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3 **Title:** An economic cost minimization analysis of remote physiatry outreach clinics in Manitoba.
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Introduction

Approximately 1 in 5 adults in Canada live with a disability that limits their daily activity, resulting from chronic conditions such as stroke, spinal cord injury, amputation and brain injury.¹ Individuals with these conditions commonly have a higher risk for mortality as a consequence of chronic, manageable complications such as bladder, skin, or respiratory infection, cardiovascular events, or suicide.²⁻³ Life-long patient-centred rehabilitation from a physiatrist is essential for symptom management and prevention of complications, in addition to curative treatment. The primary model of care delivery for these services centres around the outpatient setting.

Rural patient access to specialized physiatry services is limited in Canada by centralization in urban tertiary hospital environments. With 20% of people in Canada living in a small population centre (census less than 30,000),⁴ centralized urban services require rural rehabilitation patients to travel with variable public funding. Geography and care needs compound with social determinants of health for complicated, expensive transportation, overnight stays, weather-related delays, attendants to support activities of daily living, unfamiliar environments, and disconnection from family and community supports.⁵ For Indigenous patients in Canada who report disproportionate disability, complexity in access to care is further complicated by funding gaps and racism.⁶⁻¹⁰ Fulfilling the Canada Health Act mandate of equal access to care necessitates understanding these intersecting barriers,¹¹ while also recognizing the benefits and resiliencies of patients remaining in their rural communities such as maintaining social roles and inclusion.^{7,12-14}

Visiting specialist outreach services improve access for the rural physiatry population compared to telehealth by enabling the essential components of specialized physical examination and interventional treatments. Systematic reviews from Cochrane and the UK examining specialist outreach found health outcomes were generally similar or better compared to conventional care.¹⁵⁻¹⁶ Rural outreach consultation in oncology and orthodontics increased guideline-based care,¹⁷⁻¹⁸ and in general and specialty surgery increased consultations,¹⁶ and maintained safety and health outcomes.¹⁹ In Manitoba, outreach physiatry clinics were developed in collaboration with local health services in the remote communities of Churchill and St. Theresa Point. They primarily followed a “shifted outpatients” model to replicate the conventional urban outpatient services provided in Winnipeg,¹⁶ with a goal of providing equivalent care. To consider the preliminary economic cost implications of these outreach clinics, we compared their societal costs with the estimated costs of seeing the same patients in conventional urban physiatry outpatient clinics.²⁰

Methods

The outreach physiatry clinics conducted in 2018-2019 included 6 clinic dates, 3 each for the remote northern communities of St. Theresa Point (population approx. 3,300) and Churchill (population approx. 900), Manitoba.⁴ Travel access to these communities was complex, and limited to expensive domestic turboprop flights for both communities, winter ice road, helicopter or boat to St. Theresa Point, and 2-day train trip to Churchill. Clinics utilized flights for access. Community selection for clinics was motivated by existing relationships with local health care providers, regional health authority collaboration with direct written requests for outreach physiatry care, familiarity with Ongomiizwin

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3 Health Services specialist outreach programs, and identified high needs populations for outpatient
4 physiatry care.
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6 The outreach clinics were provided within a specialist “shifted outpatients” model, commonly defined as
7 service provision in a similar manner to conventional urban centres.¹⁶ They provided comparable
8 physiatrist consultation, follow-up, and management such as investigation and procedural treatments.
9 Funding for the clinics was provided through Ongomiizwin Health Services, which through contracts with
10 Manitoba Health and Non-Insured Health Benefits facilitated logistical support and physician stipend.
11 The physiatrist team of 1 attending physician and 1 resident physician carried specialized equipment
12 (portable EMG/stimulator, portable ultrasound).
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16 Description of the outreach clinics is seen in Table 1, where a total of 31 individual patients were seen
17 including new consults from local health care providers and Winnipeg-based services, follow-ups in
18 outreach from patients previously seen in consultation in Winnipeg, and follow-ups from previous
19 outreach clinics. Total number of clinic visits included 26 new consults and 22 follow-ups.
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22 We conducted a cost minimization analysis from the societal perspective of individuals living in rural
23 Manitoba. We examined the costs of receiving care for all clinic visits from the 2018-2019 outreach
24 clinics compared to the costs of bringing those patients to the conventional urban outpatient setting.
25 We identified outcomes of direct and indirect costs to government health services, providers, and
26 patients.²¹⁻²³ Table 2 provides a list of study costs and assumptions.
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29 Direct costs attributed to government health services (Manitoba Health, Non-Insured Health Benefits,
30 Ongomiizwin Health Services) and patients were categorized into travel, staff, and living.
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- 32 i. Travel costs for doctors, patients, and attendants were included for all modes, which vary
33 seasonally and were accounted for proportionally using actual costs and standard mileage costs
34 (airplane, helicopter, boat, taxi, health centre vehicle).^{21,24-25}
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36 ii. Staff costs for outreach clinics included attending physician stipend and general administration
37 from Ongomiizwin Health Services. For conventional clinics costs included attending physician
38 billing and specialized nursing salary.²⁶⁻²⁷ Staffing costs for both clinic types included resident
39 physician salary and clinic administration.^{26,28-29} Costs for transcription services, medications,
40 clinic supplies, referrals, and investigations were excluded as they would be medically necessary
41 and assumed to be equivalent in both locations.
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43 iii. Living costs included overnight accommodation for patients and attendants,³⁰ and daily food
44 stipend.
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47 We included the indirect cost of time required to receive care or provide care (opportunity cost) which
48 could otherwise be used for work, household production, or leisure.²¹⁻²² For patients and attendants, the
49 total time to receive care in an urban setting included travel from their home communities, an overnight
50 stay and travel back home the following day (1.5 days) with an assumption of maximum 8 hours per day.
51 For physician travel, the total travel time per clinic was an estimated 7 hours for St. Theresa Point and 5
52 hours for Churchill. The hours of travel for patients, attendants, and the resident physician was
53 multiplied with an hourly value of work time calculated from the respective average yearly employment
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3 income for an individual working in Canada and the average yearly salary for a resident physician in
4 Manitoba respectively.^{28-29,31}
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6 We extracted costs data for service provision from the relevant administrative and health care providers
7 for both types of care delivery and both communities. Input costs reported from prior years were
8 inflated to 2020 Canadian dollars.³² The psychiatrists involved in the outreach clinics recorded the
9 numbers of patients, type of visit, and number of attendants and travel mode required to access
10 conventional care in Winnipeg based on patient functional needs. We calculated total costs of outreach
11 and conventional clinics, including breakdown for cost type (travel, staff, living), average unit cost per
12 patient clinic visit, and incremental costs for outreach compared with conventional clinics. We analyzed
13 the study data using Microsoft Excel. Results are presented using descriptive statistics.
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17 We conducted one-way sensitivity analyses to examine the robustness of the cost-minimization analysis
18 to changes in the cost inputs. Single inputs were varied one at a time, and the total incremental costs
19 was recalculated. The ranges of cost input changes are presented in Table 3.
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22 We conducted two scenario analyses to examine the impact of some plausible variations in categories of
23 cost inputs on the study results. The base analysis incorporated helicopter travel to St. Theresa Point
24 during ice formation and breakup in the fall and spring months (\$914 per two way trip per person x
25 estimated 0.2 of year). In the first scenario analysis we assumed that outreach clinics did not occur
26 during the fall and spring season and were evenly distributed amongst summer and winter conditions
27 allowing for boat and winter road travel, which decreased cost inputs of “Community based travel
28 unshared” to \$15 and “Community based travel shared” to \$3.
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31 We developed a second scenario to capture increased support needs for transportation for 19% of clinic
32 visits (4 of 31 patients) who would be unable to take commercial flights to access conventional urban
33 clinics. For these remote communities this requires air ambulance transport, which does occur in
34 Manitoba for psychiatry outpatient visits. The cost of air ambulance flights ranges from \$12,000-\$20,000
35 per one-way trip, and the lower estimate was used for the scenario. All flight cost inputs for the patient
36 and attendants were replaced with the air ambulance cost.
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40 **Results**

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42 Table 4 and 5 present total costs, per unit costs, and outreach clinics costs as a percentage of standard
43 care with conventional urban clinics. The cost of providing specialist psychiatry services outreach clinics is
44 an estimated 21% of the total cost of the standard care of transporting rural patients to an urban centre.
45 Stratified by site, outreach clinics in St. Theresa Point is an estimated 16% and in Churchill 29% of the
46 cost of providing standard conventional care. Including only direct costs, outreach clinics cost an
47 estimated 24% of conventional care.
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50 Cost distribution according to living, travel, staffing, or indirect cost of travel as a relative percentage of
51 per unit costs for each community is seen in Figure 1. Of note the majority of conventional clinic costs
52 were from travel, and represented the greatest decline in costs for both St. Theresa Point and Churchill
53 outreach clinics.
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3 The outcomes of the one-way sensitivity analyses are presented in Figure 2. The incremental cost
4 resulting from changes in single inputs ranged from -\$105,523 to -\$134,486. Results of the cost
5 minimization analysis were observed to be most sensitive to the airplane flight costs and the travel time
6 to visit the conventional psychiatrist clinic.
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9 Scenario analyses results are seen in Table 6. Restricting outreach clinics to times where helicopter
10 flights to St. Theresa Point are not required reduced the costs of outreach clinics in that community to
11 from 16% to 15% of conventional clinic costs. Including specialized medical transport with air ambulance
12 for 13% of patients (19% of clinic visits) reduced costs of outreach from 21% to 10% of conventional
13 clinic costs.
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16 **Interpretation**

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18 Our cost analysis of psychiatry outreach clinics in Manitoba reveal substantial cost savings compared to
19 conventional care. The results suggest that for the direct costs of providing a rural resident with a single
20 psychiatrist clinic visit in an urban centre, 4 visits could be provided with a psychiatry outreach clinic.
21 Incorporating the indirect costs of travel time, 5 visits could be provided at similar costs. Accounting for
22 specialized medical transport for some patients to access conventional care suggests that 10 outreach
23 visits can be provided for the cost of one conventional visit.
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26 Most economic analysis literature regarding care for rural populations focuses on telehealth and e-
27 consult options.¹⁶ For psychiatry patients, these emerging services are largely inadequate as the
28 specialized physical examination (e.g. spasticity assessment, electrodiagnostic testing) and
29 interventional treatments (e.g. injections) cannot be provided and therefore necessitates in-person
30 visits. Large travel costs are concerning and can impact care decisions for patients without travel funding
31 in Canada, especially those in rural settings with lower average incomes.³¹ A previous cancer care survey
32 in Newfoundland and Labrador found travel costs were disproportionately important for rural compared
33 to urban patients in making treatment decisions.³³ For rural rehabilitation patients limited by travel due
34 to cost or complexity, inaccessible urban psychiatric care increases risk of chronic complications resulting
35 in inpatient admissions, morbidity, and mortality.^{7,14} The studied outreach intervention therefore also
36 may have long term implications on health system costs and access. Other reports of rural outreach care
37 provided in different formats generally show reduced costs (converted here into 2020 Canadian Dollars).
38 This includes Australian combined specialist outreach cost per visit compared to regional and urban care
39 (\$382 vs. \$492 and \$620),³⁴ and cataract procedures in the UK cost per procedure compared to urban
40 hospital (\$169 vs. \$256),¹⁹ rural cancer collaborative outreach in the USA net annual costs per patient
41 (\$8,421 vs. \$22,313),³⁵ or similar costs with internal medicine outreach in the USA (\$260 vs. \$256).³⁶
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47 Future research is needed to further examine the temporal variation of travel costs and patient
48 demographics. Including other outreach psychiatry services in Canada would help generalize incremental
49 costs estimates across various settings. Despite comprehensive inclusion of physician services in
50 Canadian public health care, payers for rural communities and populations can be complex. Delineating
51 the incremental costs amongst provincial, federal, and patient payers can further inform policy. The
52 psychiatry outreach clinics likely increased access, especially for patients requiring air ambulance
53 transport, however data on effectiveness can further inform implications on health system costs.
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3 Investigation of process measures should be patient-centred and include access, utilization, and
4 satisfaction. These process outcomes have known challenges within a rural context with lack of
5 infrastructure, limited communication between hospitals and rural health services, perceptions of costs
6 and efficiency of health care professionals, doctor-patient communication, and cultural differences.^{11,18-}
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8 ²⁰ Health system costs are influenced by long-term health outcomes. Quantifying change in health
9 outcomes from outreach psychiatry care in maintaining quality of life and preventing inpatient
10 admissions, morbidity and mortality, and at what cost, will likely be the most impactful future evaluation
11 of this care model. Finally, further exploration of the impact of carbon emissions resulting from lengthy
12 air and land travel to access health care would be important to understand the environmental impact of
13 delivering care to individuals in rural settings.
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17 There are some limitations of our economic appraisal. The relatively small size did not allow us to
18 examine the impact of uncertainty of analysis inputs and may not be fully representative of the rural
19 psychiatry patient population. The short follow-up duration in our study may not be representative of the
20 costs of an ongoing established service, which would likely be less, and precluded outcomes evaluation.
21 Outreach and conventional clinics were considered in isolation of their fixed overhead costs, which may
22 vary between the health centres studied despite similar care provision. Methods of estimation of
23 opportunity cost of travel time is a controversial topic and showed some sensitivity with one-way
24 analysis. The applicability and sustainability of outreach service models is specialist and community-
25 specific, where adaptation of outreach services based on interest, support, access, and rehabilitation
26 populations will influence effectiveness in a heterogenous Canadian environment.
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30 **Conclusion**

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32 We found through societal cost minimization analysis that psychiatry remote outreach clinics in Manitoba
33 represented 21% of the estimated costs of providing conventional care for these patients in an urban
34 outpatient setting. The majority of costs savings were from travel, and vary with season and patient care
35 needs. Physician services in Canada are primarily paid for by the public health care system, and for rural
36 patients often include travel funding. Understanding influence on health care outcomes is a critical next
37 step in evaluating this rare form of specialist outreach, contextualizing it amongst telehealth services
38 and conventional care in providing access to chronic outpatient rehabilitation.
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References

1. Morris SP, Fawcett G, Brisebois L, Hughes J. A demographic, employment and income profile of Canadians with disabilities aged 15 years and over, 2017. Ottawa (ON): Canadian Survey on Disability Statistics Canada; 2018. 25p. Available: <https://www150.statcan.gc.ca/n1/en/pub/89-654-x/89-654-x2018002-eng.pdf?st=AH38MaCh> (accessed 2020 Apr. 29).
2. Complete Public Version of the 2012 Annual Statistical Report for the Spinal Cord Injury Model Systems. Birmingham (AL): National Spinal Cord Injury Statistical Center; 2013. 104 p. Available: [https://www.nscisc.uab.edu/PublicDocuments/reports/pdf/2012 NSCISC Annual Statistical Report Complete Public Version.pdf](https://www.nscisc.uab.edu/PublicDocuments/reports/pdf/2012%20NSCISC%20Annual%20Statistical%20Report%20Complete%20Public%20Version.pdf) (accessed 2020 Apr. 29).
3. Dennis MS, Burn JPS, Sandercock PAG, Bamford JM, Wade DT, Warlow CP. Long-term Survival After First-Ever Stroke: The Oxfordshire Community Stroke Project. *Stroke*. 1993;24:796–800. DOI: 10.1161/01.STR.24.6.796
4. Statistics Canada. Table 17-10-0135-01 Population estimates, July 1, by census metropolitan area and census agglomeration, 2016 boundaries. Ottawa (ON): Statistics Canada; 2016. Available: <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710013501> DOI: 10.25318/1710013501-eng (accessed 2020 Apr. 29).
5. Wilkinson RG, Marmot MG, editors. *Social determinants of health: the solid facts* 2nd edition. Copenhagen (DK): World Health Organization, Regional Office for Europe; 2003. 31 p. Available: https://www.euro.who.int/__data/assets/pdf_file/0005/98438/e81384.pdf (accessed 2020 Apr. 29).
6. Keightley ML, Ratnayake R, Minore B, Katt M, Cameron A, White R, et al. Rehabilitation challenges for aboriginal clients recovering from brain injury: A qualitative study engaging health care practitioners. *Brain Inj*. 2009;23:250–61. DOI: 10.1080/02699050902748331
7. Wearmouth H, Wielandt T. “Reserve is no place for a wheelchair”: Challenges to consider during wheelchair provision intended for use in First Nations community. *Disabil Rehabil Assist Technol*. 2009;4:321–8. DOI: 10.1080/17483100902807120
8. Truth and Reconciliation Commission of Canada. Final report of the Truth and Reconciliation Commission of Canada. Honouring the truth, reconciling for the future : summary of the final report of the Truth and Reconciliation Commission of Canada. Toronto (ON): James Lorimer & Company Ltd.; 2015. 536 p. Available: http://www.trc.ca/assets/pdf/Honouring_the_Truth_Reconciling_for_the_Future_July_23_2015.pdf (accessed 2020 Apr. 29).
9. Allan B, Smylie J. *First Peoples, Second Class Treatment: The role of racism in the health and well-being of Indigenous peoples in Canada Executive Summary*. Toronto (ON): the Wellesley Institute; 2015. 20 p. Available: <https://www.wellesleyinstitute.com/wp-content/uploads/2015/02/Summary-First-Peoples-Second-Class-Treatment-Final.pdf> (accessed 2020 Apr. 29).
10. King M, Smith A, Gracey M. Indigenous health part 2: the underlying causes of the health gap. *Lancet*. 2009;374:76–85. DOI: 10.1016/S0140-6736(09)60827-8
11. Justice M of. House of Commons. Canada Health Act C. 6, s.1. Ottawa (ON): Queen’s Printer; 1985, amended 2017. 18 p. Available: <https://laws-lois.justice.gc.ca/PDF/C-6.pdf> (accessed 2020

- 1
2
3 Apr. 29).
4
5 12. Keightley ML, King GE, Jang S-H, White RJ, Colantonio A, Minore JB, et al. Brain injury from a First
6 Nations' perspective: Teachings from elders and traditional healers. *Can J Occup Ther*.
7 2011;78:237–45. DOI: 10.2182/cjot.2011.78.4.5
8
9 13. Haozous EA, Doorenbos AZ, Stoner S. Pain Management Experiences and the Acceptability of
10 Cognitive Behavioral Strategies Among American Indians and Alaska Natives. *J Transcult Nurs*.
11 2016;27:233–40. DOI: 10.1177/1043659614558454
12
13 14. Frier A, Barnett F, Devine S. The relationship between social determinants of health, and
14 rehabilitation of neurological conditions: a systematic literature review. *Disabil Rehabil*.
15 2017;39:941–8. DOI: 10.3109/09638288.2016.1172672
16
17 15. Powell J. Systematic review of outreach clinics in primary care in the UK. *J Health Serv Res Policy*.
18 2002;7:177–83. DOI: 10.1258/135581902760082490
19
20 16. Gruen RL, Weeramanthri TS, Knight SE, Bailie RS. Specialist outreach clinics in primary care and
21 rural hospital settings. *Cochrane Database Syst Rev*. 2003;(1):CD003798. DOI:
22 10.1002/14651858.CD003798.pub2
23
24 17. Howe HL, Lehnerr M, Katterhagen JG. Effects of Physician Outreach Programs on Rural-Urban
25 Differences in Breast Cancer Management. *J Rural Health*. 1997;13:109–17. DOI: 10.1111/j.1748-
26 0361.1997.tb00940.x
27
28 18. O'Brien K, Mattick R, Mandall N, Wright J, Conboy F, Gosden T. Are specialist outreach clinics for
29 orthodontic consultation effective? A randomised controlled trial. *Br Dent J*. 2001;191:203–7.
30 DOI: 10.1038/sj.bdj.4801140
31
32 19. Haynes R, Gale S, Mugford M, Davies P. Cataract surgery in a community hospital outreach clinic:
33 patients' costs and satisfaction. *Soc Sci Med*. 2001;53:1631–40. DOI: 10.1016/s0277-
34 9536(00)00448-2
35
36 20. Kapp KW. The social costs of business enterprise. Nottingham: Russell Press Ltd.; 1978. 374 p.
37 Available: http://www.kwilliam-kapp.de/documents/SCOBE_000.pdf (accessed 2020 Aug. 3).
38
39 21. Loane MA, Oakley A, Rademaker M, Bradford N, Fleischl P, Kerr P, et al. A cost-minimization
40 analysis of the societal costs of realtime teledermatology compared with conventional care:
41 results from a randomized controlled trial in New Zealand. *J Telemed Telecare*. 2001;7:233–8.
42 DOI: 10.1258/1357633011936453
43
44 22. Scuffham PA, Steed M. An economic evaluation of the Highlands and Islands teledentistry
45 project. *J Telemed Telecare*. 2002;8:165–77. DOI: 10.1177/1357633X0200800307
46
47 23. Smith AC, Stathis S, Randell A, Best D, Ryan VN, Bergwever E, et al. A cost-minimization analysis
48 of a telepaediatric mental health service for patients in rural and remote Queensland. *J Telemed*
49 *Telecare*. 2007;13:79–83. DOI: 10.1258/135763307783247239
50
51 24. Driving Costs Calculator. Canadian Automobile Association. Available: <https://carcosts.caa.ca/>
52 (accessed 2019 Sep 14).
53
54 25. Shah JN. Taking specialist surgical services to the rural district hospitals at one forth cost: A
55 sustainable 'return on investment' public health initiative of Patan hospital, Patan academy of
56
57
58
59
60

- 1
2
3 health sciences, Nepal. Kathmandu Univ Med J. 2015;13:186–92. DOI: 10.3126/kumj.v13i2.16797
4
- 5 26. Deloitte. Schedule of Compensation for the Manitoba Public Sector Compensation Disclosure Act
6 of Winnipeg Regional Health Authority. Winnipeg (MB); 2018. 172 p. Available:
7 <https://wrha.mb.ca/files/public-compensation-disclosure-2018.pdf> (accessed 2020 Apr 14).
8
- 9 27. The Minister of Health. The Manitoba Physician’s Manual. Winnipeg (MB); 2020. 469 p. Available:
10 <https://www.gov.mb.ca/health/documents/physmanual.pdf> (accessed 2020 Apr 14).
11
- 12 28. Professional Association of Residents and Interns of Manitoba and Winnipeg Regional Health
13 Authority. COLLECTIVE AGREEMENT July 1, 2014 to June 30, 2018. Winnipeg (MB); 2015. 54 p.
14 Available: [https://parim.org/wp-content/uploads/2015/06/PARIM-Collective-Agreement-2014-](https://parim.org/wp-content/uploads/2015/06/PARIM-Collective-Agreement-2014-2018-OSB.pdf)
15 [2018-OSB.pdf](https://parim.org/wp-content/uploads/2015/06/PARIM-Collective-Agreement-2014-2018-OSB.pdf) (accessed 2019 Sep 14).
16
- 17 29. Professional Association of Residents and Interns of Manitoba and Shared Health. COLLECTIVE
18 AGREEMENT July 1, 2018 to June 30, 2021. Winnipeg (MB); 2018. 46 p. Available:
19 [https://www.parim.org/wp-content/uploads/2020/06/2018-2021-PARIM-Collective-Agreement-](https://www.parim.org/wp-content/uploads/2020/06/2018-2021-PARIM-Collective-Agreement-Final-signed-3.pdf)
20 [Final-signed-3.pdf](https://www.parim.org/wp-content/uploads/2020/06/2018-2021-PARIM-Collective-Agreement-Final-signed-3.pdf) (accessed 2020 Jul 13).
21
- 22 30. Canad Inns. Canad Inns Online Reservations Health Sciences. 2019. Available: [https://canadinns-](https://canadinns-res.tng-secure.com/index.php?propid=723a233b-733f-46da-8900-5cc4534b8004&mcode=)
23 [res.tng-secure.com/index.php?propid=723a233b-733f-46da-8900-5cc4534b8004&mcode=](https://canadinns-res.tng-secure.com/index.php?propid=723a233b-733f-46da-8900-5cc4534b8004&mcode=)
24 (accessed 2019 Sep 14).
25
- 26 31. Statistics Canada. Table 11-10-0239-01 Income of individuals by age group, sex and income
27 source, Canada, provinces and selected census metropolitan areas. Ottawa (ON): Statistics
28 Canada; 2018. Available: <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1110023901>
29 (accessed 2020 Apr. 29).
30
- 31 32. Bank of Canada. Inflation Calculator. Available from:
32 <https://www.bankofcanada.ca/rates/related/inflation-calculator/> (accessed 2020 Apr 29).
33
- 34 33. Mathews M, West R, Buehler S. How important are out-of-pocket costs to rural patients’ cancer
35 care decisions? *Can J Rural Med.* 2009;14:54–60. Available:
36 <https://link.gale.com/apps/doc/A198547904/HRCA?u=univmanitoba&sid=HRCA&xid=727d09c9>
37
- 38 34. Gruen RL, Bailie RS, D’Abbs PH, O’Rourke IC, O’Brien MM, Verma N. Improving access to
39 specialist care for remote Aboriginal communities: Evaluation of a specialist outreach service.
40 *Med J Aust.* 2001;174:507–11. DOI: 10.5694/j.1326-5377.2001.tb143400.x
41
- 42 35. Desch CE, Grasso MA, McCue MJ, Buonaiuto D, Grasso K, Johantgen MK, et al. A Rural Cancer
43 Outreach Program lowers patient care costs and benefits both the rural hospitals and sponsoring
44 academic medical center. *J Rural Health.* 1999;15:157–67. DOI: 10.1111/j.1748-
45 0361.1999.tb00735.x
46
- 47 36. Oboler SK, Blieden MA, Carter SA, Jahnigen DW, Luck TC, Mathew M, et al. A Mobile Internal
48 Medicine Clinic. *Arch Intern Med.* 1983;143:97–9. DOI: 10.1001/archinte.1983.00350010103018
49
- 50 37. Perimeter. Perimeter Reservations Site - Search Flights. Available:
51 <https://book.perimeter.ca/ViewFlights.aspx?lang=en&st=pb&sesid=> (accessed 2019 Sep 14).
52
- 53 38. Calm Air. Calm Air Reservations Site - Search Flights. Available: <https://book.calmair.com/>
54 (accessed 2019 Sep 14).
55
56
57
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59
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Table 1 – Description of outreach clinic visits and patient characteristics

	St. Theresa Point	Churchill	Total
Number of clinics per site	3	3	6
Total number of individual patients	20	11	31
Total clinic visits	31	17	48
New consults	16	10	26
Follow-ups	15	7	22
Number of clinic visits for patients who cannot fly commercially	6	3	9
Total attendant-trips	38	15	53
Average attendants per patient-trip	1.2	0.9	1.1

Table 2 – Characterization of cost inputs divided into Direct (Staff, Travel, Living) and Indirect (Opportunity costs of travel).

Type of Cost	St. Theresa Point	Churchill	Calculation
Staff			<i>* based on data extraction</i>
Attending physician conventional billing per clinic visit	\$194	\$203	<i>Services provided to patients* valued using conventional billing codes from the Manitoba Physician's Manual,²⁷ divided by number of clinic visits</i>
Attending outreach stipend per clinic visit	\$237	\$431	<i>Stipends paid by Ongomiizwin health services (\$2444/clinic*) divided by number of clinic visits</i>
Resident physician outreach salary cost per clinic visit	\$14	\$26	<i>8hr work day per clinic + 4 hrs* of planning/wrap-up per clinic multiplied by resident \$37/hr salary,²⁸⁻²⁹ divided by number of clinic visits</i>
Conventional clinic nurse cost per clinic visit	\$11	\$11	<i>15 mins* of clinic time per patient multiplied by nurse \$42/hr salary.²⁶</i>
Front desk administration cost per clinic visit	\$4	\$4	<i>10 mins* of time per patient multiplied by administrative staff \$26/hr salary.²⁶</i>
Outreach general administration cost per clinic visit	\$3	\$5	<i>1 hr* of time per outreach clinic multiplied by staff \$30/hr salary* divided by number of clinic visits</i>
Travel			
Flight (airplane) cost per person	\$670	\$1,274	<i>2 way trip, averaged from receipts from outreach clinics*</i>
Winnipeg taxi cost per trip	\$37	\$41	<i>2 way trip typical cost with tip* from tertiary hospital to respective airports</i>
Community based travel unshared per person	\$195		<i>2 way trip airport to community in St. Theresa Point seasonal cost per person via boat \$40 x 0.4 of year* and helicopter \$914 x 0.2 of year*</i>
Community based travel shared per clinic visit	\$2	\$51	<i>2 way trip airports to community in St. Theresa Point using health centre vehicle using standard mileage costs,²⁴ Churchill flat rate taxi fare*</i>
Living			
Patient accommodation cost per conventional clinic visit	\$168	\$168	<i>Nightly cost of double queen room at hotel adjacent to tertiary hospital.³⁰</i>
Food cost per person per day	\$51	\$51	<i>Stipend typical of Ongomiizwin Health Services and provincial health services provided to staff and patients*</i>
Indirect			
Opportunity cost per conventional clinic visit	\$613	\$519	<i>12 hours (1.5 days) for all patients and attendants multiplied by \$23/hr average employment income for adult in Canada,³¹ divided by number of clinic visits</i>
Opportunity cost resident physician per outreach clinic visit	\$8	\$11	<i>7 hrs travel for St. Theresa Point* and 5 hrs travel for Churchill* multiplied by resident \$37/hr salary,²⁸⁻²⁹ divided by number of clinic visits</i>

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Table 3 – One-way sensitivity analysis description of upper and lower variations of cost inputs

Type of Cost	St. Theresa Point		Churchill		Explanation
	Lower	Upper	Lower	Upper	
Resident physician salary outreach cost per clinic visit	\$14	\$16	\$25	\$29	<i>* based on data extraction</i> <i>Senior resident salary varied based on post-graduate year (lower PGY 3 and upper PGY 5).²⁸⁻²⁹</i>
Conventional clinic nurse cost per clinic visit	\$4	\$21	\$4	\$21	<i>Time spent with patient varied with lower limit 5 mins and upper limit 30 mins*</i>
Patient accommodation cost per conventional clinic visit	\$157	\$192	\$157	\$192	<i>Cost of nightly room varied based on season.³⁰</i>
Flight (airplane) cost per person	\$562	\$738	\$778	\$1,443	<i>Fare varied using lowest fare available in advance in online booking system of Perimeter Air for St. Theresa Point,³⁷ and Calm Air for Churchill,³⁸ upper using highest fare from outreach clinics*</i>
Opportunity cost per conventional clinic visit - time varied	\$409	\$818	\$346	\$692	<i>Travel time varied with lower limit same-day travel and return (8hrs), no overnight stay required; upper limit 2 full days of travel (16hrs) with 1 overnight stay</i>
Opportunity cost per conventional clinic visit - employment income varied	\$602	\$628	\$509	\$531	<i>Average employment income varied with lower and upper limits set at respective 95% confidence intervals (\$23/hr, \$24/hr) based on the maximum coefficient of variation (2%) for this dataset.³¹</i>
Opportunity cost outreach for resident physician per clinic visit	\$7	\$13	\$10	\$20	<i>Travel time varied with lower limit most efficient trip time* (St. Theresa Point 6hrs, Churchill 5hrs) upper limit representing 4-hour delay in flights occurring for both communities within the scope of these clinics* (St. Theresa Point 11hrs, Churchill 9hrs)</i>

Table 4 – Total costs of outreach clinics compared to estimated costs of conventional urban clinics.

Type of Cost*	St. Theresa Point			Churchill			Both Centres		
	Outreach	Conventional	Incremental costs	Outreach	Conventional	Incremental costs	Outreach	Conventional	Incremental costs
Staff subtotal	\$8,895	\$7,340	\$1,555	\$8,834	\$4,205	\$4,629	\$17,729	\$11,545	\$6,184
Travel subtotal	\$5,416	\$60,878	-\$55,462	\$8,043	\$42,336	-\$34,293	\$13,459	\$103,214	-\$89,755
Living subtotal	\$305	\$10,463	-\$10,158	\$305	\$5,292	-\$4,987	\$611	\$15,755	-\$15,144
DIRECT SUBTOTAL	\$14,616	\$78,682	-\$64,066	\$17,182	\$51,833	-\$34,651	\$31,798	\$130,514	-\$98,716
INDIRECT SUBTOTAL	\$780	\$19,012	-\$18,232	\$557	\$8,817	-\$8,260	\$1,337	\$27,830	-\$26,493
GRAND TOTAL	\$15,395	\$97,694	-\$82,299	\$17,739	\$60,650	-\$42,911	\$33,135	\$158,344	-\$125,209

* More details of the type of costs in each category are provided in Table 2.

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Table 5 – Costs per unit patient visit in outreach clinics compare to estimated costs of conventional urban clinics

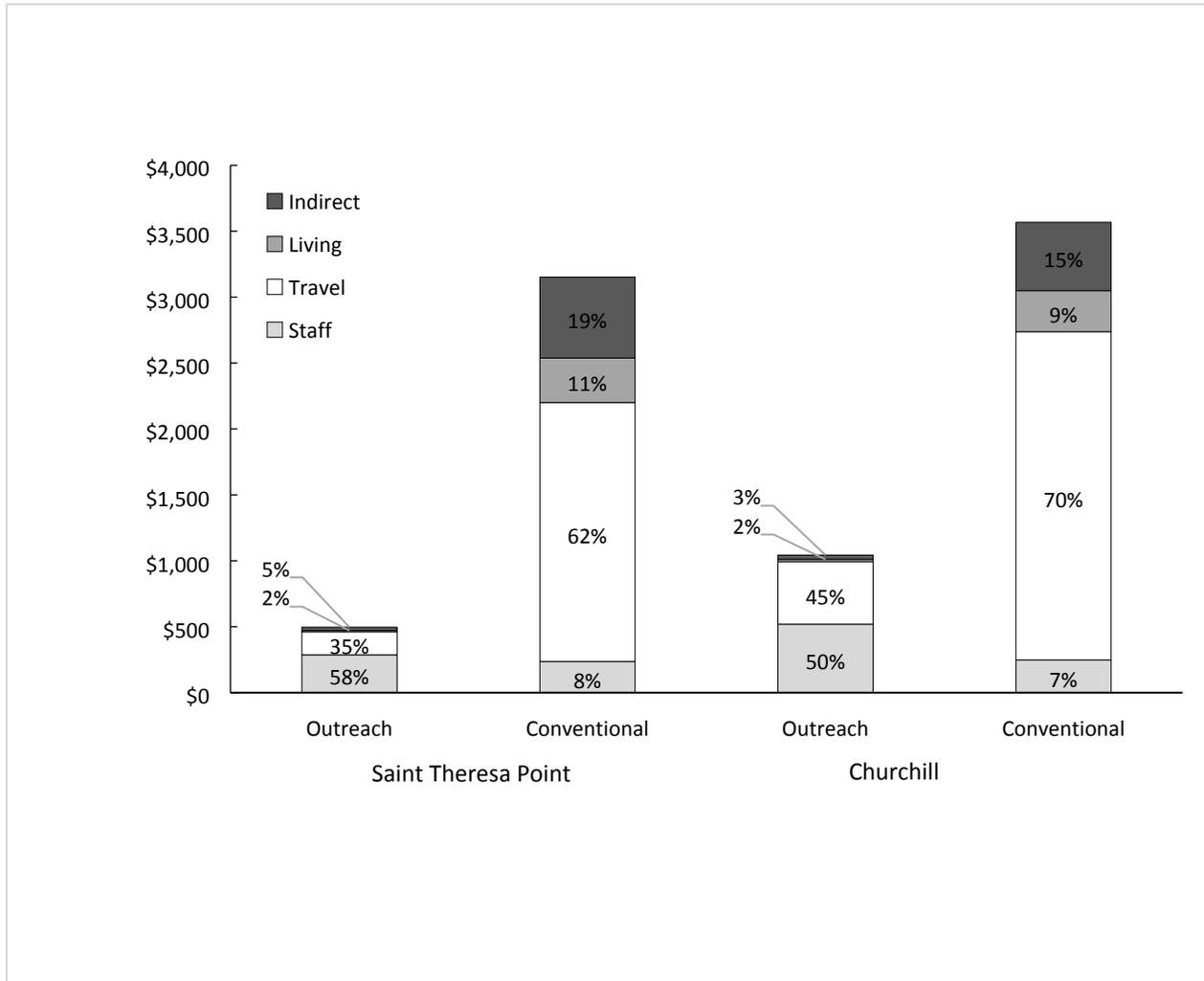
Type of Cost*	St. Theresa Point			Churchill			Both Centres		
	Outreach	Conventional	Incremental costs	Outreach	Conventional	Incremental costs	Outreach	Conventional	Incremental costs
Staff subtotal	\$287	\$237	\$50	\$520	\$247	\$273	\$369	\$241	\$128
Travel subtotal	\$175	\$1,964	-\$1,789	\$473	\$2,490	-\$2,017	\$280	\$2,150	-\$1,870
Living subtotal	\$10	\$338	-\$328	\$18	\$311	-\$293	\$13	\$328	-\$315
DIRECT SUBTOTAL	\$471	\$2,538	-\$2,067	\$1,011	\$3,049	-\$2,038	\$662	\$2,719	-\$2,057
INDIRECT SUBTOTAL	\$25	\$613	-\$588	\$33	\$519	-\$486	\$28	\$580	-\$552
GRAND TOTAL	\$497	\$3,151	-\$2,655	\$1,043	\$3,568	-\$2,524	\$690	\$3,299	-\$2,609

* More details of the type of costs in each category are provided in Table 2.

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Figure 1 – Costs per unit patient visit in outreach clinics compared to estimated costs of conventional urban clinics broken down by cost type.

* More details of the type of costs in each category are provided in Table 2.



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Figure 2 – One-way sensitivity analysis of total incremental costs of outreach clinics compared to conventional urban clinics varying cost inputs individually

* More details of the type of costs in each category are provided in Table 3.

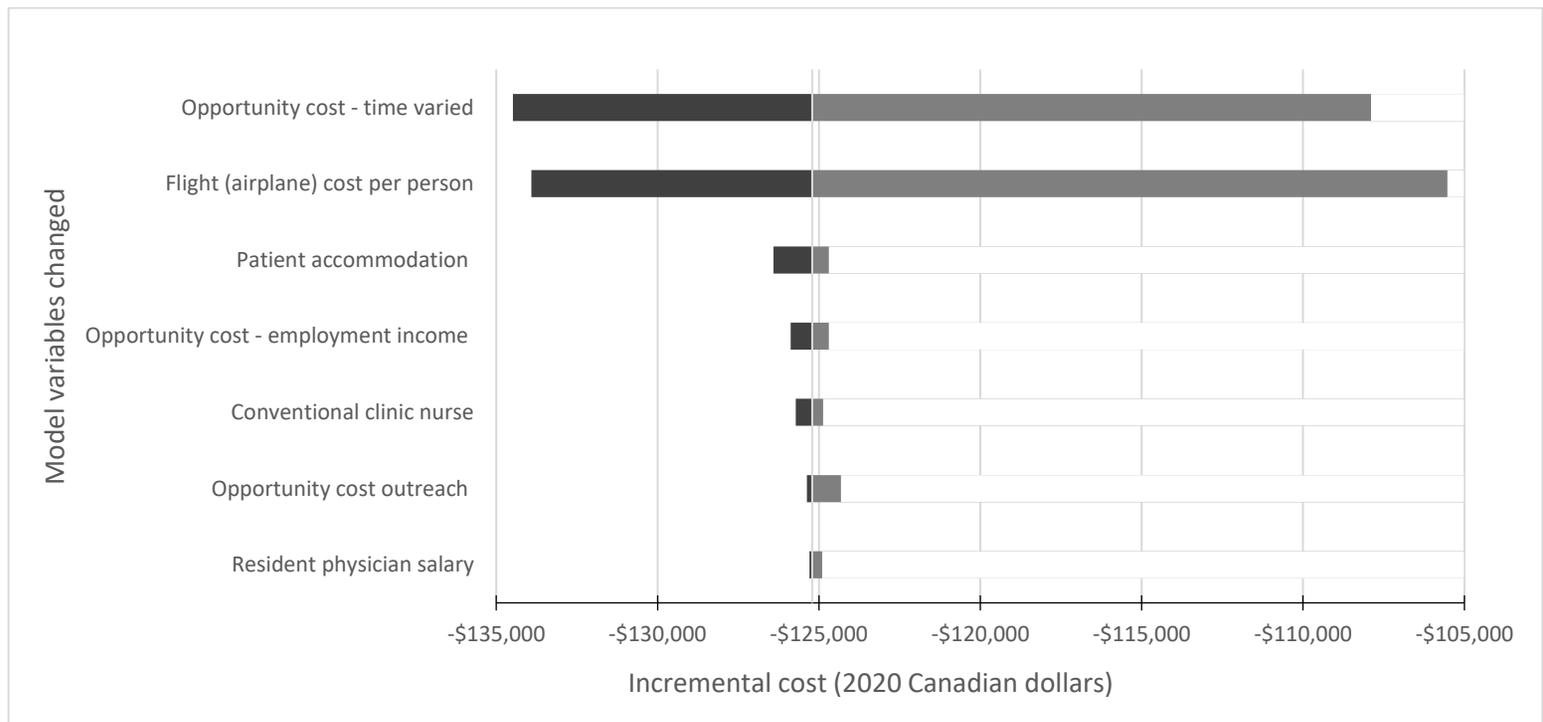


Table 6 – Scenario analyses for total costs of outreach clinics compared to conventional urban clinics when removing helicopter travel for outreach clinics, and when including specialized medical transport by air ambulance for conventional clinics.

	St. Theresa Point			Churchill			Both Centres		
	Outreach	Conventional	Incremental costs	Outreach	Conventional	Incremental costs	Outreach	Conventional	Incremental costs
Base case	\$15,395	\$97,694	-\$82,299	\$17,739	\$60,650	-\$42,911	\$33,135	\$158,344	-\$125,209
Outreach clinics helicopter travel eliminated	\$14,318	\$97,694	-\$83,376	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Conventional clinics air ambulance included	\$15,395	\$220,706	-\$205,310	\$17,739	\$117,084	-\$99,344	\$33,135	\$337,790	-\$304,655