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Estimating patterns in the under-reporting of suicide deaths in India: comparison of administrative data and Global Burden of Disease Study estimates, 2005-2015

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What is already known on this subject?

Existing evidence suggests that the publicly available, National Crime Records Bureau (NCRB) data under-estimates suicide deaths in India. Two previous studies reporting suicide death rates using verbal autopsy data found higher suicide rates compared to suicide death rates reported by the NCRB. However, none of the studies have compared the NCRB data with any other data sources to report the extent of under-reporting by sex, age or geographic area.

What this study adds?

The is the first study to provide a detailed comparison of the estimates of suicide death rate from the Global Burden of Disease (GBD) Study with suicide death rate from NCRB for the period 2005-2015 by sex, age-group and geographic area. Results highlight that suicide death rates are consistently lower in the NCRB reports for most states in India, and the under-reporting was higher among females, youngest and the oldest age groups, and higher for states belonging to low Socio-demographic Index. These results can be used to improve reporting of suicide deaths by community and documentation of suicide deaths by the police.

Abstract

Background: It has been proposed that the National Crime Records Bureau (NCRB), which reports suicides in India, differentially under-enumerates suicides by geographic and demographic factors**.** We assessed the extent of potential under-enumeration by comparing suicides recorded in NCRB data with recent estimates of Indian suicides developed by the Global Burden of Disease (GBD) initiative.

Methods: Age standardised suicide rates were calculated for both data sources by sex, age and state, and rate ratios of NCRB to GBD estimates by corresponding strata were compared to ascertain the relative under-reporting in the NCRB report.

Results: The GBD study reported an additional 802,684 deaths by suicide (333,558 male and 469,126 female suicide deaths) compared to the NCRB report between 2005-2015. Among males, the average under-reporting was 27% (range 21%-31%) per year, and, among females, the average under- reporting was 50% (range 47%-54%) per year. Under-reporting was more evident among younger (15-29 years) and older age groups (≥60 years) compared to middle age groups. Indian states belonging to low Socio Demographic Index (SDI) generally had greater under-enumeration compared to middle and high SDI states.

Conclusion: NCRB data under-reports suicides in India, and differentially by sex, age, and geographic area, possibly because of lack of community level reporting of suicides due to social stigma and legal consequences. While the recent decriminalisation of suicide is expected to improve community level reporting of suicides, suicide prevention policies should be developed, with a priority to address social stigma attached with suicide and suicidal behaviour, especially among females.

Introduction

The Global Burden of Disease (GBD) Study estimated 230,000 suicide deaths in India in 2016, accounting for 37% and 25% of the global male and female deaths by suicide, respectively.[1] The estimated number of suicide deaths in the GBD Study was higher than that reported by the National Crime Records Bureau (NCRB), which is the administrative data source of unnatural deaths in India, including suicide deaths, which is based on the cases reported to police.[2] While the reliability of suicide death statistics has been questioned both in lower and higher income countries, very few studies worldwide have assessed the extent of underreporting of suicide deaths.[3 4] The under-reporting of suicide deaths in the NCRB has been previously noted,[1 5-7] however, the extent of under-reporting by sex, age, and state has not been analysed. This is important, as NCRB data are widely accessible and are routinely used to estimate the burden of suicide deaths to inform policy responses in jurisdictions across India.[8] We addressed this gap by undertaking a detailed comparison of the estimates of suicide deaths from the GBD Study with that from the NCRB to explore the extent of potential under-reporting of suicide deaths in the NCRB data.

Methods

Data on deaths by suicide were extracted from the publicly available NCRB reports for the period 2005-2015.[2] These data were available by state, sex and in pre-defined age-groups (15-29, 30-44, 45-59 and ≥60 years). The corresponding data on suicide deaths and population totals for each year from the GBD Study was provided by the India GBD collaborators. The GBD study uses a combination of multiple sources, with the primary source being the Sample Registration system (SRS) data based on verbal autopsies and individual level studies based on community surveillance programmes, and use ensemble modelling methods to estimate underlying case counts.[1 9] This data was available by year, state, sex, and in corresponding age-groups to the NCRB report.

Suicide death rates for each age group was estimated for each year from 2005 to 2015 from both the datasets, stratified by sex and state, using the 2010 GBD Study population as the standard. Age-standardised suicide death rates were estimated by multiplying the crude age specific rate (for each year) by the number of people in that age group in the 2010 GBD population to calculate the number of expected suicide deaths for each year if they had the 2010 GBD age specific population distribution. The total number of expected suicide deaths for each year was then divided by the total number of people in the 2010 GBD population to calculate standardised rates. 95% confidence intervals (CIs) for age-standardised suicide death rates were calculated by assuming a Poisson distribution for the number of standardised suicide deaths.[10]

To estimate the extent of discrepancy between the two data sources, the age-standardised suicide death rate from the NCRB was divided by that from the GBD Study for each year stratified by sex and state, and was expressed as rate ratio (RR). Similarly, the age-specific rates stratified by sex from both the data sources were divided and expressed as RR to determine the difference in suicide death rates by sex. RRs were also presented for the three specific groups of Indian states categorised based on their Sociodemographic Index (SDI) as calculated by the GBD Study: low SDI (≤0.53), middle SDI (0.54-0.60), and high SDI.[11 12] SDI is a composite indicator of development status, which ranges from 0 to 1, and is a geometric mean of the values of the indices of lag-distributed per capita income, mean education for those 15 years of age or older, and total fertility rate in women younger than 25 years.[11] All the RRs were reported with 95% uncertainty intervals (UIs), based on Monte Carlo simulations using Ersatz software to account for uncertainty around the RR estimates.[13] The ErRelativeRisk function, which assumes normal distribution for the In(RR) with a standard deviation of SE[In(RR)], was used to estimate the 95% UIs after 1000 iterations to ensure convergence of model outcomes.

Results

At the national level, the age-standardised suicide death rate was consistently lower in the NCRB report compared to the GBD Study (Figure 1). There were 802,684 fewer deaths by suicide for both sexes combined in the NCRB report for India as compared to the GBD Study (2,188,413) between 2005 and 2015. On average, the NCRB age-standardised suicide death rate for both sexes combined was 37% (range 35%-40%) lower per year compared to the respective GBD rates. The age-standardised suicide death rates from the NCRB data converged with the GBD rates by 8.3% over the study period (RRs decreasing from 0.60 to 0.65 over the study period) (Supplementary Table 1).

Among the different SDI state groups, the states belonging to the low SDI group generally had lower suicide death rates based on the NCRB report compared to the GBD estimates than the middle and high SDI states (Supplementary Table 1). The NCRB age-standardised suicide death rates were on average 56% (range 53%-61%), 28% (range 26%-33%) and 28% (range 23%-33%) lower per year for the low, middle and high SDI states, respectively, compared to the GBD study age-standardised suicide death rates. In the latest year 2015, the states of Bihar and Uttar Pradesh among the low SDI state group had the lowest NCRB suicide death rates. Five other states including Sikkim, Goa, Mizoram, Delhi and Chhattisgarh (all high SDI states except Chhattisgarh) had higher suicide death rates in NCRB compared to the GBD study estimates (Figure 2).

The male age-standardised suicide death rates were lower in the NCRB report with 333,558 fewer male suicide deaths reported in the NCRB data compared to the GBD study (1,243,583) between 2005 and 2015 (Figure 1). The male suicide death rates were similar for the NCRB and the GBD study for the 45-59 years age group as reflected from the RR over time (Supplementary Figure 1 and Supplementary Table 2). The RR for those aged 15-29 years indicate increasing convergence of estimates between the two data sources in the most recent period, whereas a divergent trend is seen for those aged ≥60 years with suicide death rates from NCRB moving further away from GBD estimates in the latter part of the study period (Figure 3). The NCRB estimates for 30-44 years remained lower than the GBD estimates with a reasonably stable RR across these years. All the states in the low SDI state group, except Chhattisgarh, had lower NCRB suicide death rates compared to the GBD estimates for males ≥15 years of age, with the RR in these states ranging from 0.15 in Bihar in 2015 to 1.29 in Chhattisgarh in 2005 (Supplementary Table 3). Bihar was the state with the least RR across all these years and Chhattisgarh had nearly similar rates from the NCRB and GBD study males ≥15 years of age (Supplementary Table 3). The RR among all age groups for males remained below 0.8 in the low SDI states (Figure 4). Among the middle SDI states, Meghalaya, Manipur and Jammu & Kashmir were outliers with low RR as compared with the other states in this category (Supplementary Table 3). In contrast, Goa, Sikkim and Union Territories had RR of nearly two times of more, indicating higher age-standardised suicide death rates in the NCRB as compared with the GBD study. In the middle SDI states, despite the extent of variations in the RR over the study period, the RR for 15-29, 30-44 and 45-49 years was closer to 1.00 in 2015 whereas the RR for ≥60 years remained low and continued to decline over this period (Figure 4). A similar trend was seen in the high SDI states with the exception of ≥60 years for which the RR was higher as compared with the middle SDI states (Figure 4).

Age standardised female suicide death rates were also lower in the NCRB data with a total of 469,126 fewer female suicide deaths reported in the NCRB reports compared to the GBD study (944,830) between 2005-2015 (Figure 1). Female suicide death rates for the NCRB closely matched the GBD estimates for the 45-59 years age group between 2005-2012, as reflected from the RR over these years (Supplementary Figure 1 and Supplementary Table 2). The RR for the youngest age group (15-29 years), showed increasing convergence of estimates between the NCRB and the GBD estimates in the recent years. However, remaining age groups indicate a divergent trend, with the NCRB suicide death rates moving further away from the GBD estimates in the latter period of the study (Figure 3). All the states belonging to the low SDI state category, except Chhattisgarh, had lower NCRB suicide death rates comparted to the GBD estimates for females ≥15 years of

age, with the RR in these states ranging from 0.07 in Bihar in 2015 to 1.53 in Chhattisgarh in 2011 (Supplementary Table 4). Bihar had the lowest RR across the study period while Chhattisgarh consistently recorded higher suicide rates in the NCRB data compared to the GBD estimates among females ≥15 years of age (Supplementary Table 4). The RR among all age groups for females remained below 0.7 in the low SDI states (Figure 5). Among middle SDI states, Tripura reported similar suicide death rates for the NCRB and the GBD estimates with RR generally close to 1.0 while Manipur and Jammu & Kashmir generally observed lower RR compared with the other states in this category (Supplementary Table 4). Among the high SDI states, Goa, Delhi and Union territories had similar age standardised suicide death rates among the NCRB and the GBD estimates as reflected by the RR while Sikkim had two to four times higher RR signifying higher age-standardised suicide death rates in the NCRB as compared with the GBD study (Supplementary Table 4). While the RR for the age group of 45-59 years remained close to 1.0 (except the last three years), RR among the middle and high SDI state groups for all the other age groups remained low, especially for ≥60 years age group (Figure 5).

Discussion

This study investigated the potential under-reporting of suicide deaths in India by comparing the estimates reported in the routinely available NCRB report based on the cases reported to police with that from the GBD study from 2005 to 2015. The NCRB report generally reported lower suicide death rates compared to the GBD estimates, especially for females. For both sexes combined, lower suicide death rates were evident in the NCRB among the oldest and the youngest age groups, and in the states belonging to the low SDI category. There was greater concordance between NCRB report and GBD study for the middle age groups.

The major difference between the GBD study and the NCRB reports is the data collection method. The GBD study primarily uses Sample Registration system (SRS) data based on verbal autopsies and individual level studies based on community surveillance programmes.[1 9] The NCRB data in comparison is not designed for surveillance, and is dependent upon the passive collection of information contained in the First Information Report (FIR) lodged by family/friends to their local police station to report the case.[6] Some of the demotivating factors for community level reporting of suicide might include social stigma and legal consequences attached with suicide coupled with a general hesitation among people to engage with police in India.[14-17] The decriminalisation of suicide in 2017 might help with better reporting of suicide deaths at the community level.[16]

There is also likely to be some misclassification of suicide deaths as homicides in the NCRB reports resulting in further underreporting.[5]

An additional issue with NCRB data is the transmission of data from the local police station to the NCRB report. Similar to road traffic collision (RTC) deaths,[2 18] the police data on suicide deaths recorded at a local level, is referred in aggregate form to the district level, and then to the state and, finally to the national level. Each of these steps in aggregation represent points at which information can be unreported or miscoded, resulting in under-reporting of suicide death cases. Our analysis found that Indian states with low SDI had a higher under-reporting in NCRB data compared to GBD estimates, compared to states with middle and high SDI. It has been suggested that budget, infrastructure and overall police force strength and adequacy is generally much weaker among less developed states compared to more developed states.[19] It is plausible that a general lack of infrastructure and resources among low SDI states produces complications concerning the recording and dissemination of suicide death data collected and maintained by the police. NCRB data is collected passively, and the surveillance of suicide deaths is not the primary function of the police system. However, the quality of police data on suicide deaths can be improved by standardization of collection methods as well as an increase in budget and training of the staff to compile and disseminate suicide data. RRs between NCRB and GBD data observed a slight trend towards convergence between 2005-2015 which likely reflects a marginal improvement in overall reporting of suicide death cases over the study period in the NCRB data. The reasons for this convergence are not clear but it might be reflective of an improvement in the local level police reporting and/or the transmission of local level data at the district and state level. Awareness programmes targeting stigma reduction can help further improve suicide reporting in India. For example, the *beyondblue* initiative in Australia, which had community awareness and de-stigmatisation of depression as one of its priority areas, observed a positive effect on communities regarding certain beliefs about depression treatment.[20]

Compared to males, female suicide death rates were almost twice as under-enumerated in NCRB data compared to GBD estimates. India is home to some of the highest female suicide death rates in the world,[1] which are frequently explained in relation to rigid patriarchal norms, gender-based discrimination and mistreatment evident in many parts of the country.[21 22] However, explanations for higher under-reporting of female compared to male suicide deaths are less certain. One possible explanation is the heightened legal consequences associated with female suicide deaths that are associated with sexual or physical violence or other mistreatment by family or in-laws. The death of a woman during the first seven years of matrimony is governed by a specific section of law, stipulating that any suspected unnatural death must be subject to an inquest by a

magistrate.[23] It is also possible that some families may be concerned that a suicide death investigation may uncover abuses or sexual violence that may tarnish the memory of a deceased female, potentially creating incentives for deaths to be classified as either natural deaths or accidents. Whatever the explanation, it is clear that this under-reporting of female suicide deaths has served to make invisible a major societal problem, causing it to be de-emphasised in public policy debates and resource allocation. Increasing awareness of female death by suicide has appropriately lead to it becoming a "core focus" for suicide prevention in India.[1 6 24]

Among different age groups, suicide death rates in the youngest (15-29 years) and older age group (≥60 years) were lower in the NCRB data compared to GBD estimates than among middle age groups. Lower rates in these age groups were also more prominent among females compared to males. Under-enumeration of suicide deaths in the youngest age group could likely be due to increased stigma associated with some of the commonly reported reasons for suicide in this age group compared to other age groups. For example, reasons for suicide death cases listed under the categories of 'love affairs' and 'dowry disputes' in the NCRB reports, are generally highest among the age group of 15-29 years.[2 6] Non socially sanctioned 'love affairs' are highly stigmatized in India while 'dowry disputes' carry legal implications in the Indian penal code.[25-27] Furthermore, adolescent suicide deaths can also relate to a perceived lack of love, neglectful or abusive behaviour of the parents and hence carry more shame and stigmatization for the family.[28]

The under-enumeration of suicide deaths in the NCRB data compared to GBD estimates among older age groups may reflect the predominance of the elderly living in rural parts of India in social isolation.[29] Approximately two-thirds of the Indian elderly reside in rural regions,[30] and the extent of under-reporting of suicide deaths is likely higher in rural areas than in urban areas. Also, the cause of death in older age groups relating to overdose (e.g. by prescription medicine) may be more likely to be misreported in death certificates as death due to medical illness or accident,[31] and a propensity among medical examiners to less accurately record the cause of death in older age-groups.[32]

Results of this study should be interpreted with caution. The GBD estimates, while arguably providing better estimations of suicide deaths compared to the NCRB data, also have limitations which have been highlighted elsewhere.[33 34] Importantly, evidence suggests that specific causes of death in the GBD might be overestimated, due to the re-assignment of partially specified causes of death to specific causes of death (e.g. re-assignment of 'injuries with intent undetermined' to accidental and intentional injuries).[35] For India, in the SRS verbal autopsy data, while 86.8% of deaths were directly assigned as suicide deaths, the remaining cases were redistributed from other unspecified causes.[1] Conversely, lower suicide death rates in some states (e.g. Sikkim,

union territories including Delhi) in the GBD estimates compared to the NCRB data perhaps also highlights the need to understand possible under-reporting in the GBD estimates. Another more important issue is the poor death registration coverage and inadequacy of medical certification of cause of death in India.[36 37] While the GBD data provides the best estimates of suicide death burden in the Indian population, the focus should remain on improving the quality of routinely collected and publicly available data sources. The quality and coverage of the death registration and cause of death assignment systems must improve to better estimate mortality burden and its associated causes in India. As national and regional suicide prevention polices are developed in response to the increasing burden of suicide deaths in India, there is also an increased need to have accurate recording and dissemination of suicide data for the timely evaluation of suicide prevention activity and assessment of population burden associated with suicide deaths.

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Declaration of interests

None

Acknowledgments

None

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Figure 1: Comparison of the age-standardised suicide death rates from the Global Burden of Disease (GBD) Study and National Crime Records Bureau (NCRB) for India, 2005-2015.

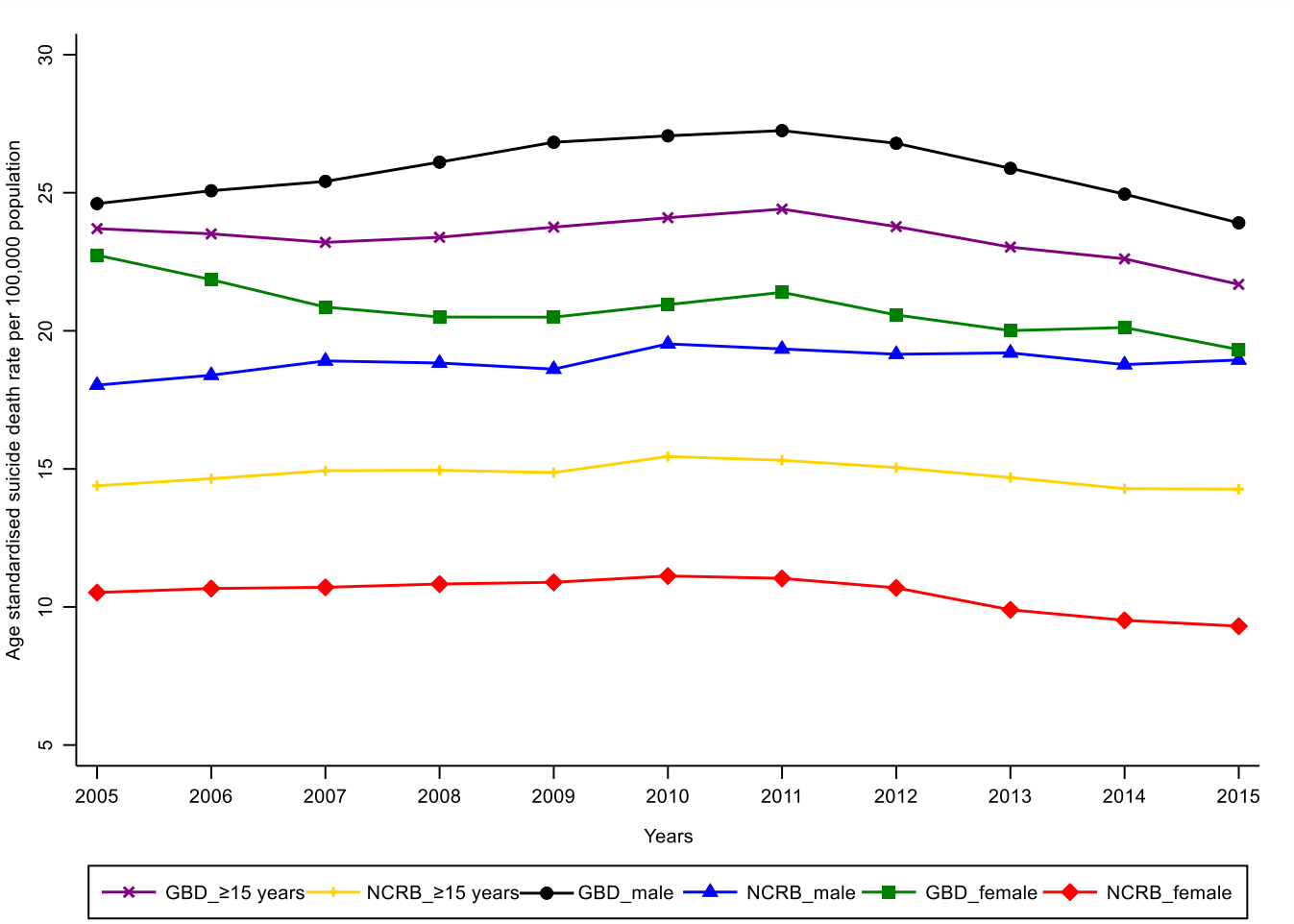

Figure 2: Rate ratio (RR) for the age standardised suicide death rates based on comparison between the National Crime Records Bureau (NCRB) and Global Burden of Disease (GBD) Study estimates for the Indian states for both sexes combined, 2015

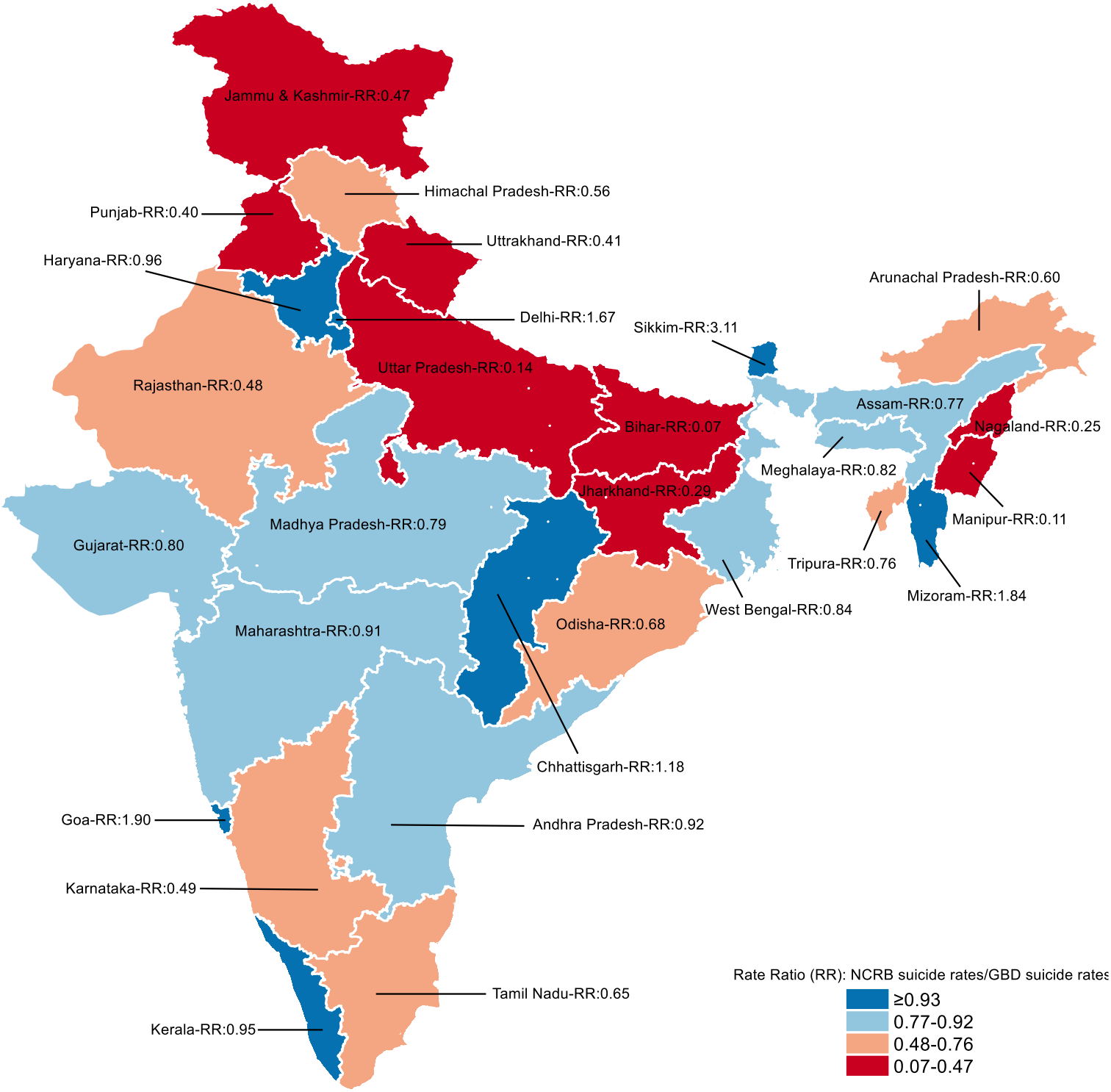

Figure 3: Trends in rate ratio of age standardised suicide death rates between the National Crime Records Bureau and Global Burden of Disease Study by sex and age group for India, 2005-2015.

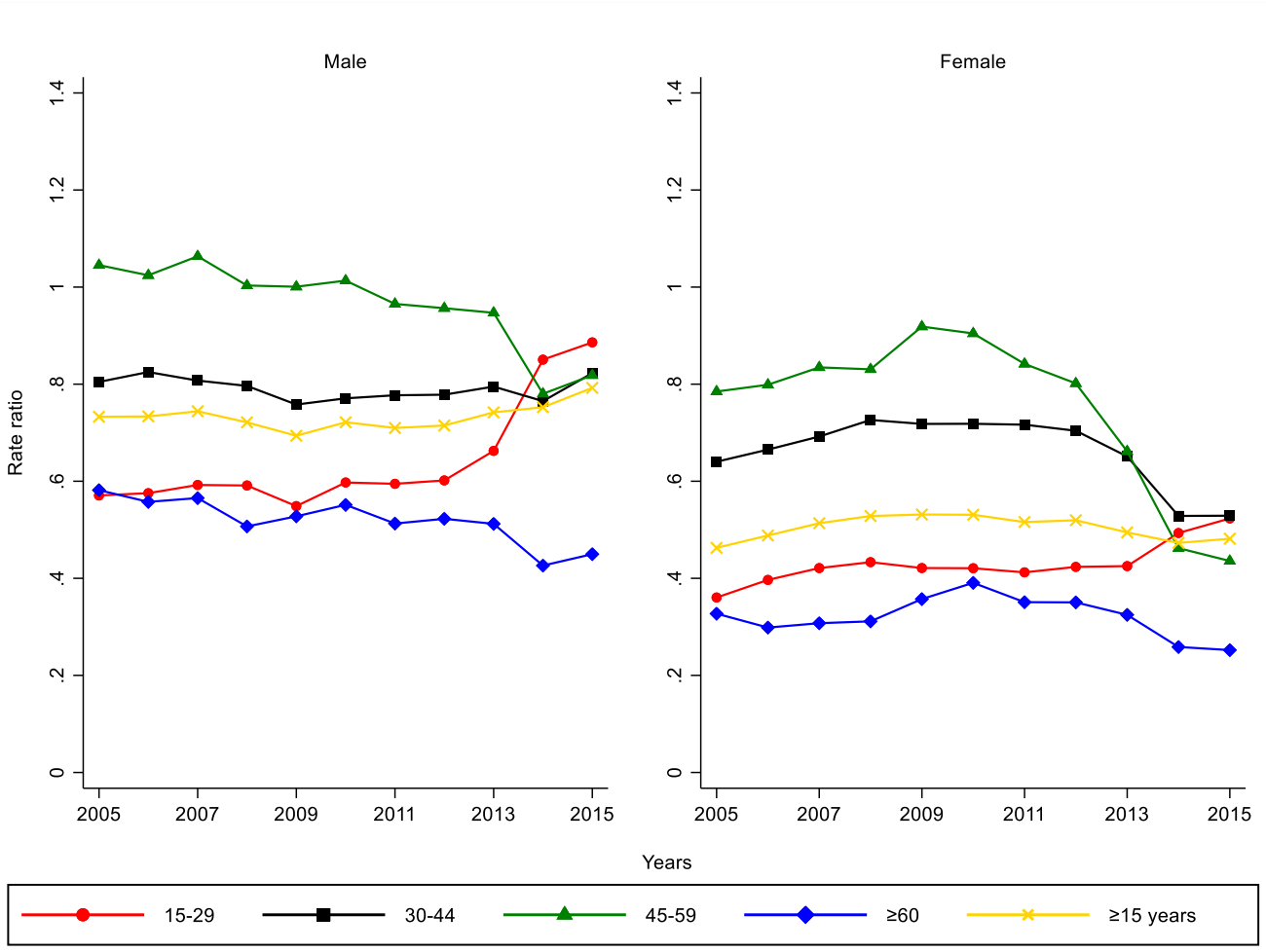

Figure 4: Trends in rate ratio of age standardised suicide death rates between the National Crime Records Bureau and Global Burden of Disease Study by age-groups for males for each state SDI group, 2005-2015.

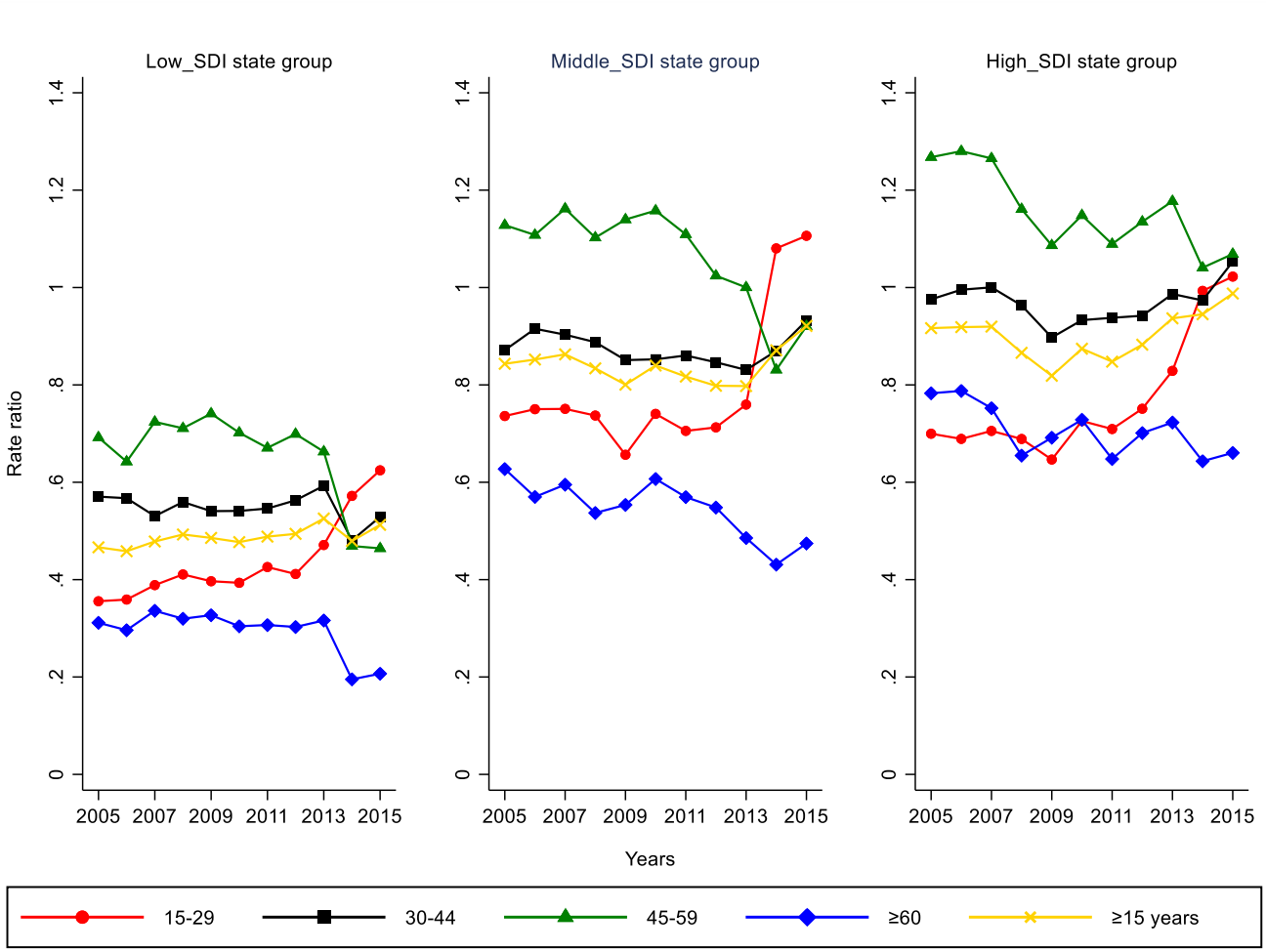

Figure 5: Trends in rate ratio of age standardised suicide death rates between the National Crime Records Bureau and Global Burden of Disease Study by age-groups for females for each state SDI group, 2005-2015.

