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Project Title: # Antibiotic prescription patterns amongst children residing in remote Northern Manitoba communities

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SUMMARY: (no more than 250 words single spaced)

In recent years, there has been growing concerns with respect to health care providers in relation to over-prescription of antibiotics in a primary care setting, compounding the rising concerns of antibiotic resistance. There currently is a deficit in the literature with respect to prescription patterns being quantified and reported as it pertains to children and adolescents residing in remote northern Manitoba communities. We sought to address this discrepancy in the literature via evaluating trending data regarding antibiotic prescription patterns in select remote northern communities in Manitoba in children aged 0 to 19. We attempted to address this discrepancy in the literature via evaluating trending data regarding antibiotic prescription patterns in select remote northern communities in Manitoba in children aged 0 to 19. Our results show preliminary evidence of decreasing rates of antibiotic prescriptions in remote northern Manitoba communities. More work is necessary to get a broader picture of past and current antibiotic prescription patterns in order to serve as a catalyst for clinical guideline reforms when necessary, to give us a better picture of the overall quality of care these patients receive and ultimately to improve the health outcomes of patients in these communities

Student Signature **Supervisor Signature**

ACKNOWLEDGEMENTS:
I gratefully acknowledge the support by one or more of the following sponsors;
CancerCare MB
H.T. Thorlakson Foundation
Dean, College of Medicine
Research Manitoba
Children's Hospital Research Institute of MB
Kidney Foundation of Manitoba
Manitoba Medical Service Foundation
Associate Dean (Research), College of Medicine
Heart and Stroke Foundation
Health Sciences Centre Research Foundation

Other:
Kenneth and Elizabeth Walton Research Scholarship in Medicine Fund.

Antibiotic prescription patterns amongst children residing in remote Northern Manitoba communities

Introduction & Background

In recent years, there has been growing concerns with respect to health care providers in relation to over-prescription of antibiotics in a primary care setting. Perhaps of even greater concern is the overuse of antibiotics in certain subsets of vulnerable populations, such as pediatric patients and adolescents, of whom reside in remote northern communities which primarily receive their care via nursing stations. The literature is abundant with recent data which evidences increasing rates of methicillin-*resistant Staphylococcus Aureus* (MRSA), albeit at alarming rates, in children residing in Northern Manitoban communities[1,9].

The incidence and relative rates of antibiotic resistant associated illnesses among children is increasing, and most evidence would suggest the prospect of further surges in the future. This is problematic as not only does increased resistance limit the available treatments for bacterial related illnesses, it further obscures available treatment options and leads to increased rates of poor health outcomes[4]. Perhaps the most important factor that can contribute to increased prevalence of antibiotic resistance is prescription of antibiotics in a non-judicial liberal manner. It is worthy to note that over prescription of antibiotics which heavily influences the emergent problem of antibiotic resistance is amendable via health care providers following strict observance to clinically derived evidence based prescription practices[5,8].

During the past few decades there have been interesting trends with respect to antibiotic prescription patterns observed in Canada. While there exists minor empirical variation amongst the literature when quantifying trending patterns of antibiotic prescription patterns over the past few decades in Canada, which can likely be accounted for via variable statistical metrics and categorization such as class of antibiotics, age, socioeconomic status etc. Nonetheless the general consensus is the amount of antibiotic prescriptions in Canada reached a peak in the late 1990's and then subsequently proceeded to drop in the mid 2000's, largely due to increased awareness amongst health care providers of the risks associated with over-prescription of antibiotics and increased levels of antibiotic resistant organisms[2,7].

When we analyze the trends of prescription patterns in Manitoba amongst children and adolescents on the surface the Canadian trends discussed above also hold true as overall antibiotic usage amongst our target research group decreased by approximately one-third from 1995 to 2001[2,3]. However this data on the surface doesn't' give us the entire situation as when we specifically filter the data to analyze this apparent decline in prescription patterns and quantify the difference of said decline based on socioeconomic status, children who belong to lower income households experienced a significantly smaller rate of decline when compared to children of higher socioeconomic classes. Hence as a consequence of this finding they were subject to higher rates of antibiotic usage (relative to higher socioeconomic status counterparts) and subsequently greater prospective of antibiotic resistance in this population. Furthermore the rates of broad spectrum macrolides antibiotics being dispensed in fact increased during this time period[3]. These findings are paramount as they demonstrate an apparent gap with respect to quality of care potentially being influenced largely by socioeconomic status as well as

increased levels of broad spectrum antibiotics being dispensed, theoretically further compounding the rising concerns of antibiotic resistance.

There currently is a deficit in the literature with respect to prescription patterns being quantified and reported as it pertains to children and adolescents residing in remote northern Manitoban communities. Health care delivery in remote nursing stations is inherently complex relative to care received in urbanized settings by and large due to unique geographical considerations consequently leading to relative seclusion, lack of resources, and underlying cultural dynamics which influence delivery of care[6]. This additional complexity not experienced in urbanized settings is crucial to note as a potential variable negatively influencing quality of care in these settings, making these populations vulnerable to subpar care and hence critical to study. Three of the four communities we studied in this report are only accessible via air access. We sought to address this discrepancy in the literature via evaluating trending data regarding antibiotic prescription patterns in select remote northern communities in Manitoba in children aged 0 to 19.

It is of principal importance to note prescriptions distributed in remote nursing stations from stock supplies are currently not captured in the literature, nor is this data available in any electronic database. Consequently we must consider the likely possibility of undercounting as it pertains to our data and hence the numbers of antibiotics truly being prescribed in these northern remote areas to be potentially greater. Future projects from our research group intend to address this discrepancy and capture the number of prescriptions from these nursing stations.

Materials and Methods

Antibiotic prescription data

Data with respect to antibiotic prescriptions dispensed was obtained from the Non-insured health benefits program (NIHB) electronic records database of Canada. Population data for each respective community was determined from the Indian Registry population file from Indian and Northern Affairs Canada (INAC). The NIHB Program is Health Canada's national health benefit program which offers coverage for essential prescription medications, as well as a range of other medically necessary services for eligible First Nations and Inuit populations[7]. The individuals comprised in this report have all filled at least one prescription at a Manitoba pharmacy and that prescription was paid for by Health Canada's NIHB program.

These NIHB pharmacy claims are captured electronically by pharmacies and submitted for payment. Consequently data based on pharmacy claims coming from this databank can be used as a rough indicator regarding the extent of antibiotic prescriptions being dispensed and overall usage by those individuals residing in the selected remote northern Manitoban communities[7]. This report includes persons registered to the northern Manitoban communities of Cross Lake, Berens River, Redsucker Lake as well as Wasagamack. By choosing and subsequently analyzing the data from these four communities, we hoped to acquire a glimpse into the overall pattern with respect to antibiotic prescription patterns in remote northern communities over the past decade.

Data was obtained from children and adolescents aged 0 to 19 whom resided and/or were registered to the communities listed above annually starting from 2005 to 2014. We collected data from six major classes of antibiotics including Cephalosporins (08:12:06), Macrolides (08:12:12), Penicillins (08:12:16), Quinolones (08:12:18), Tetracyclines (08:12:24) and Sulfonamides (08:12:20). The data was expressed as rate of prescriptions dispensed per 1000 children and analyzed by community as well as class of antibiotic. Relevant diagnostic data pertaining to the antibiotic prescribed was not available.

Statistical Analysis

We performed an observational population-based epidemiological investigation where our data was analyzed for trending patterns with respect to overall antibiotic usage. We looked at antibiotic prescriptions dispensed in each community, as well as performed a comparative analysis of various antibiotic classes used and reported as the amount of prescriptions per 1000 children.

Results

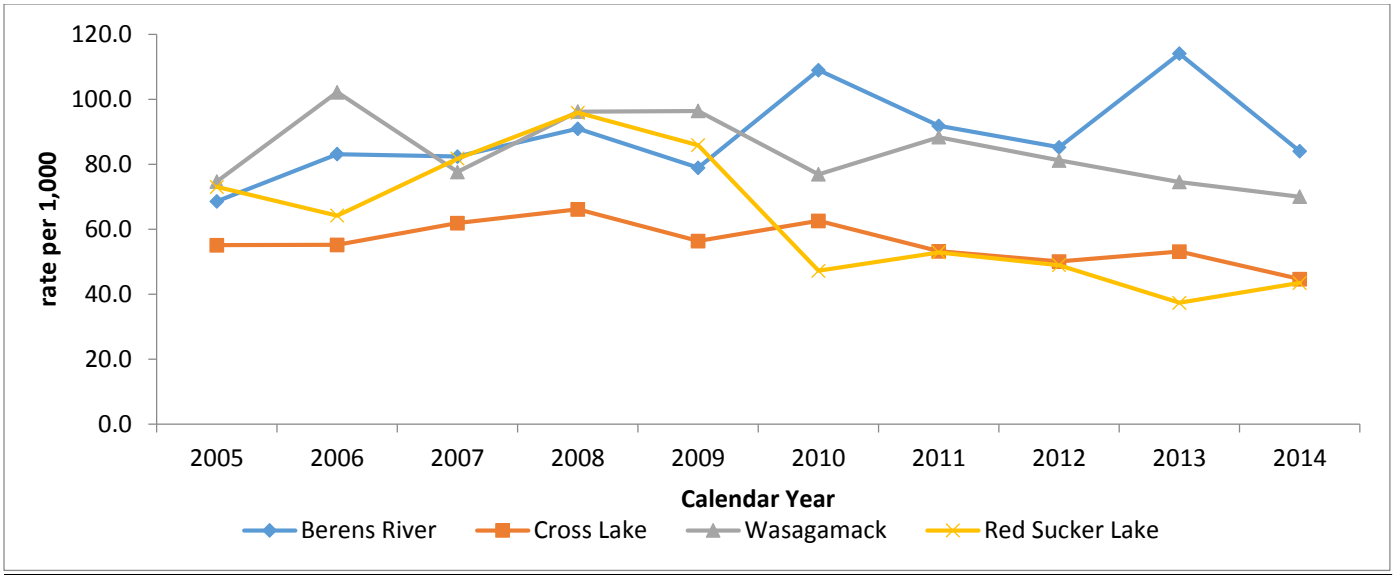
Class specific consumption trends from 2005 to 2014

Cephalosporin prescriptions were observed to decrease in Cross Lake, Wasagamack and Red Sucker Lake. Cross Lake was observed to drop 19% from 55.1 to 44.6 prescriptions per 1000 children. Wasagamack dropped by the smallest margin of 6.6% from 74.7 to 70.0 prescriptions per 1000 children. Finally Red Sucker Lake decreased by the largest percentage of 41% from 73.0 to 43.5 prescriptions per 1000 children respectively. Berens River cephalosporin usage on the contrary was observed to increase by 11% from 68.4 to 84.0 prescriptions per 1000 children.

Macrolides usage was also observed to decrease in Cross Lake, Wasagamack, Red Sucker Lake as well as Berens River. Cross Lake decreased 18% from 48.6 to 39.8 prescriptions per 1000. Wasagamack decreased by 40% from 58.5 to 35.0 prescriptions per 1000. Red Sucker Lake had the largest decrease of 76% dropping 70.5 to 16.6 prescriptions per 1000 children. Berens river macrolides usage also decreased by 45% from 96.1 to 52.5 prescriptions per 1000 children.

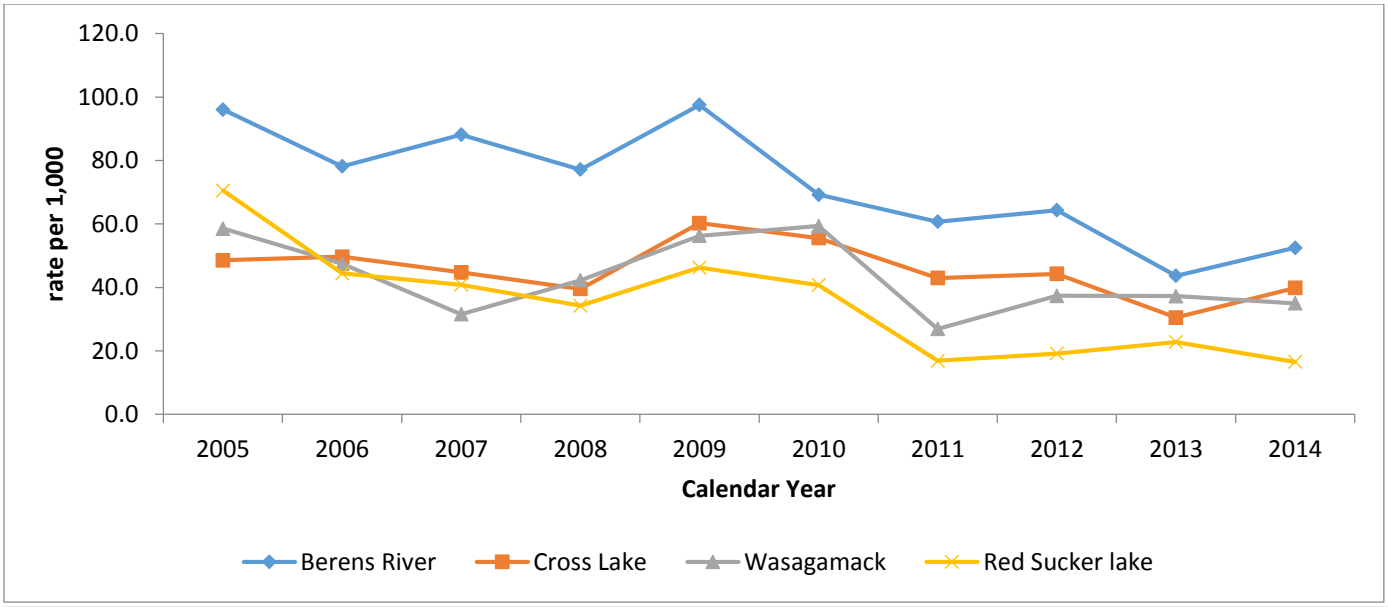
Penicillin's saw uniform trends toward decreasing amounts of prescriptions being dispensed in all communities. Cross Lake decreased by 23% from 157.4 to 121.9 prescriptions per 1000 children. Berens River decreased by 16% from 241.00 to 202.7 prescriptions per 1000 children. Wasagamack decreased by 26% from 160.6 to 119.5 prescriptions per 1000 children. Finally Red Sucker Lake decreased by the largest margin of 55% from 146.1 to 66.3 prescriptions per 1000 children.

Data from the Quinolones, Tetracyclines and Sulfonamides classes demonstrated non uniform sporadic trends. The data from these classes is included in this report for the sake of completeness, however the data for these classes of antibiotics was too small to observe meaningful fluctuating trends.



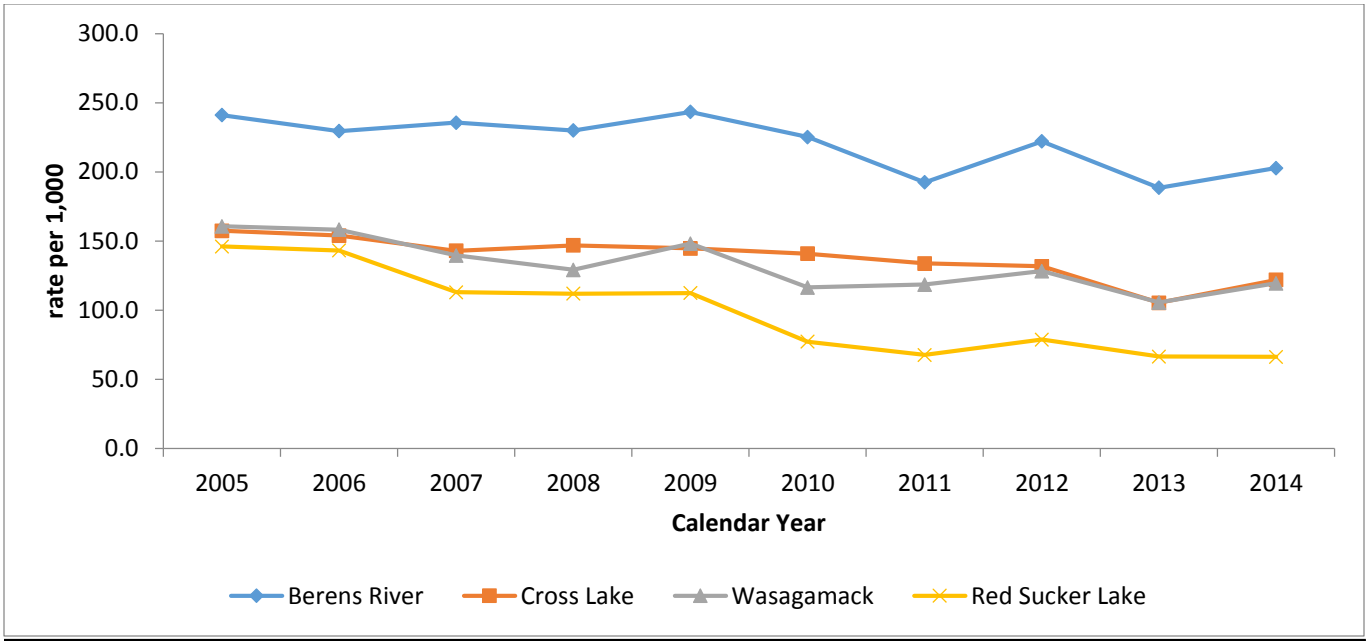
Band	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Berens River	68.6	83.1	82.4	91.0	79.0	109.0	91.9	85.3	114.1	84.0
Cross Lake	55.1	55.2	61.9	66.1	56.4	62.6	53.2	50.1	53.1	44.6
Wasagamack	74.7	102.2	77.7	96.2	96.4	76.9	88.4	81.2	74.5	70.0
Red Sucker Lake	73.0	64.2	81.7	95.9	85.9	47.2	52.9	48.9	37.3	43.5

Figure 1 Cephalosporins usage in children aged 0-19 from 2005 to 2014 reported as rates per 1000.



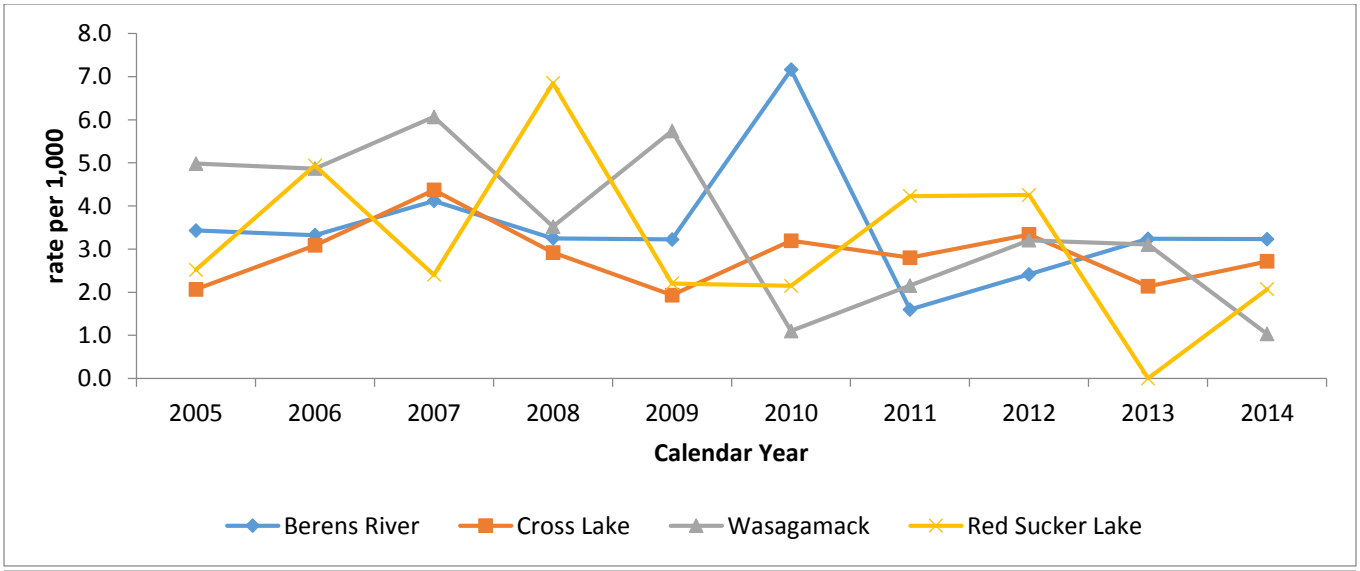
Band	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Berens River	96.1	78.1	88.1	77.2	97.5	69.2	60.7	64.4	43.7	52.5
Cross Lake	48.6	49.7	44.7	39.5	60.2	55.6	43.0	44.3	30.5	39.8
Wasagamack	58.5	47.4	31.6	42.3	56.3	59.3	26.9	37.4	37.3	35.0
Red Sucker lake	70.5	44.4	40.9	34.2	46.3	40.8	16.9	19.1	22.8	16.6

Figure 2. Macrolides usage in children aged 0-19 from 2005 to 2014 reported as rates per 1000.



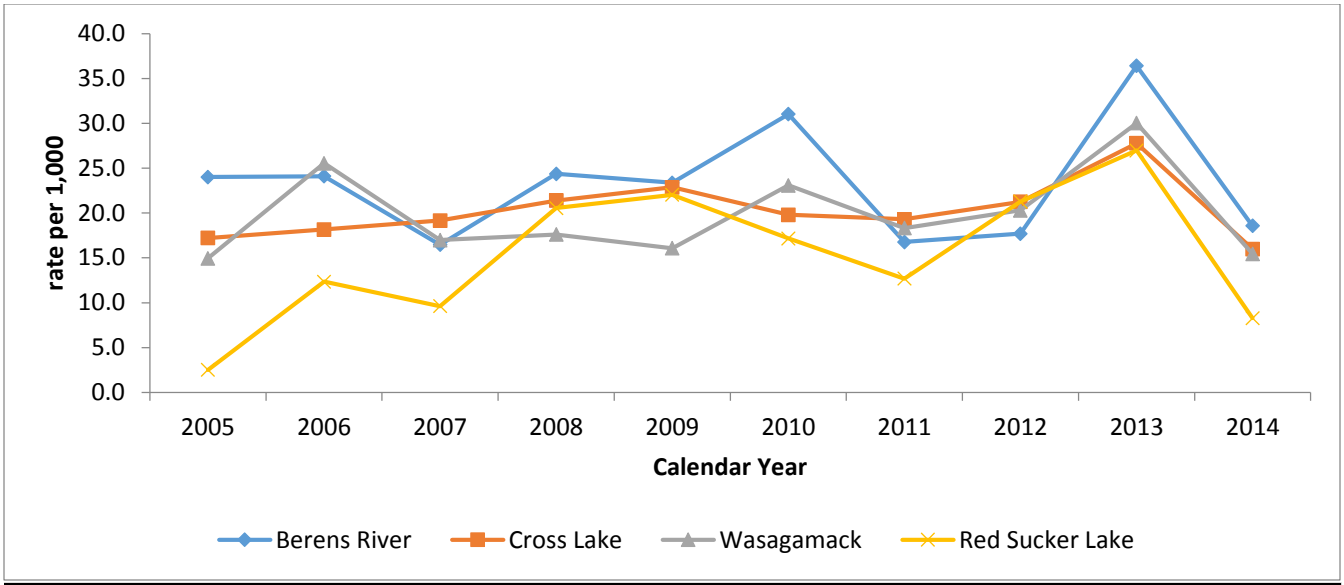
Band	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Berens River	241.0	229.4	235.6	229.9	243.4	225.1	192.5	222.0	188.5	202.7
Cross Lake	157.4	153.9	142.9	146.8	144.7	140.8	133.8	131.7	105.3	121.9
Wasagamack	160.6	158.2	139.6	129.1	148.1	116.5	118.5	128.2	105.6	119.5
Red Sucker Lake	146.1	143.2	113.0	111.9	112.3	77.3	67.7	78.7	66.4	66.3

Figure 3. Penicillins usage in children aged 0-19 from 2005 to 2014 reported as rated per 1000.



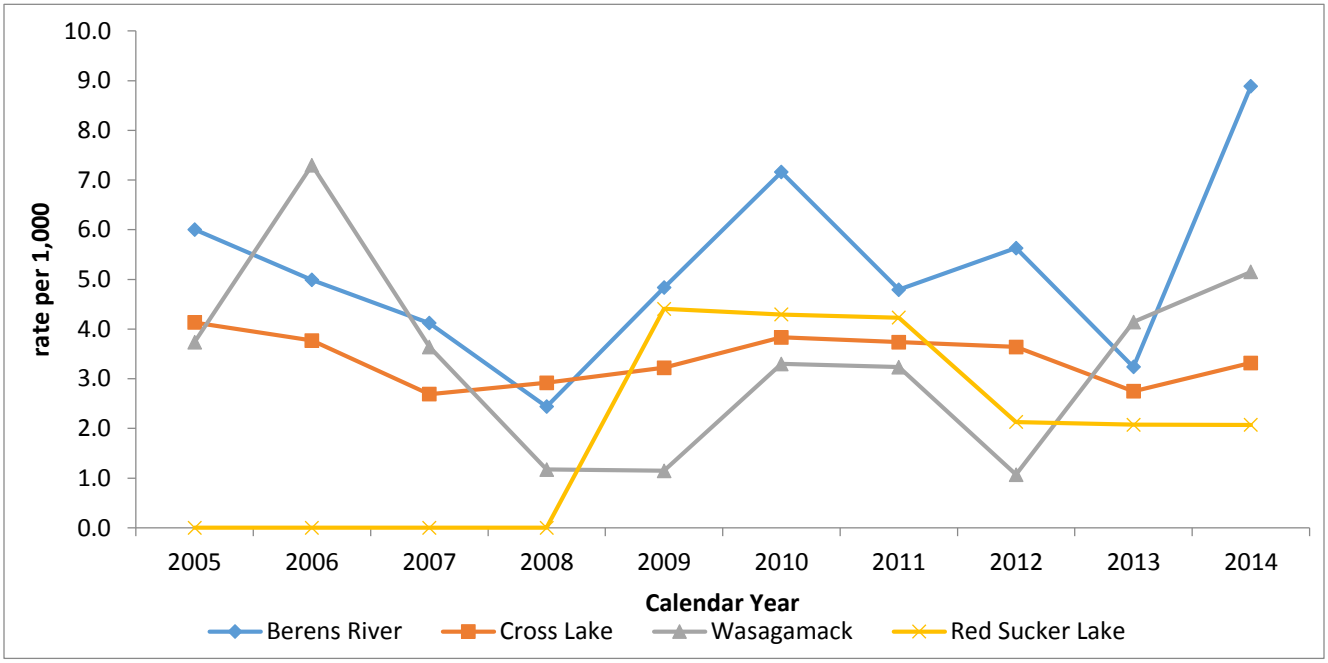
Band	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Berens River	3.4	3.3	4.1	3.2	3.2	7.2	1.6	2.4	3.2	3.2
Cross Lake	2.1	3.1	4.4	2.9	1.9	3.2	2.8	3.3	2.1	2.7
Wasagamack	5.0	4.9	6.1	3.5	5.7	1.1	2.2	3.2	3.1	1.0
Red Sucker Lake	2.5	4.9	2.4	6.8	2.2	2.1	4.2	4.3	0.0	2.1

Figure 4. Quinolones usage in children aged 0-19 from 2005 to 2012 reported as rates per 1000. Data was not statistically significant.



Band	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Berens River	24.0	24.1	16.5	24.4	23.4	31.0	16.8	17.7	36.4	18.6
Cross Lake	17.2	18.2	19.2	21.4	22.9	19.8	19.3	21.2	27.8	16.0
Wasagamack	14.9	25.5	17.0	17.6	16.1	23.1	18.3	20.3	30.0	15.4
Red Sucker Lake	2.5	12.3	9.6	20.5	22.0	17.2	12.7	21.3	27.0	8.3

Figure 5 Sulfonamides usage in children aged 0-19 from 2005 to 2014 reported as rates per 1000.



Band	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Berens River	6.0	5.0	4.1	2.4	4.8	7.2	4.8	5.6	3.2	8.9
Cross Lake	4.1	3.8	2.7	2.9	3.2	3.8	3.7	3.6	2.7	3.3
Wasagamack	3.7	7.3	3.6	1.2	1.1	3.3	3.2	1.1	4.1	5.1
Red Sucker Lake	0.0	0.0	0.0	0.0	4.4	4.3	4.2	2.1	2.1	2.1

Figure 6. Tetracyclines usage in children aged 0-19 from 2005 to 2014 reported as rate per 1000.

Discussion:

This retrospective population based study was conducted on 4 remote northern Manitoban communities and included a total of 23464 prescriptions dispensed from 2005 to 2014 belonging to children registered to these communities from ages 0 to 19. Our data indicates decreasing prescriptions rates of all classes of antibiotics in all the communities analyzed with the exception being cephalosporins, which were observed to increase moderately in Berens River. We observed the largest decreases coming from the Macrolides (Wasagamack decreased by 40% and Red Sucker Lake a decrease of 76%) with modest decreases in the Penicillins (Cross Lake decreased by 23%, Berens River decreased by 16%, Wasagamack decreased by 26% and Red Sucker Lake decreased by the largest margin of 55 %.)

Our results from this study for the most part are in agreement with similar studies performed on other populations in that the general trends with respect to antibiotic prescriptions patterns by primary care health professionals is decreasing over time[3]. It does provide counter evidence regarding the notion presented earlier involving lower socioeconomic status children being subjected to increasing rates of antibiotic usage[2,3].

One key limitation to our study mentioned earlier was the inability to acquire the data regarding prescription rates of antibiotics dispensed on the nursing stations from stock supplies and it deserves more mention. While using the NIHB databases can provide us with a preliminary empirical view of antibiotic usage in children residing in isolated northern communities, a comprehensive depiction of overall antibiotic usage is necessitated by having this data included. It is essential to note the unique difficulties of acquiring this data. Several attempts were made to gain access to this data to no avail. Amongst the many challenges my research group faced attempting to get access to this data was the lack of jurisdictional autonomy the communities have with respect to giving consent for researchers to their medical charts. There are no apparent legal precedents set forth that outline the appropriate path for researchers to follow regarding whom requests of consent should be directed in order to access medical records at nursing stations, as well as there are discrepancies regarding ownership of said medical charts. Another relative limitation involves the nature in which data are reported in NIHB databases. They are reported solely by band registration, hence comprise all members of the band, whether they reside on the selected communities we studied or not. Our report also assumes 100% compliance with respect to medication adherence, therefore we must keep in mind the data represents what the NIHB program paid for and not necessarily what the patients consumed.

Conclusions

Our results show preliminary evidence of decreasing rates of antibiotic prescriptions in remote northern Manitoban communities. More work is necessary to get a broader picture of past and current antibiotic prescription patterns in order to serve as a catalyst for clinical guideline reforms when necessary, to give us a better picture of the overall quality of care these patients receive and ultimately to improve the health outcomes of patients in these communities.

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