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Research Article

Effect of a Community-Based Diabetes Awareness Program on the Detection of Diabetes

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Abstract

Introduction: In Canada, family physicians are expected to screen individuals over 40 years of age every 3 years for diabetes. The CHAD (Community Health Awareness of Diabetes) Program assisted family physicians in the diabetes-screening process, by risk-stratifying patients at community pharmacy screening sessions. The paper describes the effectiveness of the program at detecting incident diabetes.

Methods: Patients of family physicians were invited to attend risk-assessment sessions (diabetes risk questionnaire and capillary blood glucose tests). Results were sent to family physicians and given to attendees. The effect of the program on incident diabetes detection rates was assessed using a retrospective observational chart audit of patients in local family practices, using a before-and-after design.

Results: Charts of 1030 eligible patients were audited; including 387 charts of CHAD program attendees. The diabetes incidence rate-ratio in program attendees versus non-attendees, comparing one year before-and-after CHAD's implementation, was 1.65 (0.028/0.017), [95% CI = 0.04 - 61.6]. However, the difference between the rates of diabetes diagnosis for the 28 participating physicians before-and-after the program was not significantly different (p= 0.28, df = 27, [95% CI -0.09, 0.03].

Conclusion: Programs like CHAD may increase the detection of diabetes by family physicians. This may be a useful community program approach, modifiable for different communities by health-services planners.

ABBREVIATIONS

CHAD: Community Health Awareness of Diabetes Program; T2DM: Type 2 Diabetes

INTRODUCTION

Diabetes is a chronic condition, increasing in prevalence [1] that uses a great deal of health care resources [2-4]. Global estimates indicate that diabetes affected 285 million adults in 2010, and its prevalence will increase to 7.7%, or 439 million adults by 2030 [5]. Between 2010 and 2030, there will be a 20% increase in diabetes prevalence in developed countries alone [5]. Now, as many as 1 in 10 adults in the USA are estimated to have diabetes [6]. In the UK in 2009 the prevalence of diagnosed diabetes is 4% [7]. In Ontario, the age and sex adjusted prevalence of diagnosed diabetes increased by 69%, from 5.2% in 1995 to 8.8% in 2005 [8], exceeding the global prevalence of Type 2 Diabetes (T2DM) projected for 2030 [9]. Furthermore, up to one third of people with diabetes are estimated to be undiagnosed [10,11].

The Canadian Diabetes Association clinical practice guidelines of 2008 recommend that all individuals over the age of 40 be routinely screened for diabetes [12]. In Canada, family doctors are responsible for implementing these recommendations. However, this is a monumental task given the current shortages of family physicans [13,14]. Therefore, rather than a program of regularly screening everybody over 40 years of age, pre-screening in the community to identify high risk individuals may be more appropriate. In order to test this approach, the Community Health Awareness of Diabetes program (CHAD) was developed.

The study's primary objective was to determine the effectiveness of the CHAD program. This was achieved in two ways. Firstly by determining whether the availability of the CHAD program increased the detection of diabetes in a sample of family practice patients aged 40 years or more who were diabetes free and eligible to attend the program (whether they attended or not). Secondly by determining whether the detectable annual incidence (rate) of diabetes in patients who attended the CHAD program, compared to patients from the same practices that did not attend the program.

The secondary objective was to determine which patient risk-factor information when presented to family physicians, was associated with the subsequent diagnosis in a population of patients who had attended the CHAD program.

METHODS

Design

A retrospective observational chart audit comparing incidence rates of diabetes per physician during one year before and one year after the introduction of the CHAD program was conducted in two populations – those who had attended the CHAD program (attendee group) and those who did not and thus were subject to usual care (non-attendee group). Details of the CHAD Program are described in more detail in Appendix 1.

Setting

The setting was the community, and participating pharmacies (self-selected), physicians and their patients from the communities of Grimsby, Vineland and Smithville in Ontario, Canada.

Participants and recruitment

Community-dwelling individuals 40 years of age and older who resided in the study area during the program were included, since all of these individuals were theoretically eligible to participate in the CHAD Program. Patients who attended the CHAD Program consented to an audit of their family physician medical charts 1 year after the program – they formed the 'attendee group'. Patients under the care of local family doctors participating in CHAD but who did not attend the CHAD sessions were chosen randomly from a list of all eligible patients over the age of 40 years without diabetes - they formed the 'non attendees'. This population also underwent a chart audit, though no identifying data was extracted (names, dates of birth and postal codes were not needed, but merely clinical data from their medical record) and therefore consent was not sought.

Inclusion/Exclusion criteria

For the chart audit, patients were included if they were aged 40 years of age or older on Feb 22nd 2004 or received their regular medical care from their family doctor (defined as having seen their doctor at least once or more during the preceding 3 years). Patients were excluded if they had died, or moved away and ceased to see the physician (between 22nd Feb 2004 and 21st Feb 2006).

Intervention

The intervention was the provision of the CHAD Program (a community diabetes risk-assessment program). This was a community public health program that was piloted between February 22nd and April 26th 2005 in several small communities in Southwestern Ontario, Canada. Community members were invited to attend and participate in the CHAD Program thereby assessing their own risk of developing diabetes. Those who attended the program completed the Finnish Diabetes Risk Score [15] (for impaired glucose tolerance detection), the Cambridge diabetes risk score [16] (for undiagnosed diabetes), fasting capillary blood glucose (fasting status was self-reported by participants and had been requested in advertisments) and a glycosylated hemoglobin level. All CHAD participants' assessments were faxed to their family physicians. Initially, CHAD solicited the support of local family doctors, educating them about the program and inviting them to formalise their support for CHAD by signing a 'letter of understanding'. Participating doctors (self selected from all doctors in the area) could participate in CHAD in a number of ways; at the most basic level, they would allow CHAD advertising materials to be displayed in their clinics, and at a more involved level, they would invite patients personally to attend CHAD screening by giving attending patients a CHAD invitation. The most involved level of physician participation involved mailing a personal invitation to the CHAD sessions. Therefore, within the community, people over 40 years old could be sent invitations if their family doctor wanted to, or they could see adverts in their family doctors' offices or in the newspaper, on the radio or television. These 'diabetes awareness and risk assessment' sessions were delivered by specially trained community volunteers, in a network of local community pharmacies (see Appendix 1 for program description). Members of the local community, who had not been invited in any of the above ways, were made aware of the CHAD sessions by a local TV broadcast and radio and newspaper advertisements.

Sample size

Based on Canadian figures [17] from 1999, a 'normative annual incidence' rate of 12[1*] cases per 1000 people over 40 years of age was assumed. Based on clinical significance, a twofold increase in the diabetes incidence rate per physician was postulated (24 cases per 1000 people over 40) as a result of the CHAD program. Using the difference in annual rate of new diabetes diagnosis per physician as the primary outcome, and performing a paired t-test before and after the program at the physician level, with a power of 80% at a significance level of 0.05[2#], the sample size was calculated to be 8 physicians [18]. Further estimating recruitment of approximately 125 charts per physician, a total patient sample size of 1000 would be obtained.

Data collection

Using a standardized data collection form, chart data was collected between October 2006 and December 2007 in the family practices of physicians whose patients had participated in the CHAD Program. Randomly selected charts of CHAD attendees were reviewed, as well as charts of non-attendees in those practices. Charts of non-attendees were randomly selected by family physicians' staff from their electronic rosters, since these

1 * in 1999 there the incidence of diabetes was 1.045 per 100 in >35 year old women, and 1.378 in over 35 year old men (ICES Diabetes in Ontario, A Practice Atlas p1.4)

2 # using the formula for sample size (Machin and Campbell, p.79) [18]

$$m = \frac{(z_{1-\alpha} + z_{1-\beta})^2}{d^2} + \frac{1}{2} z^2 1-\alpha$$

where m = sample size; $z_{1-\alpha} = 1.96$; $z_{1-\beta} = 0.84$; d = effect size of Cohen's d
Cohen's d = μ0 - μ1/ std deviation
std deviation = 0.009 (based on range of incidence rates possible/4); range of incidence rates estimated as 0 to 0.036
and μ0 is rate of diabetes incidence at time 0; estimated as 0.012
and μ1 is rate of diabetes incidence at time 1; estimated as 0.024
therefore Cohen's d = 0.012 / 0.009 = 1.33333333

patients had been eligible to attend but had not. Collected data was double-entered by 2 research assistants. In the non-attendee group, data extraction staff followed confidentiality procedures of the clinics. They did not collect any identifiable information in keeping with Canadian Health Information Privacy Laws. The only demographic information that it was possible to collect in both groups was gender, age and employment status.

MAIN OUTCOME MEASURES

Incidence rates (annual) of diabetes per physician, during a one year period before and one year period after the introduction of the CHAD program were compared in a random sample of charts. Diabetes diagnosis in the charts was determined as either having been noted by a physician or as medication for diabetes having been prescribed. The annual incidence rate of diabetes per physician was calculated as follows: number of new diabetes cases/number of charts reviewed. More specifically, the numerator was defined as the absolute number of patients, newly identified with diabetes, in a specified one year period, in all charts of a particular physician that were reviewed. The denominator was defined as the actual number of charts that were reviewed for that named physician.

Analysis

The main analysis was conducted at the physician level and involved a paired t-test. This was due to the fact that the CHAD Program was a diabetes risk assessment program designed to target high risk patients for formal diabetes screening. This formal screening could only be initiated by physicians, and was dependent upon their behavior. Thus the CHAD Program, although multi-faceted, was mainly targeting physician behavior. The difference in rates of diabetes diagnosis before and after the program, was calculated per physician (pooling the sample and also comparing attendees to non-attendees). At the individual patient level, multi-level regression modeling was estimated to address the clustering issue.

Incidence rates per 1000 patients, incidence rate ratios and likelihood ratios comparing change in incidence rates in risk assessment attendees versus non attendees were calculated. Estimates of the intra-cluster correlation coefficient for the outcome of diagnosis of diabetes were also calculated. Multi-level modeling (random effects logit model) was used to conduct a multivariate analysis, accounting for potential patient-level and physician-level confounders for the outcomes of diagnosis of diabetes during one year following the CHAD program and the likelihood of being diagnosed with diabetes in those who had attended the program only. The statistical programs SPSS version 17, [19] STATA intercooled version 8.1 [20] and SAS [21] were all used for the analysis. The demographic characteristics of attendees versus non attendees were statistically compared.

Ethics

The McMaster University Research Ethics Board approved the study protocol. (Project number 04-404).

RESULTS

Overall, 1030 charts of people eligible to attend the CHAD program were randomly audited from 28 family doctors practices (patients audited per doctor ranged from 2 to 147); of these 387 charts were of patients who had attended the CHAD program (from a potential pool of 585 CHAD attendees) and 643 charts were of people who did not attend (from a potential sample of 656) but who met the program eligibility criteria (Figure 1).

Main outcomes

Absolute diabetes detection rates (Irrespective of attendance at the program): The difference between the rates of diabetes diagnosis for the 28 physicians before-and-after the program was not significantly different for the whole sample when assessed using a paired t-test ($p = 0.28$, $df = 28$, [95% CI -0.09, 0.03]. The impact of patient clustering by physician on the outcome of diabetes diagnosis was estimated by calculating the intra-cluster correlation (ICC) coefficient and found to be 0.0182 using the sum of mean squares method, and 0.0193 using the Chi Squared test calculation method.

Comparing diabetes incidence rates: The diabetes incidence rate ratio in those who attended the program and those who did not was 1.65(0.028/0.017), [95% CI = 0.04 - 61.6]. Diabetes incidence rates and incidence rate ratios were not statistically significant comparing before and after the CHAD program (Table 1).

In the community, pooling the numbers for analysis from

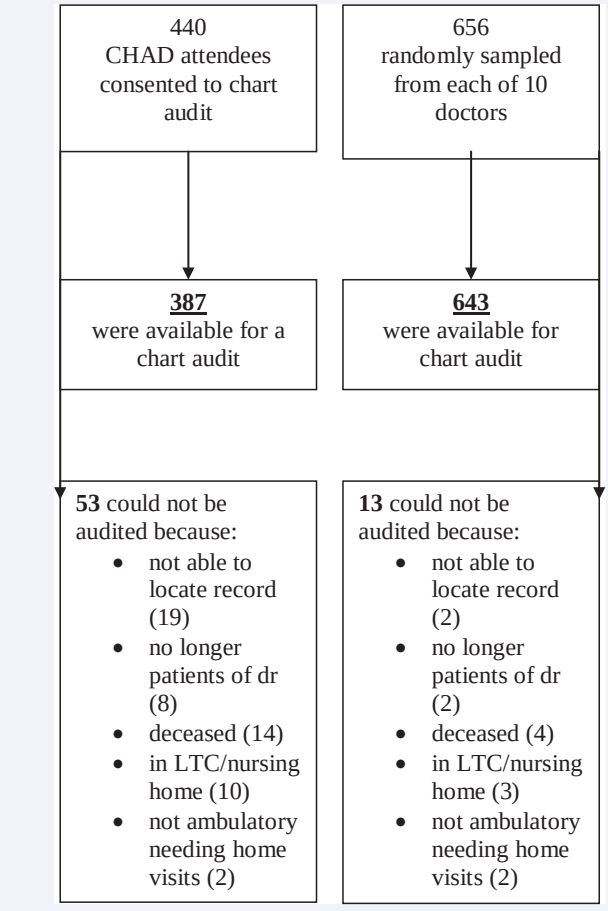

Figure 1 To show source of chart audit data.

those who had attended the CHAD program and those who did not, the annual rate of new diabetes diagnosis was 27 per 1000 [95% CI = 17.90 to 39.00] in the year before the introduction of the CHAD program, and 45 per 1000 [95% CI = 33.00 to 59.80] in the year after; the rate ratio (before: after) was 0.06 (0.027/0.045) [95% CI = 0.60 to 1.00].

Comparing the attendee and non-attendee group: CHAD attendees and non-attendees were significantly different (Table 2); attendees were more likely to be female, retired and older. The patients in each sample were clustered to their physicians differently; attendees consisted of 28 physician-patient clusters ranging from 3 to 51 in size, while the non-attendees consisted of only 10 clusters ranging from 59 to 75 in size, primarily due to chart audit implementation factors. Chart audit on non-attendees was limited to fewer practices, of a more even number per practice due to the constraints of being able to conduct such a large audit in a practical way.

Diabetes diagnosis accounting for confounding factors: Multi-level regression modeling showed that attending CHAD (see Table 3) had a positive effect on whether diabetes was diagnosed; however, this effect was reduced both in statistical significance and magnitude when the effect of the physician, patient gender, patient employment status and patient age were adjusted for.

Secondary outcome

Information associated with future diabetes diagnosis: In the CHAD group, of all those diagnosed with diabetes (n=13), 9 were identified as at high risk of diabetes from the CHAD risk score, and 3 had a moderate risk score and 1 was not identified as being at elevated risk. The yield of diabetes diagnosis from the CHAD risk score was 11.3% (9/80) for the high risk category and 1.3% (3/266) for the moderate risk category. In the group who attended the CHAD program, logistic regression showed that a high CHAD Risk Score was significantly predictive of later diabetes diagnosis (OR=22.11 CI = 4.58 to 100.78) and a fasting capillary glucose greater than 7mmol/l was also significantly predictive (OR=17.96, CI=3.71 to 86.84) (see Table 4). Accounting for physician level clustering using robust modeling and random effects modeling, the significance remained unchanged. Male gender and systolic blood pressure greater than 130 mmHg were associated with diabetes diagnosis though non-significant at conventional levels. Diastolic BP was not significantly associated. It was not possible to do a comparable analysis in the non-attendee group since this group did not have variables collected from the CHAD risk scoring assessment in their charts since they had not attended the program, nor was it possible to approximate a risk score from the charts due to lack of information or missing information needed to complete the CHAD risk scores.

DISCUSSION

The CHAD program may have had an effect on the diagnosis of diabetes in the community practices involved, and this trend is strongly demonstrated by the facts that the diabetes incidence rate ratio in program attendees and non-attendees 1.65 and that the annual rate of new diabetes diagnosis was 27 per 1000 before the introduction of the CHAD program, and 45 per 1000 in the year after.

However, other results are difficult to conclusively interpret since they did not reach statistical significance at the conventional levels. This is most likely to due to a number of factors; the number of diabetes cases diagnosed was small overall, thus the study was statistically underpowered despite reaching an adequate a-priori calculated sample size; the actual effect size in the study was smaller than that assumed for the purposes of sample size calculation (1.67 vs. 2) which partially explains why statistical significance was not reached in this sample when comparing the diagnosis rates using a paired t-test; the data was clustered, [22,23] the inter-practice variability was high [22]. The original sample size calculations required an estimation of the standard deviation, which was estimated following a commonly applied algorithm (SD = [largest possible value - smallest possible value]/4). Though the incidence estimations used for this calculation were based on the literature, a post-hoc calculation has shown that, most likely due to the inter-practice variability, the standard deviation was actually much larger (0.15 instead of 0.009), which resulted in a smaller sample size estimation than was actually needed.

All these factors in combination decreased the effect size of the CHAD program and the corresponding statistical power. Furthermore, results displayed in Table 2 and 3 though valid, were not a result of the primary hypothesis from which the study was driven therefore did not reach sufficient power. However it is probable that there was an impact on diagnosis of diabetes in

Table 1: Comparison of incidence rates and incidence rate ratios.

	1 year Before CHAD (Feb 23rd 2003 – Feb 22nd 2004)	1 year After CHAD (Feb 22nd 2004 – April 26th 2005)	Difference before and after CHAD
Annual new diabetes diagnosis rate per 1000 patients			
CHAD attendee group	8	28	20 [95% CI = 0.012 to 0.031]
Non attendee group	19	17	-2 [95% -0.001 to 0.002]
Incidence rate ratios			
Attendee group			3.5 [95% CI = 2.25 to 3.50]
Non-attendee group			0.9 [95% CI = 0.90 to 1.00]

Table 2: Comparison of demographics of samples.

	CHAD attendees (n=387)	Random sample (n=643)	*p* value
Female (%)	62	54	0.005*
Employed (details below)	23.0	48.6	
Unemployed	4.7	4.7	
Retired	36.4	13.3	
On disability	1.6	1.9	
Employed vs. other	23.0	48.6	0.000*
Retired vs. other	36.4	13.3	0.000*
40-44	3.9	19.4	
45-49	4.5	22.3	
50-54	8.2	14.5	
55-59	10.0	14.1	
60-64	13.9	8.6	
65-69	16.8	4.6	
70-74	13.2	6.7	
75-79	14.8	4.3	
80-84	10.0	2.6	
85-89	3.0	.9	
>90	0.9	19.4	
Mean age	66.6	53.9	0.000*, [95% CI of difference, 8.8 to 16.6]

* denotes statistical significance

Table 3: Odds Ratios of being diagnosed with DM after the risk assessment Program for CHAD attendees vs. Non attendees, taking account of confounding factors using multi-level regression modeling.

After controlling for:	Analysis with random effects modeling (physician as random variable effect)* - reported as OR	CI	P value
Physician	*2.96*	*1.03 to 8.54*	*0.04**
Physician, Gender	*3.12*	*1.06 to 9.53*	*0.04**
Physician, Gender, Employment status	2.37	0.81 to 6.99	0.12
Physician, Gender, Employment status, Age	1.67	0.55 to 5.11	0.37

*Assumptions made are:
1) Attributes of individuals (τ_i) within clusters are the results of random variation and do not correlate with the individual regressors
2) The random effects (τ_i) are normally distributed with a mean of '0' and constant variance (i.e., NID(0,σ_τ)

the community as a result of CHAD as demonstrated by the basic trends in the diabetes incidence rate ratios.

Ultimately CHAD's goals were to detect incident diabetes earlier thereby reducing complications, mortality and healthcare expenses related to diabetes (since lifestyle change prevents diabetes and may prevent the complications of diabetes [24,25]), and help family physicians meet the increased expectations of early screening for diabetes placed upon them. The key to the program was that family doctors received information about their patients who attended the sessions, which should have assisted them in targeting certain high risk individuals for subsequent diabetes screening. Additionally overall awareness of diabetes in the community (at a physician level and a patient level) should have been raised, though this is difficult to measure accurately, and therefore was not attempted in this study.

In order to reach the population sample of over 40 year olds, the program provided sessions at different times in the day and sessions were offered during the weekend. Despite this, the people who attended CHAD were a distinct group, comprised of more females, more elderly people and more retired or unemployed people and different from the population of primary care patients potentially eligible for T2DM screening (non-

Table 4: Odds ratios multi-level regression model on CHAD sample (n=387) to show. The predictive effect of variables on diagnosis of diabetes.

Odds ratio of variable described within the model specified (P value, 95% CI)	Individual variable in model only:	Age, Gender, CHAD Risk Score, Systolic BP, Diastolic BP:	Age, Gender, Glucose, Systolic BP, Diastolic BP:
Age (continuous)	1.02 (0.40, 0.97 to 1.08)	1.05 (0.25, 0.96 to 1.15)	0.98 (0.71, 0.86 to 1.10)
Male Gender	2.22 (0.22, 0.63 to 7.91)	1.77 (0.47, 0.37 to 8.44)	2.79 (0.43, 0.21 to 36.32)
CHAD Risk Status Score, low/moderate or high	*21. 76 (0.00, 4.38 to 108.03)	*18.28 (0.00, 3.41 to 97.96)	
Glucose, <7, >=7	*39.51 (0.00, 3.89 to 401.13)		*86.07 (0.01, 2.52 to 2879.77)
Systolic BP, <130 or >130	2.08 (0.31, 0.51 to 8.56)	1.12. (0.81, 0.43 to 2.97)	2.03 (0.37, 0.44 to 9.47)
Diastolic BP, <90 or >90	0.70 (0.74, 0.08 to 6.05)	0.63 (0.47, 0.37 to 8.44)	1.33 (0.87, 0.09 to 19.53)

attendee group). These differences may be due to the fact that the CHAD risk assessment sessions took place in the day, and were more accessible to older people and females (described in the literature as attending healthcare more frequently [26]). In designing an ideal program, specific groups need to be targeted in different ways. Though the older population can be reached using methods demonstrated by the CHAD program, a different strategy may be required for those between the ages of 40 and 65 – possibly workplace screening.

The limitations of the study were as follows; practices chosen in this study were not representative of rural populations; people from visible minorities [27] (such as South East Asians, Aboriginals and Hispanics who have a higher rate of diabetes incidence [28-30]) did not reside in the area of study; it was not possible to follow all CHAD attendees (Figure 1) due to patients deaths and also because some family doctors were reluctant to allow their patients records to be audited despite pre-arranged patient consent.

The fact that the ICC was small demonstrates that physicians exert a small but measureable effect on the diagnosis of diabetes in their patients [23]. However, the notion that diabetes diagnosis was affected by practice, physician and other environmental characteristics is highly plausible and likely. This is demonstrated by the clustering effects in the results and specifically the change in confidence intervals in random effects modeling techniques. In the individual level analysis where the multilevel modeling technique was used (Table 3), when physician, age, gender, employment status were taken into account, the overall effect of the CHAD program was still positive (OR = 1.67), indicating a true effect of the program on diabetes diagnosis. When the addition of confounders in the data, statistical precision was reduced and the confidence intervals widened as expected.

The secondary outcome of the study was to examine factors associated with subsequent diabetes diagnosis in attendees of the CHAD program, and it is possible that combinations of tests and scores could have been used to have a similar outcome. Given that a fasting capillary glucose level of >7 mmol/l was a significant positive predictor for later diabetes diagnosis, this may be all that is needed to prompt family physicians to screen people potentially at high risk, but further investigation is definitely warranted.

APPENDIX 1: DESCRIPTION OF THE CHAD PROGRAM

Population invited

The Community Health Awareness of Diabetes (CHAD) program was a community based diabetes risk assessment program, whereby community members 40 years and older were invited to attend special sessions to assess their risk of developing or of having diabetes. Extensive community-wide advertising (household flyers with local newspapers detailing the prior need for fasting and the location and timings of the sessions) and program promotion occurred concurrently throughout the program.

CHAD risk assessment tools

The CHAD program used a combination of questionnaire based risk-scoring (the Finnish Diabetes Risk Score) and near-patient testing (fasting capillary blood glucose and HbA1c) at specific local pharmacies in Grimsby, Beamsville, Smithville and Vineland, between February 22nd and April 26th 2005. Participants filled out a scoring tool themselves (see Appendix 2 for example of tool) with the assistance of a peer health educator. The whole procedure took approximately 10 minutes. The finger-prick capillary blood tests were performed by the participants themselves, and the peer health educators merely advised and helped with the procedure, but did not touch any blood or blood-soiled products. The risk assessment sessions provided were either by invitation or drop-in in nature, lasted for 3 hours and took place twice weekly in 4 different pharmacy locations.

Involvement of family physicians

Local family physicians had been invited by the CHAD Program organizers to be part of the program. Involvement of family physicians was voluntary and all physicians in the local area chose different levels of participation with the program. At the most involved level, some family physicians personally invited, by mail, all of their rostered patients over the age of 40, to specific risk-assessment sessions. At the next level, physicians had tear-off invitation pads in their consultation rooms and used these to opportunistically invite patients they saw for the risk assessment sessions. At the lowest level of involvement physicians displayed advertising materials about the risk-assessment session in their waiting rooms. However, regardless of the level of involvement in inviting patients to attend, or whether they had been involved whatsoever, all local family physicians received the results of the risk assessment sessions for their patients.

Peer health educators

Community peers (trained for 10 hours by a public health nurse) performed the diabetes risk assessments on the session participants and completed a health data form on each attendee.

The training received consisted of teaching around how the risk assessment forms should be completed and how a finger prick capillary blood glucose test and A1c test should be conducted. The peer health educators were mostly retirees who had participated in community health education programs before; a large number were in fact retired health professionals.

Results of the risk assessment and follow up of patients

Patients received a copy of the health data forms and an immediate calculation of their diabetes risk score status. Data from the completed risk-assessment forms were entered into the CHAD electronic database and a 'CHAD combined risk score for diabetes' (which was an aggregate of the blood tests and scoring tool score) was generated. The CHAD combined risk score was faxed to the participants' appropriate family doctor, together with an explanation of what it comprised and the recommendations following on from this (as per the 2003 Canadian Diabetes Association guidelines).

These recommendations encouraged family doctors to initiate formal screening for diabetes in those who had a high CHAD combined risk score. Results requiring urgent attention[3*] were faxed immediately. Other results were faxed within 1 week. By encouraging family physicians to appropriately screen high risk individuals, the program sought to change family physicians' behavior, by altering them to those individuals needing timely screening. An example of the faxed information sheet is displayed in Appendix 2.

In addition, participants identified as having high risk for being diagnosed with diabetes, received educational information and individual counseling around diabetes and modifiable risk factors, and were referred to the local diabetes education centre.

CONCLUSION

In conclusion, though the CHAD program may have had a positive effect on increasing the detection of diabetes, though the magnitude and significance of this effect was not clearly demonstrated due to the small sample size attained. Though the incidence rate ratios suggest a positive program effect on diabetes diagnosis, they were not statistically significant. Further studies reaching adequate power, would be required to definitively support the notion that the CHAD program did have an effect on diabetes diagnosis in the community.

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Authors' contributions

None of the authors had any conflicts of interest regarding this paper.

GA was the principal investigator, led the study, obtained funding for the study, coordinated the research effort, led the analysis and drafted the first draft of the paper. The paper formed part of GA's doctoral thesis. All authors fulfill the criteria for authorship by having taken part in the conception, design, process and analysis and write up of this paper.

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3 * Capillary Blood Glucose >15 mmol/l

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