
Nova Scotia Prediabetes Project: upstream screening and community intervention for prediabetes and undiagnosed type 2 diabetes

P. Talbot, MSc; M. J. Dunbar, MEd

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Abstract

Introduction: Identifying individuals in the prediabetic state may help delay/prevent disease progression to type 2 diabetes mellitus. We explored the feasibility of a household mailing approach for population-based screening of prediabetes and unidentified type 2 diabetes mellitus, developed standard protocol, and developed and implemented community-based lifestyle programs.

Methods: The 16-item Canadian Diabetes Risk Assessment Questionnaire (CANRISK) was mailed to every household in two rural Nova Scotia communities. In total 417 participants aged 40 to 74 years with no prior diagnosis of diabetes self-administered the CANRISK and completed a 2-hour oral glucose tolerance test (OGTT) at a local health care facility. Those with prediabetes were invited to participate in a Prediabetes Lifestyle Program.

Results: Glycemic status was identified as normal, prediabetes or diabetes for 84%, 13% and 3% of participants, respectively. Association between glycemic status and overall CANRISK risk score was statistically significant. Six CANRISK items were significantly associated with glycemic status: body mass index, waist circumference, history of hypertension and hyperglycemia, education and perceived health status. Participants and physicians gave positive feedback on the CANRISK screening process.

Conclusion: The CANRISK holds promise as a population-based screening tool.

Keywords: *prediabetic state, hyperglycemia, primary prevention, health education, health behaviour, type 2 diabetes mellitus, lifestyle risk reduction, blood glucose*

Introduction

According to the National Diabetes Surveillance System (NDSS), Nova Scotia (NS) has the second highest rate of diabetes mellitus (DM: type 1 and type 2 combined) in Canada.¹ The crude prevalence of DM among NS adults aged over 19 years increased from 7.3% in 2001/2002 to 8.7% in 2005/2006.² On average, 5000 individuals are referred to the province's 39 Diabetes Centres (DCs) annually. The percentage of newly diagnosed cases presenting at DCs with

prediabetes (PreDM) increased from 11.4% in 2003/2004 to 22.2% in 2007/2008.

The 2003 and 2008 Canadian Diabetes Association Clinical Practice Guidelines support the need for early identification of PreDM and reinforce lifestyle and pharmacotherapy, but little has been stated regarding targets and recommended approaches.^{3,4} Consequently, the standard of care varies. Labelling individuals as having PreDM without offering appropriate care and guidance is also a concern.

The mandate of the Diabetes Care Program of Nova Scotia (DCPNS), "to improve, through leadership and partnerships, the health of Nova Scotians living with, affected by, or at risk of developing diabetes," includes standardizing the approach to DM care and education in NS by ensuring that DCs promote self-care, monitor the development and progression of DM complications, and follow national and provincial guidelines for optimal care. The DCPNS facilitates innovative, multi-site research by acting as a central co-ordination site, providing access to expert consultants in DM and DM surveillance; research design and ethics; and data collection, management, analysis and interpretation. In 2008, DCPNS released Prediabetes Guidelines for Nova Scotia to help standardize the approach to PreDM identification and intervention.⁵ These guidelines stress the importance of community-based programming aimed at preventing or delaying the onset of DM through modest weight reduction, healthful eating, physical activity, stress reduction and management, and the modification of cardiovascular risk factors.

The Public Health Agency of Canada (PHAC) adapted the Canadian Diabetes Risk Assessment Questionnaire (CANRISK) from the Finnish Diabetes Risk Score (FINDRISC) questionnaire⁶ to identify individuals at high risk for developing DM.⁷ The DCPNS partnered with two District Health Authorities (DHAs) in rural NS to help validate the CANRISK for the Canadian population and to foster the development and implementation of two community-based programs promoting lifestyle

Author references:

Diabetes Care Program of Nova Scotia, Halifax, Nova Scotia, Canada

Correspondence: Pam Talbot, Suite 548 Bethune Building, 1276 South Park Street, Halifax, NS B3H 2Y9; Tel.: (902) 473-2622; Fax: (902) 473-3911; Email: ptalbot@diabetescareprogram.ns.ca

changes known to prevent or delay the onset of type 2 DM among those with PreDM.⁸⁻¹¹

Objectives

Our project had two sets of objectives. In partnership with DHAs

1. explore the feasibility of a household mailing approach for population-based screening of adults aged 40 to 74 years living in rural NS with the CANRISK by
 - evaluating the association between CANRISK responses and glycemic status,
 - examining the suitability of CANRISK items, and
 - exploring perceptions of participants and physicians about population-based DM screening using the CANRISK and an oral glucose tolerance test (OGTT);
2. develop standard OGTT protocol for the project; and
3. develop and implement community-based lifestyle programs for individuals identified as having PreDM.

In partnership with PHAC, our objective was to pool NS data with data from other provinces to validate the CANRISK for the Canadian population.

Methods

Key local and provincial stakeholders were engaged early to reflect the realities of each community in the project design. Local advisory committees provided critical local context pertaining to the design and delivery of the PreDM screening and community-based lifestyle programs; a provincial advisory committee provided overall guidance for the project, facilitated joint decision-making between the project sites and helped build capacity to conduct applied research. The DCPNS Advisory Council provided advice regarding the implications of the project.

This project conducted population-level screening for PreDM and undiagnosed DM using a mailed DM risk survey—the CANRISK—followed by an OGTT. Adults

aged 40 to 74 years with no prior diagnosis of DM from Annapolis Valley Health (AVH) and Guysborough Antigonish Strait Health Authority (GASHA) self-administered the CANRISK and completed a 2-hour OGTT at a hospital laboratory or health centre. Feedback about the CANRISK screening process was collected from participants and physicians through self-administered surveys. Participants found to have PreDM were invited to take part in a community-based Prediabetes Lifestyle Program. The study protocol was approved by local DHA ethics committees, and all participants provided informed written consent.

Recruitment

Adults aged 40 to 74 years residing in the towns of Kentville / New Minas (in AVH) and Antigonish County (in GASHA) were targeted for participation. Individuals who already had DM or PreDM were excluded as were pregnant women who receive screening for gestational diabetes (GDM) as part of routine prenatal care.

To raise awareness about the project prior to data collection, the project managers spoke about it at community events, physicians who championed the project discussed it with their colleagues and on the radio, and broadcast and print media ran advertisements about it.

During initial recruitment (AVH: 2008-06-02 to 2008-07-08; GASHA: 2008-05-26 to 2008-08-28), study packages containing a one-page invitation, seven-page letter of information and consent, 16-item CANRISK and a measuring tape were distributed to every household in the town of Kentville (N = 3700) and the county of Antigonish (N = 6500) through the regular postal service as a bulk delivery (N = 10200). Delivery was staggered so that the hospital laboratories or health centres would not be overwhelmed by a high volume of participants scheduling tests.

To increase enrolment, a second recruitment phase occurred in AVH (2008-10-02 to 2008-11-05). A one-page flyer inviting

residents to participate in the project and a one-page information sheet about PreDM were delivered to all households in the towns of Kentville and New Minas (N = 7391). Interested residents called the project manager to have a complete study package mailed to them. In GASHA (2008-09-29), 100 complete study packages were hand-delivered to residents of the Paq'tnekek First Nations Community. In total, 17 691 study packages were distributed (10 300 complete study packages and 7391 invitation flyers) at a cost of \$7,560.

CANRISK (NS version)

Participants self-administered the CANRISK*. They could call the project manager of the Prediabetes Project for help if required. The CANRISK booklet did not include corresponding scores for the eight items derived from the FINDRISC; this scoring system⁶ was applied during data entry.

Instructions on how to prepare for an OGTT were printed in the CANRISK booklet.

Scores ranged from 0 to 26; a higher score represented a higher 10-year risk of developing type 2 DM (Table 1). The eight items added for CANRISK were not scored, but their association with the glycemic results was examined. The 16 CANRISK items included age group (0–4), body mass index (BMI: 0–3), waist circumference (0–4), physical activity (0–2), nutrition (0–1), history of hypertension (0–2) or hyperglycemia (0–5), family history of DM (0–5), mother's ethnicity, father's ethnicity, year of birth, education, perceived health, sex and, for women, history of GDM or large birth-weight babies.

Laboratory procedure

Potential participants gave verbal consent to participate in the study and then were booked for an OGTT. The project manager reviewed the OGTT preparation instructions with participants at this time and again when making a reminder call three days before their scheduled OGTT appointment. Participants were instructed to eat as usual for the three days prior to the OGTT

* The CANRISK questionnaire used for this study is available in Appendix A (online only) from: <http://www.phac-aspc.gc.ca/publicat/cdic-mcbc/32-1/ar-02-eng.php#ar0208>.

TABLE 1
Description of the scoring system^a applied to the CANRISK during data entry

Score	Risk category	Proportion of people who will develop DM within 10 years
0–6	Low	1/100
7–11	Slight	1/25
12–14	Moderate	1/6
15–20	High	1/3
21–26	Very high	1/2

Abbreviations: CANRISK, Canadian Diabetes Risk Assessment Questionnaire; DM, diabetes mellitus; FINDRISC, Finnish Diabetes Risk Score.

^a Adapted from FINDRISC.⁶

and then fast (no food or drink, except for sips of water) for at least 8 hours before the test.

Upon arriving at the participating hospital or health centre, participants signed an informed consent form. They then had a 4 ml venous blood sample drawn for a fasting plasma glucose (FPG) test. A phlebotomist or certified lab technician tested their capillary blood glucose (CBG) by collecting a single drop of blood using a lancet and tested this with a CBG meter. Participants with a CBG less than 7.0 mmol/L completed a 75 g OGTT. Participants remained on-site, sedentary, and neither eating nor smoking for two hours. They then had a 4 ml venous blood sample drawn for their 2-hour plasma glucose (2hPG), after which they were offered fruit juice and a snack.

Participants with a fasting CBG equal or greater than 7.0 mmol/L did not complete the OGTT but were referred to their family physician (FP) for appropriate follow-up care. These participants were not excluded from the study.

All specimens were centrifuged and analyzed as per the test tube manufacturer's guidelines.

Glycemic status

Glycemic status (i.e., normal, PreDM or DM) was determined using the most complete data possible. When available, FPG and 2hPG readings were combined to derive glycemic status; otherwise FPG was used alone (Appendix B).

Participant feedback

The project managers provided participants with their blood test results in writing or verbally as well as appropriate recommendations based on the results. They also mailed them an anonymous self-administered Participant Feedback Form. This addressed participants' awareness of the project, prior knowledge of PreDM, ability to understand the CANRISK and OGTT preparation instructions, concerns about having PreDM or DM before and after participation in the project, and reasons for participating in the study.

Physician feedback

After the data collection, physicians from each project site (Kentville/New Minas: n = 40; Antigonish County: n = 74) were invited to contribute their thoughts about the project by responding anonymously to a three-item Physician Feedback Form. This form asked them how the PreDM screening had impacted their work, whether the CANRISK should be used to screen for PreDM or DM and about their awareness of community-based programs promoting healthy lifestyle choices.

Prediabetes Lifestyle Program

The project managers worked with existing resources and personnel within their communities to develop and deliver a PreDM Lifestyle Program (Appendix C). All participants identified as having PreDM were invited to take part in the Program.

Statistical analyses

Descriptive statistics were computed to describe the participants by site. A Pearson chi-square (χ^2) test was computed to assess the association between CANRISK risk category and glycemic status, and a series of Pearson chi-square tests were computed to assess the association between each CANRISK item and glycemic status. All analyses were conducted using Statistical Package for Social Sciences (SPSS) version 15.0 for Windows (SPSS, Chicago, IL).

Results

Study sample

In total, 417 adults aged 40 to 74 years living in AVH (n = 186; 45%) or GASHA (n = 231; 55%) participated in the NS Prediabetes Project (initial recruitment: n = 335; second recruitment: n = 82). Approximately 70% of participants (n = 289) were women, over 95% (n = 397) reported having only White ancestry, and nearly 40% held a post-secondary diploma (n = 10; 2%) or degree (n = 156; 37%). Of the 411 participants who reported year of birth, the average age was approximately 57 years (men: 58 years; women: 56 years).

Of the 417 participants, 416 completed all (n = 400; 96%) or part (n = 16; 4%) of the CANRISK, all completed an FPG test and CBG reading and 399 (96%) completed an OGTT. Approximately 5% of participants (n = 22) had a CBG equal or greater than 7.0 mmol/L at their initial OGTT appointment and were ineligible to receive the 75 g Trutol drink at that visit; four of these participants completed the protocol on a different day. One participant was unable to retain the Trutol drink at the initial appointment but completed the protocol on a different day.

Case ascertainment

Approximately 84% (n = 350) of participants had normal blood glucose levels, 13% (n = 54) had blood glucose in the PreDM range and 3% (n = 13) had blood glucose in the DM range. Within the PreDM group, the percentage of cases with isolated impaired fasting glucose

(IFG), isolated impaired glucose tolerance (IGT) or IFG/IGT combined was 48%, 41% and 11% respectively.

CANRISK profile

A CANRISK score was calculated for the 400 participants who completed all items on the CANRISK; scores ranged between 0 and 25. There was a significant association between participants' glycemic status and their CANRISK risk category ($p < .01$). Approximately 98% of participants in the low-risk category, compared to 46% in the very high-risk category, had blood glucose in the normal range (Figure 1). Approximately 23% of individuals with blood glucose in the normal range had a high to very high CANRISK score, compared to 64% of those in the PreDM range and 58% of those in the DM range (Figure 2).

There was a significant association between participants' glycemic status and six of the CANRISK items: BMI, waist circumference, history of hypertension, history of hyperglycemia, post-secondary education and perceived health status (Table 2). Although not statistically significant, there were trends in the expected direction for six additional items: daily physical activity, daily fruit and vegetable consumption, family history of DM, history of GDM and history of high birth-weight babies (> 4 kg) among women, and sex (19% versus 15% with blood glucose in PreDM or DM range for males and females, respectively). There was no significant association or trend for age group and ethnicity (Table 2).

Participant feedback

Approximately 62% of participants ($n = 257$) returned a Participant Feedback Form (AVH: 75%; GASHA: 51%). The following results pertain only to those who completed this form. We cannot compare the characteristics of these respondents to those of non-respondents as the Feedback Form was anonymous.

Approximately 42% of Participant Feedback Form respondents ($n = 109$) indicated that they had heard about the project before receiving the study package. The most commonly cited sources of this information were the newspaper (28%), work (24%), friends and family (23%) and the radio (22%); less common sources included notices in doctor's offices (6%) and community boards, grocery store flyers, church bulletins, and community television ads (all $\leq 5\%$).

Nearly all respondents ($n = 252$; 98%) reported being able to complete the CANRISK on their own. All respondents agreed that the OGTT instructions were not difficult to understand, with 85% rating them as very easy to understand.

Approximately 53% of respondents ($n = 136$) indicated that they knew what PreDM was prior to receiving the study package, and approximately 62% ($n = 160$) indicated that they were not worried about having PreDM or DM at any time. Of the 96 respondents who reported that they worried about having PreDM or DM at some point, 73% ($n = 70$) were worried before the study

package arrived and 27% ($n = 26$) were not worried before the study package arrived but started to worry after completing the CANRISK and OGTT.

Nearly all respondents ($n = 252$; 98%) indicated why they took part in the study: 48% ($n = 124$) wanted to be tested, 41% ($n = 106$) wanted to help the study and 41% ($n = 106$) had a family history of DM.

Physician feedback

Approximately 22% of physicians ($n = 25$) returned a Physician Feedback Form (AVH: 33%; GASHA: 16%). Of the 25 responding physicians, 40% ($n = 10$) indicated that the CANRISK screening process had no impact on their work, and 60% ($n = 15$) indicated that there was a minimal to moderate impact. When asked how the CANRISK screening process affected their work, these 15 physicians described two main effects: that it provided an opportunity to speak about positive lifestyle changes with patients ($n = 7$; 47%) and that it identified previously undiagnosed cases of PreDM or DM ($n = 6$; 40%). Other less common examples included more office visits, that patients asked more informed questions about PreDM or DM, that it encouraged patients to take charge of their health behaviours and that there were more phone calls (all $\leq 33\%$).

When asked if the CANRISK should be used to screen for DM in their community, 52% ($n = 13$) replied "yes," 28% ($n = 7$) replied "no" and the remainder were undecided or did not respond.

FIGURE 1
Percentage of participants in each glycemic status category by CANRISK risk category

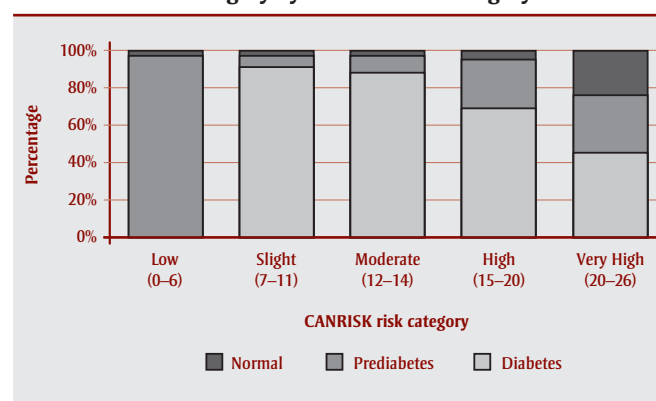


FIGURE 2
Percentage of participants in each CANRISK risk category by glycemic status

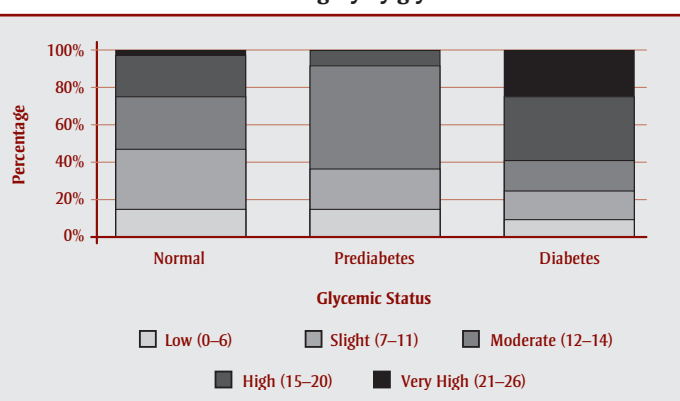


TABLE 2
Percent frequency of response options for CANRISK items by glycemic status

CANRISK response option ^a	Glycemic status,			χ^2
	Normal	PreDM	DM	p-value
BMI (kg/m ²) ≥ 25 (n = 281/415)	64.2	86.8	84.6	< .01
Waist circumference (> 35 in / 88 cm for women; > 40 in / 102 cm for men) (n = 225/410)	50.9	80.8	58.3	< .01
History of hypertension (n = 135/414)	28.7	52.8	53.8	< .01
History of hyperglycemia (n = 39/410)	7.2	17.6	38.5	< .01
Post-secondary degree/diploma ^b (n = 166/415)	42.7	30.2	7.7	.04
Excellent / very good perceived health (n = 227/414)	59.2	34.0	23.1	< .01
Engaged in daily physical activity (n = 248/412)	62.4	49.1	46.2	.10
Ate fruits and vegetables daily (n = 350/414)	85.6	81.1	69.2	.21
≥ 1 first degree relative with DM ^c (n = 229/416)	52.3	69.8	69.2	.08
History of GDM (n = 20/287 females)	6.1	11.8	12.5	.40
History of large birth-weight (> 9 pounds / 4 kg) baby (n = 50/288 females)	16.7	20.6	25.0	.72
Age 45–64 years (n = 292/416)	70.9	62.3	84.7	.45
White ethnicity for mother and father (n = 397/411)	96.5	96.1	100.0	.78
Female (n = 289/416)	70.6	64.2	61.5	.52

Abbreviations: BMI, body mass index; CANRISK, Canadian Diabetes Risk Assessment Questionnaire; DM, diabetes mellitus; GDM, gestational diabetes; PreDM, prediabetes.

Note: This table contains responses to 14 CANRISK items of the 16 in the questionnaire. White ethnicity combines two CANRISK items: mother's and father's ethnicities. Year of birth is a continuous variable and was therefore not analyzed.

^a Number of participants who selected an option as a proportion of the number who completed the item in the CANRISK survey.

^b n = 10 participants added post-secondary diploma as an option; all 10 had normal blood glucose levels.

^c Based on "yes" response to family history of DM: parent, sibling or child having DM, non-response (11%, 8%, 17%, respectively) assumed to be "no."

Most responding physicians (n = 21; 84%) indicated that they were aware of programs in the community that promoted healthy lifestyle choices and indicated that they recommended these programs to their patients with PreDM or DM.

Prediabetes Lifestyle Program

Each project site developed a Prediabetes Lifestyle Program that included five core components addressing lifestyle factors known to prevent or delay⁸⁻¹¹ the development of type 2 DM among at-risk individuals (Appendix C). The 54 individuals identified as having PreDM were invited to take part in a community-based PreDM Lifestyle Program; 19 (35%) did so.

Discussion

Population-level screening process

This project provided an opportunity to conduct population-level screening for PreDM and undiagnosed DM using a

mailed self-administered DM risk survey. A mail-out approach rather than one-on-one recruitment was used as it more closely mirrored the context within which the CANRISK would be used if adopted by the province, especially given the current climate of fiscal restraint and limited health care human resources. The project team was cognisant of the need to contain expenses and not infringe on the workloads of already overburdened FPs. Over 10 000 CANRISK questionnaires were distributed in the pilot communities, and 417 residents were screened in seven months by two part-time (0.5 full-time equivalent) project managers using the existing laboratory infrastructure. The distribution cost was approximately \$0.43 per package, and the overall cost was \$18.13 per screened participant.

Based on 2006 Census estimates, approximately 14 600 residents in the pilot communities were between 40 and 74 years of age.¹²⁻¹⁴ Approximately 3% of this eligible population participated in

the screening pilot. It is possible that the two-hour time commitment coupled with a seven-page letter of information and consent may have overwhelmed potential participants, thus negatively impacting the participation rate.

In survey research, a low response rate typically limits the generalizability of findings. Study participants were more educated than the general population, possibly resulting in lower case ascertainment. Although the distribution of CANRISK scores in the study sample may not be representative of that in the general population, there is no reason to believe that the actual CANRISK responses would correlate differently with blood glucose values for study participants than for the general population.

If adopted as part of a chronic disease prevention strategy, the CANRISK would be only one facet of a multi-faceted approach. It is not reasonable to assume the study response rate would be

replicated if the CANRISK were to be used as part of a province-wide initiative. Ideally, the CANRISK would be widely available through multiple venues (e.g. Internet, newspaper, insert with health-card renewal form, physician offices, etc.) with the hope that people would fill it out and that those who score high would speak to their FP about having their blood glucose tested. To reach more vulnerable and underserved populations, alternative strategies would need to be used.

Case ascertainment

Overall, 84% of participants had blood glucose levels in the normal range, 13% in the PreDM range and 3% in the DM range. These sites in Nova Scotia had a slightly higher percentage of participants with normoglycemia compared to the percentage for the first wave sites combined¹⁵ in New Brunswick, Prince Edward Island and Saskatchewan (79%). The distribution of participants within the PreDM group also differed for NS compared to the first wave sites. In NS, the percentages of IFG and IGT cases within the PreDM group were similar at 48% and 41%, respectively, compared to 29% and 59% for the first wave sites.¹⁵ The percentage of IFG/IGT cases within the PreDM group was similar for NS and the first wave sites at 11% and 12%, respectively.¹⁵ There are several possible explanations for the observed differences.

Despite variable practice across the province, the NS project sites used uniform OGTT protocol, requiring standard preparation for the three days preceding the OGTT. These protocols were printed in the CANRISK booklet and orally communicated to participants at the time of their OGTT booking and during a reminder call three days before their OGTT. During the OGTT, participants were required to remain sedentary and non-smoking on-site for two hours between administering the 75 g Trutol and the 2hPG collection.

The project sites were considered to be well staffed with physicians, and all participants had an FP at enrolment. Both sites have a regional hospital, increasing participants' access to FPs and specialists, compared to

other regions in the province. Also, the DC at each site offers PreDM programming aimed at delaying or preventing the development of DM.

Finally, participants were highly educated with 37% holding a post-secondary degree, compared to 22% of the general NS population.¹⁶ Education is a well-known determinant of health with increasing levels of education equating to better health.

CANRISK

The NS project team did not include the FINDRISC scoring system⁶ on the self-administered CANRISK for several reasons:

- Although slightly different versions of the FINDRISC have been validated for European and Mediterranean populations,¹⁷⁻¹⁹ differences in the ethnic composition, lifestyle, and genetic and environmental exposures in Canada warranted that FINDRISC cut-off points and relative weights be validated for the Canadian population before being put into use.¹⁹⁻²⁴
- Misclassification based on the Finnish scores could have caused participants to worry needlessly.
- Not all CANRISK items had a corresponding score, possibly leading to participant confusion or response bias.
- The interpretation of the 10-year DM risk requires a high degree of literacy or numeracy.

During analysis, a CANRISK score was calculated based on the Finnish scoring system,⁶ and it was significantly associated with glycemic status. Based on this observation, the Finnish scoring system⁶ could be used for the CANRISK until a Canadian scoring system is devised, but some effort should be made to determine how well individuals understand the risk scores.

When examined individually, six CANRISK items were significantly associated with participants' current glycemic status; six additional items showed a trend in the expected direction. For these six, the lack of significance might be the result of low power due to the small sample size rather than a true lack of association.

Modifications to the CANRISK format could improve the completeness and accuracy of data collected. Approximately 11% of participants ($n = 46$) recorded their waist circumference range but not their waist circumference measurement. The waist circumference measurement could be omitted from future versions of the CANRISK as risk is assigned based on the range.

Most participants (98%) reported a waist circumference range; however, the accuracy of this measure may be suspect. A high percentage ($> 80\%$) of those with blood glucose in the PreDM range reported having a waist circumference more than 35 inches (88 cm) for females or more than 40 inches (101 cm) for males; however, for those in the DM range, this percentage was much lower (58%). This unexpected finding may be a result of the small number of participants in the DM group ($n = 13$). However, this pattern was not observed for BMI, an alternative measure of obesity. A similar percentage ($> 84\%$) of participants in the PreDM and DM groups had a BMI over 25 kg/m². The waist circumference item will need to be examined in more detail using the pooled national dataset.

The greatest non-response rate for a CANRISK item was for the one addressing family history of DM. The item requires that participants check "yes," "no" or "don't know" for five different familial relationships: mother, father, siblings, children and other; however, the only response that adds to the risk score is "yes." This item could be simplified by requesting participants to check all the family members that have DM.

Approximately 3.5% of female participants ($n = 10$) did not respond to the items addressing GDM and/or giving birth to a large baby, 8 of these women indicated that the items were not applicable. Forcing women to choose between yes or no for these items implies that all female respondents must have been pregnant or given birth at some time. A third option of "not applicable" would alleviate this problem and make the items more sensitive toward women who have neither been pregnant nor given birth. The "not applicable" option would also apply to

women who have not been screened for GDM, especially those in older age groups who would have been screened at their FP's discretion.

Participant feedback

Although not all participants completed the Participant Feedback Form, the 62% (n = 257) who did indicated that the CANRISK screening process was generally positive. Participants found the CANRISK and OGTT protocol easy to understand, a fact that likely reflects the high educational attainment of participants as well as local enhancements to formatting that improved the CANRISK's appearance and readability.

Approximately half the participants who responded to the Participant Feedback Form indicated that they knew what PreDM was prior to receiving a study package. Recognising that the risk for adverse health outcomes may be higher among those who do not access health care services on a regular basis, NS opted to use a mail-out approach to participant recruitment. In this way, a broad population was reached with educational literature about PreDM and its risk factors. Every household in the two project sites received a study package, regardless of the residents' eligibility to take part in the study.

Physician feedback

In the planning stages of the project, FPs expressed concern about the impact of the study on their workload. These concerns

proved to be unfounded. Approximately 92% of the 25 physicians who responded to the Physician Feedback Form indicated that the CANRISK screening had little to no impact on their workload. When specific impacts were noted, many were positive; for example, the study provided an opportunity to discuss positive lifestyle choices with patients, or the screening identified previously undiagnosed cases of PreDM and DM. Although the responses received were overwhelmingly positive, it should be noted that the response rate for the Physician Feedback Form was fairly low (22%).

Prediabetes Lifestyle Program

It was hoped that a "real world" program that reflected community realities and partners would be developed by mobilizing available community resources, become part of the standard of care within the community, and serve as a template for the development of similar programs across the province. However, the 12-month funding window did not allow sufficient time to build the partnerships necessary to develop and sustain this type of programming.

Although the initial vision of the Prediabetes Lifestyle Program was not fully realized in this project, important ground-work was established. The successful partnership with DHAs resulted in a willingness to continue the work started through this project. With funding from PHAC-Atlantic Region (2009/2010 and 2010/2011) and in partnership with local and provincial stakeholders, AVH

developed and evaluated a comprehensive and sustainable community-based lifestyle program for people with PreDM, other at-risk populations and individuals in the early stages of chronic disease.

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Appendices

APPENDIX B Definitions for glycemic status

TABLE B1
Glycemic status based on fasting plasma glucose
and 2-hour plasma glucose

Classification	FPG, mmol/L		2hPG, mmol/L
Normoglycemia	< 6.1	and	< 7.8
Prediabetes	Isolated IFG	and	< 7.8
	Isolated IGT	and	7.8–11.0
	IFG & IGT	and	7.8–11.0
Diabetes	≥ 7.0	or	≥ 11.1

TABLE B2
Glycemic status based on
fasting plasma glucose test

Classification	FPG, mmol/L
Normoglycemia	< 6.1
Prediabetes	6.1–6.9
Diabetes	≥ 7.0

Abbreviations: FPG, fasting plasma glucose.

Abbreviations: FPG, fasting plasma glucose; 2hPG, 2-hour plasma glucose;
IFG, impaired fasting glucose; IGT, impaired glucose tolerance.

APPENDIX C Nova Scotia Prediabetes Project – Prediabetes Lifestyle Projects

A major objective of the NS Prediabetes Project was to explore, develop and implement a community-based lifestyle program for at-risk individuals, including those with PreDM. The project managers worked with community partners and health care personnel to identify and mobilize available community resources. The Prediabetes Lifestyle Programs developed as part of this project included five core components, which were presented at both screening sites, Annapolis Valley Health (AVH) and Guysborough Antigonish Strait Health Authority (GASHA):

- 1. Prediabetes education:** This component focused on the importance of making healthy lifestyle choices to prevent or delay the onset of DM. It explained the risk factors for developing DM, criteria used to diagnose DM, prevention and treatment of DM and healthful eating.
 - AVH: Presented by a certified diabetes educator (CDE) at Valley Regional Hospital (VRH).
 - GASHA: Presented by a CDE at Health Connections, a community space designated for health-related education and programs.
- 2. Goal setting:** This component focused on factors that help people effect change, challenges to meeting goals and setting specific, measurable, attainable, relevant and time-bound (SMART) goals. Participants could set an achievable and meaningful goal.
 - AVH: Presented by a professional psychologist at VRH.
 - GASHA^a: Presented by a health motivator at Health Connections.
- 3. Nutrition:** This component focused on information about how to read labels and choose healthier foods and discussed topics such as sodium, fats, and fibre.
 - AVH: Presented by a community dietitian at VRH^b.
 - GASHA: Presented by a public health dietitian at Health Connections.
- 4. Physical activity:** This component focused on exercise suitable for those who may have been inactive for some time. Participants learned about the value of walking and were instructed how to use a pedometer.
 - AVH: Presented by a professional kinesiologist / trained exercise instructor at VRH (Cardiac Rehab).
 - GASHA: Presented by the Director of the Antigonish Recreation Department at Health Connections.
- 5. Stress management:** This component focused on stress symptoms, stressors, and stress management.
 - AVH: Presented by a professional psychologist at VRH.
 - GASHA^a: Presented by a health motivator at Health Connections.

^a Goal setting and stress management were delivered as a combined session in GASHA.

^b This session was to be delivered by a dietitian from one of the local grocery stores; however, by the time the session was delivered, the grocery chain had laid off all their staff dietitians in many rural locations.

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