

Distribution and Completion of Treated Latent Tuberculosis Infection in Winnipeg

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Executive Summary

Distribution of Treated Latent Tuberculosis Infection (LTBI) Cases in Winnipeg

- 744 individuals received LTBI treatment in Winnipeg between 2012 and 2014.
- There were a similar number of female and male LTBI cases.
- More than half of the individuals receiving LTBI treatment were between 15 and 44 years of age.
- Half of the individuals receiving LTBI treatment lived in three community areas: Downtown, Seven Oaks and Point Douglas.
- The majority were treated with the medicine Isoniazid (INH).
- Of the INH-treated LTBI cases, almost half were prescribed by General Practitioners, 15% were prescribed by Chest Medicine Specialists, 22% were prescribed by Paediatricians and 10% by Nurse Practitioners.
- Of the RFP-treated LTBI cases, over half were prescribed by Chest Medicine Specialists and almost a quarter of RFP-treated LTBI cases were prescribed by other specialists
- General Practitioners and Chest Medicine Specialists treated about six out of ten LTBI cases (including young adults age 15+) LTBI cases. Nurse Practitioners treated about one in ten cases.
- Paediatricians treated the majority of pediatric LTBI cases (<18 years of age).
- LTBI Primary Care, including Klinik, Access Downtown and Bridge Care, provided LTBI treatment services to over half of the adult (18+ years of age) LTBI cases in Winnipeg. Health Science Centre (HSC) Provided LTBI treatment services to just over a quarter of the adult LTBI cases.
- Children's Hospital treated nine out of ten pediatric cases (<18 years of age).

Completion of Treated Latent Tuberculosis Infection Cases in Winnipeg

- 723 individual's completion rates were studied and of these, 525 cases completed treatment, representing an overall completion rate of 73%.
- Completion rates were higher in females than in males.
- There was a downward trend of completion rates from younger age groups to older age groups. The youngest age group had the highest completion rates and the oldest age group had the lowest completion rates.
- Individuals treated with Isoniazid had a higher completion rate than those treated with Rifampin.
- Patients of Nurse Practitioners and Paediatricians had the highest completion rates.
- Individuals treated at Children's Hospital had the highest completion rates followed by those treated by the LTBI Primary Care group and specialists at Respiratory Services Out Patient Department (RSOPD) at HSC.
- LTBI cases treated by prescribers who had low LTBI case loads (1-10 LTBI cases in 3 years) had low completion rates compared to prescribers who had medium or high LTBI case loads (11-50 and 51+ LTBI cases in 3 years, respectively).

Introduction

Manitoba has active tuberculosis (TB) rates well above the national average, particularly in First Nations (FN) and foreign-born populations (PHAC, 2012). Tuberculosis is a bacterial disease that affects the lungs and is transmitted through the air. Treatment of latent TB infection (LTBI) is an effective method to prevent LTBI from progressing to active TB disease (Bishara, Ore, & Ravell, 2014). People with latent tuberculosis infection have been infected by TB bacteria but cannot transmit it and are not yet sick with the disease but have a lifetime risk of developing active tuberculosis. In Manitoba, publicly funded medications are provided for individuals diagnosed with LTBI. The clients, healthcare providers, Regional Health Authorities, First Nations and Inuit Health Branch (FNIHB) and Manitoba Health, Seniors and Active Living share the responsibility of treatment management. Currently, Winnipeg Regional Health Authority (WRHA) Integrated TB Services is reviewing LTBI treatment services in Winnipeg. This study was conducted at the request of the WRHA Integrated TB Services.

Prospective clinical cohort studies (Hirsch et al, 2015; Maleiczuk et al, 2014; Pettie et al, 2013) and retrospective observational studies based on the population-based drug dispense database in Quebec (Rubinowicz et al, 2014; Rivest et al, 2013) reported relatively low or moderate LTBI treatment completion rates (31-74%). There is no information on LTBI treatment completion rates in Manitoba or in Winnipeg. Therefore, the overarching goal of this study was to evaluate LTBI management in Winnipeg and to provide evidence to improve TB prevention program planning and policy development.

The objectives of this study were to:

1. describe the demographic and geographical distribution of individuals receiving LTBI treatment, and
2. evaluate LTBI treatment completion rates and potential factors related to treatment non-completion in Winnipeg.

Methods

Study Design

This is a population-based retrospective cohort study based on the prescription dispensing records of all Winnipeg residents from 2012-2014. To ensure that all LTBI cases between 2012 and 2014 were identified, and to calculate the completion rates, the data source for this study covers five years (January 01, 2011 - November 30, 2015). Since an individual can have LTBI treatment over a lengthy period with multiple medication dispensing dates, the first LTBI drug dispensing date, during the period of January 01, 2011 - November 30, 2015, was used for data grouping.

Data Source

The prescription records of anti-TB medications and selective antibiotics were extracted on February 4, 2016 from the provincial Drug Program Information Network (DPIN) database. DPIN is an electronic, online, point-of-sale prescription drug database in Manitoba that includes adjudicated and non-adjudicated files. DPIN generates complete drug profiles for

each client including all transactions at the point of distribution. The information of healthcare providers was sourced from the Manitoba doctor billing database, which was linked to the DPIN data with the prescribers' identification number called the College of Physician and Surgeons Identification Number (CPSID). If the prescriber had more than one billing address in the dataset, the first address in the dataset was selected. If a prescriber's billing address was an address of a healthcare facility, it was used as the location where the prescriber provided the service. If a prescriber's billing address was not an address of a healthcare facility, a reference list provided by WRHA was used to identify where the prescribers provided the service. All prescribers' names were removed in this report. The demographic information for LTBI cases was extracted from the health insurance registry, which was linked to DPIN data based on the Personal Health Identification Number (PHIN).

LTBI Case Definition

Isoniazid (INH) and Rifampin (RFP) were the two medications commonly used as monotherapy treatment for LTBI in Manitoba; therefore, those two medications were chosen to represent LTBI treatment. The LTBI case definition was:

- Individuals who were supplied with Isoniazid (INH) in the first prescription and no other anti-TB medications were provided at the same time; or
- Individuals who were supplied with Rifampin (RFP) in the first prescription, not combined with other anti-TB medications or the selected antibiotics at the same time;

Note: Children under six years old who were treated with INH but for less than a period of 12 weeks were not included in the analysis for the purpose of excluding window period prophylaxis.

A 1-year run-in period (2011) was used to identify those with INH or RFP as the first LTBI prescription. The detailed TB medications and selected antibiotics are listed in Table A (Appendix A).

LTBI is not a reportable disease. Therefore, in the absence of data on all diagnosed LTBI cases, it is not feasible to estimate the prevalence of LTBI in Winnipeg. It is also not possible to calculate LTBI treatment acceptance rates. However, LTBI treatment is covered by provincial health insurance and because of this we are able to estimate the total number of people living in Winnipeg who have been dispensed (or accepted) mono-therapy of INH or RFP for treating LTBI based on the provincial Drug Program Information Network (DPIN) database. LTBI treatment is recommended to those with a positive Tuberculosis Skin Test (TST) or Interferon Gamma Release Assay (IGRA) test (in the absence of evidence of active TB), in individuals:

- having had close contact with infectious TB cases, or
- being immunosuppressed (such as HIV/AIDS, chemotherapy, transplant, certain immunosuppressive medications), or
- immunocompromised (such as diabetes, chronic renal insufficiency), or
- who are immigrants from high TB incidence countries, or
- who are injection drug users, or
- living in correctional facilities or homeless shelters, or
- from high TB burden communities, or
- who are health care workers.

LTBI treatment indication data was not available in the DPIN database. Therefore, this study reports on the LTBI distribution and treatment completion rates based on those individuals

who had accepted LTBI treatment (regardless of indication) and received the dispensed LTBI medication.

Healthcare Providers and Facilities

Based on the information provided by the WRHA Integrated Tuberculosis Services (ITBS) program, healthcare providers were further grouped into the following groups:

- a. Key LTBI primary care sites (Klinik, Access Downtown, Bridge Care) providing assessment and management to individuals who need non-complex LTBI assessment and management;
- b. Health Sciences Centre (HSC) Respiratory Outpatient Department (RSOPD) providing assessment and management to individuals who are referred from other jurisdictions and require non-complex and complex LTBI assessment and management;
- c. Children's Hospital Outpatient Clinic providing assessment and management for children who are referred from other jurisdictions and require non-complex and complex LTBI assessment and management;
- d. Other clinics include centers that provide LTBI assessment and management but are not part of the above mentioned centers.

Based on the number of LTBI cases per prescriber, the healthcare providers were further grouped into three groups;

1. low LTBI case load (treated 1-10 LTBI cases over 3 years),
2. medium LTBI-case load (treated 11-50 LTBI cases over 3 years), and
3. high LTBI-case load (treated 51+ LTBI cases over 3 years).

LTBI Treatment Completion Criteria

Nine months of daily self-administered INH or four months of daily self-administered RFP are recommended (7th Canadian TB Standard) and commonly practiced in Manitoba as LTBI treatment. To be observed "treatment complete" LTBI cases had to have either been dispensed INH for 270 days or more within a 12-month period **or** RFP for 120 days or more within a six-month period.

Statistical Analysis

Descriptive statistics and geographical mapping were used to describe the distribution of individuals who received LTBI treatment during the study period. Winnipeg community areas and FSAs of postal codes were used to display the distribution of LTBI cases in Winnipeg. The completion rate was calculated as the percentage of individuals who completed the treatment based on the criteria mentioned above. Potential factors including; age, gender, treatment, residential area, healthcare providers' specialty and prescribers' LTBI case load during the 3-year study period, were tabulated with treatment completion rates.

Limitations

LTBI "case" definition in this report was only based on medication dispensing records in the DPIN database without accessing clinical chart and laboratory test results. Actual administration and/or taking of the medication could not be confirmed.

Results A – Demographic Characteristics and Geographic Distributions of LTBI Cases in Winnipeg

Gender and Age Distribution of LTBI Cases

A total of 744 individuals receiving LTBI treatment in Winnipeg were identified during the period of 2012-2014 (Table 1). Over half of the individuals were female (n=400, 53.8%). The mean age of those receiving LTBI treatment in Winnipeg was 33.7 years (+/- Std Deviation 18.5 years) with over half of the individuals between 15 and 44 years of age. There were more female LTBI cases than male LTBI cases among individuals 0-44 years of age, while there were more male than female LTBI cases among individuals 45 years of age and older. However, the largest difference occurred among the 15-29 year old age group, where there were 141 female LTBI cases (35.3%) compared to 76 male LTBI cases (22.1%). The oldest age group (60+ years) had both the smallest number of male and female LTBI cases (Figure 1).

Table 1: Number and Percentage of Individuals Treated for Latent Tuberculosis Infection by Sex and Age Group, Winnipeg, 2012-2014

Age group	Female		Male		Both	
	Cases (n)	%	Cases (n)	%	Cases (n)	%
0-14 years	67	16.8	62	18.0	129	17.3
15-29 years	141	35.3*	76	22.1	217	29.2
30-44 years	94	23.5	89	25.9	183	24.6
45-59 years	65	16.3	75	21.8	140	18.8
60+ years	33	8.3	42	12.2	75	10.1
Total	400	100.0	344	100.0	744	100.0

*Comparing to males $p < 0.05$.

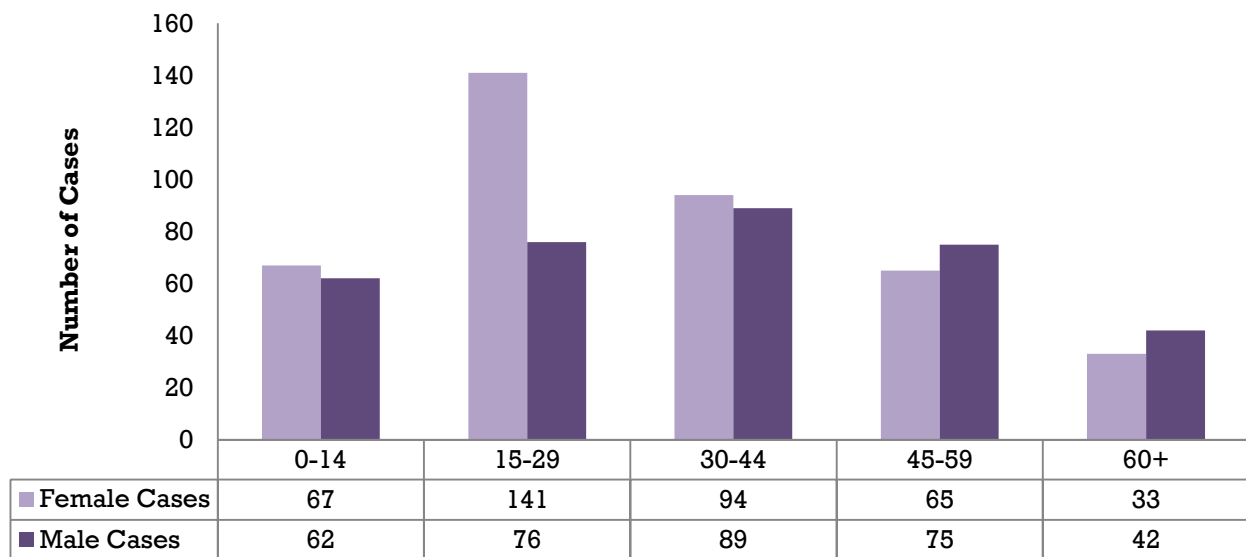


Figure 1: Number of Individuals Treated for Latent Tuberculosis Infection by Sex and Age Group, Winnipeg, 2012-2014

Geographic Distribution of LTBI Cases

Figure 2 shows that among the 744 individuals receiving LTBI treatment in Winnipeg, half lived in three community areas; Downtown (24%), Seven Oaks (13%) and Point Douglas (13%) and a quarter lived in three other community areas; Inkster (9%), River East (9%), and Fort Garry (7%) (Figure 2, Table 2). In Figure 3, each of these community areas are further broken down into Neighborhood Clusters. This gives a visual of which sections of each community area have a greater distribution of LTBI. For instance, among Fort Garry LTBI cases, more are distributed in Fort Garry South than in Fort Garry North.

Table 2: Number and Percentage of Individuals Treated for Latent Tuberculosis Infection by Community Area and Year, Winnipeg, 2012-2014

Community Area	2012		2013		2014		Total	
	Cases	%	Cases	%	Cases	%	Cases	%
Downtown	69	25.0	55	23.0	58	25.3	182	24.5
Seven Oaks	35	12.7	39	16.3	26	11.4	100	13.4
Point Douglas	40	14.5	29	12.1	26	11.4	95	12.8
Inkster	24	8.7	23	9.6	20	8.7	67	9.0
River East	29	10.5	12	5.0	22	9.6	63	8.5
Fort Garry	16	5.8	17	7.1	21	9.2	54	7.3
St. Vital	15	5.4	19	7.9	12	5.2	46	6.2
Assiniboine South and St. James-Assiniboia	14	5.1	16	6.7	13	5.7	43	5.8
St. Boniface	10	3.6	12	5.0	13	5.7	35	4.7
River Heights	13	4.7	10	4.2	9	3.9	32	4.3
Transcona	11	4.0	7	2.9	9	3.9	27	3.6
Total	276	100.0	239	100.0	229	100.0	744	100.0

*Community areas Assiniboine South and St. James-Assiniboia were combined due to small counts in the Assiniboine South area

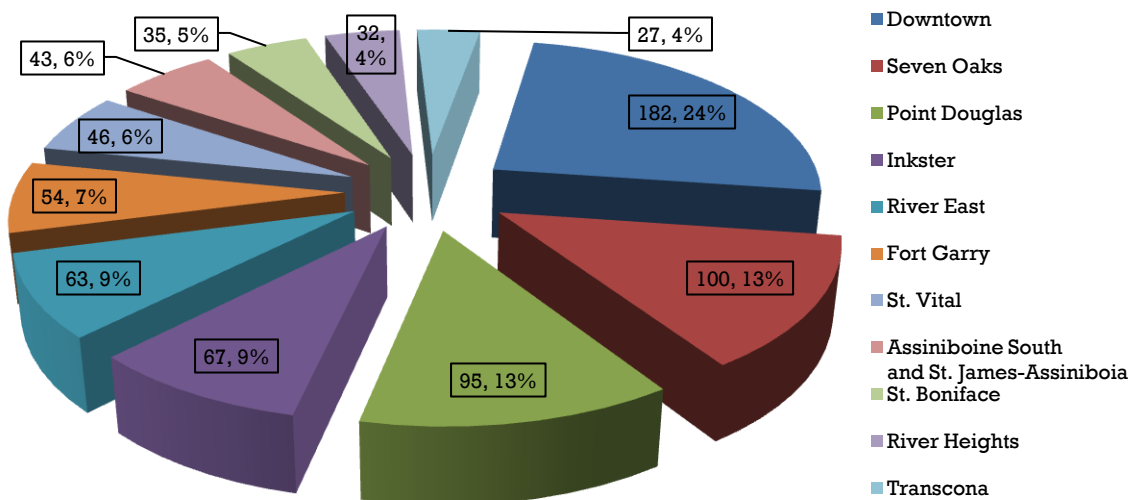


Figure 2: Number and Percentage of Individuals Treated for Latent Tuberculosis Infection (LTBI) by Community Area, Winnipeg, 2012-2014

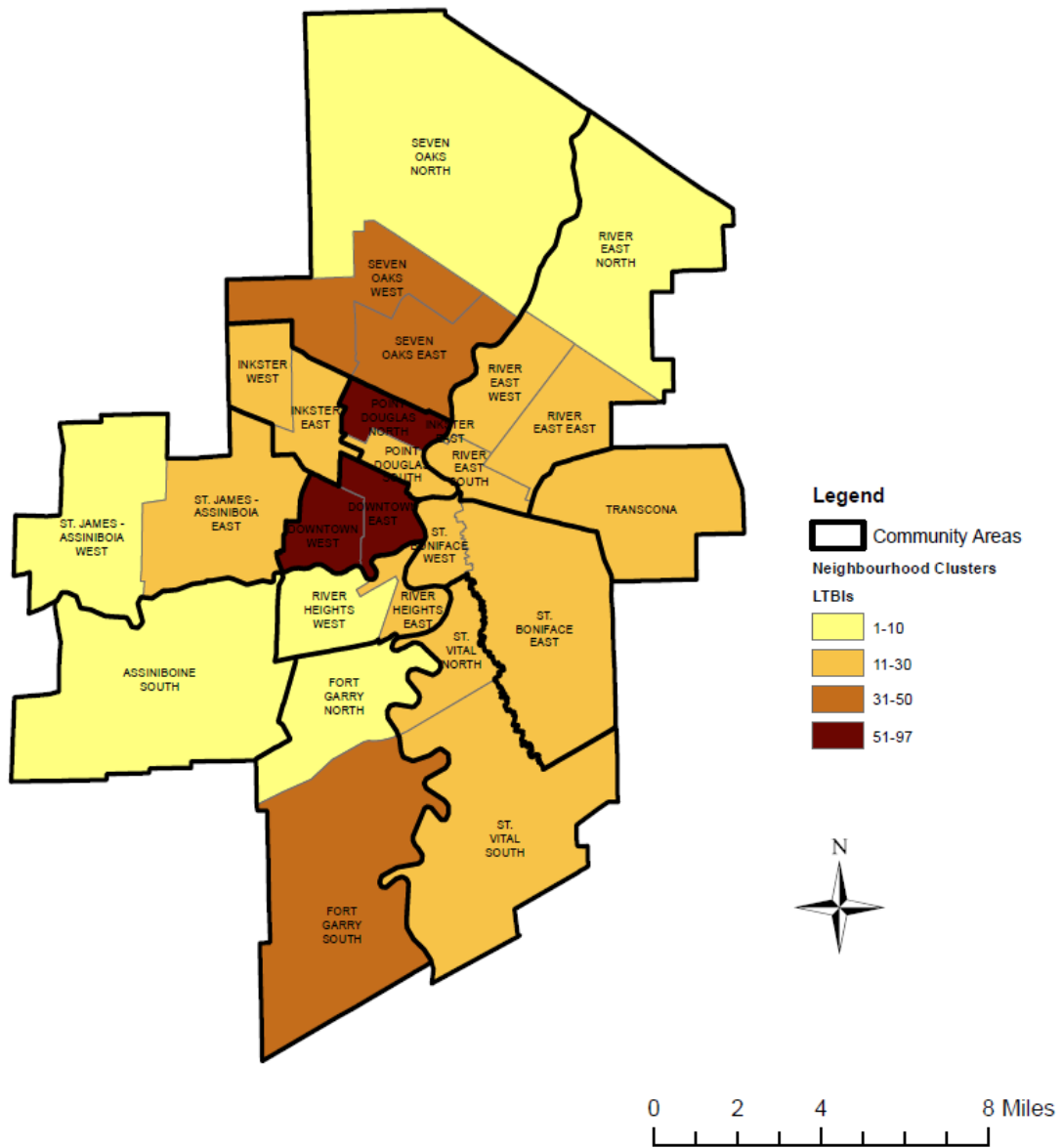


Figure 3: Distribution of Latent Tuberculosis Cases by Neighborhood Cluster, Winnipeg, 2012-2014

If the data was grouped instead by Forward Sortation Area (FSA) of the individuals' residential address, the 744 LTBI cases were distributed in 33 FSAs, and more than a half lived in eight FSAs; R3B, R2W, R2P, R2X, R3E, R2R, R2V and R3T (see Figure 4).

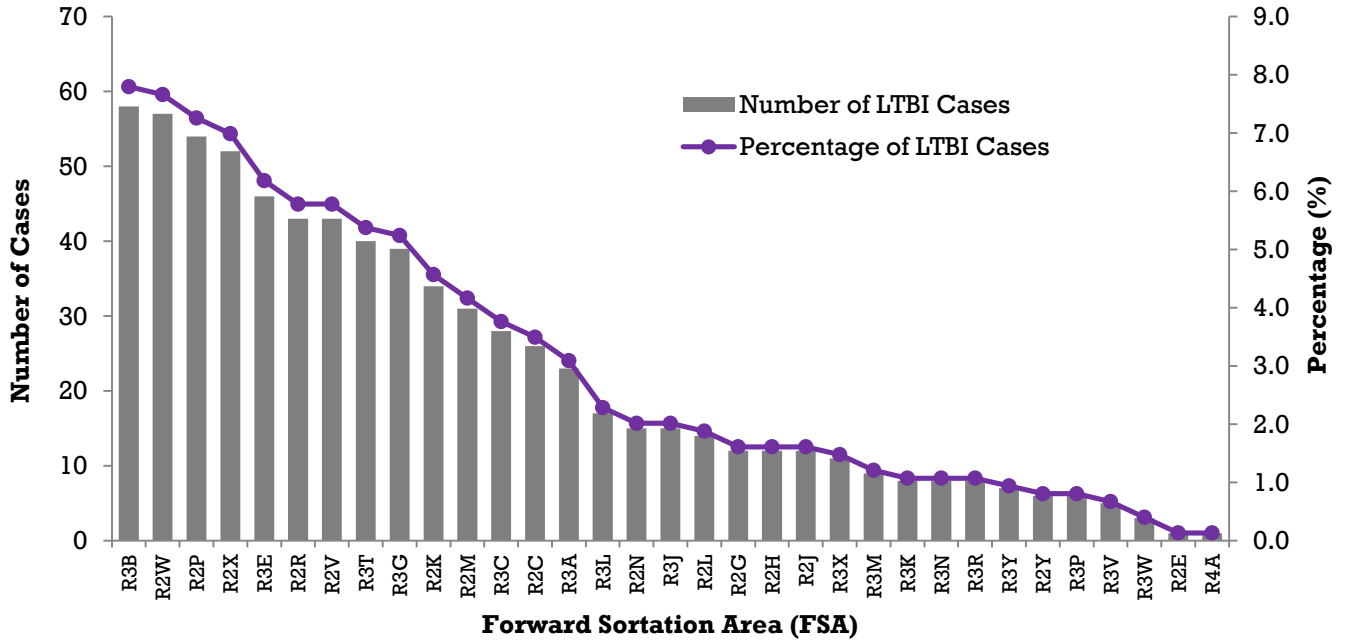


Figure 4: Number and Percentage of Individuals Treated for Latent Tuberculosis Infection by FSA, Winnipeg, 2012-2014

Distributions of LTBI cases by Medication and Prescriber’s Specialty

Among the 744 individuals treated for LTBI between 2012 and 2014, the majority (78.6%) were treated with INH and only 21.4% (159 individuals) were treated with RFP (Figure 5).

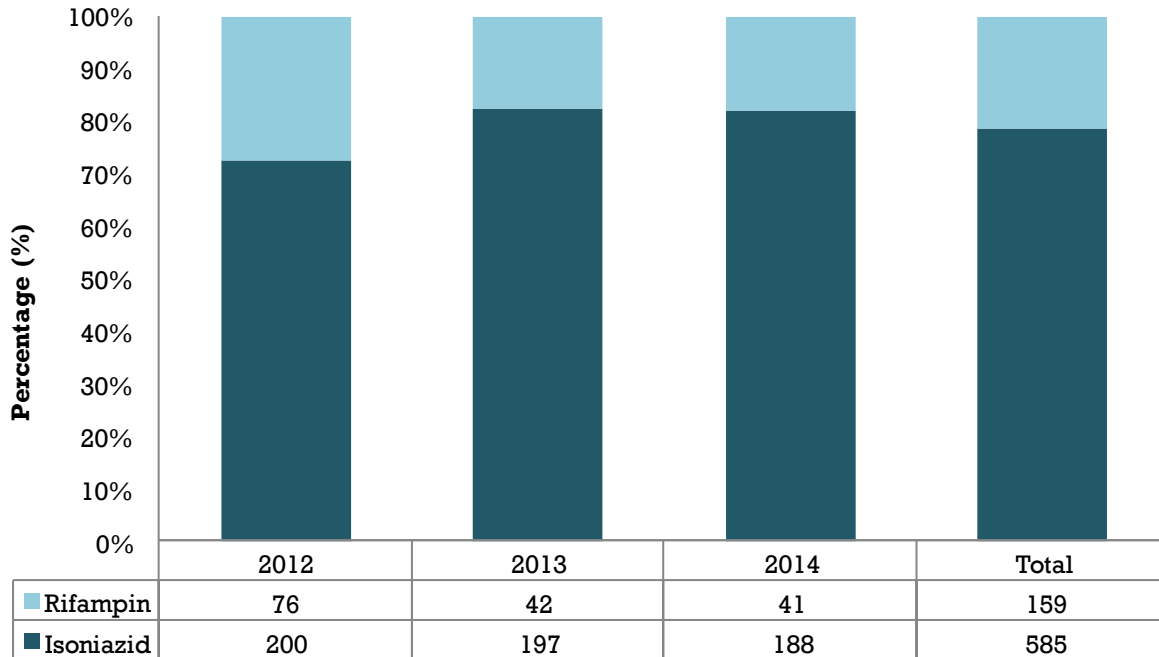


Figure 5: Number of Individuals Treated for Latent Tuberculosis Infection (LTBI) by Treatment Medication and Year, Winnipeg, 2012-2014

Almost half of the INH treated LTBI cases were prescribed by General Practitioners (46.2%) while the majority of the RFP treated LTBI cases were prescribed by Chest Medicine Specialists (55.3%). Paediatricians treated just over 20% of the INH treated LTBI cases and Nurse Practitioners treated 10% of the INH treated LTBI cases. Combined, pediatricians and Nurse Practitioners treated under 6% of the RFP treated LTBI cases.

Table 3: Number and Percentage of Individuals Treated for Latent Tuberculosis Infection (LTBI) by Treatment Medication and Healthcare Providers' Specialty, Winnipeg, 2012-2014

Healthcare Providers' Specialty	Isoniazid		Rifampin		Total	
	Cases (n)	%	Cases (n)	%	Cases (n)	%
General Practitioners	270	46.2	26	16.4	296	39.8
Chest Medicine Specialists	90	15.4	88	55.3	178	23.9
Paediatricians	131	22.4	10	6.3	201	27.0
Nurse Practitioners	60	10.3				
Other Non-Chest Medicine Specialists	34	5.8	35	22.0	69	9.3
Total	585	100.0	159	100.0	744	100.0

Note: Number of individuals treated with RFP by Nurse Practitioners and Paediatricians were combined due to small counts

LTBI Case Distribution by Healthcare Providers and Facilities

General practitioners and chest medicine specialists treated the majority (63.6%) of LTBI cases in Winnipeg (Table 4). Paediatricians treated almost all (91.5%) of the pediatric (0-14 years) LTBI cases in Winnipeg.

Table 4: Number and Percentage of Individuals Treated for Latent Tuberculosis Infection (LTBI) by Healthcare Provider and Age, Winnipeg, 2012-2014

Healthcare Providers' Specialty	0-14 years		15-29 years		30-44 years		45-59 years		60+ years		Total	
	Cases (n)	%	Cases (n)	%	Cases (n)	%	Cases (n)	%	Cases (n)	%	Cases (N)	%
General Practitioners	S	S	115	53.0	97	53.0	61	43.6	22	29.3	295	39.7
Chest Medicine Specialists	0	0.0	37	17.1	57	31.1	52	37.1	32	42.7	178	23.9
Nurse Practitioners	0	0.0	41	18.9	17	9.3	S	S	S	S	58	7.8
Paediatricians	118	91.5	16	7.4	0	0.0	S	S	S	S	134	18.0
Other Prescribers*	11	8.5	8	3.7	12	6.6	27	19.3	21	28.0	79	10.6
Total	129	100.0	217	100.0	183	100.0	140	100.0	75	100.0	744	100.0

*S = Suppressed, which denotes cell sizes between 1 and 5 (counts too small to report)

*Other Prescribers includes cases treated by non-Chest Medicine Specialist as well as the counts that were suppressed for that age group

Table 5: Number and Percentage of Individuals Age 18+ Treated for Latent Tuberculosis Infection (LTBI) by Clinic Group, Clinic Center, Winnipeg, 2012-2014

Clinic Group	Clinic Center	Age 18+	
		Cases	%
Health Science Center (HSC)	HSC – RSOPD *	141	24.2
	HSC – Other	21	3.6
LTBI Primary Care	Access Downtown/Bridge Care	90	15.4
	Klinik	214	36.7
Other clinics		91	15.6
Missing		26	4.5
Total		583	100.0

* Other clinics include those that treated less than 6 LTBI cases by each clinic
 *Missing: 26 adult patients' service provider facilities could not be ascertained
 *HSC = Health Science Centre
 *RSOPD = Respiratory Services Out Patient Department

Table 5 shows that the key LTBI Primary Care centers (which include Klinik, Access Downtown and Bridge Care) provided LTBI treatment services to over half of the adult (age 18+ years) LTBI cases in Winnipeg (52.1%). HSC provided LTBI treatment services to just over 25% of LBTI cases with the majority being treated by HSC-RSOPD. The majority of clinic centers treated a similar amount of female and male LTBI cases (Figure 6). The exception was Klinik which treated 52 more female LTBI cases than male LTBI cases between 2012 and 2014 (data not shown).

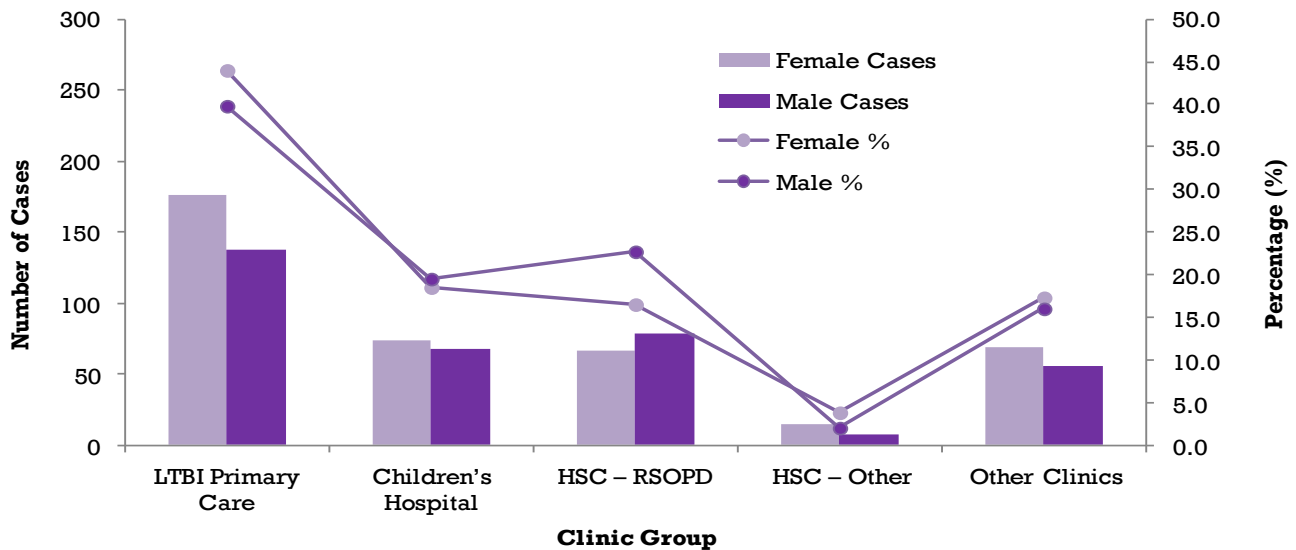


Figure 6: Number of Individuals Treated for Latent Tuberculosis Infection by Clinic Group and Sex, Winnipeg, 2012-2014

*LTBI Primary Care includes Klinik, Access Downtown and Bridge Care
 *HSC = Health Science Center
 *RSOPD = Respiratory Services Out Patient Department

Results B – LTBI Treatment Completion

Treatment Completion Rates by Demographic Characteristics

Among the 744 LTBI treated individuals identified during the study period 2012-2014, 21 individuals whose treatment started in December 2014 were excluded from estimating the treatment completion rate. This was the cases because some of their treatment data was not available when the data was extracted. Of these 723 treated LTBI cases identified, 525 of the cases completed treatment, representing an overall completion rate of 72.6% (Table 6). The completion rate was higher in females (INH = 80.0%; RFP = 58.97%) than in males (INH = 75.39%, RFP = 45.95%). Among those who used INH treatment, there was a downward trend of completion rates from younger age groups to older age groups. The youngest age group (ages 0-14 years) had the highest completion rate, just over 90%, and the oldest age group (ages 60+ years) had the lowest completion rate, just under 60%. Similar to INH treatment, younger LTBI cases (ages 0-44 years) had relatively higher RFP completion rates (60.6-63.4%), followed by the age group 45-59 years (51.3%). Older LTBI cases (ages 60+ years) had the lowest RFP completion rate (35%).

Comparing the completion rates by the medication (Table 6 and Figures 7 and 8), LTBI cases treated with INH had a significantly higher completion rates than those treated with RFP (77.93% versus 52.63%).

Table 6: Latent Tuberculosis Infection (LTBI) Treatment Completion Counts and Rate by Medication and Demographics, Winnipeg, 2012-2014

Demographic		Isoniazid			Rifampin		
		Completion (n)	Total Prescribed (N)	Completion Rate (%)	Completion (n)	Total Prescribed (N)	Completion Rate (%)
Gender	Female	252	315	80.00	46	78	58.97
	Male	193	256	75.39	34	74	45.95
	Total	445	571	77.93	80	152	52.60
Age	0-14	111	123	90.24	20	33	60.61
	15-29	148	177	83.62			
	30-44	105	137	76.64	26	41	63.41
	45-59	61	99	61.62	20	39	51.28
	60+	20	35	57.14	14	39	35.90
	Total	445	571	77.93	80	152	52.63

Note: Age groups 0-14 and 15-29 were combined for RFP due to small counts in the 0-14 year old age group

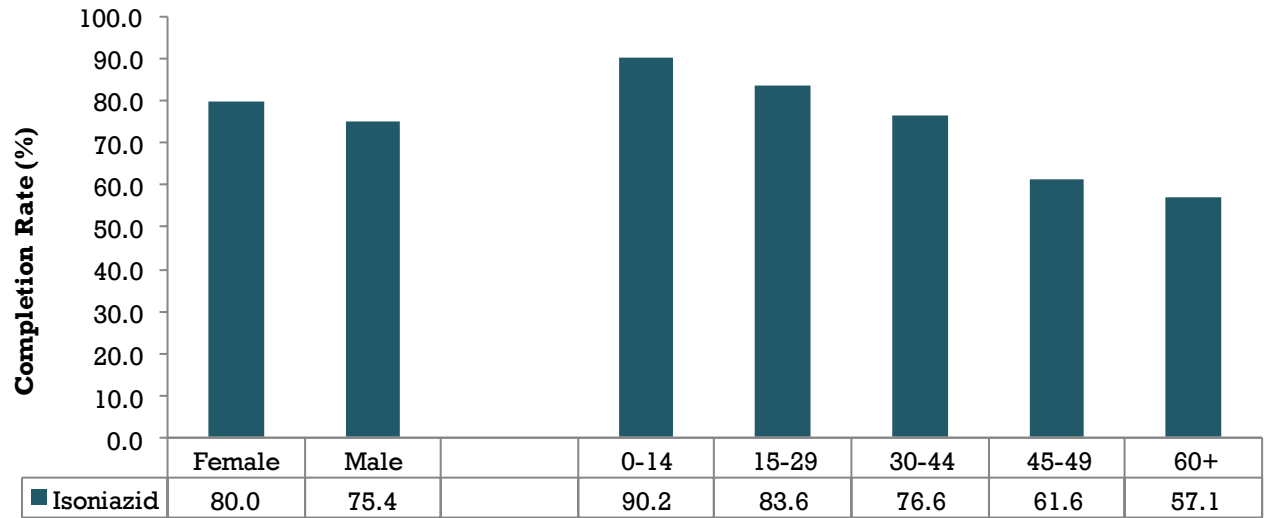


Figure 7: Latent Tuberculosis Infection Isoniazid Treatment Completion Rates by Demographics, Winnipeg, 2012-2014

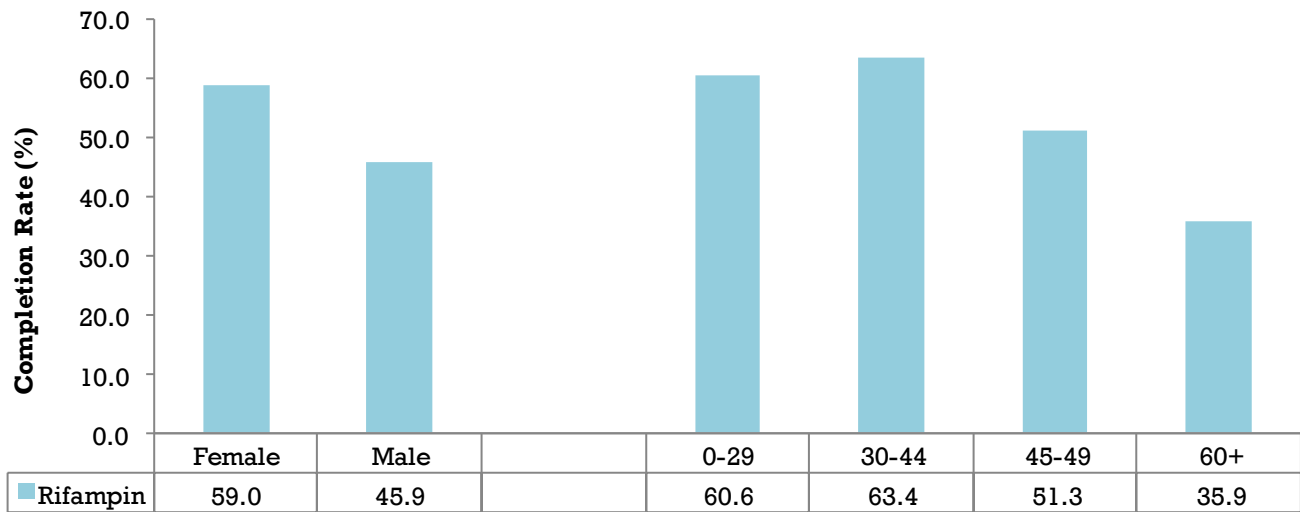


Figure 8: Latent Tuberculosis Infection Rifampin Treatment Completion Rates by Demographics, Winnipeg, 2012-2014

LTBI Treatment Completion Rates by Health Care Providers

Health care providers' clinic group and LTBI case loads (Figure 9) were associated with LTBI treatment completion rates. Among all LTBI cases, those treated at Children's Hospital had the highest completion rate (91.2%), followed by those treated by the LTBI Primary Care group (78.3%), and specialists at RSOPD at Health Sciences Centre (77.7%). Those treated by the prescribers at other clinics or non-RSOPD prescribers at Health Sciences Center had the lowest completion rates (31- 40%). The LTBI cases treated by prescribers who had low LTBI case loads (1-10 LTBI cases in 3 years) also had the lowest completion rates (34.4%) compared to prescribers who had medium or high LTBI case loads (77.9% and 81.5% respectively).

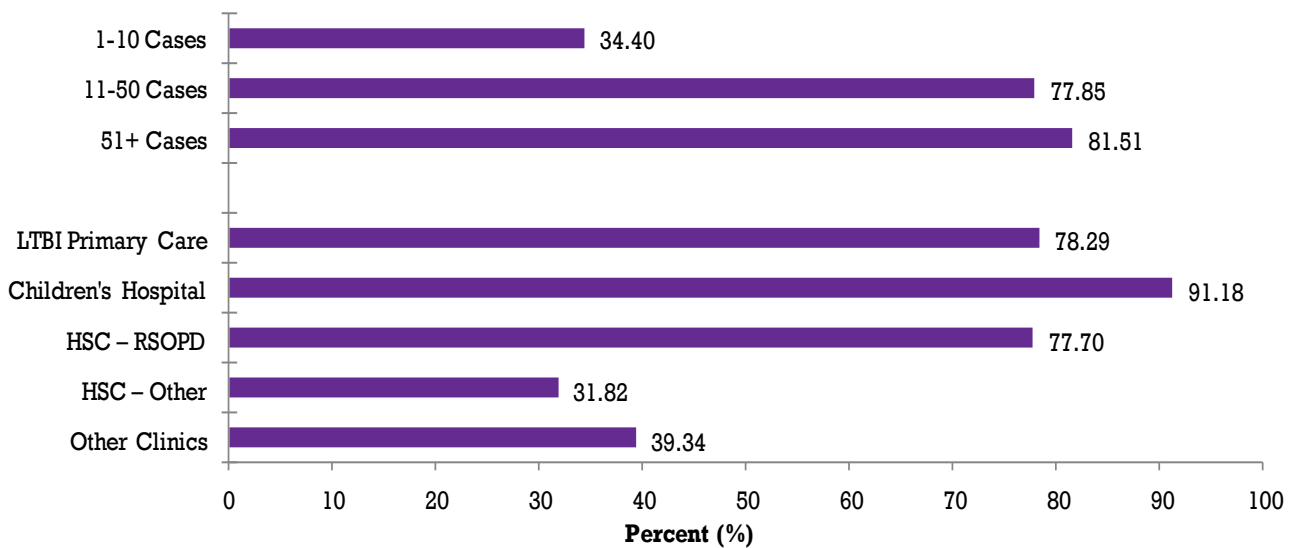


Figure 9: Treatment Completion Rates of Latent Tuberculosis Infection (LTBI) by Prescriber Case Loads and Health Care Providers' Clinic Group, Winnipeg, 2012-2014

*LTBI Primary Care includes Klinik, Access Downtown and Bridge Care

*HSC = Health Science Center

*RSOPD = Respiratory Services Out Patient Department

Figure 10 shows LTBI completion rates by healthcare providers' specialty. Between 2012 and 2014, Nurse Practitioners and Paediatricians had the highest completion rates, both over 80%, with the exception of the male completion rate by Nurse Practitioner (73.9%). Other prescribers whose specialties are non-Chest Medicine had the lowest completion rates. In all specialties, females had a slightly higher completion rate than males.

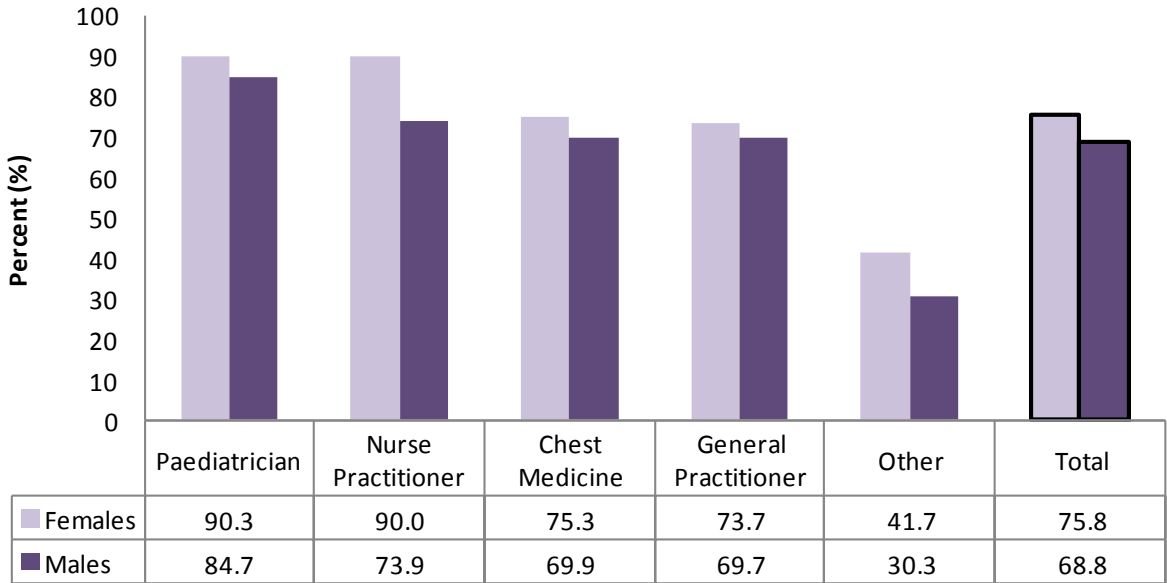


Figure 10: Treatment Completion Rates of Latent Tuberculosis Infection (LTBI) by Sex and Healthcare Providers Specialty, Winnipeg, 2012-2014

Discussion

The purpose of treating LTBI is to prevent LTBI progressing to active TB disease. Daily INH for 6 to 12 months or RFP for 3 to 4 months are two common LTBI treatments practiced in Manitoba and recommended by the 7th Edition of Canadian Tuberculosis Standard (PHAC, 2014). The main objectives of this report are: to provide information on the epidemiologic characteristics, demographic and geographical distribution of LTBI cases and to evaluate the LTBI treatment completion rates and potential factors for treatment non-completion in Winnipeg. The findings of this analysis are important for TB prevention program planning and evaluation at regional and provincial level.

Overall Distribution of LTBI Cases

During the 3-year period (2012-2014), a total of 744 individuals, 400 females and 344 males, received LTBI treatment in Winnipeg. The majority of individuals (79%) were treated with INH. The mean age of individuals receiving LTBI treatment was 33.7 years (+/- Std Deviation 18.5 years). The majority of Winnipeg LTBI cases being treated (90%) were among individuals younger than 60 years of age and in particular, one in five LTBI cases were being treated in children younger than 18 years of age. Half of the individuals receiving treatment for LTBI live in three community areas (Downtown, Point Douglas, and Seven Oaks) and another quarter of LTBI cases live in three community areas, Inkster, River East and Fort Garry. This is the first time that distributions and completion rates of treated LTBI in Winnipeg has been reported. This report established methodology and baseline data for future LTBI program planning and evaluation.

Clinic Centers and Prescribers who provided LTBI Services

A total of 93 prescribers from 28 Winnipeg clinics dispensed LTBI medications during the study period. However, 11 prescribers treated almost 80 percent of adult LTBI cases, 18 years of age and older. Paediatricians and general practitioners prescribed primarily INH, while Chest Medicine specialists prescribed both INH and RFP. Four clinics (Klinik, Health Sciences Centre, Children's Hospital and Access Downtown/Bridge Care), all located in downtown Winnipeg, provided LTBI services to 83% of LTBI cases during the study period. Among the LTBI cases treated by primary care providers, 41% were treated by clinics or centers which are all located in the city centre and provide assessment and management to individuals from Winnipeg who need non-complex LTBI management.

LTBI Treatment Completion

Pediatric LTBI cases treated with INH had the highest treatment completion rates (90%). Comparing to younger LTBI cases (age <15 years), older individuals are at 2.5 to 4 times higher risk of LTBI treatment non-completion. It is well known that older age decreases the tolerance of INH and RFP (Fountain, Tolley, Chrisman, & Self, 2005; Smith, Schwartzman, Bartlett, & Menzies, 2011). Older cases, particularly male LTBI cases, had lower completion rates, as did LTBI cases who were dispensed RFP, and those treated by prescribers with low LTBI case loads.

The completion rates of those treated with INH were higher (77.93%) than those treated with RFP (52.63). This may be due to INH being the first line treatment in Winnipeg and the larger number of cases that were treated with INH. It is possible that those who were offered RFP

treatment may have had more complicating factors (clinical observations, personal communication with Dr. Pierre Plourde, September 2016) leading to the selection of a shorter treatment course. Those complicating factors could have contributed to lower treatment completion rates. Future evaluation should use this data as a baseline as RFP may become the first line treatment choice for LTBI which will impact RFP treatment completion rates.

The completion rate (78%) of LTBI cases dispensed treatment by either the key primary care prescribers or chest medicine specialists at RSOPD are much higher than rates previously reported in the literature (Rubinowicz et al, 2013). Both our study and Rubinowicz's are retrospective cohort studies based on administrative health insurance databases in a Canadian province. However, the proportion of LTBI treatment prescribed by primary care providers in Rubinowicz's study was 41% versus 78% by the LTBI primary care physicians and 39% completion rate by the non-LTBI primary care physicians in our study. The completion rates reported in Rubinowicz's study are more comparable to the completion rate prescribed by the non-LTBI primary care physicians in this study. Intuitively, we would conclude that other factors are contributing to the higher LTBI treatment completion rates, such as "LTBI specialty development" or clinics having cultural relevance and/or other supports for clients built into their operations.

Overall this report showed high LTBI treatment completion rates in Winnipeg, compared to other jurisdictions (Malejczyk et al., 2014; Rivest, Street, & Allard, 2013; Rubinowicz et al., 2014) and previously published reports (Hirsch-Moverman et al., 2015; Pettit, Bethel, Hirsch-Moverman, Colson, & Sterling, 2013). Winnipeg paediatric LTBI cases had much higher completion rates (88%) than the United States immigrant and refugee children population (Taylor, Painter, Posey, Zhou, & Shetty, 2015). Nurse practitioners had the second highest completion rate among healthcare providers (84%), higher than completion rates of General Practitioners (72%) and Chest Medicine Specialists (73%).

Program implications

LTBI treatment initiated by prescribers who had high LTBI case loads (greater than 10 cases in a 3-year period) resulted in higher completion rates than the treatment by prescribers with low LTBI case loads. It is unknown why clinicians who prescribe treatment for more than 10 cases in a 3-year period have higher completion rates. Perhaps they have a higher proportion of patients within the populations at risk and have therefore supports and structures in place that are more culturally relevant to the patient population. Further evaluation of prescribers/clinics with higher treatment completion rates to determine what unique features contribute to success is needed so that Integrated TB Services can support capacity building and spread of those features. Until the unique features that support treatment completion are better understood, care should be taken when developing or expanding LTBI services care to ensure that clinicians who undertake LTBI assessment will have adequate case loads.

Yearly monitoring of treatment completion rates by prescriber and clinics should occur in order for ongoing identification of areas of success and locations where further exploration of needs should occur in order to support increased completion rates. The high LTBI completion rates of patients prescribed by nurse practitioners should also be noted as this

should encourage consideration of more use of nurse practitioners for the delivery of LTBI services.

Clinicians and clinics should be individually apprised of their initiation of treatment and treatment completion rates in order to enter into dialogue about what factors support the treatment success and to identify and advocate for appropriate supports where challenges exist. In addition, consideration of the client's perspective/voice is needed to identify what the system needs to have in place to support them to successfully complete their LTBI treatment. Personal socioeconomic data is not included in the administrative data. Hence, analysis using the ecological socioeconomic data (income by neighborhood) was not feasible and it was not possible to explore the association of potential attributable underlying demographic factors (such as income, education, social cultural environment) on LTBI treatment completion rates. Intuitively, it is assumed that patients' demographic background may play a key role in the LTBI treatment completion. \

Conclusion

Consideration should be given to support a WRHA Primary Care Non-Complex LTBI Management Strategy that operates within a Primary Health Care Intersectoral Model to:

- a. maintain or improve quality standards;
- b. support equity of access to services especially for identified Tuberculosis population of priority;
- c. be culturally relevant; and
- d. maximize efficiency and effectiveness of resources which will ultimately improve patient/client flow.

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Appendix - DINS for Anti-TB Drugs and Antibiotics

Anti-TB drugs included for checking and their DINS

- Isoniazid, 11 products (02181428, 00236799, 00261289, 00265500, 00261270, 00272655, 00577782, 00577790, 00577804, 00577812).
- Rifampin: four products (02091887, 02092808, 00393444, 00343617).
- Rifabutin: one product (02063786).
- HRZ (Isoniazid+ Rifampin+ Pyrazinamide): (02148625)
- Pyrazinamide, two products (00618810, 00283991)
- Ethambutol: two products (00247960, 00247979).
- SM: 02243660.
- Amikacin: one product (02242971).
- Moxifloxacin: three products (02242965, 02246414, 02252260).
- Levofloxacin: 21 products (02315424, 02315432, 02315440, 02284707, 02284715, 02325942, 02236842, 02246804, 02415879, 02314932, 02313979, 02313987, 02248262, 02248263, 02285649, 02284677, 02284685, 02305585, 02298635, 02298643, 02298651).

Selective antibiotics for checking and their DINS:

- Vancomycin, 32 products (00788716, 00800430, 02407744, 02407752, 02420295, 02420309, 02420317, 02420325, 02430193, 02241821, 02241820, 02230192, 02230191, 02342855, 02342863, 02405830, 02377470, 02377489, 02396386, 02411032, 02411040, 02139243, 02139375, 02139383, 02241807, 02394626, 02394634, 02394642, 02394650, 02407914, 02407922, 02407930).
- Fusidic acid, four products (00586668, 02238578, 02243861, 02243862).
- Cloxacillin, 13 products (00618292, 00618284, 00644633, 00337757, 00337765, 00337773, 02367408, 02367416, 02367424, 02400081, 01912410, 01912429, 01975447).
- Ciprofloxacin, 25 products (02247339, 02247340, 02247341, 02229521, 02229522, 02229523, 02263130, 02381907, 02381923, 02381931, 01945270, 02200864, 02155958, 02155966, 02155974, 02237514, 02247916, 02251787, 02252716, 02353318, 02353326, 02353334, 02386119, 02386127, 02301296)
- Minocycline, 22 products (02084104, 02084090, 02278219, 02239667, 02239668, 02239982, 02287226, 02287234, 02154366, 02153394, 02230735, 02230736, 02294133, 02294141, 02239238, 02239239, 02294419, 02294427, 02237313, 02237314, 02108143, 02108151).
- Doxycycline, 19 products (00024368, 00740713, 00874256, 00817120, 00860751, 00887064, 00725250, 02375885, 02242473, 02289547, 02289598, 02351234, 02351242, 02247104, 02289431, 02289458, 02289466, 02289539, 02158574).
- TMP/SMX, 14 products (00445282, 00445266, 00445274, 00846465, 00512524, 00550086, 00510637, 00726540, 00510645, 02240363, 02011956, 02239234, 02243116, 02243117)
- Azithromycin, 25 products (02255340, 02256088, 02247423, 02415542, 02274388, 02274396, 02330881, 02297566, 02368846, 02334844, 02385473, 02278499, 02278502, 02274531, 02274566, 02274574, 02278359, 02267845, 02315157, 02315165, 02278588, 02282380, 02282410, 02261634, 02261642).
- Clarithromycin, 25 products (02390442, 02390450, 02403196, 02274744, 02274752, 02413345, 02146908, 02244641, 01984853, 02126710, 02244756, 02324482, 02324490,

02408988, 02408996, 02442469, 02442485, 02351005, 02238525, 02248856, 02248857,
02247573, 02247574, 02361426, 02361434).