Interactive Data Visualization (DS612)

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A Visual Story of Suicide in India

Group-14

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Abstract

Suicide remains one of the top three leading causes of death among young individuals globally. In India, the challenge is even more pressing due to its diverse demographics, socioeconomic disparities, and rapidly changing lifestyle and mental health dynamics. This project aims to explore suicide trends in India through a detailed data-driven analysis, identifying key demographic patterns, regional differences, and risk factors. Using descriptive analytics and visualization tools, this study examines the influence of variables such as age, gender, state, year, education, and profession on suicide rates. By combining statistical exploration with visual storytelling, this project supports the creation of culturally-sensitive and data-informed prevention strategies. The visualizations are designed to be both informative and intuitive, helping stakeholders, researchers, and policymakers understand the magnitude and nature of the problem more clearly.

Introduction

Suicide is a complex and deeply personal act, yet it is also a critical public health concern that impacts individuals, families, and societies at large. According to the World Health Organization, nearly one million people die due to suicide every year. Particularly alarming is its prevalence among youth, making it one of the top causes of death among individuals aged 15 to 29. In India, a country characterized by diverse cultural, social, and economic factors, the patterns of suicide reveal several unique trends—such as a higher female-to-male suicide ratio, and marital status not necessarily being a protective factor.

This project investigates the epidemiological and demographic landscape of suicide in India, based on real-world data. The primary goal is to analyze and visualize how suicide trends vary across states, genders, age groups, professions, education levels, and over time.We aim to extract actionable insights and present them through clear, engaging visual formats—both single-frame and multi-frame dashboards.

Problem Statement

Although suicide is a deeply personal and an individual act, suicidal behaviour is determined by a number of individual and social factors. With such increasing numbers in suicide, it becomes mandatory to analyse and understand why one commits suicide. Studying this pattern will help understand the factors and evaluate them on a demographic front. Suicides occur as a result of multiple factors, perhaps of high complexity. This complexity can be lessened by conducting research and study of adequate expertise. Many non-governmental organizations can take up programs to curb suicides if solid research on these factors that actually lead to suicidal tendencies is well established since suicide rates are observed to be greater in areas having advanced health systems.

Dataset

Suicide is a major concern and requires serious attention, a proper system to perform suicide analysis and prediction using reliable data. The approach to suicide analysis is not restricted to one method or medium. If performed systematically, research to detect suicide ideation from myriad of sources will become a powerful tool in future that will guide family members of people vulnerable to suicides to identify suicidal tendency at early stages. The dataset used [2] has a total of 12 years observations from 2001 – 2012 which contains the details of natural & un natural accidents, traffic accidents and suicides. Major causes of accidental deaths are traffic accidents, drowning, lightning, heart attacks, accidental fire, falls, poisoning. Major causes of suicides are family problems, illness, bankruptcy or indebtedness. This data helps the analytical study of suicide by providing relevant data over the years regarding deaths, by suicide and by other reasons as well.

Sr No	Columns	Importance
1	State	To specify the State/UT of death.
2	Year	Year of death
3	Type Code	Contains parameters like professional status, Education, Causes, etc.
4	Type	Details for each type code
5	Gende	Male/Female
6	Age group	Categorized into 5 groups those are 0-14, 15-29, 30-44, 45-59 and 60+
7	Total	Total number of suicides corresponding to previous attribute values

Workflow

1. Data Cleaning and Preprocessing

- We started by loading the raw dataset, which contains suicide records across India from 2001 to 2012.
- Any missing or inconsistent data points were carefully handled to ensure analysis accuracy.
- Column names were cleaned and standardized for better readability (e.g., fixing typos like "Gende" to "Gender").
- Where needed, we normalized the data—for example, adjusting figures to account for gender population differences, so comparisons were fair.

2. Dataset Segmentation

- To better understand different aspects of the problem, we divided the dataset based on `Type_code` categories like:
    - **Education_Status**
    - **Professional_Profile**
    - **Social_Status**
    - **Causes**, and more.
- This helped us focus on each group individually and identify unique patterns within them.

3. Clustering by Type

- For each `Type_code`, we grouped similar `Type` values—for example, clustering all job roles or education levels together.

- We then aggregated this data by year, gender, state, and age to uncover deeper insights and time-based trends.

4. Visualization and Storytelling

- We created both interactive and static visualizations to communicate our findings effectively.

- Some of the key plots included:

· Year-wise trends in suicide cases.

· Suicide rates broken down by age and gender.

· State-wise comparisons for total cases, as well as for males and females separately.

· Impact of education, profession, and social status.

· Most common suicide methods and how they vary across groups.

Cause-wise analysis with emotional context (e.g., linking family issues or mental health).

- We used a mix of bar charts, line graphs, and stacked visuals to make the insights more digestible and engaging.

Key Research Questions Addressed

1. What are the overarching trends in suicide rates across India from 2001 to 2012?

2. Which Indian states exhibit the highest and lowest suicide rates, and how do these regional variations evolve over time?

3. How do suicide rates vary across different age groups and genders?

4. Are specific occupational groups more susceptible to suicide, and what might this indicate about work-related stress in India?

5. What impact does educational attainment have on suicide rates?

6. How does marital or social status influence the likelihood of suicide?

7. What are the most common causes and methods of suicide, and how do these vary across demographic categories?

8. Are there any noticeable temporal or seasonal patterns in suicide occurrences?

9. Is there an observable correlation between socio-economic indicators and suicide rates at the state level?

10. How can visual storytelling effectively communicate the complexity and urgency of suicide trends in India?

Hypotheses

1. Males are more likely to commit suicide than females for every age.

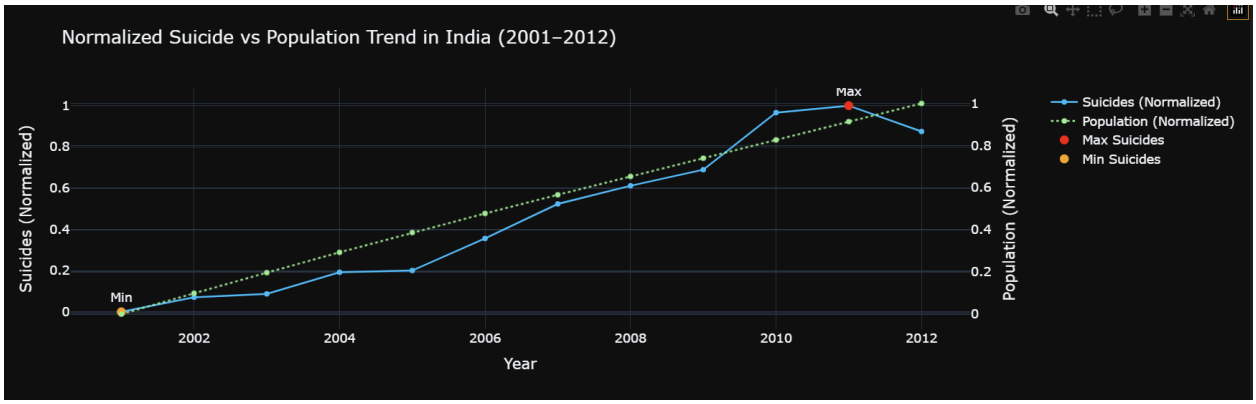
2. Individuals with lower levels of education are at a higher risk of suicide.
   and *Women are more likely to fall into the lower education category compared to men.*

3. Married women are at a higher risk of suicide than unmarried women.

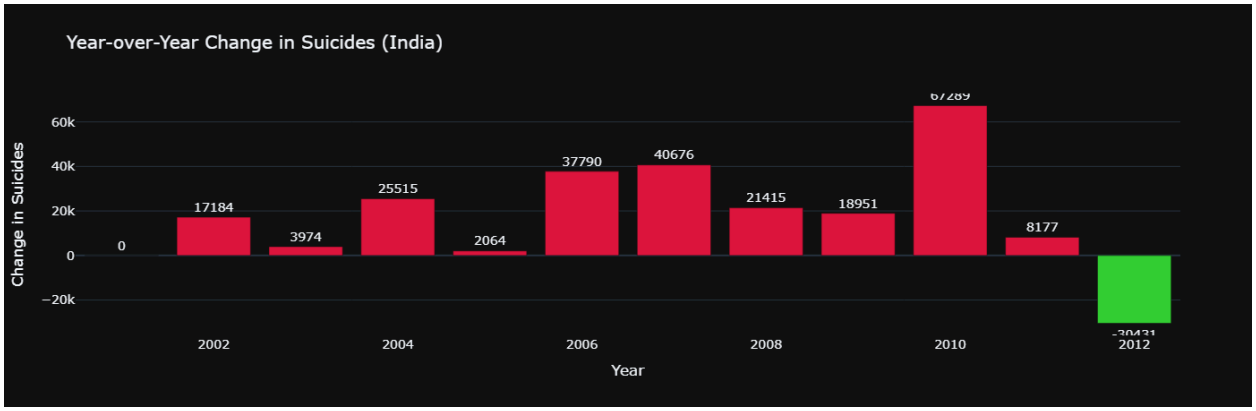
4. Men are more likely to commit suicide due to financial reasons, while women are more affected by family-related issues.

5. Men go with lethal means of suicide and women does not?

All Over trend of suicide

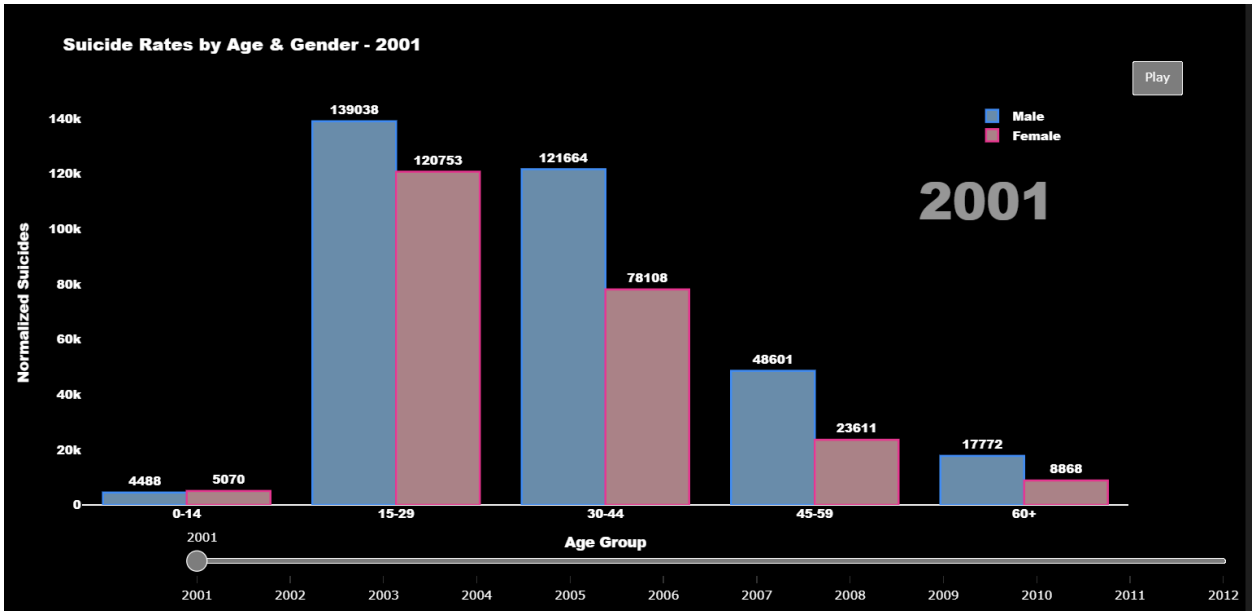


The graph titled "India Suicide Trends (2001–2012)" shows the suicide rate per 100,000 population and total suicides over 12 years. While it's often assumed that suicides increase every year, the data tells a different story. From 2001 to 2004, rates remained fairly stable, followed by a noticeable dip in 2005—the lowest point—possibly due to early mental health interventions. A steady rise occurred from 2006 to a peak in 2010, likely driven by socio-economic pressures.

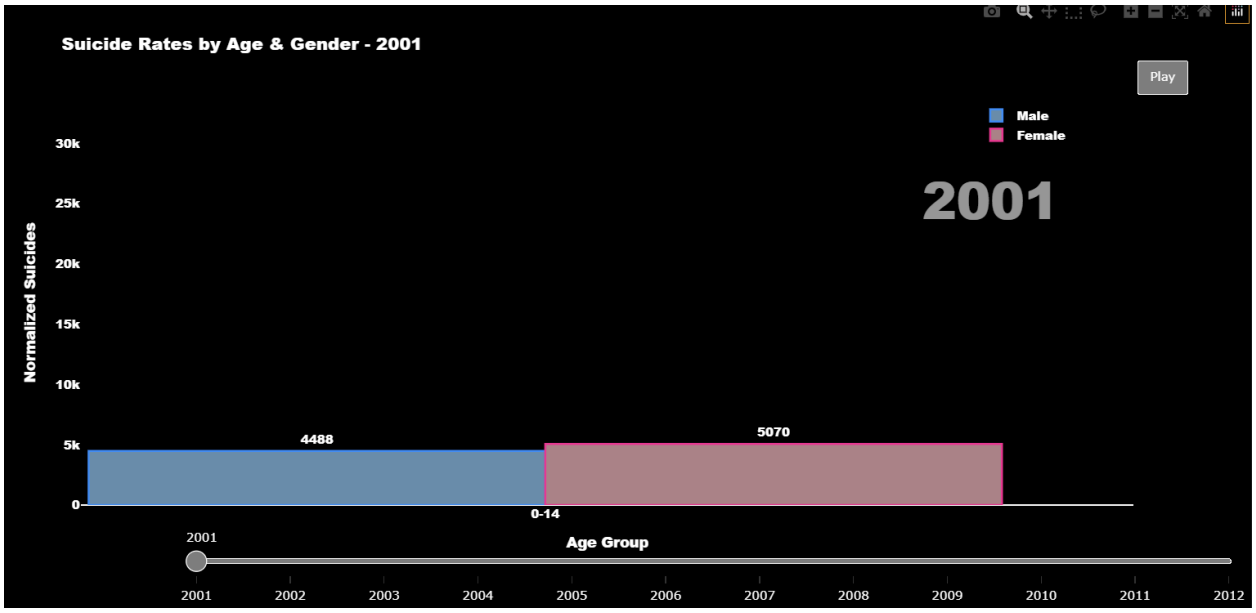


However, both the suicide rate and total suicides declined in 2011 and 2012, indicating possible improvements in awareness, support systems, and policy action. This challenges the idea of a constant upward trend and highlights the complexity of suicide patterns in India.

Age-wise analysis of suicide

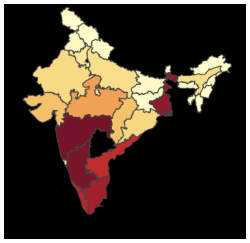
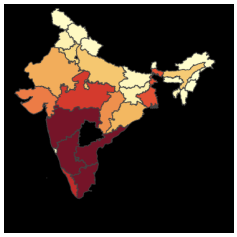
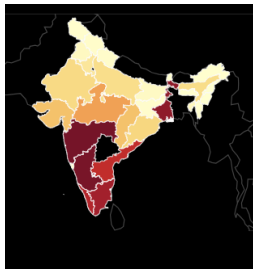
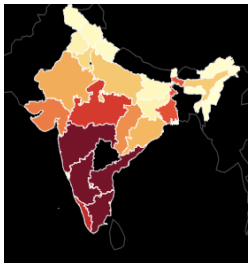
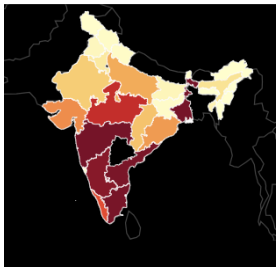
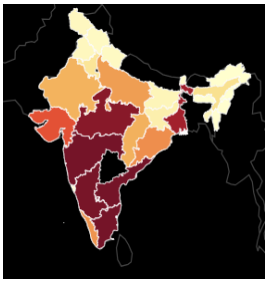


The age-wise analysis of suicide trends reveals that contrary to the common assumption that older adult males are most vulnerable, the highest suicide rates are observed among adolescents and young adults. Our graph reflects this shift, showing a significant concentration of suicides in the 15–29 age group. This period of life appears to be marked by intense emotional, social, and psychological stress, particularly among young women in rural areas, who face additional gender-related disadvantages.



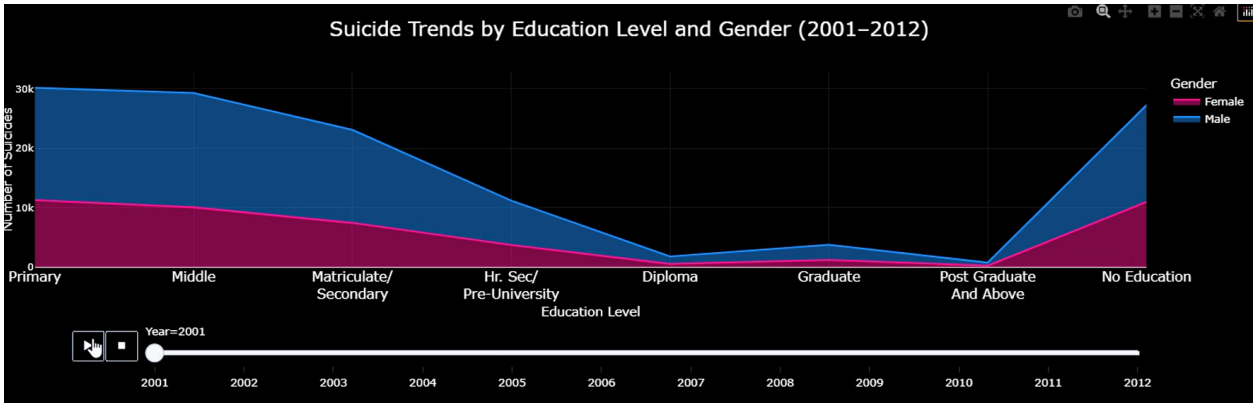
Interestingly, while it is often hypothesized that males are more likely to commit suicide, data from the 0–14 age group shows a reversal—female suicides were notably higher. To ensure a fair comparison and avoid misinterpretation due to population imbalance, we normalized the data using the male-to-female population ratio. This striking observation highlights the evolving nature of suicide patterns in India and calls for a re-evaluation of gender-based assumptions in mental health strategies, especially for vulnerable age groups. As we move forward in our analysis, a deeper look into the state-wise distribution of suicides can further uncover the socio-cultural and regional factors influencing these trends.

State wise analysis of Suicide

Year	2001	2012	Insights
All over			In Central India, especially Madhya Pradesh and Chhattisgarh, suicide cases have increased over time. Southern states like Tamil Nadu, Andhra Pradesh, and Karnataka have consistently shown high rates, while Maharashtra remains one of the most affected. In contrast, Northern and Northeastern states show lower and more stable suicide rates. Overall, southern and central regions show rising concerns, likely due to economic and social pressures.
Male			Even Gender wise , male suicide rates increased in Central India over the years and remained consistently high in Southern states like Tamil Nadu, Karnataka, and Andhra Pradesh. Maharashtra again stayed among the most affected. and Northeastern states showed lower rates throughout.Overall, male suicide is more concentrated and consistently high in Southern and Central India, likely due to ongoing economic and social challenges.
Female			female suicide rates as well remained high in the Southern states , Andhra Pradesh, and Karnataka, , indicating persistent issues. Central India (especially Chhattisgarh and parts of Odisha) also shows a rise in female suicides over time. Meanwhile, Northern and Northeastern states continue to have lower reported cases. Overall, female suicides are concentrated in Southern and Central regions, showing consistent regional problems.

Despite being among the most educated regions in the country, the Southern states like Tamil Nadu, Kerala, and Karnataka consistently show high suicide rates for both males and females. This highlights an important contradiction — higher education does not necessarily protect against suicide.

Education and Gender Wise analysis

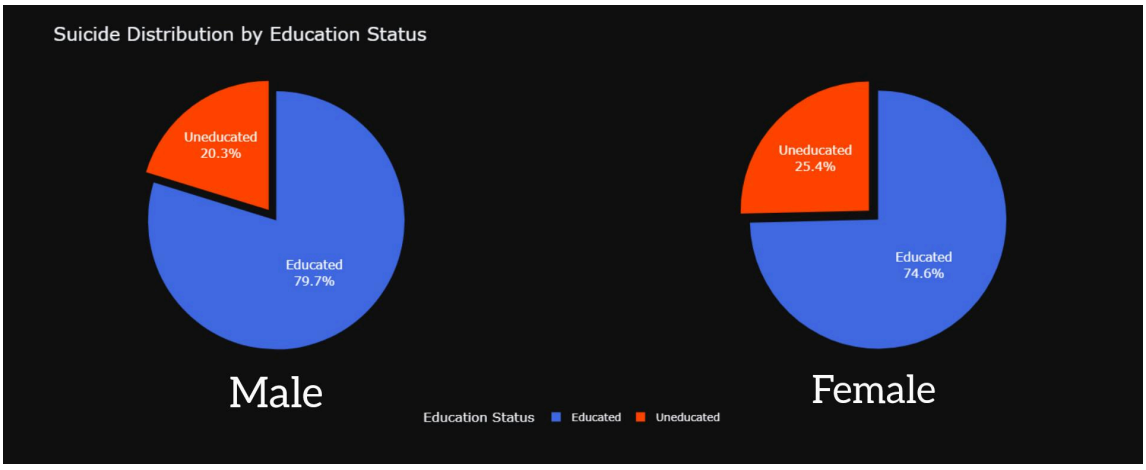


It clearly shows that most people who died by suicide had low education. Many of them were either not educated at all or had only studied up to primary or middle school. Very few were graduates or had higher education.

At first, it might look like people with more education are safer from suicide. But we have to be careful with this idea. In India, fewer people complete higher education, so it's normal to see fewer suicide cases from that group. This means we can't say for sure that more education always protects someone from suicide.

Take Kerala as an example. It has the highest literacy rate in India, but still reports a high number of suicides. This tells us that just being educated is not enough.

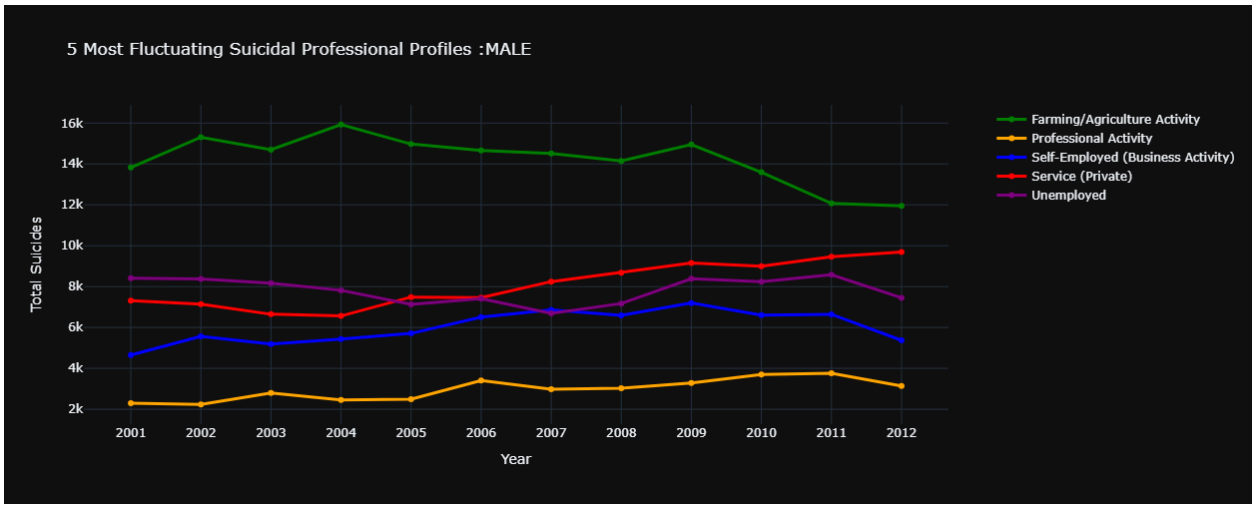
When we focus on gender, we notice something important in the uneducated group: the number of women who died by suicide is higher than the number of men. This difference is clearly visible in the graph, especially in the illiterate and low-education sections.



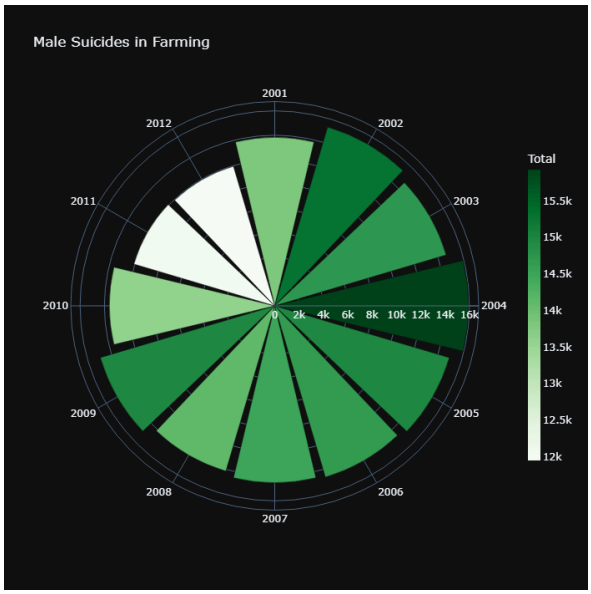
Overall, the graph shows a pattern where lower education levels have more suicide cases, and among the uneducated, women appear more affected than men. This brings out important points about how suicide is connected with both education and gender.

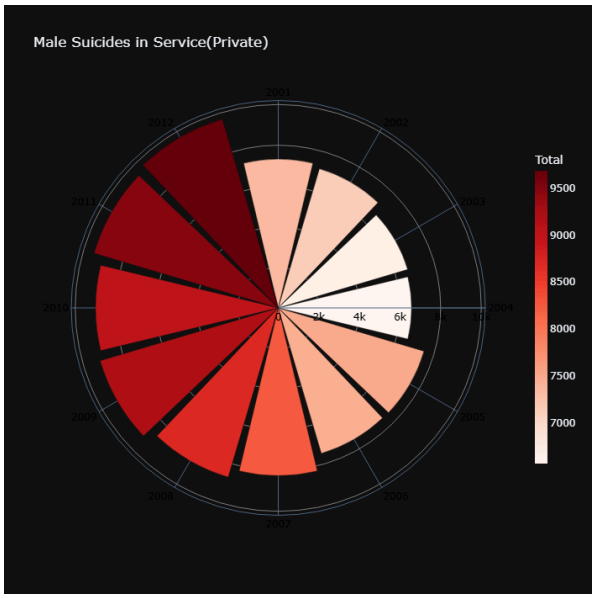
Now, if we connect these dots, education often leads to profession. It shapes what kind of work we do, the roles we take on in society, and how we deal with daily challenges. So, to understand the bigger picture, it’s important to also explore how profession and gender interact when it comes to suicide cases.

Profession and Gender wise Total Suicide



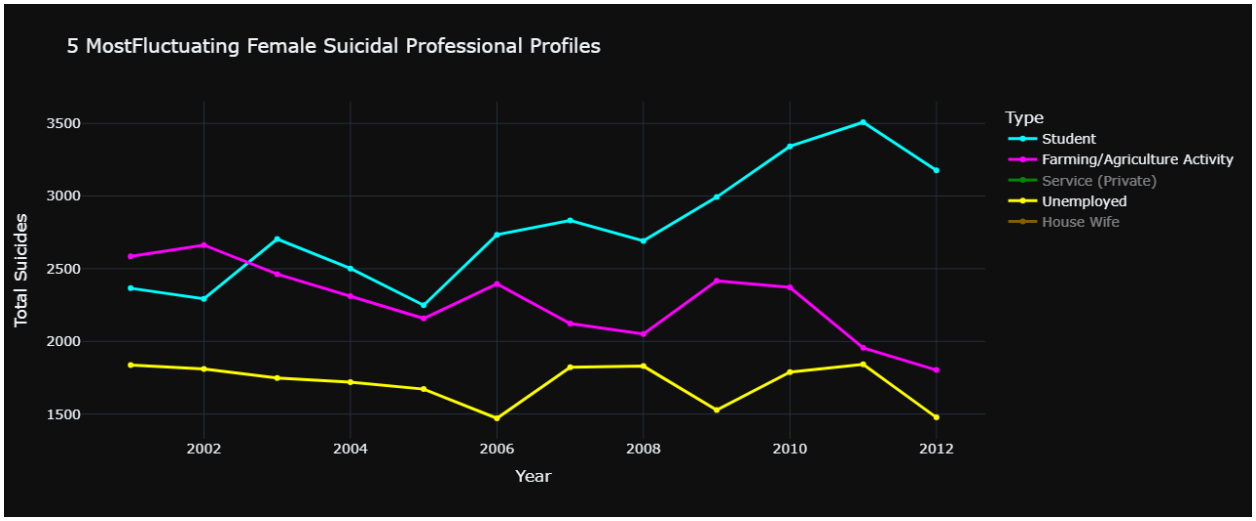
We now focus on the professions with the highest total suicide counts, revealing where the impact is most severe. Farming/Agriculture Activity tops the list, reflecting rural distress from debt, climate issues, and lack of support. Housewives follow, facing emotional and societal pressures. Self-Employed individuals rank third, often burdened by financial and business stress. The Private Service sector comes next, with job insecurity and performance pressure as key factors. Finally, the Unemployed group highlights the mental toll of financial instability and social stigma. This underlines the urgent need for mental health support and targeted interventions across these vulnerable sectors.

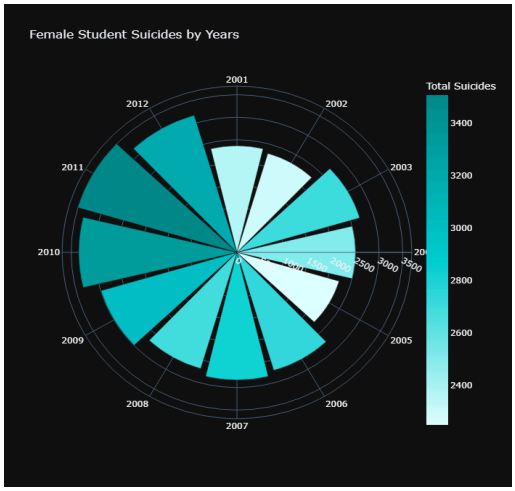


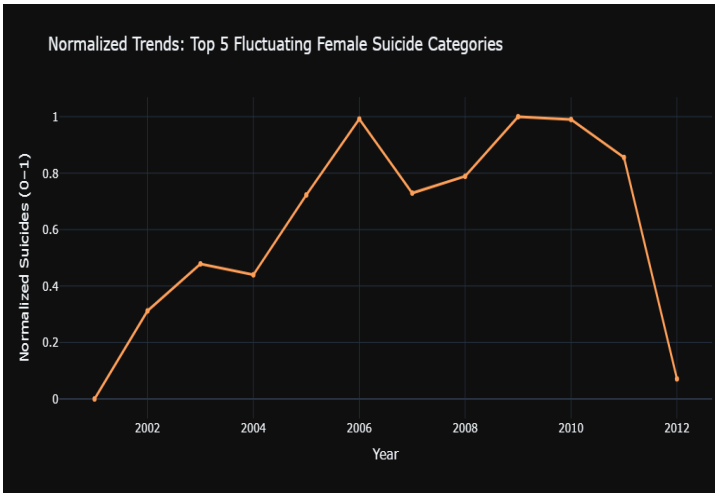


Among males, Farming/Agriculture Activity has historically recorded the highest suicide rates. However, there's a significant decline after 2011, possibly due to increased attention, support

schemes, or migration to other sectors. On the other hand, Service-based professions show a gradual but steady increase, reflecting rising stress, job insecurity, and urban pressures. This trend marks a shifting pattern in suicide risk from traditional rural occupations to modern service-sector roles, emphasizing the need for sector-specific mental health interventions.

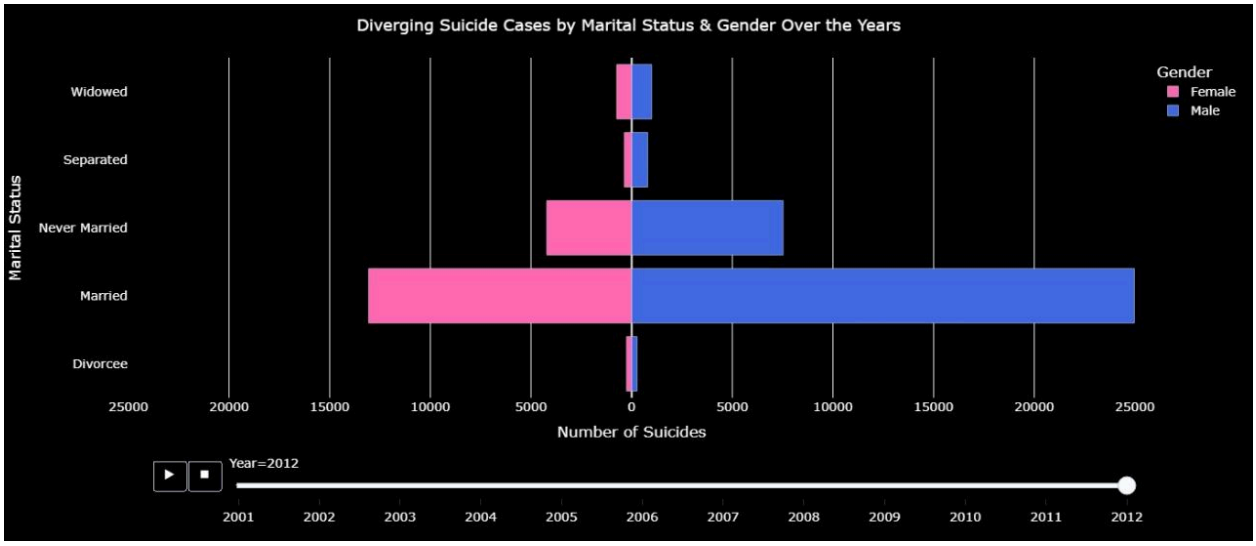




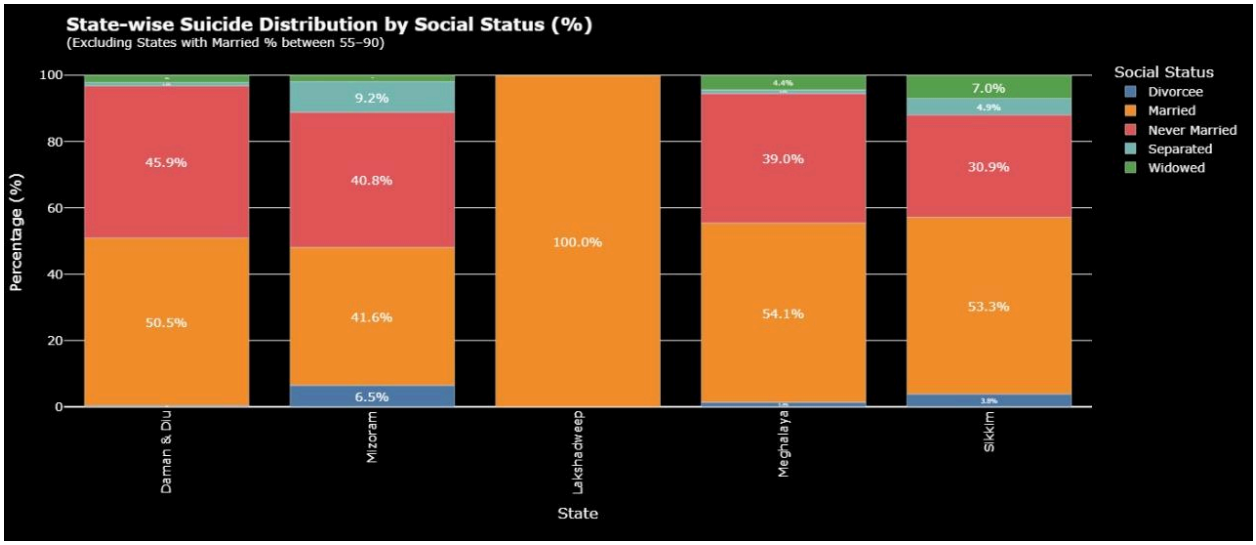


Among females, Housewives represent the most affected group, highlighting the silent mental health struggles faced within domestic environments. Emotional isolation, societal expectations, and lack of support systems contribute significantly. Apart from this, female self-employed and service-based professionals also show notable suicide numbers, reflecting increasing pressures on women balancing work and home responsibilities. This underscores the urgent need for gender-sensitive mental health awareness and support programs

Social Status effect on Total Suicide

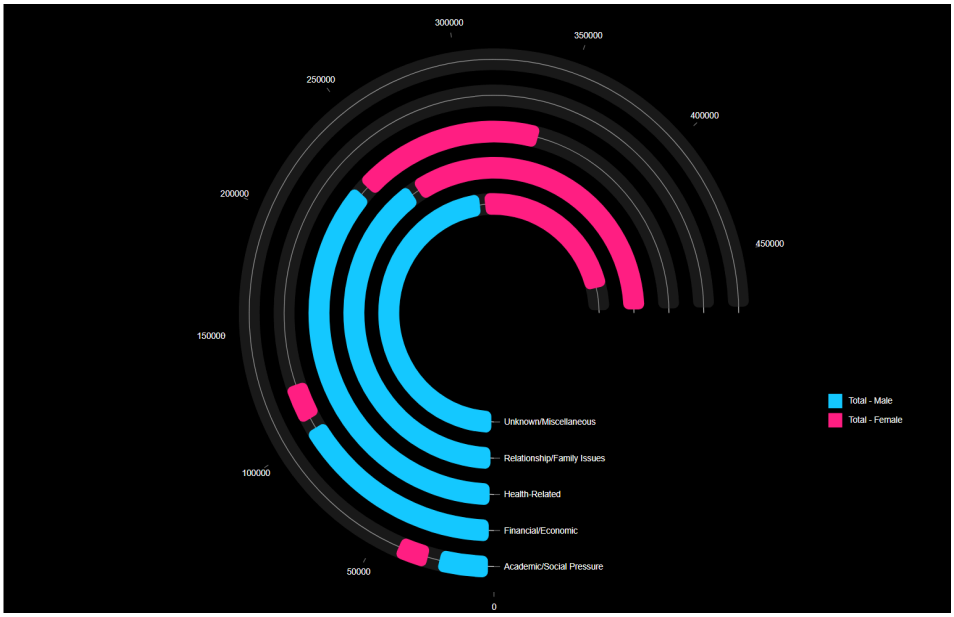


Initially, we hypothesized that married individuals would be less likely to commit suicide, following the general belief that marriage offers emotional and social support. However, the data from India suggests otherwise. A significant number of suicide cases are among married individuals, especially men. This challenges the assumption that marital status alone acts as a protective factor. It indicates that the stresses within marriage—such as financial burden, societal pressure, and emotional strain—may outweigh the support marriage is expected to provide, particularly in the Indian context.



Among the states, Lakshadweep stands out with no variation, as all cases belong solely to the married category. In contrast, Daman & Diu displays a fairly even distribution between married and never married individuals, with slight representation from other groups. Mizoram shows a mixed pattern, primarily involving married and never married people, along with a small presence of divorcees and widowed individuals. Meghalaya also reflects diversity, mainly in the married and never married categories, with a minor portion from the separated group. Sikkim has the most varied distribution, covering all social statuses including married, never married, divorcee, separated, and widowed.

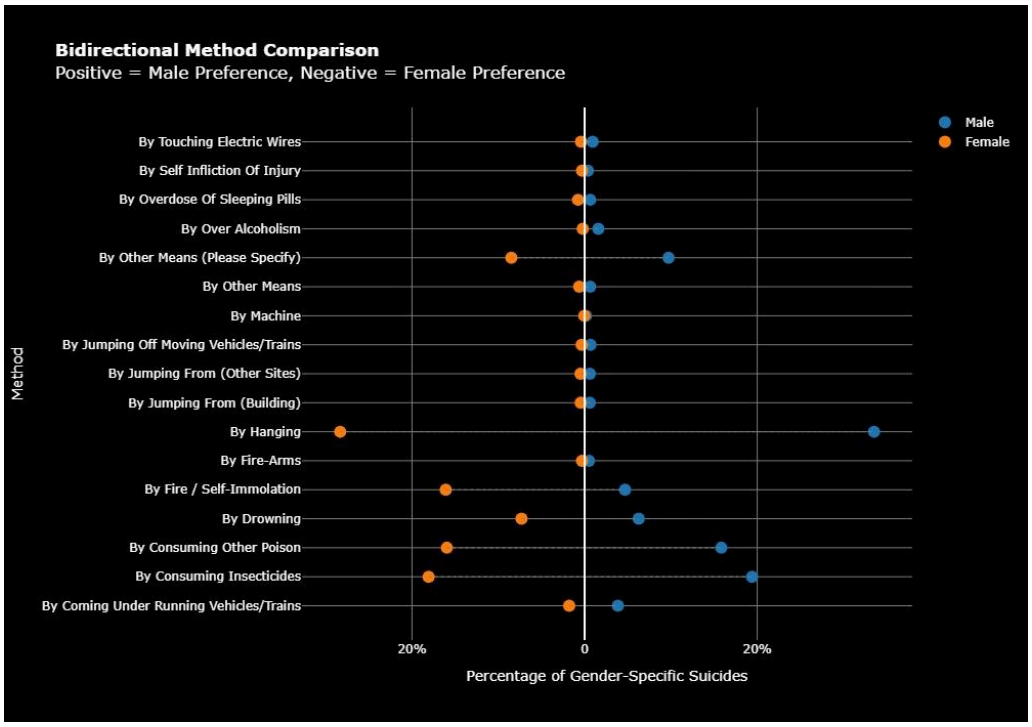
Analysis of Causes of Suicide



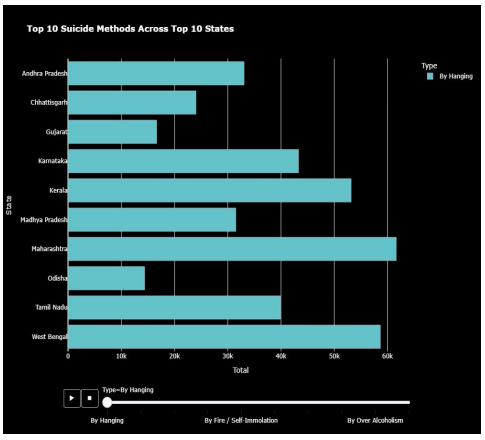
India is an emotionally rooted country, especially when it comes to relationships. Family bonds, marriage, and social ties are given a lot of importance in Indian culture. But the same emotional weight can sometimes turn into pressure. When relationships become a source of stress instead of support, it deeply affects people. Looking at the graph, we can feel that relationship issues are a common and silent cause behind many suicides. Whether it's the fear of being alone, the pain of separation, or the pressure to maintain a marriage, these emotional burdens often remain hidden. In a country like India, where relationships are considered everything, it's important that we also learn to create healthy, understanding, and emotionally safe spaces — where people are not just connected, but truly cared for.

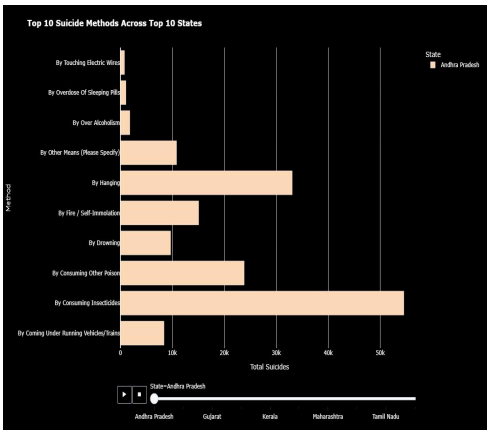
This pattern suggests that suicidal thoughts are not limited to a specific life situation. We often assume that men mostly die by suicide due to economic and financial pressure, and that women are more affected by relationship problems. But the presence of suicides in both married and never married categories, and across all statuses, shows that both men and women are struggling silently. This also reflects how our society may still lack emotional connection and support, even in close relationships like marriage. The fact that married people are also ending their lives indicates that having a relationship doesn't always mean having emotional safety

Analysis of Means Adopted for Suicides



The graph highlights clear gender-based differences in suicide methods. By fire/self-immolation women have higher suicide rates then men which may sometimes reflect dowry-related violence disguised as suicide. while by coming under running vehicles men have higher suicide rates than women, men are more likely to die by hanging or coming under vehicles, possibly due to greater public mobility and impulsive access to such methods .Overall, there is a consistent trend for most methods but certain methods are more commonly used by one gender than the other, showing a distinct pattern in how males and females approach suicide.





As we can see, hanging is the most common method of suicide across most states, indicating a general national trend. However, a state-wise analysis reveals that in some regions, other methods surpass hanging. For example, in Andhra Pradesh, consuming insecticides is the leading method of suicide. This is likely due to the agriculture-based economy, where farmers have easy access to pesticides, and issues like crop failure, mounting debts, and financial pressure often lead to such tragic outcomes. Similarly, in Uttar Pradesh, firearm-related suicides are higher compared to other states, which may be linked to the greater availability of licensed and unlicensed firearms in rural areas, along with longstanding gun culture and political conflicts. These cases highlight how local factors such as occupation, access to means, socio-economic conditions, and even cultural or regional behavior heavily influence the method of suicide in different parts of India.

Attempter vs Completer

Indian studies show that people who attempt and those who complete suicide share many similarities—mainly middle-aged, unemployed, married men and housewives from rural areas with high school education. Unlike Western trends, the age gap between attempters and completers is minimal in India.

Major risk factors for fatal suicides include previous attempts, mental illness, alcohol use, marital or financial issues, and lack of coping skills.

Location

The location of suicide can reflect the individual's mental state and intent. Studies show that most suicides occur at home, especially among women. About one-third of men chose outdoor sites like hotels, riverbeds, or workplaces. Indoor suicides were nearly twice as common as outdoor ones, often during the rainy season. Women's preference for home may be due to social restrictions on their mobility.

Conclusion

Our analysis confirmed that males are significantly more prone to suicide compared to females, likely due to societal expectations, emotional suppression, financial pressure, and higher substance abuse rates among men. Age-wise, individuals between 30 to 45 years were observed to be the most vulnerable, possibly due to career stress, family responsibilities, and economic burdens. These hypotheses were accepted based on the evidence. We also identified that suicide rates are not evenly distributed across states—regions like Maharashtra, Tamil Nadu, and West Bengal reported significantly higher cases, which may be influenced by urban stress, population density, or differing reporting mechanisms. Hence, the hypothesis of uniform state distribution was rejected.

Further, the data supported the assumption that unemployed and self-employed individuals are at greater risk, as occupational insecurity and lack of steady income can severely impact mental well-being. Similarly, those with lower levels of education appeared to be more vulnerable to suicide, potentially due to reduced access to resources, lower awareness of mental health, and limited economic opportunities. Interestingly, our findings showed that married individuals, particularly men, had higher suicide rates compared to their unmarried counterparts—challenging the common belief that marriage always offers emotional protection. Therefore, the hypothesis suggesting marriage as a protective factor was rejected.

Overall, the results highlight that suicide is a multifaceted public health issue influenced by economic, psychological, and social stressors. It cannot be attributed to a single cause but rather to a combination of risk factors that vary across populations and regions. This underscores the need for targeted interventions such as strengthening mental health services, creating community-based awareness programs, enhancing education and employment support, and training general physicians to detect early signs of distress. Individuals too play a critical role—by fostering empathy, breaking the stigma around mental health, and encouraging open conversations, we can collectively build a more supportive environment.

Prevention

1. **Address Root Causes** – unemployment, gender inequality, and mental illness must be tackled to reduce suicide triggers.
2. **Medical & Psychological Care** – Early detection of depression, therapy (like DBT), and medications (lithium, antidepressants) can save lives. Follow-up care for suicide attempters is critical.
3. **Protect High-Risk Groups** – Farmers (debt relief, pesticide control), students (exam reforms, counseling), and women (domestic violence prevention) need targeted support.

4. **Community & Policy Action** – Train teachers/doctors to spot warning signs, restrict lethal means (pesticides), and implement national suicide prevention programs.
5. **Media & Culture Change** – Responsible reporting reduces copycat suicides. Reducing stigma around mental health encourages help-seeking.

Marks and Channels

Idiom	**Marks**	**Channels**
Bar Chart	Line	Length
Stacked Bar Chart	Vertical stack of Line Marks	Length and Color Hue
Line Chart	Points and Line connection mark between them	Aligned Length to express quantitative value
Heatmap	Point	Color Saturation
Pie Chart	angle	Color Hue,Area
Coxcomb	line	Color Hue,Length
Normalised stacked bar	line	Color Saturation
Dual axis line charts	line	Color Hue
Choropleth map	point	Color Hue,Position(both)
Small multiples	Line	Position

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