A retrospective cohort study of the prescribing trends of nurse practitioners to older adults in Ontario: 2000 –

2010

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Abstract

Background: Nurse prescribing is a health care practice that has, and will continue to evolve in response to emerging trends, particularly in primary care. The overall goal of this study was to describe the trends and patterns in medication prescription to persons ≥ 65 years of age in Ontario by nurse practitioners (NPs) over a 10 year period.

Methods A population-based descriptive retrospective cohort study was conducted. All NPs registered in the Corporate Provider Database (CPDB), between 1 January 2000 and 31 December 2010, were identified. Active NP prescribers were defined through linkage of dispensed medications to persons ≥ 65 years, from the Ontario Drug Benefit (ODB) to NPs. As a comparator, all prescription medications dispensed by family physicians (FPs) to a similar group were identified. Geographical location was determined based on site of NP practice.

Results: The number and proportion of actively prescribing NPs increased from 2000 to 2010 [44/340 (12.9%) to 888/1424 (62.4%)]. The number and proportion of medications dispensed for chronic conditions by NPs increased: in 2010, 9 out 10 top medications dispensed were for chronic conditions. There was substantial variation in the proportion of NPs dispensing medication to older persons across LHINs.

Interpretation: NP prescribing to older adults, and in particular medications related to chronic conditions, increased between 2000 and 2010. The integration of NPs into primary care has not been consistent across the province, and not in relation to population changes. Further investigation into the nature and effect of NP practice on patient care is warranted.

Word count: 250

INTRODUCTION

Nurse prescribing is a health care practice that has, and will continue to evolve in response to emerging health system changes and concerns about access, costs and quality. The number of countries in which nurses legally prescribe medication is growing(1;2) and is expected to increase. While the defining criteria for nurse prescribing practices vary, two models are generally described. The first model is the independent nurse prescriber, in which the nurse is responsible for the clinical assessment, diagnosis and medical treatment, within a regulated scope of practice. Independent nurse prescribers can prescribe from a limited formulary containing a list of medications, or from an open formulary, with or without restriction of selected classes of medications, depending on the jurisdiction within which the individual practices. The second model is supplementary nurse prescribing in which the nurse in partnership with an independent prescriber (i.e., physician), after initial assessment and diagnosis, may prescribe medication, usually from a limited formulary.

This study focused on autonomous Nurse Practitioners (NPs). In Ontario, NPs are registered nurses with additional education who collaborate with physicians and other health care providers in the provision of care and are able to assess, order diagnostic tests, diagnose, prescribe medication, and manage patient health conditions within their legal scope of practice.(3) Although various educational programs have existed in Ontario since the 1970's, the *Regulated Health Professions Act* (RHPA, 1991) first paved the way for regulation of the NP role; yet it was not until 1994 that registration as RN-extended class [RN(EC)] occurred.(4-6) The role of the NP in primary practice has evolved in response, predominantly, to the needs of the populations served, and directions established by the provincial ministries.(5;7) Medications prescribed by NPs in Ontario were, historically, outlined in a list of drugs found in Reg.275/94 of the *Nursing Act, 1991.* In 2008, the list was amended to add 24 additional drugs. In December 2009, Bill 179 the *Regulated Health Professions Statute Law Amendment Act* was passed in Ontario

amending 26 health statutes, including both the *Nursing Act, 1991* and the *Regulated Health Professionals Act, 1991*.(8) New authorizations to NP practice include the ability to broadly prescribe medications based on individual NPs' knowledge, competencies and practice setting.(9;10) This specific regulatory change occurred in October 2011 and eliminated the previous allowable list of drugs.(11)

Our knowledge of the patterns and impact of nurse prescribing is limited, but growing.(4;6)   Studies examining nurse prescribing tend to be disease-specific(12-16) and employ a variety of non-population-based research designs. Findings from these limited studies generally support nurse prescribing as an effective health care practice; none have explored nurse prescribing practice in Ontario and Canada. Therefore, the objective of this study was to describe NP medication prescribing patterns to persons 65 years of age or older in the province of Ontario across a 10 year period preceding the recent change in prescriptive practice. It is anticipated that findings from this study will provide a baseline and platform for ongoing evaluation of NPs' contribution to primary health care.

METHODS

Study design and data sources

 A population-based, retrospective cohort study was conducted to examine the prescribing patterns of NPs providing care to older adults between 2000 and 2010. The study examined four administrative health databases: 1) the Corporate Provider Database (CPDB), which is derived from the list of health professional registered with each respective licensing college, for demographic and practice information on all NPs and physicians with an Ontario Health Insurance Program (OHIP) billing number; 2) the ICES Physician Database (IPDB) to identify family physicians (FPs) and link the physician's encrypted unique identifier to prescriptions dispensed under Ontario's Drug Benefit

(ODB) program; 3) the OBD database for detailed information on all outpatient prescriptions covered by the provincial drug formulary; and 4) the Registered Persons Database (RPDB) for basic demographic information on all residents who have ever received an Ontario health card number (OHCN). These databases are held securely in a linked, de-identified form at the Institute for Clinical Evaluative Sciences (ICES) in Toronto and were analyzed at the ICES satellite unit located at Queen's University,

Study cohorts

All NPs who were registered between 01 January 2000 and 31 December 2010 and had an OHIP billing number in the CPDB database were identified. An NP's eligibility to prescribe in a given year was determined using OHIP eligibility start and end dates, and the Local Health Integration Network (LHIN) where the NP practiced each year was derived using the NP's practice site postal code at the start of each year. To account for the influence of changes in population demographics over time, as well as changes in drug availability, marketing, and formulary coverage during the study period, a cohort of FPs was identified using a similar approach.

Prescription medications

All medications in the ODB database prescribed by a member of the NP or FP cohort and dispensed to patients 65 years of age and older during the study period were identified; the patient's age at dispensation date was obtained through record linkage with the RPDB. As such, only prescriptions with a valid OHCN were included in the analysis. Drugs were categorized on the basis of their pharmacologic and/or therapeutic class, as well as whether they were indicated for an acute (i.e., episodic treatment) or chronic (i.e., chronic treatment) conditions. The categorization of drugs used for both acute and chronic conditions (e.g., nonsteroidal anti-inflammatory drugs [NSAIDs]) was based on the proportion of prescriptions written for a short (<30 days) versus long (≥30 days) duration of use. Using this approach, acetaminophen, NSAIDs, proton pump inhibitors (PPIs), and stool softeners were categorized as chronic medications in this older adult population, since the vast majority of prescriptions were >= 30 days.

Analysis

The NP cohort was described with respect to the number of NPs newly registered each year, age at registration and the proportion who had at least one prescription filled by a patient 65 years and older within their first year of practice (an indicator of 'active' prescribing). To examine geographical variation in the prevalence of NPs prescribing to older adults over time, the number of NPs per 10,000 residents who had at least one prescription filled each year by a patient 65 years of age and older within each of Ontario's 14 LHIN regions was identified. As well, to assess whether changes in the prevalence of prescribing NPs were due to changes in population demographics, the change in the percentage of older adults living within each LHIN during the study period to that of NPs prescribing to older adults within the same LHIN was compared. The proportion of medications prescribed and dispensed each year to older adults for each therapeutic class were identified and ranked according to their frequency of use. All analyses were performed using SAS software version 9.3 (SAS Institute, Inc., Cary, NC).

This study was approved by the Health Services Research Ethics Board at Queen's University.

RESULTS

Insert Table 1

Over the 10 year time period, the number of NPs registered and the proportion who had a prescription dispensed to persons 65 years or older increased (Table 1). In 2000, only 44 of 340 (12.9%) of registered NPs actively prescribed to older adults within their first year of licensure compared to 888 of 1423 (62.4%) eligible NPs in 2010.

Insert Table 2 and Figure 1

In 2000, the highest number of NPs actively prescribing was in the North East Ontario LHIN; the lowest number was in Central and Central West LHIN, and a similar pattern was noted in 2010. However, the number of active NP prescribers increased across the 10 years for all health regions. See Figure 1. The differential increase in the prevalence of actively prescribing NPs across health regions was not solely attributable to an aging population within individual regions as indicated in Table 2. For example, in North East Ontario the percentage increase in seniors across the 10 years was 18.2 %, whereas, the proportion of NPs prescribing to seniors decreased by 15.9%. The Mississauga LHIN had the largest increase in seniors (53.2%) but only a modest increase in the proportion of NPs prescribing (2.5%).

Insert Table 3 and Figure 2

Tables 3 and 4 provide a description of the most common classes of medications prescribed by NPs, in comparison to FP's during the same time period. For NPs, the switch to prescribing medications for more often for chronic compared to acute conditions occurred around 2005; by the following year this trend was well established, with 6 out of the 10 most frequently dispensed medications being those to treat chronic illnesses. The proportion continued to increase to a high of 9 out of the top 10 in 2008 (and sustained thereafter). In contrast, FPs consistently prescribed a higher proportion of medications for chronic conditions throughout the study period. By 2010, 8 of the top 10 most frequently prescribed medications were the same for NPs and FPs. The only differences were that FPs prescribed serotonin inhibitors and benzodiazepines and NPs prescribed laxatives and bisphosphonates; NPs were not regulated to prescribe benzodiazepines during the study period.

INTERPRETATION

Key findings

Within the last decade the number of NPs prescribing medications to older persons in Ontario has increased significantly. The prescribing pattern of NPs has also changed substantially during this time period from prescribing

of medications predominantly for episodic illness (i.e., acute indications) to prescribing of medications for chronic illnesses, a practice that is similar to that of family physicians. While the number of NPs has increased substantially in the province, there continues to exist important differences in the number of practicing NPs across health regions in Ontario, with the northern regions having the highest prevalence of NPs and the central regions having the lowest prevalence per capita. Interestingly, the proportion change of NPs actively prescribing within each LHIN region was not in line with the change in proportion of older persons within the region.

The increase in the actual number of NPs followed logically the introduction of NP educational programs across Canada, specifically the Ontario Primary Health Care Nurse Practitioner Program (PHCNP, a collaboration of nine universities). In 1996, the Ontario PHCNP graduated the first cohort of students; beginning in 2008, new graduate-level curriculum was implemented across the nine university sites. Currently, there are approximately 220 admission seats in Ontario.(17) Ongoing primary and community health care reform, such as the introduction of Family Health Teams, has supported the integration of NPs into primary care practices. We were not able to differentiate between primary care and non-primary care NPs, however; the findings are likely reflective of NPs in primary and community care, as most non-primary care nurse practitioners work in the hospital setting where medications are dispensed by hospital pharmacies.

The largest proportion of NPs was in the northern regions of the province, regions supposedly less well served by FPs. The slow uptake of NPs within the central regions of the province is an interesting trend and may reflect the slower uptake of primary health care reform strategies within this region. Currently, of the 200 or so FHTs within the province, 38 are located in the Central West, Mississauga, Toronto Central and Central East Regions – regions with the largest population base. Furthermore, as evident from these findings, the proportional increase (or decrease) of NPs within a region is not aligned with changes in the aging population needs.   Of particular concern, is

the increasing number of persons residing in the central region and the limited increase in NP integration and, as well, the decrease in the proportion of NPs per population in the north east region. While we can be reassured that our educational programs are graduating NPs, the integration of NPs into the health care system seems to be driven more by available health system resources and uptake (i.e., FHT and Community Health Centres) rather than by population needs.

NPs prescribing patterns changed across the 10 years and became similar to that of FPs. The shift to prescribing of medications for chronic conditions appears not to be attributable to underlying trends in population demographic as evidenced by the corresponding prescribing trends of FPs. These study findings extend those of other non-population based studies that have explored and compared the prescribing patterns of independent or supplementary role NPs (13;18-20) in comparison to physicians or physician assistants, and clearly show that NPs are prescribing in accordance with their role.

With the growing number of older persons, the increasingly complex medication protocols for disease conditions, the desire to focus care in the primary care setting (and not in hospitals), the goal to optimize the functional health of older persons, and the limited availability of health care resources will challenge primary health care professionals to optimize their respective roles and contributions to care. NPs should be well positioned to contribute to the care of patients with chronic conditions. However, the care of the elderly patient with multiple chronic conditions is complex and challenging (21;22), with risk for medication error that is associated with increasing age, serious health conditions, multiple medications and multiple transfers between community and hospital care(23;24). This will raise some interesting challenges and opportunities for NPs, FPs and the health care teams in which they work.   Recent innovative interdisciplinary models of care in which the NP (or nurse) assumes a major role in the care of patients with complex chronic conditions are promising.(25-29) Moreover, funding and

practice models need to support innovation, across traditional health sectors. NPs can assume an important and unique role within the primary health care team, by complementing and augmenting the team approach to elder care.

The strength of this study is its population base and the ability to capture most medications dispensed to older adults in Ontario by NPs with prescribing privileges and FPs across a 10 year time period. This allowed the capture of baseline patterns, before substantial primary health care reform around 2005, and trends across the 10 year time period.   More importantly, these data will enable us to ascertain the impact of future health care reform policy, as well as practice changes on prescribing patterns. The data did not include detailed information on patient clinical characteristics or health related outcomes; this will be the focus for further study. As well, there was an inability to determine the practice setting of NPs; this limitation does not influence the interpretation of the results, as we analyzed medications dispensed not prescribed, which predominantly identifies ambulatory or primary care practices

CONCLUSIONS

The study findings clearly demonstrate the growth in numbers of NPs and the number and types of medications dispensed across a 10 year time period.   NPs are an integral and important component of the primary health care system and play an important role in the care of persons with chronic conditions. However, the findings also show that, perhaps, NPs are not being optimally positioned in their practice (or within models of care) to best meet the

population needs of the older person.   Further research in regard to the impact of NP prescribing on patient and system outcomes is warranted.

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Table 1: Characteristics of Nurse Practitioners registered in Ontario between 2000 and 2010

Year	Number newly registered	Mean age at registration (SD)	Age range (yrs)	Total number registered	Number with ≥1 prescription dispensed to persons ≥65 years
2000	65	40.3 (6.5)	26-58	340	44 (12.9%)
2001	50	40.9 (7.6)	27-60	389	71 (18.3%)
2002	40	41.1 (7.0)	27-55	429	79 (18.4%)
2003	87	40.7 (7.4)	27-56	516	89 (17.2%)

2004	56	41.0 (7.6)	28-59	572	119 (20.8%)
2005	55	39.9 (7.8)	27-55	627	192 (30.6%)
2006	75	39.0 (8.0)	26-57	702	275 (39.2%)
2007	162	40.0 (9.0)	26-64	863	399 (46.2%)
2008	156	39.6 (8.3)	25-59	1019	536 (52.6%)
2009	234	40.0 (8.8)	25-63	1252	694 (55.4%)
2010	171	38.6 (9.4)	26-61	1423	888 (62.4%)

Figure 1: Prevalence of Nurse Practitioners actively prescribing in 2000, 2005 and 2010 according to the Local Health Integration Network (LHIN) of their practice site
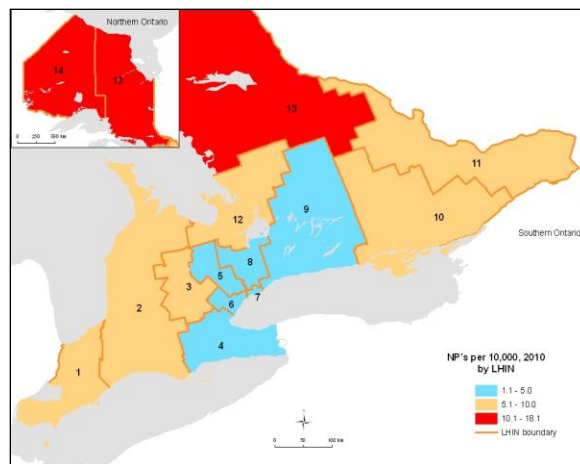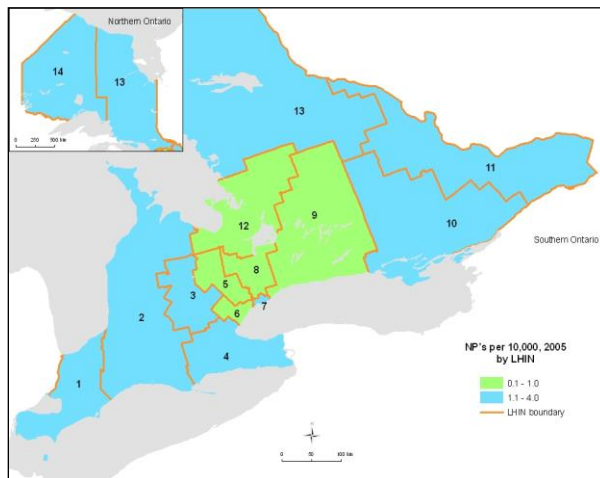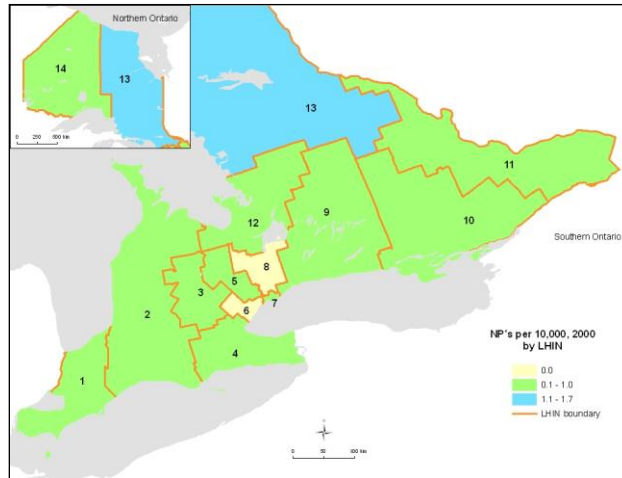
Table 2: Comparison of changes in the proportion of older persons and the prevalence of Nurse Practitioners prescribing to older adults between 2000 and 2010 by local health integration network (LHIN)

Local health integration network (LHIN)	Change in the proportion of older persons (%)	Change in the prevalence of NPs prescribing to older persons (%)
Erie St. Clair	13.9	-0.8
South West	17.3	1.0
Waterloo Wellington	26.4	5.2
Hamilton Niagara Haldimand Brant	19.3	-0.7
Central West	41.2	-2.7
Mississauga Halton	53.2	2.5
Toronto Central	6.3	-5.6
Central	37.0	2.6
Central East	20.1	3.2
South East	22.0	3.4
Champlain	21.7	1.4
North Simcoe Muskoka	41.5	3.9
North East	18.2	-15.9
North West	5.9	4.6

Figure 2: Comparison of the prescribing trends of NPs and GPs of medications for acute and chronic indications
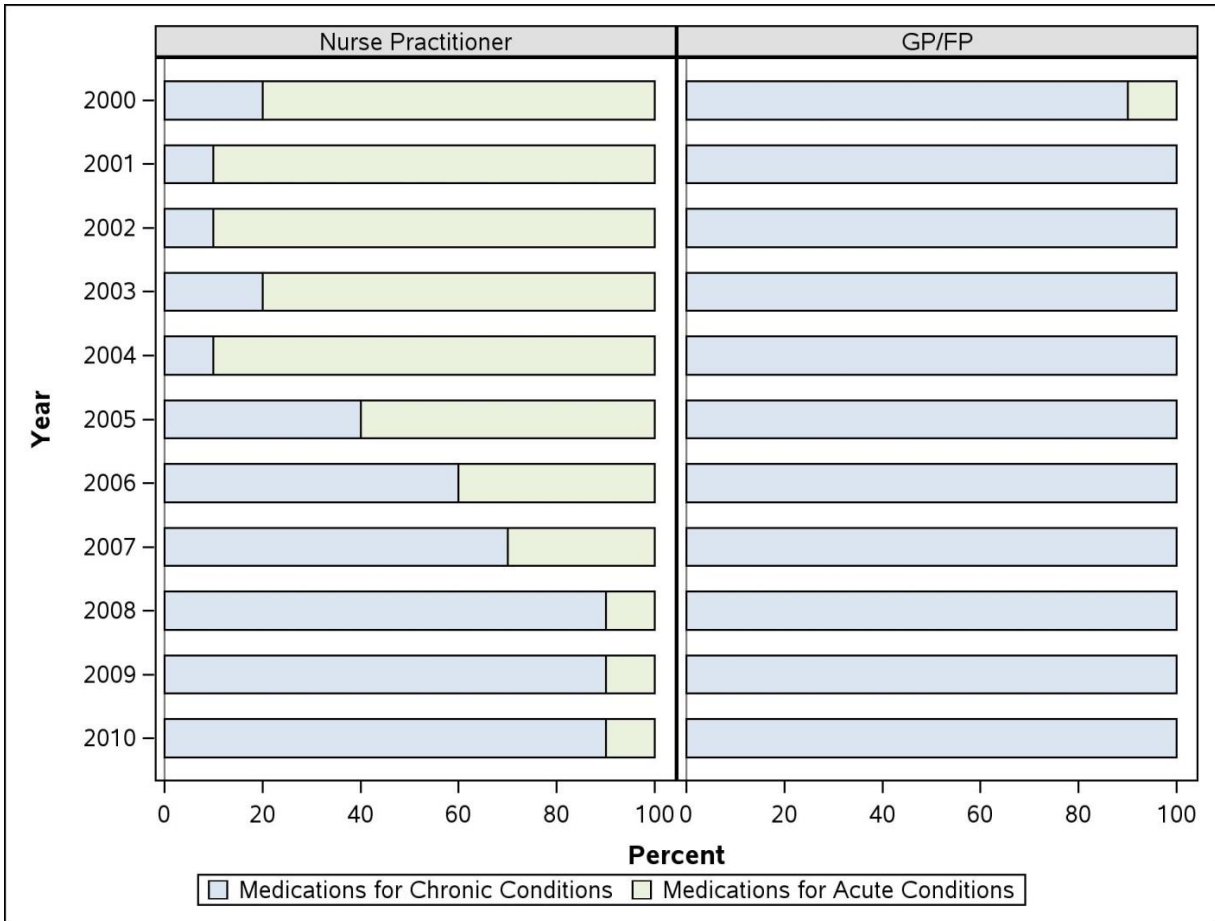
Table 3: Top 10 medications dispensed to persons 65 and older by NPs and GPs in 2000, 2005 and 2010.

Rank	2000		2005		2010	
	NP	GP	NP	GP	NP	GP
1	Sulf/tmp (22.8%)	ACEI (6.1%)	Fungicides (9.6%)	Diuretics (6.7%)	Statins (9.2%)	Statins (7.4%)
2	Penicillins (12.3%)	Benzodiazepine derivatives (6.0%)	Non-systemic corticosteroids (7.7%)	ACEI (6.5%)	ACEI (6.5%)	PPI (5.6%)
3	Non-systemic corticosteroids (11.1%)	Diuretics (5.5%)	Laxatives (6.8%)	Statins (5.9%)	Diuretics (6.4%)	Diuretics (5.6%)
4	NSAID (7.7%)	CCB (4.9%)	Diuretics (5.1%)	CCB (4.9%)	PPI (5.2%)	ACEI (5.2%)
5	Fungicides (7.1%)	BB (4.0%)	Misc local anti-infectives (5.1%)	BB (4.8%)	BB (4.8%)	CCB (4.7%)
6	Antibiotics (5.5%)	Statins (3.8%)	Macrolides (5.0%)	PPI (4.4%)	CCB (4.7%)	BB (4.7%)
7	Urinary anti-infectives (5.2%)	NSAID (3.7%)	Analgesics simple (3.8%)	Benzodiazepine derivatives (4.2%)	OHA (4.6%)	OHA (4.2%)
8	Laxatives (4.0%)	OHA (3.6%)	ACEI (3.8%)	OHA (3.9%)	Hypothyroidism therapy (3.4%)	Hypothyroidism therapy (3.2%)
9	Analgesics simple (3.4%)	Histamine h2 receptor antagonist (3.5%)	Sulf/tmp (3.7%)	Hypothyroidism therapy (3.3%)	Laxatives (3.0%)	Selective serotonin reuptake inhibitors (3.1%)
10	Metronidazole (3.1%)	Narcotics: opiate agonists (3.3%)	Stool softeners (3.5%)	Selective serotonin reuptake inhibitors (2.9%)	Bisphosphonates (3.0%)	Benzodiazepine derivatives (3.0%)
Percentage of all medication prescriptions	82%	45%	54%	48%	51%	47%

☐ Medications for chronic conditions   ☐ Medications for acute conditions

OHA= Oral anti-glycemics; BB= Beta-blockers; PPI= Proton pump inhibitors; CCB= Calcium blockers; Sulf/tmp= Sulfonamides, trimetroprim and combination; NSAID= Non-steroidal anti-inflammatory: non-asa base; Statins= Antilipemic: statins; ACEI= ACE Inhibitors; Misc local anti-infectives= Miscellaneous local anti-infectives; Analgesics and antipyretics: misc= Analgesics and antipyretics: miscellaneous