

# Using mathematical modelling to improve our understanding of the HIV prevalence among the “hidden” population of men who have sex with men (MSM) in southern India: Implications for HIV programming. (MOPE135)

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## Background

- In Bangalore, southern India, epidemiological and behavioural data on MSM (including hijra) have mainly been collected from public-place ‘cruising’ sites<sup>1</sup>.
- The sampling methods capture predominantly receptive and versatile MSM subgroups and only a higher-risk subsample of the predominantly insertive MSM.
- A lower-risk predominantly insertive ‘hidden’ MSM population may not be represented in these surveys.
- The aim of this study is to use mathematical +modelling to estimate the HIV prevalence of the predominantly insertive MSM, including this ‘hidden’ population.

## Results

- ✓ Approach 1, estimates an HIV prevalence in the “hidden” population of 6.5% (median), approximately 2% higher than approaches 2 and 3.
- ✓ For all three fitting approaches over 98% of model fits estimated the HIV prevalence to be below the mean estimate from the survey data.
- ✓ Model fits for all three approaches were clustered towards the lower end of the 95% CI for the survey data.
- ✓ The median model fit for HIV prevalence in the total MSM population for approaches 1, 2 and 3 is 9.8%, 8.4% and 8.2%, this is despite the survey data estimating a prevalence of 17% from the IBBA for MSM in Bangalore .
- ✓ The median estimate for the total MSM population size for approach 1, is 44700, this equates to 2.4% of all urban males aged 15-49 in Bangalore. For approaches 2 and 3 this estimate is slightly higher, 3% and 3.2%, respectively.
- ✓ All three fitting approaches suggest the ‘hidden’ population comprise 60-70% of the total population of MSM.
- ✓ Approximately 3 infections out of every 10 in the urban male population may be attributed to MSM, in all 3 approaches.
- ✓ The “hidden” population are estimated to account for 33% of all infections in the MSM population or 1 in every 10 infections in the male population.
- ✓ This compares to 2 in every 10 infections in male clients of female sex workers, based on prevalence

## Methods

- ❑ A deterministic model of HIV/STI transmission was developed. MSM were grouped into three sexual identity subgroups based on the survey data<sup>2</sup>, closely related to role taken in anal sex: *hijras/kothis* (KH), double deckers (DD), and *panthis/bisexuals* (PB), figure 1.
- ❑ Whilst all subgroups are sampled in the survey, it is thought the data are a better representation of the KH and DD groups and is only capturing higher-risk insertive MSM (figure 1).

3 different parameterisation and fitting approaches were taken to obtain more insight into the HIV prevalence in the insertive lower-risk MSM subgroup:

The model was parameterised and fit to all MSM subgroup data from the survey, allowing the predominantly insertive MSM population size to vary and assuming the higher-risk PB data is representative of all the predominantly insertive MSM in the population.

- The model was parameterised and fit to the KH and DD subgroup data only and the PB parameter estimates were allowed to vary as much as possible (but ensuring their percentage of insertive sex acts was greater than 50%), to allow for a high level of uncertainty in behavioural characteristics of this population.
- The third approach used the same parameterisation and fitting strategy as the second approach, but additionally excluded fits in which the PB population had more sex acts than the higher risk KH, in agreement with current knowledge from the literature.

Figure 1: MSM are divided into 3 subgroups based on sexual role and identity. The light blue circles depict MSM sampled in the survey data who are thought to be a good representation of their respective subgroups. The outer white area represents the entire MSM population which includes, what is perceived to be a much larger subset of “hidden” lower-risk insertive MSM whose behaviour is not captured by the survey data.

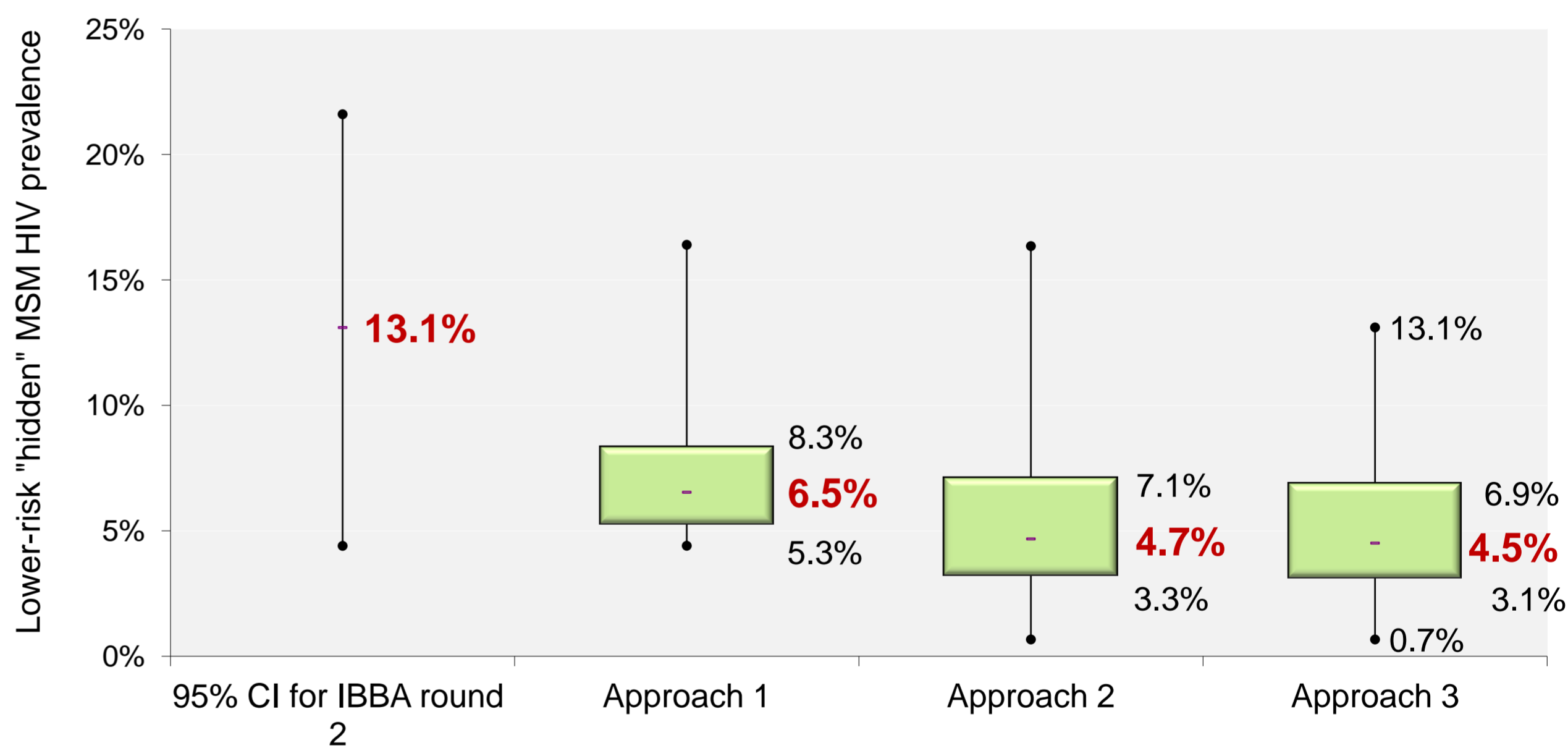
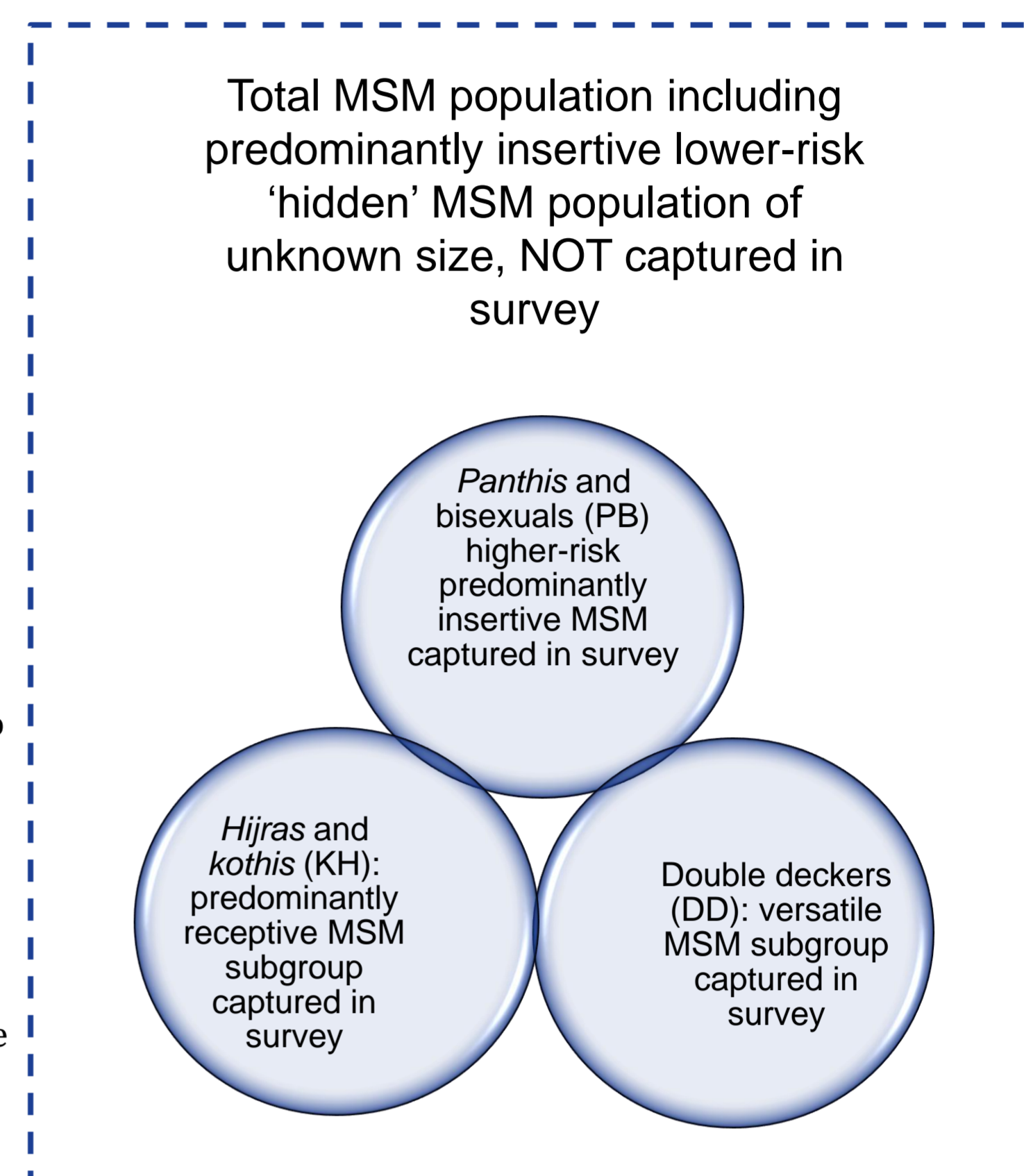


Figure 2: Median and inter-quartile range values from the model fits are displayed, along with the mean (13.1%) and 95% CI from the survey data for the 3 different model parameterisation and fitting approaches

## Conclusions

Model projections suggest the HIV prevalence in MSM is significantly lower than estimated by the survey data for the PB population. The lower-risk more “hidden” population, may however contribute a significant number of infections to the epidemic and their tendency to form partnerships with both males and females means they have the potential to act as a key bridging population in the context of the wider HIV epidemic.

## References

- Phillips, A.E., M.C. Boily, C.M. Lowndes, G.P. Garnett, K. Gurav, B.M. Ramesh, et al., *Sexual Identity and Its Contribution to MSM Risk Behavior in Bangaluru (Bangalore), India: The Results of a Two-Stage Cluster Sampling Survey. Journal of LGBT Health Research, 2008. 4(2): p. 111 - 126.*
- Integrated biological and behavioural Assessments, collected within the monitoring and evaluation of Avahan, the India AIDS Initiative.
- Phillips, A.E., J. Bradley, C.M. Lowndes, J. Anthony, and M. Alary, *Sexual behaviour and HIV risk among men who have sex with men, and transgendered individuals in Bangalore, India, in CHARME Working Paper No. 72009.*

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