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Original Research

Enhancing Health Surveillance: Validation of a Novel Electronic Medical Records-Based Definition of Cases of Pediatric Type 1 and Type 2 Diabetes Mellitus

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Key Messages

- We describe a novel method of calculating the prevalence of type 1 or type 2 diabetes on the basis of electronic medical records in a pediatric primary care population.
- An electronic medical records–based case definition showed higher sensitivity than existing administration-based methods (96.9% vs 48.5%, respectively).
- The use of an electronic medical records–based case definition can improve the capture of data concerning patients with pediatric diabetes.

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ABSTRACT

Objectives: To compose and validate an electronic medical records–based case definition for pediatric diabetes in primary care.
Methods: Data from the electronic medical records of 221 primary care providers participating in the Manitoba Primary Care Research Network were extracted from April 1, 1998, to March 31, 2015. We assessed agreement among the 3 case definitions of pediatric diabetes and compared the performance of each with the clinical database of the Manitoba Diabetes Education Resource for Children and Adolescents.
Results: Our reference dataset included 41,055 pediatric patients. Electronic medical records–based case definitions, which included billing records, health conditions lists, prescription records and laboratory results, showed substantially higher sensitivity compared to the administration-based case definition that relied on billing and prescription records (96.9% and 94.9% vs 48.5%). Our study suggests a higher prevalence of pediatric diabetes in Manitoba than was previously reported through administration-based case definitions or in patients whose data were captured in the Manitoba Diabetes Education Resource for Children and Adolescents clinical database.
Conclusions: We describe a novel method of calculating the prevalence of pediatric diabetes in a primary care population. This case definition will improve the surveillance of pediatric diabetes and enhance service planning and the development of strategies to support prevention and management.

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R É S U M É

Objectifs : Composer et valider une définition de cas basée sur les dossiers médicaux électroniques pour le diabète pédiatrique en soins primaires.
Méthodes : Les données des dossiers médicaux électroniques de 221 intervenants en soins primaires participant au Réseau de Recherche sur les Soins Primaires au Manitoba ont été extraites du 1er avril 1998 au 31 mars 2015. Nous avons évalué la concordance entre les 3 définitions de cas du diabète pédiatrique et comparé la performance de chacune avec la base de données clinique de la Ressource Educative sur le Diabète au Manitoba pour les Enfants et Adolescents.
Résultats : Notre jeu de données de référence comprenait 41 055 patients pédiatriques. Les définitions de cas basées sur les dossiers médicaux électroniques, qui comprenaient les enregistrements de facturation, les listes de problèmes de santé, les enregistrements d'ordonnances et les résultats de laboratoire, montraient une sensibilité nettement supérieure à la définition de cas basée sur l'administration qui reposait sur des enregistrements de facturation et d'ordonnances (96,9% et 94,9% contre 48,5 %). Notre étude suggère une prévalence plus élevée de diabète pédiatrique au Manitoba que ce qui était préalablement rapporté à travers les définitions de cas basées sur l'administration ou chez les patients dont les données ont été consignées dans la base de données clinique de la Ressource Educative sur le Diabète au Manitoba pour les Enfants et Adolescents.
Conclusions : Nous décrivons une nouvelle méthode de calcul de la prévalence du diabète pédiatrique dans une population nécessitant des soins primaires. Cette définition de cas améliorera la surveillance du diabète infantile, et facilitera la planification des services et l'élaboration de stratégies d'appui à sa prévention et à sa gestion.

Introduction

Diabetes mellitus is 1 of the most prevalent chronic diseases in children and youth (1). The prevalence of pediatric type 1 and type 2 diabetes (in people 1 to 18 years of age) is increasing worldwide (2,3). An increase in rates of pediatric diabetes, particularly type 2 diabetes, is a major health concern in Canada (4) and around the world (5). Between 2001 and 2009, diagnosed cases of type 2 diabetes in youth in the US increased by 30.5% (6). The current incidence of type 2 diabetes in youth in Canada is 1.54 per 100,000 youth (4). Within Canada, Manitoba has a significantly higher burden of type 2 diabetes than other provinces; 25 cases per 100,000 children are diagnosed each year (7).

Type 1 and type 2 diabetes diagnosed in childhood are associated with poor glycemic control in adolescence and greater risk for related complications (6,8). Therefore, patients with either type 1 or type 2 diabetes benefit from coordinated care by an interdisciplinary care team (4,8–13). Differing treatment regimens are recommended for pediatric type 1 and type 2 diabetes; they include insulin, oral medications and/or lifestyle modifications. Pediatric diabetes care is optimized when it is comanaged by primary care providers and pediatric endocrinologists so as to provide comprehensive care tailored to the individual, with advice and guidance on type-specific care strategies (12–14).

Existing estimates of the prevalence of pediatric diabetes are based on either case findings through broad surveys of practitioners (4) or through a validated administration-based algorithm (15). The addition of clinical and biochemical variables available in electronic medical records (EMR) have the potential to improve case detection and, thus, our understanding of disease epidemiology so as to inform prevention and management strategies (16,17). Evidence supports the use of EMR-based repositories for health surveillance in the adult population (16,17), demonstrating comparable sensitivity and specificity and even increased case detection of patients with diabetes (16–18). Therefore, the aim of this study was to construct and validate an EMR-based case definition of pediatric diabetes that adequately detects these patients in primary care.

Methods

Data sources

This retrospective validation study was conducted using data from the Manitoba Primary Care Research Network (MaPCReN) repository and the Manitoba Centre for Health Policy (MCHP). MaPCReN is part of the Canadian Primary Care Sentinel Surveillance Network (CPCSSN), the largest multisystem database in Canada; it collects and processes deidentified EMR data from consenting community-based primary care practices. CPCSSN extracts anonymous data from consenting providers' EMR quarterly to build a pan-Canada EMR-based repository that can be used for health surveillance. Between April 1, 1998 and March 31, 2015, the MaPCReN contained information regarding 41,594 patients, 1 to 18 years of age, extracted from the EMR of 221 family physicians, community pediatricians and nurse practitioners practicing in 1 of 37 clinics in Manitoba. The MCHP Population Health Research Data Repository houses administrative data from health and social services across Manitoba. Data held at MCHP are deidentified. Scrambled personal health identification numbers enable linkage among datasets held in the repository at MCHP.

Case definitions

To detect the prevalence of pediatric diabetes, 3 case definitions were applied to the pediatric population in MaPCReN, including: 1) an administration-based definition used to capture diabetes in the MCHP repository (15); 2) an EMR-based definition developed and validated for the CPCSSN's EMR-based repository to capture cases of adult diabetes (16,19); and 3) a case definition expanded and tailored to diagnostic guidelines for pediatric diabetes (12,13) (Table 1). Case definition 1 identified pediatric patients based on billings and prescription records. Case definition 2 identified pediatric patients with diabetes based on billings, health-condition lists, prescription records and glycated hemoglobin (A1C) test results $\geq$7.0%. Similar to case definition 2, case definition 3 captured patients with diabetes based on billings, health condition lists,

Table 1
Case definitions of pediatric diabetes mellitus

Case definition 1: Administration-based definition (15)	Case definition 2: EMR-based definition: CPCSSN (16)	Case definition 3: EMR-based definition, expert consensus
1. Two primary care appointments billed with an ICD-9-CM code for diabetes within 2 years (ICD-9-CM 250.xx) *or* 2. One prescription for a diabetes medication (ATC code: A10^)	1. Two primary care appointments billed with an ICD-9-CM code for diabetes within 2 years (ICD-9-CM 250.xx) *or* 2. Diabetes listed as a health condition in the EMR (ICD-9-CM 250.xx) *or* 3. One prescription for a diabetes medication (ATC code: A10BF01, A10BB01, A10BB09, A10BB12, A10AB01, A10AC01, A10AD01, A10AE01, A10AB05, A10AC03, A10AD05, A10AE05, A10AE04, A10AB04, A10AD04, A10BA02, A10BD03, A10BH01, A10BB03)* *or* 4. A1C results ≥53 mmol/mol (7%)	1. Two primary care appointments billed with an ICD-9-CM code for diabetes within 2 years (ICD-9-CM 250.xx) *or* 2. Diabetes listed as a health condition in the EMR (ICD-9-CM 250.xx) *or* 3. One prescription for a diabetes medication (ATC code: A10^* excluding A10BA02†) *or* 4. Two A1C results ≥48 mmol/mol (6.5%) within 1 year

A1C, glycated hemoglobin; *ATC,* Anatomical Therapeutic Chemical Classification System; *CPCSSN,* Canadian Primary Care Sentinel Surveillance Network; *EMR,* electronic medical records; *ICD-9-CM,* International Classification of Diseases-Clinical Modification.

* Patients with ICD-9-CM codes of 256.4 (polycystic ovarian syndrome), 648.8 (gestational diabetes), 249 (chemically induced diabetes), 790.29 (hyperglycemia) or 775.1 (neonatal diabetes) required 2 billing records, health conditions list or A1C results in addition to medication (ATC code A01^) to be flagged in the pediatric diabetes cohort.

† A10BA02 represents a prescription for metformin, which is not used exclusively for treatment of diabetes.

prescription records and A1C results. However, case definition 3 was tailored to capture pediatric diabetes by removing metformin medications from the prescription-inclusion criteria and requiring 2 A1C results ≥6.5% within 1 year, reflecting changes in the diagnostic guidelines for diabetes (12,13). Canadian EMR predominantly use International Classification of Diseases-Clinical Modification (ICD-9-CM) codes for billing and problem lists; therefore, ICD-9-CM codes are used in the case definitions (Table 1).

Reference standards

To form the reference of confirmed positive cases, patients with type 1 or type 2 diabetes who have presented in the clinical registry at the Diabetes Education Resource for Children and Adolescents (DERCA) were matched via scrambled personal health-identification number to the EMR in the MaPCReN EMR-based repository (Figure 1). Therefore, these numbers represent cases that were identified as having pediatric diabetes (type 1 or type 2 diabetes) by both a primary care provider in MaPCReN (i.e. family physician, pediatrician or nurse practitioner) and a pediatric endocrinologist at DERCA. All patients with records in the DERCA repository have diagnoses of pediatric diabetes. The DERCA is the only subspecialty pediatric diabetes referral centre that provides service to patients with pediatric diabetes in Manitoba, Northeastern Ontario and parts of Saskatchewan. There are no pediatric endocrinologists practicing outside of the DERCA interdisciplinary clinic in Manitoba. The DERCA database has previously demonstrated a capture rate of 87% for all patients with pediatric diabetes (20) and >99% for type 1 diabetes (15).

No true-negative cases are recorded in DERCA. To obtain true-negative cases for our reference set, the 41,594 pediatric patients from MaPCReN were reviewed for any indication of diabetes. There were 636 patients who had billing records, health condition lists, prescriptions or A1C results ≥6.5% consistent with diabetes or DERCA records. There were 40,958 pediatric patients with no indication of diabetes, representing our true-negative cases (Figure 1).

Statistical analyses

We calculated kappa coefficients and 95% confidence intervals to assess the agreement among each of the case definitions (Table 1) against the reference standard dataset we created (Figure 1). We were unable to calculate false-negative cases; DERCA does not hold the records of patients without diagnoses of diabetes. Therefore, our results focus on calculated sensitivity and attendant 95% confidence intervals for all 3 definitions against our reference dataset. Bivariate comparisons assessed similarities and differences between and within the pediatric cohorts. All analyses were conducted using SAS software v. 9.4 (SAS Institute, Cary, North Carolina, United States). This study was approved by the Health Research Ethics Board at the University of Manitoba.

Results

There were 41,594 patients, 1 to 18 years of age, who visited a clinic participating in MaPCReN between April 1, 1998 and March 31, 2015. The mean age of the MaPCReN pediatric population was 8.7±5.0 years. There was a similar proportion of female and male patients (50.6% female, 49.4% male) and a slightly higher rural population than urban population (56.6% vs 43.4%). Pediatric patients visited their primary care providers an average of 6.5 times a year.

At the time of the study, the DERCA cohort contained ~1,300 patients; 205 of these patients had records in MaPCReN and were diagnosed with type 1 or type 2 diabetes. Other types of diabetes, including cystic fibrosis–related, medication-induced and genetic forms of diabetes, were not included in this study. Of the confirmed cases of pediatric diabetes from DERCA, 97 also had records in the MaPCReN data repository that met our study inclusion criteria (i.e. age <18, type 1 or type 2 diabetes recorded in the EMR, Manitoba resident; duplicate records were removed). These numbers represent the true-positive cases in our reference standard (Figure 1). The MaPCReN repository contained 636 pediatric patients (1 to 18 years of age) who had at least 1 billing record, health condition record, prescription or A1C result consistent with diabetes and/or a DERCA record. Our true-negative (n=40,958) represents pediatric patients with no indication of diabetes (Figure 1).

Table 2 shows the agreement among the 3 possible case definitions compared to the reference dataset. The sensitivity of case definition 2 (96.9%) and case definition 3 (94.9%) demonstrated high agreement with the true-positive cases in the reference dataset. Case definition 1 had a sensitivity of only 48.9%, capturing less than half of the true-positive cases in the reference (Table 2).

When case definition 2 was applied to the MaPCReN pediatric cohort (n=41,594), 423 children (1% of the pediatric population)

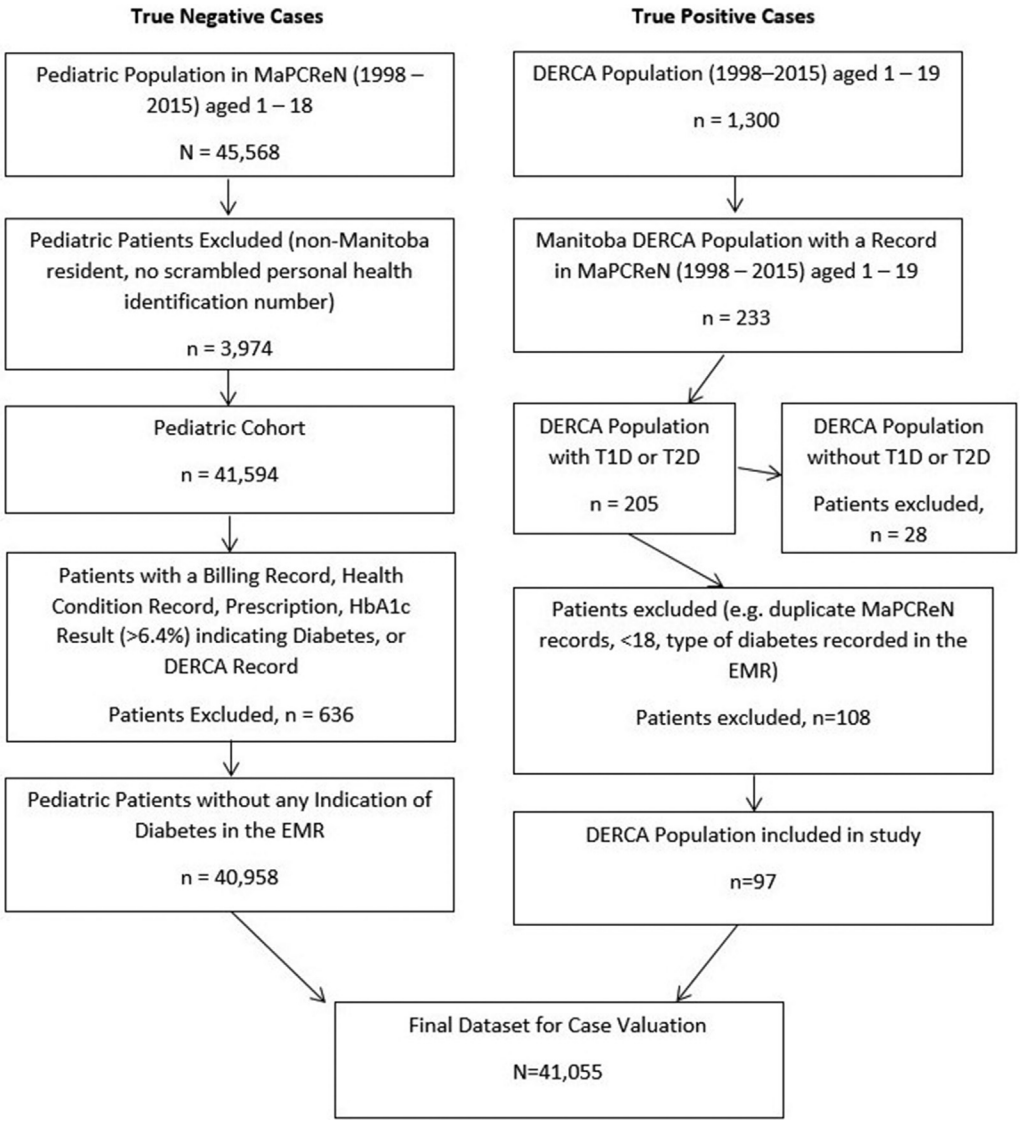

Figure 1. The pediatric diabetes reference standard describes the Manitoba Primary Care Research Network (MaPCReN) pediatric population used for validation of the case definitions. There were 41,594 pediatric patients in MaPCReN. To create our true-negative cases (n=40,958), 636 patients were removed from the pediatric cohort due to evidence in the elctronic medical records (EMR) that was consistent with diabetes. There were 97 pediatric patients who were seen by an MaPCReN provider and a pediatric endocrinologist at the Diabetes Education Resource for Children and Adolescents (DERCA) and were not excluded from our study cohort due to age, duplicate records or type of diabetes recorded in the EMR. Agreement between the MaPCReN and DERCA cohorts assessed an EMR-based algorithm to capture pediatric patients diagnosed with diabetes.

were identified as having pediatric diabetes on the basis of 1 of the following characteristics: billing records, health condition lists, prescribed medications used solely for diabetes or A1C levels ≥7.0% (Figure 1). Case definition 2 captured the majority of patients in our reference dataset (96.9%). The majority of MaPCReN patients captured in case definition 2 (60.8%) had A1C levels ≥7.0%, whereas 30.7% had diabetes listed as a health condition in the EMR, 14.4% had 2 or more primary care visits billed for diabetes and 7.6% were prescribed a diabetes medication (categories not mutually exclusive). All of the patients prescribed a diabetes medication were also captured in the health-condition list and/or the billing records.

Case definition 3, applied to the MaPCReN pediatric cohort, captured 352 children (0.8% of the pediatric population), in whom diabetes was identified from 1 of the following characteristics: billing records, health condition lists, diabetes medications or 2 A1C results ≥6.5% within 1 year. Recent changes in the diagnostic guidelines for diabetes have lowered the A1C results from ≥7.0% and suggest 2 A1C tests ≥6.5% within 1 year should be obtained (12,13,21). Case definition 3 captured the majority of patients in the reference dataset (94.9%).

Case definition 3 performed similarly to case definition 2 in terms of agreement with the reference standard (Table 1). Of the pediatric patients captured in case definition 3, 9% had a prescription for a diabetes medication that was present in the EMR. The inclusion of 2 or more A1C levels ≥6.5% within 1 year in case definition 3 identified a total of 186 pediatric patients meeting the criteria for diabetes in the MaPCReN database. The majority of these patients (n=184) were not in the reference dataset, suggesting that these patients were not receiving subspecialty diabetes care. These

Table 2
Definitions of cases of pediatric diabetes mellitus in the Manitoba Primary Care Research Network population compared to our reference dataset (N=41,055)

Case definition 1: Billing and medication				Case definition 2: Billing, health condition, medication, A1C >7%				Case definition 3: Billing, health condition, medication, 2 A1C ≥6.5% within 1 year			
Case definition 1	Reference dataset			Case definition 2	Reference dataset			Case definition 3	Reference dataset		
	Percent of patients in reference dataset	Percent of patients not in reference dataset	Total (number, %) patients		Percent of patients in reference dataset	Percent of patients not in reference dataset	Total (number, %) patients		Percent of patients in reference dataset	Percent of patients not in reference dataset	Total (number, %) patients
Percent of patients in case definition 1	0.11* 48.45† 100‡	0* 0† 0‡	47 0.11	Percent of patients in case definition 2	0.23* 96.91† 100‡	0* 0† 0‡	94 0.23	Percent of patients in case definition 3	0.22* 94.85† 100‡	0* 0† 0‡	92 0.22
Percent of patients not in case definition 1	0.12* 51.04† 0.12‡	99.76* 100.00† 99.88‡	41,008 99.89	Percent of patients not in case definition 2	0.01* 3.09† 0.01‡	99.76* 100.00† 99.99‡	40,961 99.77	Percent of patients not in case definition 3	0.01* 5.15† 0.01‡	99.76* 100.00† 99.99‡	40,963 99.78
Total (number, %) patients	97 0.24	40,958 99.76	41,055 100.00	Total (number, %) patients	97 0.24	40,958 99.76	41,055 100.00	Total (number, %) patients	97 0.24	40,958 99.76	41,055 100.00

Agreement between case definitions and reference standard

	Case definition 1	Case definition 2	Case definition 3
Kappa	0.652 (0.562–0.743)	0.984 (0.967–1)	0.974 (0.950–0.997)
Sensitivity	48.45% (38.18%–58.82%)	96.91% (91.23%–99.36%)	94.85% (88.38%–98.31%)
Specificity	100.00% (99.99%–100.00%)	100.00% (99.99%–100.00%)	100.00% (99.99%–100.00%)
PPV	100.00%	100.00%	100.00%
NPV	99.88% (99.84%–99.91%)	99.99 (99.98%–100.00%)	99.99 (99.97%–100.00%)

NPV, negative predictive value; *PPV,* positive predictive value.
* Percent of patients in the column.
† Percent of patient in the row.
‡ Percent of patients in the cohort.

patients had evidence of diagnostic bloodwork for diabetes, often having substantially elevated A1C levels (Table 3). One-fifth of the patients with 2 A1C results ≥6.5% also had fasting glucose results greater than 11.1 mmol/L recorded in the EMR (21.2%).

Throughout the duration of the study: 1) cases of pediatric diabetes were captured using differing EMR fields (i.e. health conditions lists, billing records, laboratory results and medications); and 2) data concerning pediatric patients with diagnoses of diabetes in the EMR (case definition 3) were more likely also to have been captured in our reference standard. Of the data concerning pediatric patients captured by both case definition 3 and our reference standard, 52% had their first diabetes-related encounter with an MaPCReN provider in 2010 or later, 30.5% had their first encounter between 2010 and 2004 and only 17.5% had their first encounter before 2004.

The number of pediatric patients with elevated A1C levels and no diabetes ICD-9-CM code in the health-condition lists or billing records in the MaPCReN repository is decreasing; 75.3% of pediatric patients with only A1C levels ≥6.5% occurred before 2010. Within MaPCReN, the number of pediatric patients with billing records or health conditions indicating diabetes has increased; 52.2% were recorded between 2010 and 2015, 40.9% were recorded between 2010 and 2004 and. 6.9% were captured before 2004.

Table 3
Pediatric patients captured by case definition 3 with A1C results recorded in the EMR of a provider participating in the Manitoba Primary Care Research Network (N=186)

A1C results	Patients with A1C levels
6.5%–7.4%	110 (59.1%)
7.5%–8.4%	42 (23.0%)
8.5%–9.4%	27 (14.5%)
≥9.5%	7 (3.8%)

A1C, glycated hemoglobin; *EMR,* electronic medical records.

Discussion

The formation and validation of an EMR-based pediatric definition of diabetes will assist in describing the epidemiology of pediatric diabetes, including its prevalence in an expanded sample of both subspecialist and primary care practitioners. Similar to other studies (16,18,19,22), the inclusion of EMR-specific fields (i.e. health conditions, laboratory results) greatly improved case detection of the pediatric diabetes algorithm. The administration-based case definition (case definition 1) had low sensitivity (48.9%) when applied to an EMR repository, and it captured less than half of the reference standard. The EMR-based case definition 2 and case definition 3 improved sensitivity (96.9% and 94.9%, respectively), suggesting that similar to other studies, clinically detailed information provides contextual data about patients that can enhance disease surveillance (16–18,22).

Independent of the case definition applied, some patients captured in the MaPCReN population were not in the reference standard derived from the DERCA clinical repository. This finding is similar to that of Harris et al, who identified adult patients with diabetes and with EMR-based algorithms who were not captured by an administration-based algorithm (18). The pediatric diabetes cases captured in MaPCReN, but not in the DERCA database, probably have pediatric diabetes that is not comanaged by pediatric endocrinologists. This is suggested by the consistent evidence (i.e. repeated A1C results, fasting glucose test results, billing and medication records consistent with diabetes) that supports their provision of care outside of the DERCA database. The reasons patients with pediatric diabetes were not seen by pediatric endocrinologists at DERCA may be: 1) our case definition, which was based on current diagnostic guidelines (A1C ≥6.5%; previous guidelines suggested that A1C levels ≥7.0% are required for diagnosis); 2) patient ages, geographic locations or willingness or ability to attend an appointment at DERCA; or 3) lack of referral to DERCA. The discordance of cases of pediatric diabetes between the

EMR case definition and subspecialty documentation (DERCA) suggests the need to further understand the patients with biochemical evidence of diabetes but no record of diagnosis in the EMR and no evidence of accessing subspecialty care. Case definition 3 captured pediatric patients with 2 A1C levels ≥6.5% within 1 year, suggesting that a second A1C test was performed to confirm the diagnosis of diabetes. Current guidelines specify that a confirmatory A1C test ≥6.5%, in combination with clinical symptoms, can be used to diagnose diabetes, assess short-term (3-month) glycemic control and predict future diabetes-related complications (6,12,13,21).

Cases of pediatric diabetes captured in both case definition 3 and our reference dataset increased between 1998 and 2015. In our cohort, more than half of the cases of pediatric diabetes captured in both case definition 3 and in our reference dataset had their first diabetes encounter with a provider participating in MaPCReN between 2010 and 2015. As recommended by current guidelines, the care of patients with pediatric diabetes is increasingly being comanaged by primary care providers and pediatric endocrinologists (12,13). A comprehensive pediatric diabetes algorithm (case definition 3) captures a wide variety of patients and practices. Further, the 16-year study period and inclusion of multiple primary care clinics enables case definition 3 to consider changes in capture rates based on practice-specific service provision and EMR input.

Limitations

Although the MaPCReN represents a comprehensive sample of primary care visits in Manitoba, it does not include all primary care appointments in Manitoba. It is possible that care provided by other providers did not enter the primary care EMR. Northern Manitoba is composed of many remote communities and reserves serviced by nursing stations that are not represented in the MaPCReN repository. These populations have higher rates of diabetes than other areas of Manitoba, levels that are attributable to a higher proportion of First Nations people living in the northern health region (23,24). This study has validated a definition of pediatric diabetes designed for application in primary care EMR repositories in Canada. Prior to application of this definition, researchers should consider the appropriateness of the definition for their contexts. Additionally, the present study is based on structured data from EMR and did not explore additional clinical information found in the free text of encounter notes. In Manitoba, EMR contain 1 International Classification of Diseases-Clinical Modification (ICD-9-CM) diagnosis code per visit to a health-care provider for the purpose of remuneration within the provincially managed, single-payer, universal health-care coverage system. As a result, the capture of some patients may have decreased, specifically in regard to those with complex clinical presentations. There is also the possibility of error with respect to physician coding, missing diagnoses and incomplete documentation; however, the inclusion of medications and laboratory data ensured that study results did not rely on physician coding alone.

There were major improvements to EMR systems and data quality during the time of the study, which may have had an impact and could partially account for both the increase in data concerning pediatric patients with diabetes captured using health condition lists and the decrease in data concerning patients captured solely by using laboratory results. This study focused on the ability of the algorithms to capture data about patients in a reference dataset derived from patients seen by a pediatric endocrinologist (DERCA), and there were a small number of true-positive cases linkable to the MaPCReN repository; thus, the small number of patients with records in both DERCA and MaPCReN limited our ability to assess differences between cohorts. Further, the chosen reference standard, derived from the DERCA dataset, did not have any record of confirmed negative cases; therefore, the true-negative cases were determined by eliminating records with indications of diabetes, and it is possible that we may have eliminated patients who did not have diabetes. A chart review may provide a more robust sample to calculate specificity and negative predicted values.

At present, we are unable to differentiate between type 1 and type 2 diabetes within the MaPCReN population, given the variation in availability of prescription records within and among EMR. ICD-9-CM codes are not reliable enough to distinguish diabetes type. Currently, there is no EMR or administrative case definition that has successfully separated type 1 from type 2 diabetes.

Conclusions

The increasing prevalence of pediatric diabetes has long-term implications for patients and the health-care system; therefore, the application of a pediatric diabetes algorithm to an EMR data repository provides essential information for understanding disease epidemiology and informing health-system planning (16,18). Our study describes a novel method of capturing the prevalence of pediatric diabetes using primary care EMR data. Previous research has focused on capturing records of adult populations diagnosed with diabetes. This more robust methodology should be used to estimate the effects of specificity when 2 A1C tests below ≥6.5% are obtained within 1 year. Additionally, the present study illuminates the burden of pediatric diabetes in Manitoba and begins to identify key characteristics in this patient population, such as where patients are accessing care (i.e. primary vs subspecialty vs both) that will be helpful in further developing the enhanced services and strategies necessary to support the timely diagnosis and management of pediatric diabetes.

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Author Disclosures

Conflicts of interest: None.

Author Contributions

Approvals for this study were obtained by LK and AS; analysis for the study was conducted by LK, with assistance from and guidance by AS, BW and JQ; interpretation of the results and preparation of the manuscript were completed by LK, AS, BW, JQ, RY and SA.

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