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Original Article

Community Pharmacy-Based Blood Pressure Screening in Newfoundland and Labrador, Canada for World Hypertension Day 2022: A Cross-Sectional Study

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ABSTRACT

Background: High blood pressure (BP) is a leading cause of cardiovascular and stroke-related events. Office-based BP measurement has declined in recent years due to the COVID-19 pandemic, which may have resulted in higher rates of undetected and uncontrolled hypertension. To gain a better idea of adult BP levels in Newfoundland and Labrador, we engaged community pharmacists in BP screening on World Hypertension Day.

Methods: Data collection and BP screening occurred on May 17, 2022. Pharmacists and pharmacy students collected 3 seated BP

RÉSUMÉ

Contexte : L'hypertension artérielle est une cause majeure d'événements cardiovasculaires et d'AVC. Or, la mesure de la pression artérielle (PA) en clinique a connu un déclin ces dernières années en raison de la pandémie de COVID-19, de sorte que les taux d'hypertension artérielle non détectée et non maîtrisée pourraient avoir augmenté. Afin de nous faire une idée plus précise de l'état de la PA des adultes de Terre-Neuve-et-Labrador, nous avons organisé une campagne de mesure de la PA dans les pharmacies de détail à l'occasion de la Journée mondiale de l'hypertension artérielle.

Hypertension, or high blood pressure (BP), is a leading cause of death worldwide[1] and affects almost 1 in 4 Canadians.[2] The prevalence of uncontrolled high BP is growing, especially among women—less than 50% of cases are well controlled.[3] The detection, treatment, and control of hypertension are essential measures to reduce the risk of heart disease, stroke, and premature death.[2,4] High BP also increases bleeding risk for those individuals who are taking anticoagulants or antiplatelet agents,[5] and it is an important variable in the determination of an individual's bleeding risk.[6] Given the potential risks associated with undetected and/or uncontrolled BP, opportunistic screening for high BP in the community is an essential first step in addressing this growing public health concern.[1,7] Primary care providers, such as family physicians, nurse practitioners, and pharmacists, play a critical role in screening for hypertension, providing patient education, and monitoring the effectiveness of therapy.[1,8]

Over the past 3 years, the COVID-19 pandemic has changed the delivery of primary healthcare in Canada and beyond. For example, in the first year of the COVID-19 pandemic, fewer in-person family physician visits occurred, and the number of virtual office visits increased.[9,10] Yet, at present, little is known about the impact of the COVID-19 pandemic on the rates of hypertension detection, treatment, and control in Canada. In the US, significant declines in BP measurement and control have been reported.[11,12] These reports have prompted healthcare professionals in Canada to sound the alarm on the potential impacts of COVID-19 on hypertension detection, treatment, and control in the country, calling upon governments and policymakers to include community pharmacists and paramedics in BP screening initiatives.[8]

In a province such as Newfoundland and Labrador (NL), which has high rates of hypertension, cardiovascular (CV) disease, and stroke, as well as poor health-system performance[13] and a family-physician shortage,[14] the potential negative impact of COVID-19 on BP monitoring may in fact lead to higher levels of morbidity and mortality. In an attempt

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readings from participants, using an automated device. The average of readings 2 and 3 was used to estimate BP, with elevated BP defined as ≥ 140/90 mm Hg, or ≥ 130/80 mm Hg for individuals with diabetes. Data on participant demographics, access to primary care, medical history, and antihypertensive use were also collected. Data analysis included descriptive statistics and logistic regression techniques.

Results: A total of 460 participants were included in the analysis. The mean age was 56.3 years (standard deviation: 16.95); 63.3% (n = 291) were female; and 43.7% (n = 201) reported having hypertension. Elevated BP was identified in 27% (n = 123). Of those with elevated BP, 41.5% (n = 51) had no history of diagnosed hypertension. Age, sex, and diabetes were statistically significant predictors of elevated BP in the multivariable model.

Conclusions: A large proportion of participants in our study had elevated BP. Targeted measures are needed to improve the detection, treatment, and control of high BP in Newfoundland and Labrador. Community pharmacists can support BP care.

Méthodologie : La collecte des données et les mesures ont eu lieu le 17 mai 2022. Les pharmaciens aidés par des étudiants en pharmacie ont pris 3 relevés en position assise par participant à l'aide d'un dispositif de mesure automatisé. La moyenne des 2 derniers relevés a été utilisée pour obtenir la PA estimative. La PA était considérée comme élevée si les valeurs étaient égales ou supérieures à 140/90 mmHg, ou à 130/80 mmHg chez les personnes diabétiques. D'autres renseignements ont été recueillis, notamment les caractéristiques démographiques des participants, leur accès aux soins primaires, leurs antécédents médicaux et leur prise d'antihypertenseurs. Les données ont ensuite été analysées à l'aide de statistiques descriptives et de techniques de régression logistique.

Résultats : Au total, 460 participants ont été inclus dans l'analyse. L'âge moyen était de 56,3 ans (écart-type : 16,95); 63,3 % (n = 291) étaient de sexe féminin et 43,7 % (n = 201) ont indiqué être atteints d'hypertension. Une PA élevée a été observée chez 27 % des participants (n = 123), dont 41,5 % (n = 51) qui n'avaient jamais reçu un diagnostic d'hypertension artérielle. L'âge, le sexe et le diabète se sont avérés des facteurs de prédiction de PA élevée statistiquement significatifs dans un modèle multivarié.

Conclusions : Un pourcentage important des participants à notre étude présentait une PA élevée. Des mesures ciblées s'imposent pour mieux dépister, traiter et maîtriser l'hypertension artérielle à Terre-Neuve-et-Labrador. Les pharmaciens de proximité pourraient également jouer un rôle dans la surveillance de la PA.

to raise awareness about the risks associated with elevated BP and to gain a better understanding of BP levels and BP control among adults in NL, we partnered with Hypertension Canada and the Pharmacists' Association of NL (PANL) to offer BP screening by community pharmacists on World Hypertension Day in 2022. Community pharmacists are one of the most accessible groups of healthcare providers who are present in most rural and urban communities across the province. Furthermore, substantial research evidence demonstrates the ability of pharmacists to effectively detect, monitor, and help manage cases of high BP in the community setting.[15-19]

Methods

Study design and setting

We conducted a cross-sectional (descriptive) study of adult BP levels in communities throughout NL on May 17, 2022 (World Hypertension Day). A total of 32 community pharmacies served as data-collection sites for this study, including chains (eg, Shoppers Drug Mart, Lawtons Drugs), banner programs (eg, PharmaChoice Pharmacies, Pharmasave), and independent pharmacies. Pharmacies were located in all 4 health regions of the province.

Participants

All residents of NL age ≥ 18 years were eligible to take part in this study. No exclusion criteria were applied. Individuals interested in taking part in the study could visit one of the study sites (ie, pharmacies) on World Hypertension Day. Participants did not have to be a regular patient of the pharmacy or have a diagnosis of hypertension to take part in this study; in fact, the recruitment of patients who have prescriptions filled at the pharmacy for hypertension was discouraged. All participants were provided with a study information letter, and verbal consent was obtained from each participant prior to enrollment.

Recruitment

We used a comprehensive media campaign to recruit participants, including outreach via television, radio, and social media outlets. For example, 115 "shares" of the study poster were made on Facebook, with a total of 34,302 user interactions. The study poster was distributed by our partner organizations (PANL and Hypertension Canada) and pharmacies. The poster included a Web link to the list of research sites (ie, pharmacies), including the pharmacy address, telephone number, and hours of data collection and BP measurement. To incentivize participation, we offered participants the opportunity to take part in a lottery to win 1 of 10 CAD$100 gift cards.

Data collection

Study data were collected and managed using the Research Electronic Data Capture (REDCap) tool hosted at the University of Alberta. REDCap is a secure, Web-based software platform designed to support data capture for research studies.[20,21] The following demographic characteristics were reported by participants: age, sex, gender, race and ethnicity, and first 3 digits of their postal code. We collected information on these specific demographic characteristics for a couple of different reasons: (i) sex and gender are important considerations when examining the occurrence of elevated BP in a population[22]; (ii) racial and ethnic disparities in the prevalence of hypertension have been documented in the literature[23]; and (iii) rurality has been shown to influence a number of health indicators, including the presence of high BP, in a

population.[24] We applied the Government of NL Rural Lens tool, which essentially defines "rural" as characterizing all communities outside the Northeast Avalon,[25] a categorization that can be used when determining whether a residence is rural or urban based on the first 3 digits of a participant's postal code. Other data variables reported by participants included the following: (i) access to a primary care physician (PCP) or nurse practitioner (NP); (ii) relevant medical conditions (hypertension, heart disease, diabetes, chronic kidney disease); and (iii) current prescriptions for antihypertensive medications. Three BP readings, taken when participants were seated, were also obtained from each participant. The average of readings 2 and 3 was used to determine BP. The majority of pharmacies engaged in data collection from 9 AM to 5 PM.

BP measurement

The research team supplied each pharmacy with an automated office BP device recommended by Hypertension Canada. BP measurement was completed by a pharmacist or pharmacy student, after the participant had been sitting at rest for at least 5 minutes, and the procedures recommended by Hypertension Canada were followed.[26] Elevated BP was defined as an average BP $\geq$ 140/90 mm Hg, or $\geq$ 130/80 mm Hg for individuals with diabetes.

Pharmacist training and care

All pharmacists and pharmacy students completed the virtual, short course on accurate BP measurement offered by the Pan American Health Organization,[27] and a 2-hour training session with the research team. Consistent with the provincial scope of practice for pharmacists, a thorough patient assessment, including assessment of automated office BP device readings, relevant health conditions, and medication therapies, was performed. Although this study was not an intervention, we offered pharmacists guidance on referral and management strategies for participants with elevated BP, as follows: (i) refer participants to their PCP or NP for follow-up and assessment; (ii) refer participants to emergency services if they met the criteria for hypertensive urgency, described by Hypertension Canada as systolic blood pressure (SBP) $\geq$ 180 mm Hg or diastolic blood pressure (DBP) $\geq$ 110 mm Hg; and (iii) adjust the dose of an existing antihypertensive medication, as appropriate, and in agreement with provincial pharmacy regulations.[28] For participants who required referral and did not have a regular PCP or NP, the pharmacist connected them with the nearest walk-in or virtual care clinic. Patient education resources, supplied by Hypertension Canada, also were made available to participants.

Sample size

The target sample size for this study was 956 participants. Sample size was calculated using the formula for frequency in a population with an estimated population size of 420,000 residents aged $\geq$ 18 years,[29] an assumed prevalence of elevated BP of 34%,[30] and a 3% margin of error at a confidence level of 95%.

Data analysis

Data were exported from REDCap and analyzed using SAS 9.4 software (SAS Institute, Cary, NC). We included data in the analysis for only those participants with BP readings 2 and/or 3 recorded in REDCap. We calculated a participant's BP using the average of readings 2 and 3; if one of those readings was missing, we used the available reading (ie, reading 2 or 3) to estimate BP. Participant characteristics, as well as the proportion of patients with elevated BP, are presented using descriptive statistics. Logistic regression techniques were used to examine the relationship between participant characteristics (ie, independent variables) and the presence of elevated BP (ie, the binary dependent variable), defined as BP $\geq$ 140/90 mm Hg, or $\geq$ 130/80 mm Hg for individuals with diabetes. First, univariable analyses were performed to identify factors of significance at a level of $P < 0.05$. Variables that were found to be statistically significant in the univariable analyses, as well as those that were considered clinically significant, were included in the multivariable model. Odds ratios with associated 95% confidence intervals are reported, and statistical significance was defined as $P < 0.05$. The final model goodness of fit (C-statistic) is also reported.

Results

A total of 487 participants took part in the study. However, data from one site were discarded due to provider nonadherence to the BP measurement protocol. In addition, BP readings 2 and 3 were not recorded in REDCap for one participant, and therefore, data for this participant were not included. As a result, data from a total of 460 participants were included in the analysis. The mean age of participants was 56.4 years (standard deviation [SD] = 16.95); 63.3% (n = 291) were female; 55.2% (n = 254) were living in a rural area of the province; and 10.4% (n = 48) did not have access to a PCP or NP. In our sample, 43.7% of participants (n = 201) reported having a known diagnosis of hypertension, and of these, 89.6% (n = 180) were prescribed antihypertensive therapy. Further details regarding participant characteristics are presented in Table 1.

The mean SBP in our sample was 128 mm Hg (SD = 16.54; range = 92 to 190 mm Hg), and the mean DBP was 74 mm Hg (SD = 9.44; range = 51 to 115 mm Hg). A total of 123 participants, or 26.7% of our sample, had elevated BP. Of the participants with elevated BP, 58.5 % (n = 72) reported having been previously diagnosed with hypertension. In other words, 35.8% of participants with known hypertension (ie, 72 of 201 participants) had elevated BP. The other 51 participants with elevated BP reported having no previous diagnosis of hypertension. Three participants met the criteria for hypertensive urgency (ie, SBP $\geq$ 180 mm Hg or DBP $\geq$ 110 mm Hg) and reported having no previous diagnosis of hypertension. Furthermore, 46.2% of participants with diabetes (n = 36) had BP above the recommended target of 130/80 mm Hg.

The relationship between participant characteristics and the dependent variable, elevated BP, is presented in Table 2, with older age, male sex, known hypertension, and the presence of diabetes being statistically significant. These 4 variables were entered into the multivariable model, as well as access to a PCP or NP, and the presence of diabetes, heart disease, and chronic kidney disease. Age, male sex, and diabetes remained statistically significant (see Table 3), with a C-

Table 1. Participant characteristics (n = 460)

Characteristic	Frequency, n (%)
Age, y*	
Mean (SD)	56.3 (16.95)
18–39	87 (19.0)
40–49	57 (12.4)
50–59	93 (20.3)
60–69	109 (23.8)
≥ 70	112 (24.5)
Sex	
Female	291 (63.3)
Male	169 (36.7)
Gender	
Woman	291 (63.3)
Man	169 (36.7)
Rural residence	254 (55.2)
Ethnicity	
Black	0
East/South East Asian	3 (0.7)
Indigenous	11 (2.4)
Mixed	22 (4.8)
South Asian	1 (0.2)
White	419 (91.1)
Other	2 (0.4)
Prefer not to answer	1 (0.2)
Attached to a PCP or NP	412 (89.6)
Medical conditions	
Hypertension	201 (43.7)
Diabetes	78 (17.0)
Heart disease	55 (12.0)
Chronic kidney disease	6 (1.3)

NP, nurse practitioner; PCP, primary care physician; SD, standard deviation.

*n = 458 due to 2 missing results.

statistic of 0.739. Individuals with diabetes were 3.5 times more likely to have elevated BP than were those without it. The predicted probability of elevated BP for male sex (Fig. 1A) and diabetes (Fig. 1B) increases with each passing decade.

Discussion

The results of our cross-sectional study provide important insights into the frequency of elevated BP in communities throughout NL. We found that 27% of those screened had elevated BP. This finding is important because the detection of elevated BP is the first step toward better hypertension care and reductions in CV risk,[31] and in bleeding risk in patients

Table 2. Relationship between participant characteristics and elevated blood pressure*

Characteristic	Odds ratio (95% CI*)	*P*
Age	1.044 (1.029–1.060)	< 0.0001
Female sex	0.479 (0.315–0.730)	0.0006
Rural residence	1.317 (0.866–2.004)	0.1982
Has a PCP or NP	1.106 (0.556–2.203)	0.7737
Medical conditions		
Hypertension	2.276 (1.495–3.467)	0.0001
Diabetes	4.335 (2.608–7.207)	< 0.0001
Heart disease	1.481 (0.816–2.690)	0.1965
Chronic kidney disease	1.376 (0.249–7.609)	0.7144

CI, confidence interval; NP, nurse practitioner; PCP, primary care physician.

*Univariable analysis.

Table 3. Factors associated with elevated blood pressure*

Factor	Odds ratio (95% CI*)	*P*
Age	1.037 (1.020–1.055)	< 0.0001
Female sex	0.523 (0.331–0.827)	0.0056
Diabetes	3.452 (1.935–6.156)	< 0.0001

CI, confidence interval.

*Multivariable analysis.

prescribed anticoagulants.[5,6] Early detection, treatment, and control of high BP offers significant benefits to individuals and communities.[7,32] In fact, healthcare initiatives aimed at achieving BP control through the combination of lifestyle and medication therapy have been described as cost-effective or cost-saving when they are applied to individuals at moderate to high CV risk.[7]

The findings of our research suggest that the prevalence of elevated BP among individuals with known hypertension in our province is relatively high. More than one-third of participants in our study with known hypertension had BP levels above the recommended treatment targets set by Hypertension Canada,[26] a percentage greater than the national population estimates of 21% reported as part of the most recent Canadian Health Measures Survey.[33] Surprisingly, the majority of participants in our study (ie, almost 90%) reported having access to a PCP or NP. This finding suggests that the COVID-19 pandemic may have influenced the number of office visits for BP measurement and monitoring, and it is consistent with the concern expressed by healthcare professionals that individuals with high BP have not been managing their condition adequately due to the pandemic.[8] However, at least 2 important considerations apply when interpreting these results: (i) out-of-office BP measurement is the preferred method for monitoring BP[26,34]; and (ii) a time-series analysis of adult BP levels pre- and post-pandemic is needed to better understand the impact of COVID-19 on rates of hypertension control. Furthermore, a point that should be acknowledged is that the responsibility for hypertension care should not rest on the shoulders of one single PCP. Rather, collaborative and interdisciplinary approaches to care, including the patients and their preferences, are needed to achieve BP targets and improve health outcomes.[8]

Another important finding is that nearly 20% of the participants in our study who reported having no prior diagnosis of hypertension had elevated BP. Indeed, a noteworthy point is that this 1-day opportunistic screening initiative was able to uncover a total of 50 participants who required further assessment and/or referral for high BP. Three of these participants met the criteria for hypertensive urgency and were referred to the nearest emergency room. However, we expected the total number of participants in this group to be higher, as the national prevalence of hypertension unawareness is approaching 29%.[33] This low number of participants who met the urgency criteria may have been due to the small number of participants aged 18-39 years in our sample, which may have resulted from data collection being conducted during working hours on a single day; other studies have reported high levels of hypertension unawareness among adults aged less than 40 years.[34,35] Despite these unexpected results, the findings of our study lend support for the critical need for annual hypertension awareness campaigns, as well as highly

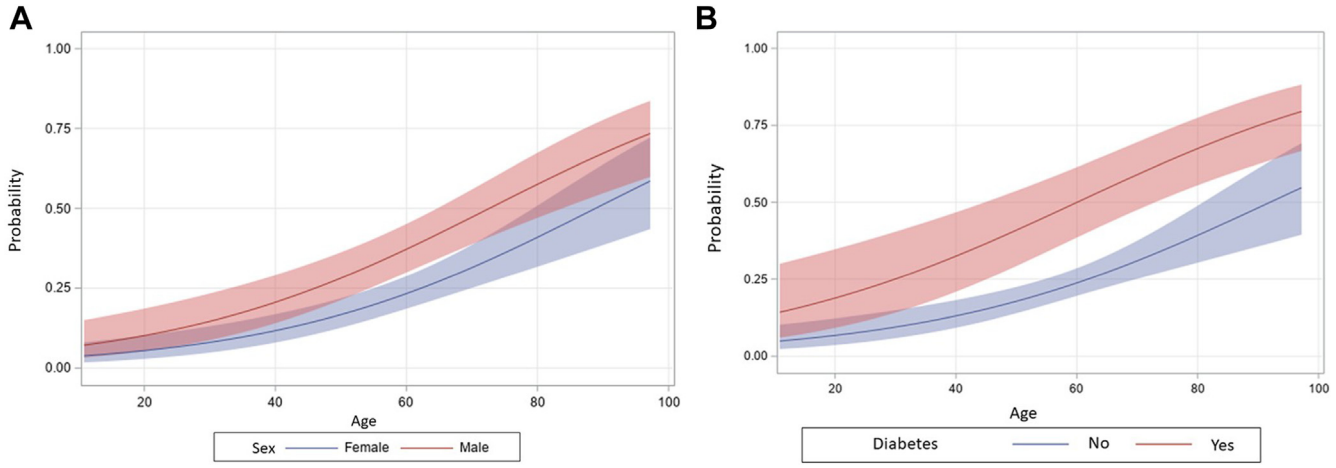

Figure 1. Predicted probability of elevated blood pressure according to (**A**) sex and (**B**) diabetes status.

accessible, community-based BP screening programs to reach people with unknown high BP that may otherwise go undetected.[8,35] Models such as the National Health Service (United Kingdom) pharmacy hypertension case-finding service, which remunerates pharmacists for BP screening and conducting 24-hour ambulatory BP measurement,[36] may provide a reasonable strategy as a starting point.

Finally, our research provides further evidence to support the need for targeted measures to reduce BP in patients with diabetes. Just under half of the participants in our study with diabetes had BP greater than the recommended target of 130/80 mm Hg.[26,37] Participants with diabetes were 3.5 times more likely to have elevated BP. We also observed a higher predicted probability for elevated BP among individuals with diabetes in each decade of life (see Fig. 1B). This finding is concerning, as CV disease is a leading cause of premature morbidity and mortality in patients with diabetes.[37] Our research suggests that community pharmacists may be able to help address this phenomenon by offering BP screening to individuals with diabetes. Other researchers have reported that individuals with diabetes tend to be regular users of pharmacy services and frequently visit their pharmacy.[38] Researchers at the University of Alberta have reported that pharmacists can engage patients with diabetes effectively, in hypertension case-finding, and intervene to reduce CV risk.[19,39] Thus, BP screening by pharmacists as part of routine follow-up care for patients with diabetes may, therefore, offer significant benefit to individuals and the healthcare system. Community pharmacists are uniquely positioned to support patients in achieving their BP targets, through the provision of lifestyle advice and/or medication therapy.

Strengths and limitations

Our study has notable strengths. By partnering with PANL, we were able to engage a large number of community pharmacy sites in BP screening and data collection in each health region of the province. In addition, we were able to raise awareness about high BP and screen nearly 500 residents of NL using a comprehensive province-wide media campaign. We are not aware of any other regional, national, or international community pharmacy–based BP screening initiatives that have achieved such high rates of participation for a single day of screening.

Our study has several limitations. The proportion of participants in our study who had elevated BP should not be interpreted as a true estimate of its population prevalence, as convenience sampling was used.[40] We accounted for non-probability sampling in our calculation of sample size by using a 3% margin of error; however, we did not reach our target sample size of 956 participants. However, given our goal of raising awareness about the risks associated with high BP and our desire to offer BP screening to all interested residents of the province, probability sampling was not deemed appropriate. Another point that should be acknowledged is that data on medical and medication history were self-reported by participants (as they are in most screening studies), possibly introducing elements of reporting bias. BP screening and data collection occurred on a single day, with the majority of sites taking part in data collection from 9 AM to 5 PM. This time period may have excluded individuals, such as middle-aged adults, who are working during these hours. As discussed previously, adults aged <40 years are an important population group who often present with hypertensive urgency or emergency.[3,34] Possibly, more cases of hypertension unawareness and hypertensive urgency would have been uncovered if screening had been more accessible to this prospective participant group. In future research, we will certainly account for this observed result and adjust our methods of data collection accordingly. Furthermore, we acknowledge that a single set of BP measurements is not adequate for establishing a diagnosis of hypertension, as "white-coat" hypertension or masked hypertension may be present; nevertheless, the identification of elevated BP via community-based screening is a starting point. Another possibility is that we may have missed some cases of elevated BP as a result of not using SBP $\geq$ 120 mm Hg as the target for individuals at high CV risk.[26] Given our focus on the general public, rather than patients who regularly have prescriptions filled at one of the pharmacy research sites, we were unable to access health information that would allow calculation of CV risk. As a result, the total number of participants who were identified as having elevated BP in our study is likely an

underestimate of the total number who actually had elevated BP. Finally, although we did have sites involved in data collection from each of the province's health regions, due to time constraints associated with obtaining community approvals, we were not able to include pharmacies in Labrador in the data collection. As a result, the findings reported here may not be generalizable to Labrador specifically.

Conclusion

A relatively large proportion of participants in our study had elevated BP, including those with no prior diagnosis of hypertension. Furthermore, uncontrolled BP was a relatively common finding among those with known hypertension in our sample. This finding suggests that targeted measures are needed, by ministries of health, local health administrators, and healthcare professionals, to improve the detection, treatment, and control of high BP in the community. Pharmacists are healthcare providers who are accessible in the community to support BP screening and treatment initiatives.

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Ethics Statement

Ethics approval for this project was obtained from the NL Health Research Ethics Board (HREB #2022.069).

Patient Consent

The authors confirm that patient consent was obtained for this article.

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