Journal of Student-Run Clinics
Original Study

Student-Led Blood Pressure Clinics: A Community-Level Intervention to Improve Blood Pressure Health Literacy Among Adults Living in Northern Ontario

Emma Harland[1]; Claire Poulin[1]; Laura Schmanda[1]; Emily Hunt[1]; Kallie Ritchie[1]; Susan Powell[1]; Gayle Adams-Carpino, PhD, MSW[1]

[1]Northern Ontario School of Medicine University, Thunder Bay, Ontario, Canada

Corresponding Author: Emma Harland; email: harlandemma@gmail.com

Published: February 24, 2026

Abstract

Background: High blood pressure affects approximately 25% of the Canadian population and is implicated in several poor health outcomes. Limited health literacy is a well-documented barrier to blood pressure control. Evidence suggests that targeted educational interventions delivered through student-run free clinics can improve health literacy and hypertension-related outcomes. However, there is a paucity of data examining the effectiveness of mobile, student-led blood pressure clinics in rural and northern Canadian contexts. This study evaluates whether participation in student-led blood pressure clinics is associated with improvements in hypertension-related health literacy in Northern Ontario.

Methods: Blood pressure clinics were held at four different publicly accessible sites in Thunder Bay, Ontario. A total of 110 participants were presented with a survey before and after their participation in an educational intervention centered on hypertension. Pre- and post-test scores were compared, and linear regression analyses were conducted to assess relationships between scores and sociodemographic.

Results: A total of 110 participants were included. A significant increase in post-test scores across all domains was observed ($p<0.05$ was considered statistically significant). Linear regression analyses revealed that income and previous diagnosis of hypertension were significant predictors of pre-test performance, income and education level were significant predictors of post-test performance, and education was a significant predictor of percent score improvement.

Conclusions: This study highlights the effectiveness of a student-led educational intervention designed to improve hypertension health literacy among community members in Thunder Bay, ON. The findings suggest that structured, student-led education can enhance blood pressure related knowledge and may encourage hypertension prevention and/or more effective blood pressure management. This pop-up clinic model offers a scalable framework for other student-run free clinics to adopt, providing them with a practical approach to addressing hypertension-related health literacy disparities in their own communities.

Introduction

Hypertension affects approximately 25% of Canadians and is a major modifiable risk factor for stroke, myocardial infarction, and kidney failure.[1,2] While effective management through lifestyle changes and medication can reduce associated risks, many individuals face challenges in making and sustaining healthy behaviour changes. Limited health literacy is a well-documented barrier to hypertension control.[2,3]

Health literacy, defined as the ability to access, understand, evaluate, and apply health information, is critical for effective self-care and improved clinical outcomes.[4] Nearly 60% of Canadian adults have low health literacy which is associated with higher blood pressure readings, poorer medication adherence, and worse hypertension outcomes.[5-8] Additional social determinants such as age, education level, and cultural background further exacerbate challenges associated with accessing health care and maintaining health.[6,8-12]

Student-run free clinics (SRFCs), such as Compass North in Northern Ontario, play a vital role in addressing health disparities. This region faces unique health and social challenges, primarily stemming from its sprawling geography, physician and health professional shortages, and limited social and economic opportunities. Through a pop-up clinic model, Compass North aims to empower individuals to better understand hypertension, make informed lifestyle choices, and engage more actively in managing their health. Evidence suggests that this approach to preventive care services can be more effective than structured or scheduled services in increasing preventative health engagement.[13,14]

Targeted educational interventions delivered through SRFCs have been shown to improve health literacy, hypertension management, and overall patient outcomes.[15,16] A systematic review found that such interventions were particularly effective among individuals with comorbid conditions such as diabetes or obesity, suggesting that patients with existing health burdens may derive greater benefit.[17] While much of the literature focuses on SRFCs integrated into fixed-location primary care models, emerging evidence supports the value of mobile or pop-up formats. For example, an SRFC hosting pop-up clinics in Australia reported that users felt empowered and motivated to improve their health following their appointment.[16] The present study aims to build on prior SRFC research to assess whether student-led blood pressure clinics can effectively enhance hypertension-related health literacy in Northern Ontario.

Methods

Authors created a brochure (Appendix A) and a ten-minute education session based on Hypertension Canada's 2020 Comprehensive Guidelines.[18] The education session covered the definition of hypertension, causes and consequences of hypertension, ways to lower blood pressure, and how to measure blood pressure. Participants completed a questionnaire before and after the education intervention which included four demographic questions (Appendix B) and 14 questions (Appendix C) to assess knowledge of blood pressure. The questions were based on the validated Hypertension Evaluation Lifestyle and Management (HELM) Knowledge Scale.[19]

Pre- and post-test scores were calculated. One point was assigned for each correct answer. Incorrect answers, questions left blank, and responses where multiple answers were selected were assigned a score of zero. A paired t-test was then completed to determine the statistical significance between the pre- and post-intervention test performance. Linear regression analyses were conducted to examine relationships between demographics and outcome measures, including pre-test scores, post-test scores, and percent change in scores from pre-test to post-test. Standard errors were calculated to assess the variability of coefficients, t-values to evaluate the statistical significance of predictor variables, and p-values (with a threshold of 0.05) to determine the strength of evidence against the null hypothesis. This approach allowed for the assessment of the direction and strength of associations with each outcome. JASP was used to perform statistical analyses (JASP Version 0.95.1, JASP Team, Amsterdam, Netherlands).

A total of nine pop-up clinics, two to three hours in length, were held between April and July of 2024. Sites included a mall, soup kitchen, academic centre, and an older adult recreational centre. Sites were selected based on Compass North's existing partnerships and an attempt to reach a diverse population. Inclusion criteria required participants to be above the age of 18, currently living in Northern Ontario, and English speaking. Participants were recruited using promotional flyers as well

as in-person. Clinic attendees were permitted to have their blood pressure measured regardless of whether they participated in the study. Ethics approval for this study was obtained from the Lakehead University Research Ethics Board. Participation in this study was voluntary, and informed consent was provided by each participant.

Results

A total of 110 individuals participated. As observed in Table 1, gender distribution indicates that 57.3% of participants identified as female and 42.7% as male. The majority of participants (54.6%) were 65 to 84 years old, followed by those aged 45 to 64 years old (22.2%), and those aged 85 and older (16.7%). Most participants (60.9%) have completed postsecondary education, while only a small proportion (4.5%) have less than a high school diploma. Regarding family income, 34.8% of participants earn between $50,000 and $74,000 annually, with 18.0% of participants earning under $24,000 and 5.4% earning over $100,000. Additionally, the majority (80.9%) have a healthcare provider and half of the sample (50.0%) have high blood pressure.

The average pre-test score (57.3%) seen in Figure 1 is lower than the average post-test score (71.2%), indicating an improvement in performance following the intervention. The data has a t-value of 5.627 with 109 degrees of freedom (df) indicating a notable difference between the pre-test and post-test scores. The p-value of the paired t-test is less than 0.001, thus the difference is statistically significant. The mean difference between the scores is 13.961, suggesting that on average, the post-test scores were 13.961 percentage points higher than the pre-test scores. Lastly, the Cohen's *d* of 0.536, a measure of effect size, signifies that the increase in scores is moderate and meaningful.

Domain 1 average increased from 59.4% (pre-test) to 68.8% (post-test) as seen in Table 2. Most questions within this domain showed improvement, particularly questions 1, 3, 4, 5, and 6; although question 2 showed no improvement. Domain 2 average increased from 56.9% to 73.5% with questions 8, 9, and 11 showing notable improvements. Notably, questions 4 and 5 were the lowest and highest scoring questions, respectively, in the pre-test assessment. Question 5 remained the highest-scoring question in the post-test assessment. Finally, Domain 3 average improved from 56.1% to 67.6%. Significant predictors of pre-test score performance include income ($p = 0.028$) and previous diagnosis of hypertension ($p = 0.010$), while age, gender, and education level do not show significant effects. Significant predictors of post-test performance include income ($p = 0.038$) and education level ($p = 0.028$). Education level is the only significant predictor ($p = 0.044$) of positive percent change in score. Variables, including income, age, gender, and previous diagnosis of hypertension, show no significant association with change in test scores.

Figure 1. Pre-Test Average Score vs. Post-test Average Score (N=110)

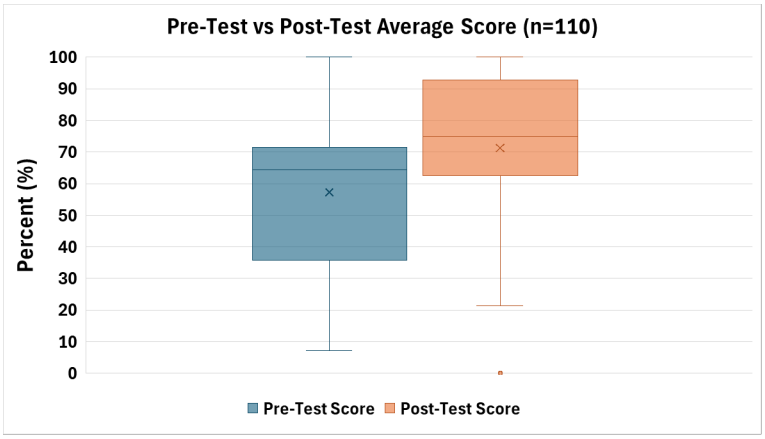

Figure 1 displays the average pre-test and post-test scores, with data ranges beyond the first and third quartiles indicated by the whiskers. Outliers are identified by a dot (0 assigned for incomplete post-test surveys). "X" represents the mean.

Table 1. Sociodemographic characteristics of participants (N=110)

Characteristic	N	n	%
Gender			
Female	110	63	57.3
Male	110	47	42.7
Other	110	0	0.0
Age			
18 to 24 years	108	2	1.9
25 to 44 years	108	5	4.6
45 to 64 years	108	24	22.2
65 to 84 years	108	59	54.6
85 years and over	108	18	16.7
Highest Level of Education			
Less than secondary (high) school graduation	110	5	4.5
Secondary (high) school diploma or equivalency certificate	110	22	20.0
Some postsecondary education	110	16	14.5
Postsecondary certificate, diploma, or degree	110	67	60.9
Family Income			
Under $24,000 (including loss)	92	17	18.5
$25,000 to $49,000	92	20	21.7
$50,000 to $74,000	92	32	34.8
$75,000 to $99,000	92	18	19.6
$100,000 and over	92	5	5.4
Have a Primary Health Care Provider			
Yes	110	89	80.9
No	110	21	19.1
Other	110	0	0.0
Have Diagnosed High Blood Pressure			
Yes	110	55	50.0
No	110	53	48.2
Transient elevation during hospitalization for an acute illness	110	2	1.8

This table presents the sociodemographic characteristics of the study participants. N= total number of participants that answered the question; n = number of participants that answered the category.

Discussion

Participants in this study were generally older, had lower household incomes, and were more educated compared to regional averages. Participants also reported reduced access to healthcare providers and a markedly higher prevalence of diagnosed hypertension, with 50% reporting high blood pressure compared to 16% of Ontario residents.[20] The demographic characteristics of participants were found to have associations with pre-test performance, post-test performance, and percent change in scores. Higher income and previous diagnosis of hypertension were significant predictors of pre-test performance. This finding is consistent with existing literature, as lower income is often associated with reduced health literacy and limited comprehension of health-related information.[21]

Table 2. Domain and Question Performance (N=110)

Domain	Question #	Pre-Test Mean (%)	Post-Test Mean (%)	Domain Pre-Test Mean (%)	Domain Post-Test Mean (%)
General Hypertension Knowledge	1	73.6	84.5	59.4	68.8
	2	68.2	68.2		
	3	36.4	53.6		
Lifestyle and medication management	4	32.7	55.5	56.9	73.2
	5	84.5	93.6		
	6	36.4	60.9		
	7	78.2	85.5		
	8	43.6	69.1		
	9	50	68.2		
	10	71.8	81.8		
	11	58.2	73.6		
Monitoring and setting goals	12	82.7	87.3	56.1	67.6
	13	50	65.5		
	14	35.5	50		

Note. Table 2 presents the mean pre-test and post-test scores across three domains: general hypertension knowledge, lifestyle and medication management, and monitoring and setting goals.

Individuals with higher income and a prior diagnosis may have had previous access to hypertension specific education thus enhancing their baseline knowledge. Income and education were significant predictors of post-test performance, suggesting that these individuals were more responsive to the education intervention. This result was not unexpected given the known positive relationship between income and literacy.[21] Moreover, education confers cognitive benefits, particularly as one ages.[22] This may therefore explain the high post-test performance among those more highly educated and the limited association of age with both pre- and post-test performance. Interestingly, education level emerged as the only significant predictor of positive percent change in test scores. This suggests that while baseline disparities exist, educational attainment plays a crucial role in knowledge gain, potentially offsetting some of the effects of socioeconomic disadvantage.

In this study, Domain 1 (general hypertension knowledge) showed moderate improvement post-test. This result is not unexpected given that the educational brochure contained a dedicated section detailing the definition of hypertension, as well as its clinical manifestations and consequences. Notably, 84% of participants correctly identified the definition of hypertension. This closely aligns with a study by Oliveria et al. wherein they surveyed participants with known hypertension and found that 81.8% of the study sample knew what the term hypertension meant.[23] Question 2 did not show improvement suggesting that the intervention did not help participants identify that individuals with hypertension may be asymptomatic. Future sessions should emphasize this beyond listing possible symptoms. Understanding key concepts related to the definition of hypertension, as well as symptoms of hypertension are important to promote early detection and treatment, symptom recognition in acute situations, and improved health management.

The most significant domain improvement was observed in Domain 2 (lifestyle and medication management). Again, this result may be attributed to the dedicated content of the brochure and didactic teaching covering the tested topics. SRFCs seeking health education ideas may consider prioritizing lifestyle and medication management given the results suggest that participants

had reduced baseline knowledge in this area and responded well to the education intervention. Interestingly however, question five was the highest scoring question pre- and post-intervention suggesting that participants already had a strong baseline understanding that regular exercise does not entirely negate the necessity of anti-hypertensive medications.

Domain 3 also showed meaningful gains. Notable improvements in questions related to monitoring and goal setting suggest that the intervention helped participants better understand how to track their health metrics and set achievable targets, key components of effective hypertension management. During the education session, participants were provided with a chart displaying the breakdown of blood pressure targets for patients with different comorbidities. This component of the education may explain the improvements observed in participant understanding of blood pressure monitoring and goal setting.

Overall, the results indicate that the intervention was successful in enhancing knowledge and skills across all measured domains, with the greatest impact seen in lifestyle and medication management. These improvements are critical, as better management of lifestyle factors and adherence to medication are well-established strategies for controlling hypertension and reducing associated health risks.[18] Therefore, student-led educational interventions focused on hypertension education, delivered in association with public blood pressure clinics, may improve the blood pressure health-literacy of adults.

Adoption of this pop-up model should be considered by other SRFCs. SRFCs may even consider establishing a dedicated team to host regular pop-up clinics with community partners. Moreover, with social accountability now a key accreditation requirement for many health programs, this model presents a compelling approach for educators seeking to enhance student learning while addressing community health needs.

Limitations

This study has several limitations. Firstly, the small sample size limits the generalizability of the results. Moreover, the population is not representative of the greater population of Northern Ontario, as identified in the discussion. This may be attributed to the few and specific sites that were selected to conduct the study. Future studies may choose a wider variety of public locations to enhance participant diversity.

Self-selection, recency, and surveyor bias are additional limitations of this study. Participants who selected themselves to participate may have been more motivated and engaged than those who did not participate; this attitude may have resulted in the participants being more receptive to the intervention. Individuals who chose to participate may also have had greater confidence in their blood pressure knowledge at baseline, making them more inclined to engage in the study. In addition, the educational intervention was provided only in English, restricting the inclusion of non-English speakers which comprise a significant portion of Northern Ontario's population. Future blood pressure clinics should consider translating resources to French and Ojibway.

Environmental factors, such as background noise, occasionally hindered participants' ability to focus. Additionally, the proximity of the educational intervention to pre-test takers may have led to inadvertent exposure to information, potentially influencing pre-test scores. Selecting sites more strategically and adjusting table orientation could help mitigate these issues. It should also be acknowledged that the closed-ended HELM Knowledge Scale may not have fully captured nuanced knowledge levels.

Conclusions

In conclusion, this study highlights the effectiveness of a student-led educational intervention designed to improve hypertension health literacy among adults in Northern Ontario. The findings

suggest that structured, student-led education can enhance blood pressure-related knowledge and may encourage hypertension prevention and/or more effective management. Adoption of this community outreach pop-up model may be considered by other SRFCs.

Acknowledgements

We extend our gratitude to Mrs. S. Powell and Dr. Gayle Adams-Carpino for their invaluable guidance and support throughout this research. We also thank Compass North, the student-led health outreach organization, for their collaboration. Finally, we are deeply appreciative of the study participants for their time and contributions.

Disclosures

The authors have no conflicts of interest to disclose.

References

1. Mills KT, Stefanescu A, He J. The global epidemiology of hypertension. *Nat Rev Nephrol*. 2020;16(4):223-237. doi:10.1038/s41581-019-0244-2.LINK
2. Leung AA, Bell A, Tsuyuki RT, Campbell NRC. Refocusing on hypertension control in Canada. *CMAJ*. 2021;193(23):E854-E855. doi:10.1503/cmaj.210140 LINK
3. Choudhry NK, Kronish IM, Vongpatanasin W, et al. Medication adherence and blood pressure control: A scientific statement from the American Heart Association. Hypertension. 2022;79(1):e1-e14. doi:10.1161/HYP.0000000000000203 LINK
4. Liu C, Wang D, Liu C, et al. What is the meaning of health literacy? A systematic review and qualitative synthesis. *Fam Med Community Health*. 2020;8(2):e000351. doi:10.1136/fmch-2020-000351 LINK
5. Canadian Council on Learning. Health Literacy in Canada: Initial Results from the International Adult Literacy and Skills Survey. September 2007. Accessed 10 Nov 2024. LINK
6. McNaughton CD, Kripalani S, Cawthon C, Mion LC, Wallston KA, Roumie CL. Association of health literacy with elevated blood pressure: a cohort study of hospitalized patients. *Med Care*. 2014;52(4):346-353. doi:10.1097/MLR.0000000000000101 LINK
7. Halladay JR, Donahue KE, Cené CW, et al. The association of health literacy and blood pressure reduction in a cohort of patients with hypertension: The heart healthy lenoir trial. *Patient Educ Couns*. 2017;100(3):542-549. doi:10.1016/j.pec.2016.10.015 LINK
8. Mohd Isa D, Shahar S, He FJ, Majid HA. Associations of health literacy with blood pressure and dietary salt intake among adults: a systematic review. *Nutrients*. 2021;13(12):4534. Published 2021 Dec 17. doi:10.3390/nu13124534 LINK
9. McNaughton CD, Jacobson TA, Kripalani S. Low literacy is associated with uncontrolled blood pressure in primary care patients with hypertension and heart disease. *Patient Educ Couns*. 2014;96(2):165-170. doi:10.1016/j.pec.2014.05.007 LINK
10. Warren-Findlow J, Coffman MJ, Thomas EV, Krinner LM. ECHO: A pilot health literacy intervention to improve hypertension self-care. *Health Lit Res Pract*. 2019;3(4):e259-e267. Published 2019 Dec 5. doi:10.3928/24748307-20191028-01 LINK
11. Du S, Zhou Y, Fu C, Wang Y, Du X, Xie R. Health literacy and health outcomes in hypertension: An integrative review. *Int J Nurs Sci*. 2018;5(3):301-309. Published 2018 Jun 9. doi:10.1016/j.ijnss.2018.06.001 LINK
12. Hall E, Lee SY, Clark PC, Perilla J. social ecology of adherence to hypertension treatment in latino migrant and seasonal farmworkers. *J Transcult Nurs*. 2016;27(1):33-41. doi:10.1177/1043659614524788 LINK
13. Roberts DJ, de Souza VC. A venue-based analysis of the reach of a targeted outreach service to deliver opportunistic community NHS Health Checks to 'hard-to-reach' groups. *Public Health*. 2016;137:176-181. doi:10.1016/j.puhe.2016.03.004 LINK
14. Trivedy C, Vlaev I, Seymour R, Philpott M. An evaluation of opportunistic health checks at cricket matches: the Boundaries for Life initiative. *Sport in Society*. 2016;20(2):226-234. doi:10.1080/17430437.2016.1173919 LINK
15. Short HB, Guare EG, Spanos K, et al. The impact of a student-led health education clinic on the health literacy and behaviors of a rural community in the state of Pennsylvania, USA. *J Community Health*. 2024;49(3):458-465. doi:10.1007/s10900-023-01306-5 LINK
16. Coombs NM, Sewell L, Jackson MR, Borgelt K, Lee J, Porter JE. Student-led pop-up health check clinics: innovative health prevention strategy for a low socioeconomic community. *Aust J Prim Health*. 2023;29(6):606-612. doi:10.1071/PY23034 LINK
17. Suen J, Attrill S, Thomas JM, Smale M, Delaney CL, Miller MD. Effect of student-led health interventions on patient outcomes for those with cardiovascular disease or cardiovascular disease risk factors: a systematic review. *BMC Cardiovasc Disord*. 2020;20(1):332. Published 2020 Jul 11. doi:10.1186/s12872-020-01602-1 LINK
18. Rabi DM, McBrien KA, Sapir-Pichhadze R, et al. Hypertension Canada's 2020 comprehensive guidelines for the prevention, diagnosis, risk assessment, and treatment of hypertension in adults and children. *Can J Cardiol*. 2020;36(5):596-624. doi:10.1016/j.cjca.2020.02.086. LINK
19. Schapira MM, Fletcher KE, Hayes A, et al. The development and validation of the hypertension evaluation of lifestyle and management knowledge scale. *J Clin Hypertens* (Greenwich). 2012;14(7):461-466. doi:10.1111/j.1751-7176.2012.00619.x LINK
20. Government of Canada SC. Census profile, 2021 census of Population profile Table [Internet]. 2023. Accessed 10 Nov 2024. LINK

21. Berkman ND, Sheridan SL, Donahue KE, Halpern DJ, Crotty K. Low health literacy and health outcomes: an updated systematic review. *Ann Intern Med.* 2011;155(2):97-107. doi:10.7326/0003-4819-155-2-201107190-00005 LINK
22. Lövdén M, Fratiglioni L, Glymour MM, Lindenberger U, Tucker-Drob EM. Education and cognitive functioning across the life span. *Psychol Sci Public Interest.* 2020;21(1):6-41. doi:10.1177/1529100620920576 LINK
23. Oliveria SA, Chen RS, McCarthy BD, Davis CC, Hill MN. Hypertension knowledge, awareness, and attitudes in a hypertensive population. *J Gen Intern Med*. 2005;20(3):219-225. doi:10.1111/j.1525-1497.2005.30353.x LINK