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Medical Student Outcomes and Implementation Lessons from Community-Partnered Vision Screening and STEAM Outreach in a Rural First Nations Community: A Mixed-Methods Program Evaluation

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Abstract

Background

Medical students have few supervised opportunities to apply cultural-safety teaching while contributing to a community-defined service. We evaluated learner outcomes and implementation experience from Futures in Focus, a community-invited school vision-screening and STEAM outreach event in Fort McKay First Nation, Alberta.

Methods

Eight medical students completed anonymous pre- and post-event questionnaires. Five participated in vision screening while three participated in STEAM workshops. The author-developed instrument used five-point Likert items covering cultural safety, screening skills, and general outreach. Domain scores included only identically worded or directly corresponding items administered at both time points. Two-sided exact Wilcoxon signed-rank tests were used for three exploratory domain comparisons. A post-event focus-group transcript and open-text survey responses were summarized descriptively; no formal thematic analysis or saturation claim was made.

Results

Eight unique pre/post pairs were identified after excluding test and incomplete duplicate records. Cultural-safety scores increased from a median of 3.8 (IQR 3.5–3.9) to 4.2 (IQR 4.1–4.5; n = 7 complete pairs; exact p = 0.031). Screening-skill scores increased from 1.8 (IQR 1.4–2.2) to 4.4 (IQR 4.2–4.6; n = 5; exact p = 0.063). Two general-outreach items administered to all roles changed from 4.0 (IQR 4.0–4.0) to 4.5 (IQR 4.0–4.6; n = 8; exact p = 0.313). The clinical workshop was rated 4.40/5 by five screeners, whereas the cultural-safety module was rated 3.13/5 by eight respondents. All eight respondents agreed or strongly agreed that they would participate again. Feedback emphasized supervised skill acquisition, pediatric communication, crowded space, limited workflow rehearsal, and insufficient coordination support for STEAM delivery.

Conclusions

This first iteration was associated with increased self-reported cultural-safety confidence and a large descriptive increase in screening confidence, but the small sample, exploratory testing, and self-report design preclude conclusions about competence or durability. Future events should use community-specific preparation, rehearse the complete workflow, provide separate coordination for each stream, and measure community-defined outcomes and referral completion.

Background

Indigenous children in Canada experience inequitable access to eye care, including barriers to examination, corrective eyewear, and specialist follow-up [1, 2]. Rural and remote geography can amplify these barriers through limited local provider availability, travel, administrative complexity, and systemic inequities rooted in colonialism [2, 3]. Because amblyogenic conditions require timely recognition, school-based screening may reduce an important initial detection barrier [4].

Undergraduate medical curricula increasingly include Indigenous health and cultural-safety content, yet learners may have little opportunity to apply that teaching in a supervised community setting [5]. Service-based learning can connect education to a real community priority, but evaluation must separate learner confidence from competence and must not assume that participation itself constitutes cultural safety.

Futures in Focus paired supervised pediatric vision screening with parallel science, technology, engineering, arts, and mathematics (STEAM) activities during a two-day school outreach event. Hands-on, inquiry-based programs delivered in formal and informal settings have been reported to support Indigenous students' engagement in science and STEM learning, particularly when they are culturally relevant [6]. This evaluation asked three questions: (1) how learner self-ratings changed immediately after the event; (2) how learners assessed the preparation they received; and (3) which implementation features should be retained or changed.

Methods

Design and setting

We conducted a convergent mixed-methods program evaluation of the first Futures in Focus event at Elsie Fabian School in Fort McKay First Nation, Alberta. Questionnaire results, a post-event focus group, open-text responses, and aggregate service indicators were used to inform program improvement. The reporting approach draws selectively on GRAMMS, SRQR, and TIDieR, while recognizing that the qualitative component was a descriptive evaluation summary rather than a formal qualitative study.

Partnership and intervention

Partnership and intervention
The Elsie Fabian School and Fort McKay Health and Wellness Centre identified the need for pediatric vision screening, invited the academic team, and shaped delivery. The Health and Wellness Centre retained responsibility for consent, referral entry, family contact, and follow-up. The academic team coordinated learner recruitment, training, supervision, and evaluation.

Eight volunteer medical students participated: three solely in screening, three solely in STEAM activities, and two in both streams. All completed an online Indigenous cultural-safety module and attended a

hands-on pediatric screening workshop. Students screened through sequential stations under two ophthalmology residents and an orthoptist, with the most responsible physician available virtually. Uncertain or abnormal findings were repeated by a supervisor before follow-up was determined. The STEAM stream delivered hands-on science and introductory clinical-skills activities to grade-level groups.

Questionnaire and quantitative analysis

The questionnaire was developed by the authors for this evaluation and has not been published elsewhere; the English-language version is provided in Additional file 1. It used a five-point scale (1 = strongly disagree to 5 = strongly agree). The cultural-safety score was the mean of five corresponding pre/post items. The clinical score was the mean of five corresponding items completed by learners who participated in screening; a post-only equipment-comfort item was not included. The general-outreach comparison used the two items—seeking support and collaborating with supervisors, liaisons, and peers—administered consistently to all roles at both time points. A scope-of-practice item was omitted from the pooled general score because the post-event export was blank for STEAM-only learners. No overall composite was calculated because item availability differed by role.

Records were linked by self-generated anonymous codes. Test records, blank records, and incomplete records were excluded. One code appeared twice in the pre-event export; the earlier 83%-complete record was excluded and the later complete record retained. Domain analyses used complete pairs without imputation. We report medians and interquartile ranges (IQRs), mean scores for comparison with post-only ratings, median paired changes, and rank-biserial correlations. Two-sided exact Wilcoxon signed-rank tests excluded zero differences. The three domain tests were exploratory and were not adjusted for multiplicity; exact p-values are therefore interpreted with the effect estimates and sample sizes rather than as confirmatory evidence.

Descriptive qualitative summary

A facilitated post-event focus group and open-text questionnaire items addressed motivation, perceived learning, pediatric communication, health-equity awareness, logistics, and future participation. During manuscript preparation, the deidentified transcript and open-text responses were organized into these evaluation categories and recurring points were summarized across the two sources. No formal codebook, independent second coding, member checking, or saturation assessment was undertaken. We therefore report a structured descriptive summary and do not present the categories as independently validated themes. Direct quotations are omitted to reduce identifiability in the small participant group.

Service indicators

The Fort McKay Health and Wellness Centre provided aggregate counts of children screened and follow-up outputs. The dataset recorded 25 optometry follow-up recommendations and 19 ophthalmology referral events. Possible overlap was not available, so these counts were not combined into a unique-child referral total. Referral completion and downstream diagnoses were not captured.

Ethics and governance

Research ethics board approval was not required for this project. The University of Calgary Conjoint Health Research Ethics Board (CHREB) reviewed the project and determined that, as a program evaluation and quality improvement initiative, it was exempt from research ethics board review under the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2, 2022), Article 2.5. The project was conducted in accordance with the ethical principles of TCPS 2.

The service was requested by the community; no intervention was assigned, withheld, randomized, or modified for evaluation. Identifiable child health information remained with the Health and Wellness Centre. Learner participation was voluntary. Each questionnaire opened with a written consent form describing the purpose of the evaluation, what participation involved, its voluntary nature, and how responses would be stored; completing the questionnaire indicated implied informed consent. Focus-group participants gave verbal informed consent at the start of the session. Questionnaire responses were pseudonymous through self-generated linkage codes. Focus-group participants were known to one another and the facilitator, but reporting was deidentified. No learner was graded or advantaged by participation. Written informed consent for vision screening was obtained from the parents or guardians of all screened children; when consent forms were not returned, school staff contacted parents or guardians by telephone to obtain verbal informed consent. Child assent followed local school and Health and Wellness Centre procedures. The STEAM activities were delivered as part of regular school programming, and no evaluation data were collected from students about these activities; separate consent was therefore not required.

Results

Participation and baseline experience

After data cleaning, eight unique learners had matched pre/post questionnaires. Five participated in vision screening and five joined the post-event focus group. Six of eight learners (75%) reported no prior Indigenous outreach experience, and seven of eight (87.5%) reported no prior rural outreach experience.

Learner outcomes

Cultural-safety scores increased from a median of 3.8 (IQR 3.5–3.9) to 4.2 (IQR 4.1–4.5) among seven complete pairs (Table 1); the median paired increase was 0.6 points (IQR 0.3–0.8; exact p = 0.031; rank-biserial correlation = 1.00). One learner was excluded from this domain because one pre-event item was missing.

Among five screening participants, clinical scores increased from a median of 1.8 (IQR 1.4–2.2) to 4.4 (IQR 4.2–4.6), with a median paired increase of 2.8 points (IQR 1.6–2.8; exact p = 0.063; rank-biserial correlation = 1.00). The direction and magnitude were consistent across all five participants, but the smallest attainable conventional two-sided exact p-value with five nonzero pairs was 0.0625.

For the two general-outreach items administered consistently to all roles, the median increased from 4.0 (IQR 4.0–4.0) to 4.5 (IQR 4.0–4.6); the median paired change was 0.5 (IQR 0.0–0.6; exact p = 0.313; rank-biserial correlation = 0.52). These items were near the top of the scale at baseline.

Table 1
Matched learner self-ratings by domain

Domain	Complete pairs	Pre median (IQR)	Post median (IQR)	Median change (IQR)	Exact p	Rank-biserial r
Cultural safety (5 items)	7	3.8 (3.5–3.9)	4.2 (4.1–4.5)	0.6 (0.3–0.8)	0.031	1.00
Clinical screening (5 items)	5	1.8 (1.4–2.2)	4.4 (4.2–4.6)	2.8 (1.6–2.8)	0.063	1.00
General outreach (2 items)	8	4.0 (4.0–4.0)	4.5 (4.0–4.6)	0.5 (0.0–0.6)	0.313	0.52

Scores are participant-level means of corresponding five-point Likert items. Exact two-sided Wilcoxon signed-rank tests exclude zero differences. Tests were exploratory and unadjusted for multiplicity.

Preparation, acceptability, and implementation

The five screening participants rated the resident-led clinical workshop a mean of 4.40/5 (median 4.0; IQR 4.0–5.0). All eight learners rated the cultural-safety module, with a mean of 3.13/5 (median 3.0; IQR 2.8–4.0). All eight agreed or strongly agreed that they would participate in a similar event again; seven strongly agreed.

The focus-group transcript and open-text responses converged on four recurring points. Learners valued authentic responsibility and direct engagement with children. Screening participants described gaining confidence through repeated supervised practice and immediate confirmation of uncertain findings. Learners in both streams adapted language, pacing, activities, and use of teacher support to individual children and classroom dynamics. They also identified practical barriers: late training, no full workflow rehearsal, a crowded and noisy screening space, unclear transitions, transportation constraints, and less coordination support for the STEAM stream. Implementation findings and the corresponding planned revisions are summarized in Table 2.

Table 2
Implementation findings and planned revisions

Area	Observed issue	Revision
Cultural preparation	Generic online content was rated less highly and was not specific to Fort McKay.	Use community-specific, preferably in-person orientation led or co-led locally where desired.
Clinical preparation	Skills were practiced separately, but the complete station flow was not rehearsed.	Train earlier and complete a timed, multi-station dress rehearsal.
Screening environment	Noise, crowding, and uncertain room flow affected testing and pace.	Confirm room layout, station spacing, equipment ownership, and escalation points before travel.
STEAM delivery	Material handling, transitions, and supervision were less structured than in screening.	Assign a dedicated STEAM lead, duplicate key materials, and protect transition time.
Referral continuity	Referral completion was not systematically captured.	Agree prospectively on community-governed tracking and reporting.

Community service outputs

Seventy-six children aged 4–15 years were screened over two days. The service generated 25 optometry follow-up recommendations and 19 ophthalmology referral events. Because possible overlap was not available, the data do not establish that 44 unique children required follow-up. These counts describe service output and should not be interpreted as population disease prevalence or screening accuracy.

Discussion

The evaluation documents short-term changes in medical students' self-ratings and identifies specific revisions for the next event. Cultural-safety scores increased among seven complete pairs. Clinical scores increased substantially for all five screeners, although the exact two-sided test did not cross the conventional 0.05 threshold. The more defensible interpretation is therefore a large, consistent descriptive increase in self-reported screening confidence, not proof of competence or a statistically confirmed educational effect.

The clinical findings are consistent with reports that repeated participation in supervised community vision screening can increase learner confidence [7]. The present evaluation adds a rural First Nations context and shows how supervision, meaningful responsibility, and immediate escalation were experienced together. Objective skills assessment and later follow-up are needed before claiming competence or durable learning. Recommendations for student-led vision screening programs likewise emphasize standardized volunteer training that includes assessment, dependable faculty or resident oversight, and structured follow-up [8].

The cultural-safety findings require cautious interpretation. Learners asked for locally specific preparation and rated the generic online module lower than the clinical workshop. This aligns with concerns that cultural-safety education may be generic and developed with limited local Indigenous participation [9]. Learner self-rating cannot determine whether care was culturally safe; that judgment rests with children, families, and the community. The result identifies a program-design priority rather than a competency endpoint.

Implementation data explain how the learning environment was produced. Noise, room size, station sequence, escalation pathways, material management, and transition time all affected delivery. The clinical stream attracted more structured supervision because its risks were more visible. Future events should resource the STEAM stream with equally explicit leadership, preparation, and objectives.

The two streams were coordinated in parallel. They shared a community invitation, schedule, learners, and logistics, but did not constitute a single integrated curriculum for each child. A program-logic model developed with community partners could clarify how the clinical service and youth-facing education are intended to relate in future iterations.

Limitations

This evaluation involved one event, eight volunteer learners, no comparison group, and no objective or delayed outcome. The questionnaire was author-developed and not psychometrically validated. Item availability differed by role; one cultural-safety response was missing, and only five learners completed the clinical domain. Three exploratory tests were not adjusted for multiplicity. Self-generated codes are pseudonymous rather than fully anonymous, and duplicate/incomplete export records required a prespecified cleaning decision. The qualitative component was a descriptive summary of one focus group and open-text responses without independent coding, member checking, or saturation assessment. Direct quotations were omitted, which limits auditability but reduces identifiability. Youth STEAM outcomes, referral completion, treatment, and community-reported experience were not measured.

Conclusions

Futures in Focus was associated with short-term increases in self-reported cultural-safety and screening confidence and was acceptable to participating learners. The evidence does not establish clinical competence, sustained learning, or community benefit beyond documented service delivery. The next iteration should use community-specific orientation, rehearse the complete workflow, provide dedicated leadership to each stream, and prospectively measure community-defined outcomes and referral completion.

Abbreviations

CHREB

Conjoint Health Research Ethics Board
GRAMMS
Good Reporting of A Mixed Methods Study
IQR
interquartile range
SRQR
Standards for Reporting Qualitative Research
STEAM
Science, Technology, Engineering, Arts, and Mathematics
TCPS 2
Tri-Council Policy Statement:Ethical Conduct for Research Involving Humans
TIDieR
Template for Intervention Description and Replication.

Declarations

Ethics approval and consent to participate

Research ethics board approval was not required for this project. The University of Calgary Conjoint Health Research Ethics Board (CHREB) determined on 19 November 2025 that “Community-Partnered Vision – STEAM Health Screening: A program evaluation and quality improvement initiative” was exempt from research ethics board review because it did not constitute research under the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2, 2022), Chap. 2, Article 2.5. The project was conducted in accordance with the ethical principles of TCPS 2. Documentation of the exemption is available from the corresponding author. Identifiable child health information remained with the Fort McKay Health and Wellness Centre. Informed consent was obtained from all participants. Medical student participation in the evaluation was voluntary: each questionnaire opened with a written consent form describing the purpose of the evaluation, what participation involved, its voluntary nature, and how responses would be stored, and completing the questionnaire indicated implied informed consent (Additional file 1). Verbal informed consent was obtained from all focus-group participants at the start of the session. Questionnaire linkage used self-generated codes, and focus-group reporting was deidentified. For vision screening, written informed consent was obtained from the parents or guardians of all screened children; when consent forms were not returned, school staff contacted parents or guardians by telephone to obtain verbal informed consent. Child assent followed local procedures. The STEAM activities were delivered as part of regular school programming, and no evaluation data were collected from students about these activities; separate consent was therefore not required.

Consent for publication

Not applicable. No images, direct quotations, or individually identifiable information are reported.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

K.S., A.H., D.H., J.S., and L.H. contributed to conceptualization. K.S., A.H., D.H., and J.S. contributed to data collection, analysis, and drafting. B.R., M.B.H., E.I., and L.H. contributed supervision, clinical oversight, and critical revision. K.S., A.H., and J.S. contributed funding acquisition. All authors approved the submitted version.

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Data Availability

The questionnaire is provided in Additional file 1. Additional program materials may be available from the corresponding author subject to community governance and privacy requirements. Deidentified aggregate data are available from the corresponding author on reasonable request.

References

1. Bondok M, Tao BK, Hanson C, Sarohia G, Ing E. Ophthalmologic care for Indigenous Canadians. AJO Int. 2024;1(4):100067.
2. Kritzinger J, Chaban YV, Lichter M, Dimaras H. The state of eye care and health among Indigenous Peoples in Canada. Can J Ophthalmol. 2025;60(1):1–7.
3. Brise LS, de Leeuw S. Seeing clearly: a community-based inquiry into vision care access for a rural northern First Nation. Can J Optom. 2015;77(2):34–43.

4. Hensch TK, Quinlan EM. Critical periods in amblyopia. Vis Neurosci. 2018;35:E014.
5. Ansell A. Five ways to get a grip on the need to include clinical placements in Indigenous settings. Can Med Educ J. 2022;13(3):47–51.
6. Jin Q. Supporting Indigenous students in science and STEM education: a systematic review. Educ Sci. 2021;11(9):555.
7. Burton E, Assi L, Vongsachang H, Swenor BK, Srikumaran D, Woreta FA, et al. Demographics, clinical interests, and ophthalmology skills confidence of medical student volunteers and non-volunteers in an extracurricular community vision screening service-learning program. BMC Med Educ. 2022;22:143. https://doi.org/10.1186/s12909-022-03194-0.
8. Devanathan N, Scheive M, Selvam A, Nawash BS, et al. Recommendations for the optimization of student led free vision screening programs. BMC Med Educ. 2024;24:1432. https://doi.org/10.1186/s12909-024-06396-w.
9. Hardy BJ, Filipenko S, Smylie D, Ziegler C, Smylie J. Systematic review of Indigenous cultural safety training interventions for healthcare professionals in Australia, Canada, New Zealand and the United States. BMJ Open. 2023;13:e073320.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Additionalfile1Questionnaires.pdf