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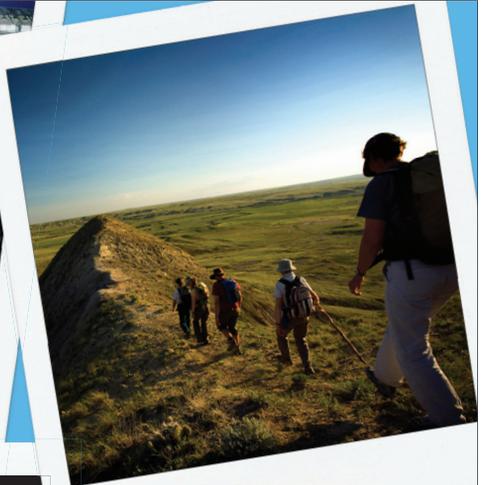
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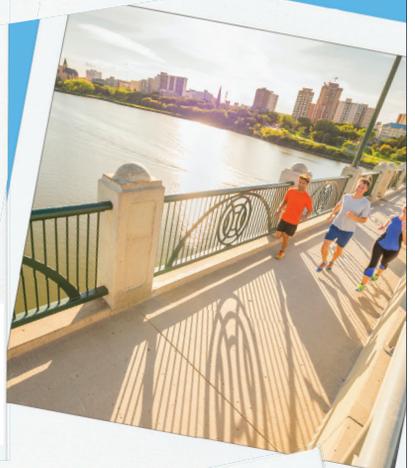
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25 Years of RuralMed

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“We rarely get to hear that so many other rural physicians experience similar concerns. We can’t meet in the hallways of the big virtual rural hospital to find solutions because the corridors are dozens or hundreds of kilometers in length.” Dr Jim Thompson RuralMed Oct 16, 1995.

Back when E-mail was hyphenated, Dr. John Wootton took a break from a Rural and Remote Medicine Course of the Society of Rural Physicians of Canada: “I hiked up to the McGill Computer store. and noticed on a cork-board an advertisement about an Engineering faculty listserv”. This was a new concept to John and as he read its description of a method to join disparate individuals together, it seemed to him something that rural doctors could use.

“I phoned the McGill Computer department who was in charge of hosting the listservs and set one up”, continues Dr Wootton. “I walked back to the hotel and announced the listserv at the Annual General Meeting, and that was it”.

The RuralMed listserv had its first message on Mother’s Day on 11 May, 1995, at 8:29 PM.

While there have been competitors (CaRMeN from the College of Family Physicians of Canada [CFPC], RURALNET-L from Marshall University, RURAL-CARE and RURAL-DOCTORS)¹ only RuralMed survives to this day.

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From the first issue of this Journal,² RuralMed topics from then seem both old and new today:

“One of the many topics under debate since the fall of 1995 has been the provision of rural anaesthesia. Several articles in the Canadian Medical Association Journal in November 1995 and subsequent letters sparked a lively discussion on RuralMed.

There was disagreement on whether western Canada needs to train GP anaesthetists. Some sources suggest there are not enough positions even for specialist anaesthetists.”

Since then family practice anaesthesia is now supported by a national curriculum written by rural doctors in conjunction with programmes and fellowship anaesthetists. It is recognised by a certificate of added competence by the CFPC. However, rural challenges, even in anaesthesia, remain.

Paul Mackey wrote in RuralMed December 7, 2019, “There are currently 15 vacancies in B.C. alone and I get locum requests from Port Alberni to St Antony, all from communities that are running short-staffed. I know I’m preaching to the choir when talking about the key role this service plays in rural communities”.

RuralMed and its raison d’etre, to connect rural doctors, remains.

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2. The Society. Can J Rural Med 1996; 1:178.

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RuralMed a 25 ans

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“ On entend rarement parler des préoccupations semblables vécues par tant d'autres médecins en milieu rural. Il est impossible de se rencontrer dans les corridors du grand hôpital rural virtuel pour trouver des solutions parce que les corridors font des dizaines ou des centaines de kilomètres”. Dr Jim Thompson *RuralMed*, 16 oct. 1995

À l'époque où le courrier électronique était séparé par un trait d'union, le Dr John Wootton est sorti de sa classe de Médecine rurale et éloignée de la SRMC: 'Je suis allé à la boutique informatique de McGill... et j'ai vu sur le babillard une annonce au sujet d'une liste de diffusion de la faculté d'ingénierie'. C'était là un nouveau concept pour John alors qu'il lisait la description d'une méthode pour réunir un groupe hétérogène de personnes, il a pensé que ce serait utile aux médecins en milieu rural.

'J'ai téléphoné au département d'informatique de McGill où se trouvait l'ordinateur hôte des listes de diffusion et j'en ai créé une, poursuit le Dr Wootton. Je suis retourné à l'hôtel et j'ai annoncé la création de la liste de diffusion à la réunion générale annuelle. Et voilà'.

La liste de diffusion RuralMed a reçu son premier message le jour de la fête des Mères, le 11 mai 1995 à 20 h 29.

Bien qu'elle ait fait face à la concurrence (CaRMEN pour le CMFC, RURALNET-L pour l'Université Marshall, RURAL-CARE et RURAL-DOCTORS)¹, seule RuralMed est toujours en activité aujourd'hui.

Dès le premier numéro de cette revue², les sujets de RuralMed d'alors nous semblent aujourd'hui anciens et nouveaux à la fois:

"L'un des nombreux sujets débattus depuis l'automne 1995 est la prestation de l'anesthésie en milieu rural. Plusieurs articles publiés dans le numéro de novembre 1995 du Journal de l'Association médicale canadienne et des lettres subséquentes ont déclenché une discussion animée sur RuralMed.

On ne s'entendait pas pour dire si l'Ouest du Canada devait former des anesthésistes généralistes. Certaines sources laissent croire que le nombre de postes ne suffit pas à employer tous les anesthésistes spécialistes."

Depuis, l'anesthésie en pratique familiale est appuyée par un cursus national rédigé par les médecins en milieu rural en conjonction avec les programmes d'anesthésie et les bourses en anesthésie. Elle est reconnue par un certificat de compétences acquises du CMFC. Les défis propres au milieu rural demeurent cependant, même en anesthésie.

Paul Mackey a écrit sur RuralMed le 7 déc. 2019: 'Il y a 15 postes vacants en C.-B. seulement et je reçois des demandes de suppléance de Port Alberni à St. Anthony, de communautés qui manquent toutes de personnel. Je sais que je prêche aux convertis lorsque je parle du rôle clé joué par ce service dans les communautés rurales'.

RuralMed et sa raison d'être, soit relier les médecins en milieu rural, demeurent.

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President's Message. Rural residents need specialist services too

Eighteen per cent of Canadians live in rural Canada, yet only 8% of physicians practise in rural communities. The disparity is even greater for specialists – only 3% practise in rural communities.¹

Dr. Wieslaw Rawluk was one of the 3%, an obstetrician who had a 30-year career in Goose Bay, Labrador. I was privileged to work with Dr. Rawluk as a colleague, sometimes giving anaesthetics for his surgeries and sometimes requiring his assistance for difficult deliveries. His skills were needed for the delivery of my two children. If he had not been there, I would have had to fly out, but instead, I was surrounded by doctors and nurses who were colleagues and friends. Dr. Rawluk died in December. He had retired a few years earlier, but still lived in Goose Bay, which had become his home. He will be missed.

The Royal College has convened a working group to look at the issue of specialist services for rural Canadians and hopes to make recommendations over its 2-year mandate. There are a number of ways that specialist services can be supplied to rural Canadians. First, many family physicians have

acquired advanced skills in areas such as anaesthesia, surgery and many others. These family physicians often struggle to find a supportive peer group and to find ways to maintain their skill sets. Yet, their skills are vital to their communities.

Second, as virtual care advances, some specialist services can be provided by telemedicine. Most provinces now have fairly advanced systems. At this point, consultation services are more compatible with telemedicine than the procedural services. Ironically, technology in many cases is no longer the issue. It is organisational, scheduling and funding issues that bedevil the success of telemedicine.

Third, many specialists have long-term commitments to rural communities and make regular visits. They develop relationships with both the local family physicians and the patients. Their role often involves mentoring family physicians.

Finally, most rural residents currently obtain specialist services by travelling to larger centres. These trips may involve air travel or lengthy drives. For residents who have chronic illnesses, the continuity of care they receive from their yearly visits is

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very important to them. The Access to Specialist Services working group will be examining various models for specialist care delivery and making recommendations to decrease the urban–rural disparities.

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Message du Président. Les résidents en milieu rural ont aussi besoin des services des spécialistes

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Ce sont 20 % des Canadiens qui vivent en milieu rural au Canada, mais à peine 7 % des médecins y pratiquent. L'écart est encore plus grand dans le cas des spécialistes: seuls 3 % pratiquent dans les communautés rurales.

Le Dr Wieslaw Rawluk, un obstétricien ayant fait carrière pendant 30 ans à Goose Bay, au Labrador faisait partie de ce 3 %. J'ai eu le privilège de travailler aux côtés du Dr Rawluk, parfois pour administrer des anesthésiques durant ses chirurgies, et parfois pour obtenir son aide durant des accouchements difficiles. On a fait appel à ses compétences pour donner naissance à mes deux enfants. S'il n'avait pas été là, il aurait fallu me transférer par avion, mais j'étais plutôt entourée de médecins et d'infirmières qui étaient mes collègues et mes amis. Le Dr Rawluk est décédé en décembre. Il avait pris sa retraite quelques années plus tôt, mais vivait toujours à Goose Bay, où il se sentait chez lui. Il va nous manquer.

Le Collège royal a formé un groupe de travail devant se pencher sur le problème des services spécialisés à l'intention des Canadiens vivant en milieu rural et espère émettre des recommandations à la fin de son mandat de 2 ans. La prestation des services spécialisés aux Canadiens

vivant en milieu rural prend plusieurs formes. D'abord, beaucoup de médecins de famille ont acquis des compétences avancées dans des domaines tels que l'anesthésie, la chirurgie et beaucoup d'autres. Ces médecins de famille ont souvent de la difficulté à trouver un groupe de soutien par les pairs, et des façons de maintenir leurs compétences. Et leurs compétences sont vitales à leur communauté.

Ensuite, avec les progrès des soins virtuels, certains services spécialisés peuvent être assurés par télémédecine. Les provinces se sont dotées de systèmes assez avancés. Pour le moment, les services de consultation sont plus compatibles avec la télémédecine que les services interventionnels. Ironiquement, la technologie n'est plus le problème dans bien des cas. Ce sont des problèmes liés à l'organisation, aux horaires et au financement qui compromettent le succès de la télémédecine.

Troisièmement, beaucoup de spécialistes se sont engagés à long terme envers les communautés rurales et les visitent régulièrement. Ils nouent des relations avec les médecins de famille et les patients de la localité. Ils prennent souvent un rôle de mentor pour les médecins de famille.

Finalement, la plupart des personnes qui vivent en milieu rural

obtiennent des services spécialisés en se rendant dans les grandes agglomérations. Ces voyages se font par avion, ou plus longuement par la route. Les personnes atteintes d'une maladie chronique donnent beaucoup d'importance à la continuité des soins qu'elles reçoivent à leurs visites annuelles.

Le groupe de travail Accès aux services spécialisés se penchera sur divers modèles de

prestation des soins spécialisés, et feront des recommandations pour réduire l'écart entre les soins urbains et ruraux.

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- Off Call articles: a grab-bag of material of general interest to rural doctors (e.g., travel, musings on rural living, essays) (1500 words or less).
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Screening for gestational diabetes in pregnancy in Northwestern Ontario

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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.

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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

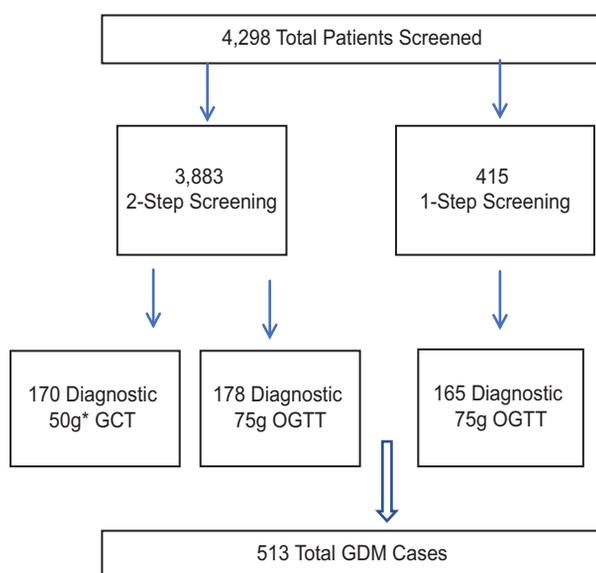


Figure 1: Gestational diabetes mellitus testing and outcomes Sioux Lookout Meno Ya Win Health Centre catchment area 2010–2017. *2010–2013 ≥ 10.3 ; 2013–2018 ≥ 11.1 .

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

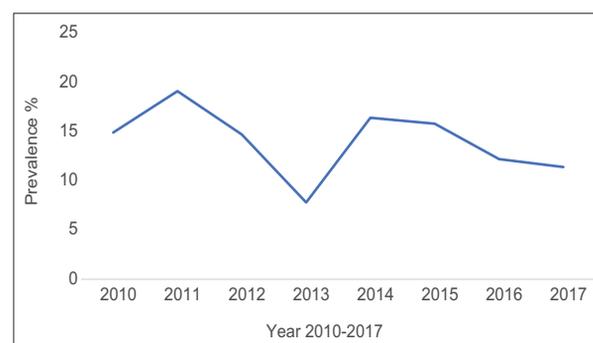


Figure 2: Annual gestational diabetes mellitus prevalence in Sioux Lookout Meno Ya Win Health Centre catchment area 2010–2017.

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 indeterminate 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 indeterminate 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.

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Conflicts of interest: There are no conflicts of interest.

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Recruitment and retention of healthcare professionals in rural Canada: A systematic review

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Abstract

Introduction: This review explores a pertinent issue for healthcare professionals and recruiters alike: which factors are most important in the recruitment and retention of these professionals in rural practice in Canada. Existing research concentrates on specific factors or focused populations. This review was created to explore multiple factors and a wider population of healthcare professionals, including chiropractors, osteopaths, dentists and physiotherapists.

Methods: A literature search was carried out on four databases. Data from included studies were extracted, and thematic analysis was conducted on relevant findings. The quality of individual studies was assessed, and then themes were evaluated for overall confidence based on four components, using the Confidence in the Evidence for Reviews of Qualitative Research.

Results: One quantitative and four qualitative articles were identified, all of which targeted physicians. Five themes – Personal/family matters, Community factors, Professional practice factors, Professional education factors and Economic factors – were generated in two domains, recruitment and retention. Forty major codes were generated through axial coding of open codes. Codes included attraction to rural lifestyle, recreational activities, Scope of practice, rural training and incentives. Scope of practice was deemed very important as a factor of recruitment, as was attraction to rural lifestyle. Incentives were found to be of little importance in influencing the recruitment of healthcare professionals, and even less important for retention.

Conclusion: Wide scope of practice and attraction to the rural lifestyle were considered the most important for recruitment and to a lesser extent, retention, among the five papers studied. A lack of research was determined in the realm of factors influencing the recruitment and retention in healthcare professionals other than medical doctors in Canada. Therefore, it is recommended that further such studies investigate specific healthcare professionals.

Keywords: Canada, primary care, recruitment, retention, rural health services

Résumé

Introduction: Cette revue de synthèse se penche sur un enjeu pertinent pour les professionnels de la santé et les recruteurs; quels sont les facteurs les plus importants du recrutement et de la rétention de ces professionnels en pratique rurale au

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Canada? La recherche actuelle se concentre sur des populations ou des facteurs précis. La présente revue de synthèse étudie de multiples facteurs ainsi qu'une vaste population de professionnels de la santé, y compris chiropraticiens, ostéopathes, dentistes et physiothérapeutes.

Méthodologie: Une recherche a été effectuée dans 4 banques de données de publications scientifiques. On a extrait les données des études incluses, et on a effectué une analyse thématique des constatations pertinentes. La qualité de chaque étude a été évaluée, puis les thèmes, à l'aide de la méthode CERQual (*Confidence in the Evidence for Reviews of Qualitative Research*) pour leur confiance générale en fonction de 4 éléments.

Résultats: Un article quantitatif et quatre articles qualitatifs ont été relevés, et ils ciblaient tous les médecins. Cinq thèmes, soit affaires personnelles ou familiales, facteurs communautaires, facteurs liés à la pratique professionnelle, facteurs liés à l'éducation professionnelle et facteurs économiques, ont été générés dans les domaines du recrutement et de la rétention. Quarante codes majeurs ont été générés par codage axial des codes ouverts. Ces codes étaient attirance pour le mode de vie rural, activités récréatives, champ de pratique, formation rurale et incitatifs. Le champ de pratique a été jugé être un facteur très important du recrutement, tout comme l'attirance pour le mode de vie rural. Les incitatifs se sont révélés avoir peu d'influence sur le recrutement des professionnels de la santé, et encore moins sur la rétention.

Conclusion: Dans les cinq articles à l'étude, un large champ de pratique et l'attirance pour le mode de vie rural étaient considérés être les facteurs les plus importants du recrutement et, dans une moindre mesure, de la rétention. On a déterminé que la recherche était insuffisante dans le domaine des facteurs qui influent sur le recrutement et la rétention des professionnels de la santé autres que les médecins au Canada. Il est donc recommandé d'effectuer d'autres recherches sur des professions médicales précises.

Mots-clés: Canada, soins de première ligne, recrutement, rétention, service de santé ruraux

INTRODUCTION

The World Health Organization encourages the establishment of sustainable health systems and promotes retention of health workers in underserved areas.¹ Although Canada does not have the shortage of health workers that some developing countries demonstrate, the rural health system may not be sustainable. To transform this shortage into a sustainable structure, recruitment and retention strategies should be evaluated. Multiple factors influence the recruitment and retention of health-workers in rural Canada, including personal, economic, professional, education, family and community.^{2,3} Previous research focused on specific elements.⁴⁻⁷ This review aimed to conduct a broader synthesis by reviewing multiple factors of recruitment and retention.

METHODS

Search strategy

Subject-specific electronic databases including PubMed, Medline Complete, Index of Chiropractic Literature and Cochrane Library were searched. Hand-searching and "snowballing" were performed. Key

terms were combined with Subject Heading Terms, relating to recruitment, retention and healthcare professionals. Study selection was pre-determined by using inclusion and exclusion criteria and was screened for eligibility accordingly. Both qualitative and quantitative papers were eligible [Table 1]. Only English language primary research conducted in Canada was included. Studies were chosen if they investigated multiple factors affecting recruitment and retention. Exclusively Francophone and Indigenous culture-specific studies were dismissed, as they may not be

Table 1: Inclusion/exclusion criteria

Inclusion criteria	Exclusion criteria
Primary research	Exclusively francophone studies
Qualitative papers	Exclusively indigenous culture studies
Quantitative papers	Studies exploring a single factor affecting recruitment and/or retention
English language	
Research conducted in Canada	
Healthcare professionals with diagnostic capabilities practicing in rural Canada	
All age groups, genders, career stages, specialisations	

generalisable. Study participants were healthcare professionals with diagnostic capabilities such as medical doctors, chiropractors, dentists, osteopaths and physiotherapists practising in rural Canada. All age groups, genders and career stages were considered applicable. Specialisation was not an exclusion criterion.

Data extraction, quality appraisal and synthesis

Study and participant characteristics were extracted and tabulated [Table 2]. An inclusive extraction of findings was conducted and analysed using thematic analysis. Concepts were combined, resulting in the axial coding of open codes. Themes, sub-themes, major and minor codes were generated. Major codes represented the factors influencing recruitment and retention. Minor codes were the individual impact of these factors on recruitment and retention, respectively. These were scored high or low, based on frequency, prevalence in text and description of importance.

Overall study quality was judged using a combination of critical appraisal checklists,

assessment of bias and limitations of study and participant characteristics.^{8,9} Themes were assessed for overall confidence using the Confidence in the Evidence for Reviews of Qualitative Research (CERQual) approach.¹⁰ Each theme was assessed based on methodological limitations, relevance, coherence and adequacy of data. A final table was developed summarising the CERQual assessments [Tables 3 and 4].

RESULTS

Study selection

A total of 139 papers underwent a screening process. After 28 duplicates were removed, 111 papers remained. A further 102 studies were excluded based on title/abstract screening and inclusive and exclusive criteria [Table 1]. A full text assessment led to the rejection of four papers. One of these papers focused on a culturally specific cohort, and the remaining three addressed specific factors. Five papers fit the review's pre-determined inclusion and exclusion criteria^{2,3,5-7} [Figure 1].

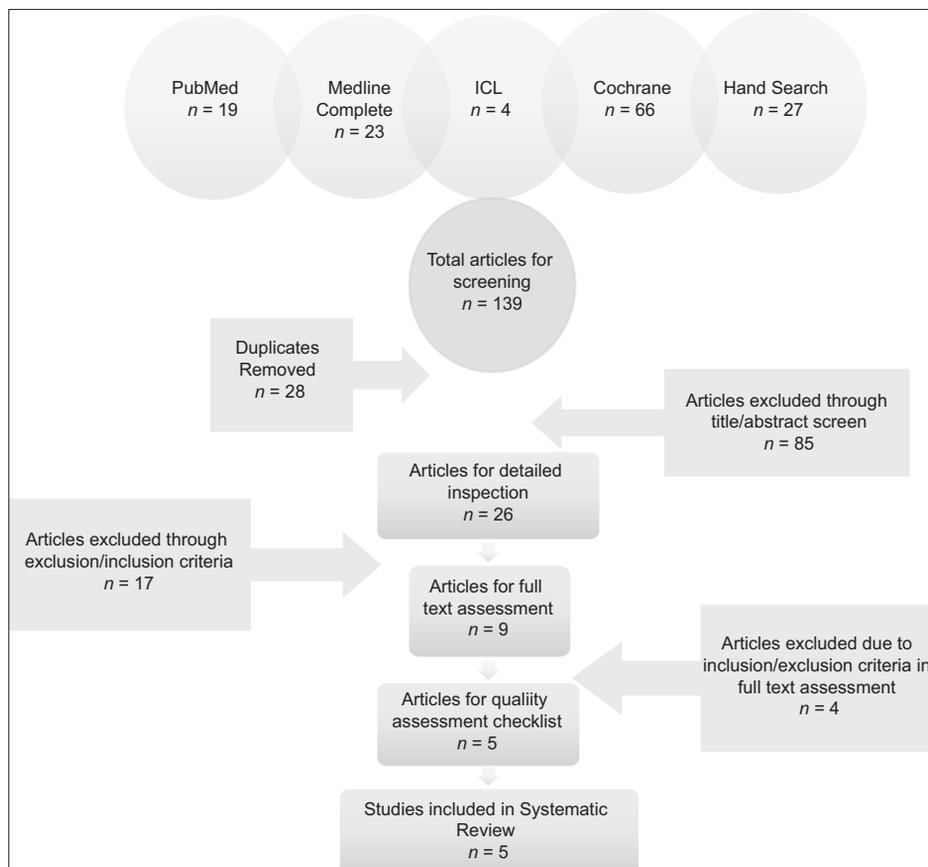


Figure 1: PRISMA diagram.

Table 2: Study characteristics

Study	Aim	Design	Location	Sample size	Analysis	Findings	Participant characteristics
2	Explore reasons, through qualitative analysis, why Canadian family physicians decide to work in rural and remote communities	Qualitative Participatory research approach Semi-structured interview	Canada	17	Thematic analysis	Attractive and deterring factors, strategies for improving recruitment and retention	Rural family physicians in Canada (West, East, North, Quebec) Experience as a family physician in a rural (population <10,000) or remote area (no road access, hospital >6 h away) Early - (<5 years), mid - (5-15 years), and late - (>15 years) career physicians
3	Determine factors which motivate physicians to select rural practice and result in long term retention	Qualitative Standardised, direct interviews	Saskatchewan	62	Inductive analysis	Community, personal, practice, compensation factors	Physicians practicing in rural Saskatchewan
5	Examine the implications of personal, professional, and community factors on physician retention in four rural Albertan communities	Qualitative Collective case study Interviews, documents, observation	Alberta	43	Not stated	Professional, personal, community factors	4 communities, 1-4 h from nearest urban centre Physicians, Staff Members, Spouses, Community members Mean age of physicians: 46.0 Mean age of other participants: 47.5 Duration of practice ranged from 4-30+years 7/15 physicians Canadian born
6	Find recruitment strategies and improve physician retention, especially in younger physicians	Qualitative Semi-structured interviews	Saskatchewan, Newfoundland and Labrador	48	Thematic analysis	Personal/family, professional practice, education, economic, community factors	Physicians graduating from Memorial University of Newfoundland or University of Saskatchewan Early - (1995-1999), mid - (1985-1989), late - (1975-1979), end - (1965-1969) career physicians
7	Assess national trends of migration from rural to urban areas and how to reduce this flow	Quantitative Cross-sectional survey	Canada	642	Descriptive statistics	Incentive, recruitment factors, current personal and professional satisfaction, rural training	Physicians in rural practice in Canada Physicians grouped into aged ≤45 years, and >45 years

Study characteristics

Four qualitative studies and one quantitative study were identified.^{2,3,5-7} All studies examined

physicians who were in rural practice. There were no studies involving other healthcare professionals that fit our criteria. The physicians in these studies either practised family medicine

Table 3: Confidence in the Evidence for Reviews of Qualitative Research Qualitative Evidence Profile - Recruitment

Objective: To identify, appraise and synthesise qualitative research evidence on the factors which influence the recruitment of healthcare professionals in rural Canada

RF	Studies contributing to the RF	Assessment of methodological limitations	Assessment of relevance	Assessment of coherence	Assessment of adequacy	Overall CERQual assessment of confidence	Explanation of judgment
Personal and family factors	Studies 2, 3, 6	Minor methodological limitations (two studies with minor and one study with moderate methodological limitations)	Minor concerns about relevance (one study was from two provinces, one study was from one province, one study was Canada wide)	Moderate concerns about coherence (one factor had 3/3 studies, three factors had 2/3 studies, five factors had 1/3 studies)	Minor concerns about adequacy (three studies that together offered moderately rich data overall)	Moderate confidence	This finding was graded as moderate confidence because of minor concerns regarding methodological limitations and adequacy, and moderate concerns regarding relevance and coherence
Community factors	Studies 2, 3, 6	Minor methodological limitations (two studies with minor and one study with moderate methodological limitations)	Minor concerns about relevance (one study was from two provinces, one study was from one province, one study was Canada wide)	Moderate concerns about coherence (two factors had 2/3 studies, six factors had 1/3 studies)	Minor concerns about adequacy (three studies that together offered moderately rich data overall)	Moderate confidence	This finding was graded as moderate confidence because of minor concerns regarding methodological limitations and adequacy, and moderate concerns regarding relevance and coherence
Professional practice factors	Studies 2, 3, 6	Minor methodological limitations (two studies with minor and one study with moderate methodological limitations)	Minor concerns about relevance (one study was from two provinces, one study was from one province, one study was Canada wide)	Moderate concerns about coherence (one factor had 3/3 studies, five factors had 1/3 studies)	Minor concerns about adequacy (three studies that together offered moderately rich data overall)	Moderate confidence	This finding was graded as moderate confidence because of minor concerns regarding methodological limitations and adequacy, and moderate concerns regarding relevance and coherence
Professional education factors	Studies 2, 6	Minor-moderate methodological limitations (one study with moderate and one study with minor methodological limitations)	Minor concerns about relevance (one study was from two provinces, one study was Canada wide)	Minor concerns about coherence (one factor had 2/2 studies, one factor had 1/2 studies)	Minor concerns about adequacy (two studies that together offered rich data overall)	High confidence	This finding was graded as high confidence because of minor concerns regarding relevance, coherence and adequacy of data, and minor-moderate methodological limitations
Economic factors	Studies 2, 3, 6	Minor methodological limitations (two studies with minor and one study with moderate methodological limitations)	Minor concerns about relevance (one study was from two provinces, one study was from one province, one study was Canada wide)	Minor concerns about coherence (one factor had 3/3 studies, one factor had 1/3 studies)	Minor concerns about adequacy (three studies that together offered moderately rich data overall)	High confidence	This finding was graded as high confidence because of minor concerns regarding methodological limitations, coherence and adequacy, and minor concerns regarding relevance

RF: Review finding, CERQual: Confidence in the Evidence for Reviews of Qualitative Research.

Table 4: Confidence in the Evidence for Reviews of Qualitative Research Qualitative Evidence Profile - Retention

Objective: To identify, appraise and synthesise qualitative research evidence on the factors which influence the retention of healthcare professionals in rural Canada

RF	Studies contributing to the RF	Assessment of methodological limitations	Assessment of relevance	Assessment of coherence	Assessment of adequacy	Overall CERQual assessment of confidence	Explanation of judgment
Personal and family factors	Studies 2, 3, 5	Minor methodological limitations (two studies with minor and one study with no methodological limitations)	Minor concerns about relevance (two studies were from individual provinces in Canada, one study was Canada wide)	Moderate concerns about coherence (one factor had 2/3 studies, eight factors had 1/3 studies)	Minor concerns about adequacy (three studies that together offered moderately rich data overall)	Moderate confidence	This finding was graded as moderate confidence because of minor concerns regarding methodological limitations, relevance, and adequacy of data, and moderate concerns regarding coherence
Community factors	Studies 3, 5	Minor methodological limitations (one study with minor and one study with no methodological limitations)	Moderate concerns about relevance (two studies were from individual provinces in Canada)	Minor concerns about coherence (four factors had 2/2 studies, two factors had 1/2 studies)	Moderate concerns about adequacy (two studies that together offered relatively thin data overall)	Moderate confidence	This finding was graded as moderate confidence because of minor concerns regarding methodological limitations and coherence, and moderate concerns regarding relevance and adequacy of data
Professional practice factors	Studies 2, 3, 5	Minor methodological limitations (two studies with minor and one study with no methodological limitations)	Minor concerns about relevance (two studies were from individual provinces in Canada, one study was Canada wide)	Moderate concerns about coherence (three factors had 2/3 studies, seven factors had 1/3 studies)	Moderate concerns about adequacy (three studies that together offered thin data overall)	Moderate confidence	This finding was graded as moderate confidence because of minor concerns regarding methodological limitations and relevance, and moderate concerns regarding coherence and adequacy of data

Table 4: Contd...

Objective: To identify, appraise and synthesise qualitative research evidence on the factors which influence the retention of healthcare professionals in rural Canada

RF	Studies contributing to the RF	Assessment of methodological limitations	Assessment of relevance	Assessment of coherence	Assessment of adequacy	Overall CERQual assessment of confidence	Explanation of judgment
Professional education factors	Study 2	Minor methodological limitations (one study with minor methodological limitations)	No concerns about relevance (study performed was the first Canada wide qualitative study)	Substantial concern about coherence (RF only present in one study)	Substantial concerns about adequacy (only one study offering thin data)	Low confidence	This finding was graded as low confidence because of minor concerns regarding methodological limitations, no concerns about relevance, and substantial concerns about coherence and adequacy of data
Economic factors	Studies 2, 3	Minor methodological limitations (two studies with minor methodological limitations)	Minor concerns about relevance (one study was from an individual province in Canada, one study was Canada wide)	No concerns about coherence (one factor had 2/2 studies)	Moderate concerns about adequacy (two studies that together offered moderately rich data overall)	High confidence	This finding was graded as high confidence because of minor concerns regarding methodological limitations, relevance, and no concerns regarding coherence, and moderate concerns regarding adequacy of data

RF: Review finding, CERQual: Confidence in the Evidence for Reviews of Qualitative Research.

or had specialised. The qualitative studies used varied, with three studies using pre-determined questions to interview their subjects^{2,5,6} and one basing their method on the grounded theory.⁵ Two qualitative studies assessed both recruitment and retention,^{2,3} one explored factors of recruitment,⁶ with one focused on retention.⁵ Cameron *et al.* also interviewed, observed and retrieved information from staff members, spouses and community members.⁵ The quantitative study by Chauban *et al.* included both recruitment and retention in their survey.⁷ The quantitative study contained the largest sample size, surveying 642 participants.⁷ The analysis varied among papers. Descriptive text, numerical ranking and percentages and the number of communities out of four were used.

Synthesis of results

A total of 40 factors influencing recruitment and retention were allocated to 5 common themes, across 2 domains. There were 13 professional practice factors, 12 personal and family factors, 10 community factors, 3 professional education factors and 2 economic factors. The factors either had an impact on recruitment, retention or both. Tables 5-9 illustrate examples of the overlap of common factors among papers and list the weighting of importance of each paper in their respective outcome measurements.

Personal/family factors

Attraction to the rural lifestyle was one of the main factors deemed important for recruitment. It was

Table 5: Professional practice factors in recruitment

Factors	Study	Additional Information
Scope of practice	3	First most prevalent theme for recruitment. The frequency of this response as an important factor of recruitment was notable; 21 of 62 respondents answered "scope of practice"
	7	Young: #1, 86%
	6	Older: #1, 83%
	2	Not specified
Work schedule/hours of work	3	Fifteenth most prevalent theme for recruitment. Seven of 62 respondents answered, "work schedule/hours of work"
Positive work environment/physician dynamics	3	Tenth most prevalent theme for recruitment; 16% of respondents answered "positive work environment//physician dynamics"
Group practice	3	Ninth most prevalent factor (16% respondent choice)
Independence	3	Sixteen most prevalent factor. 11% frequency of answer
Practice opportunity was available	7	Young: #4, 73%
		Older: #4, 77%
Preference for rural practice	7	Young: #3, 79%
		Older: #3, 79%
Feeling appreciated by patients	3	Eleven most prevalent answer. 16% frequency of answer

Table 6: Personal/family factors recruitment

Factors	Study	Additional information
Rural background (physician)	3	Third most important factor for recruitment. 21% of respondents answered this
	2	Not specified
Rural background (spouse)	3	Thirteenth most important factor, 13% of respondents selected this factor
	7	Young: #2, 83%
Attracted to rural lifestyle		Older: #2, 81%
	3	Second most important factor of recruitment in the personal/family realm. 27% frequency of answer
Friends and family living in the area	2	Not specified
	3	Sixth most prevalent factor. 18% frequency of answer
Spouse/family enjoy the community	7	Young: #8, 49%
		Older: #8, 40%
Spouse/family enjoy the community	6	Most important factor of recruitment for this study
	3	Fourteenth most important factor for this study. 13% of respondents found this factor to be key in recruitment
Grew up/previously lived in specific community (physician or spouse)	3	Fourth most important. Near one-fifth of the study's respondents voiced the importance of this factor
Work/life balance	6	Important for younger generation primarily
Spouse found employment	3	Fourteenth most important factor for this study. 13% frequency of answer
	2	Not specified
Adventure/seeing new places	6	Important for younger generation primarily
	6	Important for older generation primarily

the second most influential recruitment factor for both the study by Chauban *et al.* and Wasko *et al.*^{3,7} Eighty-three per cent of the younger physicians, compared to 81% of older physicians, considered liking the rural lifestyle as an important factor

for recruitment.⁷ This factor was also important for retention, with Wasko *et al.* ranking it fifth of twenty factors investigated.⁵ However, in comparison to recruitment, it was less influential, which was a common pattern among papers.

Table 7: Community factors' recruitment

Factors	Study	Additional information
Feeling appreciated by the community	3	Twelfth most important factor. 13% of respondents marked this factor as important
Recreational/leisure activities	3	Fifth most important community factors affecting recruitment. Near 1/5 of the respondents marked this factor as important
	7	Young: #6, 71%
	6	Older: #6, 60%
Integration and enjoyment of the community	3	Eighth most important factor. 16% of respondents selected this answer
Medical need of the community	6	Important for older generation primarily
Regional support	3	5% of study participants found regional support to be an important community factor for recruitment. It placed 20 th in the ranking of importance
Education system	3	Nineteenth most important factor. 6% of respondents marked this factor as important
community needs are a good match with my career interests	7	Young: #5, 73%
		Older: #5, 70%
Proximity to larger centre	3	Seventh most important. 16% frequency of answer
	2	Distance from large centres seen as a negative factor
Recruitment strategies	6	Not specified

Table 8: Professional education factors recruitment

Factors	Study	Additional information
Rural training site	6	Not specified
	2	Not specified
Rural experience in training/rotations	7	Young: #7, 71%
	2	Older: #7, 40%
		Mentioned multiple times

Community factors

Recreational and leisure activities were nearly equal in importance for recruitment and retention. According to Asghari *et al.*, “those who enjoyed nature and being outdoors found rural practice to be attractive.”² Wasko *et al.* ranked its importance as #5.³ By frequency, 71% of younger physicians and 60% of older physicians in the study by Chauban *et al.* mentioned this.⁷ Four of 4 communities in Cameron *et al.*'s study found this important as a factor of retention.⁵

Professional practice factors

The most frequently mentioned factor was scope of practice, appearing in each paper either under recruitment, retention or both. In terms of recruitment, this factor overlapped in four studies.

Two papers listed this as their most influential factor. In the study by Chauban *et al.*, 86% of young physicians and 83% of older physicians found this important.⁷ Of twenty total factors that Wasko *et al.* looked at for retention, the ability to practice full-scope medicine was the second most important.³

Professional education factors

In one study, rural experience in training ranked as the seventh most important for recruitment in both younger and older generation practitioners.⁷ Seventy-one per cent of younger physicians rated this factor positively with regards to recruitment, compared to 40% of older physicians. The higher percentage of rural rotations and experience in training in the younger generation also correlated with a higher satisfaction with their preparedness for rural practice. Physicians who had completed rural rotations were more likely to have received incentives. They also listed preference for rural practice as their most influential factor for choosing rural practice. On the contrary, those physicians who had not completed rural rotations noted the wide scope of practice as their primary reason.² Continuing professional development was mentioned multiple times as a factor for retention.

Table 9: Economic factors recruitment

Factors	Study	Additional information
Incentive/bonuses	3	Eighteenth most important factor. 8% frequency of answer
	7	Financial incentives Young: #9, 49% Older: #9, 32% Other non-financial incentives Young: #10, 36% Older: #10, 22%
	2	Some disagreement regarding effectiveness of incentives
	3	20 th most important economic factor for recruitment. 5% of respondents indicated this factor to be important in recruitment
	2	States that incentive is not important for retention
	7	Young: #4, 73% Older: #4, 77%
Adequate amount/mode of remuneration	6	Not specified

Economic factors

Four of the papers rated incentives (financial and/or non-financial) as not effective in recruiting healthcare professionals. Eight per cent of participants in the study by Wasko *et al.* noted the benefit of bonuses or incentives for recruitment.⁵ While Asghari *et al.* found disagreement on the effectiveness of incentives for recruitment, they stated that incentives were even less influential on retention.² Wasko *et al.*'s economic factor findings were similar to those of the above mentioned study, with incentives being their least important factor for retention.⁵ Incentives were of greater importance to younger versus older physicians.⁷

DISCUSSION

This review aimed to explore the most important factors in the recruitment and retention of healthcare professionals in rural practice in Canada. Five eligible studies were included, and 40 factors were identified across the 2 domains of recruitment and retention. This systematic

review of the literature determined attraction to the rural lifestyle, recreational activities, scope of practice, rural training and incentives as discussion worthy.

Personal and family

A prominent influencer with regard to personal and family factors is attraction to the rural lifestyle. This can be very difficult to manage from a recruitment point of view since it is personal preference. Advertisement campaigns such as Travel Alberta's "Remember to Breathe," can be crucial in promoting the attractiveness of a certain location.¹¹ Government-endorsed campaigns are another strategy to promote the advantages of rural lifestyle.¹²

Community

The availability and quality of recreational activities in rural areas is an important community-based factor for both recruitment and retention of physicians. Canadians are known to have an affinity for the outdoors.¹³ Three of four households disclosed a family member participating in outdoor activities close to home.¹⁴ Health professionals, who are aware of the benefits of exercise, will be even more likely to engage in outdoor activities, making recruitment and retention an ideal match for this population.

Professional practice

In terms of recruitment, factors of professional practice were considered very important in this review, especially scope of practice. As a general physician in rural areas, additional skills must be enhanced. These areas of medicine include general anaesthesia and surgery.¹⁵ Wasko *et al.* state: "it is in a rural setting that full-scope family medicine is most often practised."³ Specialists, on the other hand, found rural practice patient populations simply too small to support a practice. This is reflected by the Canadian Medical Association (CMA), which states that in 2015, 14% of Canada's family physicians practised in rural locations, compared to only 2% of the specialists.¹⁶ Specialisation and sub-specialisation is a growing trend among medical students.¹⁷ This poses the risk of more new graduates congregating in urban

centres, which could create a surplus in these areas and increase the shortage in rural locations.

Professional education

Our review also explored the impact of professional education, such as rural training, on recruitment. Based on the pattern identified by Chauban *et al.*, one can devise that many of the participants of papers in this review did not have rural training.⁷ Scope of practice being the number one factor for recruitment in our review may not be entirely accurate, as it depends on the participant characteristics that were not mentioned by some of the examined studies.

Though our review found incentives to have a minimal effect on retention, strategies encouraging this are still in place. For example, Alberta has a Retention Benefit Program which offers payments for each year in practice.¹⁸ Incentives had varying degrees of influence on differing participant ages.

Economic

Economic factors were a largely debated finding. Younger physicians were far more likely to find incentives very, or somewhat, important. This may be due to the higher costs of medical school tuition in recent years, leading to a greater need of financial support during their early careers to alleviate their student debt.⁷ According to the Graduation Questionnaire National Report, the median amount of debt accumulated directly from medical studies was \$94,000.¹⁹ In addition, rural-origin students are more likely to have a higher debt load on entry to medical school, due to the necessary added costs of living away from home.²⁰

“The increasing cost of medical education and student debt may decrease physicians’ interest in rural practice, leading them to choose a more lucrative urban medical specialty.”²¹ Indeed, Canadian family physicians received an average gross of \$253,683. Medical specialists however, averaged \$349,039.²²

Bias, limitations and strengths

The factors discussed within our review were but a small sample of the reasons why practitioners choose rural practice. The raw numerical data

extracted can be used for further interpretation of correlations.

Each study used their own unique pool of questions. Asghari *et al.* minimised question bias using the Delphi method to reach consensus regarding interview questions.² They piloted the interview on two rural physicians. The other studies did not mention whether they had accounted for question bias. Misunderstood or unanswerable question bias could have occurred in any of the studies, especially in studies researching older generation physicians, where recall bias could appear. Biased reporting was mentioned as a limitation in Wasko *et al.*³ The halo effect may have been present in studies that examined financial factors, such as incentives or remuneration.²³ Physicians may have been reluctant to report on the importance of or role of financial factors. Moderation bias may have been present in the study by Wasko *et al.* since students and residents with a lower educational rank and inexperience in questioning were the interviewers.³ External validity may have been affected simply by participant involvement in the survey, when participants realised their role in the study, known as the Hawthorne effect.²⁴

Due to the heterogeneous outcome measures among the studies, a comparison of the importance of individual factors was difficult. Choosing one representative example of each theme, based on their importance or frequency of appearing in the studies, may have created outcome and reporter bias, influencing the validity of the review. Using only four databases, important studies may have been missed. However, the exploratory and explanatory data design, which combined both qualitative and quantitative data, improved study reliability. The mixed methods approach provided a holistic view of the research topic.

The overall level of evidence gathered in our review, taking both the articles’ and review’s strengths and limitations into account, is moderately high. Although the studies had minor flaws individually, the results still demonstrated a commonality. Therefore, recommendations could be derived from the data.

Recommendations

Based on the literature, the following recommendations can be established. The

effectiveness of retention-benefit programs should be questioned. The connection between rural experience in training and the likelihood of choosing rural practice, should be thoroughly explored. Further exploration of the link between the amount of student debt and the preference of financial incentives for recruitment should be conducted.

Although this systematic review sought to explore factors influencing healthcare professions, no published study looking at additional healthcare professions was found. Thus, the papers in this review, as well as the results, were based solely on physicians with medical training. There is need for further research looking at specific healthcare professionals to gain a deeper understanding of this subject area.

CONCLUSION

The ability to practice full-scope medicine was the most important factor in terms of physician recruitment, and to a lesser extent, retention, among the five articles studied. Attraction to the rural lifestyle was also considered important in these realms, but to a slightly lesser extent compared to scope of practice. Our review found a lack of research in terms of factors of recruitment and retention in non-physician healthcare professionals in rural Canada. Further research is recommended in this realm.

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The occasional nail bed laceration

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INTRODUCTION

Injuries to fingertips are not uncommon with manual work, especially in a rural setting where there is more home-based use of power tools. Fingertip injuries are usually accompanied by lacerations to the distal nail bed.¹ Simple lacerations of the nail bed [Figure 1] can be managed by suturing the damaged structures, and this procedure can be done in an emergency department setting.² Avulsion or severe crush injuries may require grafting for optimum outcome.¹ Tuft fractures are commonly associated with nail bed lacerations [Figure 1] which can often be managed with the repair of the nail bed and surrounding structures.¹ In addition to closing lacerations in the repair of a nail bed injury, the eponychium should be stented to prevent the adhesion to the germinal matrix.³ In this article, we describe a procedure for managing simple lacerations to the nail bed.

PROCEDURE

Initial assessment

Tetanus vaccination status should be determined for patients with any lacerations and booster shots should be given if required. Obtain a history

for the mechanism of injury and assess the extent of injury. If there is significant germinal matrix damage, the nail may not grow. Perform a physical examination to determine the presence of tendon injury and obtain X-ray imaging to assess injury to bones.

Material

- Local anaesthesia (1% lidocaine, bupivacaine or ropivacaine, bicarbonate solution)
- Tourniquet (Penrose drain)
- 5-0 Monocryl sutures
- Suture kit: Haemostat for nail removal, toothed forceps, needle driver and scissors
- Aluminium foam finger splint and non-adhesive dressing
- Chlorhexidine preparation.

Digital nerve block

Proper digital nerves (PDNs) run on the volar side from the metacarpophalangeal (MCP) joint to the fingertip along either side of a finger and trifurcate at the level of the distal interphalangeal joint to give off branches that supply the nail bed, pulp and distal fingertip.¹ Blocking PDN at the web space level will provide sufficient anaesthesia. A mix of short-acting anaesthetic, long-acting anaesthetic and bicarbonate solution

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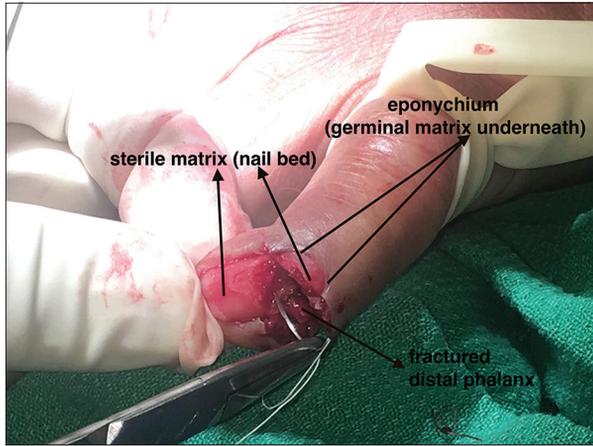


Figure 1: Nail bed injury with tuft fracture of the left fifth digit resulted from working with garden scissors. Finger nail is removed and important structures are labelled.

at 7:2:1 ratio, results in a neutral solution that provides rapid and prolonged pain relief.⁴ For example, 7 ml of 1% lidocaine, 2 ml of ropivacaine (or bupivacaine) and 1 ml of sodium bicarbonate solution can be mixed just before the use. We recommend a 'three-point injection' technique for local anaesthetic administration.

1. On the dorsum of the proximal phalanx, just distal to the MCP, infiltrate in the center [Figure 2a] where skin laxity is the greatest
2. Once the dorsum is infiltrated, withdraw the needle slightly and through the same puncture, advance needle to the ulnar/radial side to infiltrate further, ensuring to stop just before penetrating the volar surface
3. Next, withdraw the needle completely and inject radial [Figure 2b] and ulnar side of the finger. It is important to infiltrate the anterior aspect of the affected finger because PDN has a volar course. We believe this method is less painful in comparison to injecting the volar side directly; it also provides additional anaesthesia through acting on the dorsal nerves
4. Prepare the area with antiseptic solution followed by sterile draping
5. Place tourniquet on the base of the finger after sufficient anaesthesia and remove the nail with haemostat.
6. Grasp nail with haemostat and use gentle side-to-side motion to remove the nail completely. The removed nail can be used for stenting if intact
7. For the purpose of stenting, the nail should

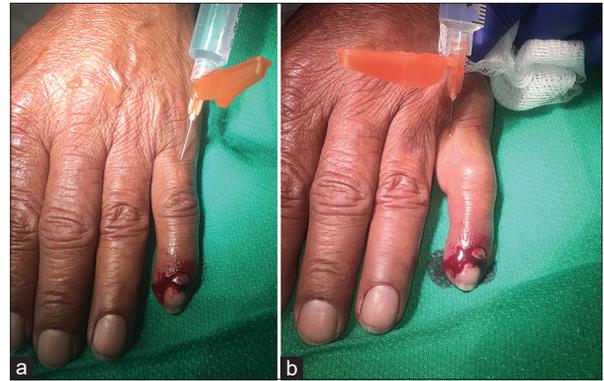


Figure 2: Dorsal injection of local anaesthetic in the (a) middle and (b) radial side of the injured finger.

be cleaned thoroughly, and any attached soft tissue should be removed; it should also be immersed in antiseptic solution before use.

Repair of the nail bed and surrounding structures

1. Irrigate wound with saline after nail removal
2. Repair the nail bed with simple interrupted sutures using 5-0 Monocryl (other small dissolving sutures if 5-0 Monocryl unavailable). The monofilament dissolvable suture is preferred because it has lower bacterial adherence and glides easily
3. Start suturing at the outermost aspect of sterile matrix for better approximation
4. Gently grasp the fingertip with toothed forceps to bring wound edges together and take adequate bite from the sterile matrix
5. Add subsequent sutures to close the sterile matrix. Sutures should provide just enough tension to allow wound edge approximation; pulling sutures too tight will compromise blood flow and possibly result in tissue necrosis. Good nail bed approximation is key for healing
6. Continue with simple interrupted sutures to repair damage to surrounding skin with 5-0 dissolvable suture.

Stenting

Stenting of the germinal matrix can be achieved using the patient's own nail when available. Alternatively, a suture package can be modified to serve the same purpose.

1. Cut plastic suturing package to approximate the size of the removed fingernail and insert underneath the eponychium; a small piece is



Figure 3: Stenting of the eponychium involves the following steps: (a) Insert customized stenting material underneath eponychium and hold stenting material in place by passing needle through proximal nail fold and taking adequate bite from the pulp of the finger; arrow indicates direction of suture, dashed lines indicate suture beneath skin, dotted lines indicate suture between stenting material and finger, solid lines indicate suture on top of structures. (b) Stenting of the eponychium with figure-of-eight stitch.

- cut off the stenting material distally to hold the suture in place
2. Stenting material is held in place with a figure of 8 suture.
 - The first suture passed through the proximal nail fold [Figure 3a]
 - The second suture passed through the pulp of the finger [Figure 3a]
 - Pass suture through indentation and tie up loose ends with the surgeon's knot [Figure 3b].

Recovery¹

1. The fingertip should be dressed loosely with non-adhesive dressing, gauze, aluminium splint and tape or bandage. Stax splint is another option for splinting given that it is large enough to allow loose dressing
2. The injured finger should be protected with a splint for 4 weeks or more depending on whether there is an underlying fracture
3. Patients should avoid strenuous activities and keep injured finger dry and clean
4. Oral antibiotics should be given to prevent infection. Patients should be on cefalexin (500 mg every 6 h) or clindamycin (if allergic to penicillin, 450 mg every eight hours) for 7 days. Suture material will dissolve and the stent will automatically come out.
5. It takes 100 days for a new nail to grow and typically a year for the nail to start getting normal

6. Referral to physiotherapy and occupational therapy is paramount for optimal recovery
7. Note additional splinting is required for associated tendon injury.

CONCLUSION

This article presents the management of simple nail bed lacerations which can be carried out in a rural setting. Important things to note for a nail bed laceration are to use appropriate anaesthesia with the 'three-point injection' technique, using fine dissolvable sutures for nail bed repair, stenting of eponychium to allow nail growth and therapy and splinting for best outcomes.

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Hypoxia in the rural emergency department: Discussion and case report

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INTRODUCTION

The cardiorespiratory system is responsible for oxygen delivery to the body. Abnormalities in either system can lead to hypoxaemia and its detrimental effects on every organ system. Oxygenation begins in the alveolus and diffuses passively into the pulmonary capillaries, binding to red blood cells and then beginning transportation to the peripheral tissues.¹

Oxygenation is commonly measured non-invasively with pulse oximetry to get oxygen saturation (SaO₂). This measures the proportion of red blood cells whose haemoglobin is bound to oxygen.² This is typically 94%–99% in healthy individuals and lower in disease states.² An unexpected low SaO₂ level should trigger an investigation into the cause, and subsequent treatment, given the pathological consequences of hypoxia.³

The rural family physician should be familiar with the approach to hypoxaemia, which has a broad differential diagnosis and includes life-threatening causes. An uncommon cause of hypoxaemia is a right-to-left

shunt, caused by pulmonary arteriovenous malformations (AVMs), abnormal communications between a pulmonary artery and vein.⁴ The incidence is quite rare, ~2.5/100,000; most are congenital and occur as part of hereditary haemorrhagic telangiectasia (HHT).^{4,5} In this paper, we present the case of a 25-year-old female with hypoxaemia and discuss the differential diagnosis and management of hypoxia in the clinic and rural emergency department.

CASE REPORT

A 25-year-old Caucasian female presented to her family physician in Banff, Alberta, with complaints of feeling unwell when riding a gondola up to altitude for snowboarding. She attested to headache, nausea and malaise when at altitude. This improved as she descended the mountain. She felt much better by the time she was seen by her family physician. When not dyspnoeic, her SaO₂ measured at the family clinic was 82% on room air. She was then sent urgently to the local rural emergency department for evaluation.

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The Banff Emergency Department had 24/7 access to X-ray imaging and basic laboratory investigations. The closest access to computed tomography (CT) imaging at that time was 120 km away in Calgary, Alberta.

The patient's presenting vital signs were temperature 36.3°C, heart rate 82, blood pressure 114/74, respiratory rate 18 and SaO₂ of 94% on 5 L nasal cannula. The patient had no distress, no increased work of breathing and no infectious symptoms. Her physical examination was unremarkable, with normal heart sounds, normal breath sounds with no adventitious sounds and no signs of deep venous thrombosis.

Pertinent laboratory results were as follows: complete blood count was normal, with a haemoglobin of 157 g/L and a normal white blood cell count. Electrolytes and creatinine (78 µmol/L) were normal. A venous blood gas on oxygen showed a pH of 7.39, pCO₂ of 42, PO₂ of 46 and HCO₃ of 25. Her D-Dimer was negative at 0.36 (normal <0.50). Beta-HCG was negative. Electrocardiogram (ECG) showed sinus bradycardia with a heart rate of 57 beats/min. Her chest X-ray showed a rounded opacity in the left lower lobe ~1.7 cm, interpreted as indeterminate aetiology [Figure 1].

Differential diagnosis of hypoxaemia

The differential diagnosis of hypoxaemia can be subdivided into five aetiologies: decreased inspired oxygen tension, hypoventilation, ventilation-perfusion (V/Q) mismatch, right-to-left shunt and diffusion impairment.^{1,6,7} Often, hypoxaemia is due to a combination of these aetiologies.

Decreased inspired oxygen tension (PiO₂)

Inspired oxygen tension (PiO₂) is influenced by both the fraction of inspired oxygen (FiO₂) and the atmospheric pressure (P_{atm}). Changes in either variable will result in a decrease of PiO₂.

$$PiO_2 = FiO_2 \times (P_{atm} - PH_2O)$$

A reduction in PiO₂ will reduce the PAO₂ or the alveolar oxygen tension. A reduction in PAO₂ will directly affect the PA-aO₂ gradient and will result in reduced transfer of oxygen from the alveoli to the arteries, ultimately causing hypoxaemia.

The most common cause of reduced PiO₂ is high altitude travel, i.e. a reduction in atmospheric pressure, as might occur during aircraft travel.⁸ Other less common causes include asphyxiation, or exposure to low-oxygen environments.

Hypoventilation

Hypoventilation refers to a mismatch between the elimination of CO₂ and the metabolic production of CO₂. It is conventionally defined as the pCO₂ above the normal limits of 35–45 mmHg in a conscious patient. As PaCO₂ (arterial CO₂) rises, so does the PACO₂ (alveolar). The rising partial pressure of CO₂ in the alveoli displaces the alveolar tension of O₂ (PAO₂), reducing the diffusion of O₂ into the pulmonary capillaries and ultimately resulting in hypoxaemia. Hypoxaemia caused by hypoventilation will result in a normal A-a gradient in isolation.⁶

Hypoxaemia due purely to hypoventilation can be recognised by two features: elevated PaCO₂ and rapid response to an increase in FiO₂.

Clinical presentations include⁹: CNS depression from respiratory centre ischemia, structural lesions, or drug overdose, impaired neural conduction such as in amyotrophic lateral sclerosis, Guillain-Barré Syndrome, high cervical spine injury, phrenic nerve paralysis, or aminoglycoside blockade. Muscular or mechanical pathologies include diaphragmatic paralysis, myasthenia gravis, Eaton-Lambert syndrome, polymyositis, muscular dystrophy,



Figure 1: Posterioranterior chest X-ray showing a small rounded mass in the left lateral mid lung zone, not typical for pneumonia.

severe hypothyroidism, obesity hypoventilation, flail chest and kyphoscoliosis.

Right-to-left shunt

A right-to-left shunt occurs when blood passes from the right heart to the left heart without being oxygenated. Right-to-left shunts can be divided into physiologic or anatomic shunts.⁶

Physiologic shunting occurs when non-ventilated alveoli are perfused with blood. Common causes include pneumonia, atelectasis and acute respiratory distress syndrome. Anatomic shunting occurs when ventilating alveoli are bypassed, such as in intracardiac shunts, pulmonary AVMs and hepatopulmonary syndrome.

Ventilation-perfusion mismatch

VQ mismatch occurs when the ventilation and perfusion of the lung are imbalanced.^{10,11} Both ventilation and perfusion of the lung vary from the apices to the bases in a normal patient. These changes allow for the A-a gradient, which is essential for proper gas exchange across the lung. When either perfusion or ventilation is abnormal, the VQ ratio is disrupted and hypoxaemia may result. Common causes of abnormal VQ mismatch include chronic bronchitis, asthma, pulmonary embolism (PE) and emphysema.

Diffusion impairment

Diffusion refers to the movement of oxygen from the alveolus to the pulmonary capillary. It is most often limited or impaired by alveolar inflammation or fibrosis, as in interstitial lung disease.¹⁰⁻¹² Patients with diffusion abnormalities often present with exercise-induced hypoxaemia. At rest, blood traverses the lung slowly allowing for sufficient oxygenation regardless of diffusion limitations. With exercise, however, the impaired oxygen diffusion is more apparent and when fibrotic alveoli cannot compensate hypoxaemia results. Diffusion impairment is often accompanied by VQ mismatch.¹²

Case management

At this point, the differential diagnosis included atypical pneumonia, PE (uncommon but possible

despite a negative D-dimer) and right-to-left shunt from a pulmonary AVM or cardiac source. Because she had hypoxaemia requiring supplementary oxygen, the decision was made to arrange a CT pulmonary angiogram of the chest. It was late evening in winter with limited local ambulance resources, so the patient was admitted overnight for observation and CT was arranged for the next day in Calgary.

Later that evening, the emergency physician was called to reassess the patient in hospital. Although still asymptomatic and with no increased work of breathing, she had developed oxygen saturations of 92% on 10 L non-rebreather mask. Her examination was unchanged, aside from the increased oxygen requirements. The decision was made to transfer her immediately to Calgary for CT imaging.

CT pulmonary angiography demonstrated multiple bilateral pulmonary AVMs, the largest in the left lower lobe 2.1 cm × 3.0 cm [Figure 2]. She was admitted in Calgary for percutaneous transcatheter embolisation with good clinical outcome. Diagnosis of HHT was made clinically based on a history of epistaxis, telangiectasias and pulmonary lesions. A magnetic resonance imaging brain scan showed no cerebral AVMs.

Managing the hypoxic patient in the rural emergency department

What to look for

SaO₂ is an essential vital sign and should be closely scrutinised for any cardiorespiratory chief complaint. Low SaO₂ necessitates an emergent workup and evaluation for the cause, unless known to be a chronic finding (e.g. a patient with chronic obstructive pulmonary disease [COPD] and known SaO₂ 89%–92%).

Evaluate the airway, breathing and circulation of the patient.¹³ Assess for airway obstruction, increased work of breathing and accessory muscle use. Apply additional oxygen to the patient using nasal cannula, a non-rebreather mask and if necessary with other advanced airway manoeuvres such as bag-valve mask ventilation, non-invasive positive pressure ventilation and establishment of a definitive airway through endotracheal intubation.¹⁴ These therapies are outside the scope of this discussion, but in general, practitioners

should be aware of temporising manoeuvres to supply a critically ill patient with oxygen when awaiting specialist consultation or transport.

Basic investigations include venous or arterial blood gas, complete blood count, serum chemistry, ECG and chest X-ray. Further investigations and simultaneous treatment should be directed at the suspected underlying cause. Consider life-saving treatments during the primary assessment as indicated, such as needle decompression or placement of a chest tube for pneumothorax, or antidotes such as naloxone for suspected opioid toxicity. The chest radiograph is invaluable at diagnosing acute and chronic cardiorespiratory disease, such as pneumonia, congestive heart failure, complications of COPD or other structural lesions. Similarly, a normal chest X-ray might suggest hypoventilation, right-to-left shunt or VQ mismatch and necessitate further investigations.

The stable versus unstable patient

Smaller emergency departments often have limited access to CT scanning, making it necessary to transfer a patient to a centre with such capabilities. This often requires significant logistical decisions regarding timing (immediate or next day) and local resources (access to ground or flight transport). In general, the unstable or very ill patient should be transferred for definitive imaging and management immediately. The stable patient without major vital sign abnormalities or work of breathing

can often be treated for the presumed diagnosis when awaiting next-day definitive imaging. This decision should be made in consultation with local experts, including radiology, emergency medicine or other specialist consultants. The timing should take into consideration the patient's clinical trajectory, work of breathing, vital signs, oxygen requirements and suspected underlying diagnosis. For example, a suspected small PE without supplemental oxygen requirements may be suitable to be treated empirically until next-day imaging, whereas an undifferentiated patient with a high oxygen requirement may be approaching the maximal medical care available at the local hospital.

CONCLUSION

This case highlights the importance of measuring SaO₂ in the family medicine clinic and then having an approach to the hypoxaemic patient. Consider the five aetiologies of hypoxaemia when initiating therapy and diagnostic testing. The ability to do advanced imaging (example, CT) is often limited in rural settings, which necessitates making difficult decisions about empiric treatment, transportation and timing of investigations. In general, stable patients with low oxygen requirements and a projected clinical course that can be managed with current resources can have next-day imaging arranged. These decisions are complex, depend on local resources and should be made with specialist consultation.

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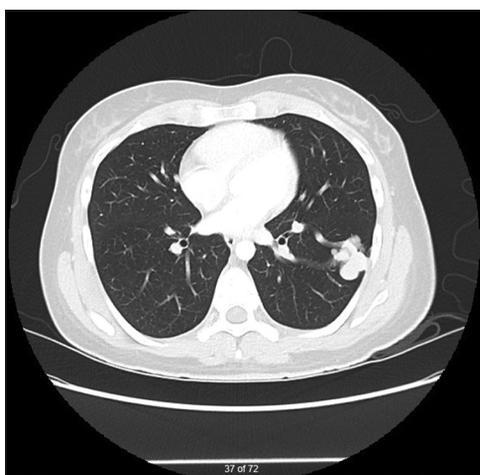


Figure 2: Computed tomography pulmonary angiogram showing a large pulmonary arteriovenous malformation in the left lower lobe, 2.1 cm × 3.0 cm.

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The plight of being a rural applicant for medical school

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In light of the recent article, 'Is Northern Ontario School of Medicine there yet?', highlighting the failed social mandate to produce a sufficient number of physicians who are willing to practise in rural locations upon graduation, I believe I can add some insight from my experience as a rural applicant applying to medical school.¹

The realities of being a competitive applicant for medical school in an underserved area are a significant challenge. And with Canada having up to 4000 applicants for some schools that may only have 100 seats available, the competition is extreme.² Often, rural applicants are at a severe disadvantage, and out of desperation, try to find the route of least resistance. The reality is that compared to their urban counterparts, rural students stand a slim chance of gaining acceptance and therefore seek out seats that are reserved for rural applicants without genuinely having the intention of practising in a small community once they are qualified.

Through anecdotal experience, having grown up in a rural community where there were no MCAT[®] courses, no laboratories, a discontinuity of extracurricular activities and where the local community college did not offer the necessary prerequisite subjects, I was intimidated by my

urban counterparts who were able to engage in all of the above. As a result, when application time came, I was scared to apply to schools that did not have seats reserved for rural applicants because, based on an unholistic point-based approach application system that was blinded to my realities, I stood a slim chance of gaining acceptance. From this standpoint, I applied to schools, including Northern Ontario School of Medicine (NOSM), as a rural applicant who had honestly grown up and lived in a rural community for my entire life but never had the genuine interest in returning in the future. I believe this is the crux of the problem: students caught between their realities of where they statistically stand the best chance of acceptance and their integrity of where they genuinely hope to practise. They take the opportunity provided by schools such as NOSM and the University of British Columbia that have seats available for rural students because they consider that it is their best chance of gaining acceptance, but once they have that diploma in hand, few students return to the communities where they grew up.

In my unsolicited opinion, there are real rural students – the true diehards of the North – who have

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the potential to return; however, these are the students who do not make it to the application phase. Due to the financial and psychological burdens required to round out one's application coupled with the myriad of inaccuracies printed online, these students often feel like lone wolves in the application process and many change career paths before they even apply. When it comes time to apply to medical school, though we are all from the North, we do not all hope to return to the North, and there is where your discontinuity lies.

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Erratum: Rural Recommendations

In the article titled Rural Recommendations, published in pages 14-19, Issue 1, Volume 25 of Canadian Journal of Rural Medicine¹, the first three names were missed from ledger at the bottom of the Box 3. The correct Box 3 ledger should read as following:

AFMC—Association of Faculties of Medicine of Canada, CaRMS—Canadian Resident Matching Service, CARRN—Canadian Association for Rural and Remote Nursing, CASPR—Canadian Association of Staff Physician Recruiters, CFHI—Canadian Foundation for Healthcare Improvement, CFPC—College of Family Physicians of Canada, CIHI—Canadian Institute for Health Information, CMA—Canadian Medical Association, F/P/T—Federal, provincial, territorial government, FMRAC—Federation of Medical Regulatory Authorities of Canada, IPAC —Indigenous Physicians Association of Canada, RCPSC—Royal College of Physicians and Surgeons of Canada, SRPC—Society of Rural Physicians of Canada. *Green indicates the action is either implemented or in the final stages of implementation, yellow indicates the action is in progress for development, and red indicates no progress.

Also, the Royal College of Physicians and Surgeons of Canada should have been referred to as RCPSC and not RC on the score card.

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