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SUMY STATE UNIVERSITY
FACULTY OF ELECTRONICS AND INFORMATION TECHNOLOGY
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MASTER GRADUATION THESIS

INFORMATION TECHNOLOGY FOR SUICIDOLOGICAL DATA MINING

Applicant gr. IH.m-12ан — Hojo Olajide Joshua

Supervisor,
Associate Professor, PhD — Igor SHELEHOV

Head of the department
Associate Professor, PhD — Igor SHELEHOV

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THE TASK
OF A MASTER GRADUATION THESIS FOR APPLICANT

Hojo Olajide Joshua

1. Topic *Information Technology for Suicidological Data Mining*
approved by order of the Sumy State University from«___» _____ 20 ___ . № _____
2. Deadline for submission of master graduation thesis by the applicant_____
3. Input data for the master graduation thesis_____
4. Content of the master graduation thesis (list of issues to be developed)
1. Introduction; 2) Information Review; 3) Objective of the Study; 4) Research Methodology; 5) Infoware and Software.
5. List of graphic material (with exact indication of mandatory drawings)_____
6. Consultants for the master graduation thesis, indicating the chapter of the project that concern them

Chapter	Consultant	Signature, date	
		Consultant	Applicant

7. The date of issue of the task «___» _____ 20 ___ p. Supervisor_____

Applicant _____

CALENDAR PLAN

№	Name of the stages of the diploma project (work)	Deadline	Note
1	*Information Review and Objective of the Study*		
2	*Research Methodology*		
3	*Infoware and software*		
4	*Completion of a master graduation thesis*		

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ABSTRACT

Note: 50 pages, 16 figures, 9 tables,1 appendix, 20 reference sources.

The object of study – Process of Suicidological Data Mining

Purpose – design and implementation of the Information Technology for Suicidological Data Mining

Results – A complex of methods and algorithms for defining the top causes of suicide among adult, gender-based, age-based, mental health based suicide was proposed. Program implementation was done by Python Programming Language. Data sets from 1987 to 2014 were analyzed.

DATA MINING, PYTHON PROGRAMMING LANGUAGE, GENDER-BASED, AGE-BASED, MENTAL HEALTH BASED SUICIDE

TABLE OF CONTENTS

INTRODUCTION

Suicide was defined as a death brought on by intentionally harming oneself by the Centre for Disease Control 2012. A suicide attempt is when someone causes harm to themselves with the goal of taking their own life but does not actually do so. Suicide, according to the Merriam-Webster dictionary, is defined as the deliberate and voluntary taking of one's own life. Additionally, some academics have argued that suicide is an act of intentionally causing one's death.[1]

The intentional act of causing one's own death is known as suicide. Risk factors include physical illnesses like chronic fatigue syndrome, alcoholism, and substance misuse such as the use of and withdrawal from benzodiazepines as well as mental problems like schizophrenia, bipolar disorder, depression, and anxiety disorders. Some suicides are impulsive acts brought on by stress, such as pressures from work or school, relationship issues, such as breakups or divorces, or bullying and harassment. Those who have attempted suicide in the past are more likely to do so again. Effective suicide prevention techniques include limiting access to instruments of suicide like guns, pills, and poisons, treating mental illnesses and substance abuse, keeping an eye on media coverage of suicide, and improving economic conditions.[2]

Suicide has an impact on the health and happiness of friends, family, coworkers, and the community as a whole. When someone commits suicide, their surviving loved ones and friends may feel shocked, angry, guilty, depressive or anxious symptoms, or even suicidal thoughts.

Suicide costs society a lot of money as well. In terms of medical expenses, lost productivity, the value of statistical life and quality of life expenditures, suicide, and nonfatal self-harm cost the country almost $490 billion in 2019.[3]

Between 1999 and 2004, suicides exceeded killings nationwide by almost two to one. During the same years, the Commonwealth of Kentucky's suicide rate averaged 18% higher than the national rate, and in 2005, suicides outweighed homicides by a ratio of almost three to one. Even though suicides devastate families and communities, the public

rarely hears about these events. The media is understandably reluctant to report suicide, both out of respect for the family grieving a loss that is still widely regarded as disgraceful and out of fear of copycatting.

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The public's lack of knowledge is a drawback to the media's perspective on suicide. The CDC reports that suicide rates vary by age, gender, race, and ethnicity. The highest rates of suicide are among men who identify as American Indian or Alaska Native, followed by non-Hispanic White men.

The suicide death rate among preteens and younger teens has increased over time, albeit still being lower than that of older adolescents and adults. Suicide is currently the second-leading cause of death for kids between the ages of 10 and 14. A study found that the suicide death rate among Black children under the age of 12 was higher than that of White children.

In addition to the 703 000 suicides per year, many more people make suicide attempts. Every suicide is a tragedy that has a profound impact on the surprofoundly impactsmilies, communities, and entire nations. Suicide occurs at any age and was the fourth biggest cause of death worldwide for people aged 15 to 29 in 2019.

Suicide is a global epidemic that affects all parts of the world, not only high-income nations. In reality, in low- and middle-income nations, suicide rates rose to over 77% in 2019. Suicide is a significant public health issue, yet it can be avoided with prompt, evidence-based, and frequently inexpensive interventions. A thorough multi-sectorial suicide prevention strategy is necessary for effective national responses.

1 INFORMATION REVIEW

Suicide is a tragedy that has a lasting impact on those left behind and impacts families, communities, and even nations. Suicide happens at any age and was the fourth biggest cause of death worldwide for people between the ages of 15 and 29 in 2019. (WHO 2021). The World Health Organization (WHO) reports that there were 7,019 suicide deaths documented as of 2019—5,110 men and 1,909 women. Suicide is a severe public health issue. Additionally, 88% of adolescent suicides happened in low- and middle-income nations, while 58% of suicides worldwide occurred before the age of 50. (Vanguard news Nigeria, 2021). Between 2000 and 2018, there was a 30% spike in suicide rates, which then fell in 2019 and 2020. There were 45,979 suicides in the United States in 2020. Even more people contemplate suicide or make an attempt at it. According to estimates, 12.2 million American people considered suicide seriously in 2020, 3.2 million made plans to commit suicide, and 1.2 million actually succeeded in doing so.

The rate of male suicide is roughly four times higher than that of female suicide, according to a 2008 study that used 2005 NVDRS data from 16 states. Intimate relationship problems (IPPs) were identified as a contributing factor in 26% of suicides among women and 33% of suicides among men. Given the high rate of male suicides, the existence of possibly behaviourally changeable environmental factors, and the requirement for preventative initiatives, Gender-specific efforts may not effectively target men under current practices.

Suicide ideation is a mental and behavioural experience that generates serious concerns because they trigger suicide attempts in those who experience them. The researcher noticed paucity in the awareness and perception of suicides in both males and females, hence, this has prompted the researcher to conduct a study on the awareness and perception of suicidal attempts in some European countries.

1.1 Framework for the study

Suicide is still a very complicated phenomenon that involves interactions between elements at various levels of analysis, including the systemic level (access to suicide means like post-war firearms and ammunition), the societal level (socio-economic determinants of mental health), the community level (support from the community, family, and peer-group), and the individual level (sex, age, medical and biological determinants). Despite this, there hasn't been much thorough epidemiological research done on the population-wide study of suicide in Croatia in the twenty-first century that would take these various aspects into consideration.

This chapter will attempt to critically evaluate the beliefs, viewpoints, and impressions of earlier researchers on suicide from various countries around the world. There isn't a single definition of suicide that is regarded as correct. However, it can be summed up as purposeful self-immolation. In their definition from 2020, Pridmore state that suicide is "the conscious act of self-induced annihilation, best characterized as the multi-dimensional malaise in a needy individual who defines an issue for which the suicide act is viewed as the best remedy." Suicide is not an arbitrary or senseless act; rather, suicide is a solution to a problem. In the entire world, suicide is a substantial cause of death. "A self-inflicted death" is defined as "an intentional, direct, and conscious effort to end one’s life”

Approximately 1.4% of people die by suicide, a mortality rate of 11.6 per 100,000 persons per year (Rukundo *et al*., 2018)(Pajić & Orešković, 2022). Suicide resulted in 842,000 deaths in 2013 up from 712,000 deaths in 1990 (Hedegaard and Warner, 2021). Rates of suicide have increased by 60% from the 1960s to 2012, with these increases seen primarily in the developing world (Bould, Mars, Moran, Biddle and Gunnell, 2019). Globally, as of 2008/2009, suicide is the tenth leading cause of death. For every suicide that results in death there are between 10 and 40 attempted suicides (Ueda, Nordström and Matsubayashi, 2021).

Suicide rates differ significantly between countries and over time. As a percentage of deaths in 2008 it was: Africa 0.5%, South-East Asia 1.9%, Americas 1.2% and Europe 1.4% (Hedegaard and Warner, 2021). Rates per 100,000 were: Australia 8.6, Canada 11.1, China 12.7, India 23.2, United Kingdom 7.6, United States 11.4 and South Korea 28.9 (Ueda *et al*., 2021). It was ranked as the 10th leading cause of death in the United States in 2016 with about 45,000 cases that year. Rates have increased in the United States in the last few years, with the highest value being in 2017 (Hedegaard and Warner, 2021). In the United States, about 650,000 people are seen in emergency departments yearly due to attempting suicide. The United States rate among men in their 50s rose by nearly half in the decade 1999–2010 (Ueda *et al*., 2021). Greenland, Lithuania, Japan, and Hungary have the highest rates of suicide. Around 75% of suicides occur in the developing world (Bould *et al*., 2019). The countries with the greatest absolute numbers of suicides are China and India, partly due to their large population size, accounting for over half the total. In China, suicide is the 5th leading cause of death (Ueda *et al*., 2021).

Comprehensive school-based programs have shown some success in reducing suicide rates. Screening programs, support and skills training groups and school based crisis response teams can create a coordinated effort that identifies youth at risk for suicide and provides individual follow-up in developed nations (Black, Scott, Baker-Young, Thompson, McGarry, Hayden-Evans and Milbourn, 2021). If done appropriately, these interventions can provide the skills that allow young people to cope effectively with their life stresses (Arensman, Scott, De Leo and Pirkis, 2020).

The present study aims to look at the level of awareness and perception towards suicidal attempts among adolescents in selected secondary schools in Ibadan, Oyo state. Suicide is a very complex act. It is not merely a simple, isolated, incidental act of compulsion. It is a death in which the murderer and the murdered are combined into one person (Black *et al*., 2021). Since 1999, there has been a dramatic upsurge in suicide deaths.

Suicide deaths climbed for everyone in the US between 1999 and 2014, with the exception of African-American men, according to a 2016 research from the Centers for Disease Control and Prevention. They rose across all age and racial categories. The surge in suicide among middle-aged white women, a population not often thought to be at high risk, surprised experts the most. Suicide is difficult to understand. Risk factors and motivational theories have both been studied by researchers. For doctors and organizations that place a strong emphasis on intervention and prevention, they have created taxonomies and typologies that are getting more and more sophisticated.(Meyer et al., 2017)

1.2 History of suicide

Focusing on culture, religion, and science has helped historians explain how views and practices around suicide have changed over time. The historical focus will be on North American peoples of Native American, European, and African descent in the early modern and modern eras, for the trends established there, because this book is comprised of our study of contemporary, mid-western Americans, examined with other contemporary studies from the western world. Few publications on suicide give a significant analysis to changes in suicide practices, techniques, and motivations. The majority of books on suicide provide just a minimum historical description of the time from the ancient world to the present, mainly focusing on legal, religious, and medical developments.(Meyer et al., 2017)

Since Hippocrates in 460–377 BC, the diagnosis and treatment of suicide and mood disorders have advanced significantly. The diagnostic and therapeutic procedures, particularly the terminology, have been steadily developed via a lengthy history of studies on mood disorders. However, questions surrounding diagnosis and treatment still exist. The diagnosis and treatment of mood disorders and suicide in large part falls short of expectations. Despite the existence of contemporary, helpful diagnostic techniques, no focused therapy medication is 100% effective.

Scholars have been able to analyze suicide statistically since the Protestant Reformation and the advent of literacy, not only anecdotally. Parish and county records were first kept in England, and the country begin to take interest in suicide.

Suicide became more prevalent across the nation (MacDonald & Murphy, 1990). With the 1774 release of Goethe's The Sorrows of Young Werther, the suicide note also started to gain some notoriety. The novel's protagonist, a sensitive and driven artist, gave his sweetheart a farewell message that became an example for others (Minois, 1999). In the contemporary era, suicide became a topic of scientific study. The dissemination of suicide-related concepts in literature, art, media, academic journals, public records, and victim's notes across the past.

Suicide came to be regarded as a sin in Christian Europe and was condemned at the Council of Arles (452) as the work of the Devil (Merrick, 2021). In the middle Ages, the Church had drawn-out discussions as to when the desire for martyrdom was suicidal, as in the case of martyrs of Córdoba. Despite these disputes and occasional official rulings, Catholic doctrine was not entirely settled on the subject of suicide until the later 17th century (Pridmore, 2018). A criminal ordinance issued by Louis XIV of France in 1670 was extremely severe, even for the times: the dead person's body was drawn through the streets, face down, and then hung or thrown on a garbage heap. Additionally, all of the person's property was confiscated (Miller and Black, 2020). Attitudes towards suicide slowly began to shift during the Renaissance. John Donne's work *Biathanatos* contained one of the first modern defenses of suicide, bringing proof from the conduct of Biblical figures, such as Jesus, Samson and Saul, and presenting arguments on grounds of reason and nature to sanction suicide in certain circumstances.

For the sake of social knowledge, reports of human suicide date back more than 3000 years. Suicide was frowned upon and prohibited in ancient Greece, Egypt, and Rome. The bodies of the victims will be dumped in the wild and given to animals. The first time it was recognized as a human ailment was in the UK in 1642. Many social

reforms have started as a result of society's increasing realization that social injustice and poverty are what lead people to commit suicide.(Lu et al., 2020)

Jesuit priests who lived among the Native Americans in the Great Lakes region, Maine, and eastern Canada produced the first reports of suicide in North America. A Huron chief named Soranhes passed away in 1636, and Father Le Jeune noted his passing, grieved by the fact that he did so "miserably" and without conversion. Indian youngsters would threaten suicide, according to Pierre de Charlevoix, who preached to the Miami and Potawatomie Indians, if they were scolded in a way that violated their dignity or made them feel inferior. He believed that females in particular were driven mostly by retaliation against their moms because they were unable to take their mother's correction. He did not, however, provide any particular instances of real suicides within that community suicide threats or attempts. It is challenging to determine whether the Native people of Michigan had a suicide problem because threatening or trying to commit suicide is not the same as actually doing it (as will be discussed later). But in Maine, the number of suicides was alarmingly high to Catholic observers. Grief, dishonor, unrequited love or bad marriages did result in suicide. Among the Micmac, Jesuits witnessed what they thought was a suicide epidemic. In 1691, 50 years after colonization, Le Clerq wrote about the terrible spate of suicides in his mission. The eastern seaboard, according to other accounts, saw frequent suicides among both Algonquian and Iroquoian people. Le Clerq attributed their motivation for suicide to “affronts,” especially those which “tarnished their honor and reputation” (Axtell, 1981, pp. 214–215). Like the Indians of Michigan, the Micmac used both poisonous herbs and strangulation to kill themselves. He described their melancholy as “so black and so profound that they become immersed wholly in a cruel despair” (p. 215). The priest espoused some sympathy for those who lost their true loves, but ultimately saw their deaths as examples of an impoverished, non-Christian culture. Nevertheless, his list of reasons for Micmac suicides resembles our own: humiliation from which there was no recovery, lost love, revenge, and grief. The Jesuits were learned men, and their taxonomies reflected both old religious categories and newer scientific ones.

They were, though, oblivious to a degree about the many traumas that colonization inflicted on the Native people, such as the dramatic decline of their population from disease, the upending of gender roles, and the disruption to domestic life and the community caused by the fur trade. All of these situational elements could have been sources of severe depression (Pelletier, 1980). Ethnographer Fenton found that among the Iroquois, who like the Micmac were enmeshed in the fur trade, social disruption more than economic factors played the largest role in suicide (Fenton, 1986). In many ways, what the Jesuits observed conforms to a theory advanced by modern scholars about relationship-related suicides and the concept of reciprocity.(Meyer et al., 2017)

By the 19th century, the act of suicide had shifted from being viewed as caused by sin to being caused by insanity in Europe (Merrick, 2021). Although suicide remained illegal during this period, it increasingly became the target of satirical comments, such as the Gilbert and Sullivan comic opera *The Mikado*, which satirized the idea of executing someone who had already killed himself. By 1879, English law began to distinguish between suicide and homicide, although suicide still resulted in forfeiture of estate (Creţu, 2022). In 1882, the deceased were permitted daylight burial in England and by the middle of the 20th century, suicide had become legal in much of the Western world (Dine, 2020). The term suicide first emerged shortly before 1700 to replace expressions on self-death which were often characterized as a form of self-murder in the West (Sethi, 2019).

1.3 Suicide Ideation

Suicidal thoughts include the desire to take one's own life. The word "suicidal thoughts" has no established definition in the medical profession, nonetheless.

Suicidal ideation, often known as suicidal thoughts, refers to having thoughts about perhaps taking one's own life. Although it is not a diagnosis, it is a symptom of various mental disorders and can also happen as a result of negative experiences without a mental disease being present.

Suicidal ideation can range from passing ideas to meticulous planning, according to suicide risk scales. The concept of not wanting to live or fantasizing about dying is known as passive suicidal ideation. Suicidal thoughts that is actively contemplating suicide or making a death plan.

According to a reliable source, suicidal ideation entails actively planning suicide, although suicidal thoughts do not always signal that a person intends to take their own life.

Others, however, differentiate planning from ideation and think that both are equivalent to suicide thoughts.

Though most people who have suicidal thoughts do not actually attempt suicide, having suicidal thoughts is nevertheless seen as a risk factor. According to estimates, 8.3 million American people (18 and older), or 3.7% of the adult population, reported having suicidal thoughts the year before, while another 2.2 million said they had made preparations to commit themselves. In 2019, 12 million adult U.S. citizens had suicidal thoughts, 3.5 million had plans to commit suicide, 1.4 million made an attempt, and more than 47,500 people died by suicide. Teenagers frequently have ideas of harming themselves.

Suicidal thoughts are frequent. 12.2 million Trusted Source Americans admitted to having thought about suicide in the past year. 10% of them made an attempt at suicide. Suicide can be avoided, nevertheless, with support and care.

Suicidal ideation is covered in this article, along with its signs, causes, treatment, diagnosis, and prevention. It also outlines how to receive assistance.

A person who is thinking about or planning suicide may show changes in their speech, feelings, and behavior. They may start to talk about:

- their feelings of guilt or shame
- being a burden to others
- death

The person may feel:

- unbearable emotional pain
- extremely anxious and sad, full of rage, or agitated
- trapped, hopeless, empty, or that there is no reason to live
- severe fluctuations in mood or mood swings

Their behavior may also change. A person contemplating suicide may:

- withdraw from friends or family
- use alcohol or drugs more frequently
- sleep or eat more or less
- take dangerous risks
- research ways to die
- stockpile medications
- make a plan for their suicide
- purchase a gun
- make a will
- give away important possessions or money
- say goodbye

Not everyone who is thinking about suicide shows these warning signs. Sometimes, the signs may be subtle.

In one study, suicidal thinking was found to be related to greater loneliness (Martin, Rozanes, Pearce & Allison, 1995). In that study, as in many studies, depression was the strongest factor to emerge in the regression analyses. In fact, in one study, when the effect of depression was removed, the relationships between suicidal ideation and other correlates weakened or disappeared (De Man, 1999). In longitudinal studies, depression has been found to be the most frequent predictor of subsequent suicidal ideation and attempts, with suicidal ideation and attempts, in turn, being predictors of subsequent depression.

Studies have shown that adolescent in Africa have that feelings of low self-worth, school difficulties, feelings of separation anxiety and inability to solve problems were all

causes for attempted suicide (Rukundo, G. Z., Kemigisha, E., Ocan, M., Adriko, W., & Akena, D. H. (2018). Clearly adolescents are at high risk of attempting suicide and various factors would influence their level of suicide ideation before they would carry out an attempt. Coping strategies may be one such of these factors. When adolescents do not cope effectively, depression may manifest and could lead to suicide ideation. Families like all systems, attempt to maintain balance. When faced with a stressor, the family uses its capacities, Internal and external resources and coping skills, to meet demands, internal and external stressors (Berg-Cross, 2000). Ackerman (1984) says that adolescence is a common time for the onset of major mental illness. This is associated with the biological fragility of the adolescent combined with inevitable involvement with the family. The family may not be able to comprehend adolescent ways and the loss of "emotional headquarters" can lead to breakdown (Aca kerman, 1984). At this time the adolescent may feel isolated from the family as the family does not understand the situation that the adolescent finds him/herself in. Due to this lack of understanding, the adolescent loses the family as a support system and at this time either increases or decreases the intensity of involvement with the family. As Frydenburg (1997) points out, those adolescents who use fewer problems solving, less positive reappraisal, more cognitive avoidance and resigned, acceptance were more depressed and anxious. These adolescents would be more prone to suicide ideation. Kaplan *et al* (2000) include a history of depression, family disruption, abuse and alcohol, as some of the risk factors involved in suicide attempts. Parental conflicts, school difficulties and social isolation are some of the precipitating factors.

The risk factors for suicidal ideation can be divided into three categories: psychiatric disorders, life events, and family history.

1.3.1 Psychiatric disorders

Suicidal ideation is a symptom of many mental diseases and can develop as a reaction to traumatic life experiences without a mental condition being present.

Suicidal ideation appears to be associated with a number of several psych, and these conditions also significantly raise the likelihood of developing suicidal ideation. For

instance, a large number of people with borderline personality disorder have recurring suicide behavior and ideation. According to one study, an average of 3.4 attempts were made by people with borderline personality disorder, or 73% of them. The conditions that have been found to be the best indicators of suicidal ideation are listed below. These are not the only disorders that can make someone more likely to have suicidal thoughts. The following conditions have the highest risk of risk:

- Dysthymia
- Anxiety disorder
- Bipolar disorder
- Autism spectrum disorder
- Personality disorder
- Attention deficit hyperactivity disorder
- Gender disorder
- Conduct disorder
- Paranoia
- Schizophrenia
- Major depressive disorder

1.3.2 Medication side effects

Patients with moderate to severe clinical depression frequently take antidepressant prescriptions to relieve their symptoms. However, several studies suggest a link between antidepressant usage and suicidal thoughts and tendencies, which may increase some patients' risk of having suicidal thoughts.

Suicidal ideation is a potential side effect of some drugs, including selective serotonin re-uptake inhibitors (SSRIs). Additionally, the intended effects of these medications may have the unintended consequence of raising both the individual and societal rates of suicide behavior: A portion of those on the drug experience distress severe enough to wish to try suicide (or to desire the perceived outcomes of suicide), but are prevented from doing so by symptoms of depression, such as fatigue and lack of

motivation. Among this subset, a "sub-subset" may discover that the drug relieves their secondary psychological symptoms, such as a lack of motivation, before or at lower doses than it relieves their primary psychological symptom of sad mood. In this group of people, the desire for suicide or its effects endures even after significant barriers to suicide are removed, leading to an increase in the incidence of suicide and suicide attempts.

1.3.3 Life Events

Events in life have a substantial correlation with an increased likelihood of having suicidal thoughts. Furthermore, the aforementioned psychiatric diseases can co-occur or be caused by life circumstances, which can then be used to predict suicidal ideation. The list of events that raise risk can differ for adults and children because of the differences in the life experiences that adults and children experience. The incidents in life that have been demonstrated to significantly raise risk include:

- Employment.
- Alcohol abuse.
- Chronic illness or pain.
- Major change in life standard e.g. relocation abroad.
- End of relationship or a romantic affair.
- Death of family members or friends.

1.4 Awareness of Suicidal attempts

Suicide awareness programs have become increasingly commonplace in high school curricula, yet controversy exists over their risks and benefits. Educating the general public about the importance of mental health is an essential preventative measure that needs to be taken by parents and school systems alike. Many people might not recognize symptoms of a mental health condition or might even mistake warning signs as a “normal” part of growing up (Bakian *et al*., 2021). This confusion and lack of information can make suicidal thoughts all the more dangerous, as teenagers and even adults might not know how to find help or that help is even an option. Many mental health conditions begin to

manifest during adolescence and young adulthood, which means that there is a need for them to be informed about the signs and symptoms that they might be experiencing or starting to experience.

Any age group can experience suicidal thoughts. But according to surveys and research, suicide thoughts are most common in adults between the ages of 18 and 26. According to the NIMH, one in ten people in that age range have had these ideas in the previous year. An ACHA survey conducted in February 2018 found that 2,000 UVA students had experienced significant suicidal thoughts in the previous year.

There are numerous factors that can contribute to suicidal thinking. People generally are not expected to determine whether or not these justifications are true. It is advised that they instead:

1) Listens intently.
2) Asks open-ended inquiries.
3) Gives the person a sense of hope and determines their motivation for receiving care.
4) Ensures their safety.

1.5 Suicidal Psychosis

In her 2015 meta-analysis, Chapman looked at two distinct populations of people: adults with mood disorders (11 studies reporting on 860 suicides) and adults with schizophrenia spectrum psychotic illnesses to see if expressing SI was associated with later suicides (14 studies reporting on 567 suicides). According to the findings of 14 research, those with schizophrenia spectrum psychosis who displayed SI had a suicide risk that was more than six times higher [OR 6.49, 95% CI 3.82-11.02]. In contrast, there was no correlation between expressing SI and suicide among patients with mental disorders (OR 1.49, 95% CI 0.92-2.42; 11 studies).

Data from 50 longitudinal studies that monitored people who had experienced psychotic symptoms were used in a different meta-analysis. These researchers made an effort to distinguish between the effects of both positive and negative psychotic symptoms

and their correlation with SI. The results demonstrated a weak association between SI and positive symptoms in psychosis (OR = 1.70, 95% CI 1.39-2.08; 50 studies). On the other hand, psychotic negative symptoms were discovered to be protective variables against suicide death and failed to demonstrate relevance with SI.

People who reported having at least one lifetime psychotic experience had double the odds of experiencing SI in the future (5 articles; n = 56,191; OR 2.39, 95% CI, 1.62-3.51), triple the odds of a future suicide attempt (8 articles; n = 66,967; OR = 3.15, 95% CI, 2.23-4.45), and four times the odds of further psychotic experiences (n > 84.000 representing 12 samples from 23 countries). The scientists came to the conclusion that these higher risks went beyond what co-occurring psychopathology could account for advising that everyone with a history of psychotic experiences should be investigated for SI by healthcare specialists. These findings highlight the significance of psychosis as a risk factor for SI and suicidal behavior for healthcare professionals.

1.6 Suicide Prevention

The most effective means of preventing suicidal ideation and suicide attempts are early detection and therapy. Early identification of risk factors, symptoms, or indicators may encourage the person to seek help before making an attempt at suicide. 91% of those who did commit suicide were likely to have one or more mental diseases, according to a study of those who did so. Only 35% of those people, however, had received or were receiving treatment for a mental disorder. This highlights the need of early diagnosis; if a mental condition is found, it can be treated and managed to help prevent suicide attempts. Another study focused solely on adolescent suicide ideation. Sometimes family members or friends may notice a person has signs of having suicidal thoughts. When this happens, people are advised to:

- Increasing the amount of early-stage therapy available
- increasing public awareness of when receiving psychiatric assistance might be beneficial for them

- talking calmly with them in private and expressing care
- taking what they say seriously and assuring them that their life matters
- removing dangerous objects, such as guns and drugs, from their reach
- calling for help and staying with them until help arrives
- following up with them after the crisis is over

1.7 The Interpersonal Theory of Suicide

The interpersonal theory of suicide attempts to explain why individuals engage in suicidal behavior and to identify individuals who are at risk. It was developed by Thomas Joiner and is outlined in "Why People Die by Suicide" (Han, Batterham, Calear, and Ma 2018). The theory consists of three components that together lead to suicide attempts. According to the theory, the simultaneous presence of thwarted belongingness and perceived burdensomeness produce the desire for suicide. While the desire for suicide is necessary, it alone will not result in death by suicide. Rather, Joiner asserts that one must also have acquired capability (that is, the acquired ability) to overcome one's natural fear of death (Pelton, Crawford, Robertson, Rodgers, Baron-Cohen and Cassidy, 2020). A number of risk factors have been linked to suicidal behavior, and there are many theories of suicide that integrate these established risk factors, but few are capable of explaining all of the phenomena associated with suicidal behavior as the interpersonal theory of suicide does. Another strength of this theory lies in its ability to be tested empirically. It is constructed in a way that allows for falsifiability. A number of studies have found at least partial support for the interpersonal theory of suicide (Forkmann, Glaesmer, Paashaus, Rath, Schönfelder, Stengler and Teismann, 2020). Specifically, a systematic review of 66 studies using the interpersonal theory of suicide found that the effect of perceived burdensomeness on suicide ideation was the most tested and supported relationship. The theory's other predictions, particularly in terms of critical interaction effects, are less strongly supported.

1.8 The Interactive Nature of the Theory

Thus far each component of the theory has been described in isolation, providing evidence for the independent effects of perceived burdensomeness, failed belongingness, and acquired capability on levels of suicide. We have not yet explored the interactive nature of the theory, which posits a three-way interaction between these components. Particularly, the theory suggests that the *joint* occurrence of perceived burdensomeness and failed belongingness is sufficient to produce the desire to die, and that this desire translates into lethal or near-lethal behavior *only* in the presence of the acquired capacity for lethality (Pelton *et al*., 2020). The interpersonal-psychological theory is promising, with a growing empirical base to support it. The theory suggests that clinicians be cognizant of their patients' levels of belongingness, burdensomeness, and acquired capability (especially previous suicide attempts), as this knowledge may aid clinicians in the task of suicide risk assessment and of targeting therapeutics (Forkmann *et al*., 2020).

1.9 Conceptual Framework

The interpersonal theory of suicidal behavior (Joiner, 2005; Van Orden et al., 2010) proposes that suicidal behavior takes place when an individual has both the desire for suicide, which results from thwarted belongingness and perceived burdensomeness, and an acquired capacity to enact lethal self-injury. One conceptualization for a desire for suicide is suicidal ideation (Van Orden, Cukrowicz, Witte, & Joiner, 2012). Thwarted belongingness is a sense of feeling disconnected or alienated from others while burdensomeness reflects a perception that one is a burden on others; a person's sense of burdensomeness may be reflected in feelings that one's death will be worth more than one's life to family, friends, or society (Joiner et al., 2009). The third component, the

acquired capacity for suicide, is described as fearlessness about physical pain and death itself, acquired through risky behaviors or painful and provocative experiences that habituate a person toward self-injury and suicidal behaviors. Suicide risk factors, such as major depressive disorder and family history of suicide, are hypothesized to be associated with suicidal thoughts when they involve feelings of thwarted belongingness and perceived burdensomeness, and, if further combined with acquired capacity, may lead to suicidal behavior (Van Orden et al., 2010). Social connectedness is a key aspect of thwarted belongingness (Van Orden et al., 2010). In a nationally representative sample of 12,118 adolescents, Resnick and colleagues (1997) found that greater levels of family and school connectedness were both negatively associated with suicidal ideation/attempts. In a study of psychiatrically hospitalized adolescents, improvements in family connectedness following hospitalization were associated with less severe suicidal ideation during the entire year following hospitalization; however, this protective effect extended only to adolescents without histories of multiple suicide attempts (Czyz *et al*., 2012). In the same study, adolescents reporting greater post-hospitalization peer connectedness were half as likely to attempt suicide during the 12-month follow-up period.

The association between connectedness and suicide-related outcomes has received more research attention, much less is known about perceived burdensomeness, the second component of the theory. The few existing studies that examined perceived burdensomeness have shown that it is associated with higher suicide risk. In a study of suicide notes, the notes of those who died by suicide were found to contain more perceived burdensomeness compared to the notes of those who survived their suicide attempts (Joiner *et al*., 2002). In a study involving adult outpatients, perceived burdensomeness was also associated with current suicidal ideation and past number of suicide attempts; importantly, this effect was significant even after controlling for hopelessness (Van Orden, Lynam, Hollar, & Joiner, 2006). Little is known, however, about the impact of burdensomeness on adolescent suicidal ideation and behaviour. Different authors found that higher scores on a psychotherapist-rated scale of expendability, or a sense of being

unwanted and/or a burden on their families, differentiated adolescents with suicidal ideation or history of attempts from other adolescents. After careful review of journals relating to suicide among teenagers and adolescents, it was discovered that; in line with the theory, low family connectedness (thwarted belongingness) combined with a high sense of perceived burdensomeness was significantly associated with more severe suicidal ideation in these adolescents. These results provide evidence that the simultaneous presence of low family connectedness and high burdensomeness predicted suicidal ideation above and beyond what the two components could predict individually. Explained another way, when perceived burdensomeness was high, lower levels of family connectedness were associated with more severe suicidal ideation. Adolescents and teenagers feel alone and disconnected at that stage of life, they feel no one understands them or what they are going through. These feelings of thwarted belongingness and perceived burdensomeness triggers suicide ideation in most teenagers and adolescents which validates the theory of interpersonal theory of suicidal behavior.

1.10 Objective of the study

This study's main goal is to learn how some factors contribute to and affect the rate of suicide. In this research univariate analysis, multivariate analysis, and bi-variate analysis will be calculated and inferences are drawn from the result to be able to tell the factors that contribute more or less to the rate of suicide between the two genders. The precise goals are to:

- To determine the factor that has the highest influence on the rate of suicide between both males and females using the data set provided over a period of time across some European countries.
- To be able to use the results gotten from the dataset to predict what the suicide rate might possibly be in the nearest future.
- To also ascertain the variable that has the least effect on the rate of suicide between males and females.

1.11 Research questions

1. Which year has the most suicides?
2. Which year has the least suicides?
3. Which country has the most suicides?
4. Are certain age groups more inclined to suicide?
5. What is the relationship between gender and the number of suicides?

1.12 Significance of the study

The threat of suicide has spread throughout the world, and it now poses a serious emotional risk to the affected families, communities, and entire countries. Therefore, it is hoped that this research will contribute to raising awareness about the things that lead to teenage suicide attempts and ideas. Finding out how different teenagers see suicide would also be useful. The study may also reveal elements that contribute to suicidal attempts and how to avoid them.

1.13 Scope of the study

This study focuses on the statistical inferences that can be generated from the data set used for this research such as how some qualitative and quantitative variables relate to one another. For example how the population of a country might affect the rate of suicides in that particular country. For this research variables such as age, income, and size of the population will be used to predict the suicidal rates in those countries.

2 RESEARCH METHODOLOGY

2.1. Research Design

The goal of data analysis, according to Brink (1999), is to condense and synthesize information so that it makes sense and permits inference about a population. The goal of interpretation, on the other hand, is to combine the outcomes of data analysis with value statements, criteria, and standards in order to arrive at conclusions, judgments, and recommendations. This chapter discusses the techniques used to process the results as well as the techniques used to analyze and interpret the outcomes. The research design is first described. The population, sample, and sampling techniques are then mentioned. The chapter also describes the procedures for gathering data and the strategy for doing so. Finally, topics relating to reliability, validity, and bias are covered.(Langkos, 2014)

The study employed quantitative and non – experimental design. The study was designed to assess the various factors and variables that contribute to the rate of suicide across some European counties all over the world. The methodology explains the population sample instruments used for collecting data and analysis of data collected.

2.2 Research Approach

For the aims of this investigation, an inductive research methodology was used. This method starts with specific observations, which are then used to develop broader theories and draw research-based conclusions. The inductive approach was chosen because it is most suitable for large samples that yield qualitative data and takes into account the context in which research is being conducted

2.3 Population and Sample Size

The population of the study comprises of dataset of different variables such as population, age-range, income per gdp etc that were collected over a period of years across different countries. This dataset clearly shows the difference in the number of suicides

been committed by both genders across different age range and the effects some other variables or factors have on the rate of suicides.

2.4 Method of Data Analysis

The dataset used for this project was analyzed using Python programming language. All the calculations were done with these program and some other packages such as Pandas and Numpy.[4-7]

All graphs and heat maps are plotted with Matplotlib and Seaborn packages. This research work was done with the following analysis

- Univariate Analysis: This is the one off the easy to use form of statistical analysis. Like other types of statistics, univariate analysis can be inferential or descriptive. The main definition is that only one variable is in univariate analysis. The options used in analyzing the univariate analysis of this research are as follows:
    - Box plot
    - Histogram
    - Frequency distribution tables
    - Bar plot
- Bivariate analysis: This means the analysis of bivariate data. It is used to find out if there is a relationship between two sets of values. It usually involves the variables *X* and *Y*. The result generated from bivariate analysis can be stored in a two-column data table. For example, the relationship between no of suicide and income can be looked at using no of suicide as the independent variable *X*-axis and income as the dependent variable *Y*-axis. The following options can be used to analysis bivariate analysis
    - Scatter plots
    - Regression Analysis
    - Regression analysis can be calculate using the below formular;

$$Y = a + bX + €$$

where;

- Y is the dependent variable.
- X is the independent (explanatory) variable.
- b is the slope.
- a is the intercept.
- $€$ is the residual error.

The intercept a and slope b can be calculated using the formula below

$$a = (\Sigma y)(\Sigma x^2) - (\Sigma x)(\Sigma xy) / n(\Sigma x^2) - (\Sigma x)^2$$

$$b = n(\Sigma xy) - (\Sigma x)(\Sigma y) / n(\Sigma x^2) - (\Sigma x)^2$$

- Correlation co-efficient A statistical concept known as the correlation coefficient aids in establishing a relationship between expected and actual values gained through statistical experimentation. The estimated correlation coefficient's value explains how well the expected and actual values match. The covariance of two variables divided by the product of their standard deviation gives Pearson's co-efficient correlation. This is usually represented by ρ(rho)

$$\rho(X,Y) = \text{cov}(X,Y) / \sigma X \, \sigma Y.$$

where;

- cov is the covariance.
- σX is the standard deviation of X
- σY is the standard deviation of Y.

- Multi-variate Analysis: is defined as a process of involving multiple dependent variables resulting in one outcome. This explains that the majority of the problems in the real world are Multivariate. Many businesses, including the healthcare

industry, frequently use multivariate analysis. A group of data scientists made a forecast for the latest COVID-19 event, estimating that by the end of July 2020, Delhi would have more than 5 lakh COVID-19 patients. This analysis was based on a number of factors, including governmental decisions, citizen behavior, population, occupation, public transportation, healthcare services, and general community immunity.

Multivariate analysis is a Statistical procedure for analysis of data involving more than one type of measurement or observation. It can also be describe as a procedure for solving problems where more than one dependent variable is analyzed simultaneously with other variables.

The following options are used in this research to analyze the multivariate data

- Variance
- Covariance

3 IMPLEMENTATION

3.1 Description of Program

Python is a popular computer programming language used to create software and websites, automate processes, and analyze data. Python is a general-purpose language, which means it may be used to make many various types of applications and isn't tailored for any particular issues. Its adaptability and beginner-friendliness have elevated it to the top of the list of programming languages in use today.[5-8]

Python is frequently used for creating websites and applications, automating repetitive tasks, and analyzing and displaying data. Python has been used by many non-programmers, including accountants and scientists, for a variety of routine activities including managing finances since it is very simple to learn.[9-12]

Python is popular for Rapid Application Development and as a scripting or glue language to tie existing components together because of its high-level, built-in data structures, dynamic typing, and dynamic binding. Python is also used for server-side web development, software development, mathematics, and system scripting. Python's easy-to-learn syntax and emphasis on readability result in lower program maintenance costs. Additionally, Python's support for modules and packages makes it easier to reuse code and create modular programs. As an open source community language, Python is constantly being developed by multiple independent programmers.[12-14]

For backend web development, data analysis, artificial intelligence, and scientific computing, Python is excellent. Python is also used by programmers to create desktop applications, games, and productivity tools.[15-20]

3.2 Features and benefits of Program

Python can be used for all lots of operations. Few of those operations are listed below

- Has a straightforward syntax similar to that of English, allowing developers to use less lines than they would with other programming languages.
- Python is able to be handled in a functional, procedural, or object-oriented manner.

- The library and module repository for Python, which consists of collections of code written by third parties to enhance Python's functionality, is enormous and constantly expanding.
- A sizable and vibrant community supports Python, adds to its collection of modules and libraries, and serves as a valuable resource for other programmers. Because of the large support network, finding a solution to a coding problem is usually not too difficult because it is likely that someone else has already come into the same issue.
- It's user-friendly for beginners, making it popular among beginning programmers.
- It is simpler to read and understand because of its straightforward grammar, which mimics natural English. Project development and improvement are sped up as a result.
- Compatible with a wide range of operating systems, including Windows, Mac, Linux, Raspberry Pi, and others.

3.3 Uses of Program

Python can be used to do or perform a lot of operation. Some of those operations include

- Data analysis and machine learning.
- It can be used for software testing and prototyping.
- Performing complex mathematics.
- It can also be used for the development of production ready software.
- Building workflow that can be used in conjuction with software.
- Web development.
- Automation or scripting.

3.4 Program commands and results

Some of the commands or codes used for analysis in this project are listed below;

- The following commands were used for the importation of the necessary packages:

```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

```
import warnings
warnings.filterwarnings("ignore")
```

- The lines of codes were used to calculate the country with the year highest and lowest number of suicide.

```
data['suicides_no'] = data['suicides_no']
          mean_value=data['suicides_no'].mean()
          data['suicides_no']=data['suicides_no'].fillna(mean_value)

def find_minmax(x):
     #use the function 'idmin' to find the index of lowest suicide
    min_index = data[x].idxmin()
    #use the function 'idmax' to find the index of Highest suicide
    high_index = data[x].idxmax()

    high = pd.DataFrame(data.loc[high_index,:])
    low = pd.DataFrame(data.loc[min_index,:])

    #print the Year with high and low suicide
    print("Year Which Has Highest "+ x + " : ",data['year'][high_index])
    print("Year Which Has Lowest "+ x + "  : ",data['year'][min_index])
    return pd.concat([high,low],axis = 1)

find_minmax('suicides_no')
The year with the highest number of suicide is 1994
The year with the lowest number of suicide is 1987
```

Table 3.1 – Results

20996	9	
country	Russian Federation	Albania
year	1994	1987
sex	male	female
age	35-54 years	5-14 years
suicides_no	22338	0
population	19044200	311000
suicides/100k pop	117.3	0.0
country-year	Russian Federation1994	Albania1987
HDI for year	0.0	0.0
gdp_for_year ($)	395,077,301,248	2,156,624,900
gdp_per_capita ($)	2853	796
generation	Boomers	Generation

4 RESULTS AND DISCUSSION

4.1 Data description

Table 4.1 – Data Head

	country	year	sex	age	suicides_no	population
0	Albania	1987	male	15-24	21	312900
1	Albania	1987	male	35-54	16	308000
2	Albania	1987	female	15-24	14	289700
3	Albania	1987	male	75+	1	21800
4	Albania	1987	male	25-34	9	274300

	suicides/100k pop	country-year	HDI for year	gdp_for_year ($)
0	6.71	Albania1987	NaN	2,156,624,900
1	5.19	Albania1987	NaN	2,156,624,900
2	4.83	Albania1987	NaN	2,156,624,900
3	4.59	Albania1987	NaN	2,156,624,900
4	3.28	Albania1987	NaN	2,156,624,900

	gdp_per_capita ($)	generation
0	796	Generation X
1	796	Silent
2	796	Generation X
3	796	G.I. Generation
4	796	Boomers

Table 4.2 – Data Tail

	country	year	sex	age	suicides_no	population
27815	Uzbekistan	2014	female	35-54	107	3620833
27816	Uzbekistan	2014	female	75+	9	348465
27817	Uzbekistan	2014	male	5-14	60	2762158
27818	Uzbekistan	2014	female	5-14	44	2631600
27819	Uzbekistan	2014	female	55-74	21	1438935

	suicides/100k pop	country-year	HDI for year	gdp_for_year ($)
27815	2.96	Uzbekistan2014	0.675	63,067,077,179
27816	2.58	Uzbekistan2014	0.675	63,067,077,179
27817	2.17	Uzbekistan2014	0.675	63,067,077,179
27818	1.67	Uzbekistan2014	0.675	63,067,077,179
27819	1.46	Uzbekistan2014	0.675	63,067,077,179

	gdp_per_capita ($)	generation
27815	2309	Generation X
27816	2309	Silent
27817	2309	Generation X
27818	2309	Generation X
27819	2309	Boomers

Data Shape

The data contains 27820 rows and 12 columns

Length of Data

27820

Table 4.3 – Data information

	year	suicides_no	population	suicides/100k pop
count	27820	27820	2,78E+04	27820
mean	2001,258375	242,574407	1,84E+06	12,816097
std	8,469055	902,047917	3,91E+06	18,961511
min	1985	0	2,78E+02	0
25%	1995	3	9,75E+04	0,92
50%	2002	25	4,30E+05	5,99
75%	2008	131	1,49E+06	16,62
max	2016	22338	4,38E+07	224,97

	HDI for year	gdp_per_capita ($)
count	8364	27820
mean	0,776601	16866,46441
std	0,093367	18887,57647
min	0,483	251
25%	0,713	3447
50%	0,779	9372
75%	0,855	24874
max	0,944	126352

Table 4.4 – Check for missing value

country	0
year	0
sex	0
age	0
suicides_no	0
population	0
suicides/100k pop	0
country-year	0
HDI for year	1,95E+04
gdp_for_year ($)	0
gdp_per_capita ($)	0
generation	0
dtype:	int64

Table 4.5 – Check for missing value

country	0
year	0
sex	0
age	0
suicides_no	0
population	0
suicides/100k pop	0
country-year	0
HDI for year	0
gdp_for_year ($)	0
gdp_per_capita ($)	0
generation	0
dtype:	int64

4.2 Check for Data uniqueness

For Age: 15-24 years, 35-54 years, 75+ years, 25-34 years, 55-74 years, 5-14 years

For Country: Albania', 'Antigua and Barbuda', 'Argentina', 'Armenia', 'Aruba', Australia', 'Austria', 'Azerbaijan', 'Bahamas', 'Bahrain', Barbados', 'Belarus', 'Belgium', 'Belize', 'Bosnia and Herzegovina', 'Brazil', 'Bulgaria', 'Cape Verde', Canada', 'Chile', 'Colombia', 'Costa Rica', 'Croatia', 'Cuba', Cyprus', 'Czech Republic', 'Denmark', 'Dominica', 'Ecuador', El Salvador', 'Estonia', 'Fiji', 'Finland', 'France', 'Georgia', Germany', 'Greece', 'Grenada', 'Guatemala', 'Guyana', 'Hungary', Iceland', 'Ireland', 'Israel', 'Italy', 'Jamaica', 'Japan', Kazakhstan', 'Kiribati', 'Kuwait', 'Kyrgyzstan', 'Latvia', Lithuania', 'Luxembourg', 'Macau', 'Maldives', 'Malta', Mauritius', Mexico, Mongolia', 'Montenegro', 'Netherlands', New Zealand', 'Nicaragua', 'Norway', 'Oman', 'Panama', 'Paraguay', Philippines', 'Poland', 'Portugal', 'Puerto Rico', 'Qatar', Republic of Korea', 'Romania', 'Russian Federation', Saint Kitts and Nevis', 'Saint Lucia', Saint Vincent and Grenadines', 'San Marino', 'Serbia', Seychelles', 'Singapore', 'Slovakia', 'Slovenia', 'South Africa', Spain', 'Sri Lanka', 'Suriname', 'Sweden', 'Switzerland', Thailand', 'Trinidad and Tobago', 'Turkey, Turkmenistan', Ukraine', 'United Arab Emirates', 'United Kingdom, United States', 'Uruguay', 'Uzbekistan.

For Year: 1987, 1988, 1989, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 1985, 1986, 1990, 1991, 2012, 2013, 2014, 2015, 2011, 2016.

Table 4.6 – Missing Data correction

Total		Percent
country	0	0.0
year	0	0.0
sex	0	0.0
age	0	0.0
suicides_no	0	0.0
population	0	0.0
suicides/100k pop	0	0.0
country-year	0	0.0
HDI for year	0	0.0
gdp_for_year ($)	0	0.0
gdp_per_capita ($)	0	0.0
generation	0	0.0

4.3 Calculations and Plots

The calculations, tables, graphs, plots done in this project was done using several coding packages with Phyton.

Year Which Has Highest suicides_no : 1994

Year Which Has Lowest suicides_no : 1987

Table 4.7 – Descriptive view of the year with the highest suicide numbers

20996	9	
country	Russian Federation	Albania
year	1994	1987
sex	male	female
age	35-54 years	5-14 years
suicides_no	22338	0
population	19044200	311000
suicides/100k pop	117.3	0.0
country-year	Russian Federation1994	Albania1987
HDI for year	0.0	0.0
gdp_for_year ($)	395,077,301,248	2,156,624,900
gdp_per_capita ($)	2853	796
generation	Boomers	Generation

This table clearly shows the country with the highest and least number of suicides.

Country Which Has Highest suicides_no : Russian Federation

Country Which Has Lowest suicides_no : Albania

Table 4.8 – Descriptive view of the country with the highest numbers of suicide

	9	20996
country	Albania	Russian Federation
year	1987	1994
sex	female	male
age	5-14 years	35-54 years
suicides_no	0	22338
population	311000	19044200
suicides/100k pop	0.0	117.3
country-year	Albania1987	Russian Federation1994
HDI for year	0.0	0.0
gdp_for_year ($)	2,156,624,900	395,077,301,248
gdp_per_capita ($)	796	2853
generation	Generation X	Boomers

Graph of the first 20 countries with the highest Number of Suicides

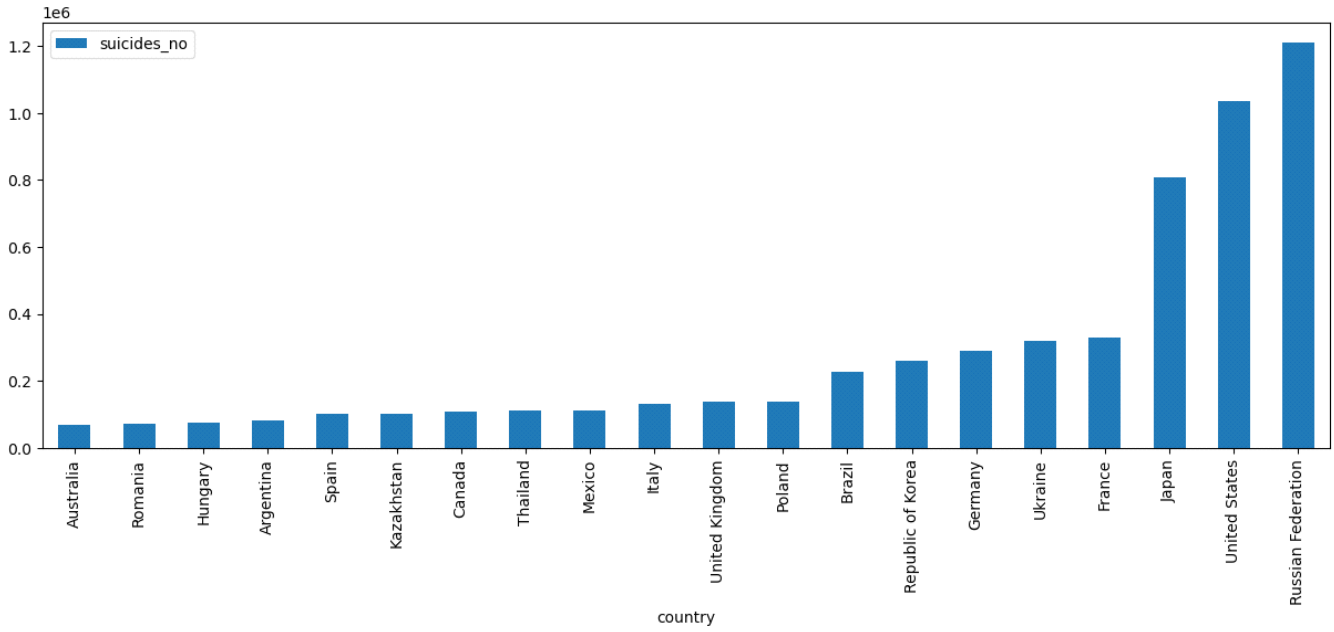


Figure 4.1 – Graph of Number of Suicides against Country.

Graph of the last 20 countries with the lowest Number of Suicides

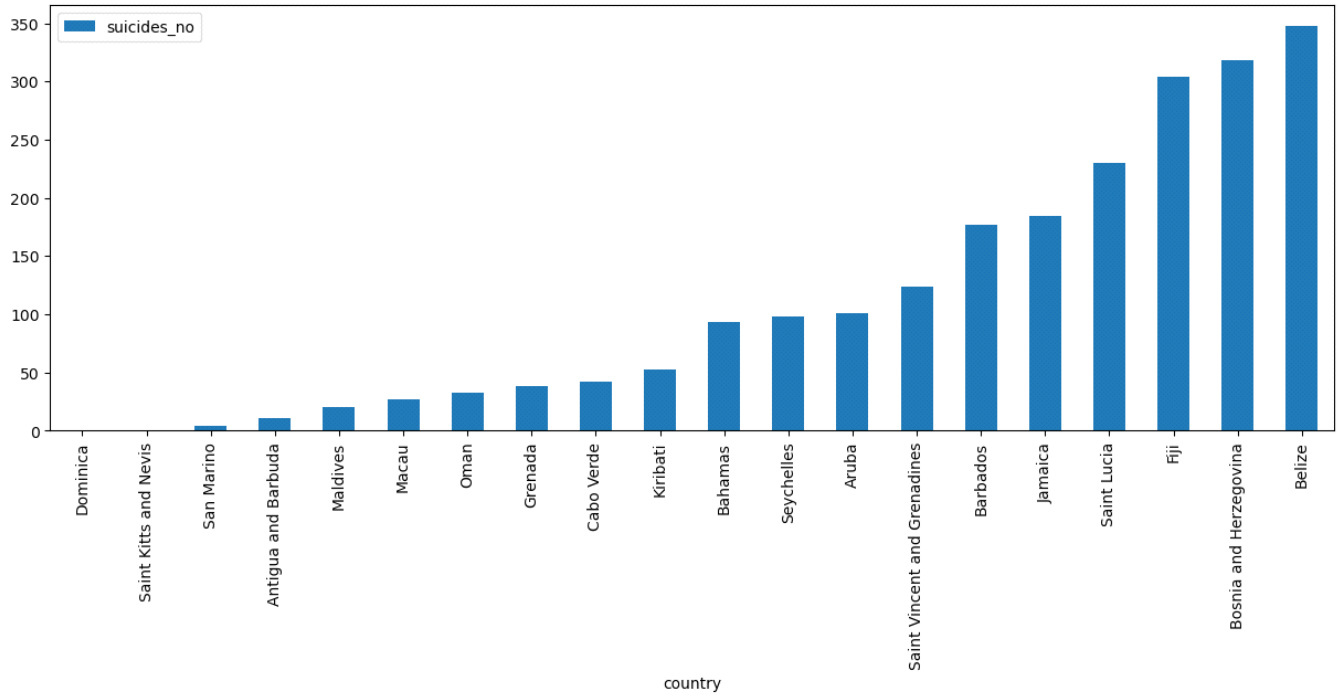


Figure 4.2 – Graph of Number of Suicides against Country

Russia has the highest suicides number while San Marino has the lowest number of suicides.

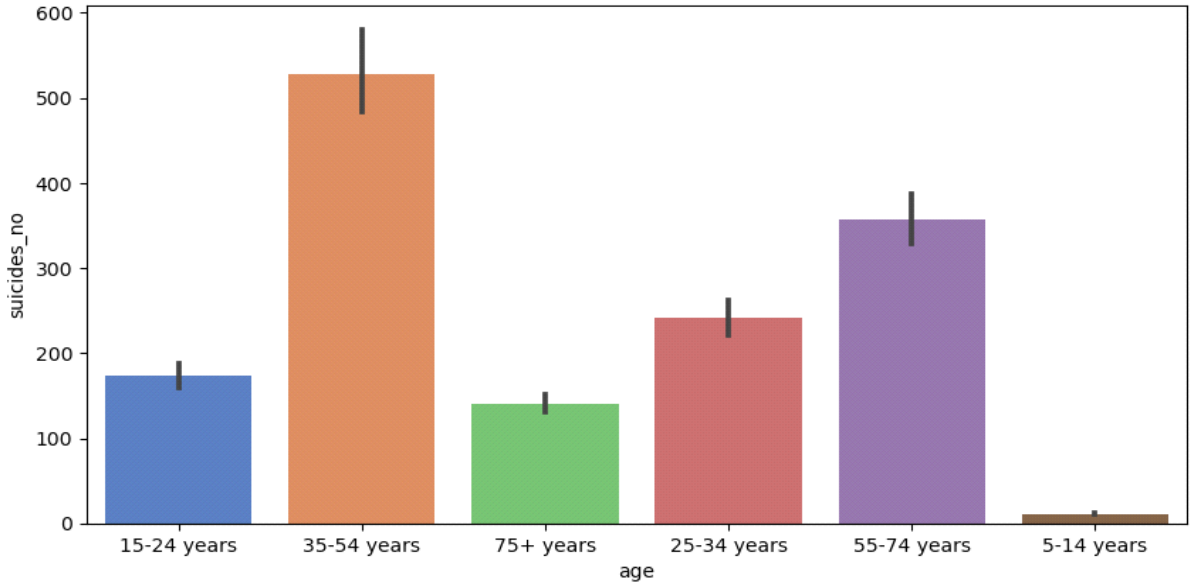


Figure 4.3 – Barplot of Suicides number against Age

Age range 35-54years has the higest number of suicides followed by 55-74years while age range 5-14years has the lowest suicide number followed by 75years and above age range.

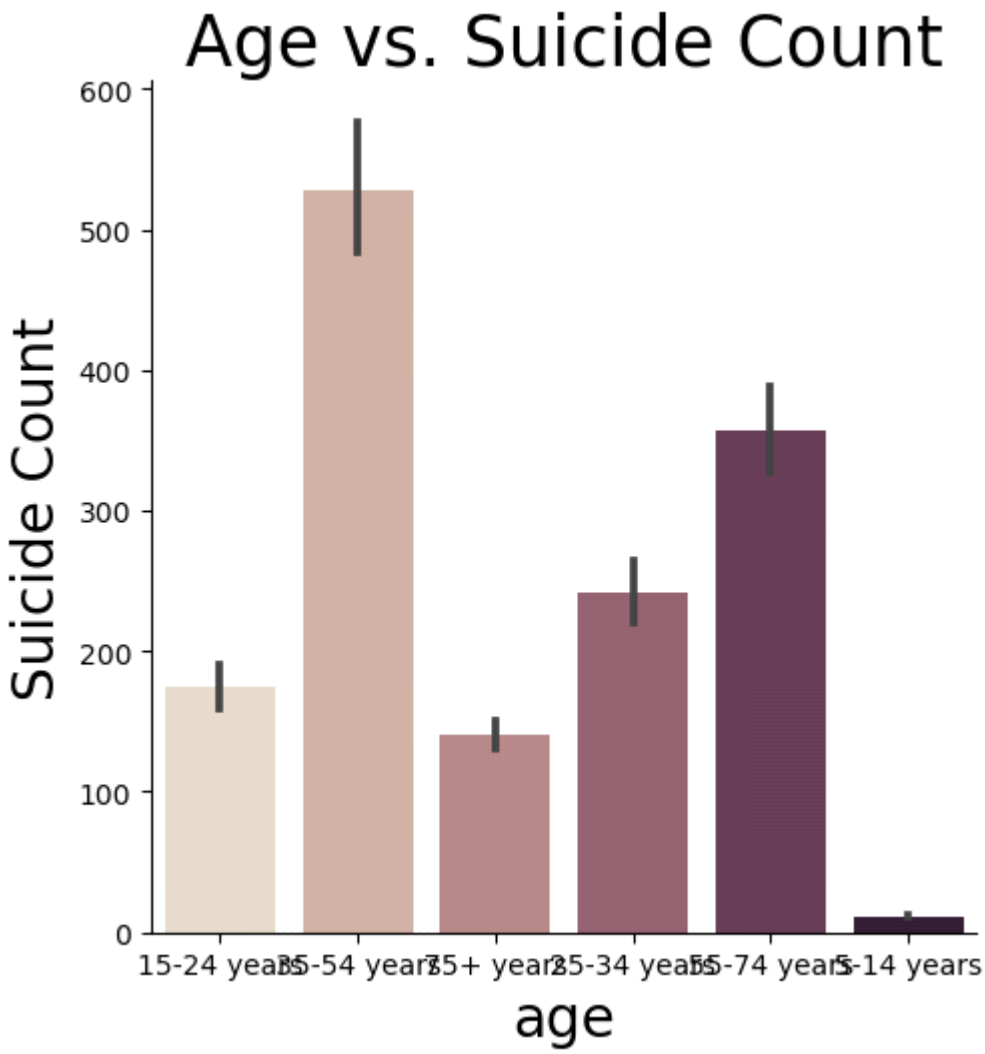


Figure 4.4 – Catplot of Suicide count against Age

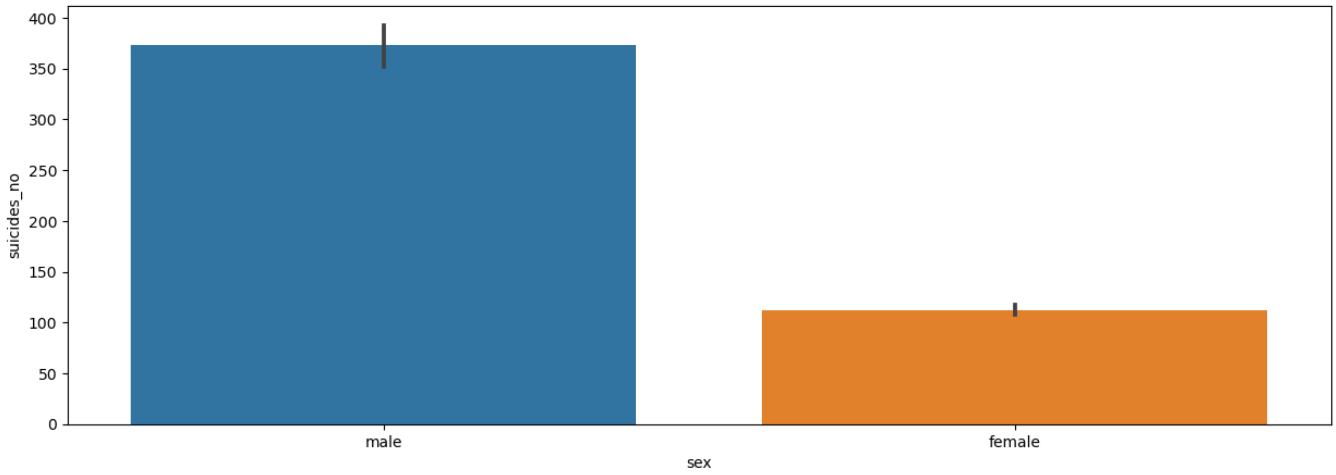


Figure 4.5 – Graph of Suicides number against Sex

Total number of male is 13910

Total number of female is 13910

From fig.4.5 it could be clearly seen that males has the highest number of suicides compared to females

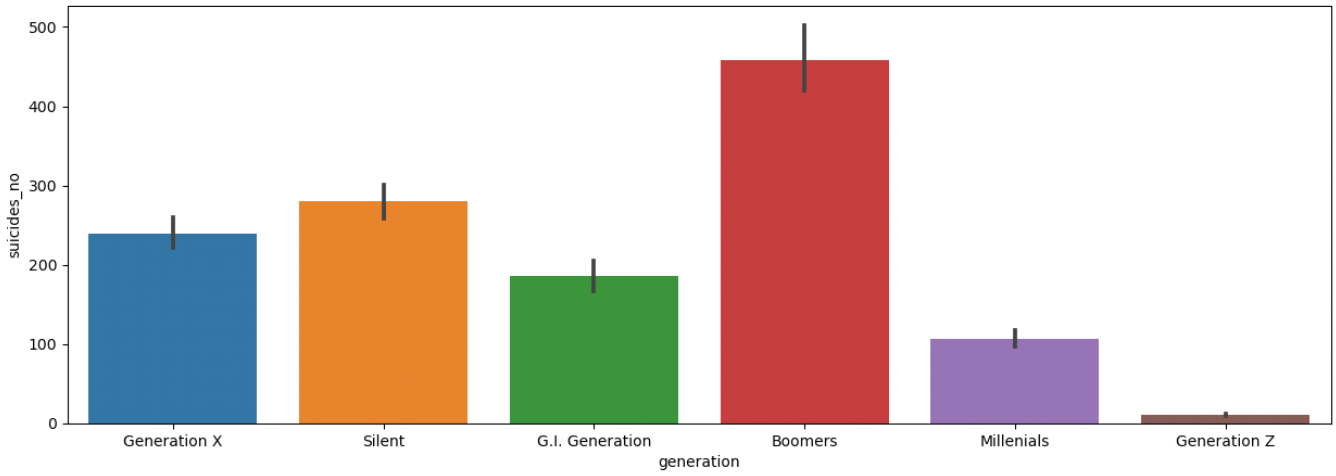


Figure 4.6 – Barplot of Generation against Suicides number

Fig.4.6 shows that generation of boomers commits the highest number of suicide followed by the silent generation. Generation Z has the lowest number of suicide followed by the Millennial generation.

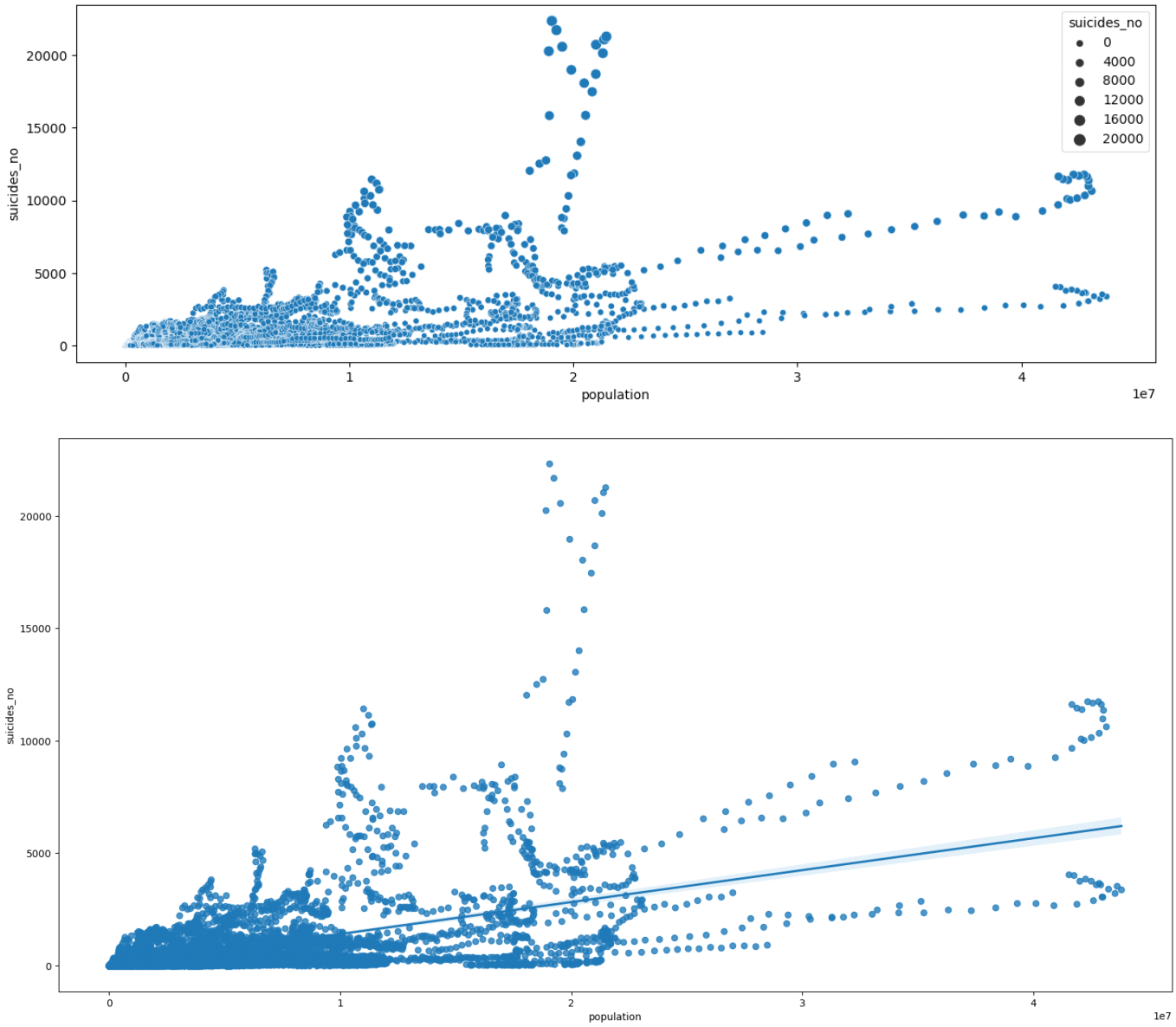


Figure 4.7 – Scattered plot of Suicides number against Population

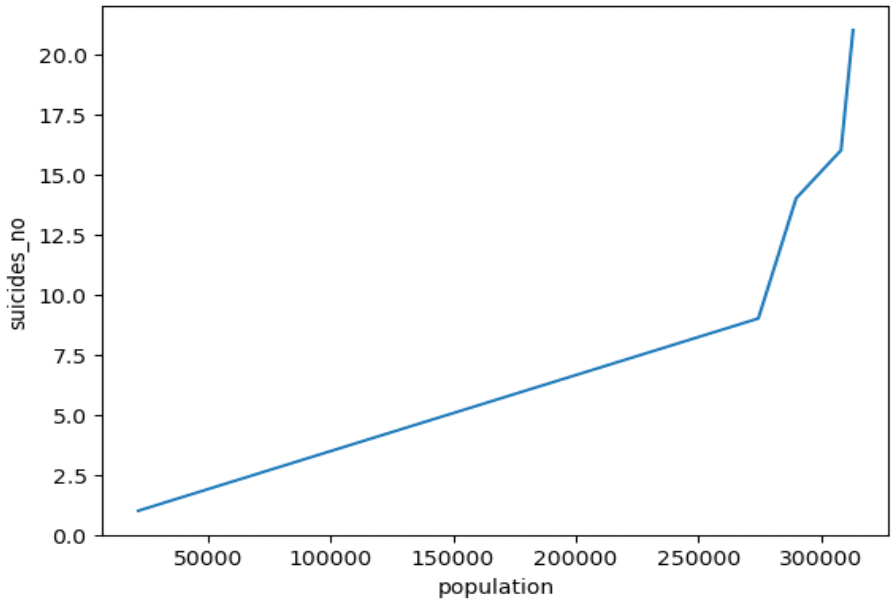


Figure 4.8 – Line plot of Suicides number against Population

This graph shows that the suicide number increase as the population increases. So it can be said that based on the dataset that population of countries is a determinant of suicide rate i.e the higher the population the higher the number of suicides.

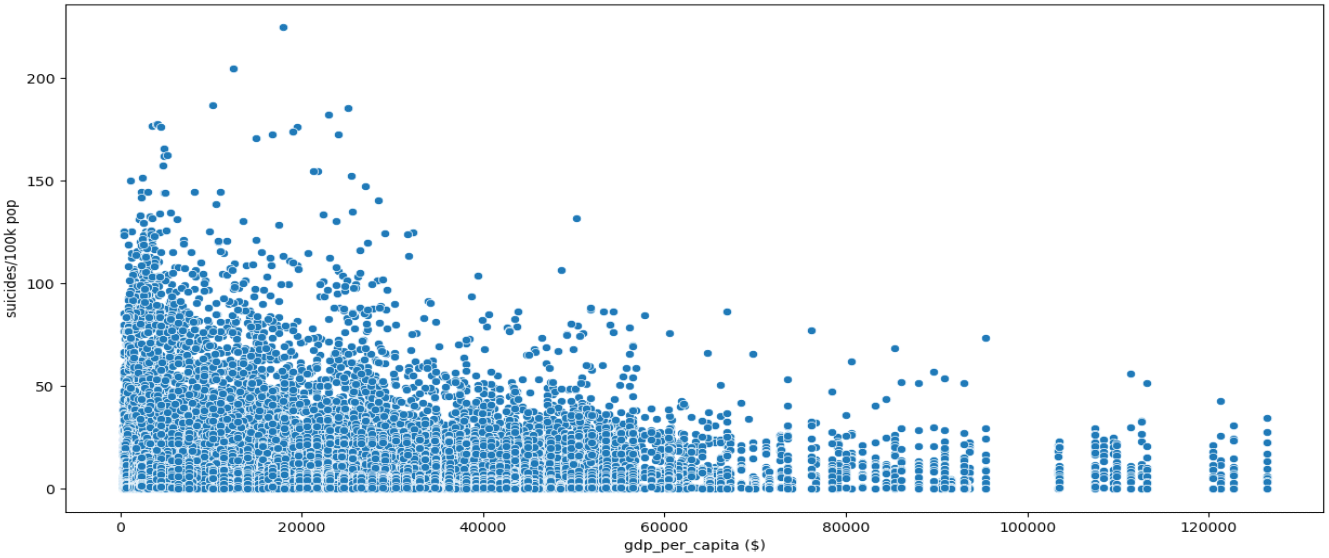


Figure 4.9 – Scatter plot of GDP per capital against Suicides/100kpop

It can be read from this graph that the category of people with lower gdp_per_capital has the highest suicide rate compared to the category that earns higher salary.

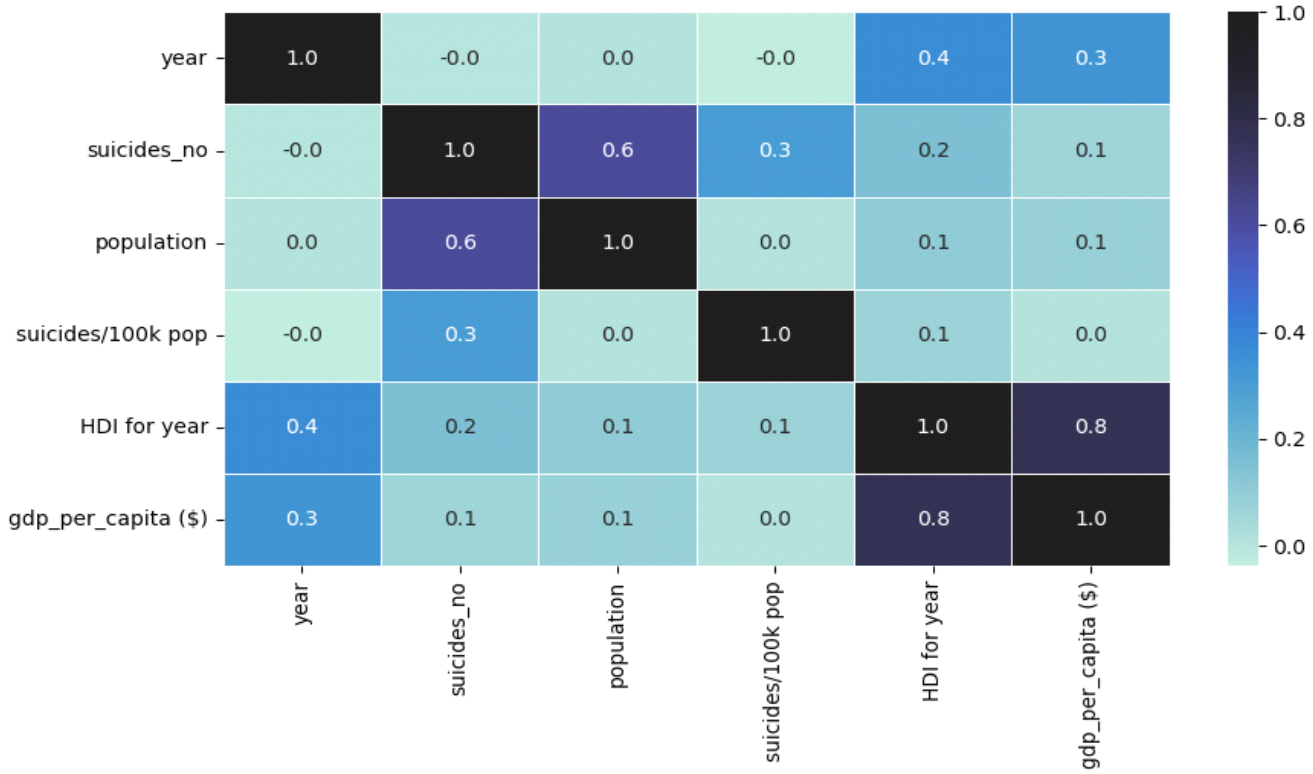


Figure 4.10 – Heatmap Showing correlation between all the stated variables

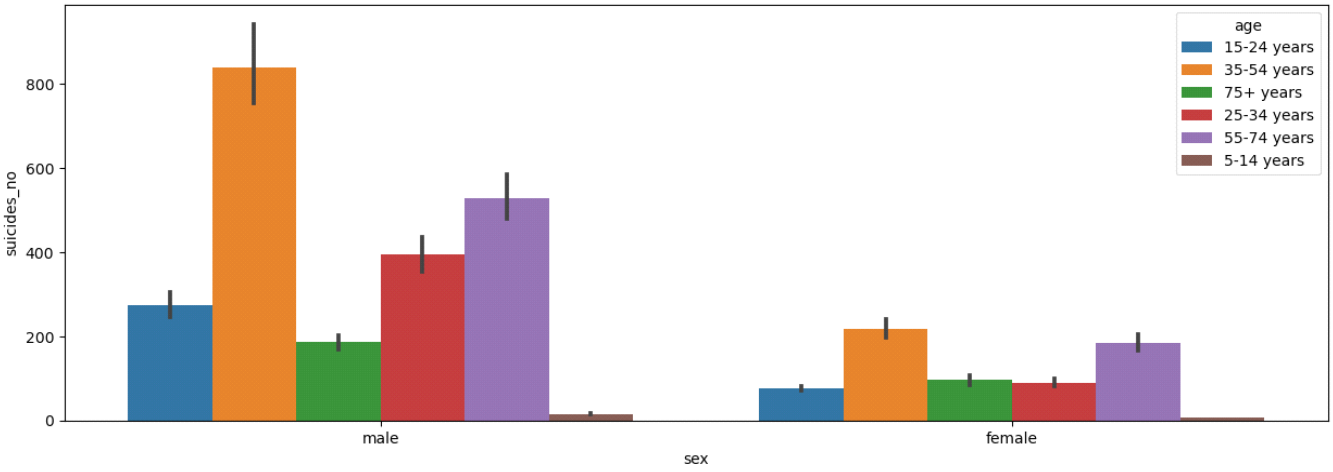


Figure 4.11 – Barplot of Suicides number against Sex using Age as hue

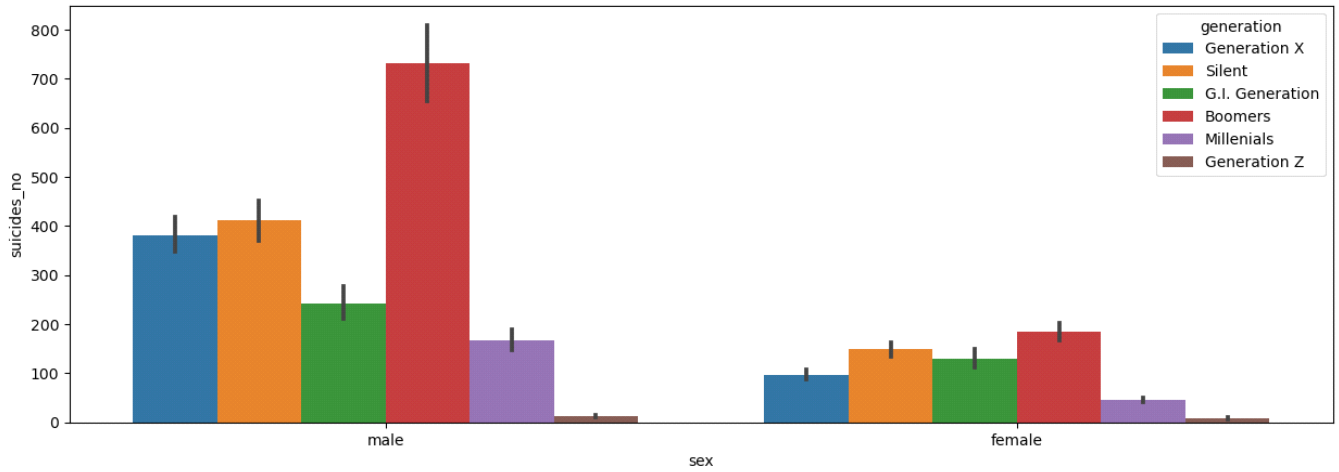


Figure 4.12 – Barplot of Suicides number against Sex using Generation as hue

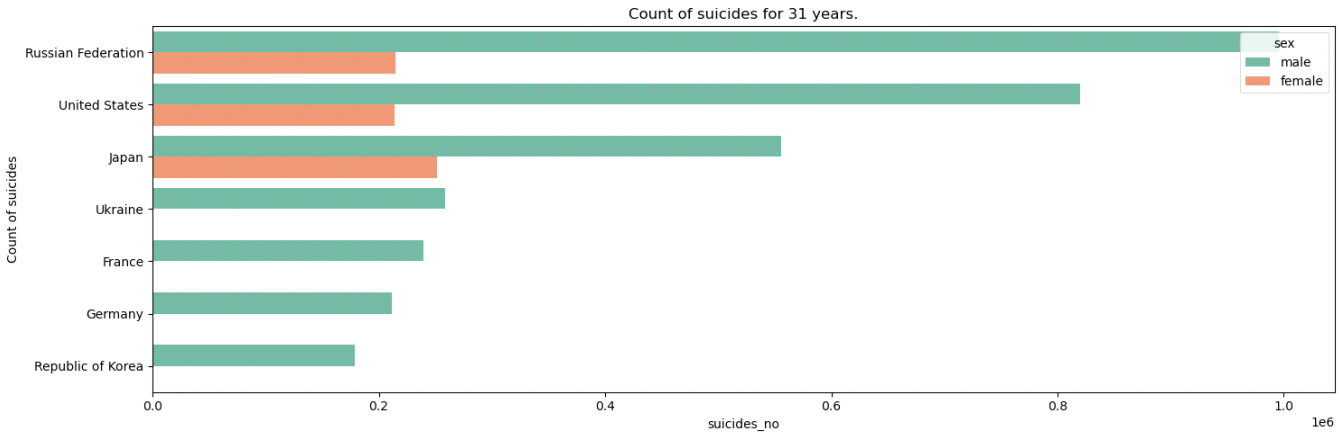


Figure 4.13 – Barplot of Count of suicides number against counntry using Sex as hue for 31years

This graph tells us that Russia federation men has the highest count of suicides followed by United states men compared to their female counterpart. Republic of Korea men has the lowest count of suicides followed by men in Germany.

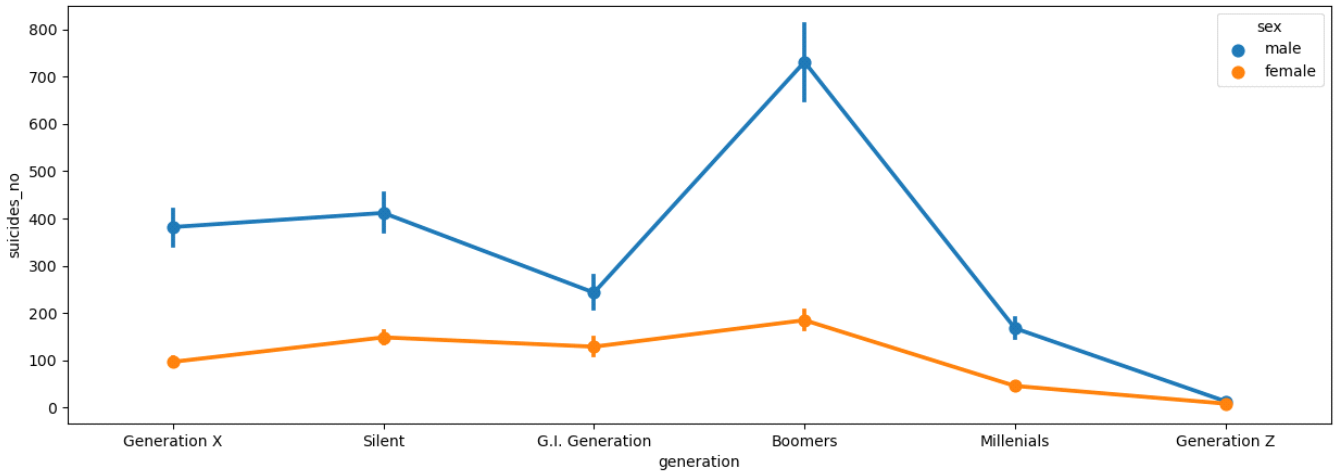


Figure 4.14 – Pointplot of Suicides number against Generation using Sex as hue

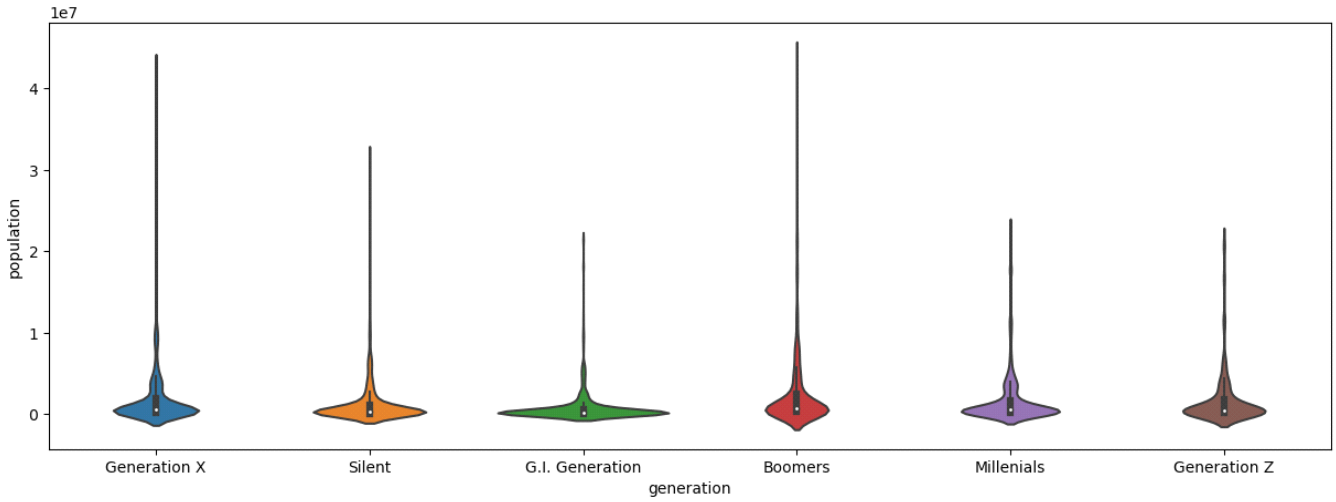
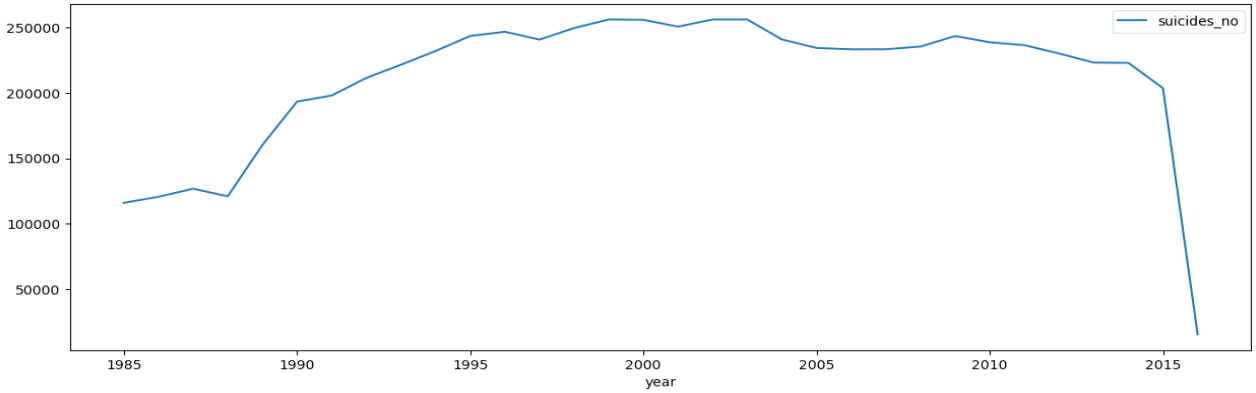
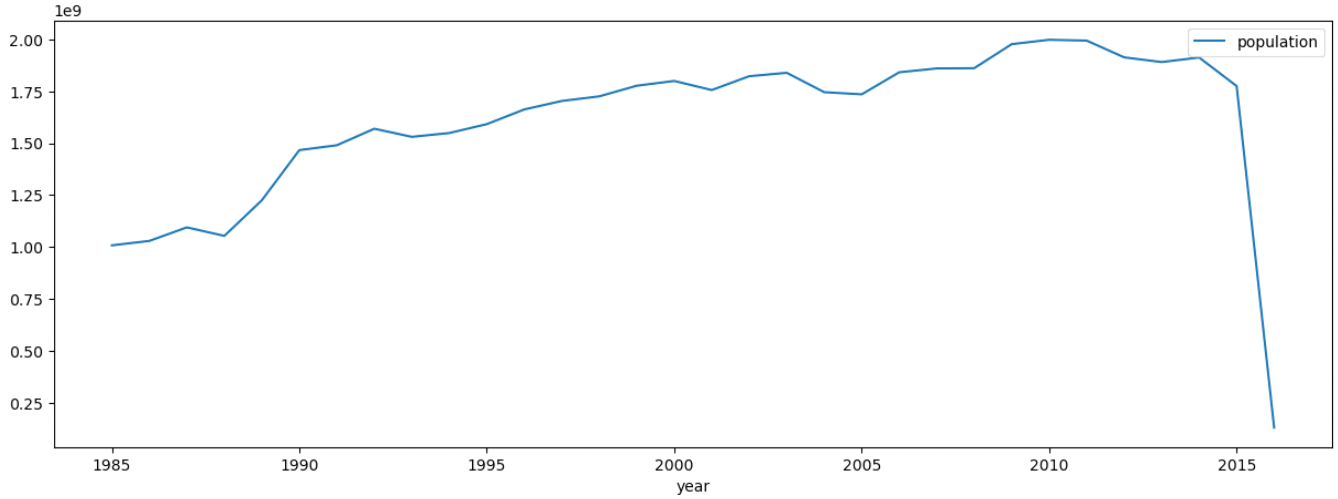


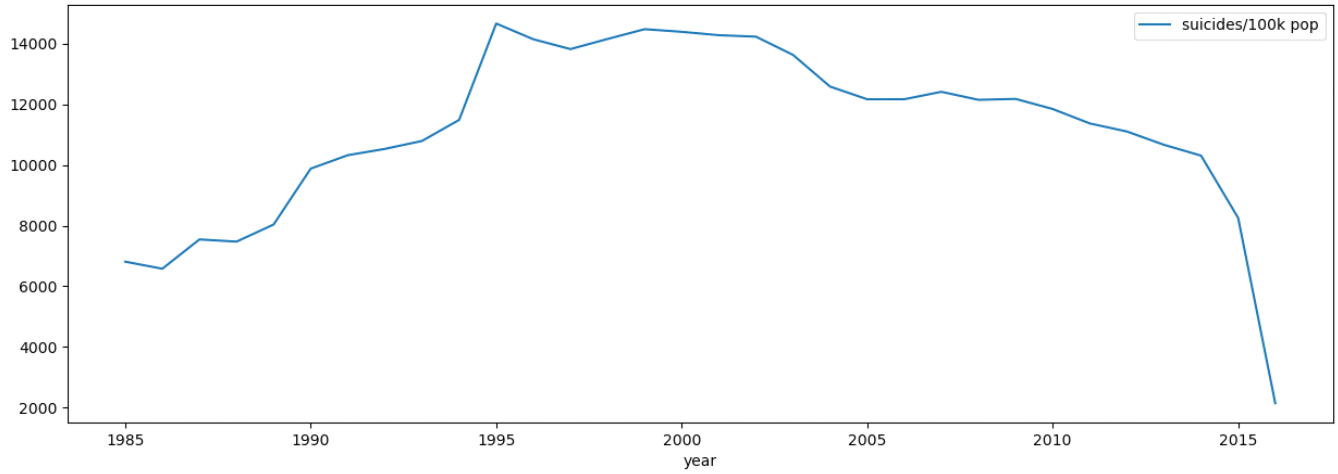
Figure 4.15 – Violinplot of Population against Generation



a)



b)



c)

Figure 4.16 – Groupedby Plot of various variables against each other to show clearly the trend of suicide numbers across 1985 – 2015

CONCLUSION

One of the top causes of death among adult is suicide as seen from the tables and graphs plotted. Data reveal startling gender-based suicide disparities. It is clear that men are more likely than women to commit suicide. Additionally, a significant predictor of suicide is mental health.

Suicides started to decline in the 1980s. This might be a result of increased knowledge of risk factors and mental health issues in the 1980s. However, shortly afterward, we started to detect an increase in suicides.

Due to Soviet secrecy, data to support the idea that Russia's high suicide rate is significantly influenced by alcohol consumption levels is scarce.

The statistics show that the largest suicide rate is among middle-aged persons, or those between the ages of 30 and 60. Elderly people and children have roughly half as much as middle-aged individuals.

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APPENDIX

```
data.groupby(by=['country'])['suicides_no'].sum().reset_index().sort_
values(['suicides_no']).tail(20).plot(x='country',


y='suicides_no',

kind='bar',

figsize=(15,5))
plt.show()

data.groupby(by=['country'])['suicides_no'].sum().reset_index().sort_
values(['suicides_no']).head(20).plot(x='country',

y='suicides_no',

kind='bar',

figsize=(15,5))
plt.show()

plt.figure(figsize=(10,5))  # setting the figure size
ax = sns.barplot(x='age', y='suicides_no', data=data,
palette='muted')  # barplot

sns.catplot(x="age", y="suicides_no",palette="ch:.25",
kind="bar",data=data);

plt.title('Age vs. Suicide Count',size=25)
plt.xlabel('age',size=20)
plt.ylabel('Suicide Count',size=20)
```