What proportion of prescriptions are unfilled or not picked up by patients?

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Describing the Data and Analysis

- **Data Custodian Organization(s) and data sources**: Manitoba Primary Care Research Network – MaPCReN and the Manitoba Centre for Health Policy (MCHP)

- **List of Datasets Used (e.g. names of database and/or data origins)**: The MaPRCeN is composed of de-identified primary care data collected from participating primary care clinics. The repository is managed in partnership with the Canadian Primary Care Sentinel Surveillance Network (CPCSSN). A copy of the MaPCReN database is stored inside the MCHP repository to allow for linkage with administrative and social services data.
  MCHP is a research unit within the Department of Community Health Sciences, in the College of Medicine, Faculty of Health Sciences at the University of Manitoba. It carries out population-based research on health services, population and public health and the social determinants of health. MCHP uses de-identified data from administrative records of Manitobans (personal data collected for other purposes stored by a variety of government departments). Each record comes with a scrambled identified which allows linkage of each record in different datasets.
  For this study MCHP linked the MaPCReN database of primary care EMR data to the Drug Program Information Network (DPIN).
  The DPIN database contains information on prescriptions filled by community pharmacies (hospital pharmacies are not included). Each drug approved in Canada in accordance to the Food and Drug Regulation is assigned an 8-digit number (Drug Identification Number or DIN) by the Health Canada Drugs Program. The data are available from 1995/96 to 2013. The Anatomical Therapeutic Chemical (ATC) classification system is used to classify drugs according to the system or organ that they affect and/or their chemical/therapeutic characteristics.
  The prescription for the MaPCReN databased was matched with the dispensing record in DPIN for medications that belonged to the cardiovascular system grouping based on the ATC classification including the following categories:
  C01 Cardiac therapy
  C02 Antihypertensives
  C03 Diuretics
  C04 Peripheral vasodilators
  C05 Vasoprotectives
  C07 Beta blocking agents
  C08 Calcium channel blockers
  C09 Agents acting on the renin-angiotensin system
  C10 Lipid modifying agents

- **Exclusions**: Patients under the age of 18, patients who opted out of data collection in the MaPCReN. Patients admitted to hospital or who died during the period surrounding the prescription.

- **Nature and Size of Cohort (e.g. geographic area covered, number of patients included)**: The linked data in the MCHP represents the MaPCReN 2015 Q1 dataset and the DPIN 2013/2014 dataset. This represents 151 sentinels (primary care practices) from 27 sites (clinics) participating in the Winnipeg and the Southern Health Region of Manitoba. This represents data from 184,646 patients.

  Clinics are recruited to participate in MaPCReN directly by the Network Director and represent a diversity of primary care providers including Family Physicians and Nurse Practitioners in both Fee-for-Service and Salary models. The services offered at the primary care clinics include but are not limited to same day access, inter-professional team care, social services and specialty medical care.
  The Research Ethics Board Approval (REB) at the University of Manitoba has granted permission for all data collected from EMRs related to MaPCReN's work in building this repository. A second related REB approval has been obtained related to the ongoing study which involves the linkage of data from the MaPCReN with the MCHP repository. In addition the study and associated linkage has been approved by Manitoba's Health Information Privacy Committee.

- **Data timeframe**:
  Prescriptions created between April 1st 2012 and Dec 31st 2013.
  Data included from the MCHP and the MaPCReN data spans from April 2012 to March 31st 2014 to account for 90 days follow-up. In addition the DPIN database was searched up to April 2011 to define prescriptions not made in the previous year in order to define "new prescriptions"

Describing the Findings

- Numerator and Denominator (as specified in the question definition).
  There were a total of 117,600 prescriptions in our sample representing the denominator. Of those 69,302 were eventually filled. A total of 25,252 prescriptions of those filled were filled between 30-90 days and were considered "delayed".

- State the key statistics from your analysis.

  In our sample 58% of the prescriptions were filled eventually. A total of 21% of the prescriptions filled were delayed. Analysis is ongoing to describe the patient and provider feature that affect the likelihood a prescription will be filled or not.

- Please also provide a brief summary of the findings including any key limitations or interpretation issues (may also include figures/tables).

Our findings show the capacity to link two large databases with millions of records containing both prescribing and dispensing data. We found that an astonishing number of prescriptions were not filled in this data set. However, we are unable to identify particular causation to describe which medications are filled or not and for what reason.

That being said, our complete analysis has not been completed so we cannot state during which we hope to describe the variables affecting the likelihood of having a filled, delayed or non-filled prescription. As our data relates to prescriber and dispenser databases we have no patient centred data that could describe the rational for the individual choice to fill, delay or not fill a prescription. This dataset also lacks the granularity to describe the prescribers' documentation so the exact indication and documented patient counselling remains uncertain.

MCHP holds only dispensing data from Manitoba in DPIN, so it is possible a small number of prescriptions were filled out of province. Additionally, in primary care EMR's it is also possible that a small number of prescriptions were created erroneously or in error and patients were counselled subsequently not to fill them so some of the unfiled prescriptions may have been correct. In addition some unfilled prescriptions may relate to community pharmacists intervening to advise patients not to use a certain medication based on potential side effects or interactions.

Nonetheless this very large dataset presents many exciting opportunities for further understanding of adherence that we hope to undertake in the near future.

The following table demonstrates all of the medications with the entire matched dataset for each matched medication.

ATC Code	Fill type	Frequency
C01AA05	delayed rx	143
C01AA05	filled rx	755
C01AA05	non-filled rx	246
C01BA01	non-filled rx	25
C01BA02	non-filled rx	8
C01BA03	filled rx	0
C01BA03	non-filled rx	0
C01BB01	non-filled rx	26
C01BB02	delayed rx	0
C01BB02	filled rx	12
C01BB02	non-filled rx	6
C01BC03	delayed rx	6
C01BC03	filled rx	21
C01BC03	non-filled rx	21
C01BC04	delayed rx	6
C01BC04	filled rx	23

C01BC04	non-filled rx	18
C01BD01	delayed rx	30
C01BD01	filled rx	132
C01BD01	non-filled rx	41
C01BD02	non-filled rx	0
C01CA02	non-filled rx	0
C01CA17	delayed rx	0
C01CA17	filled rx	25
C01CA17	non-filled rx	0
C01CA24	delayed rx	52
C01CA24	filled rx	334
C01CA24	non-filled rx	533
C01CA74	non-filled rx	0
C01DA02	delayed rx	149
C01DA02	filled rx	949
C01DA02	non-filled rx	1153
C01DA08	delayed rx	27
C01DA08	filled rx	103
C01DA08	non-filled rx	38
C01DA14	delayed rx	8
C01DA14	filled rx	7
C01DA14	non-filled rx	s
C01EA01	non-filled rx	s
C01EB09	non-filled rx	65
C02AB02	delayed rx	11
C02AB02	filled rx	40
C02AB02	non-filled rx	18
C02AC01	delayed rx	59
C02AC01	filled rx	310
C02AC01	non-filled rx	80
C02CA01	delayed rx	3
C02CA01	filled rx	57
C02CA01	non-filled rx	11
C02CA04	delayed rx	36
C02CA04	filled rx	135
C02CA04	non-filled rx	63
C02DB02	delayed rx	18
C02DB02	filled rx	64
C02DB02	non-filled rx	45
C02KX	non-filled rx	22
C02KX01	filled rx	1
C02LA01	non-filled rx	1
C03AA03	delayed rx	1550

C03AA03	filled rx	5616
C03AA03	non-filled rx	3617
C03BA04	delayed rx	49
C03BA04	filled rx	198
C03BA04	non-filled rx	119
C03BA08	delayed rx	2
C03BA08	filled rx	30
C03BA08	non-filled rx	20
C03BA11	delayed rx	72
C03BA11	filled rx	304
C03BA11	non-filled rx	301
C03CA01	delayed rx	508
C03CA01	filled rx	3195
C03CA01	non-filled rx	1773
C03CC01	filled rx	2
C03DA01	delayed rx	98
C03DA01	filled rx	567
C03DA01	non-filled rx	170
C03DA04	delayed rx	1
C03DA04	filled rx	1
C03DB02	non-filled rx	10
C03EA01	delayed rx	189
C03EA01	filled rx	538
C03EA01	non-filled rx	314
C04AC01	filled rx	6
C04AC01	non-filled rx	65
C04AD03	filled rx	1
C04AD03	non-filled rx	83
C05AA01	delayed rx	44
C05AA01	filled rx	557
C05AA01	non-filled rx	449
C05AA51	filled rx	3
C05AA51	non-filled rx	204
C05AD03	non-filled rx	3
C05AD07	non-filled rx	17
C05AD57	non-filled rx	1
C05AX03	non-filled rx	18
C05AX04	non-filled rx	11
C05BA04	delayed rx	5
C05BA04	filled rx	29
C05BA04	non-filled rx	11
C05BA53	non-filled rx	4
C07AA02	non-filled rx	70

C07AA03	delayed rx	4
C07AA03	filled rx	8
C07AA03	non-filled rx	24
C07AA05	delayed rx	93
C07AA05	filled rx	567
C07AA05	non-filled rx	276
C07AA06	delayed rx	6
C07AA06	filled rx	15
C07AA06	non-filled rx	1
C07AA07	delayed rx	54
C07AA07	filled rx	161
C07AA07	non-filled rx	39
C07AA12	delayed rx	17
C07AA12	filled rx	129
C07AA12	non-filled rx	62
C07AB02	delayed rx	1282
C07AB02	filled rx	4935
C07AB02	non-filled rx	2152
C07AB03	delayed rx	452
C07AB03	filled rx	1670
C07AB03	non-filled rx	892
C07AB04	delayed rx	37
C07AB04	filled rx	116
C07AB04	non-filled rx	74
C07AB07	delayed rx	100
C07AB07	filled rx	395
C07AB07	non-filled rx	87
C07AG01	delayed rx	12
C07AG01	filled rx	94
C07AG01	non-filled rx	76
C07AG02	delayed rx	43
C07AG02	filled rx	171
C07AG02	non-filled rx	90
C07CB03	delayed rx	12
C07CB03	filled rx	45
C07CB03	non-filled rx	16
C08CA01	delayed rx	1023
C08CA01	filled rx	4188
C08CA01	non-filled rx	2206
C08CA02	delayed rx	37
C08CA02	filled rx	124
C08CA02	non-filled rx	215
C08CA05	delayed rx	83

C08CA05	filled rx	539
C08CA05	non-filled rx	317
C08CA55	non-filled rx	3315
C08DA01	delayed rx	70
C08DA01	filled rx	243
C08DA01	non-filled rx	141
C08DB01	delayed rx	250
C08DB01	filled rx	1120
C08DB01	non-filled rx	609
C09AA01	delayed rx	15
C09AA01	filled rx	26
C09AA01	non-filled rx	9
C09AA02	delayed rx	110
C09AA02	filled rx	544
C09AA02	non-filled rx	368
C09AA03	delayed rx	176
C09AA03	filled rx	808
C09AA03	non-filled rx	608
C09AA04	delayed rx	106
C09AA04	filled rx	582
C09AA04	non-filled rx	73
C09AA05	delayed rx	1138
C09AA05	filled rx	4671
C09AA05	non-filled rx	2978
C09AA06	delayed rx	52
C09AA06	filled rx	143
C09AA06	non-filled rx	164
C09AA07	delayed rx	1
C09AA07	filled rx	12
C09AA07	non-filled rx	3
C09AA08	delayed rx	52
C09AA08	filled rx	233
C09AA08	non-filled rx	211
C09AA09	delayed rx	159
C09AA09	filled rx	612
C09AA09	non-filled rx	274
C09AA10	delayed rx	107
C09AA10	filled rx	588
C09AA10	non-filled rx	122
C09BA02	delayed rx	15
C09BA02	filled rx	36
C09BA02	non-filled rx	447
C09BA03	delayed rx	11

C09BA03	filled rx	65
C09BA03	non-filled rx	72
C09BA04	delayed rx	209
C09BA04	filled rx	901
C09BA04	non-filled rx	2331
C09BA05	delayed rx	16
C09BA05	filled rx	77
C09BA05	non-filled rx	228
C09BA06	delayed rx	17
C09BA06	filled rx	63
C09BA06	non-filled rx	56
C09BA08	delayed rx	14
C09BA08	filled rx	55
C09BA08	non-filled rx	37
C09BB05	non-filled rx	108
C09CA01	delayed rx	216
C09CA01	filled rx	876
C09CA01	non-filled rx	480
C09CA02	filled rx	15
C09CA03	delayed rx	295
C09CA03	filled rx	1259
C09CA03	non-filled rx	787
C09CA04	delayed rx	443
C09CA04	filled rx	1537
C09CA04	non-filled rx	1066
C09CA06	delayed rx	125
C09CA06	filled rx	626
C09CA06	non-filled rx	569
C09CA07	delayed rx	232
C09CA07	filled rx	778
C09CA07	non-filled rx	807
C09CA08	delayed rx	7
C09CA08	filled rx	46
C09CA08	non-filled rx	16
C09DA01	delayed rx	163
C09DA01	filled rx	605
C09DA01	non-filled rx	178
C09DA02	delayed rx	1
C09DA02	filled rx	1
C09DA03	delayed rx	140
C09DA03	filled rx	672
C09DA03	non-filled rx	161
C09DA04	delayed rx	274

C09DA04	filled rx	1057
C09DA04	non-filled rx	422
C09DA06	delayed rx	54
C09DA06	filled rx	262
C09DA06	non-filled rx	236
C09DA08	delayed rx	2
C09DA08	filled rx	22
C09DA08	non-filled rx	3
C09DB04	delayed rx	1
C09DB04	filled rx	8
C09DB04	non-filled rx	19
C09XA02	delayed rx	3
C09XA02	filled rx	14
C09XA02	non-filled rx	2
C09XA52	delayed rx	1
C09XA52	filled rx	1
C09XA52	non-filled rx	4
C10AA01	delayed rx	403
C10AA01	filled rx	1314
C10AA01	non-filled rx	845
C10AA02	delayed rx	21
C10AA02	filled rx	55
C10AA02	non-filled rx	57
C10AA03	delayed rx	97
C10AA03	filled rx	333
C10AA03	non-filled rx	225
C10AA04	delayed rx	6
C10AA04	filled rx	14
C10AA04	non-filled rx	29
C10AA05	delayed rx	1903
C10AA05	filled rx	7243
C10AA05	non-filled rx	4589
C10AA07	delayed rx	1399
C10AA07	filled rx	5023
C10AA07	non-filled rx	2198
C10AB01	non-filled rx	12
C10AB02	delayed rx	3
C10AB02	filled rx	36
C10AB02	non-filled rx	5
C10AB04	delayed rx	1
C10AB04	filled rx	16
C10AB04	non-filled rx	17
C10AB05	delayed rx	145

C10AB05	filled rx	499
C10AB05	non-filled rx	392
C10AC01	delayed rx	11
C10AC01	filled rx	33
C10AC01	non-filled rx	25
C10AC02	filled rx	3
C10AC02	non-filled rx	2
C10AD02	delayed rx	2
C10AD02	filled rx	13
C10AD02	non-filled rx	5
C10AX06	non-filled rx	28
C10AX09	delayed rx	158
C10AX09	filled rx	473
C10AX09	non-filled rx	300
C10BX03	delayed rx	2
C10BX03	filled rx	17
C10BX03	non-filled rx	11

- Provide any additional analysis or insight that goes beyond what was asked in the question.

Currently we are developing statistical modeling which employs a multilevel regression analysis (patients nested within physicians) to test the patient and provider characteristics that are associated with having a "filled rx", "delayed rx" or "non-filled rx". The variable draw on data from both primary care EMR data held in the MaPCReN repository and administrative health and social service data held at MCHP.
The following co-variates will be included this model:

Patient Clinical Features:

Presence of co-morbid conditions (based on CPCSSN validated case definitions)

- Diabetes
- Hypertension
- COPD
- Osteoporosis
- Depression
- Dementia
- Parkinson's Disease
- Seizure disorder or epilepsy

Number of multiple co-morbidities and defined above
Co-morbidity burden based on:

- Charlson co-morbidity index (computed using diagnoses in physician and hospital records; use the 1-year period prior to the date of the prescription in med_calc to compute the index; categorize as 0, 1-2, 3+)

Total number of medications prescribed (categorical)

- Consider a 365 day window prior to a "new prescription"

    - 0-2 Low
    - 3-5 Medium
    - 6 and greater = polypharmacy

# of primary care visits per/year (categorical)

- Consider a 365 day window prior to a "new prescription"
    - Rare (1-2)
    - Regular (3-9)
    - Frequent (>10)

# of Emergency room visits/year (categorical)

- Consider a 365 day window prior to a "new prescription"
    - Rare (1-2)
    - Regular (3-9)
    - Frequent (>10)

# of Hospital admissions/year (categorical)

- Consider a 365 day window prior to a "new prescription"
    - Rare (1-2)
    - Regular (3-9)
    - Frequent (>10)

Patient demographic factors:

Age (at time of rx) (continuous)
Sex: male/female – if undefined, then delete
Income quintile (Categorical)

- Consider status at the date of the prescription

# of ADGs and Resource Intensity Bands (continuous)

- Consider status at the date of the prescription

Provider Characteristics (from MaPCReN Provider Table):

Provider Sex
Practice size (categorical)

- Small (<600), Medium (600-1000), Large (>1000)

Country of Graduation (categorical)

- Canada, IMG

Age of Provider (categorical)

- <35, 35-54, >54

Practitioner Type (categorical)

- Family physician, nurse practitioner

Practice Location (categorical)

- Urban, rural

- Describe the implications of this analysis for policy in no more than a few sentences.

The policy and clinical implications of this newly available linked data are only beginning to be explored. The primary focus will be to foster a better understanding regarding which patient and clinician factors affect adherence in ways that we not previously possible. The direct policy implication of a greater

understanding in this area will be the refined targeting of quality improvement interventions to drive more ideal adherence.

Cardiovascular disease remains the 2nd leading cause of death in Canada despite many medications that can reduce the risk of mortality and morbidity. This analysis has important implications for improving the usage of many of these potentially lifesaving medications.