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Abstract

Suicides has been a major concern around the globe, now a days the since the topping at charts of causing of mortalities in all the ages, the corresponding studies have shown a major increase in the rates overall

Dissertation

Master Thesis

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**Qualitative analysis of factors impacting the increased Suicide Rates in India over a decade.**

**Abstract:**

Suicides has been a major concern around the globe, now a days the since the topping at charts of causing of mortalities in all the ages, the corresponding studies have shown a major increase in the rates overall, reported cases with anonymised cases are 13071734 where 118879 are males and 118640 females combinedly estimated these statistics per 100,000 population. The methods of suicides vary among males and female victims, studies have shown that suicide rates have increased since 1994 and it’s a dilemma that should be addressed and needs to be solved.

Problem statement: Suicides are a silent alarming cause that are making it to the charts, and it’s not being recognized by the experts and people accelerating in the healthcare or mortality sector, it’s been reported around 381,000 suicides in the period from 2000 to 2019. This research aims to answer the following research questions:

1. What are the social-economic, cultural & individual factors that contribute to the upheaving of suicide rates in India?
2. How has the fluctuation in suicide rates based on occupation changed overtime & what are the potential factors contributing to these fluctuations?

By understanding the nature of the research questions this study aims to contribute to the reasons of most suicide problems in India, and further on help the more professionals in the field and help them reach the root cause of the crisis so they can investigate more properly.

Hypothesis revolves around the increasing level of poverty and social isolation and access to the lethal ways to commit the deed and that appears to be associated with higher suicide rates. There Is an argument over the previous studies that around the 16.9% population that has been accredited by the suicide death rates but there was only 3.6% of the actual suicides that has been reported over the years by the authorities.

1. **Introduction**

Suicide originates from Latin word suicidium sui caedere that means killing one self and that is one of the leading causes of fatalities among various age groups and that affects the demographics of teenagers and adults that falls under 35 years of age and WHO (World health organization) and the national safety of council rates it’s as the sixth major causes in the United States, Major increase in the suicide rates that are observed in the recent cases was the third world country and visible reasons are socioeconomic and behavioural factors induced in that, Internationally the deaths are recorded and the a million deaths falls under suicide bifurcation within 20% are Indians among 17% of the world population, suicide is among three-frontal leading causes of death among the age groups 15-44 primarily and then in some countries the secondary reasons that is responsible for deaths that consists of age range from 10-24 years; these figures don’t confirm the suicide attempts, which vary around frequency of the trails and attempts. Last two decades the suicide rates has increased from 7.9 to 10.3, , but the researcher feels like there are some insights that are being not included in the reports and there are in particular some reasons that are impacting the rates and needs to be taken into consideration, some figures from the previous studies that are evaluated based on comparison of the states and reported a comparatively lower readings in the north region (Lucknow) they were aggregately inadequate were taken of readings that were inaccurate and misleading which was thus neglected by the government. This dilemma being universal. Leading to the features of the suicide’s features changing and two researchers proposed that to prevent the under reporting of suicides, both formal and suicide verdicts and other violent deaths should be considered together it may include hidden suicides.

A recent World Health Organization data records that was available in around the year 2011 the rates plunged from to 0.7 per 100,000 In the Maldives to 63.3/100,000 in Belarus. India ranks 43rd. in descending order of suicide rates of 10.6/100,000. The rates of suicide have enormously expanded among youth, and youth are presently the bunch at most noteworthy hazard in one-third of the created and creating nations. The developing marvel of “cyber-suicide” within the internet period may be an advance cause for concern, too since the utilize of unused strategies of suicide are related with scourge increments in by and large suicide rates.[4] Suicide is nevertheless a private and individual act, and a wide dissimilarity exists within the rates of suicide over diverse nations. A more prominent understanding of region-specific factors related to suicide would empower avoidance procedures to be more socially touchy. This centre is additionally highlighted within the September 10, 2012, World Suicide Avoidance Day subject “Suicide Avoidance over the Globe:

Reinforcing Defensive Variables and Ingrains Hope”. This subjective survey investigates the verifiable and epidemiological angles of suicide in with an uncommon centre on India. We trust that introduction of the issue will encourage essential avoidance arranging.

An understanding of suicide within the Indian setting calls for an appreciation of the scholarly, devout, and social ethos of the subcontinent since convention has occasionally saturated the lives of people for as long because it has in India. Antiquated Indian writings contain stories of valour in which suicide as a implies to maintain a strategic distance from disgrace and disgrace was celebrated. Suicide has been specified within the awesome legends of Ramayana and Mahabharata. When Master Sri Slam passed on, there was a scourge of suicide in his kingdom, Ayodhya. The sage Dadhichi sacrificed his life so that the Divine beings may utilize his bones within the war against the evil presences. The Bhagavad Gita condemns suicide for childish reasons and sets that such a passing cannot have “shraddha', the all-important final customs. Brahmanical see had held that those who endeavor suicide ought to quick for a stipulated period. Upanishads, the Sacred texts, condemn suicide and state that 'he who takes his claim life will enter the sunless zones secured by invulnerable haziness after death'.

Suicides being the epicentre of the talks that researcher has perceived these days, in recent days a news article showed where a class 8 boy jumped off a high rise in the hometown of the researcher carefully considered the reasons for the act by the such a small boy wasn’t clearly justified by the reporters and the later reports and autopsy followed and the reports said that the boy committed the act after the family asked the boy to have a haircut and just after getting the haircut the boy seemed upset by the haircut and upon pacifying of teachers and sisters the boy jumped out of the bathroom window. Such incidents are a silent alarm for the people that are even living carefree and have no remorse to the problem in the real world that needs to be solved.

1. **Key Literature Review**

Suicides has been major concern issue in India, with the stigma around the cultural influence and the major impact that came into light when the journalism had a boom and main events that came to event regarding the suicides and the rate, India’s National Crime Records Bureau (NCRB) has published yearly reports on suicides since 1967 overall states and around Delhi union territories. The reported rate then fluctuated, rising between 2006 and 2011, when it reached 11.2 calculated age-standardized suicide rates across the years 2001-2013 using NCRB data. Male rates ranged around 14 per 100,00 while female rates dwindling from 9 to 7 per 100,000 in the span of 13 years. The NCRB reports the total count of suicides in India in 2015 as 133,623, the rate being 10.6 per 100,000 with a male to female ratio of 2.2.

Various studies conducted in India between 1970s to 2000s have been listed Most were from well-defined region with several relating to villages or rural areas other side that covered the cities and hospitals. Several collections from the cases studies showed the analysis of possible causative factors in those areas. Verbal autopsy studies in many various rural locations reported high suicides Prasad el al reported in the posted study that annual suicide rates of 92.1 per 100,000 in catchment area of Tamil Nādu in 2000-2002, the male to female ration being 1.5:1.further comments exceed stating that incomplete registration forms, vague reports of deaths, variable standards and legal proceedings were the obstacles that were causing hinderance between the people for collecting the data necessary involvement of health workers who lived in the villages.

Indian reports reported, unnatural deaths are reported to police, who then investigate and compile a First Information Report (FIR); which states the causes of the death based on the first-hand evidence and autopsy reports. Those FIRs are sent to the NCRB it is dependent on Community reports. There is an NCRB reports on the frequency of suicide, Keeping the underreporting of the suicides the authorities at the NCRB data recording demands a need to understand the reporting and NCRB are making some efforts to understand the desired results at the state level, around the world there is variation between jurisdictions in documented numbers. Variations between jurisdiction in a documented numbers and proportions of ‘EUI (Event of undetermined Intent)’ or coded as having died from unknown causes would the suicide rates across the states in the country, the analysis based on the factors related to causation needs to include attention to factors considered at a state level, and to factors leading to non-inclusion of completed suicide cases with the data on NCRB.

Other NCB reports that made the top charts among the other nation-wide study reported by Patel et al was the first to estimate India’s nationwide suicide rate. Accordingly with the 1991 census, India being divided among one million small areas, and in 6671 of these areas, a field-surveyor visited and double checked the affected houses that recorded suicides, and after detailed investigation and involvement if physicians, a cause of death was documented, the cause being suicide in 2741 2.24% and of all the recorded deaths the 2.8% of aged 15yr or older. The Calculated age-standardized suicide rate among those aged 30-44 showed an increase and the graph pattern among females was downward-sloping with peaking of 15-29 years old 24.9 per 100k.

Relevancy of the factors that impact the causation of suicide.

Some reasonable observations in the previous studies that were referred to the suicide rates and patterns in India differ a lot between States and territories. Possible explanations for these differences may vary. Referring to the dataset 2000-2012 and it gave out some understanding that southern part of Indian territory is most affected, In Tamil Nadu, the male suicide rate in 2013 was around 29.9 per 100,000 and female rate 14.6; Maharashtra’s corresponding rates were 19.7 and 8.5; Uttar Pradesh were 2.9 and 2.1 and Bihar’s corresponding rates were 1.1 and 0.8. The suicides rates in 2016 reported for different States, Those Derived from NCRB data More economically developed States had 3 to 4 times higher rates than less economically developed States, but part of this might be attributed to their better registration of suicide cases. Higher Suicide rates.

Studies have shown that attempters classified motivation into the wish for change on their personal and outward of life and their wish to die thinking groups and found that the former had low lethality, planning of the attempt, more rescue and were not intoxicated during the attempt. The latter group opted for drastic measures such as hanging and was more likely to have more serve psychiatric disorder with comorbid alcoholism.

Top categories for the relevance’s of impact included family problems [23.7%], illness[21%] (Inclusive insanity/ mental illness), unemployment (1.9 %), love affairs(2.9%), drug abuse/addiction (2.3%), failure in examination (1.6%), bankruptcy or sudden change in economic status (2.5%), poverty (2.3%), and dowry dispute (2.3%), The tall rates of suicide among people with mental ailment and sedate abuse/addiction, in spite of the fact that not a degree of aim, are of much concern. Numerous of the remaining causes [specifically, suspected/illicit connection, cancellation/non-settlement of marriage, not having children (barrenness/impotency), passing of an expensive one, settlement debate, separate, ideological causes/hero revere, ill-conceived pregnancy, physical mishandle (assault, inbreeding, etc.), destitution, professional/career problem] reflect the one-of-a-kind social structure of our society and the social weights that people confront.

Studies shown that a last wish was mentioned in 30%, mass suicides are seen as suicide pacts in couples or familiar, factors such as religious cult don’t have a much influence on the accounting of for the <1% of all suicides, and there is a trend in western literature showing a decrease in rates over the years. Suicide pacts almost always involve people well known to each other, mostly spouses most of them childless. However, there is an increase on the internet affected suicides, where two strangers meet online, and they are afflicted by the virtual aura of each other. Though such cases have been reported but have not been studied in scientific manner.

Mental disorders are reported mainly around the drug or alcohol users are a major risk factor for suicide in Europe and North America and it’s a big dilemma faced by govt of the country of my residence, but in case of India it differs to some extent since the impulsiveness plays an important role up to some extent. Many other reports that researcher red through this tenure consist of some autopsy that recorded physical illness, abnormal vaginal discharge and tobacco risk factors are too common mental disorders among women in India. Very relevant featured similarity is seen among suicide attempters. 1/5th of the victim’s illness in one study with dysmenorrhoea, related to somewhere in peptic ulcer disease: hypertension, bronchial asthma, and arthritis whereas ulcer is somewhere coinciding with the dietary practices of the Indian people where spices play an important role. Pain in abdominal and pelvic regions has been reported more frequently among attempters This finding was also reported is Hispanic and Americans. Determinants of suicidal attempts in this subpopulation include financial difficulties, marital discord, delusional jealousy, and suicidal ideation expressed by the alcohol abuser. Emotional reaction of the women in India in response of their martial status of they have gone through a divorce or the suspicion on their fidelity, reflecting the value Indian culture imposes on chastity.

Hopelessness and pessimism items on the Beck Depressive Inventory predicted suicides. A score of 10 or more is on the scale, Hopelessness has shown to have a positive correlation with degree of suicidal intent. 85% of children and adolescents in the 12-19 years of age and they have shown a mere inclination towards the suicide prior to the event.

3. **Methodology**

3.1 **Data Collection**

Data on Suicide, related to the features age, sex and residual details whether its rural or urban seasonally based on the attempts a particular person had, The researcher was fully aware of the methods that are integrated with the data collection of the suicide domain, but unfortunately the data that was required for this study was in person and the data was very much difficult to accumulate and since the time frame was very much constrained with only a month or two in hand and the whole process of initiating and concluding the research was to be endured. There were many reports around this domain that included reports of autopsy and detailed analysis for the cause of death to bifurcate the results between homicidal, suicidal, or accidental death. According to the census of India in 2011, the population of the state Lucknow district is around 4.5 million which is equal to Georgia nations population strength which male and female were 2.5 mil to 2.2 mil approx. total number of suicides approx. in the rural areas that 63.3 percent in urban in nature, suicides are classified into many subcategories in the dataset used for studies and the dataset that were skimmed for literature review purposes were, Family problems, Dowry, Drug Abuse, Insanity, and mental Illness etc. researcher’s final dataset was acquired from the Indian government open data portal and time frame was 2000-2012 a decade worth of data was taken into consideration for the study.

3.2 **Variable selection**

The researcher thinks that the variables that are included in the dataset are very sparsely selected the variables that are selected in the dataset that can work with the State, Year, Type code, Type, Gender, Age group, Total (number of suicides),

Whereas the features that can be explained as follows that the state is generally a polynomial feature string value that consists of the name of all states in India that data is parsed on, Year is the time frame 2000-2012 in which years the data was collected.

Type code consists of the multiple values that are used and have an adamant advantage in selection of variables for experimental purposes, it is made up of

* Education status of the victim: consisting of whether the victim is graduated, high school, Middle school, No Education, Matriculate/Secondary, Hr. Secondary/Pre-university, diploma, and post-graduation.
* Causes of suicides: the major reasons why people fall victim to this horrendous deed, which consists of family problems, major causes are still not known then change in the Economic status, Drug abuse, Love affairs and mainly other causes that needs to be considered in the study.
* Means Adopted: The ways and means that victims adopt to make their way to the conclusion of the act, which comprises of various means such as consuming insecticides, By Hanging (which is a pretty well-known act and also used for punishment in present age and time), Jumping (other one of the common practices to end lives), by touching electric wires, by machine, or doing self-harm activities these such categories make up this variable which is crucial for the research purposes.
* Professional Profile: The professional profile of the victims makes up this feature it consists of the work the victims did in their entire life before ending their lives, which includes Housewives mostly females in the counts, farmers or anyone in the agriculture activity, Service(private) sector, Unemployed that can also be a main concern for the count, students, self-employed or entrepreneurs, Public sector working professionals and lastly retired persons.
* Social Status: This feature consists of the social status such as marital, separated, never married, divorcee, Never Married, widowed or widower this also impacts the suicide rates as the major concern revolves around the causes of family problems, so this variable is one to look out and work with.

3.3 **Data Cleaning and Preparation.**

Dataset that the researcher choose was sort of pre-defined but it needed some work in some ways, it never had any null values or missing values as such since the dataset was acquired from govt website of the India, Instead I used and worked on Google, I used multiple python libraries to workup my way through the dataset and skim through the all the dataset, such as scikit learn, pandas, NumPy and seaborn for EDA purposes. Researcher used all possible variables in the dataset as it appears important to include.

Managed some outliers in the dataset, there weren’t many, had to use IQR based method to identify some outliers, but dint include it and corrected the dataset, as IQR is the most common method to identify the outliers in a dataset.

Identifying the errors in the dataset, was corrected later manually as the errors were inclusive of some wrongly formatted year in numerical format and some gender misspellings and age ranges were bit unscrutinised.

Data transformation took place when the algorithms had to be tested and feature engineering had to be done as the data is categorical in nature, whereas the categorical data is relevant to suicide risk and prevention research that focuses on discrete outcomes, many a times the results from the outcomes of these analyses are not inferred properly and are often misinterpreted and not are not presented in a clinically tangible manner. The researcher aimed to look in further in the correlations and get some useful under-hidden insights that needs to be inferred and can’t be inferred, researcher tried to highlight the categorical data and relevant methods used in clinical assessment for the same using the basic machine learning methods concepts and address the distinct utility of the current methods.

The dataset was very versatile in nature as *Type\_code* and *Type* are the two variables in the dataset that are very uniquely descriptive in nature whereas the Type code consisted of the heading of the nature of the reason for the suicide and the type consists of the more detailed sub categorized information of the Type\_code, We performed some PCA to look for the trends that are hidden in the dataset and was not seen much in the dataset with just first glance observation.

We didn’t try to reduce any data as the features are very less comparatively and I don’t think so cutting it down further would be beneficial to the results and would create much integrated problems, with the time constraint and the nature of the research problem we weren’t able to get access to much in depth data in person with more weighted features. The aim of the PCA (Principal Component Analysis) is to identify the most important variables that contributed to the variation in the dataset.

Going on for checking the validation of the dataset that was to be worked and preparing the dataset and variables for the analysis and algorithm purposes, we split the dataset into training set and test sets after the feature engineering and used the training subset to train the model up to maximized utility, whereas the test set was used to evaluate the performance and infer insightful results. Using the root mean squared error (RMSE) to evaluate the performance of the model.

Software and tools we used in the analysis purposes for the same is R language for experimental purposes, but it may be or maybe not included in the artefact R language version 4.3.0 for data cleaning and in google colab for final submission we used Python 3.10.1, using various packages in R and python proved beneficial to us in our research work even for EDA purposes.

Limitations faced during cleaning purposes was the featured data in the columns that are described above were very distinctive in nature and it proved ineffective towards the traditional feature engineering approach. We had to individually filter out the values corresponding to the type of code and type, so had to encode it based on the frequency and the most corresponding values were not appropriately clocked, preparation and process also included the reliability of the data, the imputed data may not have reflected the true values in its own sense. Our variable selection process was limited to the variables in the dataset, with the time complexity and little period, there may be other variables that could have contributed to the analysis.

Summarized, we cleaned up the data and prepared it for and accordance with our own needs and fragments, checked the missing values, identifying and checking for outliers, transforming the data, checking the dimensionality of the dataset.

3.4 **Research Approach**

This section, we describe the materials, ethical and considerations of our study. Aiming at social-economic, cultural & individual factors that are affecting the alarming suicide rates India and that has given a subsequent rise in the suicide patterns too, investigating the patterns and looking for something meaningful in the dataset.

Secondly investigation of the fluctuations in the time frame over the years of the suicide rates in India with respect to different overtime & the potential factors contributing to these changes.

Materials:

The materials that was used in the study was a dataset that was collected on the government website of India it is an open platform of the government that gives out data to various users and its for purposes like commercial, academic or research related purpose it consists of data from pretty much every domain but we further on went to fetch the data on socii-demographic factor such as mental health, professional profile, social status and means used and other relevant variables.

3.4.1 **Procedure:**

The study was conducted using a cross-sectional design, in which data was directly acquired from the govt website at single point of time. Participants weren’t involved in this study all the involved participants are anonymised and the final dataset was acquired, collected data was from the Indian govt data portal.

Data became a very useful source after the business and policymakers started making profits and making money of it and having insights and the resource proved very useful in itself and was very beneficial to the people who extracted useful information and racked it up properly and stored, govt of India had huge amount of raw datasets that were collected from longer time decades of decades through the publicly funded projects and schemes like mahatma Gandhi national rural employment guarantee act 2005 etc these were some few acts that helped in the information to be bettered at policymaking.

Open Access data allowed citizen to track the effectiveness of the government and the efficiency of the government schemes and enables businesses to build community-oriented innovations. It also facilities data and knowledge of the government and the officials and the citizens that are residing in the republic of India or any government per say, it also allows and deals with the right to practice the freedom of press, etc. helps in breaking silos and monitor the schemes that are working behind and beyond their departments, it even collaborates to identify the issues for intra and inter-ministerial collaboration. It pushes governments and the subsidiary businesses have an accountability which are the cornerstones of resilient and inclusive societies.

Governments are currently working toward maximizing their potential of data collected missing datasets, asynchronous approaches to data collection methods and metadata, and counterintuitive approaches to data visualization limit the access and usability of OGD. This is the exact statement from the website what they posted.

Only a few datasets have approached and have made it up to the mark of where the citizens can make use of the data that is pretty much usable in terms of analysis. Whereas the data collection and methodologies and the terminologies also differ in many scenarios, for example you can see the same information and same dataset under different headings, such as the data for suicides can also be found under the heading of accidental and fatal deaths and self-harm killings.

Data can be retrieved from the websites in many forms, but it depends on the person and study to study about which type of data and what are useful, scanned PDFs or images on government websites making data extraction non-convenient, India is still struggling with data anonymisation till the recent years. Ministry of Electronics and Information Technology released a draft data anonymisation guidelines only recently in August 2022 but withdrew it because they thought the draft needed more expert guidance and consultation. Upper hierarchy people such as officials from the central government and state departments should have alignment towards the framework to ensure the privacy and data protection.

NDSAP has played a vital role in the wider data outreach towards the Indian data retrieval and research based studies, further it also aims at enhancing the data usability, since the data users of the web portal are innovators, bureaucrats, policy designers, citizens and researcher so they are making it sure the data stays true to its nature and coherent, by maintaining the communication between data users and data producers, it clearly maintains the quality of the datasets that are being used.

Within the nonattendance of comprehensive information anonymisation and assurance system in India, the central government should guarantee values relegated to information are in match up with the existing laws and systems of data administration and enough organize person security. Besides, the ultimate draft of the information administration system must moreover layout convention to dodge guile of endeavours in collecting and uploading information.

3.4.2 **Data Analysis:**

This study used the machine learning methods and algorithm to come up with some undefined insights that were overlooked in the major areas of research, we are going to discuss some important aspects of machine learning overtime, The later victory of machine learning (ML) models in improving classification exactness for the forecast of discrete suicide-related has made these approaches prevalent in suicide inquire about. In spite of the fact that we don't give a comprehensive outline of these different approaches we emphasize to peruses fascinated by ML procedures that the strategies (e.g., logistic relapse, Recipient Working Characteristic [ROC] bend examinations) and ideas (e.g., affectability, specificity, positive prescient values, negative prescient values) depicted in this paper are foundational for models including the classification of categorical results. Undoubtedly, writings approximately ML, such as Hastie et al. (2009) and Kuhn and Johnson (2013), give devoted scope of a few of the models (e.g., calculated relapse) and phrasing (e.g., ROC Bends) included in this composition. It is our trust that the current manuscript can be utilized as a accommodating apparatus for peruses who are curious about way better processing current work that utilizes ML inside the field of suicidology or those who are looking for to actualize these approaches in their possess work.

Further on we will discuss about the Logistic regression algorithm its background and mechanisms that come into play. an outline of twofold calculated relapse examinations with a centre on how to translate discoveries from calculated relapse models and interpret discoveries from calculated relapse models into clinically unmistakable data. We moreover distinguish common coefficient translation mistakes and give rectify elucidations. Finally, we offer illustrations of how to change over calculated relapse gauges into probabilities and survey illustrations that are especially pertinent to suicide inquire about. Other assets are accessible for an in-depth jump into the basic presumptions and arithmetic of these examinations.

We implemented PCA in the early stages of the analysis. One of the essential inspirations for utilizing PCA is to diminish the dimensionality of a dataset. In numerous real-world scenarios, datasets contain a huge number of factors (highlights), which can lead to computational challenges, expanded show complexity, and challenges in deciphering comes about. PCA changes the first factors into an unused set of uncorrelated factors called central components, which are requested by the amount of variety they clarify within the information. By selecting a subset of the foremost vital components, analysts can diminish the dimensionality of the dataset whereas holding most of the data.

But the researcher didn’t have any intentions to reduce any dimensions dataset as the dimensions were only less, but the PCA was used for much visualization as in where the clusters fall. PCA empowers analysts to imagine high-dimensional information in a lower-dimensional space. By lessening the measurements, the information can be spoken to in two or three measurements, permitting for simpler visualization and translation. This visualization can offer assistance recognize clusters, patterns, or exceptions which will not be clear within the unique high-dimensional space. For this study the PCA was an aid for visualization and it’s an important step in pre-processing to consider the multicollinearity or remove the noise from the dataset. Multicollinearity happens when the variables in the dataset are highly correlated with each other, which can lead to unstable into uncorrelated principal components, thus can transform the multicollinearity issue. Additionally, PCA can assist to remove noise or irrelevant information by discarding components with low variances.

Further on regression techniques was used Poisson's proportion in datasets with a target variable speaking to passing checks when they need to investigate the relationship between two factors and get it the designs of mortality. Poisson's proportion could be a degree of the relationship between two random factors taking after a Poisson dissemination. Within the setting of passing checks, it can give experiences into the relationship between an informative variable and the recurrence of passings.

Scientifically, Poisson's proportion is characterized as the proportion of the change to the cruel of a Poisson-distributed variable. Let's indicate the irregular variable speaking to passing tallies as X. The equation for Poisson's proportion (indicated by ν) can be communicated as:

ν = Var(X) / E(X)

Here, Var(X) speaks to the change of the passing checks and E(X) signifies the anticipated (or cruel) number of passings.

If the variance of the death counts is equal to, higher than, or less than the mean, it may be calculated using Poisson's ratio. When v equals 1, it means that the variance and mean are both equal, indicating that the Poisson distribution is well-fit. If is less than 1, under-dispersion is implied, indicating that the observed data vary less than anticipated. On the other hand, if is larger than 1, it indicates over-dispersion, which means the observed data vary more than anticipated, it is termed as the Assessing Over or Under Dispersion

The Poisson's ratio can provide light on the association between a death count and an explanatory variable. For instance, researchers could look at whether specific elements (such as socioeconomic status, professional profiles, or methods used) have an impact on the incidence of fatalities. Researchers can check to see if there is a link between the explanatory variable and mortality rates by computing Poisson's ratio for various levels or categories of the explanatory variable This gives the Relationship Assessment between the variables in the dataset.

A Poisson regression model's quality of fit may be assessed with the help of Poisson's ratio. Researchers may use Poisson regression to model the link between the explanatory variable(s) and mortality rates in the setting of death counts. Researchers can examine if the model sufficiently accounts for the observed variation or if there are departures from the Poisson assumption by examining the ratio of variance to the mean, thus Poisson Regression Model can help in rechecking the model and evaluation of the turgidity of the model.

To find differences in mortality trends, we have analysed Poisson's ratio across various populations or time periods. To evaluate if the ratio significantly deviates from a particular value (such as v = 1), hypothesis tests can also be used. These comparisons and testing can offer insightful information about the variables affecting death rates, this concludes the comparison and Hypothesis Testing of the patterns in the dataset.

We also applied a logistic regression model that is a common practice for the people that are working on the dataset with some similar natured dataset, when a researcher believes that a variable or collection of factors will predict a binary or dichotomous outcome variable, binary logistic regression is utilized. In this context, x is a predictor variable (in the majority of our cases, a continuous depression score serves as our x), and y denotes an outcome variable (in our example, the status of a suicide attempt serves as our y variable). Assume that suicide attempt status in our examples and explanations was recorded as no suicide attempt = 0 and suicide attempt = 1 for the entirety of this essay. Odds ratio (OR) values from these models are most frequently reported by researchers (sometimes inaccurately); but, as will be shown below, it is challenging to evaluate an OR clinically. In order to increase clinical usefulness, we thus support turning ORs into projected probability values, and we review and illustrate this conversion.

It is crucial to keep in mind that logistic regression is still a regression (i.e., a generic linear model) as we get started. Logistic regression employs the same linear equation (y=b0+b1[x]; or the projected suicide attempt status = intercept + slope of depression [depression score]), similar to linear regression models with continuous y variables, but first y needs to be transformed. We may determine the likelihood of falling into each group when our y is binary (for example, the likelihood of having attempted suicide). A probability scale is confined between zero and one in this situation, which makes it impossible to employ a linear model when using a binary y in a general linear model. So that y is unbound and may be examined as a continuous variable in a generic linear model, we must convert y. A log-link function is needed in logistic regression for these modifications, which are referred to as "link functions." The log-odds of y (suicide attempt vs. no suicide attempt) across levels of x (depression) may be calculated using a log-link function to approximate the linear connection between x (depression) and a binary y. The only aspect of a log-link function that affects how estimates from statistical program output for logistic regression models should be interpreted is the topic of this research. This research is not going in too deep with the statistics of the nature of the mathematics of the regression. It more over tries to look out for the any trends and patterns in the decade worth of data and insights or correlations in the nature of the features.

Interpretations of the results is a usually most confusing thing one can come across and interpreting through log-odds is one approach to the One could wonder what a "log-odds" means clinically. We predict that this is a frequent query that may impede correct results interpretation and the therapeutic implementation of statistical findings. One has to be familiar with both odds and logs (in logistic regression, the so-called natural log) in order to comprehend log-odds. Odds are the ratio of the event's probability (such as a suicide attempt) to the event's probability (such as no suicide attempt). The odds of having a suicide attempt are 10/40, which decreases to 14, or 0.25, if a sample of 50 participants contains 10 people who have attempted suicide at some point in the past (for instance, throughout the course of their lifetime) and 40 people who have not. The default is to use log-odds.

Time Series analysis was the second approach and the last approach of this study!

In order to comprehend and forecast patterns in sequential data, time series analysis is essential. Analysing historical trends in the context of data on suicide can give important insights into the complexity of this social issue. Time series analysis of data on suicide can provide a deeper understanding of underlying factors and aid in the creation of successful prevention strategies by utilizing machine learning techniques. The purpose of this article is to examine the context and importance of using time series analysis on suicide data that uses the year as the date column. Understanding Data on Suicide: The tragic global problem of suicide has wide-ranging societal effects. To pinpoint risk factors, monitor trends, and create effective interventions, data collection and analysis on suicide are essential. A strong framework is provided by time series analysis.

Dataset needs to be pre-processed to ensure its suitability for modelling before using time series analysis. This covers how to deal with missing values, outliers, and erratic time periods. Depending on the research question and the granularity of the available data, the data may also need to be aggregated or transformed to a suitable frequency, such as annually or monthly. In time series analysis, stationarity is a key premise. It implies that constant statistical characteristics over time include mean, variance, and autocovariance. Then there are further on some suitable tests statistical that helps validate the suitability of the data for modelling.

Understanding suicide data requires an understanding of autocorrelation, which measures the relationship between an observation and previous observations at various lags. Insights into the lagged dependencies and potential predictive factors influencing suicide rates can be gained by analysing the autocorrelation function (ACF) and partial autocorrelation function (PACF). This analysis aids in choosing the proper placements for moving average (MA) and autoregressive (AR) terms in time series models.

When the year is used as the date column in a time series analysis of suicide data, it can reveal important patterns, seasonal patterns, and potential risk factors. Policymakers, healthcare workers, and mental health advocates can use it to pinpoint crucial junctures and high-risk demographics while gaining a thorough understanding of temporal variations in suicide rates. To lower suicide rates, these insights can be used to guide targeted interventions, resource allocation, and prevention strategies. This time series analysis actually helped the researcher filter out the trends of the suicide rates that has followed through out a decade of time from 2001-2012 investigating the areas of potential risks and evaluation of the potential genders that have dwindled the outlook towards the deed.

Suicide data time series analysis offers a potent framework to investigate temporal patterns, identify underlying causes, and forecast future trends. Researchers can better understand the intricate dynamics influencing suicide rates by utilizing machine learning techniques, and they can create data-driven strategies for both prevention and intervention. Researchers can contribute to the ongoing efforts to lessen the global burden of suicide and promote mental health by studying suicide data with the year as the date column. Further on it helps the doctors and the professionals in the time frame to analyse the trends and make and expect the outcomes as that have happed in the past in some similar manner, and thus they can actually prevent some happenings to the potential victims and help them out and help the upcoming new generational professionals to be a part of the process and retain the mental health Stata. The Irregularities in the demographics over the year of time over the gap in the data collection and result interpretability or research work around it, but due to time constraint of this research, this research doesn’t look too much into depth of those factors.

**4.Summary Interpretation of the Results:**

This study aims at sorting out the data based on the empirical features getting the major inputs from the dataset and performing EDA along side with two regression models.

Findings go along with the dataset, Maharashtra is the highest suicide rating state in the whole of India with 9,01,045 where the age range Adolescent age range people 15, 538 deaths reported in state West Bengal, 15-29 aged folks the 2,04,870 Maharashtra, Tamil Nadu has recorded most suicides from 45-59 which is a major concern for the authorities. But there are most cases in the other cases, The major causes of suicide rates were family problems, 1,25,135 counts. Whereas the major suicide rates revolves around, the primary educated Stata people they seem more prone towards the act, where as that raises the question that is education system of India is a questionable venture? Do government need to upheaval the education system so the better educated people need to understand the real meaning of life and make the most out of it?

The means adopted by people around the India that tops the list is hanging with crossing over 1,69k deaths recorded by hanging which was discussed in the literature review above and the usual means that are is the lower sized ceilings to be blamed? The architecture of the Indian civil engineering is to be questioned? Or the accessibility to the heights. The second and foremost reasons to get the deed done is consumption of pesticides and consumption of insecticides, where the easily accessibility of the poisonous substances without proper channel or license/ authorization and that too with much ease in the market that can be given to commoner and the authorization to use it in the proper senses, with such illegal practices revoking of the license of such vendors can be a good practice? There are many other areas where people have adopted to end their lives by electrocuting themselves by touching open live wires as the Indian electricity infrastructure is bound should there be any hazardous coverings around the electric wires or any changed should be needed for the prevention of such practices.

By professional profile if we infer from the findings reflected in the visualizations that the miscalculation in the dataset gave out the professional profile with other professions or undisclosed professions that might include according to researchers’ insight beggars, sex workers and eunuchs because these professions in Indian culture is mainly looked down upon even the dancers in ladies bar which are mostly the transgenders they are a taboo and they are mostly fall under the cases that go unreported or the people they don’t consider such cases to report worthy, whereas the women folk mainly are suffering from the household domestic violence and hence the records of housewives affected by the deed around the statistics are a major alarming concern with 42k death count around the corner, and lastly the major category that is affected by the death rates are the Farmers with alarming rate 40.7k deaths reported, India has seen a worrisome increase in farmer suicides in recent years, underscoring the terrible predicament of the agricultural sector. The causes of this worrying trend are many and include cultural pressures, financial hardships, a lack of resources for mental health care, and environmental variables.

The difficulties farmers in India confront economically play a key role in their hopelessness. Farmers are exposed to changing crop prices, market demands, and erratic weather because of the volatile nature of agriculture. This unpredictability, in addition to growing debt from high-interest loans and unsuccessful harvests, generates a hefty load that is hard to bear. Their financial difficulties are further exacerbated by their restricted access to inexpensive credit and crop insurance, making it difficult for them to support their way of life, Farmers experience significant social pressures as well, which exacerbates their psychological discomfort. Agricultural communities must contend with societal stigmas and the ingrained need to support their family and preserve their social standing. The inability to live up to these expectations and the worry that they may let their loved ones down cause excruciating tension and a sense of helplessness. Farmers' emotional load is further exacerbated by their dread of looking foolish and their obligation to fit in with society's expectations.

The situation is made worse by a lack of care for mental health. Because of the arduous nature of their labour, their financial difficulties, and cultural expectations, farmers frequently endure significant levels of stress, anxiety, and melancholy. However, issues with mental health are frequently disregarded or neglected in rural communities. Climate change and other environmental issues have had a significant negative influence on farming and farmers' mental health. The frequency and severity of unusual rainfall patterns, droughts, floods, and other extreme weather events have increased.

A broad strategy is required to handle this situation. The main goals of agrarian reform should be to increase access to finance, stabilize farmer incomes, and put in place efficient crop insurance programs. Farmers may lessen the dangers presented by climate change by promoting sustainable agricultural practices and climate-resilient farming methods. Prioritizing mental health support services is also crucial, especially in rural regions, to address farmers' emotional wellbeing and provide them the coping skills they need. Government should approach this subject of farmer death toll with non-biased approach.

Majorly the cases that caused the statistic to boom falls under the married people and sadly and the count goes more around with males out of 30,65k registered cases the 92k are males that suffer from the deed, whereas the awareness of mental health of men should be really a talk of the town for more countries as the women in every field is celebrated. Males should be taken care of and there should be professionals working around the deterioration of the male depression and male mental health stigma. And efforts should be made public.

The models that were run on the dataset for finding the correlation and the trends gave out a subtle output, The reduced residual deviance in comparison to the null deviance and the comparatively lower AIC value indicate that the model has established a respectable fit to the data. The statistical importance of each predictor variable in predicting the response variable will be detailed in the significance codes linked with the coefficient estimates. However, it is challenging to offer a more precise interpretation of the findings in the absence of other information or the precise coefficients and their accompanying factors.

The Time series analysis made a low progress and couldn’t approach the predicted output expectations, the resulted output is sinusoidal in nature as the pickled data from the year was just 1st of every month of every year and researcher fears that might give off wrong results, so results are included in the artefact files but a short go through of the fore cast readings we found out are as follows Point Forecast: 1.345596 is the anticipated value for the upcoming period.

Lo 80: The range of the anticipated value's lower 80% confidence interval is between -4.462416 and 7.153608. This indicates that we have a 80% chance of correctly predicting where the actual value will fall.

Hi 80: The range of the anticipated value's upper 80% confidence interval is from -4.462416 to 7.153608. This indicates that we have a 80% chance of correctly predicting where the actual value will fall.

Lo 95: The predicted value's lower 95% confidence interval is -7.536992. This indicates that there is a 95% chance that the actual result will be higher or equal to this value.

Hi 95: The anticipated value's upper 95% confidence interval is 10.22818. This.

**5.Conclusion & Future research and Limitations:**

Be expected the actual suicide risk prevention initiative could have been much aided but the data that was acquired by the government, it was extremely limited in its nature and not much in person detailed to extract the as expected results from the research questions as proposed. Given the much sparse dataset and the nature of data being. Obscure, whereas the timeline for every state was not very much defined and the time only consisted of year.

This cannot falsify the clinical utility of the models that are put into practice, in fact we hope this study helps as a guide for how researchers view this subject of suicide and can further on use this approach to identify keen trends in the real-world application of the work, (logistic regression or binary models, Poisson regression model). This can be a clinical decision maker with replication of this work and integrating it with other useful machine learning approach it can prove more beneficial with more diverse samples. Considering a clinical head-off does not provide perfectly accurate information and may differ with the samples and outcomes of different interests.

Due to time being literally few weeks where we had to do the literature review around the work and the similar kind of work to be worked up on and do a throughout study of the approaches, we happen to not find any gap in the literature review as matter of fact the time for this work was very little and in that short time of span detailed and derived literature review was not possible, The data set being categorical in nature and a few approaches that the demographics permitted us to mediate with the features.

5.1 **Limitations:**

The present study provides the insights and trends in the dataset through some machine learning concepts of LDA, PCA, the acquire of the dataset was from the government website, which was set up using self-administered structured, there was no participant’s involved in the research and so in detailed patients information on how the act happened, and inaccurate representation of the participant’s detail. It proved to be advantageous for the master thesis project to work on a low-featured dataset enabled a low-cost way of obtaining results.

The other big limitation that proved very effective around the timeline of the thesis was time duration there was not enough time for data scanning and data acquisition, there are many factors I suppose were missing in the count such as the adolescence suicide related to overuse of tech and etc, where as the technical difficulties that were faced was lack of comprehension on the data, the data was in mixed format with some fewer insights.

Limitations may be introduced by the selection of statistical techniques, models, and analytical methods. The chosen models' or statistical tests' underlying presumptions might not accurately reflect the complexity of suicide data. Different outcomes might be obtained with different methodologies or different approaches.

Readings of the models are not that accurate due to the object type and the data was pickled to fit in the model but at the end of the day if we tamper the data its not the original dataset that we are working on and the results are bit not straight, It's likely that some of the people in this dataset committed suicide during the research period, which might have influenced the studies that determined the risk of committing multiple acts of self-harm by hanging and drowning. In one study, for instance, men were shown to have reduced probabilities of returning to the hospital for repeated attempts at hanging and drowning compared to women. It is likely that women were.

It is also plausible that males were as, if not more, likely than women to participate in multiple episodes of hanging and drowning self-harm, but this study did not account for those episodes of self-harm that eventually led to completed suicide. Men were more likely than women to engage in recurrent self-harm attempts, Whereas the authorities of the data collection in Indian they don’t collect the data.

I did encounter some errors that were not solvable initially and took most of my time in debugging sorting out the data was very challenging as the data was in vertical sorted format. Some errors I faced in Encoding the feature variables and One hot encoding as the all the variables that were available in the dataset was in the data type object as usual parsing the object into actual string values or integer and int64.

Then we faced some issues while we generated a valued vector to parse into the model of regression as the size of 1.8 mb as the free available RAM in google colab is until 12gb and due to the size of the dataset and the dataset couldn’t be sub set-ed for the reason for a generalization of the results, so we ran out of the RAM space twice and our code due to complex calculation in the hyperparameters, it crashed, Further the problems were with feature tuning, “One Hot encoder has no attribute get\_features.” We oversaw this error by manually retrieving the features names after the executing one-hot encoding.

Lastly, we faced some issues because the dataset missed many important virtues, such as the variables that made under the category of type are poorly recorded, there are more factors that have influenced the suicide in the country other than mentioned factors, there might be another reasons recorded in the suicide notes of the victims or the patient notes of the survivor, a major readings where lynching and paid killings. For example, the readings show the state of Maharashtra has many suicides in fact the readings might have been miscalculated many reports from the other suicides with low media coverage. In depth detail of the actual dates were also missing in the data and which was hinderance with the time series analysis.

5.2 **Future Research & Conclusion**

Self-harming and the suicides are growing concern around in the public health sectors in Ireland. Multiple subsets of the population are involved in the hanging of oneself and taking away their lives whereas the ideas of killing self by consuming lethal intoxicants can be an area of major areas need prevention as in the adolescent, so prevention strategies around this should be prepared and that can be multifaced and addressing the imminent risk factors across the lifespan of the. As the individual who self-harm by hanging and consumption of insecticides and pesticides. As the individuals who self-harm should be a priority for suicide prevention strategies. Addressing the many determinants of these highly lethal methods, self-harm should be categorized suicide prevention should strategies.

Ethical approval for the Open Government of India has been granted by the national research ethics committee of the Faculty of Indian government, this study has been performed in accordance with the ethical standards laid down in recent years.

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