ORIGINAL ARTICLE

Missing risks in opportunistic screening for type 2 diabetes - CroDiabGP study

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ABSTRACT

Aim To examine two methods of extracting risks for undetected type 2 diabetes (T2D): derived from electronic medical record (EMR) and family medicine (FM) assessment during pre-consultation phase. All risks were structured in three lists of patients' data using Wonca International Classification Committee (WICC). Missing data were detected in each list.

Methods A prospective study included a group of 1883 patients (aged 45-70) identified with risks. Risks were assessed based on EMR for continuity variables and FM's assessment for episodes of disease and personal related information. Patients were categorized with final diagnostic test in normoglycaemia, impaired fasting glycaemia and undetected T2D.

Results Total prevalence of diabetes was 10.9% (new 1.4%), of which 59.3% were females; mean age was 57.4. The EMR risks were hypertension in 1274 patients (yes 67.6%, no 27.9%, missing 4.4%), hypolipemic treatment in 690 (yes 36.6%, no 30.9%, miss 32.5%). In the episodes of disease: gestational diabetes mellitus in 31 women (yes 2.8%, missing 97.2%). Personal information: family history of diabetes in 649 (yes 34.5%, no 12.4%, missing 53.1%), overweight in 1412 (yes 75.0%, no 8.4%, missing 16.6%), giving birth to babies >4000g in 11 women (yes 0.9%, missing 99.1%). Overweight alone was the best predictor for undiagnosed type 2 diabetes, OR: 2.11 (CI: 1.41-3.15) (p<.001).

Conclusion Two methods of extraction could not detect data for episodes of the disease. In the list of personal information, FMs could not assess overweight for one in six patients and family history for every other patient. The study can stimulate improving coded and structured data in EMR.

Key words: primary care, electronic records classification, pre-consultation phase

INTRODUCTION

Family practitioners require comprehensive and accurate data about patients at the point-of-care if they are to provide high quality health care to their patients. It is recommended that all patients who are at risk for undiagnosed type 2 diabetes (T2D) must be screened in three year interval period (1-3). The most accepted method is opportunistic screening in primary care setting as a continuous process during usual care. It involves personalized approach of screening patients at-risk who visit family medicine (FM) for reasons not related to the condition for which screening is offered (4,5). The base for personalized medicine includes data about bioinformatics sets and their dynamics, genetic, environmental and lifestyle data. Dynamics of personalized data determines whether risk (or risks) will turn into the disease (6-9). Although there are suggestions that diabetes can be prevented and treated through early detection, lifestyle intervention and treatment, opportunistic screening for diabetes has not been adopted as a part of routine practice.

In order to make screening a part of routine practice FMs need a simple process of finding patients at risk derived from family practice electronic medical records (EMR), which mostly contain routine data via the continuity of care (1-3). However, much of important information about risks is still missing in the EMRs because they are not related to data in continuity of care and patients' visits to FM . These data provide extra information for predefined conditions such as unknown T2D (6,8,9).

For risks that are not in the EMR, FMs need to collect them using other methods of detection: interviews during usual consultations (burdens the consultation), „paper and pencil" questionnaires in waiting rooms (unreliable), whose performance depends on the use of existing health service, but they are likely to be more acceptable, cost less and are less time-consuming to administer. Finnish Diabetes Risk Score (FINDRISC) (questionnaires for „healthy" people) can be effective in population without diabetes assessment risk. Another (mostly complementary) method of risk detection is FM estimation from continuity of care during pre-consultation phase (9,10, 13-16). The reasons for lacking data about risks in EMR could be they were not detected and collected, or because they are not sufficiently coded and structured in a retrievable way (8-12). Despite a lot of research about methods of data detection, little is known about where improvements in data collection are needed (17,18). Wonca International Classification Committee (WICC) suggested three lists of structured personalized patient information in EMRs at their conference (7,11,12). Recommendations for coding were given as a result of long discussion in WICC work groups as important elements of quality care in family practice and EMRs (7). The study of missing risks for opportunistic screening in family medicine was not done in transitional health care settings.

The aim of this study was to examine two methods of extracting risks for undetected T2D derived from EMRs and FM assessment during pre-consultation phase of opportunistic screening. All risks were structured in three lists of patients' individual data using WICC classification. Missing data were detected in each list.

PATIENTS AND METHODS

Patients and study design

A prospective CroDiabGP study, which was a part of CroMaKo study (Croatia, Macedonia and Kosovo), was conducted in the setting of 23 FMs in Croatia in period 2010-2011. Each FM had high-level experience working in primary care and had been working with the same population for at least 5 years. All practices used the same EMR program and sent data to the national Central Health Information System (CEZIH). The registration of diagnoses was based on the electronic version of the International Classification of Disease-10 (ICD-10). Procedures in health care process were transcribed in the adopted electronic version of the International Classification of Primary Care-2 (ICPC codes-2). Prescriptions were coded in Anatomical Therapeutic Chemical (ATC) index.

The study protocol and materials were approved by the Ethic Committee of the Ministry of Health, Healthcare Law of the Republic of Croatia (NN 121/03) and Patients' Rights Law of the Republic of Croatia (NN 169/04).

Methods

Two methods to extract risks were used: derived EMR and FMs estimation.

All risks were translated into a set of three lists of patient information according to the recommendations of the WICC classification: continuous variables (age, gender, diabetes mellitus, hypertension, hyperlipidemia), episode of the disease (gestational diabetes and other diabetes in acute disease and iatrogenic diabetes), and personal related information (overweight, family history positive for diabetes, giving birth to babies >4000 gr.) (7,12).

The first step was to create a list of patients aged 45-70 at the beginning of the data collection (December 1, 2010). Patients with previously diagnosed diabetes mellitus (E10, E11) were excluded from the list.

Extraction of continuous risks noted in the EMR: treated hypertension and lipid metabolism disorders were defined as receiving antihypertensive or hypolipidemic medication within one month prior to collecting data - coded yes. If the risk was determined in the referent interval they were coded no (there is no risk now). If patients never had their blood pressure or lipid levels measured they were encrypted as – coded missing.

The second method of risk extraction was FM estimation in the list of episodes of disease, e.g, gestational diabetes. These data were coded as yes, no or missing.

Personal information was collected by general practitioner's risks estimation: weight information was collected by FM crude assessment of weight or if there was data about weight or obesity from the EMR, family history positive for diabetes mellitus and delivering a baby with birth weight >4000g. Data were coded as yes, no or missing.

This subgroup of patients with the risk was encouraged to have biometric measurements performed during the next independent visit in the study period (2,10).

Patients were divided into categories according to the values of biometric tests (2,10).

Biochemical analyses

Fasting plasma glucose was measured in capillary blood samples (cFPG) after overnight fasting (8-12h) using a plasma calibrated glucometer (CONTOUR/ISO standard-15197:2003 with 95% accuracy). Patients with positive cFPG in the first measurement: >6.1 to 6.9 and ≥7.0 were invited back for the second cFPG measurement after at least two weeks.

Diabetes classification criteria were defined on the basis of cFPG values: normoglycemia (NG) - cFPG <6.0mmol/L, and impaired fasting glycaemia (IFG) - FPG ≥6.1-6.9 mmol/L in two independent measurements. Undiagnosed T2D: cFPG ≥ 7.0 mmol/L in two independent measurements.

Derived risk for categories NG and undiagnosed T2D was calculated.

Statistical analysis

The EMR derived risks and estimated risks according to FM assessment in the pre-consultation phase were grouped into category yes. Confirmed risks with values in referent interval or if FM knew that there was no risk were grouped into category no. If the risk was not analyzed or FM had no data about a certain risk, they were grouped into the category missing. The descriptive analysis was used for standard variables: mean, standard deviation, minimum and maximum. Categorical variables, episodes of the disease and other information about patients were expressed in number and percentages. $\chi 2$ test was used to define the association between unknown diabetes and code yes of all risks. The level of significance was accepted as 5%.

RESULTS

Data for 1883 patients identified with risks for undetected T2D in the pre-consultation phase, and those who were categorized during the study period in the final diagnostic test, e.g. NG, IFG and T2D were analyzed.

A total of 1280 (68%) patients had normoglycemia, 184 (9.8%) patients had previously unknown T2D (range inter practice was: 7.1% -13.8%), and 419 (22.2%) were with IFG. After a correction prevalence of diabetes in total target group was 10.9% (new ones 1.4%).

In the subgroup of 1883 patients aged 45-70 there were 767 (40.7%) male and 1116 (59.3%) female patients. Mean age was 57.4 (SD 7.4) years.

Sources of data for EMR –derived risk were: 1274 (67.6%) patients with hypertension, 690 (36.6%) with lipid metabolism disorders, gestational diabetes in 21 (1.9%) women, overweight in 69 (3.7%) patients. Additional risk assessment by

FMs included family history of diabetes found in 649 (34.5%), overweight in 1343 (71.3%), giving birth to babies >4000 g in 11 (0.1%), and gestational diabetes in 10 (0.9%) women.

Patients with normal values of risks that entered the subgroup because they had other determined risks, were also detected in the EMR: normal blood pressure in 526 (27.9%), normal lipid level in 581 (30.9%). The FMs estimated that 158 (8.3%) patients had normal body weight and 234 (12.4%) negative family history for diabetes.

Missed set of data in FM assessment were data about gestational diabetes for 97.2% of 1116 women FM. For 99.9% of women FMs could not assess if they delivered babies >4000 g. For one of six (313; 16.6%) patients they could not assess body weight. The FMs could not assess family history for nearly half of the patients. (Table 1)

DISCUSSION

Focus of this work was not on the contribution risk to detect unknown T2D in subgroup of patients, but to examine methodology for detecting risks using a combination of two methods of extraction in the pre-consultation phase in the setting of FM office. Detection of risks for unknown type 2 diabetes in FM settings was the first step required for intervention. In this study it was convenient, simple, economical, did not burden the consultation and was easy so that FMs team members could perform it.

Using this methodology we discovered that one of ten patients with the risk in targeted population had undiagnosed T2D. After the correction for age group population (45-70), a contribution to total prevalence of DM was 1.4%. In literature the contribution to prevalence of newly detected T2D ranged from 0.7 to 3.0% (1-5, 16).

The EMR was an important source of data as it mostly contains routine data collected via the continuity of care such as: age, gender, detected diabetes mellitus, hypertension, dyslipidemia. In WICC classification those are grouped in the continuous variable (7,11,12).

Two methods of extraction (EMR and FM assessment) in the pre-consultation phase could not detect information coded in episodes of the disease - gestational diabetes in 1085 (97.2%) women.

The data from personal information, data about

Table 1. Data of subgroups with risks, aged 45-70, according two methods of extraction in pre-consultation phase

Characteristics	Extractions of risks			p
	EMR derived risk No (%)	Estimation of FMs No (%)	Missing No (%)	
Continuous variables (ICD -10 codes)				
Age (years) (mean, SD)	57.4 (7.4)			0.09
Gender				<0.001
Males	767 (40.7)			
Females	1116 (59.3)			
Previously known diabetes mellitus (E10,E11) in age 45-70 (range inter practice)	1 264 (9.5%) (7.1% (13.8%)		184 (9.8)*	
Antihypertensive treatment (I10, I11)			83 (4.4)	<0.001
Yes	1274 (67.7)			
No	526 (27.9)			
Hypolipidemic treatment (E78)			612 (32.5)	0.181
Yes	690 (36.6)			
No	581 (30.9)			
Episodes of DM				
GDM and other episodes (O24.4)			1085 (97.2)	No odder†
Yes	21 (1.9)	10 (0.9)		
No				
Other information of patients				
Overweight: Obesity (E66)			313 (16.6)	<0.001
Yes	69 (3.7)	1343 (71.3)		
No		158 (8.3)		
Family history of DM (Z83.3)			1000 (53.1)	<0.002
Yes		649 (34.5)		
No		234 (12.4)		
Birth weight babies> 4000 gr			1105 (99.0)	No odder†
Yes		11 (0.9)		
No				

*New detected T2D; †Not determined because of large number of missing data
DM, diabetes mellitus; GDM, gestational diabetes mellitus; EMR, electronic medical record; FM, family medicine; ICD-10, International Classification Disease

giving birth to babies >4000 g in 1105 (99.0%) women could not be detected. In literature those data are mostly marked as missed and are generaly not included in the analysis (16).

The EMR and FM assessment did not detect one of six overweight patients (19,20) and for every other patient they could not assess family history (21-23). In this study we did not analyze the sensitivity (proportion of overweight and obese patients identified as overweight and obese by their FMs, and specificity (the proportion of normal weight patients whom FM estimated as normal weight).

We want to emphasize that personal combination of individual risks for every patient is important, because more risks contribute to undetected T2D

if they are aggregated in one person. For example, patients >45 years, overweight and with genetic predisposition had undetected T2D in 50%. They were unaware of their diagnosis although 85% had access to primary care providers as the first point of contact for health related problems (8,9). For this most common group of patients with unknown T2D, FMs had only age registered as a risk factor. All of these data (apart from body weight) are inalterable (17, 23, 24).

This research contributes to structuring of risks according to recommendations of WICC for the use of ICPC-2 in the problem list, episode of care and personal (or other) patient information. We have shown that there is a large amount of unregistered data in episodes of the disease and personal information probably because they were not a reason for patients' visit to FM (7, 19-24). It is important to know that it is enough to enter these data only once in the search list comprising family history of diabetes, gestational diabetes, giving birth to babies >4000 g (17,24).

In order to improve the process of opportunistic screening in the pre-consultation phase the FMs need strategies to improve entered and structured data in EMRs. The FMs need better registration of family history of diabetes, overweight, gestational diabetes and data about giving birth to babies >4000 gr. Consequences of missing these data are that patients with only that one risk will not be included in the process of opportunistic screening. These missing and unanalyzed data can influence final prediction of collected and analyzed risks. Further improvements in the process of collecting and structuring risk data are necessary because without them the role of FMs in early detection of the disease can be questionable (23,24).

In conclusion, two methods of extraction could not detect data in episodes of the disease. In the list of personal information, FMs could not assess overweight for one of six patients and family history for every other patient. The study can stimulate improving coded and structured data in EMRs.

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TRANSPARENCY DECLARATION

Competing interests: None to declare.

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Nedostatni podaci o rizicima za oportunistički probir na šećernu bolest tipa 2. CroDiab studija

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SAŽETAK

Cilj Ispitati dvije metode ekstrakcije rizika: iz zapisa elektroničkog medicinskog kartona (EMR), te iz procjene liječnika obiteljske medicine (FM) za neotkrivenu šećernu bolest tipa 2 (ŠB-2), u prekonzultacijskoj fazi. Strukturirati rizike prema *Wonca International Classification Comittee* (WICC) i utvrditi koje rizike ne možemo otkriti.

Metode U prospektivnoj studiji bilo je uključeno 1.883 pacijenta, dobi od 45 do 70 godina, s identificiranim rizicima za neotkrivenu ŠB-2. Rizici su otkriveni dvjema metodama: kontinuirane varijable iz zapisa EMR-a, rizike epizoda bolesti i personalne informacije o pacijentu prema procjeni FMs-a. Prema biokemijskom dijagnostičkom testu pacijenti su kategorizirani u tri grupe: normoglikemija, oštećena glukoza natašte i novootkrivena ŠB-2.

Rezultati Ustanovljena je prevalencija šećerne bolesti od 10,9% (1,4% novootkrivenih), od čega kod 59,3% žena; prosječna dob je 57,4 godina. Rizici dobiveni iz EMR-a: hipertenzija kod 1.274 pacijenta („da" 67,6%, „ne" 27,9%, „nedostaju podaci" 4,4%), hipolipemici u terapiji kod 690 („da" 36,6%, „ne" 30,9%, „nema" 32,5%). Procjena liječnika o epizodama bolesti: gestacijski dijabetes kod 31 žene („da" 2,8%, „nedostaju podaci" 97,2%). Procjena liječnika o individualnim podacima pacijenta: pozitivna obiteljska anamneza na ŠB kod 649 („da" 34,5%, „ne" 12,4%, „nedostaju podaci" 53,1%), prekomjerna tjelesna težina kod 1.412 („da" 75,0%, „ne" 8,4%, „nema" 16,6%), rađanje djeteta porođajne mase >4.000 g kod 11 („da" 0,9%, „nedostaju podaci" 99,1%) pacijenata. Prekomjerna tjelesna težina ima statistički najbolju predikciju za neotkrivenu ŠB: OR:2,11 (CI: 1,41-3,15) (p<,001).

Zaključak Dvije metode ekstrakcije rizika nisu mogle otkriti rizike epizode bolesti. FMs nisu mogli procijeniti prekomjernu tjelesnu težinu u 1 od 6 pacijenata, te pozitivnu obiteljsku anamnezu u svakog drugog pacijenta. Studija može potaknuti na poboljšanje u unošenju i strukturiranju podataka o pacijentu u EMR-u.

Ključne riječi: primarna zdravstvena zaštita, elektronska medicinska klasifikacija, prekonzultacijska faza