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ORIGINAL ARTICLE

Mapping Suicide Trends in South India: A Secondary Data Analysis of NCRB Reports with Predictive Modelling and Policy Recommendations

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ABSTRACT

Background: Suicide presents an increasingly significant challenge to the health of the Indian population, and patterns of methods and modes of self-harm are changing. During the past few years, the southern states have continued registering one of the highest suicide rates. The growing prevalence of methods that are fatal and the advent of family related suicides are an indication of changing social, psychological and economical strains. Such patterns are crucial in creating responsive and preventive approaches to mental health.

Objectives: The objective of the study is to find out the trends of suicide in five south Indian states and predict the future trends in order to enable regional planning. It also touches on demographic trends and discrepancies set by gender on the cause basis.

Methods: Official NCRB data on suicide over ten years were combined and evaluated. Long-term developments and predictions of the future rates were made with forecasting methods. Regional and gender-related trends were evaluated on the basis of the causes reported and demography available.

Results: The results of analysis show that suicide rates continue to increase in the majority of the states in the region. Disparities were noted in the contributing factors between the male and female populations and economic stressors were more common among males and interpersonal or domestic factors were common among women.

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Conclusion: The results indicate that the need early intervention, area-specific mental health care and area-specific awareness efforts should be an essential aspect of attempting to prevent the predicted increase in the suicides in South India.

KEYWORDS

• Suicide rates • South India • National Crime Records Bureau (NCRB) • Family mass suicides • Demographic • Gender differences • Socio-economic distress • Mental health • Financial burden • Employment-related stress • Suicide prevention • Public health crisis • Intervention strategies

INTRODUCTION

The World Health Organisation stresses that suicide still represents a global public health crisis, responsible for over 700,000 victims every year. In terms of the proportion, low and middle-income countries suffer from a higher number of suicides, approximately 77% of all cases. According to the same source, suicides are the fourth leading cause of death in the age group between 15 and 29 years. For each suicide, there are more than 20 attempted analogous actions. In India, suicides occur in different forms, namely pesticide ingestion, firearms, and self-hanging, as well as numerous episodes of attempts to jump from bridges or in front of trains.[1] Moreover, as highlighted by **Soman** *et al*., according to research on suicide in Kerala, South India, the estimations for the valleys of suicides were found to be 44.7 per 100,000 people for men and 26.8 for women, with a male-to-female ratio of approximately 1.7.[2] The study took five years, namely from 2002 to 2007, and concluded that the rates of suicides exceeded 50% of all deaths of women aged between 15-24 years. The suicide ratios, calculated over the same years of the study, ranged from 0.4 in the age group of children who were 14 years or less to 4.5 in the age group of 45-54. This alarming finding implies that suicides are widespread nowadays and require immediate prevention.[3] One of the study was conducted in the state of Kerala, India, in the year 2000. A total of 99 persons in 32 incidents have been analysed. It was proved that the financial crisis was the major cause in 34.4% of the cases, followed by family problems in 25%. Mental illness was present in only 16.1% of cases. It was observed that many families had a family suicide of all members of the same family.[15] Many cases of family or mass suicides have been reported so far from different parts of India, though the incidence is relatively rare. It is usually the entire family or a group of families that may die by suicide, mainly due to heavy financial liabilities, social causes or both. A lot of incidents of this type have been reported in the recent past, especially in the States of Kerala and Tamil Nadu. This reflects the changing socioeconomic as well as social conditions. Solving this problem is difficult because of the involvement of different components of the family and society. However, attempts should be made to resolve the issue, as this is the only expected solution. The solutions should also be taken by implementing strategies like economic assistance solely or in combination with other alternatives.[4]

The COVID-19 pandemic has sparked significant debate about its potential impact on suicide rates, given its profound effects on mental health and socioeconomic conditions worldwide. This concern is particularly relevant for India, which bears the largest burden of global suicides. However, the initial effects of the pandemic on suicide rates in India remain unclear and require thorough investigation.[5]

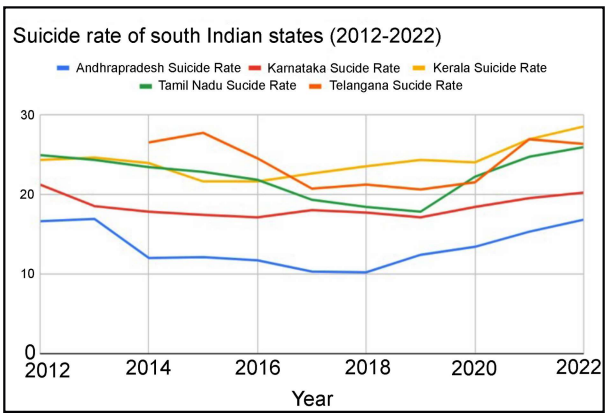

Figure 1: Suicide Rate per 1 Lakh Projected Mid-Year Population in South Indian States (2012–2022). Source: NCRB Reports (2012–2022); based on projected mid-year population estimates

Consolidated overview of suicides across the five states based on the NCRB report 2022

The analysis of suicides across five South Indian states is based on the latest *National Crime Records Bureau (NCRB) Report 2022*, which was the most recent available report on the NCRB website (**https://ncrb.gov.in**).[6]Various demographic factors such as profession, education level, and economic status have been studied to understand the patterns and causes of suicides in the region. The graphical representations for *Figures* 2, 3, and 4 illustrate cumulative data, combining all five states to provide a holistic view of suicide trends in South India.[12]

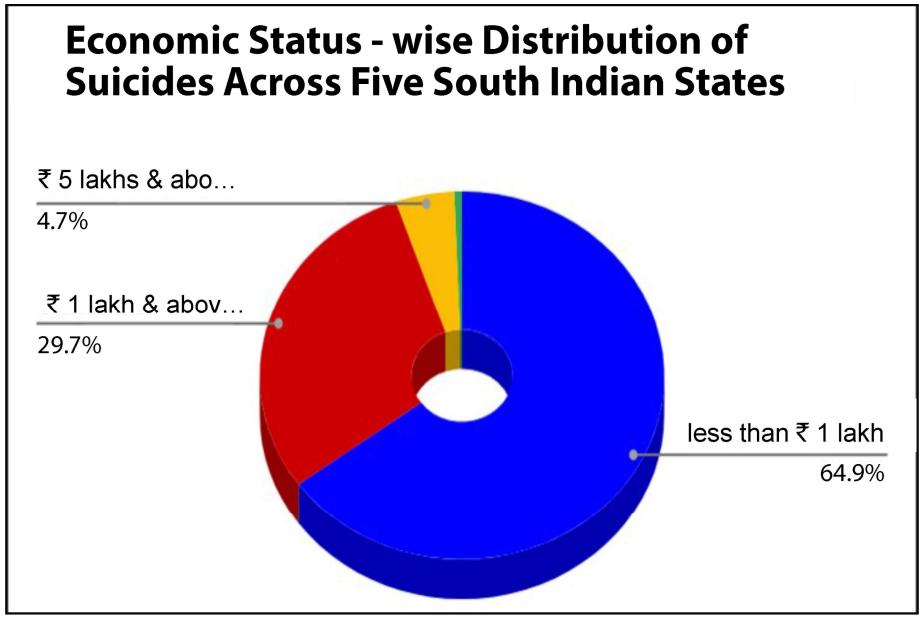

Figure 2: The Figure highlights the economic status of individuals who died by suicide, revealing that a majority (64.9%) belonged to the lowest income group (less than ₹1 lakh), indicating a strong correlation between financial distress and suicide rates

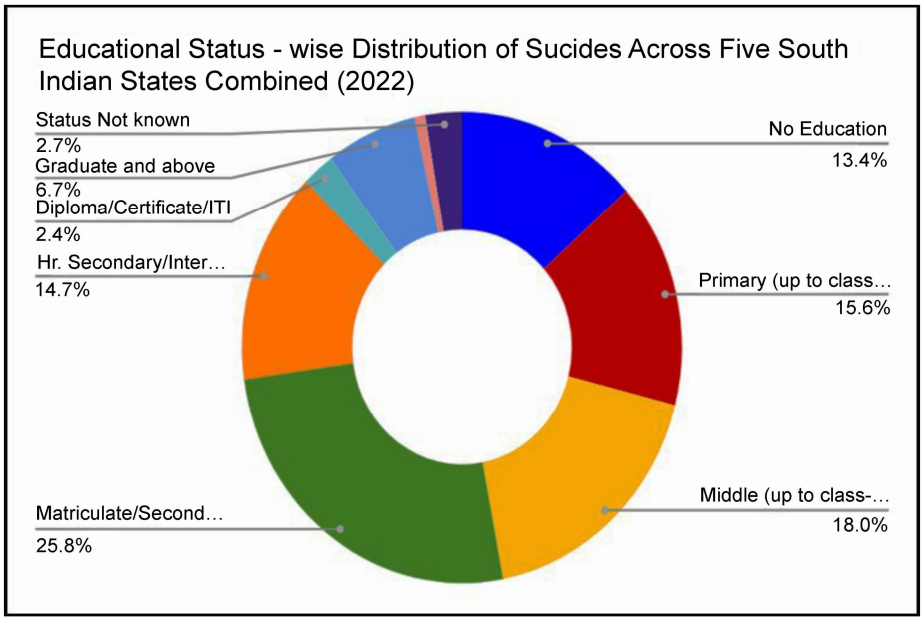

Figure 3: The figure illustrates the distribution of suicides based on educational status across five South Indian states, showing that individuals with lower education levels, particularly those with only secondary or matriculation-level education, have higher suicide rates

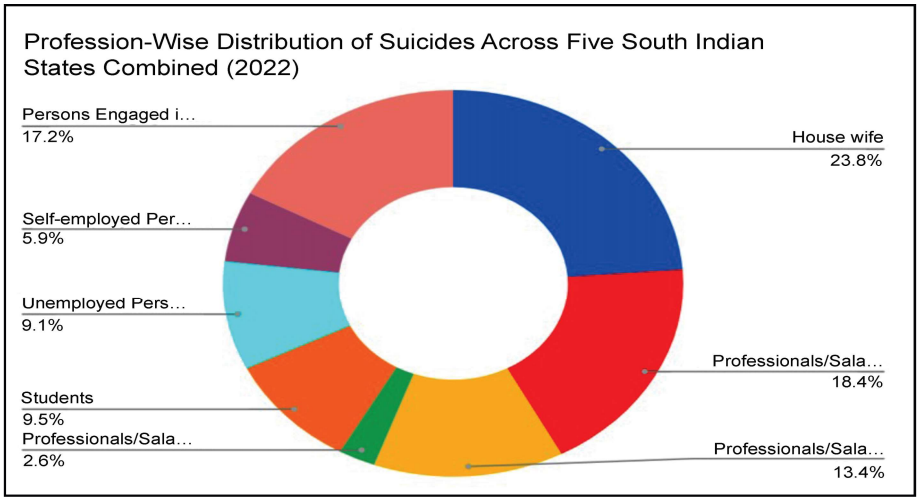

Figure 4: The chart illustrates the profession-wise distribution of suicides across five South Indian states in 2022. Housewives accounted for the highest percentage (23.8%), followed by salaried professionals (18.4%) and individuals engaged in farming (17.2%), highlighting the impact of domestic, financial, and occupational stress on suicide rates.

Income Levels and Suicide Distribution

- **Low-Income Group (< ₹1 lakh per year):** Highest suicide rates across **a**ll five states, indicating financial distress and poverty as major triggers.
- **Middle-Income Group (₹1 lakh - ₹5 lakh):** Significant suicides, reflecting economic insecurity due to job loss, debt, and family pressure, particularly in Telangana and Karnataka.
- **Higher-Income Group (₹5 lakh - ₹10 lakh):** Suicide cases decline but remain notable in Andhra Pradesh and Telangana.
- **Above ₹10 lakh: Lowest suicide rates**, though small, but considerable cases are still reported.

This trend confirms that financial instability and socio-economic pressures disproportionately affect lower-income groups, making them the most vulnerable to suicide.

Educational Status and Suicide Distribution

NCRB 2022 data highlights a **strong correlation between education levels and suicide rates** in South India.

- **Higher suicides among lower education levels:** Individuals with no formal education (8,382 cases), primary (9,737 cases), and middle school education (11,263 cases) recorded the highest suicide rates. Tamil Nadu and Telangana reported the most cases in these categories, likely due to financial distress, unstable employment, and social marginalisation.
- **Increase in suicides at the secondary level:** The matriculation/secondary category (16,107 cases) had the highest overall suicides, with Tamil Nadu (5,109) and Karnataka (3,489) leading. Academic pressure, career uncertainty, and job-related stress appear to be major contributing factors.
- **Decline in suicides among higher education levels:** Suicides drop at the higher secondary (9,165 cases), diploma (1,484 cases), and graduate (4,173 cases) levels. However, cases remain notable in Tamil Nadu and Karnataka, suggesting workplace stress and career dissatisfaction as key concerns.
- **Lowest suicide rates among professionals:** The professional category (503 cases) recorded the lowest suicides, with Tamil Nadu (268 cases) leading. This suggests that while education provides stability, it does not completely eliminate suicide risks, as work-related stress and mental health challenges persist.

Profession-Wise Suicide Trends

- **Housewives:** Tamil Nadu reported the highest number of suicides among housewives (3,093), followed by Karnataka (1,893) and Andhra Pradesh (885). Financial dependence, domestic conflicts, and social pressures likely contribute to these cases. Emotional stress and lack of support systems also play a crucial role in their vulnerability.

- **Salaried Professionals:** Suicides among salaried professionals were significantly higher in the private sector, with Karnataka (1,165) and Kerala (1,004) leading. Government employees had comparatively lower numbers, though Tamil Nadu (268) and Karnataka (86) reported the highest cases among state government workers. Job stress, workplace pressure, and financial insecurity are potential driving factors behind these suicides.
- **Students & Unemployed Individuals:** Tamil Nadu recorded the highest number of student suicides (1,416), followed by Kerala (485), suggesting academic pressure and career uncertainty as major stressors. Among unemployed individuals, Karnataka (1,360) and Tamil Nadu (578) had the most cases. Economic distress, job loss, and lack of opportunities could be significant contributors to suicides in this group.
- **Self-Employed & Farmers:** Farmers faced a severe crisis, with Karnataka (2,392) leading in suicides, followed by Andhra Pradesh (917). Agrarian distress, debts, and fluctuating income levels are among the key factors driving these tragedies. Similarly, self-employed individuals, particularly in Karnataka (1,099) and Kerala (259), faced economic uncertainties that may have led to increased stress and suicides.

Marital Status

Married individuals accounted for the highest suicide numbers, especially in Tamil Nadu (14,489) and Karnataka (9,626), indicating financial and familial stress as major contributors. Unmarried individuals also showed significant numbers, with Tamil Nadu (4,963) and Karnataka (3,013) leading. Widowed, divorced, and other categories had relatively lower cases, though Tamil Nadu consistently recorded higher figures across all marital groups. These patterns suggest that relationship struggles, family expectations, and socio-economic instability play critical roles in suicide trends.

Suicide Methods and Gender Differences

The *NCRB Reports (2012–2022)* data show varying trends in male and female suicides across five states from 2012 to 2022. In general, Tamil Nadu consistently reports the highest number of suicides, with both male and female rates steadily increasing over the decade. Andhra Pradesh experienced a significant drop in suicides after 2013, which later rebounded after 2020. Kerala exhibits a more stable trend in suicides compared to other states, while Telangana, despite fluctuating patterns, showed a steady increase post-2020. Karnataka shows a noticeable peak in 2021, particularly for female suicides, before dropping slightly in 2022. This data reflects regional disparities in suicide trends across gender lines, possibly influenced by socio-economic and cultural factors.

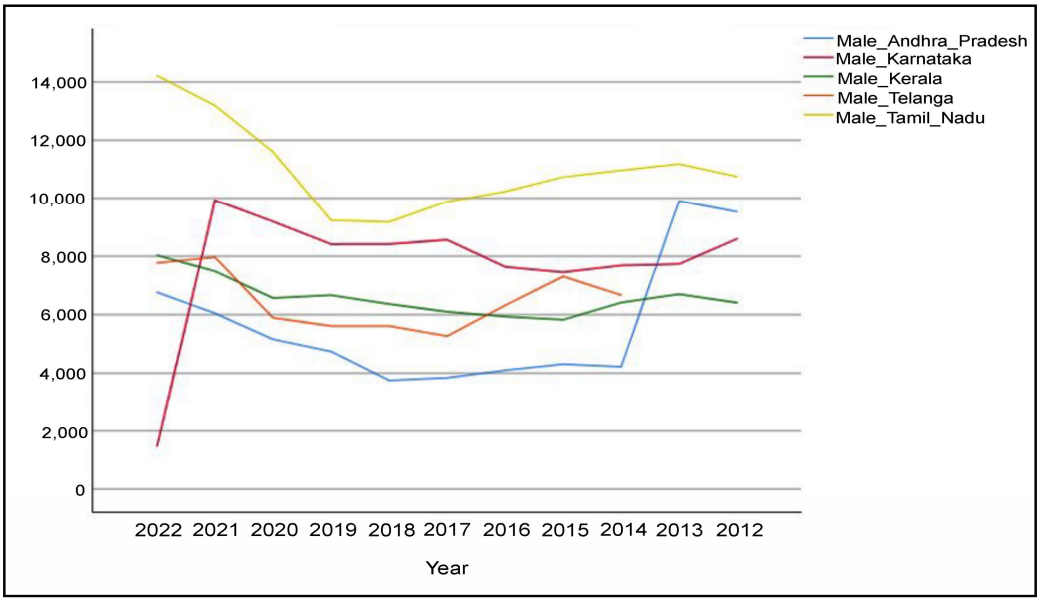

Figure 5: Male Suicidal Trend in the Five States of India (2012-2022) NCRB Reports (2012–2022)

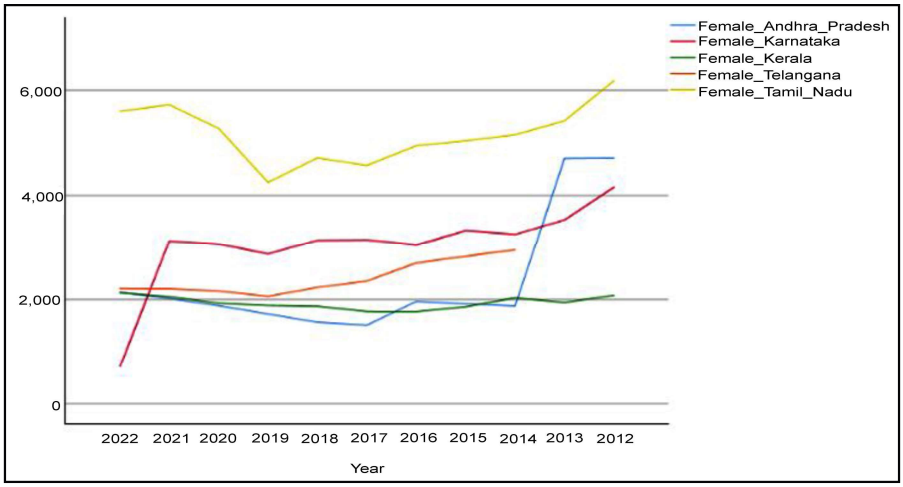

Figure 6: Female Suicidal Trend in the Five States of India (2012-2022) NCRB Reports (2012–2022)

The method of adoption by the victims is changing its profile across the globe.[7] Hanging and Poisoning are the most commonly used suicide methods across all five states, with Tamil Nadu reporting the highest cases. Males predominantly choose Hanging and Poisoning, while females have higher numbers in Jumping and Self-Immolation. Methods like Firearms and Self-Inflicted Injuries are rarely reported. State-wise variations exist, with Tamil Nadu having the highest overall cases, while Jumping is more common in Karnataka and Kerala. These trends in *Figure* 5 suggest that access to means and sociocultural factors play a role in method selection.[8]

Among the primary reasons for suicide, Family Problems and Illness are the leading causes across all states, followed by Bankruptcy (highest in Karnataka) and Drug/Alcohol Addiction (highest in Telangana). Males are more affected by financial and career-related pressures, while females are more impacted by family and marital issues. The sharp rise in suicides in 2022 is likely linked to the psychological and economic impact of COVID-19. Other less frequent causes, were excluded due to limited data. Similarly, Drowning was not considered as it can be accidental, suicidal, or homicidal.[9]

Figure 6 focuses on the most significant suicide methods and causes for a clearer understanding of trends.

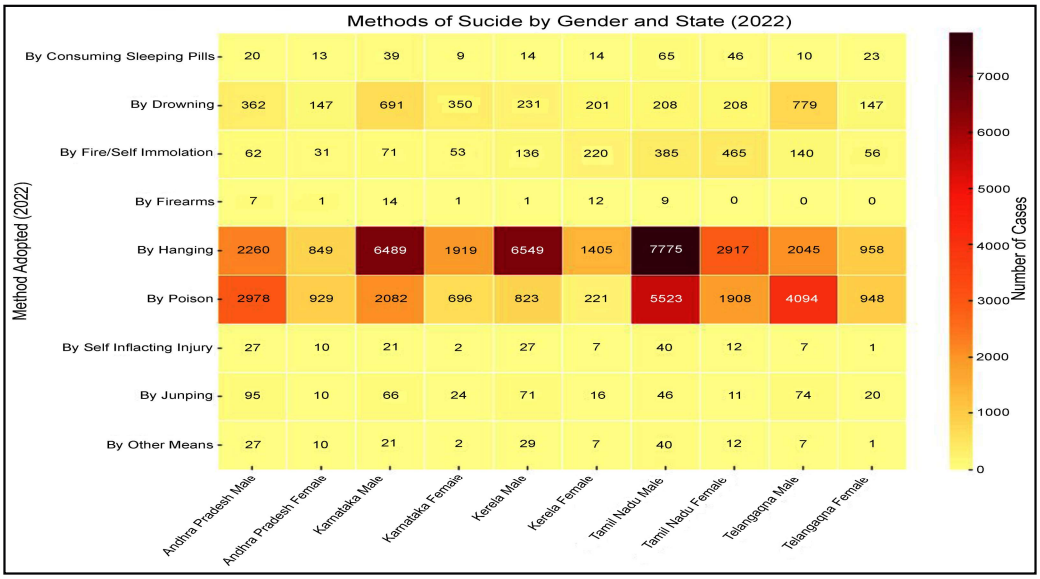

Figure 5: Gender-wise Distribution of Suicide Causes in South Indian States, 2022. The heatmap shows the number of suicide cases by Methods of suicide among males and females across five South Indian states in 2022. Darker shades indicate higher case counts, with family problems and illness being major contributors.

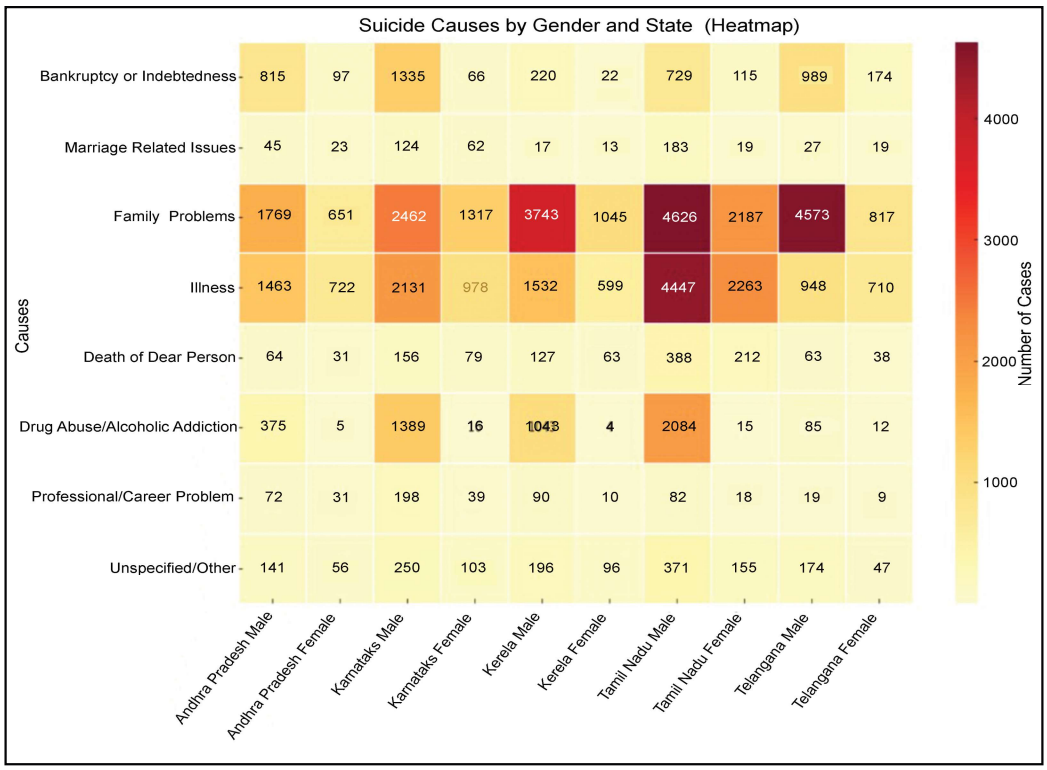

Figure 6: Gender-wise Distribution of Suicide Causes in South Indian States, 2022. The heatmap shows the number of suicide cases by cause among males and females across five South Indian states in 2022. Darker shades indicate higher case counts, with family problems and illness being major contributors.

Mass family suicide trend

The data presented outlines the total number of family suicide cases recorded across five South Indian states Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, and Telangana from 2014 to 2022. In Andhra Pradesh, the number of family suicide cases fluctuated significantly, peaking at 40 cases in 2014 and seeing a substantial decrease to 6 cases in 2016 before rising again to 22 cases in 2021. Karnataka saw a high number of cases in 2014, with 46 incidents, but the numbers dropped drastically in subsequent years, maintaining a relatively lower count, fluctuating between 1 and 10 cases annually. Kerala's family suicide rates showed a moderate range, with the highest number being 12 cases in 2021 and the lowest at 4 cases in 2022. Tamil Nadu consistently recorded high numbers, peaking at 90 cases in 2022, indicating a troubling upward trend in recent years. The state had a notable increase from 2 cases in 2015 to 90 cases by 2022. Telangana reported the lowest figures overall, with a maximum of 10 cases in 2014 and generally low numbers in subsequent years, recording zero to three cases annually. The data indicate significant variability in family suicide rates across these states. Andhra Pradesh and Tamil Nadu, in particular, have shown concerning trends with fluctuating and high numbers, respectively, whereas Karnataka, Kerala, and Telangana exhibited relatively lower and more stable figures. This information highlights the need for targeted mental health interventions and support systems in regions with higher reported cases, especially in Tamil Nadu and Andhra Pradesh.[10]

A nuanced approach is needed to address the issue. Preventive measures should include limiting access to lethal means and related hazards, instilling physical barriers in highly dangerous areas, and fostering easy access to mental health support. Importantly, it is vital to address communication concerns by creating a discussion of the topic without stigmatisation.[8] WHO suggests that effective intervention in cases of suicide requires a holistic, multilevel approach. It is vital to combine timely and beneficial intervention with relatively inexpensive measures as a basis for the development of the above approach. The emphasis on the restriction of physical access to suicide but not on general psychiatric care will be particularly beneficial. The proposed

approach that would be respectful of the local context is likely to bring success in fighting this disastrous public burden.[11,19]

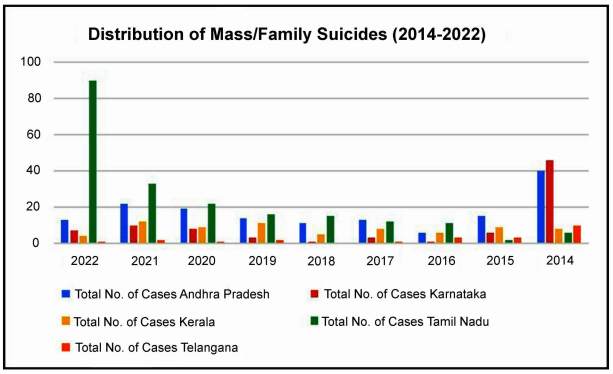

Figure 7: Family/Mass Suicidal Trend in the Five States of India (2012-2022) (***Source:*** NCRB Reports 2012–2022).

METHODOLOGY

A 10-year dataset encompassing the overall number of suicides for five South Indian states was utilized for this study. The analysis was conducted using **IBM SPSS Statistics**, specifically employing the **Expert Modeler** to determine the most appropriate forecasting models based on data characteristics and model fit. Due to the formation of Telangana in 2014, data for this state is available only from that year onward, placing some constraints on long-term comparison. The Expert Modeler identified **Holt's Exponential Smoothing** as the best-fitting model for Andhra Pradesh, while **Brown's Linear Exponential Smoothing** was selected for Karnataka, Kerala, Tamil Nadu, and Telangana. These models provided forecast values along with upper and lower confidence intervals, enabling a trend-based projection of suicide rates.[10,14]

RESULT

The Forecasting models begin their forecasts from the year following the last non-missing data point and extend to 2027, providing a comprehensive outlook for future suicide rates in each state based on the trends observed in the historical data. The use of exponential smoothing techniques allows for a nuanced understanding of both linear and nonlinear trends, as well as the potential range of future outcomes within defined confidence intervals.

- **Andhra Pradesh (Model 1)**: Holt's exponential smoothing model predicts a gradual increase in suicide numbers from 18.94 in 2023 to 26.97 by 2027. The model also provides confidence intervals, with the upper confidence limit (UCL) indicating a possible range up to 42.37 by 2027, while the lower confidence limit (LCL) suggests the numbers could fall as low as 11.58.
- **Karnataka (Model 2):** Using Brown's linear exponential smoothing, the model forecasts a steady increase from 20.93 in 2023 to 23.86 by 2027. The UCL suggests that numbers could rise to 40.03, while the LCL indicates they might drop to 7.69.
- **Kerala (Model 3):** Also modelled with Brown's linear exponential smoothing, Kerala's forecast predicts an increase from 30.1 in 2023 to 36.65 in 2027. The UCL shows a potential rise to 49.92, while the LCL estimates a decrease to 23.39.
- **Tamil Nadu (Model 4):** This state follows a similar modelling approach, forecasting an increase from 27.49 in 2023 to 33.73 by 2027. The UCL could reach up to 58.68, whereas the LCL might fall to 8.79.
- **Telangana (Model 1):** Given Telangana's shorter historical data, Holt's exponential smoothing predicts a constant forecast of 26.3 suicides per year from 2023 to 2027, with UCL and LCL ranges indicating possible deviations between 40.07 and 12.53.

Table 1: Forecasted values for years 2023, 2024, 2025, 2026 and 2027.

		Forecast				
States		**2023**	**2024**	**2025**	**2026**	**2027**
Andhra Pradesh	Forecast	18.94	20.95	22.96	24.97	26.97
	UCL	22.98	26.67	31.29	36.58	42.37
	LCL	14.9	15.23	14.62	13.35	11.58
Karnataka	Forecast	20.93	21.66	22.4	23.13	23.86
	UCL	23.25	26.67	30.66	35.13	40.03
	LCL	18.62	16.66	14.13	11.12	7.69
Kerala	Forecast	30.1	31.74	33.38	35.01	36.65
	UCL	33.12	36.86	40.93	45.29	49.92
	LCL	27.08	26.61	25.82	24.74	23.39
Tamil Nadu	Forecast	27.49	29.05	30.61	32.17	33.73
	UCL	31.59	37.28	43.75	50.91	58.68
	LCL	23.39	20.82	17.46	13.43	8.79
Telangana	Forecast	26.3	26.3	26.3	26.3	26.3
	UCL	32.46	35.01	36.97	38.62	40.07
	LCL	20.14	17.59	15.63	13.98	12.53

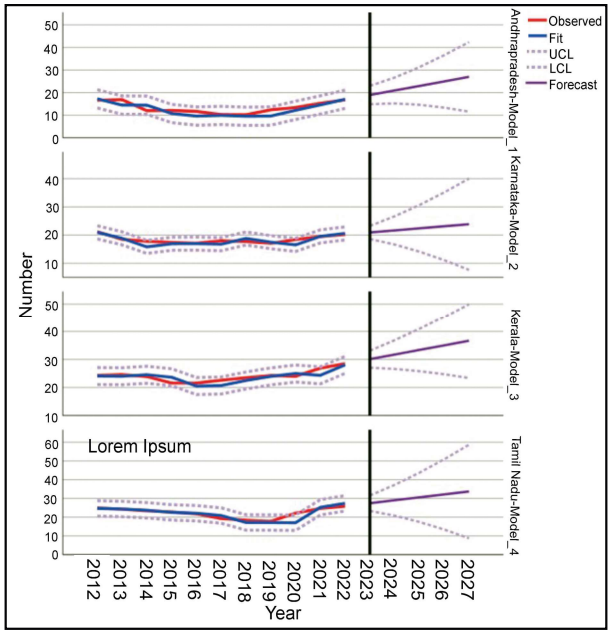

Figure 8a: Suicide Rate Projections in Andhra Pradesh, Karnataka, Kerala and Tamil Nadu (2023-2027)

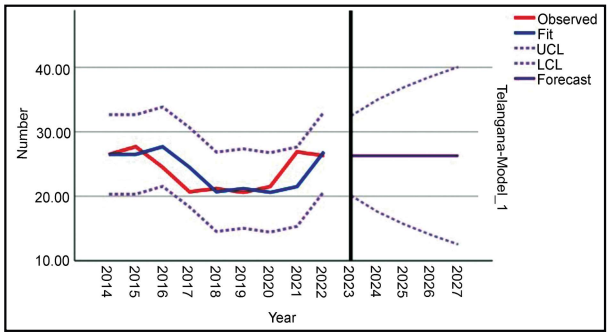

Figure 8a: Forecasted Suicide Rates in Telangana (2023-2027)

DISCUSSION

South India has consistently recorded significantly higher suicide rates than the national average, as per data from the National Crime Records Bureau (NCRB) and supporting epidemiological studies. While India's national suicide rate fluctuated between 9.9 and 12.4 per 100,000 population during this period, South Indian states particularly Kerala (peaking at 28.5), Tamil Nadu (25.9), and Telangana (~26.5) reported rates 2 to 3 times higher.[13] This disparity persists even after standardising for population denominators, as NCRB uses projected mid-year population for both national and state-level rate calculations. Recent data reveals a shift from traditional methods (e.g., pesticide poisoning) to hanging and drug overdose, particularly among women in South India, reflecting increased access to lethal means and socioeconomic stressors.[15] This trend underscores the urgent need for gender-sensitive restrictions (e.g., safer pesticide storage) and mental health interventions tailored to women's vulnerabilities.[16]

The 2014 bifurcation of Andhra Pradesh and Telangana introduces data inconsistencies, with merged pre-2014 figures complicating trend analysis. Nevertheless, post-2020, South India mirrored national spikes in suicide rates linked to socioeconomic stressors during the COVID-19 pandemic but from a far higher baseline.[8] Kerala and Tamil Nadu remain critical hotspots, with studies attributing their elevated rates to factors like agrarian distress, alcohol use, and mental healthcare gaps.[17]

Effective mitigation requires a dual focus on prevention (e.g., community-based mental health programs, restrictions on lethal means) and structural reform (e.g., debt relief for farmers, gender-sensitive counselling). The success of tele-mental health initiatives during the pandemic offers a scalable model for rural areas,[18] while school-based interventions could disrupt cycles of intergenerational trauma. Future research must prioritize real-time surveillance to capture underreported attempts and contextualize risk factors at the district level. Policymakers must act not merely on statistics but on the lived realities of vulnerability, where mental health is inextricable from dignity, equity, and hope.

Suicide Prevention Policy

The National Suicide Prevention Strategy by the Ministry of Health & Family Welfare, is a multi-sectoral, comprehensive approach to the reduction of suicide mortality by 10% by 2030. Suicide is a preventable public health problem that affects high-risk groups disproportionately, such as youth, daily wage earners and women The strategy highlights the most common means of suicide, which are hanging and poisoning, and the underlying causes of suicide, which are family stress, illness, financial hardship, and substance abuse. It emphasizes collaboration across ministries, healthcare systems, educational institutions, and community stakeholders. Key policy measures include establishing psychiatric outpatient departments (OPDs) in all districts under the District Mental Health Programme (DMHP), integrating mental health education in schools, creating crisis

intervention centers, enforcing responsible media reporting, restricting access to lethal means (especially pesticides), enhancing suicide surveillance systems, and supporting families and survivors with psychosocial care, Programs like *Ayushman Bharat* include 17 mental health service packages and aim to expand access through Health and Wellness Centers**.** The *School Health Ambassador* initiative and the *Nasha Mukt Bharat Abhiyaan* further promote preventive strategies by engaging schools and addressing substance.[19]

Additional Policy Recommendations

In order to successfully decrease the suicide rates in India, particularly among the vulnerable groups, it is urgent to implement specific, feasible policy measures that extend beyond the overall mental health reforms. Among the most important steps is to make it mandatory that all unexplained deaths of the people below the age of 25 years should be subjected to medico-legal autopsy. This would aid in distinguishing suicide and homicide or accidental death, making the legal and public health data accurate. Also, the first responders, who are usually members of the police force, should be trained on suicide response, mental health first aid, and documentation to ensure they deal with such delicate cases with precision and compassion. The formation of suicide surveillance units at the district level in cooperation with forensic and public health departments may allow monitoring and early identification of an increase in suicide rates in real-time. The incorporation of predictive modelling tools based on NCRB and hospital data would also improve the capability of determining high-risk areas and scheduling interventions in time. At the community level, training of frontline workers, including ASHA, Anganwadi workers, teachers, and Panchayat members, as gatekeepers by providing them with basic training on the identification and referral of suicide risk could have a meaningful effect. Along with these, online platforms that provide 24x7 anonymous multilingual mental health support and AI-based screening tools must be created. Primary healthcare services should also incorporate routine mental health screening with the help of such tools as PHQ-9 and GAD-7 to encourage early detection. Moreover, there should be a tight control over the toxic substances, especially pesticides which are widely used in suicides. Finally, a well-organized postvention plan is necessary, which will offer families who have experienced suicide counseling, financial aid, and reintegration help to end the cycle of trauma and susceptibility.

One of the most important elements of this wider policy strategy is the necessity to deal with family suicides a very upsetting and underestimated phenomenon. Such events are usually the results of common stressors including extreme financial difficulty, chronic disease, domestic violence, or social stigma, and they underscore the inadequacy of individual-based interventions. A district-level Family Suicide Crisis Response Program (FSCRP) needs to be created in order to respond to it. This program would start with early detection of high-risk families by trained community workers who are able to detect warning signs such as collective withdrawal, recurrent crisis episodes, or emotional distress. When identified, a multidisciplinary crisis team (consisting of a psychologist, a social worker, and a financial counselor) must be deployed within 48 hours to provide immediate psychological support and evaluate practical needs. Acute stress should be alleviated by providing short-term financial assistance in the form of emergency income support, food rations, or utility assistance. The care should be provided in terms of mental health care including group counseling sessions and individual assessment, in accordance with the District Mental Health Programme. In addition to short-term intervention, long-term resilience should be created by integrating with local NGOs, SHGs, and Panchayats, where families should be socially and emotionally supported. During the process, special attention should be paid to the preservation of dignity and privacy of affected families, in particular, to avoid the negative media coverage. This policy model promotes the shift toward compassionate, community-based prevention approaches by treating family suicides not only as individual tragedies but as a shared reaction to the unbearable situation.

CONCLUSION

The comprehensive analysis of the suicide trends in 5 states of South India was conducted in the last decade, and it provided valuable insights into the new emerging patterns of suicides regarding both gender-related

differences and state-specific peculiar trends. The given data reflects the increasing rates of suicides in the majority of states, and special attention should be paid to the striking trends in Tamil Nadu. The most dangerous trend is the increasing rates of family/mass suicides, which tend to demonstrate the existence of more profound social and psychological problems. Moreover, the development of new ways of suicide proves the necessity to implement more concentrated preventative interventions, in particular the measures to popularize mental health awareness, support effective crisis interventions, and provide the whole community with a network of preventive and support instruments.

However, the given results can be discussed and limited to the following issues. First of all, the dataset provided by NCRB, although comprehensive, is not fully sufficient to analyze the social and economic factors. It does not provide information about the causes of suicide concerning the geographic causes, psychological factors, and economic triggers. Moreover, the given regression model is limited by the available variables and the impossible to exclude the critical predictive factors because their influence is crucial for the regional models.

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