Characteristics of consistently high primary health care users in the DELPHI database

Retrospective study of electronic medical records

Heather L. Maddocks PhD Moira Stewart PhD
Martin Fortin MD MSc CCMF FCMF Richard H. Glazier MD MPH CCFP FCFP

Abstract

Objective To identify consistently high users of primary health care and describe their use of services, characteristics, and comorbidities.

Design Retrospective analysis of de-identified patient data from 23 physicians contributing to the DELPHI (Deliver Primary Healthcare Information) database of electronic medical records between October 1, 2005, and June 30, 2010.

Setting Ten primary care practice sites in southwestern Ontario.

Participants A total of 1971 patients whose data were coded with the International Classification of Primary Care.

Main outcome measures Patient characteristics analyzed included sex, age, chronic conditions diagnosed by the end of the first year, multimorbidity (defined as 3 or more total chronic conditions), urban or rural postal code, and median family income quintile. Consistency of high primary health care use was measured using the total number of primary care visits in each of the 4 years that were studied (July 1, 2006, to June 30, 2010), creating 3 outcome groups: never high users, sometimes high users (above the 90th percentile in 1 to 2 years), and consistent high users (above the 90th percentile in 3 to 4 years). Bivariate analyses and multinomial logistic regression were used to test for effects of patient characteristics on consistency of high use.

Results Older patients were significantly more likely to become sometimes or consistent high users ($P < .05$). Multimorbidity at baseline increased the odds of being a sometimes high user by 2.3 times ($P < .001$) and a consistent high user by 4.1 times ($P < .001$). Patients in rural locations were 1.8 times more likely to become consistent high users ($P = .010$). In the multinomial regression, sex and income were not associated with odds of high use. Significantly higher prevalences of chronic respiratory, musculoskeletal, and psychological conditions were seen in the consistent high users ($P < .05$).

Conclusion Older patients with multimorbidity and those in rural locations are at a significantly higher risk of becoming consistent high users of primary health care. Several years of electronic medical record data were essential to conducting this research on the characteristics associated with becoming consistent high users of primary health care.

Editor's key points

- Understanding the highest users of primary health care and the complexity of their conditions can inform physician remuneration models and health services planning.
- Rural location is a predictor of consistent high use, as are older age and multimorbidity.
- Increased visits to primary health care might be a way to avoid being a high user of emergency or in-hospital care. These high users might represent a profile of patients with higher needs that are being appropriately cared for in primary care.
- Consistent high users have a higher prevalence of respiratory, musculoskeletal, and psychological conditions.

Points de repère du rédacteur

- La compréhension des plus grands utilisateurs de soins de santé primaires et de la complexité de leur état de santé peut servir à éclairer les modèles de rémunération des médecins et la planification des services de santé.
- Le fait d'habiter en milieu rural est un facteur de prédiction d'une utilisation constamment élevée, de même qu'un âge avancé et la multimorbidité.
- L'augmentation des consultations en soins de santé primaires pourrait être un moyen d'éviter d'être un grand utilisateur des services d'urgence ou des soins hospitaliers. Ces grands utilisateurs pourraient être représentatifs d'un profil de patients aux besoins plus importants qui sont traités de manière appropriée en soins primaires.
- Les grands utilisateurs constants ont une plus forte prévalence à souffrir de problèmes respiratoires, musculosquelettiques et psychologiques.

Caractéristiques des grands utilisateurs constants de soins de santé primaires dans la base de données DELPHI

Étude rétrospective de dossiers médicaux électroniques

Heather L. Maddocks PhD Moira Stewart PhD
Martin Fortin MD MSc CCMF FCMF Richard H. Glazier MD MPH CCFP FCFP

Résumé

Objectif Identifier les grands utilisateurs constants de soins de santé primaires et décrire leur utilisation des services, leurs caractéristiques et leurs comorbidités.

Type d'étude Une analyse rétrospective des données dépersonnalisées de patients provenant de 23 médecins qui contribuent à la base de données DELPHI (Deliver Primary Healthcare Information) de dossiers médicaux électroniques, entre le 1er octobre 2005 et le 30 juin 2010.

Contexte Dix cliniques de soins primaires dans le Sud-Ouest de l'Ontario.

Participants Un total de 1971 patients dont les données ont été codées au moyen de la Classification internationale des soins primaires.

Principaux paramètres à l'étude Parmi les caractéristiques des patients analysées figuraient les suivantes : le sexe, l'âge, les problèmes chroniques diagnostiqués à la fin de la première année, la multimorbidité (définie comme étant 3 problèmes chroniques ou plus), le code postal urbain ou rural, et le quintile médian du revenu familial. La constance d'une forte utilisation des soins primaires était mesurée en calculant le nombre total de visites en soins primaires dans chacune des 4 années à l'étude (du 1er juillet 2006 au 30 juin 2010), ce qui a dégagé 3 groupes de résultats : ceux qui n'étaient jamais de grands utilisateurs, ceux qui étaient parfois de grands utilisateurs (au-dessus du 90e percentile durant 1 ou 2 années), et ceux qui étaient de grands utilisateurs constants (au-dessus du 90e percentile durant 3 à 4 années). Des analyses bivariées et la régression logistique multinomiale ont servi à vérifier les effets des caractéristiques des patients sur la constance dans la forte utilisation.

Résultats Il était significativement plus probable que les patients plus âgés deviennent parfois ou constamment de grands utilisateurs ($p < ,05$). La multimorbidité au départ multipliait par 2,3 fois ($p < ,001$) la probabilité de devenir parfois un grand utilisateur, et par 4,1 fois ($p < ,001$) celle de devenir constamment un grand utilisateur. Il était 1,8 fois plus probable que les patients en milieu rural deviennent de grands utilisateurs constants ($p = ,010$). Dans la régression multinomiale, le genre et le revenu n'étaient pas associés avec la probabilité d'une forte utilisation. Des prévalences significativement plus élevées de problèmes respiratoires, musculosquelettiques et psychologiques chroniques ont été observées chez les grands utilisateurs constants ($p < ,05$).

Conclusion Les patients plus âgés souffrant d'une multimorbidité et ceux vivant en milieu rural sont significativement plus à risque de devenir de grands utilisateurs de soins primaires sur une base constante. Plusieurs années de collecte de données à partir des dossiers médicaux électroniques ont été nécessaires pour effectuer cette recherche sur les caractéristiques associées avec ce qui mène à une forte utilisation constante des soins de santé primaires.

Canadian health care is increasing its focus on patients who require considerable health care resources. The Ontario transformation agenda, for example, focuses on the 5% of patients who use 80% of both primary and acute care resources.[1] The Canadian Institutes of Health Research's Strategy for Patient-Oriented Research Primary and Integrated Health Care Innovations Network has also prioritized these patients.[2,3] Providing services for such patients is the mandate of Ontario's Health Links program.[4] Research assisting in the identification of these patients and their characteristics is highly relevant to primary health care.

In primary health care, what data are available on these patients requiring considerable resources? Information is available in health administrative data from patient billings to the Ontario Health Insurance Plan and in patient medical records held by their providers. More than 80% of primary care physicians in Ontario have adopted electronic medical record (EMR) software,[5] enabling the extraction of data for research purposes. An advantage of using an EMR database is the rich source of patient data, including patient characteristics, diagnoses, referrals, investigations, and laboratory testing. In particular, detailed information on the number and type of diagnoses patients have can be more complete than in health administrative data. For health administrative data, only 1 diagnosis per encounter is submitted using the International Classification of Diseases coding system,[6] whereas the EMR can capture the complete list of diagnoses managed at an encounter. Another advantage of EMR data over health administrative data is the use of International Classification of Primary Care (ICPC) coding for patient diagnoses. International Classification of Primary Care coding is an internationally accepted classification system that is specifically suited to the unique practice environment of primary health care, developed by the World Organization of Family Doctors.[7] In contrast, the International Classification of Diseases coding system used in health administrative data was developed for use in hospitals and is not specific to primary care.[8]

The purpose of the present study is to identify the highest users of primary health care and describe their characteristics, comorbidities, and use of primary health care services with data from an EMR database. In our study, use includes not only visits to primary care providers, but also the workload of providing referrals and ordering laboratory tests and investigations.

Methods

Setting

The Deliver Primary Healthcare Information (DELPHI) database is based at the Centre for Studies in Family Medicine at Western University in London, Ont,[9] and contains de-identified EMR data from 60 participating physicians at 14 practice sites across southwestern Ontario. As of 2015, the database contained information from 64 377 patients at 1.9 million encounters between October 1, 2005, and December 31, 2015. The age and sex of patients in the DELPHI database have been compared with the 2011 census and are approximately representative of the population of Ontario.[10] Ethics approval for the DELPHI project was received from Western University's Ethics Review Board.

Participants

A subset of participating DELPHI physicians (n=23 physicians at 10 sites) agreed to use the ICPC system to code reasons for encounters and diagnoses per visit for a random selection of 1 patient per day until a maximum of 10% of their patients were prospectively coded between October 1, 2005, and June 30, 2010. A total of 3168 patients were selected for ICPC coding, of which 1971 were 18 years of age and older (which excluded 340), visited at least once in each year of the observation period (July 1, 2006, to June 30, 2010; which excluded 816), and had complete postal code data (which excluded 41). These physicians were all using the same EMR software program with a section to enter ICPC-coded diagnoses.

User groups

The total number of visits for each patient in each year was used to rank patients into percentile groups of health care use. Only in-office visits to patients' main family physicians in their practice were included. Patients above the 90th percentile in total number of visits compared with the remainder of the patients were considered high users in a year. Three mutually exclusive groups were created: never high users, who never ranked above the 90th percentile in any of the 4 years; sometimes high users, who ranked above the 90th percentile in 1 or 2 of the years; and consistent high users, who ranked above the 90th percentile in 3 or 4 of the years. For example, a patient who was above the 90th percentile in number of visits in years 2 and 3 would be a sometimes high user, while a patient who was above the 90th percentile in years 1, 2, and 3 would be categorized as a consistent high user.

Patient characteristics

The following patient characteristics were used in the analysis: sex (female or male), age in years, age group (18 to 44 years, 45 to 64 years, and 65 years and older), and patient's residence (rural or urban) as determined using the first 3 digits of their postal code (Canada Post forward sortation area). The 2006 Ontario census provides the median family income for each forward sortation area in the province.[11] All forward sortation areas in the province were ranked by income level and divided into 5 groups (forming quintiles). Patients were placed into the quintiles based on their forward sortation area. In our sample,

patients in the top 2 income quintiles (quintiles 4 and 5) were grouped together because of the low number of patients in the highest income quintile (n=18).

Chronic conditions diagnosed by the end of the first year (as of June 30, 2007) were identified using a list of 98 ICPC codes selected through consensus by clinician researchers from a list compiled by Lamberts and Okkes, who have published widely on the ICPC system (H. Lamberts, I. Okkes, e-mail communication, January 2005). These conditions were first selected by Lamberts and Okkes (85 in total) and reviewed by the clinician researchers, and then 13 additional conditions were added. The total number of chronic conditions was grouped for each patient (0, 1, 2, and 3 or more), and *multimorbidity* was defined as having 3 or more chronic conditions.

Outcomes

The yearly mean numbers of visits, laboratory tests, investigations, and referrals were compared across the 3 user groups. The top 10 chronic conditions were also compared across groups, as were the top 5 ICPC chapters, which are groupings of diagnoses based on bodily systems.

Analyses

Pearson χ^2 tests for significant differences were used for categorical comparisons among 3 the groups—never, sometimes, and consistent high users—with pairwise comparison of proportions tested using a Bonferroni correction factor ($P<.05$). One-way ANOVA (analysis of variance) with Tukey post hoc testing was used to test for significant differences in means for continuous outcomes. Multinomial logistic regression was used to test for predictors of being sometimes high users or consistent high users compared with never high users. All analyses were performed in SPSS, version 24.

Results

Table 1 shows the characteristics of the 3 groups of patients. Sometimes and consistent high users were significantly older and had higher numbers of chronic conditions in the first year of the study. However, sex, location, and income were not significantly different between groups. Multimorbidity was significantly higher in consistent high users (22.5%) and sometimes high users (14.2%) compared with never high users (6.8%).

Table 2 shows the results of the multinomial logistic regression modeling. Age significantly increased the odds of being a sometimes or consistent high user ($P=.032$ and $P=.003$, respectively). Multimorbidity increased the odds of becoming a sometimes high user 2.3 times and a consistent high user 4.1 times ($P<.001$ for both). Patients in rural locations were 1.8 times more likely to become consistent high users ($P=.010$). Women had significantly higher odds of becoming sometimes high users ($P=.046$); however, sex was not a significant predictor of consistent high use. Income was not a significant predictor of being a sometimes high user. However, the only income quintile that was significant was quintile 3 (middle income); those in this quintile were less likely to become consistent high users ($P=.001$) in contrast to the reference group of the highest income quintiles (quintiles 4 and 5).

Table 3 presents the top 10 chronic conditions among the 3 groups. Hypertension was the most frequent condition in all 3 groups, and the proportion of patients with hypertension did not vary significantly among groups, ranging from 14.0% to 19.4%. Diabetes was the second most frequent condition for the sometimes and consistently high users at 10.8% and 15.0%, respectively. A pairwise comparison of proportions found them to be similar to each other, and significantly higher than the prevalence of diabetes in the never high users at 5.9%. Among the consistently high users, allergic rhinitis (10.8%) and asthma (9.2%) were significantly higher than in the other 2 groups. The prevalence of back syndrome was higher in those with increased use, with 9.2% of consistent high users having back syndrome compared with 4.1% of sometimes high users and only 2.9% of never high users. Consistent high users had a significantly higher prevalence of schizophrenia (5.8%); this diagnosis is not seen in the top 10 conditions of the other 2 groups.

Table 4 shows the top 5 bodily systems where chronic conditions have been diagnosed using ICPC coding across user groups.[7] The prevalence of endocrine and metabolic conditions was significantly higher in the consistent high users (25.0%) compared with the never high users (13.4%). The prevalence of musculoskeletal conditions was significantly higher in the consistent high users (20.0%) compared with the never high users (11.6%). Respiratory conditions increased with health care use: they were present in 18.3% of consistent high users, 7.8% of sometimes high users, and 4.0% of never high users. Psychological conditions were also significantly higher in the consistent high users (10.8%) compared with the sometimes (2.6%) and never high users (1.0%). All significant differences are at the .05 level.

Figure 1 shows that the mean number of visits per year increased with health care use, and all 3 groups' mean numbers of visits per year were significantly different from one another. **Figure 1** also shows the mean numbers of referrals, investigations, and laboratory tests ordered per year across the 3 groups. For referrals, all 3 groups were significantly different from one another, and referrals increased with health care use. Investigations were only significantly higher for the sometimes and consistent high users combined compared with the never high users, and laboratory testing varied among the groups, with the sometimes high users having the highest mean number of laboratory tests per year.

Table 1. Patient characteristics for each group of primary health care users in the DELPHI database (2006-2010): *N = 1971. Use is measured by the total number of visits and is ranked into percentiles. Sometimes high users were > 90th percentile in 1-2 y, and consistent high users were > 90th percentile in 3-4 y. Never high users were not above the 90th percentile in any of the 4 y.*

CHARACTERISTIC	NEVER HIGH USERS (N = 1583)	SOMETIMES HIGH USERS (N = 268)	CONSISTENT HIGH USERS (N = 120)
Sex, n (%)			
• Female	931 (58.8)	173 (64.6)	78 (65.0)
• Male	652 (41.2)	95 (35.4)	42 (35.0)
Age group,* y, n (%)			
• 18-44	369 (23.3)	67 (25.0)	16 (13.3)
• 45-64	728 (46.0)	88 (32.8)	44 (36.7)
• ≥ 65	486 (30.7)	113 (42.2)	60 (50.0)
Mean (SD) age, y†	55.7 (16.6)	58.8 (18.2)	62.5 (15.3)
Chronic conditions,* n (%)			
• 0	1015 (64.1)	167 (62.3)	57 (47.5)
• 1	297 (18.8)	37 (13.8)	17 (14.2)
• 2	164 (10.4)	26 (9.7)	19 (15.8)
• ≥ 3	107 (6.8)	38 (14.2)	27 (22.5)
Mean (SD) chronic conditions‡	0.6 (1.0)	0.9 (1.4)	1.3 (1.5)
Patient location, n (%)			
• Rural	513 (32.4)	95 (35.4)	43 (35.8)
• Urban	1070 (67.6)	173 (64.6)	77 (64.2)
Median family income quintile, n (%)			
• 1 (lowest)	97 (6.1)	13 (4.9)	7 (5.8)
• 2	214 (13.5)	37 (13.8)	17 (14.2)
• 3	670 (42.3)	111 (41.4)	35 (29.2)
• 4 and 5 (highest)	602 (38.0)	107 (39.9)	61 (50.8)

DELPHI—Deliver Primary Healthcare Information.
*Significant differences between groups at $P < .001$ in bivariate analyses.
†Consistent high users were significantly older than never high users ($P < .001$).
‡The mean number of chronic conditions significantly increased across all 3 user groups ($P < .001$ to $P = .003$).

Discussion

The key findings of this study are the characteristics of a typical high user of primary health care. An example of such a patient is a woman older than 65 years with hypertension, diabetes, and chronic musculoskeletal conditions, including back syndrome and osteoarthritis, and a chronic respiratory condition such as chronic obstructive pulmonary disease. The use of ICPC coding in the DELPHI database of EMRs facilitated this study by providing detailed diagnostic information not otherwise available in health administrative data, enabling the identification of the characteristics of the most frequent users of primary health care.

Similarities were found when comparing our results with other studies of frequent attenders in primary health care.[12-16] For example, the sometimes and consistent highest users in our sample were more likely to be older and had a higher prevalence of age-related multimorbidity. Our study also found higher odds ratios for the effect of multimorbidity on health care use than the odds ratios for age (**Table 2**). One Canadian study found that the number of chronic conditions was more important than age in resulting health care use.[17] In addition, international findings that multimorbidity is associated with higher primary health care use were supported by this study.[13,18,19] Consistent with studies of multimorbidity and income,[20,21] this study found the middle income group to have lower odds of becoming consistent high users; however, the effects were not significant for the other income quintiles. Mercer et al reported a higher mean number of visits for patients in socioeconomically deprived areas who had multimorbidity.[20] Overall, one can question whether it is good or bad to be a patient with multimorbidity and a high user of primary health care. Increased visits to primary health care might be a way to avoid being a high user of emergency or in-hospital care. These high users might represent a profile of patients with higher needs that are being appropriately cared for in primary care.

Table 2. Multinomial logistic regression predicting sometimes and consistent high use of primary health care compared with never high users in the DELPHI database (2006-2010): *N = 1971. Reference categories included male sex, < 3 chronic conditions, urban patient location, and highest median family income quintiles (4 and 5).*

	SOMETIMES HIGH USERS		CONSISTENT HIGH USERS	
PREDICTOR VARIABLE	ODDS RATIO (95% CI)	*P* VALUE	ODDS RATIO (95% CI)	*P* VALUE
Female sex	1.32 (1.01-1.74)	.046	1.34 (0.90-2.00)	.148
Age, y	1.01 (1.00-1.02)	.032	1.02 (1.01-1.03)	.003
Multimorbidity*	2.26 (1.49-3.43)	< .001	4.07 (2.44-6.80)	< .001
Rural patient location	1.29 (0.96-1.74)	.097	1.78 (1.15-2.76)	.010
Median family income quintile				
• 1 (lowest)	0.77 (0.41-1.44)	.416	0.73 (0.31-1.69)	.461
• 2	0.93 (0.61-1.43)	.756	0.70 (0.39-1.27)	.242
• 3	0.89 (0.65-1.21)	.446	0.46 (0.29-0.73)	.001

DELPHI—Deliver Primary Healthcare Information.
**Multimorbidity* is defined as ≥ 3 chronic conditions.

Table 3. Top 10 chronic condition diagnoses at each level of primary health care use in the DELPHI database (2006-2010): *N = 1971. Significant differences are at the .05 level.*

	NEVER HIGH USERS (N = 1583)		SOMETIMES HIGH USERS (N = 268)		CONSISTENT HIGH USERS (N = 120)	
RANK	CONDITION	N (%)*	CONDITION	N (%)*	CONDITION	N (%)*
1	Hypertension	221 (14.0)	Hypertension	52 (19.4)	Hypertension†	21 (17.5)
2	Lipid disorder	114 (7.2)	Diabetes	29 (10.8)	Diabetes‡	18 (15.0)
3	Diabetes	93 (5.9)	Lipid disorder	23 (8.6)	Allergic rhinitis§	13 (10.8)
4	Ischemic heart disease	59 (3.7)	Ischemic heart disease	13 (4.9)	Asthma§	11 (9.2)
5	Back syndrome	46 (2.9)	Back syndrome	11 (4.1)	Back syndrome‖	11 (9.2)
6	Osteoarthritis of the knee	42 (2.7)	COPD	9 (3.4)	Lipid disorder†	10 (8.3)
7	Osteoarthritis, other	32 (2.0)	Asthma	8 (3.0)	Schizophrenia§	7 (5.8)
8	Osteoporosis	29 (1.8)	Osteoarthritis of the hip	7 (2.6)	Osteoarthritis of the knee†	6 (5.0)
9	Asthma	26 (1.6)	Osteoarthritis of the knee	6 (2.2)	Ischemic heart disease†	5 (4.2)
10	Hypothyroidism	24 (1.5)	Atrial fibrillation	6 (2.2)	COPD¶	NA#

COPD—chronic obstructive pulmonary disease, DELPHI—Deliver Primary Healthcare Information, NA—not available.
*Pairwise comparison of proportions tested using a Bonferroni correction factor.
†Did not vary among groups.
‡Consistent and sometimes high users were not significantly different from one another, while both were significantly higher than never high users.
§Consistent high users had a significantly higher prevalence than the remaining groups.
‖Consistent high users had a significantly higher prevalence of back syndrome than never high users.
¶Did not vary between consistent and sometimes high users; however, consistent and sometimes high users had a significantly higher prevalence of COPD than never high users.
#Cell sizes < 5 are suppressed.

There has been some support for our findings of the most common conditions in high users, including the prevalence of hypertension,[15] diabetes,[22] back pain,[23] and respiratory conditions,[15] including chronic obstructive pulmonary disease.[24]

Limitations and future research

The increase in mean visits per year among the never, sometimes, and consistent high user groups shown in **Figure 1** confirms the validity of the percentile rank method used to distinguish the 3 user groups. In addition, support was found for these 3 groups having varying levels of other forms of primary health care use, including referrals, investigations, and laboratory testing. However, as described above, our sample excluded patients who did not have a visit with their primary care physician in each of the 4 years of data collection, thereby excluding some patients who might have had chronic conditions that did not require regular visits to their primary care physician. With a lower number of visits, these patients would have less opportunity to become sometimes or consistent high users, especially as the other measures of use, including referrals, investigations, and laboratory testing, all require a visit to their primary care physician.

Other studies have investigated the top 1% and 5% of health care users[24-27]; however, the sample used in this study was not large enough to compare these categories, so we compared the top 10% with the remainder of patients. In addition, our study did not account for the

burden of illness on patients or other correlates of use such as education and social supports.

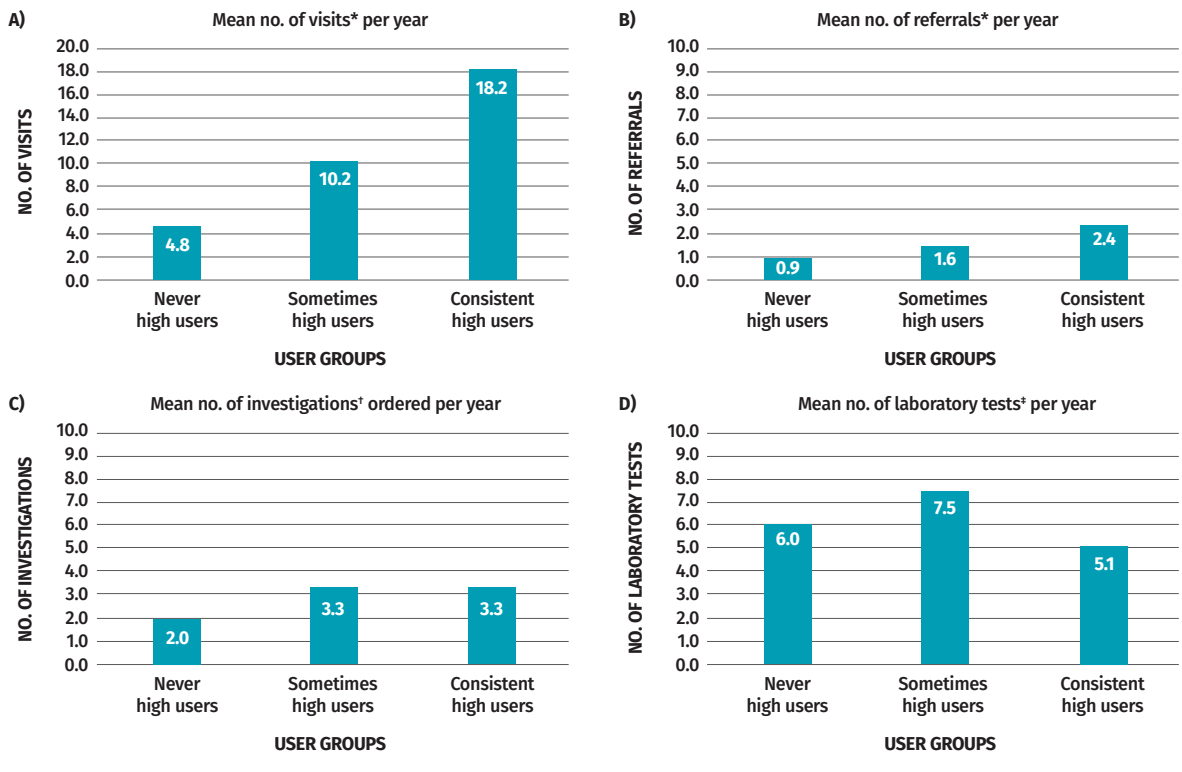
Our study also used data from providers who were using the same EMR software program and used visits by patients to these providers' practice sites, excluding information from other sources such as visits to walk-in clinics or other types of providers. We acknowledge the limitation of only measuring primary health care use

Table 4. Top 5 chronic condition diagnoses within ICPC chapters at each level of primary health care use in the DELPHI database (2006-2010): *N = 1971. The ICPC chapters are groupings of diagnoses based on bodily systems. The full list is available from the WONCA International Classification Committee.[7] Significant differences are at the .05 level.*

	NEVER HIGH USERS (N = 1583)		SOMETIMES HIGH USERS (N = 268)		CONSISTENT HIGH USERS (N = 120)	
RANK	CHAPTER	N (%)*	CHAPTER	N (%)*	CHAPTER	N (%)*
1	Circulatory	290 (18.3)	Circulatory	61 (22.8)	Endocrine and metabolic†	30 (25.0)
2	Endocrine and metabolic	212 (13.4)	Endocrine and metabolic	44 (16.4)	Circulatory‡	26 (21.7)
3	Musculoskeletal	183 (11.6)	Musculoskeletal	32 (11.9)	Musculoskeletal†	24 (20.0)
4	Respiratory	64 (4.0)	Respiratory	21 (7.8)	Respiratory§	22 (18.3)
5	Neurologic	38 (2.4)	Neurologic†	9 (3.4)	Psychological‖	13 (10.8)

DELPHI—Deliver Primary Healthcare Information, ICPC—International Classification of Primary Care, WONCA—World Organization of Family Doctors.
*Pairwise comparison of proportions tested using a Bonferroni correction factor.
†Consistent high users had a significantly higher prevalence than never high users.
‡Prevalence did not vary among groups.
§Prevalence significantly increased with use.
‖Consistent high users had a significantly higher prevalence than both sometimes high users and never high users.

Figure 1. Mean no. of A) visits, B) referrals, C) investigations, and D) laboratory tests at each level of primary health care use in the DELPHI database (2006-2010): *N = 1971.*



DELPHI—Deliver Primary Healthcare Information.
*All 3 groups were significantly different from one another at $P < .05$.
†Sometimes and consistent high users were significantly different from never high users at $P < .05$.
‡Sometimes high users had significantly more tests than never high users ($P = .024$) and sometimes high users had significantly more tests than consistent high users ($P = .033$). Consistent high users and never high users were not significantly different from one another.

by number of visits and not actual costs. In addition, we did not address high primary care use in comparison to use of other parts of the health care system. High use of primary care might be associated with lower use of other sectors, including emergency departments, hospitals, and long-term care. Future studies could form a link between the DELPHI database and Ontario health administrative data, which would allow the identification of chronic conditions not coded using ICPC and the proportion of use costs for patients with multimorbidity in the primary care and secondary care sectors.

Conclusion

The findings of this study have at least 3 implications for the primary health care system. The first 2 implications are for the provision of information. First, providers might have opinions about who their high users are and their most commonly treated conditions. However, this study provides data on high users from the primary health care sector, which has been rarely available in the past. Second, those leading the planning of primary health care coordination with other sectors of the health care system can use this information to understand who the highest users of primary health care are. The third implication of this study is its ability to inform the development of an acuity modifier to remunerate physicians based on the complexity of the patients in their practice. Overall, the findings of this research project provide a valuable description of the characteristics of the highest users of the Ontario primary health care system, taking into account their complex needs due to multimorbidity.

Dr Maddocks was Scientist in the Centre for Studies in Family Medicine in the Schulich School of Medicine and Dentistry at Western University in London, Ont, at the time of the study. **Dr Stewart** is Distinguished University Professor Emeritus in the Centre for Studies in Family Medicine and Dr Brian W. Gilbert Canada Research Chair in Primary Health Care Research (2003-2017) at the Schulich School of Medicine and Dentistry at Western University. **Dr Fortin** is a family physician in the family medicine group at the Chicoutimi Hospital and at the Centre intégré universitaire de santé et de services sociaux du Saguenay–Lac-Saint-Jean in Quebec, and Full Professor in the Department of Family Medicine and Emergency Medicine and Research Chair on Chronic Diseases in Primary Care at the University of Sherbrooke. **Dr Glazier** is Senior Scientist at ICES in Toronto, Ont, Research Scientist at the MAP Centre for Urban Health Solutions at St Michael's Hospital, and Professor in the Department of Family and Community Medicine at the University of Toronto and at St Michael's Hospital.

Contributors
All authors contributed to the concept and design of the study; data analysis and interpretation; and preparing the manuscript for submission.

Competing interests
None declared

Correspondence
Dr Heather L. Maddocks; e-mail **heather.maddocks.hm@gmail.com**

References

1. Thavorn K, Wodchis W, Maxwell C, Kone A, Gruneir A, Bronskill S, et al. *Economic burden of multimorbidity in Ontario's health care system.* Poster presented at: Canadian Association for Health Services and Policy Research Annual Conference; 2013 May 28-30; Vancouver, BC.
2. Canadian Institutes of Health Research. *Canada's strategy for patient-oriented research. Improving health outcomes through evidence-informed care.* Ottawa, ON: Canadian Institutes of Health Research; 2011. Available from: **http://www.cihr-irsc.gc.ca/e/documents/P-O_Research_Strategy-eng.pdf**. Accessed 2018 Feb 9.
3. Tamblyn R, Edwards N. *The Strategy for Patient-Oriented Research (SPOR) in Primary and Integrated Health Care Innovations Network.* Presented at: Network Strengthening Workshop; 2014 Apr 30-May 2; Toronto, ON.
4. Ontario Ministry of Health and Long-Term Care. *Transforming Ontario's health care system. Community Health Links provide coordinated, efficient and effective care to patients with complex needs.* Toronto, ON: Ontario Ministry of Health and Long-Term Care; 2014. Available from: **http://www.health.gov.on.ca/en/pro/programs/transformation/community.aspx**. Accessed 2018 Feb 9.
5. College of Family Physicians of Canada, Canadian Medical Association, Royal College of Physicians and Surgeons of Canada. *National Physician Survey, 2014*. Mississauga, ON: College of Family Physicians of Canada; 2014.
6. Centers for Disease Control and Prevention. *International classification of diseases, ninth revision, clinical modification*. 6th ed. Atlanta, GA: National Center for Health Statistics; 2010.
7. WONCA International Classification Committee. *International classification of primary care. ICPC-2-R.* Revised 2nd ed. Oxford, UK: Oxford University Press; 2005.
8. Hazelwood A. *ICD-9 CM to ICD-10 CM: implementation issues and challenges.* Chicago, IL: American Health Information Management Association; 2003. Available from: **http://library.ahima.org/doc?oid=59978#.W04k8dVKiot**. Accessed 2018 Jul 17.
9. Stewart M, Thind A, Terry AL, Chevendra V, Marshall JN. Implementing and maintaining a researchable database from electronic medical records: a perspective from an academic family medicine department. *Healthc Policy* 2009;5(2):26-39.
10. Terry AL, Stewart M, Thind A, Burge F, Cejic S, Marshall JN, et al. *Development of indicators to validate EMR data: the DIVE study. Report to the Canadian Institutes of Health Research, Institute of Health Services and Policy Research.* Ottawa, ON: Canadian Institutes of Health Research; 2013.
11. Statistics Canada. *Profile for Canada, provinces, territories and forward sortation areas, 2006 census.* Ottawa, ON: Statistics Canada; 2008.
12. Broemeling A, Watson DE, Prebtani F. Population patterns of chronic health conditions, co-morbidity and healthcare use in Canada: implications for policy and practice. *Healthc Q* 2008;11(3):70-6.
13. Hauswaldt J, Hummers-Pradier E, Junius-Walker U. Health service use among patients with chronic or multiple illnesses, and frequent attenders: secondary analysis of routine primary care data from 1996 to 2006. *Dtsch Arztebl Int* 2012;109(47):814-20. Epub 2012 Nov 23.
14. Hu T, Dattani ND, Cox KA, Au B, Xu L, Melady D, et al. Effect of comorbidities and medications on frequency of primary care visits among older patients. *Can Fam Physician* 2017;63:45-50.
15. Naessens JM, Baird MA, Van Houten HK, Vanness DJ, Campbell CR. Predicting persistently high primary care use. *Ann Fam Med* 2005;3(4):324-30.
16. Schäfer I, Hansen H, Schön G, Höfels S, Altiner A, Dahlhaus A, et al. The influence of age, gender and socio-economic status on multimorbidity patterns in primary care. First results from the multicare cohort study. *BMC Health Serv Res* 2012;12:89.
17. Terner M, Reason B, McKeag AM, Tipper B, Webster G. Chronic conditions more than age drive health system use in Canadian seniors. *Healthc Q* 2011;14(3):19-22.
18. Glynn LG, Valderas JM, Healy P, Burke E, Newell J, Gillespie P, et al. The prevalence of multimorbidity in primary care and its effect on health care utilization and cost. *Fam Pract* 2011;28(5):516-23. Epub 2011 Mar 24.
19. Taylor AW, Price K, Gill TK, Adams R, Pilkington R, Carrangis N, et al. Multimorbidity—not just an older person's issue. Results from an Australian biomedical study. *BMC Public Health* 2010;10:718.
20. Mercer SW, Zhou Y, Humphris GM, McConnachie A, Bakhshi A, Bikker A, et al. Multimorbidity and socioeconomic deprivation in primary care consultations. *Ann Fam Med* 2018;16(2):127-31.
21. Wang HH, Wang JJ, Lawson KD, Wong SY, Wong MC, Li FJ, et al. Relationships of multimorbidity and income with hospital admission in 3 health care systems. *Ann Fam Med* 2015;13(2):164-7.
22. Public Health Agency of Canada. *Diabetes in Canada: facts and figures from a public health perspective.* Ottawa, ON: Government of Canada; 2012.
23. Rapoport J, Jacobs P, Bell NR, Klarenbach S. Refining the measurement of the economic burden of chronic diseases in Canada. *Chronic Dis Can* 2004;25(1):13-21.
24. Wodchis WP, Austin PC, Henry DA. A 3-year study of high-cost users of health care. *CMAJ* 2016;188(3):182-8. Epub 2016 Jan 11.
25. Frost DW, Vembu S, Wang J, Tu K, Morris Q, Abrams HB. Using the electronic medical record to identify patients at high risk for frequent emergency department visits and high system costs. *Am J Med* 2017;130(5):601.e17-22. Epub 2017 Jan 5.
26. Guilcher S, Bronskill SE, Guan J, Wodchis WP. Who are the high-cost users? A method for person-centred attribution of health care spending. *PLoS One* 2016;11(3):e0149179.
27. Rosella LC, Fitzpatrick T, Wodchis WP, Calzavara A, Manson H, Goel V. High-cost health care users in Ontario, Canada: demographic, socio-economic, and health status characteristics. *BMC Health Serv Res* 2014;14:532.

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