiation" (n=18 329, data not shown), around 1/5 was found to be prescribed to people who had been dispensed the same OAC during the previous 6 months. In contrast, 98.2% of prescriptions clearly for short-term use (i.e., joint replacement surgery, other procedures or travelling as the only identified indication, n=8 318) were marked as short-term treatment. However, the overall validity of the variable describing permanence of the treatment seems low: only 1/3 (34.2%) of prescriptions with treatment identified as permanent based on free-text fields (n=3 804) were marked as permanent treatment. Permanent treatment has no universal definition and therefore physicians' views on which treatment is considered permanent are likely to vary.

The Kanta database offers many possibilities for future pharmacoepidemiology studies. It allows for nationwide studies on prescriptions for the first time in Finland. For example, research on treatment patterns is no longer restricted to reimbursable prescription medicines. Most importantly, the information on both prescribing and dispensing of medicines and the possibility to link dispensations to a specific prescription allows expansion of research on medication adherence from secondary to primary non-adherence.[31] Based on results on DOACs in this study, Kanta can offer access to prescribed daily dosages although this information is available only as free-text. This information will allow estimation of intensity or duration of medication exposure as well as secondary adherence without making dosage assumptions. Observations in this study on dosage instructions may be useful for future DOAC studies with no access to this information: in about 95% of prescriptions for dabigatran and apixaban the instruction was to take 2 units per day while in 91% of prescriptions for rivaroxaban the instruction was 1 unit per day.

As electronic prescribing has been mandatory in all settings in Finland since 2017, Kanta now captures all prescriptions and their dispensations. That is, Kanta provides more comprehensive information on medicine exposure than the FPR whose content is limited by the reimbursement status of medicines. However, neither of these databases provides information on use of medicines during hospitalization.

CONCLUSIONS

The Kanta database is a promising data source for pharmacoepidemiology research in the future; however, for most research questions additional data may be needed. Because of the reimbursement restrictions, use of DOACs remains under-ascertained through the FPR.

REFERENCES

1. The European Network of Centres for Pharmacoepidemiology and Pharmacovigilance (ENCePP). Guide on methodological standards in pharmacoepidemiology (revision 7). EMA/95098/2010.

2. Wettermark B, Zoega H, Furu K, et al. The nordic prescription databases as a resource for pharmacoepidemiological research - a literature review. Pharmacoepidemiol Drug Saf. 2013;22:691–699. http://doi.org/10.1002/pds.3457.

3. Furu K, Wettermark B, Andersen M, Martikainen JE, Almarsdottir AB, Sorensen HT. The nordic countries as a cohort for pharmacoepidemiological research. Basic Clin Pharmacol Toxicol. 2010;106:86–94. http://doi.org/10.1111/j.1742-7843.2009.00494.x.

4. Finnish Medicines Agency Fimea and Social Insurance Institution. Finnish statistics on medicines 2017. Helsinki, 2018. http://urn.fi/URN:NBN:fi-fe2018112148808

5. Raman SR, Man KKC, Bahmanyar S, et al. Trends in attention-deficit hyperactivity disorder medication use: A retrospective observational study using population-based databases. Lancet Psychiatry. 2018;5:824–835. http://doi.org/S2215-0366(18)30293-1.

6. Stephansson O, Kieler H, Haglund B, et al. Selective serotonin reuptake inhibitors during pregnancy and risk of stillbirth and infant mortality. JAMA. 2013;309:48–54. http://doi.org/10.1001/jama.2012.153812.

7. Furu K, Kieler H, Haglund B, et al. Selective serotonin reuptake inhibitors and venlafaxine in early pregnancy and risk of birth defects: Population based cohort study and sibling design. BMJ. 2015;350:h1798. http://doi.org/10.1136/bmj.h1798.

8. Tiihonen M, Nykänen I, Ahonen R, Hartikainen S. Discrepancies between in-home interviews and electronic medical records on regularly used drugs among home care clients. Pharmacoepidemiol Drug Saf. 2016;25:100–105. http://doi.org/10.1002/pds.3909.

9. Bruun E, Kälviäinen R, Keränen T. Outcome of initial antiepileptic drug treatment in elderly patients with newly diagnosed epilepsy. Epilepsy Res. 2016;127:60–65. http://doi.org/10.1016/j.eplepsyres.2016.08.023.

10. Raebel MA, Schmittdiel J, Karter AJ, Konieczny JL, Steiner JF. Standardizing terminology and definitions of medication adherence and persistence in research employing electronic databases. Med Care. 2013;51(8 Suppl 3):11. http://doi.org/10.1097/MLR.0b013e31829b1d2a.

11. The act on electronic prescriptions 61/2007 [in Finnish].

12. Jormanainen V. Large-scale implementation and adoption of the finnish national Kanta services in 2010–2017: A prospective, longitudinal, indicator-based study. FinJeHeW. 2018;10:381–395. https://doi.org/10.23996/fjhw.74511.

13. Kanta. Data requests for scientific research. https://www.kanta.fi/en/data-requests-for-scientific-research; Accessed Mar 28, 2019.

14. Kanta. Statistics. https://www.kanta.fi/en/statistics; Accessed Mar 28, 2019.

15. The Social Insurance Institution of Finland. Statistical database Kelasto. www.kela.fi/web/en/statistical-database-kelasto; Accessed Mar 28, 2019.

16. Lippi G, Mattiuzzi C, Cervellin G, Favaloro EJ. Direct oral anticoagulants: analysis of worldwide use and popularity using Google Trends. Ann Transl Med. 2017;5:322. http://doi.org/10.21037/atm.2017.06.65.

17. Sørensen R, Gislason G, Torp-Pedersen C, et al. Dabigatran use in Danish atrial fibrillation patients in 2011: a nationwide study. BMJ Open. 2013;3:002758. http://doi.org/10.1136/bmjopen-2013-002758.

18. European Medicines Agency. Committee for Medicinal Products for Human Use. Summary of opinion for Xarelto. EMA/CHMP/753436/2011.

19. European Medicines Agency. Committee for Medicinal Products for Human Use. Summary of opinion for Eliquis. EMA/CHMP/608476/2011.

20. European Medicines Agency. Committee for Medicinal Products for Human Use. Summary of opinion for Lixiana. EMA/CHMP/239353/2015.

21. The Social Insurance Institution of Finland. Medicinal Products Database. https://www.kela.fi/web/en/medicinal-products-database; Accessed Mar 28, 2019.

22. The Social Insurance Institution of Finland. Beginning of pharmaceutical substances' restricted reimbursement [in Finnish]. https://www.kela.fi/laakkeet-ja-laakekorvaukset_rajoitetun-korvattavuuden-alkamisajat; Accessed Mar 5, 2019.

363 23. Kanta. Data content of prescriptions [in Finnish]. https://www.kanta.fi/en/system-
364 developers/prescription; Accessed Mar 5, 2019.

365 24. Kanta. Prescription. https://www.kanta.fi/en/professionals/prescription; Accessed Mar
366 7, 2019.

367 25. Decree on the prescription of medicines (1088/2010) [in Finnish].

368 26. Timonen J, Kangas S, Kauppinen H, Ahonen R. Electronic prescription anomalies: A study
369 of frequencies, clarification and effects in finnish community pharmacies. J Pharm Health
370 Serv Res. 2018;9:183–189. https://doi.org/10.1111/jphs.12224.

371 27. Kauppinen H, Ahonen R, Mäntyselkä P, Timonen J. Medication safety and the usability of
372 electronic prescribing as perceived by physicians-A semistructured interview among primary
373 health care physicians in finland. J Eval Clin Pract. 2017;23:1187–1194.
374 http://doi.org/10.1111/jep.12759.

375 28. Peltola M, Juntunen M, Häkkinen U, Rosenqvist G, Seppälä TT, Sund R. A methodological
376 approach for register-based evaluation of cost and outcomes in health care. Ann Med.
377 2011;43 Suppl 1:4. http://doi.org/10.3109/07853890.2011.586364.

378 29. Kanta. Services and use. https://www.kanta.fi/en/professionals/services-and-use;
379 Accessed Mar 5, 2019.

380 30. McTaggart S, Nangle C, Caldwell J, Alvarez-Madrazo S, Colhoun H, Bennie M. Use of text-
381 mining methods to improve efficiency in the calculation of drug exposure to support

382 pharmacoepidemiology studies. Int J Epidemiol. 2018;47:617–624.
383 http://doi.org/10.1093/ije/dyx264.

384 31. Laius O, Pisarev H, Volmer D, Koks S, Märtson A, Maasalu K. Use of a national database
385 as a tool to identify primary medication non-adherence: The estonian ePrescription system.
386 Res Social Adm Pharm. 2018;14:776–783. http://doi.org/10.1016/j.sapharm.2017.10.003.

FIGURE CAPTIONS

Figure 1. Annual numbers of medicine dispensations in Finnish community pharmacies identified through Kanta and the Finnish Prescription Register 2010–2018.

Figure 2. Annual numbers of dispensations (A) and users (B) of all OACs, warfarin and DOACs identified through Kanta and the Finnish Prescription Register (FPR) 2012–2016.