



## **Ministry of Public Health of Belize National Aids Program**

**“Modes of Transmission Model - MOT”  
New HIV infections expected in Belize  
for 2014**

**Belize, March 2014**

## **Acknowledgments**

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## Abbreviations

<b>AIDS</b>	Acquired immune deficiency syndrome
<b>ART</b>	Antiretroviral therapy
<b>BSS</b>	Behavior surveillance survey
<b>CHS</b>	Casual heterosexual sex
<b>DHS</b>	Demographic and health survey
<b>FSW</b>	Female sex worker
<b>IDU</b>	Injecting drug user
<b>MOH</b>	Ministry of public health
<b>MOT</b>	Modes of transmission
<b>MSM</b>	Men who have sex with men
<b>NAP</b>	National Aids Program
<b>NDACC</b>	National Drug Abuse Control Council
<b>PAHO</b>	Pan American Health Organization
<b>PASMO</b>	Pan-American Association of Social Marketing
<b>PEPFAR</b>	President's Emergency Plan for Aids Relief
<b>PLWHA</b>	People living with HIV and aids
<b>PSI</b>	Population Services International
<b>REDCA+</b>	Central American Network of Persons living with HIV
<b>STI</b>	Sexually transmitted infection
<b>UNAIDS</b>	Joint United Nations Program on HIV/AIDS
<b>UNIBAM</b>	United Belize Advocacy Movement
<b>UNICEF</b>	United Nations Children's Fund
<b>USAID</b>	United States Agency for International Development
<b>WHO</b>	World Health Organization

## Executive summary

Belize is situated on Central America's Caribbean coast, consists of six administrative districts and implements a national public health system that delivers free services through a network of institutions, in which the access of male population is still limited to public health services. HIV epidemic was initially considered as generalized, but current data suggest a concentrated epidemic, with HIV prevalences of 13.8%, 0.9% and 0.6% in MSM, FSW and pregnant women, respectively. However, the country does not currently implement studies to measure incidence of HIV (new HIV infections), reason why an MOT analysis has been required.

### Objectives

Estimate the number of new HIV infections, determine the main HIV risk behaviors addressing HIV epidemic, use MOT results to improve national public health policies and determine principal deficiencies in HIV/STIs data, in order to program new studies to address these limitations in the near future.

### Methods

The "Modes of Transmission - MOT" model is based on the current prevalence of HIV infection, the number of individuals with particular exposures and the rates of these exposures. Biological and behavioral surveillance data were required to set the model, and this categorized the adult population aged 15-49 years old into 13 risk behavior groups according to their main source of exposure to HIV. Children were not included in this model. Mathematically, the model assumes that the risk of infection in susceptible individuals is a simple binomial function of their number of partners and the number of sex acts with each partner. Availability and quality of data (input parameters) were analyzed to determine pertinence to run the model. MOT analysis was conducted considering the national HIV prevalence, the upper and lower limits for expected HIV incidence according to Spectrum-2013 results, national circumcision coverage and total number of HIV cases in ART. An uncertainty analysis was performed for the percentage distribution of new HIV infections. Limitations were specified for this modeling exercise.

### Results

Data availability and quality scores were 51% and 1.53, respectively. After running uncertainty analysis, the expected number of new HIV infections were 130 (99-150); and the risk behaviors producing the highest proportions of new HIV infections were: men who have sex with other men (63.5%, 48.8% – 75.6%), persons engaged in casual heterosexual sex (20.3%, 10.2% – 35.7%) and stable heterosexual couples (8.4%, 0.9% - 19.3%).

### Conclusions

Men having sex with other men (MSM), persons engaged in casual heterosexual sex (CHS) and stable heterosexual couples (SHC) will generate the highest proportions of new HIV infections in Belize. Although further epidemiological research is required, current data suggest that Injecting Drug Users (IDUs) do not play a significant role in HIV dynamics, in Belize. Information on regular, sexual partners of overall risk behaviors pre-determined to set MOT model is lacking currently. Availability and quality of HIV risk behavioral data are still weak.

*Key words. MOT analysis, HIV incidence, HIV risks behaviors, uncertainty analysis.*

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# Background

## Geography and demography<sup>1</sup>

Situated on Central America's Caribbean coast, with Mexico to its North and Guatemala to its West and South, Belize spans nearly 23,000 square kilometers and has a total population of 349,728 in 2013. The Caribbean Sea and the Belize Barrier Reef lie to the East and consist of over 100 islands, or Cayes, and lagoons. While only few Cayes are inhabited, the Caribbean coast and the islands have become the center of the country's tourism industry. Belize is the only country in Central America with English as the official language. Belize consists of six administrative districts characterized by diverse racial/ethnic make ups, economies, and geographies. Approximately 20% of the country's population is located in the Belize District, which is home to the former capital Belize City and the majority of the country's Creole population. The current administrative capital, Belmopan, sits in the Cayo District.

## National health system<sup>1</sup>

Belize's Ministry of Health (MOH) is responsible for leading the national health sector. The national public health system delivers services through a network of institutions at the primary, secondary and tertiary levels, consisting of 56 health posts, 42 health centers and seven hospitals. Since 1990, the government through the MOH has provided universal coverage for health services, including maternal, child, mental and environmental health. The private sector is estimated to cover about 15% of the population. Health services are generally provided free to the population through regional health facilities. However, the access of male population is still limited to public health services according to the gender-based analysis of HIV conducted in 2010<sup>2</sup>, in which only 30% of male respondents, in a specific study, reported ever using health services; and 45% expressed that had never used a health service, for any purpose.

## HIV profile<sup>3</sup>

HIV epidemic was initially considered as generalized, but current data suggest a concentrated epidemic, with HIV prevalences of 13.8%, 0.9% and 0.6% in MSM, FSW and pregnant women, respectively. General trend of HIV registered cases tend to decrease, but most of these cases are detected in late stages of HIV evolution (48% of newly detected HIV cases in 2012 had CD4 counts < 200 cells/mm<sup>3</sup>). Up to date, 2 behavioral surveillance surveys have been conducted in Belize, but both final reports are still in the process to be published. Currently, the country does not implement studies to measure incidence of HIV, reason why the number and distribution of new HIV infections is not known.

# Objectives

The main objectives to set the Modes of Transmission (MOT) model for Belize are:

1. Estimate the number of new HIV infections, considering available data about specific HIV risk behaviors.
2. Determine the main HIV risk behaviors addressing HIV epidemic.

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<sup>1</sup> USAID, Analysis of the Situation and Response to HIV in Belize, 2011

<sup>2</sup> Belize's Ministry of Health/PAHO, a Gender-Based Analysis of HIV/AIDS in Belize, June 2010

<sup>3</sup> NAP, Presentation made by Dr. M. Manzanero, February 10/2014

3. Use MOT results to improve national public health policies.
4. Determine principal deficiencies in HIV/STIs data, in order to program new studies to address these limitations and improve accuracy of future MOT models.

## Methodology<sup>4</sup>

The “Modes of Transmission” model is based on:

- The current prevalence of HIV infection
- The number of individuals with particular exposures, and
- The rates of these exposures

The objective is to calculate the expected incidence of HIV infection over the coming year.

Biological and behavioral surveillance data are required. Some of these values may be reasonably well estimated, whereas others may be poorly specified. Default estimates of transmission probability per contact are based on reviews of published literature, but can also be specified by the user.

The model categorizes the adult population aged 15-49 years old into groups according to their main source of exposure to HIV. Children are not included in this model. The risk groups are defined as:

- **Injecting Drug Users (IDU):** adults (men and women) who are currently injecting, or have in the past 12 months, injected drugs.
- **IDUs partners:** the regular sex partners of those who inject drugs.
- **Female Sex Workers (FSW):** adult women who have exchanged sex for money in the last 12 months.
- **Clients of Female Sex Workers:** adult men who have paid for sex with a sex worker in the last 12 months.
- **Partners of FSW clients:** the regular, non-commercial, sex partners of clients of sex workers.
- **Men who have sex with men (MSM):** adult men who have had sex with another man in the last 12 months.
- **Female partners of MSM:** the regular female sex partners of those MSM, who also have sex with women.
- **Casual Heterosexual Sex (CHS):** those adults (men and women) who have had more than one sexual partner in the last 12 months.
- **Partners of persons who have CHS:** the regular, spousal or cohabiting sex partners of those who engage in casual heterosexual sex.
- **Stable Heterosexual Couples (SHC):** those adults who are currently in stable heterosexual relationships, i.e. adults with current low-risk behavior (including those with former high-risk behavior).
- **No risk:** adults who have been at no risk of acquiring HIV in the last year, i.e. those who do not inject drugs and are not currently involved in any sexual activity.

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<sup>4</sup> UNAIDS, Modeling the expected short-term distribution of new HIV infections by Modes of Transmission, draft manual 2012.

- **Medical injections:** adults who have received at least one medical injection in the last 12 months. In the absence of data it can be assumed to include the total adult population.
- **Blood transfusion:** adults who received a blood transfusion in the last 12 months.

## Model assumptions

If we assume that the risk of infection in susceptible individuals is a simple binomial function of their number of partners and the number of sex acts with each partner, we can derive a risk per susceptible which depends upon the current prevalence of infection within their contacts. We can further take account of the different transmission probabilities when another STI is or is not present. If we multiply this by the number of susceptible at risk in the population we get an expected incidence for the coming year using the following equation:

$$I = S \left[ 1 - \left\{ p \left( B(1 - \beta'(1 - u))^a + (1 - B)(1 - \beta)^{a(1-u)} \right) + (1 - p) \right\}^n \right]$$

“I” is the incidence of HIV in the target population, which depends upon the number of susceptible, “S”, and the HIV prevalence in the partner population, “p”. The variable “B” is prevalence of STIs in the target or partner population, whichever is higher,  $\beta'$  and  $\beta$  represent the probability of transmission of HIV during a single contact in the presence or absence of an STI (in the case of transmission by needle-sharing,  $\beta' = \beta$ ), “u” is the proportion of acts currently protected by effective condom use or the use of sterile needles, “a” is the number of contacts per partner and “n” is the number of partners.

## Analysis of availability and quality of data<sup>5</sup>

To assess the availability of data, the Epi-MOT checklist was completed, from which a percentage score was generated, based on those data that were available. To assess the data quality, it was reviewed all potential data sources for each of the risk populations (including published and unpublished studies and reports), that could be used to inform the indicators in the MOT model. Relevant information was then extracted from each study, such as year of data collection, sample size, gender, geographic area included, definition of risk group and, of course, the estimate for the specific indicator of interest and the uncertainty associated with it (such as the standard error or confidence intervals). Some of the data were clearly defined and easily extracted, whereas others were poorly specified and were estimated using indirect methods.

It was evaluated each data source by giving a quality score, using a qualitative scale, that varied from 0 when there was no data available, 1 indicating poor quality, 2 indicating limited quality and 3 indicating good quality. Criteria to evaluate quality of input parameters were: space and time delimitation, representativeness and methodology of the study. The spreadsheet finally showed the total data availability score for each risk population, used as an overall measure to decide whether the country

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<sup>5</sup> UNAIDS, Epidemiological review related to the Modes of Transmission Analysis (Epi-MoT), draft manual 2012.



could proceed with the MOT analysis. It is recommended to proceed with MOT modeling when the country presents: data availability score higher than 50%; and data quality score greater than 1.5.

## Limitations<sup>3</sup>

The model uses crude groupings of the population according to their main exposure to HIV infection. The results are only as good as the data entered in the spreadsheet on the estimated sizes of the risk groups, the current prevalence of HIV and other sexually transmitted infections, and the average risk behaviors within these groups. Even with reliable estimates, the model does not take account of the distribution of behaviors within the risk groups, the patterns of mixing by demographic, social, geographic and economic variables and the influence of specific sexually transmitted diseases. It should therefore not be used to generate accurate predictions without a full description of these many complexities.

Nonetheless, it does allow the user to identify where most of the new HIV infections are likely to be found and the relative orders of magnitude of the incident infections possible within risk groups. Furthermore, it allows users to see the type of data required, even for crude predictions, and therefore to identify the data gaps and areas in need of further data collection. The coverage and focus of the interventions can also be explored and the benefits of both increased coverage and efficacy can be illustrated.

## Uncertainty analysis

Because the quality of input parameters was variable, an uncertainty analysis was performed, considering different levels of robustness for each data source. For Belize's exercise, 1000 runs were performed and the expected range of adult incidence was obtained from the Spectrum 2013 results. By default, plausibility bounds (upper, lower) were defined as 2.5 and 97.5 percentiles. The scale used to set uncertainty for every data in the model was taken from Guatemala's and Dominican Republic's latest MOT reports, and considered: 10% for national data, 20% for the use of assumptions or data from other countries, and 15% for intermediate values.

## Results

### Data availability

In a 0-100% scale, the average score of data availability (calculated by default, by the tool-sheet) was 51%<sup>6</sup>. Most information was available for female sex workers and men who have sex with men; however, information was limited for female sex worker clients, but it was lacking for regular partners overall (see table 1). This was a limitant to improve quality of the model, but at the same time, represented an opportunity to overcome these gaps on HIV knowledge by implementing new studies, in the near future.

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<sup>6</sup> UNAIDS, Know your HIV Epidemic, evaluation package, draft 15 July 2011.

Table no. 1. Data availability for the main risk behaviors to set the Modes of Transmission Model (MOT) for Belize, February 2014

	Relevant	Population size	HIV prevalence	STI prevalence	Partners per year	Acts per partner per year	Condom use/sterile equipment	ART provision
Injecting Drug Users (IDU)	No							
Men having Sex with Men (MSM)	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Female Sex Workers (FSW)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Female Sex Workers Clients	Yes	Yes	No	No	No	No	Yes	No
Casual Heterosexual Sex (CHS)	Yes	Yes	No	No	Yes	No	Yes	No
Stable Heterosexual Couples	Yes	No	No	No	No	No	No	No
Transgender	No							
Other populations	No							

Data availability score: 51%

Classification of input parameters (excluding IDUs and IDUs partners)

Considering that, by default, the MOT model works on 11 risk behaviors and 7 criteria of exposure for each one, the number of input parameters required to set up the model are 66. For the Belize's exercise, this total number of parameters can be divided in (see table 2):

- a. **National data.** These data are those obtained from a national source (published or unpublished), corresponding to studies, statistics or programmatic reports. In terms of percentages, this category corresponds to the 39.4% (26/66) of all input parameters.
- b. **Data from other countries.** These data have been taken from other countries, different than Belize, because of the lacking of national data. In terms of percentages, correspond to 3.0% (2/66) of all input parameters.
- c. **Assumptions.** These correspond to agreements to assign values for some specific criteria of the model. In terms of percentages, correspond to 57.6% (38/66) of all input parameters.

Considering that "assumptions" were the most frequent category of inputs used to set the model, an in-depth analysis was conducted. Base on this premise, the assumptions used to configure the MOT- model for Belize can be classified as the following:

- Assumptions based on national data (BOND), corresponding to 39.5% (15/38) of overall assumptions.
- Assumptions based on foreign country data (BOFCD)), correspond to 10.5% (4/38) of overall assumptions.
- Assumptions obtained by consensus, corresponding to 50.0% (19/38) of overall assumptions.

In summarize, considering the availability of both, **national data**, and **assumptions based on national data** as well, the overall data availability score is 62.1% (41/66), which indicates that further research must be conducted in order to resolve the current gaps on HIV knowledge, specifically in regular partners of overall risk behaviors, persons engaged in casual heterosexual sex and stable heterosexual couples.

Table no. 2. Classification of the input parameters overall to set the Modes of Transmission Model (MOT) for Belize, February 2014

	Population size	HIV prevalence	STI prevalence	Partners per year	Acts per partner per year	Acts protected	ART provision
Injecting Drug Users (IDU)	Not driving HIV epidemic						
Partners of IDUs	Not driving HIV epidemic						
Men having Sex with Men (MSM)	Data	Data	Data	Data	Other country	Data	Assumption (BOND)
Female partners of MSM	Data	Assumption (BOFCD)		Other country	Assumption (consensus)	Data	Assumption (BOND)
Female Sex Workers (FSW)	Data	Data	Data	Data	Assumption (consensus)	Data	Assumption (BOND)
Female Sex Workers Clients	Data	Assumption (BOFCD)	Assumption (BOFCD)	Assumption (BOFCD)	Assumption (consensus)	Data	Assumption (BOND)
Partners of FSW Clients	Assumption (BOND)	Assumption (consensus)		Assumption (consensus)	Assumption (consensus)	Assumption (BOND)	Assumption (BOND)
Casual Heterosexual Sex (CHS)	Data	Assumption (consensus)	Assumption (consensus)	Data	Assumption (consensus)	Data	Assumption (BOND)
Partners of CHS	Assumption (BOND)	Assumption (consensus)		Assumption (consensus)	Assumption (consensus)	Assumption (BOND)	Assumption (BOND)
Stable Heterosexual Couples	Assumption (consensus)	Assumption (consensus)	Assumption (consensus)	Assumption (consensus)	Assumption (consensus)	Assumption (BOND)	Assumption (BOND)
No risk	Data	Assumption (consensus)	Assumption (BOND)	Data	Data	Data	Assumption (BOND)
Medical injections	Data	Data				Assumption (consensus)	
Blood transfusions	Data	Data				Data	

Nomenclature:

Data:

Other country:

Assumption (BOND):

Assumption (BOFCD):

Assumption (consensus):

Data from Belize

Data from other country different than Belize

Assumption, based on national data

Assumption, based on foreign country data

Assumption, based on consensus

Data quality

In a 0-3 qualitative scale (0-no data, 1-poor quality, 2-limited quality and 3-good quality), the average score of data quality was 1.53. Better quality information was available for female sex workers and men who have sex with other men; the quality information was limited for female sex worker clients (1.4), but there was a lacking of good quality information for regular partners overall, persons engaged in casual heterosexual sex, stable heterosexual couples (the lowest individual score, 0.6), no risk population and the use of medical injections (see table 3). Blood transfusions count with adequate quality of information currently (the highest score, 3.0).

Table no. 3. Data quality analysis prior to set the Modes of Transmission Model (MOT) for Belize, February 2014

Population group	Average score
Men having sex with men	1.8
Partners of MSM	1.3
Female sex workers	2.0
Clients of female sex workers	1.4
Partners of clients of female sex workers	1.3
Casual heterosexual sex	1.4
Partners of those engaging in casual sex	1.0
Stable heterosexual sex	0.6
No risk	1.3
Medical injections	1.7
Blood Transfusions	3.0

Averaged data quality score: 1.53

¿Why we think that Injecting Drug Users (UDIs) do not drive HIV epidemic in Belize?

This risk behavior was considered by the working team as **not to mainly drive the HIV epidemic** in Belize because:

- According to the “Central American Behavioral Sero-prevalence Survey of HIV and other STIs in more vulnerable populations: sex workers, men who have sex with men and persons with HIV, Belize 2011-2012”, from all MSM surveyed (n=136), only **one person** reported having used intravenous drugs (IV) once in life. From the left groups (FSW and HIV positive population), the number of persons who reported having used IV drugs was zero.
- According to the “Substance Use and other Risk Behaviors among Inmates at the Belize Central Prison, 2008” (n=635), only **one person** answered having used IV drugs.
- According to the data base for HIV cohort in Belize (2009-2013), that includes 3,420 records, the number of HIV cases reporting the use of IV drugs is **cero**.
- According to the report from the National Drug Abuse Control Council (NDACC), for 2011, out of 379 persons attended, only 8 reported having used heroin; and the number who reported this use in 2012 report was **0**, from 244 persons attended in that year.
- According to the “Belize Report Risk Profile of People with HIV of the beneficiary countries from the Regional Program REDCA+”, only **3 persons** living with HIV expressed having ever used IV drugs.

MOT results

Based on the HIV risk behaviors pre-determined in the model, and analyzed in function of population size, HIV/STIs prevalences, number of partners, acts of exposure per partner, protection during exposure, ART coverage and considering a general HIV prevalence for the country of 1.4%, the number of new HIV infections expected is 136; mainly produced by men who have sex with other men (MSM), persons engaged in casual heterosexual sex (CHS) and stable heterosexual couples (see table 4 and graphic 1).

Table no. 4. Modes of Transmission Model (MOT) for Belize, February 2014

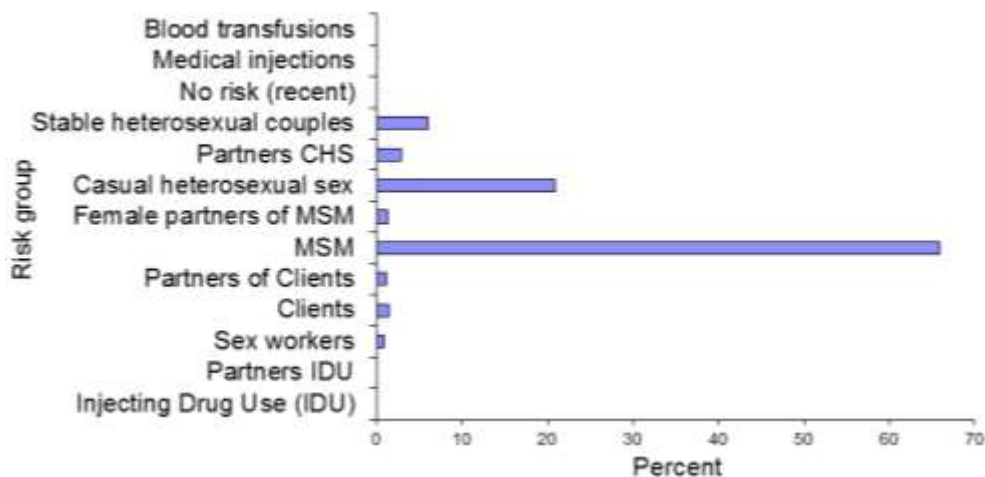
COUNTRY, YEAR	Population	HIV prev (%)	Incidence range		Transmission probability per act of exposure						Male circumcision		ART				ART Transmission reduction		
	Adults 15-49	Adults 15-49	Lower	Upper	Male → female	Female → male	IDU	MSM	STD cofactor	% Men circumcised	Reduction in transmission	receiving ART	Heterosexual	Homosexual	Needles				
Belize	181,686	1.40%	55	151	0.001	0.00100	0.010	0.010	4	0.0%	0.6	1,433	0.96	0.90	0.80				

**NB: Use either Method 1 OR Method 2 to determine the total number with risk behaviour**

Adult Risk Behaviour	Method 1: Percent of population with risk behaviour (%)		Method 2: Population with risk behaviour		Total number with risk behaviour	Prevalence of HIV (%)	Number HIV+	Prevalence of STI (%)	Number of partners per year	Number of acts of exposure per partner per year	Percentage (%) of acts that are protected*	Number of people receiving ART	% of all HIV infected people on ART	Transmission probability per exposure act		Incidence	% of incidence	Incidence per 100,000	Checks	
	Male	Female	Male	Female										with STI	No STI					
Injecting Drug Use (IDU)	0.004%	0.00%	4	4	7	1.40%	0	2.8%	0	0	0.00%	0	0.0%	0.01	0	0.00	0	518,895 (Number of partners time acts should be 526,192 about equal for SW and clients)		
Partners IDU	0.00%	0.004%	4	4	7	1.40%	0	NA	0	0	0.00%	0	0.0%	0.0040	0.0010	0	0.00		0	
Sex workers	0.00%	0.51%	0	470	463	0.91%	4	51.6%	70	16	63.11%	2	47.4%	0.0018	0.0004	1	0.76		223	
Clients	18.10%	0.00%	16,215	0	16,443	0.70%	115	25.8%	4	8	72.22%	67	58.2%	0.0022	0.0005	2	1.35		11	
Partners of Clients	0.00%	6.479%	0	5,967	5,886	0.70%	41	NA	1	48	5.10%	24	58.3%	0.0018	0.0004	1	1.04		24	
MSM	5.00%	0.00%	4,479	0	4,542	13.85%	629	27.9%	3	16	58.30%	370	58.8%	0.0188	0.0047	90	65.97		1,974	
Female partners of MSM	0.00%	0.680%	0	627	618	6.90%	43	NA	1	72	62.50%	25	58.7%	0.0017	0.0004	2	1.25		274	
Casual heterosexual sex	31.60%	4.90%	18,454	4,513	33,158	2.10%	696	4.2%	3	30	4.80%	410	58.9%	0.0017	0.0004	28	20.85		85	
Partners CHS	1.86%	7.37%	1,665	6,791	8,384	2.10%	176	NA	1	48	5.10%	103	58.5%	0.0017	0.0004	4	2.79		45	
Stable heterosexual couples	30.53%	32.45%	37,206	29,886	57,213	0.70%	400	1.4%	1	48	5.10%	235	58.7%	0.0017	0.0004	8	6.00		14	
No risk (recent)	12.90%	47.60%	11,556	43,841	54,960	0.70%	385	1.4%	0	0	0.00%	225	58.5%	-	0.005	0	0.00		0	
Medical injections	100.00%	100.00%	89,583	92,103	181,686	1.40%	4,197	NA	1	1	100.00%				0.005	0	0.00		0	
Blood transfusions	2.34%	2.28%	2,097	2,097	4,197	0.00%		NA	1	1	100.00%				0.9	0	0.00		0	
<b>TOTAL ADULT POPULATION</b>	<b>100.00</b>	<b>100.00</b>			<b>181,681</b>	<b>1.37%</b>	<b>2,490</b>					<b>1481</b>	<b>58.7%</b>							
												<b>Total number of new infections</b>		<b>136</b>		<b>75</b>				
												<b>New infections among partners of high risk pops</b>		<b>7</b>	<b>5.08</b>	<b>46</b>				

\* Sexual acts are protected through condom use and injecting drug acts through the use of sterile injecting equipment

Graphic no.1. Distribution (%) of new HIV infections for Belize according to MOT model, February 2014

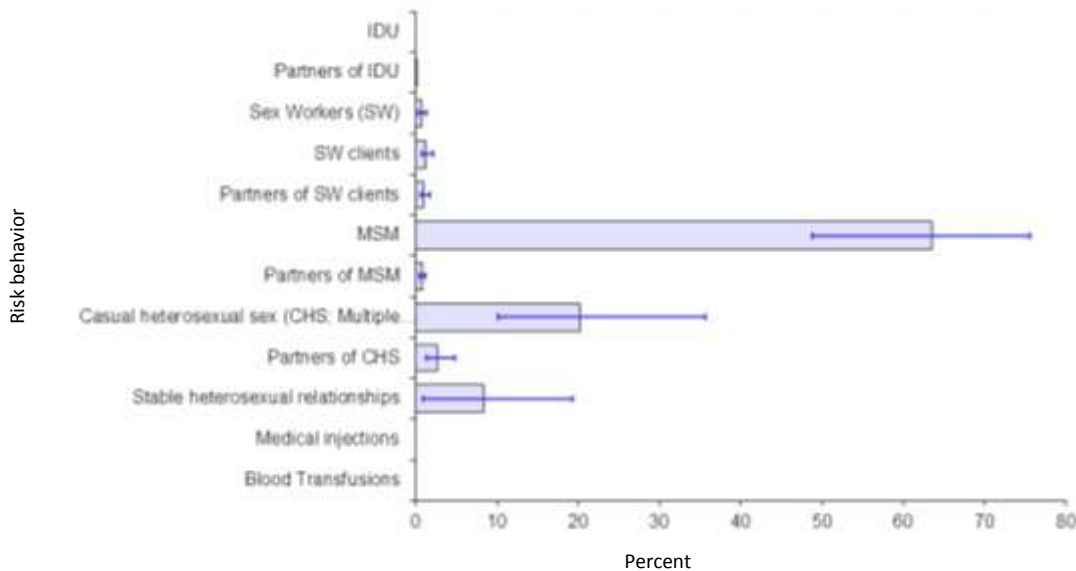


**Uncertainty analysis results**

Considering variations in quality of many data used to perform the model, an uncertainty analysis was run using UNAIDS recommendations and scales used in exercises developed in Dominican Republic and Guatemala. After running uncertainty analysis, the expected number of new HIV infections is 130 (99-150). As expected, uncertainty intervals were wide for main risk behaviors: MSM (63.5%, 48.8% –

75.6%), CHS (20.3%, 10.2% – 35.7%), stable heterosexual couples (8.4%, 0.9% - 19.3%), partners of CHS (2.7%, 1.4% - 4.9%) and FSW clients (1.3%, 0.8% - 2.2%), (see graphic 2).

Graphic no. 2. Distribution (%) of new HIV infections for Belize, according to MOT model, after running uncertainty analysis, February 2014



## Conclusions

- Men having sex with other men (MSM), persons engaged in casual heterosexual sex (CHS) and stable heterosexual couples (SHC) will generate the highest proportion of new HIV infections in Belize. These findings could have been anticipated for MSM, whose HIV prevalence is the highest in the country, but not necessarily for other risk behaviors such as CHS and SHC, whose HIV risk profile is not always perceived as important.
- MSM is the risk behavior associated with the highest proportion of new HIV infections to be expected in one year. This is important in a national health system focused on women and children, in which access of male population to public health services is still limited.
- Although further epidemiological research is required, current data suggest that Injecting Drug Users (IDUs) do not play a significant role in HIV dynamics, in Belize. This finding could be explained on the high cost of HIV drugs, a limiting factor that for population can use this kind of drugs.
- The number of new HIV infections coming from female sex workers is relatively low, based on the high rates of condom use of these women with their clients; however, the lacking of studies approaching clients in depth and their regular sex partners do not permit to conclude on the real risk of these populations to become HIV infected.

- Information on regular, sexual partners of overall risk behaviors pre-determined to set MOT model is lacking currently. This is an important finding to inform the national HIV research agenda, in the near future, to conduct studies to address this limitant.
- The data base of HIV cases currently receiving ART does not provide information to classify them by specific risk behaviors.
- Availability and quality of HIV risk behavioral data are still weak in Belize, and need to be improved to strengthen accuracy of further HIV analyses.

## Recommendations

- Design and implement national policies to improve access of male population to the public health services.
- Design and implement national programs to attend MSM, persons engaged in casual heterosexual sex and stable heterosexual couples, in order to re-inforce the importance of having “safe sex” and then, decrease the risk in these populations to become HIV infected.
- In the short term, implement studies to improve knowledge on injecting drug users, female sex worker clients, partners of female sex worker clients, female partners of MSM, persons engaged in casual heterosexual sex and their partners, and stable heterosexual couples.
- Maintain or improve current public health programs targeting female sex workers, in order to keep achievements reached in this risk group (low HIV prevalence, high rate of condom use with clients).
- In the near future, new variables could be added to the national data base of HIV cases receiving ART, in order to enhance usefulness of this technological resource, for planning purposes, when information of specific risk behaviors can be linked to each HIV case.
- Availability of data needs to be improved by continue implementing behavioral studies (behavior surveillance surveys or demographic health surveys), considering the data limitations found during this exercise. In addition, is recommended to improve data quality by developing research or surveillance protocols to generate robust and generalizable HIV/STIs data.

Annex 1.

Modes of Transmission for HIV - DATA ESTIMATES

Country: Belize

Date: February 27<sup>th</sup>, 2014

Risk behaviors	Estimation	Year of estimation	Data source	International parameters
No. of adults (15-49 years)	181,686	2013	Belize Post-censal National Population Estimates, 2010 to 2013	Not used
HIV prevalence in adult population	1.4%	2013	Belize's National Aids Program (NAP), based on Spectrum 2013 results	Not used
<b>Injecting Drug Users (IDU)</b> Size population HIV prevalence STI prevalence No. of injecting partners/year No. of acts of exchanging needles/partner/year Percentage of use of clean needles	This risk behavior was considered by the working team as <b>not to mainly drive the HIV epidemic</b> in Belize. Evidence to support this statement is: <ul style="list-style-type: none"> <li>– According to “Central American Behavioral Sero-prevalence Survey of HIV and other STIs in more vulnerable populations: sex workers, men who have sex with men and persons with HIV, Belize 2011-2012”, from all MSM surveyed (n=136), only <b>one person</b> reported having used intravenous drugs (IV) once in life. From the left groups (FSW and HIV positive population), the number of persons who reported having used IV drugs was <b>cero</b>.</li> <li>– According to “Substance Use and other Risk Behaviors among Inmates at the Belize Central Prison, 2008” (n=635), only <b>one person</b> answered having used IV drugs.</li> <li>– According to the data base for HIV cohort in Belize (2009-2013), that includes 3,420 records, the number of HIV cases reporting the use of IV drugs is <b>cero</b>.</li> <li>– According to the report from the National Drug Abuse Control Council (NDACC), for 2011, out of 379 persons attended, only 8 reported having used heroin; and the number who reported this use in 2012 report was <b>0</b>, from 244 persons attended in that year.</li> <li>– According to the “Belize Report Risk Profile of People with HIV of the beneficiary countries from the Regional Program REDCA+”, only <b>3 persons</b> living with HIV expressed having ever used IV drugs.</li> </ul>			



Risk behaviors	Estimation	Year of estimation	Data source	International parameters
<b>Sexual partners of IDUs</b>	It does not apply. This population was excluded from the model			
<b>Female Sex Workers</b> Population size	<b>470</b> (range 346-596)	2012	Central American Behavioral Sero-prevalence Survey of HIV and other STIs in more vulnerable populations: sex workers, men who have sex with men and persons with HIV", Belize 2011-2012	Not used
HIV prevalence	<b>0.91%</b> (CI 95% 0.11 - 3.26)	2012	Central American Behavioral Sero-prevalence Survey of HIV and other STIs in more vulnerable populations: sex workers, men who have sex with men and persons with HIV", Belize 2011-2012	Not used
STI prevalence	<b>For HSV-2</b> (the highest STI prevalence after HIV): <b>51.63</b> (CI 95% 44.73 - 58.48)	2012	Central American Behavioral Sero-prevalence Survey of HIV and other STIs in more vulnerable populations: sex workers, men who have sex with men and persons with HIV", Belize 2011-2012	Not used
No. of partners per year	1 FSW has <b>70</b> overall partners/year	2013	Belize (2013): HIV/AIDS TRaC Study, Evaluating Condom Use among Female Sex Workers. Third Round	Not used
No. of acts per partner per year	<b>Assumption</b> <b>16</b> acts per partner per year			
Percentage of acts protected	<b>63.11%</b> was the median of values for stable (31.85%), occasional (63.11%) and clients (81.33%)	2012	Central American Behavioral Sero-prevalence Survey of HIV and other STIs in more vulnerable populations: sex workers, men who have sex with men and persons with HIV", Belize 2011-2012	Not used
Number or percent receiving ART	<b>Assumption</b> <b>58%</b> , considering the national coverage of HIV (+) persons who are currently in ART (NAP, 2014)			

Risk behaviors	Estimation	Year of estimation	Data source	International parameters
<b>Clients of Female Sex Workers</b> Population size	1 FSW has <b>69</b> overall clients/year = 32,430. But the half (conversion factor 0.5) of overall clients visit to more than one FSWs like "new client" in a year, or repeat their visit to the same FSW. So, the adjusted number of clients is <b>16,215</b>	2013	Belize (2013): HIV/AIDS TRaC Study, Evaluating Condom Use among Female Sex Workers. Third Round	Not used
HIV prevalence	At least 50% of FSW HIV prevalence ( <b>0.70%</b> , corresponding to 75%)	2009	COPRESIDA (May 2009). First Behavior Surveillance Survey in Vulnerable Populations linked to Serological Status: Gays, Trans and other MSM, Commercial Sex Workers and Drug Users. Because access to the original study was not possible, this proportion was taken from the Dominican Republic MOT-2010 report, which makes reference to the study	Not used
STI prevalence	At least 50% of FSW STI prevalence ( <b>25.8%</b> , corresponding to 50%)	2009	COPRESIDA (May 2009). First Behavior Surveillance Survey in Vulnerable Populations linked to Serological Status: Gays, Trans and other MSM, Commercial Sex Workers and Drug Users. Because access to the original study was not possible, this proportion was taken from the Dominican Republic MOT-2010 report, which makes reference to the study	Not used
No. of partners per year	<b>Assumption</b> 4 partners/year, considering the size of population respect to Guatemala's population			
No. of acts per partner per year	<b>Assumption</b> 8 acts/partner/year			
Percentage of acts protected	<b>72.22%</b> was the average of values for occasional clients (63.11%) and clients (81.33%)	2012	Central American Behavioral Sero-prevalence Survey of HIV and other STIs in more vulnerable populations: sex workers, men who have sex with men and persons with HIV", Belize 2011-2012	Not used
Number or percent receiving ART	<b>Assumption</b> <b>58%</b> , considering the national coverage of HIV (+) persons who are currently in ART (NAP, 2014)			

Risk behaviors	Estimation	Year of estimation	Data source	International parameters
<b>Partners of clients of Female Sex Workers</b> Population size	<b>Assumption</b> The 36.8% of clients ( <b>5,967</b> ) had a regular partner, based on that 36.8% of 15 years and older male population were married, according to the Belize's Population and Housing Census- 2010			
HIV prevalence	<b>Assumption</b> The same as for clients of FSW ( <b>0.7%</b> )			
No. of partners per year	<b>Assumption</b> 5,967 partners, considering <b>1 partner</b> per regular partner of client of FSW per year			
No. of acts per partner per year	<b>Assumption</b> <b>48</b> acts			
Percentage of acts that are protected	<b>Assumption</b> <b>5.1%</b> of total 15-49 years old female population reported condom use like a contraceptive method, according to the Multiple Indicator Cluster Survey (Belize, 2011)			
No. or percentage receiving ART	<b>Assumption</b> <b>58%</b> , considering the national coverage of HIV (+) persons who are currently in ART (NAP, 2014)			

Risk behaviors	Estimation	Year of estimation	Data source	International parameters
<b>MSM</b> Population size	<b>4,479</b> (5% of 15-49 years old male population)	2013	UNIBAM perspective (5-10% of adult men)	UNAIDS reference (2-5% of adult men)
HIV prevalence	<b>13.85</b> (95% CI 8.41-20.99)	2012	Central American Behavioral Sero-prevalence Survey of HIV and other STIs in more vulnerable populations: sex workers, men who have sex with men and persons with HIV", Belize 2011-2012	Not used
STI prevalence	<b>For HSV-2</b> (the highest STI prevalence, after HIV): <b>27.91</b> (CI 95% 20.37-36.48)	2012	Central American Behavioral Sero-prevalence Survey of HIV and other STIs in more vulnerable populations: sex workers, men who have sex with men and persons with HIV", Belize 2011-2012	Not used
No. of partners per year	<b>3</b> partners per MSM, per year	2012	Central American Behavioral Sero-prevalence Survey of HIV and other STIs in more vulnerable populations: sex workers, men who have sex with men and persons with HIV", Belize 2011-2012	Not used
No. of acts per partner per year	<b>16</b> acts per partner per year	2011	The Men Health Survey 2011, Ministry of Health of Jamaica. Because access to the original study was not possible, this data was taken from the Jamaica's MOT-2012 report, that references this not published study	Not used
Percentage of acts that are protected	<b>58.3%</b>	2012	Central American Behavioral Sero-prevalence Survey of HIV and other STIs in more vulnerable populations: sex workers, men who have sex with men and persons with HIV", Belize 2011-2012	Not used
No. or percentage receiving ART	<b>Assumption</b> <b>58%</b> , considering the national coverage of HIV (+) persons who are currently in ART (NAP, 2014)			

Risk behaviors	Estimation	Year of estimation	Data source	International parameters
<b>Female Partners of MSM</b> Population size	14% of participants reported having had stable female partners. So, the value is <b>627</b>	2012	Central American Behavioral Sero-prevalence Survey of HIV and other STIs in more vulnerable populations: sex workers, men who have sex with men and persons with HIV", Belize 2011-2012	Not used
HIV prevalence	<b>Assumption</b> 50% of HIV prevalence in MSM according to Guatemala's MOT results ( <b>6.9%</b> )			
No. of partners per year	1 partner per regular female partner of MSM	2007	Based on Dominican Republic MOT-2010 report, that refers to Demographic and Health Survey for this country (2007)	Not used
No. of acts per partner per year	<b>Assumption</b> 72 acts per partner per year			
Percentage of acts that are protected	<b>62.5%</b> of MSM reported using condom consistently with stable female partner	2012	Central American Behavioral Sero-prevalence Survey of HIV and other STIs in more vulnerable populations: sex workers, men who have sex with men and persons with HIV", Belize 2011-2012	Not used
No. or percentage receiving ART	<b>Assumption</b> <b>58%</b> , considering the national coverage of HIV (+) persons who are currently in ART (NAP, 2014)			

Risk behaviors	Estimation	Year of estimation	Data source	International parameters
Casual Heterosexual Sex Population size	<p>15.4% of 15-49 years old male population had sex with more than 1 person at the last 12 months; we added 5.2% of not known/not respond + 10% considering that the methodology – face to face interview - to get this response generates under-estimation of results. So, <b>18,454 males</b> aged 15-49 years old had casual sex.</p> <p>4.9% of 15-49 years old female population had sex with more than 1 person at the last 12 months. So, <b>4,513 females</b> aged 15-49 years old, had casual sex</p>	2009	National Sexual Behavior Study, 2011	Not used
HIV prevalence	<b>Assumption</b> Increased by 50% the HIV prevalence in general population ( <b>2.1%</b> )			
STI prevalence	<b>Assumption</b> Increased by 50% the STIs prevalence in general population ( <b>4.2%</b> )			
No. of partners per year	Average number of partners in the last 30 days (among total responds): <b>2.7</b>	2013	Centroamérica (2012-2013): Estudio TRAC de Comportamientos Sexuales Saludables entre Hombres en Riesgo de varias ciudades de Guatemala, El Salvador, Nicaragua, Costa Rica, Panamá y Belice. Primera Ronda	Not used
No. of acts per partner per year	<b>Assumption</b> <b>30 acts/partner/year</b>			
Percentage of acts that are protected	<p>The percentage of 15-49 years old male population practicing CHS, who consistently used condom with non-regular partners, in the last 12 months was <b>7.9%</b> (1,090 persons).</p> <p>The percentage of 15-49 years old female population practicing CHS, who consistently used condom with non-regular partners, in the last 12 months was <b>1.7%</b> (77 persons).</p> <p>Average for both (male, female): <b>4.8%</b></p>	2009	National Sexual Behavior Study, 2011	Not used
No. or percentage receiving ART	<b>Assumption</b> <b>58%</b> , considering the national coverage of HIV (+) persons who are currently in ART (NAP, 2014)			

Risk behaviors	Estimation	Year of estimation	Data source	International parameters
<b>Partners of Casual Heterosexual Sex</b> Population size	<b>Assumption</b> The 36.8% of men aged 15 years old or higher are married, according to the Population and Housing Census of Belize-2010. So, the number of <b>female regular</b> partners of these men is <b>6,791</b> .  The 36.9% of women aged 15 years old or higher are married, according to the Population and Housing Census of Belize-2010. So, the number of <b>male regular</b> partners of these women is <b>1,665</b> .			
HIV prevalence	<b>Assumption</b> The same for those who practice casual heterosexual sex ( <b>2.1%</b> )			
No. of partners per year	<b>Assumption</b> 1 partner per regular partner of the persons practicing CHS			
No. of acts per partner per year	<b>Assumption</b> 48 acts per partner per year			
Percentage of acts that are protected	<b>Assumption</b> 5.1% of total 15-49 years old female population reported condom use like a contraceptive method, according to the Multiple Indicator Cluster Survey (Belize, 2011)			
No. or percentage receiving ART	<b>Assumption</b> 58%, considering the national coverage of HIV (+) persons who are currently in ART (NAP, 2014)			

Risk behaviors	Estimation	Year of estimation	Data source	International parameters
<b>Stable Heterosexual Couples</b> Population size	<b>Assumption</b> This number is the left of the sum of other risk behaviors respect total 15-49 years old population (37,206 males + 29,886 females)			
HIV prevalence	<b>Assumption</b> We assumed 50% of HIV prevalence in general population ( <b>0.7%</b> )			
STI prevalence	<b>Assumption</b> We assumed 50% of STIs prevalence in general population ( <b>1.4%</b> )			
No. of partners per year	<b>Assumption</b> 1 partner			
No. of acts per partner per year	<b>Assumption</b> 48 acts per partner per year			
Percentage of acts that are protected	<b>Assumption</b> 5.1% of total 15-49 years old female population reported condom use like a contraceptive method, according to the Multiple Indicator Cluster Survey (Belize, 2011)			
No. or percentage receiving ART	<b>Assumption</b> 58%, considering the national coverage of HIV (+) persons who are currently in ART (NAP, 2014)			



Risk behaviors	Estimation	Year of estimation	Data source	International parameters
<b>No risk</b> Population size	47.6% of total <b>women</b> (15-49 years old) = 43,841	2011	Belize Multiple Indicator Cluster Survey 2011	Not used
	12.9% of 15-49 years old <b>male</b> population = 11,556	2011	National Sexual Behavior Study, Belize 2011	Not used
HIV prevalence	<b>Assumption</b> The half of national HIV prevalence (1.4%) = <b>0.7%</b>			
STI prevalence	<b>Assumption</b> STIs prevalence of general population: 4951 (TB, HIV/AIDS & other STIs Programme Report-2012) / 177 043 (total population 15-49 years old-2012) = 2.8%, So, we'll take the half of national prevalence = <b>1.4%</b>			
No. of partners/year	<b>Assumption</b> CERO			
No. of acts/partner/year	<b>Assumption</b> CERO			
Condom use	<b>Assumption</b> CERO			
No. or percent receiving ART	<b>Assumption</b> <b>58%</b> , considering the national coverage of HIV (+) persons who are currently in ART (NAP, 2014)			

Risk behaviors	Estimation	Year of estimation	Data source	International parameters
<b>Medical Injections</b> Population size	Total population (15-49 years) = <b>181,686</b> ; male population (15-49 years) = 89,583; and female population (15-59 years) = 92,103	2013	Mid-year Population Estimates for Belize, 2013	Not used
HIV prevalence	<b>1.4%</b> (HIV prevalence for general population)	2012	National Aids Program, based on Spectrum-2013 results	Not used
Sterile equipment used	<b>Assumption</b> <b>100%</b> of total population has received a medical injection in the last year, using sterile equipment			

Risk behaviors	Estimation	Year of estimation	Data source	International parameters
<b>Blood transfusions</b> Population size	5115 collected blood units (discharged units were 18% according to PAHO's 2011 report). So, the number of blood units available for transfusion was <b>4,194</b> (2097 in males, 2097 in females)	2013	National Blood Bank Report 2013 (internal report)	Not used
HIV prevalence	<b>0,0%</b> considering no cases in the last 12 years	2013	National Blood Bank Report 2013 (internal report)	Not used
Blood screened	<b>100%</b>	2013	National Blood Bank Report 2013 (internal report)	Not used

**Annex 2.**

Individual revision of studies and other documents to set Belize's MOT model, February 27<sup>th</sup>, 2014

**No. of document: 1**

Variable	Description	Comment
Title: Central American Behavioral Sero-prevalence Survey of HIV and other STIs in more vulnerable populations: sex workers, men who have sex with men and persons with HIV	Behavioral Surveillance Survey on HIV and other STIs in more vulnerable populations: sex workers, men who have sex with men and persons with HIV	-
Reference	Marvin Manzanero et al; Universidad del Valle de Guatemala-CDC, preliminary report 2012	We used a preliminary report. The final report is yet to be received by the NAP
Type of document	Preliminary report	-
Population studied	Sex workers, men who have sex with men and persons with HIV	-
Sex (male, female)	Both	-
Operational definition for the population under study	MSM: men who have sex with other men FSW: female person who exchanged sex for money HIV (+): person living with HIV	-
Time	2012	-
Representativeness	Belize, Cayo, Orange Walk and Stann Creek districts	-
Modes of transmission	MSM, Partners of MSM, FSW, Clients of FSW	-
Type of study	Behavioral Surveillance Survey (cross sectional)	-
Sample size	MSM: 136; FSW: 219; HIV (+): 252	-
Method for sampling	RDS, census and convenience sampling	-
Level of risk	Not determined	-
Criteria to assign the level of risk (OR, RR, incidence...)	Not determined	-
HIV Prevalence (numerator/denominator)	FSW: 0.91 (2/129); MSM: 13.85 (18/130)	-
Incidence (numerator/denominator)	Not determined	-

No. of document: 2

Variable	Description	Comment
Title: Substance Use and other Risk Behaviors among Inmates at the Belize Central Prison, 2008	Substance Use and other Risk Behaviors among prisoners in Belize	-
Reference	HIV sero-prevalence and associated risk factors among male inmates at the Belize Central Prison, by Ethan Gough and Paul Edwards, 2008	-
Type of document	Scientific paper	-
Population studied	Prisoners	-
Sex (male, female)	Male	-
Operational definition for the population under study	Male inmates at the Belize Central Prison	-
Time	During January–March 2005 the study was carried out	-
Representativeness	No	-
Modes of transmission	UDIs	-
Type of study	Cross-sectional	-
Sample size	623	-
Method for sampling	Convenience sampling	-
Level of risk	Not Determined (ND)	-
Criteria to assign the level of risk (OR, RR, incidence...)	ND	-
Prevalence (numerator/denominator)	4% (25/623)	-
Incidence (numerator/denominator)	ND	-

No. of document: 3

Variable	Description	Comment
Title: Report from the National Drug Abuse Control Council (NDACC), 2012	Report from the National Drug Abuse Control Council (NDACC), corresponding to 2012	Based in all attendees who seek for medical attention in specific public health clinics (convenience sampling)
Reference	Report from the National Drug Abuse Control Council (NDACC), 2012	-
Type of document	Report	-
Population studied	All attendees who seek for medical attention in specific public health clinics (244)	-
Sex (male, female)	Both	-
Operational definition for the population under study	Any person who uses alcohol, crack/cocaine, cocaine, marijuana, heroin, tobacco or other	-
Time	2012	-
Representativeness	No	-
Modes of transmission	IDU	-
Type of study	Not a study	-
Sample size	Not Applicable (NA)	-
Method for sampling	NA	-
Level of risk	NA	-
Criteria to assign the level of risk (OR, RR, incidence...)	NA	-
Prevalence (numerator/denominator)	NA	-
Incidence (numerator/denominator)	NA	-

No. of document: 4

Variable	Description	Comment
Title: Belize Multiple Indicator Cluster Survey, 2011	Survey on specific indicators for Belize, 2011	Indicators correspond only to female and children populations
Reference	Belize Multiple Indicator Cluster Survey, 2011	-
Type of document	Study report	-
Population studied	Female and children	-
Sex (male, female)	Female (both for children)	-
Operational definition for the population under study	Female and children	-
Time	2011	-
Representativeness	National	-
Modes of transmission	No risk (women)	-
Type of study	Survey (cross sectional)	-
Sample size	4,900 households	-
Method for sampling	Two stages study	-
Level of risk	ND	-
Criteria to assign the level of risk (OR, RR, incidence...)	ND	-
Prevalence (numerator/denominator)	ND	-
Incidence (numerator/denominator)	ND	-

No. of document: 5

Variable	Description	Comment
Title: National Sexual Behavior Study, Belize	Study on sexual behaviors in Belize	This study has not been published yet
Reference	National Sexual Behavior Study, Belize 2011	-
Type of document	Study (not published yet)	-
Population studied	General population	-
Sex (male, female)	Both	-
Operational definition for the population under study	ND	-
Time	2009	-
Representativeness	National	-
Modes of transmission	No risk	-
Type of study	Survey (cross-sectional)	-
Sample size	4,000 individuals	-
Method for sampling	Three-staged sample design	-
Level of risk	ND	-
Criteria to assign the level of risk (OR, RR, incidence...)	ND	-
Prevalence (numerator/denominator)	ND	-
Incidence (numerator/denominator)	ND	-



No. of document: 6

Variable	Description	Comment
Title: The HIV Program Annual Statistical Report, 2012 (programmatic report)	Report developed annually by Epidemiology Unit and NAP	-
Reference	Annual Statistical Report by HIV Program, 2012	-
Type of document	Report (analysis)	-
Population studied	NA	-
Sex (male, female)	NA	-
Operational definition for the population under study	NA	-
Time	2012 (data 2012)	-
Representativeness	NA	-
Modes of transmission	Blood transfusions	-
Type of study	NA	-
Sample size	NA	-
Method for sampling	NA	-
Level of risk	NA	-
Criteria to assign the level of risk (OR, RR, incidence...)	NA	-
Prevalence (numerator/denominator)	NA	-
Incidence (numerator/denominator)	NA	-

No. of document: 7

Variable	Description	Comment
Title: National Blood Bank Report, 2013 (internal report)	An internal Belize's Blood Bank report	-
Reference	National Blood Bank Report, 2013	-
Type of document	Report (analysis)	-
Population studied	Blood donations	-
Sex (male, female)	Both	-
Operational definition for the population under study	People who donates blood	-
Time	2013	-
Representativeness	NA	-
Modes of transmission	Blood transfusions	-
Type of study	Not a study	-
Sample size	NA	-
Method for sampling	NA	-
Level of risk	NA	-
Criteria to assign the level of risk (OR, RR, incidence...)	NA	-
Prevalence (numerator/denominator)	NA	-
Incidence (numerator/denominator)	NA	-

No. of document: 8

Variable	Description	Comment
Title: Belize (2013): HIV/AIDS TRaC Study. Evaluating condom use among Female Sex Workers. Third round	Study that analyzes the use of condom in FSW	-
Reference	Belize (2013): HIV/AIDS TRaC Study. Evaluating condom use among Female Sex Workers. Third round	-
Type of document	Study report	-
Population studied	FSW	-
Sex (male, female)	Female	-
Operational definition for the population under study	ND	-
Time	2013	-
Representativeness	Belize District, Cayo, Orange Walk, Corozal, and Stann Creek	-
Modes of transmission	FSW, Clients of FSW	-
Type of study	Cross-sectional	-
Sample size	299	-
Method for sampling	Time Location Sampling	-
Level of risk	ND	-
Criteria to assign the level of risk (OR, RR, incidence...)	ND	-
Prevalence (numerator/denominator)	ND	-
Incidence (numerator/denominator)	ND	-

No. of document: 9

Variable	Description	Comment
Title: How many men who have sex with men and female sex workers live in El Salvador? Using respondent-driven sampling and capture–recapture to estimate population sizes	Study designed to determine size population of MSM and FSW in El Salvador	This study was used in the first draft of MOT-model, but MSM population size for Belize seems to be higher, reason why UNAIDS and UNIBAM (United Belize's Advocacy Movement) references were used to determine this size population
Reference	Paz Bailey et al, Sexual Transmitted Infections 2011;87:279-282	-
Type of document	Study abstract	-
Population studied	MSM, FSW	-
Sex (male, female)	Both	-
Operational definition for the population under study	ND	-
Time	2008	-
Representativeness	No, it was implemented only in San Salvador	-
Modes of transmission	MSM	-
Type of study	Cross-sectional	-
Sample size	First capture: 400 MSM. Second capture: 624 MSM	-
Method for sampling	Respondent-driven sampling and capture–recapture	-
Level of risk	ND	-
Criteria to assign the level of risk (OR, RR, incidence...)	ND	-
Prevalence (numerator/denominator)	ND	-
Incidence (numerator/denominator)	ND	-

No. of document: 10

Variable	Description	Comment
Title: Centroamérica (2012-2013): Estudio TRAC de comportamientos sexuales saludables entre hombres en riesgo de varias ciudades de Guatemala, El Salvador, Nicaragua, Costa Rica, Panamá y Belice. Primera ronda	Integration of TRAC studies implemented in Guatemala, El Salvador, Nicaragua, Costa Rica, Panamá and Belize	-
Reference	División de investigación y métricas de PASMO/PSI, "Centroamérica (2012-2013): Estudio TRaC de monitoreo de comportamientos sexuales saludables entre hombres en riesgo de varias ciudades en Guatemala, El Salvador, Nicaragua, Costa Rica, Panamá y Belice. Primera ronda"; reporte resumen TRaC, 2013	-
Type of document	Study report	-
Population studied	Men at risk for HIV	-
Sex (male, female)	Men	-
Operational definition for the population under study	Risk Men (RM): are defined as those whose profession exposes them to risky sexual situations to become infected with HIV	-
Time	2013	-
Representativeness	Stan Creek, Cayo, Belize and Orange Walk	-
Modes of transmission	Casual Sex	-
Type of study	Compilation of studies	-
Sample size	242 for average number of partners, at the last 30 days	-
Method for sampling	Compilation of studies	-
Level of risk	ND	-
Criteria to assign the level of risk (OR, RR, incidence...)	ND	-
Prevalence (numerator/denominator)	ND	-
Incidence (numerator/denominator)	ND	-

No. of document: 11

Variable	Description	Comment
Title: Jamaica's MOT- 2012 report, that references the following study: The Men Health Survey 2011, Ministry of Health of Jamaica	A country MOT report from Jamaica	The study: The Men Health Survey 2011, conducted by the Ministry of Health of Jamaica has been not published. For this reason, it was not possible to analyze the study itself
Reference	Jamaica's MOT- 2012 report	-
Type of document	Report for MOT exercise conducted in Jamaica	-
Population studied	Risk behaviors for HIV	-
Sex (male, female)	Both	-
Operational definition for the population under study	Those of MOT model	-
Time	2012	-
Representativeness	NA	-
Modes of transmission	MSM, FSW	-
Type of study	Mathematical modeling	-
Sample size	NA	-
Method for sampling	NA	-
Level of risk	NA	-
Criteria to assign the level of risk (OR, RR, incidence...)	NA	-
Prevalence (numerator/denominator)	NA	-
Incidence (numerator/denominator)	NA	-

No. of document: 12

Variable	Description	Comment
Title: Dominican Republic's MOT- 2010 report, that references the Demographic Health Survey 2007	Country MOT report for Dominican Republic	It was not possible to access the Demographic Health Survey - 2007 for this country
Reference	Dominican Republic's MOT- 2010 report	-
Type of document	MOT report	-
Population studied	Risk behaviors for HIV	-
Sex (male, female)	Both	-
Operational definition for the population under study	Those of MOT model	-
Time	2010, but DHS data correspond to 2007	-
Representativeness	NA	-
Modes of transmission	Partners of MSM, Clients of FSW	-
Type of study	Mathematical modeling	-
Sample size	NA	-
Method for sampling	NA	-
Level of risk	NA	-
Criteria to assign the level of risk (OR, RR, incidence...)	NA	-
Prevalence (numerator/denominator)	NA	-
Incidence (numerator/denominator)	NA	-

No. of document: 13

Variable	Description	Comment
Title: National Prevention of Mother to Child Transmission Report, 2012 (Belize)	A report developed by the National Prevention of Mother to Child Transmission Program	-
Reference	National Prevention of Mother to Child Transmission Report, 2012	-
Type of document	Programmatic report	-
Population studied	NA	-
Sex (male, female)	Female	-
Operational definition for the population under study	NA	-
Time	2012	-
Representativeness	NA	-
Modes of transmission	Medical Injections and Blood Transfusions	-
Type of study	NA	-
Sample size	NA	-
Method for sampling	NA	-
Level of risk	NA	-
Criteria to assign the level of risk (OR, RR, incidence...)	NA	-
Prevalence (numerator/denominator)	0.6% in pregnant women (numerator and denominator not specified)	-
Incidence (numerator/denominator)	NA	-



No. of document: 14

Variable	Description	Comment
Title: Belize Report Risk Profile of People with HIV of the beneficiary countries from the Regional Program REDCA+	Risk profile of persons living with HIV in Belize	-
Reference	Belize Report Risk Profile of People with HIV of the beneficiary countries from the Regional Program REDCA+	-
Type of document	Report of study	-
Population studied	Persons living with HIV	-
Sex (male, female)	Both	-
Operational definition for the population under study	Persons living with HIV	-
Time	Not clear	-
Representativeness	ND	-
Modes of transmission	Injecting Drug Users	-
Type of study	Cross-sectional	-
Sample size	The final sample size was 7 support centers and 347 individuals surveyed in these centers. The number of individuals with HIV surveyed in their homes was 51	-
Method for sampling	PPS (Probability Proportional to Size)	-
Level of risk	ND	-
Criteria to assign the level of risk (OR, RR, incidence...)	ND	-
Prevalence (numerator/denominator)	ND	-
Incidence (numerator/denominator)	ND	-

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