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ORIGINAL REPORT

Discrepancies between in-home interviews and electronic medical records on regularly used drugs among home care clients

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ABSTRACT

Purpose To compare discrepancies between in-home interviews and electronic medical records (EMRs) on regularly used prescription drugs among older home care clients.

Methods The participants were home care clients aged 75 years or older living in three Finnish municipalities. In-home interview data on regular prescription drug use from 276 home care clients were compared with EMRs. Agreement between the in-home interview data and EMRs was assessed using Cohen's kappa.

Results A majority (83%, $n = 229$) of the home care clients had discrepancies between in-home interview data and EMRs, and 40% had discrepancies that could clinically compromise their treatment. Living with a spouse or other family member, use of private health care services, diagnosed asthma/COPD or excessive polypharmacy was associated with having discrepancies. Discrepancies were more common among clients with better functioning and ability to self-manage drug use. Agreement between in-home interview data and EMRs was very good or good for other drug groups, but moderate for opioids, paracetamol, benzodiazepines and benzodiazepine-related drugs and lubricant eye drops, and poor for selective beta-2-adrenoceptor agonists. The most common clinically important discrepancies were psychotropics, opioids and agents acting on the renin–angiotensin system and beta-blocking agents.

Conclusions Eight out of ten home care clients had discrepancies between in-home interview data and EMRs. Of these discrepancies, 40% were clinically important. Copyright © 2015 John Wiley & Sons, Ltd.

KEY WORDS—older people; home care; drugs; discrepancies; electronic medical record; pharmacoepidemiology

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INTRODUCTION

Accurate information on patients' actual drug use is crucial for optimal and safe pharmacotherapy. Inaccuracies in recorded drug use may lead to discontinuation of clinically important drugs, introduction of an inappropriate drug or drug interactions.[1,2] Thus, these medication errors could lead to additional hospital days or problems in managing medication at home. Previous studies have focused on discrepancies between recorded drug lists and actual drug use, mainly in hospital settings and residential elderly care facilities.[3] The prevalence of discrepancies has varied in hospital settings from 3% to 97% and in residential care settings from 27% to 57%. However, only a few studies have focused on outpatient settings[4–6] (prevalence of discrepancies from 14% to 98%).

Nowadays, home care clients have several diseases and a lot of disabilities and functional decline,[7] and half of home care clients use six or more drugs.[8] Some home care clients manage their drug regimen by themselves, but a large share of them get help from family members or have home care nurses take care of administering drugs. Thus, accurate drug lists are important tools for all home care clients. As far as we know, no previous studies have focused on the accuracy of EMRs (electronic medical records (EMRs)) and actual drug use among home care clients.

The aim of this study was to compare discrepancies between in-home interviews and EMRs on regularly used prescription drugs among older home care clients.

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METHODS

This study was part of the population-based multidisciplinary intervention trial Nutrition, Oral Health and Medication (NutOrMed, ClinicalTrials.gov Identifier: NCT02214758). The participants were sampled from home care services in three Finnish municipalities in Eastern and Central Finland in 2013. A random sample from community I with 105 141 inhabitants, a random sample of 75 people from community II with 20 224 inhabitants and a total sample of 115 people from community III with 7524 inhabitants was comprised. Details of the NutOrMed study protocol are described by Tiihonen, *et al.*[7] The inclusion criteria for home care clients was age of 75 years or older. A total of 276 home care clients attended. All data collection was done at home. If a home care client had difficulty answering the questions in the in-home interview (later "interviews"), for example because of cognitive impairment, the information was checked by interviewing a caregiver or a home care nurse.

Drug use

Interview data on drug use was gathered by a trained pharmacist. The pharmacist recorded each prescription as well as non-prescription drugs and supplements used regularly, as-needed or in the past on the basis of the interview, drug lists, packages, dose dispensers and prescriptions. Assistance from nurses or family members was permitted. Additionally, use of automated dose dispensing service, dosages, quantity, timing, indications and possible adverse reactions and problems were recorded. A drug was considered regular when taken daily or at regular intervals (e.g. bisphosphonates once a week). All drugs were encoded using the Anatomical Therapeutic Chemical (ATC) classification.[9] Ability to self-manage drug use was assessed using question regarding "Responsibility for Own Medications" from Instrumental activities of daily living (IADL) with an 8-item Lawton and Brody Scale.[10] Those responsible for taking medication in correct dosages at correct time were considered to be able self-manage drug use and those who took responsibility if medication is prepared in advance in separate dosages and those who were not capable of dispensing own medication were considered as enable to self-manage drug use.

On the date of the interview, drug lists were retrieved from public primary care EMR systems. In Finland, all patient data are processed electronically in all municipalities since 1990s. EMRs contain information on drugs taken regularly or as needed. Drugs listed as regular were retrieved for analysis. In this study, discrepancy was defined as any missing or extra drugs when comparing the interview data with EMRs. In the comparisons the interview was considered the golden standard. Person-level agreement between the interview data on regularly used prescription drugs and EMRs was reported using the third, fourth or fifth ATC level, depending on the diversity of the substances in the particular ATC group. We excluded from the analysis vitamins (A11) and mineral supplements (A12), anti-infectives for systemic use (J), dermatologicals (D) and drug groups with less than 5% prevalence in either the interview data or the EMR data. We defined drugs used in diabetes (A10), diuretics (C03), beta-blocking agents (C07), calcium channel blockers (C08), agents acting on the renin–angiotensin system (C09), anti-inflammatory and antirheumatic products (M01), opioids (N02, excluding paracetamol) and psychotrophics (N05 and N06, excluding antidementia drugs) as clinically important therapeutic classes.

Functioning and health status

Sociodemographic factors, health status, functioning in the activities of daily living (ADL), cognitive functioning, mood and physical performance were determined in the interviews by trained home care nurses. ADL were measured using a 10-item Barthel Index[11] with a scale from 0 to 100, with higher scores indicating better functioning. IADL were assessed with an 8-item Lawton and Brody Scale[10] with a range from 0 to 8, with higher scores indicating better functioning. Cognition was assessed with the Mini-Mental State Examination (MMSE)[12] with a scale of 0–30 and higher scores indicating better functioning, and mood was measured with a 15-item Geriatric Depression Scale (GDS-15)[13] from 0 to 15, with scores of 6 or more indicating mild to severe depression. Physical performance was evaluated based on self-reported ability to walk 400 m.

Medical condition was verified by a physician specialised in geriatrics. Comorbidity was counted using a modified version of the Functional Comorbidity Index (FCI).[14,15] Data on 13 medical conditions were gathered: (i) rheumatoid arthritis and other inflammatory connective tissue diseases, (ii) osteoporosis, (iii) diabetes, (iv) chronic asthma or chronic obstructive pulmonary disease (COPD), (v) coronary artery disease, (vi) heart failure, (vii) myocardial infarction, (viii) stroke, (ix) depressive disorder, (x) visual impairment, (xi) hearing impairment, (xii) Parkinson's disease or multiple sclerosis and (xiii) obesity (body mass index >30). The presence of each of the 13 conditions gave one point, and a higher FCI sum score represented greater comorbidity. Private

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health care service use was assessed within interview by asking from home care clients or their caregivers whether they have used private health care services within last year.

Statistical analysis

The characteristics of the home care clients were summarised using percentages, means and standard deviations. The Chi-square test and *t*-test, with 0.05 considered statistically significant, were used for statistical comparisons between groups.

Agreement between the interview data on regularly used prescription drugs and the EMR data was assessed using Cohen's kappa. Interpretation of the value of kappa was defined as follows: poor (<0.20), fair (0.20–0.40), moderate (0.41–0.60), good (0.61–0.80) and very good (0.81–1.00).[16] The data were processed and analysed using SPSS for Windows, version 19.0 (SPSS, Inc., Chicago, IL).

RESULTS

The mean age of the home care clients was 84.5 years and 73% ($n = 200$) of them were female. Mean number of regularly or as needed prescription/over-the-counter drugs was 9.0 (SD 3.7). Of the home care clients, 83% ($n = 229$) had discrepancies between interview-based drug use and EMRs. Living with a spouse or other family member, use of private health care services, diagnosed asthma/COPD or excessive polypharmacy were associated with discrepancies (Table 1). Discrepancies were more common among home care clients with better functioning (IADL) and better ability to self-manage drug use. Use of automated dose dispensing was not significantly associated with having discrepancies.

Of the home care clients, 63.4% ($n = 175$) used more drugs than they had been listed in their EMRs and 57.6% ($n = 159$) had at least one extra drug in their EMRs. Proton pump inhibitors, metformin, warfarin, vaginal oestrogen, buprenorphine, antiepileptics, antidepressants, memantine and adrenergic combination inhalants and glucocorticoid inhalants were more often over-reported than under-reported in EMR which indicated that these drugs were not used regularly, as prescribed (Table 2).

Agreement between interview and EMR data was very good or good for the majority of the analysed drug groups (Table 2). Agreement was moderate for natural opioids (oxycodone, codeine), paracetamol, benzodiazepines and benzodiazepine-related drugs and lubricant eye drops. Agreement was poor for adrenergics, e.g. salbutamol, terbutaline, salmeterol or formoterol inhalants that were not used as needed, as had been prescribed, but were used regularly.

Of the home care clients, 40% ($n = 109$) had discrepancies in clinically important drugs. These drugs were psychotropics, opioids, beta-blocking agents and agents acting on the renin–angiotensin system (Table 3).

Table 1. Characteristic of the home care clients ($n = 276$) with or without discrepancies between in-home-interview-based regular prescription medication use and EMRs

	Total population		Discrepancies		No discrepancies		*p*-Value
Demographic characteristics							
Female, % (*n*)	72.5	(200)	72.1	(165)	74.5	(65)	0.736
Age, mean (SD)	84.5 (5.4)		84.3 (5.3)		85.7 (5.7)		0.098
Education, years, mean (SD)	8.2 (3.4)		8.3 (3.5)		7.8 (2.9)		0.327
Living with a spouse or other family member, % (*n*)	34.8	(92)	38.1	(83)	19.6	(9)	0.017
Private health care use, % (*n*)	21.8	(57)	24.7	(53)	8.7	(4)	0.017
Automated dose dispense, % (*n*)	21.4	(59)	22.3	(51)	17.0	(8)	0.354
Functioning							
IADL, mean (SD)	3.5 (2.1)		3.6 (2.1)		1.7 (2.1)		0.003
Ability to self-manage drug use, % (*n*)	29.1	(77)	32.4	(71)	13.0	(6)	0.009
ADL, mean (SD)	83.5 (19.5)		84.4 (18.6)		79.0 (23.1)		0.089
Inability to walk 400 m independently, % (*n*)	30.6	(81)	29.2	(64)	37.0	(17)	0.274
Cognitive decline (MMSE ≤ 24), % (*n*)	55.3	(142)	(55.7)	118	53.3	(24)	0.776
Health status							
Depressive symptoms (GDS-15 ≥ 6), % (*n*)	44.4	(116)	44.2	(95)	45.7	(21)	0.856
FCI, mean (SD)	2.9 (1.9)		3.0 (1.9)		2.6 (1.7)		0.184
Current diagnosis							
Diabetes, % (*n*)	29.7	(81)	30.4	(69)	26.1	(12)	0.560
Cardiovascular disease, % (*n*)	61.6	(170)	62.4	(143)	57.4	(27)	0.521
Asthma/COPD, % (*n*)	21.2	(58)	25.1	(57)	2.2	(1)	<0.001
Dementia, % (*n*)	41.4	(113)	39.2	(89)	52.2	(24)	0.103
Excessive polypharmacy, % (*n*) (use of 10 drugs or more)	54.9	(149)	57.2	(131)	38.3	(18)	<0.001

Abbreviations: SD = standard deviation; IADL = instrumental activities of daily living; ADL = activity of daily living (Barthel Index); MMSE = Mini Mental State Examination; GDS-15 = Geriatric Depression Scale; COPD = chronic obstructive pulmonary disease.

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Table 2. Person-level agreement between regular prescription drug use in interview-ascertained drug use and EMRs

Drug groups by ATC class	Prevalence, interview, % (*n*)	Prevalence EMR, % (*n*)	*N* under-reported drugs in EMRs	*N* over-reported drugs in EMRs	Kappa
Antiulcer drugs (A02)					
Proton pump inhibitors (A02BC)	20.7 (57)	21.0 (58)	6	7	0.857
Drugs used in diabetes (A10)					
Insulin (A10AC, A10AE)	8.0 (22)	7.2 (20)	2	0	0.948
Oral hypoglycemic agents, metformin (A10BA02)	13.4 (37)	14.1 (39)	0	2	0.969
Antitrombotic agents (B01)					
Warfarin (B01AA03)	38.0 (105)	38.4 (106)	0	1	0.992
ASA and antiaggregants (B01AC06)	40.6 (112)	39.5 (109)	12	9	0.819
Cardiac therapy (C01)					
Digoxin (C01AA05)	9.4 (26)	9.1 (25)	3	2	0.892
Nitrates (C01DA)	31.8 (88)	30.1 (83)	6	1	0.893
Diuretics (C03)					
Furosemide (C03CA01)	41.7 (115)	40.2 (111)	7	3	0.925
Beta-blocking agents (C07)	68.5 (189)	63.8 (176)	17	4	0.831
Calcium channel blockers (C08)	29.0 (80)	26.4 (73)	7	0	0.937
Agents acting on the renin-angiotensin system (C09)					
ACE inhibitors (C09A, C09B)	19.9 (55)	17.8 (49)	8	2	0.882
Angiotensin II antagonists (C09C, C09D)	23.9 (66)	22.8 (63)	4	1	0.949
Lipid-modifying agents (C10)					
Statins (C10AA)	47.8 (132)	47.1 (130)	8	6	0.898
Sex hormones and modulators (G03)					
Oestrogen (G03CA)	10.9 (30)	13.4 (37)	7	14	0.644
Urologicals (G04)					
Alpha-adrenoreceptor antagonists (G04CA)	9.4 (26)	9.1 (25)	5	4	0.806
Corticosteroids for systemic use (H02A)	7.6 (21)	7.2 (20)	4	3	0.816
Thyroid therapy (H03AA01)	21.7 (60)	21.7 (60)	3	3	0.936
Anti-inflammatory and antirheumatic drugs (M01)					
Glucosamin (M01AX05)	5.8 (16)	4.0 (11)	6	1	0.728
Antiosteoporosis drugs (M05)					
Bisphosphonates (M05B)	6.2 (17)	6.2 (17)	2	2	0.875
Analgesics (N02)					
Opioids, natural (N02AA)	6.2 (17)	4.3 (12)	10	5	0.455
Buprenorphine (N02AE01)	8.7 (24)	10.1 (28)	1	5	0.873
Paracetamol (N02BE01)	33.0 (91)	23.2 (64)	45	18	0.441
Antiepileptics (N03)					
Other antiepileptics (N03AX)	6.2 (17)	6.9 (19)	0	2	0.941
Psycholeptics (N05)					
Antipsychotics (N05AH)	9.8 (27)	9.2 (26)	4	3	0.854
Bentsodiazepines (N05CD)	6.5 (18)	2.5 (7)	12	1	0.460
Bentsodiazepine-related drugs (N05CF)	12.0 (33)	5.4 (15)	20	2	0.505
Melatonin (N05CH)	14.5 (40)	14.1 (39)	8	7	0.778
Psychoanaleptics (N06)					
Antidepressants (N06AB, N06AX)	21.0 (58)	21.3 (59)	2	3	0.935
Anticholinesterases (N06DA)	23.9 (66)	22.5 (62)	6	2	0.919
Memantine (N06DX)	12.0 (33)	12.3 (34)	0	1	0.983
Inhalers for obstructive pulmonary diseases (R03)					
Adrenergics (R03AC)	6.2 (17)	0.7 (2)	16	1	0.093
Adrenergics, combinations (R03AK)	9.8 (27)	10.2 (28)	2	3	0.839
Glucocorticoids (R03BA)	3.3 (9)	5.1 (14)	1	6	0.683
Ophthalmologicals (S01)					
Prostaglandin analogues (S01EE)	8.3 (23)	6.2 (17)	6	0	0.839
Lubricants (S01X)	12.0 (33)	9.8 (27)	16	10	0.479

Psychotropics with discrepancies were mostly benzodiazepines and benzodiazepine-related drugs (80% of discrepancies in psychotropics, $n=49$). Home care clients with discrepancies (61%, $n=30$) in

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Table 3. Person-level prevalence of clinically important discrepancies between in-home-interview-based regular prescription drug use and EMRs by therapeutic class (ATC) ($n = 276$)

	Prevalence of any discrepancies	
Therapeutic group (ATC class)	%	*n*
Drugs used in diabetes (A10)	3.3	9
Diuretics (C03)	5.1	14
Beta-blocking agents (C07)	5.8	16
Calcium channel blockers (C08)	2.2	7
Agents acting on the renin–angiotensin system (C09)	5.8	16
Anti-inflammatory and antirheumatic products (M01)	5.5	15
Opioids (N02)	6.9	19
Psychotropics (N05 and N06)	22.1	61

benzodiazepines or benzodiazepine-related drugs and used these drugs regularly based on interviews, but they were listed as as-needed drugs on their EMRs. Similar trend was shown in natural opioids use.

DISCUSSION

A majority—eight out of ten—of the older home care clients had discrepancies between actual drug use based on interviews and their EMRs, and nearly half of them were considered clinically important. This is a new finding and a matter of great concern, because this very vulnerable population is at a high risk for adverse drug events and institutional care.[17] Other outpatient study found only a quarter of the clinically important drug discrepancies (24%) we discovered in our findings.[5] Medication errors have been reported to cause possible moderate or severe discomfort or deterioration for more than every third patient with a medication error.[1]

In the present study, discrepancies were more common among home care clients that were using private health care services, had better IADL and ability to self-manage drug use. Although the autonomy of home care clients is important, health care providers and family members should regularly assess whether the person him/herself is able to manage drugs, because health status may change quickly. It is complicated to manage over 10 different drugs per day and administer most of them more than once a day.

Cardiovascular agents have been identified as one of the most common discrepancies in previous studies carried out in hospital, community dwelling or residential care settings.[3] In our data, although agreement between interview data and EMRs concerning cardiovascular agents in the present study was very good or good, one fifth of our study population had at least one discrepancy in cardiovascular agents that potentially can cause clinical problems.

The most common drug groups with discrepancies—opioids and psychotropics—were often used regularly instead of as-needed or for a short term as listed in the EMRs. The risks associated with analgesics, hypnotics or sedatives in older people are potentially severe due a decline in cognition, a high risk for falls and fractures and an increased risk of death.[18–20]

In this study, agreement was poorest in beta-2-adrenoceptor agonist inhalants; home care clients used them regularly instead of as needed as they were listed in EMRs. In addition, glucocorticoid inhalants were not used regularly, as prescribed. The same kind of problem with inhalants has been previously found among older people with asthma.[21] Beta-2-adrenoceptor agonist use may induce adverse events such as tremor, tachycardia or arrhythmias, and therefore these agents should be used by older people only as needed.[22]

The strength of the present study was the population-based and representative sample of home care clients. We did not have exclusion criteria in terms of morbidity and cognitive or functional status. The three municipalities involved in this study represent the Finnish population of home care clients quite good; gender distribution and age-related coverage of home care are in accordance with statistics of National Institute for Health and Welfare.[23] Additionally, municipalities have responsibilities to run social and health care including home care according to the national legislative framework. All residents of Finland have their EMR in their own municipality no matter have they ever used health care services or not. In addition, in Finland the information about residence is continuously updated and when changing your address you have to give the information within a few days by the web based system or by mail. After that information is available for all authorities. The investigation of actual drug use was thorough, as the home care clients were interviewed at home by a trained pharmacist. As with all interview studies, recall bias is possible, although here it was minimised by having the interview data confirmed by home care nurses or family members. In addition, a pharmacist went through drug lists, packages, dose dispensers and prescriptions to ensure correctness. In the home care nurse interviews, validated instruments were used to assess functioning in daily activities, cognitive functioning and mood. All the nurses took care of home care clients daily and were trained in the use of the study instruments. A limitation of the present study was its cross-sectional study design, which did not allow us to determine causes of discrepancies.

Further research is needed in other countries to find out whether this phenomenon is the same in other

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countries with home care services. Our findings raise questions concerning these problems in clinical practice. The EMR accuracy is in high importance among home care clients because of the vulnerability of home care clients. Thus accurate EMR offers an important tool for all involved in home care and guarantees the quality of drug management in home care. Reliable EMR also enables the quality use of pharmacological assessment software in reviewing medications. There is a need for a nationwide EMR across the health care with the possibility of active involvement by home care clients and their caregivers.

Home care clients' drug use and agreement with EMRs should be checked regularly by means of interviews at home conducted by home care nurses or pharmacists.

CONCLUSION

Eight out of ten home care clients had discrepancies in drug use between in-home interview data and EMRs, and nearly half of these discrepancies were clinically important.

CONFLICT OF INTEREST

The authors declare that they have no conflicting interests.

KEY POINTS

- Discrepancies between actual drug use and electronic medical records are common among older home care clients.
- Of the discrepancies, 40% were considered clinically important
- The discrepancies reflected common problems in drug use among older people; e.g. polypharmacy, regular use of opioids or psychotropics instead of proper as-needed or short-term use, and problems with asthma inhalant use.

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ETHICS STATEMENT

The study protocol was approved by the Research Ethics Committee of the Northern Savo Hospital District, Kuopio, Finland.

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