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COMPARISON OF TB-HIV COINFECTION STANDARDISED MORBIDITY RATES IN MALAYSIA USING INDIRECT STANDARDISATION METHOD

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Abstract:

For decades, Tuberculosis (TB) has been the leading cause of death from an infectious disease in Malaysia. Globally, it is the most common opportunistic disease among people living with HIV (PLHIV) and a third of the HIV-related deaths were coinfecting with TB. The objective of this study was to compare the sex-, ethnicity- and age-specific TB-HIV coinfection morbidity rates among the states and federal territories in Malaysia by using indirect standardisation method. The population data of state/federal territory for year 2013 and 2014 were applied in the analysis, where Malaysia population was selected as the standard population. StdAn computer program was used to calculate the factor-standardised morbidity rates of TB-HIV coinfection for all the populations under study. The results of the study concluded that Kelantan had the highest TB-HIV coinfection morbidity rates based on sex-, ethnicity- and age-specific. In contrast, Federal Territory of Labuan scored the lowest sex-, ethnicity- and age-standardised morbidity rates despite having high burden of TB.

Keywords: TB-HIV coinfection, indirect standardisation, Malaysia, sex- standardised, ethnicity-standardised, age-standardised.

1. Introduction

Tuberculosis (TB) and human immunodeficiency virus (HIV) are two major public health problems which rank parallel as the leading causes of death globally [1]. As such, TB and HIV coinfecting patients are more vulnerable, as each infectious agent accelerates the impairment of patients' immune system function [2]. According to World Health Organisation (WHO) reports, approximately 12% (1.2 million) of 9.6 million TB infected patients were coinfecting with HIV in 2014. About 27% (0.40 million) of 1.5 million people who died from TB were coinfecting with

HIV[1]. It was estimated 2.0 million new HIV cases, resulted in 36.9 million PLHIV at the end of 2014 worldwide. A third of 1.2 million HIV-related deaths were coinfecting with TB, making TB the leading cause of death among PLHIV[3].

Malaysia is a multi-ethnic country located in Southeast Asia, consist of Malay (50%), Chinese (23%), Indian (7%) and other ethnicities, with total population approximately 30 million in 2014[4]. It is classified as intermediate burden of TB by WHO[5].

TB has been the number one killer from an infectious disease in Malaysia for decades, where TB mortality rate was 5.4 per 100,000 population in 2013. The total of new TB cases (all forms) reported in the same year was 24,071, resulting in an incidence rate of 81 per 100,000 population[6]. As for HIV, there were 3,393 new cases, causing an incidence rate of 11.4 cases per 100,000 population and an estimated of 86,324 PLHIV by end of 2013[7]. Whereas, the total HIV-related deaths recorded was 652. The number of TB-HIV coinfection has increased from six in 1990 to 1,477 cases in 2013[7]. The objective of this study was to study the sex-, ethnicity- and age-specific of TB-HIV coinfection morbidity rates among the states and federal territories in Malaysia by using indirect standardisation method.

2. Materials and Methods

2.1 The data

Malaysia consists of two regions, i.e. Peninsular Malaysia and East Malaysia, with 13 states (i.e., Perlis, Kedah, Penang, Perak, Selangor, Negeri Sembilan, Melaka, Johor, Kelantan, Terengganu, Pahang, Sarawak and Sabah) and three federal territories (i.e. Kuala Lumpur, Putrajaya and Labuan). Other than Sabah, Sarawak and Federal Territory of Labuan which are in East Malaysia, the rest are situated in Peninsular Malaysia.

The data used in this study were obtained from Ministry of Health, TB surveillance system (MyTB), which spanned two years (2013-2014) as follows:

- a) Malaysia population, as standard population (Table I).
- b) Population by state/federal territory (Table I)
- c) TB-HIV coinfection by state/federal territory (Table II)

2.2. Indirect standardization

In epidemiology studies, comparisons between populations on mortality or morbidity rates of diseases are popular topics[8-10]. As the populations under study are usually diverse in composition, comparison with crude rate of a

disease may result in confounding phenomena, where the findings could be misleading. As such, standardisation analysis is used to eliminate the effect of confounder, where a standard population is chosen as a reference. Two methods of standardisation are direct and indirect standardisation [11]. Direct standardisation is performed when factor-specific rates of populations are known, else indirect standardisation is applied. Indirect standardisation method was used to achieve the objective of the study. Figure 1 displays the indirect standardisation procedure [11].

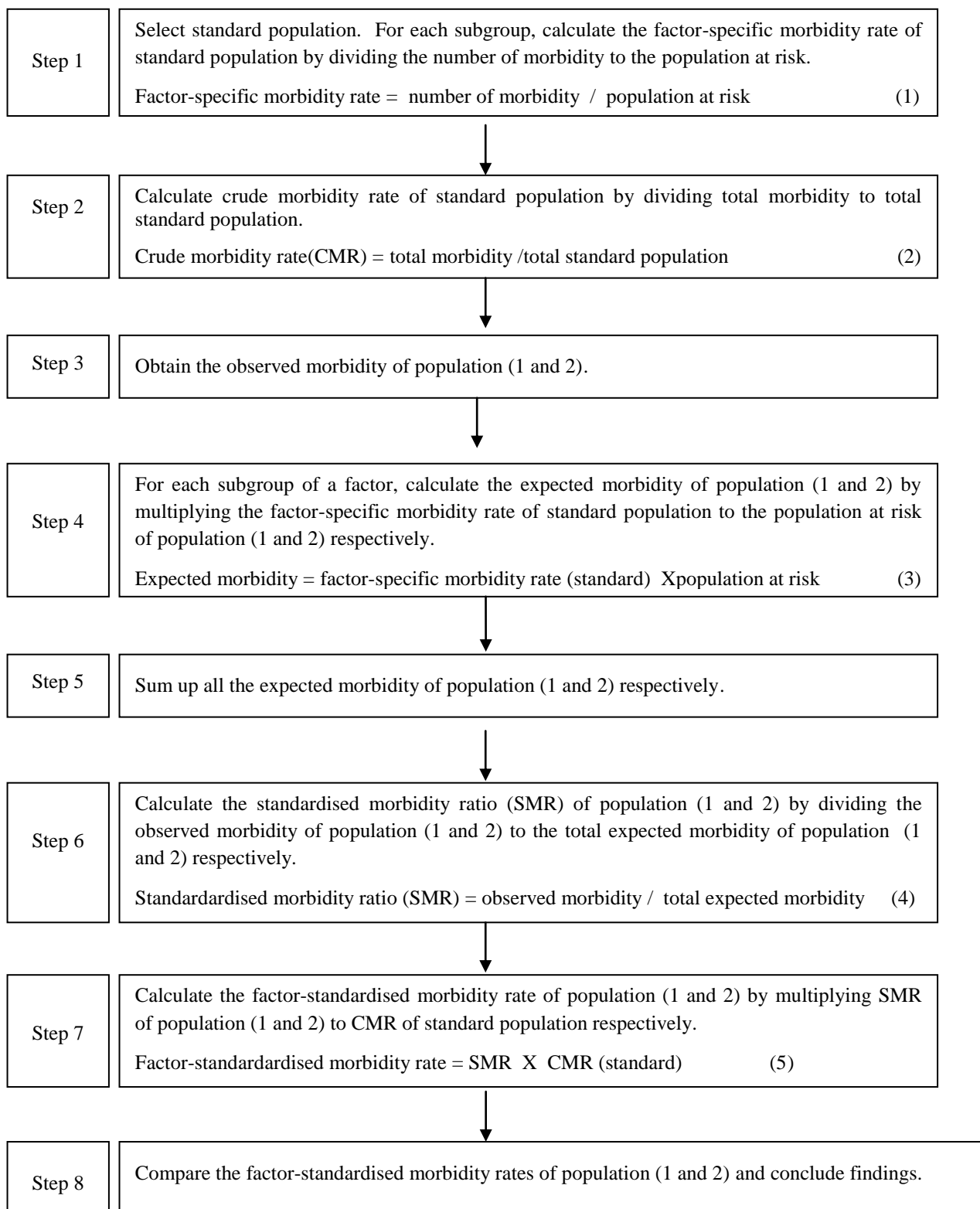


Figure 1. Flowchart showing procedures in indirect standardisation method.

2.3. Statistical analysis

The computer program used to compute the standardised morbidity rates for all the populations in the study is Std An. It is a program developed with Windows Forms application in Microsoft Visual Studio 2010 Express software, using C++/CLI programming language. StdAn has graphically easy-to-use interface which allows the execution of standardisation analysis at cheaper cost and in shorter time. It can be downloaded without charge at www.medic.usm.my/biostat/ or by sending your email to wnarifin@usm.my.

3. Results

3.1 TB-HIV coinfection in Malaysia: Table III presents TB-HIV factor-specific morbidity rates of the country. Sex-specific morbidity rate for males was much higher than females, i.e. 7.53 per 100,000 population versus 1.24 per 100,000 population respectively. As for ethnicity-specific morbidity rates, Malays scored the highest as compared to other ethnicities, i.e. 5.73 per 100,000 population. Followed by Indian (3.83 per 100,000 population) and Chinese (2.79 per 100,000 population). TB-HIV morbidity rate was relatively lower before 25 years old (0.39 per 100,000 population). However, it peaked between the ages of 35 and 44 years old (14.44 per 100,000 population) before declining after 45 years old.

3.2 TB-HIV coinfection among states and federal territories in Malaysia

TB-HIV crude morbidity rates among states and federal territories in Malaysia are shown in Table II. The country TB-HIV crude morbidity rate for year 2013 and 2014 was 4.47 per 100,000 population. Whereas, Kelantan had the highest rate (10.45 per 100,000 population) and Federal Territory of Labuan scored the lowest (1.59 per 100,000 population). Table IV displays TB-HIV sex-, ethnicity- and age-standardised morbidity rates by state and federal territory which were derived from indirect standardisation.

3.2.1 Sex-standardised morbidity rate: Based on TB-HIV sex-standardised morbidity rate among the states and federal territories in Malaysia, Kelantan scored the highest (10.64 per 100,000 population), followed by Terengganu (8.70 per 100,000 population) and Federal Territories of Kuala Lumpur/Putrajaya (7.14 per 100,000 population). Whereas Federal Territory of Labuan had the lowest risk, i.e. 1.59 per 100,000 population.

3.2.2 Ethnicity-standardised morbidity rate

Kelantan obtained the highest in ethnicity-standardised morbidity rate (8.46 per 100,000 population), followed by Federal Territories of Kuala Lumpur/Putrajaya (7.48 per 100,000 population) and Terengganu (6.91 per 100,000 population). On the contrary, Federal Territory of Labuan had the lowest risk, i.e. 1.72 per 100,000 population.

3.2.3 Age-standardised morbidity rate

Comparing the age-standardised morbidity rate, Kelantan was also ranked the highest, i.e 12.78 per 100,000 population, followed by Terengganu (10.12 per 100,000 population) and Pahang (7.85 per 100,000 population). Again, Federal Territory of Labuan was found to score the lowest, i.e. 1.59 per 100,000 population.

4. Discussion

In 2013, East Malaysia contributed around 30% of the country new TB cases, where the incidence rates for Sabah, Sarawak and Federal Territory of Labuan were more than 100 per 100,000 population, far exceeded the national incidence rate of 81 per 100,000 population[6].

Despite having high burden of TB in East Malaysia, the TB-HIV factor-standardised morbidity rates remain low. From the indirect standardisation analysis results, Federal Territory of Labuan had the lowest TB-HIV sex-, ethnicity- and age-standardised morbidity rates in the country.

Kelantan was one of the states with the highest number of new HIV cases in Malaysia[14, 15]. Malaysia was reported to have a cumulative of 101,672 HIV cases from 1986 to 2013, where Kelantan contributed approximately 11% of the total cases[16].

Based on the indirect standardisation analysis results, Kelantan was categorised as the riskiest state of TB-HIV coinfection based on sex-, ethnicity- and age-specific.

In conclusion, Kelantan which had high burden of HIV, was also found to have the highest risk of TB-HIV coinfection morbidity rate based on sex-, ethnicity- and age-specific. On the other hand, Federal Territory of Labuan which had high burden of TB, was discovered to have the lowest risk of TB-HIV coinfection among the 13 states and three federal territories in Malaysia.

This study implied that HIV accelerated TB infection, on the contrary, TB infection might not be the significant factor to contain HIV infection.

Ministry of Health is suggested to focus on prevention and control of TB infection at states/federal territories which have high HIV burden in order to control TB-HIV coinfection.

Acknowledgments

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Table I: Malaysia Population (thousands) by State or Federal Territory

Factor	State or Federal Territory																
	PLS	KDH	PNG	PRK	SLG	PTJ & KL	NS	MLK	JHR	KLT	TRG	PHG	SBH	SRW	LBN	Total	
Sex	Male	239.0	2,052.5	1,641.5	2,471.6	5,961.9	1,851.3	1,110.6	862.8	3,677.4	1,683.3	1,143.7	1,678.3	3,592.2	2,680.0	97.1	30,743.2
	Female	246.0	2,014.8	1,632.6	2,421.5	5,563.5	1,798.9	1,043.6	852.1	3,315.1	1,674.5	1,101.5	1,492.1	3,321.1	2,501.0	91.3	29,069.6
	Total	485.0	4,067.3	3,274.1	4,893.1	11,525.4	3,650.2	2,154.2	1,714.9	6,992.5	3,357.8	2,245.2	3,170.4	6,913.3	5,181.0	188.4	59,812.8
Ethnicity	Malay	414.5	3,072.2	1,350.6	2,585.9	5,984.3	1,592.4	1,214.3	1,082.6	3,708.4	3,098.8	2,126.0	2,232.9	968.5	412.9	65.9	29,910.2
	Cina	38.1	522.5	1,369.1	1,418.3	2,970.6	1,353.7	463.4	426.5	2,130.6	107.6	54.8	476.6	1,407.7	330.6	21.0	13,091.1
	India	6.0	282.5	326.5	581.4	1,405.4	324.8	304.5	101.6	454.2	9.4	5.8	130.6	613.6	1,194.0	1.6	5,741.9
	Others	26.4	190.1	227.9	307.5	1,165.1	379.3	172.0	104.2	699.3	142.0	58.6	330.3	3,923.5	3,243.5	99.9	11,069.6
	Total	485.0	4,067.3	3,274.1	4,893.1	11,525.4	3,650.2	2,154.2	1,714.9	6,992.5	3,357.8	2,245.2	3,170.4	6,913.3	5,181.0	188.4	59,812.8
	<= 24	234.9	1,909.3	1,263.9	2,171.9	4,709.7	1,399.1	972.4	773.6	3,031.1	1,807.0	1,183.8	1,530.9	3,387.7	2,382.1	89.1	26,846.5
	25-34	70.7	599.6	599.1	698.5	2,601.9	804.5	357.5	286.7	1,277.9	421.4	335.9	538.7	1,470.1	852.9	42.0	10,957.4

Age	35-44	48.9	494.5	485.0	564.3	1,769.2	546.8	263.1	203.7	959.9	345.0	239.6	364.7	880.7	671.4	23.6	7,860.4
(year)	45-54	53.8	461.5	396.5	573.9	1,233.6	436.0	237.5	194.6	784.7	342.7	221.7	322.4	622.7	572.4	18.7	6,472.7
	>= 55	76.7	602.4	529.6	884.5	1,211.0	463.8	323.7	256.3	938.9	441.7	264.2	413.7	552.1	702.2	15.0	7,675.8
Total		485.0	4,067.3	3,274.1	4,893.1	11,525.4	3,650.2	2,154.2	1,714.9	6,992.5	3,357.8	2,245.2	3,170.4	6,913.3	5,181.0	188.4	59,812.8

Source: Ministry of Health, TB surveillance data 2015.

Note: PLS- Perlis, KDH- Kedah, PNG- Penang, PRK- Perak, SLG- Selangor, PTJ- Federal Territory of Putrajaya, KL- Federal Territory of Kuala Lumpur, NS- Negeri Sembilan, MLK- Melaka, JHR- Johor, KLT- Kelantan, TRG- Terengganu, PHG- Pahang, SBH- Sabah, SRW- Sarawak, LBN- Federal Territory of Labuan.

Table II: TB-HIV Coinfection by State or Federal Territory in Malaysia.

Factor	State or Federal Territory																
	P		L					PTJ &					H				
	S	H	PNG	PRK	SLG	KL	NS	MLK	JHR	KLT	TRG	G	SBH	SRW	LBN	Total	
Sex	Male	12	101	92	122	430	215	94	71	287	313	173	203	114	86	2	2315
	Femal	5	21	17	22	56	43	11	10	29	38	21	26	34	26	1	360

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	Total	17	122	109	144	486	258	105	81	316		351	194	22 9	148	112	3	2675
Ethnicity	Malay	12	85	41	75	263	116	80	71	224		335	191	19 8	3	17	2	1713
	Cina	1	15	35	27	83	58	10	5	60		9	1	13	29	19	0	365
	India	0	17	22	34	70	33	10	3	24		0	0	6	0	1	0	220
	Others	4	5	11	8	70	51	5	2	8		7	2	12	116	75	1	377
	Total	17	122	109	144	486	258	105	81	316		351	194	22 9	148	112	3	2675
Age (year)	<= 24	2	3	3	4	19	13	4	4	10		7	6	7	12	12	0	106
	25-34	3	34	23	40	152	76	28	17	68		98	50	68	57	33	2	749
	35-44	8	39	40	60	189	91	42	42	143		194	105	10 6	34	41	1	1135
	45-54	4	36	27	28	94	58	20	17	71		41	28	39	24	15	0	502
	>= 55	0	10	16	12	32	20	11	1	24		11	5	9	21	11	0	183
	Total	17	122	109	144	486	258	105	81	316		351	194	22 9	148	112	3	2675
Crude morbidity rate (per 100K population)	3.51	3.00	3.33	2.94	4.22	7.07	4.87	4.72	4.52		10.45	8.64	7.22	2.14	2.16	1.59	4.47	

Source Ministry of Health, TB surveillance data

: 2015.

PLS- Perlis, KDH- Kedah, PNG- Penang, PRK- Perak, SLG- Selangor, PTJ- Federal Territory of Putrajaya, KL- Federal Territory

Note: of Kuala Lumpur,

NS- Negeri Sembilan, MLK- Melaka, JHR- Johor, KLT- Kelantan, TRG- Terengganu, PHG- Pahang, SBH- Sabah,

SRW- Sarawak,

LBN- Federal Territory of Labuan.

Table III: TB-HIV Factor-specific Morbidity Rate (per 100,000 population) in Malaysia

Factor		Malaysia population (‘000)	TB-HIV Coinfection	Factor-specific morbidity rate (per 100,000 population)
Sex	Male	30,743	2,315	7.53
	Female	29,070	360	1.24
	Total	59,813	2,675	4.47
Ethnicity	Malay	29,910	1,713	5.73
	Cina	13,091	365	2.79
	India	5,742	220	3.83
	Others	11,070	377	3.41
	Total	59,813	2,675	4.47
Age (year)	<25	26,847	106	0.39
	25-34	10,957	749	6.84
	35-44	7,860	1,135	14.44
	45-54	6,473	502	7.76
	≥ 55	7,676	183	2.38
	Total	59,813	2,675	4.47

Source: Ministry of Health, TB surveillance data
2015.

Table IV: Indirect Standardisation: TB-HIV Factor-standardised Morbidity Rate (per 100,000 population) by State or Federal Territory in Malaysia.

Factor	State or Federal Territory														
	PLS	KDH	PNG	PRK	SLG	PTJ & KL	NS	MLK	JHR	KLT	TRG	PHG	SBH	SRW	LBN
Sex	3.61	3.04	3.39	2.98	4.20	7.14	4.86	4.80	4.45	10.64	8.70	7.07	2.12	2.15	1.59
Ethnicity	2.93	2.63	3.59	2.92	4.19	7.48	4.70	4.45	4.52	8.46	6.91	6.51	2.63	2.65	1.72
Age	4.04	3.21	3.06	3.17	3.77	6.26	5.08	4.94	4.40	12.78	10.12	7.85	2.19	2.22	1.59

Source: Ministry of Health, TB surveillance data 2015.

PLS- Perlis, KDH- Kedah, PNG- Penang, PRK- Perak, SLG- Selangor, PTJ- Federal Territory of Putrajaya, KL- Federal Territory of Kuala

Note: Lumpur,

NS- Negeri Sembilan, MLK- Melaka, JHR- Johor, KLT- Kelantan, TRG- Terengganu, PHG- Pahang, SBH- Sabah, SRW-

Sarawak,

LBN- Federal Territory of Labuan.

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