

Screening for gestational diabetes in pregnancy in Northwestern Ontario

Jenna Poirier¹,
Ribal Kattini¹,
Len Kelly, MD, M Clin
Sci, FCFP, FRRM²,
Sharen Madden, MD,
M Epi, FCFP, FRRM⁵,
Brenda Voth, MLT,
BScApp², Joe Dooley,
MB, BCh, BAO⁵,
Brent Marazan,
MPH⁴, Ruben
Hummelen, MD, PhD,
CFPC⁵

¹Sioux Lookout Local
Education Group, Sioux
Lookout, Canada, ²Sioux
Lookout Meno Ya Win
Health Centre, Sioux
Lookout, Canada, ³Northern
Ontario School of Medicine,
Sioux Lookout, ON,
Canada, ⁴Northwest Health
Alliance, Thunder Bay, ON,
Canada

Correspondence to:
Len Kelly,
lkelly@mcmaster.ca

This article has been peer
reviewed.

Abstract

Introduction: We estimate the screening and prevalence of gestational diabetes mellitus (GDM) in a primarily first nations obstetrical population in Northwestern Ontario.

Methods: The study is an 8-year retrospective analysis of all gestational glucose challenge and tolerance tests performed at the Sioux Lookout Meno Ya Win Health Centre (SLMHC) laboratory from 1 January, 2010 to 31 December, 2017. Test, gestational timing and completion rate of screening were recorded, and GDM prevalence was calculated on the tested population. Screening completion rates were recorded for the subset of women who delivered at SLMHC from 2014 to 2017.

Results: The average annual GDM prevalence was 12%, double the Ontario rate. Over the 8-year period, 513 patients were diagnosed with GDM among the 4298 patients screened. Patients were screened with the 2-step (90%) or the 1-step (10%) protocol. Screening occurred <20 weeks in 3%; 54% occurred in <28 weeks and 40% >28 weeks. Seventy percent of the tests were from remote nursing stations. The screening completion rate for women delivering at SLMHC in 2017 was 80.8%.

Conclusion: The prevalence of GDM in Northwestern Ontario is twice the provincial rate. Most screening used the 2-step protocol; early screening was underused. Improvements in screening programming are underway and future research may match surveillance rates and results to GDM outcomes.

Keywords: Gestational diabetes mellitus, screening, pregnancy

Résumé

Introduction: Nous estimons le dépistage et la prévalence du diabète gestationnel au sein d'une population obstétrique composée principalement de femmes des Premières Nations du Nord-Ouest de l'Ontario.

Méthodologie: Il s'agissait d'une analyse rétrospective de 8 ans de toutes les épreuves d'hyperglycémie gestationnelle provoquée et de tous les tests de tolérance au glucose effectués au laboratoire *Sioux Lookout Meno Ya Win Health Centre* (SLMHC) entre le 1er janvier 2010 et le 31 décembre 2017. Le nombre de tests, le moment de la grossesse et le taux d'achèvement des tests de dépistage ont été consignés, et la prévalence du diabète gestationnel a été calculée dans la population testée. Le taux d'achèvement des tests de dépistage du sous-groupe de femmes ayant accouché au SLMHC entre 2014 et 2017 a aussi été consigné.

Received: 27-06-2019 Revised: 20-08-2019 Accepted: 07-01-2020 Published: 28-03-2020

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Poirier J, Kattini R, Kelly L, Madden S, Voth B, Dooley J, et al. Screening for gestational diabetes in pregnancy in Northwestern Ontario. Can J Rural Med 2020;25:61-6.

Access this article online

Quick Response Code:



Website:
www.cjrm.ca

DOI:
10.4103/CJRM.CJRM_51_19

Résultats: La prévalence annuelle moyenne de diabète gestationnel était de 12 %, soit le double de celle de l'Ontario. Durant les 8 ans qu'a duré l'étude, 513 patientes ont reçu un diagnostic de diabète gestationnel parmi les 4298 patientes soumises au dépistage. Le protocole à 2 étapes ou à 1 étape a servi au dépistage chez les patientes, à raison de respectivement 90 et 10 %. Le dépistage a eu lieu à < 20 semaines chez 3 %; à < 28 semaines chez 54 % et à > 28 semaines chez 40 % des patientes. Soixante-dix pour cent des tests ont été effectués dans des postes éloignés de soins infirmiers. Le taux d'achèvement du dépistage chez les femmes ayant accouché au SLMHC en 2017 était de 80,8 %.

Conclusion: La prévalence de diabète gestationnel dans le Nord-Ouest de l'Ontario est le double du taux provincial. La plupart des tests effectués ont eu recours au protocole à 2 étapes; le dépistage précoce était sous-utilisé. L'on tente actuellement d'améliorer les programmes de dépistage, et de plus amples recherches pourraient documenter le taux de surveillance et approfondir notre compréhension des issues liées au diabète gestationnel.

Mots-clés: Diabète gestationnel, dépistage, grossesse

INTRODUCTION

Diabetes in pregnancy includes pre-gestational diabetes mellitus (PGDM) and GDM. Screening for newly diagnosed diabetes in pregnancy (GDM) is clinically challenging. Rural obstetrical programmes serving indigenous populations face unique difficulties. Indigenous obstetrical populations experience higher rates of diabetes and associated complications.¹⁻⁸ Rural obstetrical programmes serving this population need to pay diligent attention to diabetes screening in pregnancy.

We reviewed GDM criteria from 2006 to 2018, as published by the Society of Obstetricians and Gynecologists of Canada; Diabetes Canada (formerly Canadian Diabetes Association) and the International Association of Diabetes and Pregnancy Study Groups (IADPSG)⁹⁻¹² [Table 1]. Screening for diabetes in pregnancy has evolved. There are currently two approaches to GDM screening. Diabetes Canada identifies the "preferred" 2-step approach as a non-fasting 1-h 50-g glucose challenge test (GCT), followed if needed by a fasting 2-h 75-g oral glucose tolerance test (OGTT).^{7,11} With this common strategy, the 50-g GCT can be diagnostic if results

are very elevated, ≥ 11.1 (was ≥ 10.3 until 2013). Indeterminant 50 g results (7.8–11.0 mmol/L) require a diagnostic 75 g OGTT.

In 2013, a 1-step "alternate" strategy was added, consisting of going directly to a fasting 75 g OGTT. This diagnostic standard was developed by the IADPSG Consensus Panel in 2010 and identifies additional patients who are at diabetes-related risk during pregnancy.¹⁰ We note that a 2014 Cochrane review did not find evidence to support either universal screening or a specific diagnostic/screening protocol.¹³

The same 75-g OGTT is performed in each protocol, but they have slightly different reference ranges if performed as part of a 1-step or 2-step approach, further complicating diagnosis [Table 1]. It is common practice for laboratories to use the 2-step reference range for both (personal communication, LK).

The timing and population indicated for testing was discretionary before 2013, but subsequently includes universal screening at 24–28 weeks and first-trimester screening of high-risk patients, a category which includes indigenous patients. Early screening allows the identification of overt diabetes, which carries increased risk for congenital anomalies and stillbirths [Table 1].^{8,10}

Table 1: Diagnostic and testing criteria for gestational diabetes mellitus

	2-step (50/75)			1-step (75)	Screening	
	50-g GCT	50 g→75 GCT/OGTT	75 g OGTT	75 g OGTT	Population, timing	Protocol
2006-2012	≥ 10.3	7.8-10.2	$\geq 5.3/10.6/8.9$	N/A	High risk, 24-28 weeks	2-step
2013-2018	≥ 11.1	7.8-11.0	$\geq 5.3/10.6/9.0$	$\geq 5.1/10.0/8.5$	Low risk: 24-28 weeks; High risk 1 st trimester	1-step or 2-step

GCT: Gestational diabetes screen, OGTT: Oral glucose tolerance test, 75 g OGTT values: $\geq$ fasting/1 h/2 h, N/A: Not applicable

This study estimates the prevalence of GDM and the screening completion rate, gestational timing and screening protocol use in Northwestern (NW) Ontario.

METHODS

Setting

Regional GDM screening data (1 January, 2010–31 December, 2017) were collected from the Sioux Lookout Meno Ya Win Health Centre (SLMHC). The SLMHC laboratory processes all regional in-patient and out-patient testing for 26 remote First Nations nursing stations and the town of Sioux Lookout. The catchment population is 29,015, with 85% of residents living in remote communities.¹⁴ The regional birth rate is double the provincial rate (19.5 vs. 10.2/100,000); 70% of regional patients deliver at SLMHC.⁴ The screening and GDM prevalence estimates are regional, including the prenatal testing of the 30% of northern women who delivered at other facilities (Thunder Bay, Winnipeg).

Gestational diabetes mellitus testing

Laboratory records were accessed for all GDM testing performed at SLMHC, including those from remote nursing stations. All 50-g GCTs and 75-g OGTTs were manually reviewed independently by

two researchers (LK, JP). The timing of screening was calculated retrospectively for the 3-year period (2014–2017) based on the date of delivery of the infant, assuming this to be on an average 39 weeks.¹¹ A sample year (2017) was chosen to estimate the proportion of screening tests performed in a nursing station. The same year was used to document the screening rate for the subset of women who delivered at SLMHC. Follow-up testing was assessed for 2014–2018 from a limited laboratory data set accessed electronically for that purpose. The delivery date was used for estimating the gestational timing of testing. Ethics approval was granted by the SLMHC Research Review and Ethics Committee.

RESULTS

Prevalence

Over the 8-year period, 4298 patients were screened for GDM through the SLMHC laboratory: 3883 (90%) with a 2-step approach and 415 (10%) with a 1-step [Figure 1]. A majority of the tests performed in 2017 (70%, 325/467) were for patients receiving screening and prenatal care in remote nursing stations.

GDM was diagnosed in 513 patients. Sixty-eight percent of GDM cases were diagnosed with the 2-step approach; 32% with a 1-step [Figure 1].

The annual prevalence ranged from 8% to 17%, with a mean of 12% [Figure 2]. The screening rate for the 421 women who delivered at SLMHC in 2017 was 80.8% (344/421).

50-g glucose challenge test

Most 50-g GCTs were negative (91%). When the diagnostic threshold was increased from ≥ 10.3

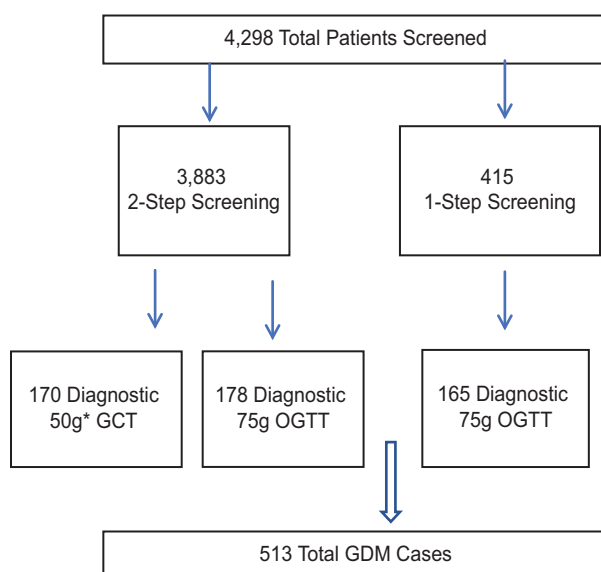


Figure 1: Gestational diabetes mellitus testing and outcomes Sioux Lookout Meno Ya Win Health Centre catchment area 2010–2017. *2010–2013 ≥ 10.3 ; 2013–2018 ≥ 11.1 .

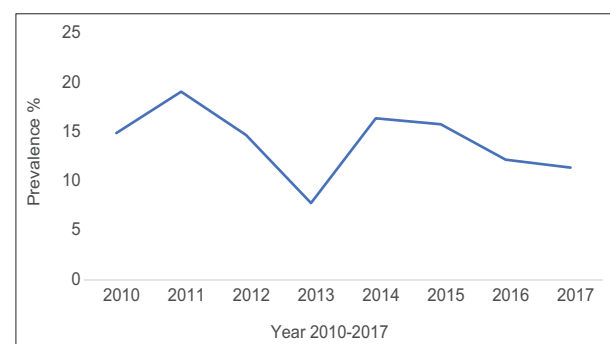


Figure 2: Annual gestational diabetes mellitus prevalence in Sioux Lookout Meno Ya Win Health Centre catchment area 2010–2017.

to ≥ 11.1 in 2013, the diagnostic contribution of the 50-g GCT decreased from 95 (2010–2013) to 75 cases (2014–2017). Of the 756 patients with an indeterminant 50 GCT in the 2-step protocol, 539 patients had the required g OGTT follow-up test (71%).

75-g glucose tolerance test

The SLMHC laboratory follows the common practice of using the reference range for the 2-step protocol for all 75-g OGTTs [Table 1]. The 1-step protocol has a lower diagnostic threshold, increasing the number of diagnoses. We, therefore, retrospectively estimated GDM prevalence using the appropriate 1- or 2-step diagnostic range for each 75-g OGTT. Using the 1-step reference range for a 75-g test done in that protocol, GDM diagnoses increased by 17% (243–284), versus using the 2-step diagnostic thresholds for all 75-g OGTTs. The 1-step 75-g OGTT had a high case yield, with 40% (165/415) being diagnostic.

Timing of screening

Until 2013, testing was recommended at 24–28 weeks; following that, high-risk patients were recommended to have earlier screening. In the 4 years following that recommendation, only 3% (58/1951) had screening < 20 weeks; 20 of these 58 early tests were 1-step 75-g OGTTs. Testing occurred before 28 weeks in 54% of the tested population, and at > 28 weeks in 40% [Table 2].

Post-partum screening

Follow-up testing up to 9 months post-partum to detect residual or transition to type 2 diabetes mellitus (T2DM) occurred in 18% of the 2014–2018 GDM cases (32/183), 56% of whom were screened with an A1C.

DISCUSSION

The GDM prevalence in this region of NW Ontario is a mean of 12%, double the 6% provincial rate.¹⁵ This is not surprising given this is a primarily First Nations population, with known high rates of diabetes.^{16–18} While this is higher than the general population, it is equivalent to the 11.7% found in James Bay Cree communities in northern Quebec, but higher than in Alberta and Manitoba First Nations studies (6%–7%).^{3,5,6,19}

The prevalence of GDM screening for the 421 women who delivered at SLMHC in 2017 was 80.8%. This compares favourably with provincial and international rates of 68%–94%.^{20–23}

Over the 8-year period, 90% of GDM screening used the 2-step approach. The 50-g GCT was negative in 91% of patients, supporting its effectiveness as an initial screen and obviating the need for further testing. A surprisingly large number of GDM cases (170) with very high glycaemic levels were diagnosed at the initial 50-g GCT, which is generally considered a screening, rather than diagnostic test.²⁰ The limited follow-up (71%) of indeterminant 50-g GCT with a 75-g OGTT is concerning. There are limited comparative data. A province-wide 2016 Alberta study found a 95% follow-up rate, while an earlier study conducted in Hamilton, Ontario, documented rates of 36%.^{20,24}

The 1-step protocol was applied in 10% of screening. The 40% case yield associated with 1-step testing is not surprising, as it was used to diagnose clinically ‘expected’ GDM. It is also in keeping with the known literature where the ‘stricter’ standard of the IADSGP 1-step criteria produces higher GDM estimates.²⁵

Since 2013 early screening of high-risk patients has been recommended.¹¹ Most of the regional pregnancies in this study would be identified as

Table 2: Gestational timing of diabetes screening in pregnancy 2014–2017

	2014, n (%)	2015, n (%)	2106, n (%)	2017, n (%)	Total 2014–2017, n (%)*
< 20 weeks	13 (3)	18 (4)	17 (4)	10 (2)	58 (3)
20–23 weeks	43 (9)	22 (5)	18 (4)	29 (6)	112 (6)
24–28 weeks	241 (48)	226 (46)	219 (45)	199 (43)	885 (45)
> 28 weeks	183 (36)	193 (39)	207 (42)	187 (40)	770 (40)
Data unavailable	25 (5)	32 (7)	31 (6)	38 (8)	126 (7)
Total	505	491	492	463	1951 (100)

*Missing data: n (%)=126 (7)

'high risk' (indigenous heritage). Early screening is generally defined as <20 weeks, the standard used in this study.¹² The uptake of early screening has been poor in this programme at 3%.

Even by low-risk testing protocol (24–28 weeks) standards, only 54% of screening occurred before 28 weeks. There are many practical considerations involved in the regional delivery of prenatal care, including the initiation of GDM surveillance. Most prenatal bloodwork (70%) is initiated at remote nursing stations, where protocols recommended the pre-2013 screening at 24–28 weeks. A review of protocols is underway and earlier screening (1 or 2-step), will be integrated into early prenatal care. These changes should improve rates of early screening as the majority of patients would be considered at high risk of developing GDM. A 50-g GCT, with its high negative predictive value, has a role, even in this high-risk population. The balance between 1-step or 2-step approaches will evolve. The 2-step approach can be effective in ruling out GDM; the 1-step in ruling it in and identifying GDM at lower levels of hyperglycaemia. Capacity and practicality will affect the development of screening practices in this complex social and geographic environment.

Follow-up screening is recommended for GDM patients at 6–36 weeks post-partum.¹² Our rate of 18% at 9 months is suboptimal. Compliance may improve with the increasing use of the less sensitive, but more practical A1C, rather than the recommended OGTT.¹²

The optimal GDM screening strategy for a population considered high risk, living in remote communities, remains unspecified but should include early screening, with repeat testing later in the pregnancy, as needed. Future prospective regional research might clarify the association of diabetes screening and treatment on maternal and neonatal outcomes in this population.

Gestational diabetes is commonly identified as an important contributor to overall population-based T2DM; it is believed to affect the subsequent development of diabetes in both mother and child.^{26,27} Given the significant diabetes-associated burden of morbidity and mortality in First Nations populations, attention to its occurrence in pregnancy warrants vigilance.

Limitation

This study relied on laboratory results of SLMHC-tested patients. The prevalence of denominator is limited to this population, excluding untested patients. We used the date of delivery for establishing the time of screening, as the estimated date of birth data was not consistently available.

CONCLUSION

There is a high prevalence of gestational diabetes in the First Nations population of NW Ontario. Most screening in this study used the 'preferred' Canadian 2-step approach; early diabetes screening in pregnancy is underused. Future research might clarify optimal testing, treatment and outcomes in this population.

Financial support and sponsorship: Nil.

Conflicts of interest: There are no conflicts of interest.

REFERENCES

1. Diabetes Canada Clinical Practice Guidelines Expert Committee, Ekoe JM, Goldenberg R, Katz P. Screening for diabetes in adults. *Can J Diabetes* 2018;42 Suppl 1:S16-S19.
2. Crowshoe L, Dannenbaum D, Green M, Henderson R, Naqshbandi Hayward M, Toth E. Diabetes Canada Clinical Practice Guidelines Expert Committee. Diabetes Canada 2018 clinical practice guidelines for the prevention and management of diabetes in Canada type 2 diabetes and indigenous peoples. *Can J Diabetes*. 2018;42(Suppl 1):S1-S325.
3. Cree Board of Health and Social Services of James Bay. Summary Health Profile March 11, 2016. Background Summary Statistical Profile of Health and Health Determinants in Eeyou Istchee for the Health Assembly. Available from: <https://www.creehealth.org/sites/default/files/A%20Health%20Profile%20for%20Health%20Assembly.pdf>. [Last accessed on 2019 Feb 5].
4. Sioux Lookout First Nations Health Authority. Our Children and Youth Health Report. Sioux Lookout, Ontario. 2018. Available from: https://slfnha.com/application/files/6215/4022/0883/CHSR_FINAL_-_Web_Version.pdf. [Last accessed on 2019 May 30].
5. Oster RT, King M, Morrish DW, Mayan MJ, Toth EL. Diabetes in pregnancy among first nations women in Alberta, Canada: A retrospective analysis. *BMC Pregnancy Childbirth* 2014;14:136.
6. Aljohani N, Rempel BM, Ludwig S, Morris M, McQuillen K, Cheang M, *et al*. Gestational diabetes in manitoba during a twenty-year period. *Clin Invest Med* 2008;31:E131-7.
7. Chen L, Wang WJ, Auger N, Xiao L, Torrie J, McHugh NG, *et al*. Diabetes in pregnancy in associations with perinatal and postneonatal mortality in first nations and non-indigenous populations in Quebec, Canada: Population-based linked birth cohort study. *BMJ Open* 2019;9:e025084.
8. Sweeting AN, Ross GP, Hyett J, Molyneaux L, Constantino M, Harding AJ, *et al*. Gestational diabetes mellitus in early pregnancy: Evidence for poor pregnancy outcomes despite treatment. *Diabetes Care* 2016;39:75-81.

9. Diabetes Canada Clinical Practice Guidelines Expert Committee, Punthakee Z, Goldenberg R, Katz P. Definition, classification and diagnosis of diabetes, prediabetes and metabolic syndrome. *Can J Diabetes* 2018;42 Suppl 1:S10-S15.
10. International Association of Diabetes and Pregnancy Study Groups Consensus Panel, Metzger BE, Gabbe SG, Persson B, Buchanan TA, Catalano PA, *et al.* International association of diabetes and pregnancy study groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy. *Diabetes Care* 2010;33:676-82.
11. Berger H, Gagnon R, Sermer M, Basso M, Bos H, Brown RN, *et al.* Diabetes in pregnancy. *J Obstet Gynaecol Can* 2016;38:667-790.
12. Diabetes Canada Clinical Practice Guidelines Expert Committee, Feig DS, Berger H, Donovan L, Godbout A, Kader T, *et al.* Diabetes and pregnancy. *Can J Diabetes* 2018;42 Suppl 1:S255-S282.
13. Tieu J, McPhee AJ, Crowther CA, Middleton P. Screening and subsequent management for gestational diabetes for improving maternal and infant health. *Cochrane Database Syst Rev* 2010;7(7): CD007222.
14. Walker R, Cromarty H, Kelly L, St Pierre-Hansen N. Achieving cultural safety in aboriginal health services: Implementation of a cross-cultural safety model in a hospital setting. *Divers Health Care* 2009;6:11-22.
15. Dooley J, Jumah N, Hummelen R, Gerber Finn L, Bollinger M, Sprague C, *et al.* C-Section and VBAC rates in a community-based First Nations obstetrical practice. *JOGC* 2019;[In Press].
16. Saad N, Wilson D, Donovan LE. Solving the mystery: The true prevalence of gestational diabetes in indigenous women. *Diabetes Metab Res Rev* 2015;31:476-8.
17. Liu SL, Shah BR, Naqshbandi M, Tran V, Harris SB. Increased rates of adverse outcomes for gestational diabetes and pre-pregnancy diabetes in on-reserve first nations women in Ontario, Canada. *Diabet Med* 2012;29:e180-3.
18. Harris SB, Caulfield LE, Sugamori ME, Whalen EA, Henning B. The epidemiology of diabetes in pregnant native Canadians. A risk profile. *Diabetes Care* 1997;20:1422-5.
19. Armstrong IE, Robinson EJ, Gray-Donald K. Prevalence of low and high birth weight among the James Bay Cree of Northern Quebec. *Can J Public Health* 1998;89:419-20.
20. Donovan LE, Savu A, Edwards AL, Johnson JA, Kaul P. Prevalence and timing of screening and diagnostic testing for gestational diabetes mellitus: A Population-based study in Alberta, Canada. *Diabetes Care* 2016;39:55-60.
21. Sella T, Shalev V, Elchalal U, Chovel-Sella A, Chodick G. Screening for gestational diabetes in the 21st century: A population-based cohort study in Israel. *J Matern Fetal Neonatal Med* 2013;26:412-6.
22. Blatt AJ, Nakamoto JM, Kaufman HW. Gaps in diabetes screening during pregnancy and postpartum. *Obstet Gynecol* 2011;117:61-8.
23. Nicotra F, Molinari C, Dozio N, Castiglioni MT, Ibrahim B, Zambon A, *et al.* Screening for gestational diabetes in the lombardy region: A population-based study. *Diabetes Metab* 2015;41:319-25.
24. Sievenpiper JL, McDonald SD, Grey V, Don-Wauchope AC. Missed follow-up opportunities using a two-step screening approach for gestational diabetes. *Diabetes Res Clin Pract* 2012;96:e43-6.
25. Caissutti C, Khalifeh A, Saccone G, Berghella V. Are women positive for the one step but negative for the two step screening tests for gestational diabetes at higher risk for adverse outcomes? *Acta Obstet Gynecol Scand* 2018;97:122-34.
26. Mendelson M, Cloutier J, Spence L, Sellers E, Taback S, Dean H, *et al.* Obesity and type 2 diabetes mellitus in a birth cohort of first nation children born to mothers with pediatric-onset type 2 diabetes. *Pediatr Diabetes* 2011;12:219-28.
27. Dyck R, Klomp H, Tan LK, Turnell RW, Boctor MA. A comparison of rates, risk factors, and outcomes of gestational diabetes between aboriginal and non-aboriginal women in the Saskatoon health district. *Diabetes Care* 2002;25:487-93.

SRPC AND THE ROUNDS

The Society of Rural Physicians of Canada is excited renew its partnership with Boondoc Technologies to deliver a customized clinical Community on The Rounds. The Rounds is a professional clinical network - developed in Halifax, Nova Scotia. Each month, over 5,000 Canadian physicians login to The Rounds to access new information, clinical content, and take part in expert-led clinical discussions.

The Rounds platform supports physicians and their associations by improving connectivity, association collaboration and providing a secure portal for information sharing.

Login to the SRPC Community by visiting this link: www.therounds.com/SRPC/home