

Can you fake it?

A Neuro-Bio-Psycho-Social study on the factors and effects of **SUICIDE AMONG ADOLESCENTS**, and its use for suicide detection, intervention, and prevention

Natania Mathew Varghese
Grade 09
Queen Elizabeth High School
Calgary AB

Table of Contents



- Introduction to topic
- Why does this matter to me?
- Defining Suicide among adolescence
- Purpose of the project
- Neuro Bio Psycho Socio Approach
 - Define Model
 - Sociological Analysis
 - Psychological Analysis
 - Biological Analysis
 - Neurological Analysis
- Data Research
- Citations
- Acknowledgements
- Conclusion

Introduction to Topic

- ★ Suicide is a deeply troubling issue with far-reaching societal and public health implications.
- ★ It impacts people of all ages, ethnicities, and gender identities in Canada and disproportionately affects some populations (e.g., men, youth, seniors, 2SLGBTQ+).
- ★ Suicide is a significant public health issue recognized by the World Health Organization and the Government of Canada.
- ★ In recent years, the prevalence of adolescent suicide has increased alarmingly, prompting a deepening concern among researchers, policymakers, and communities worldwide.
- ★ After the impacts of COVID-19, and the growth of social media, suicide rates have been at an all time high, especially in adolescents.
- ★ Adolescence is a period marked by significant physical, emotional, and social transitions, making adolescents particularly vulnerable to mental health challenges, including suicidal ideation and behaviors.
- ★ But the majority of the studies conducted, detection methods and treatment strategies are purely focused on one part of our intricate human systems.
- ★ It is imperative that we work together to
 - reduce stigma and raise public awareness
 - connect people in Canada with information and resources
 - accelerate the use of research and innovation in prevention



Why does this matter to me?


Suicidal Study Infographics

1. Statistics Canada. Canadian Vital Statistics—Death Database. 2017–2019. Released in January, 2022.
 2. Canadian Institute of Health Information (CIHI). Discharge Abstract Database (DAD), National Ambulatory Care Reporting System (NACRS) and Ontario Mental Health Reporting System (OMHRS). Fiscal year 2020–2021.
 3. Estimates are for the population in Canada aged 15 years and older.
 4. Statistics Canada. Canadian Community Health Survey—Annual component. 2020.

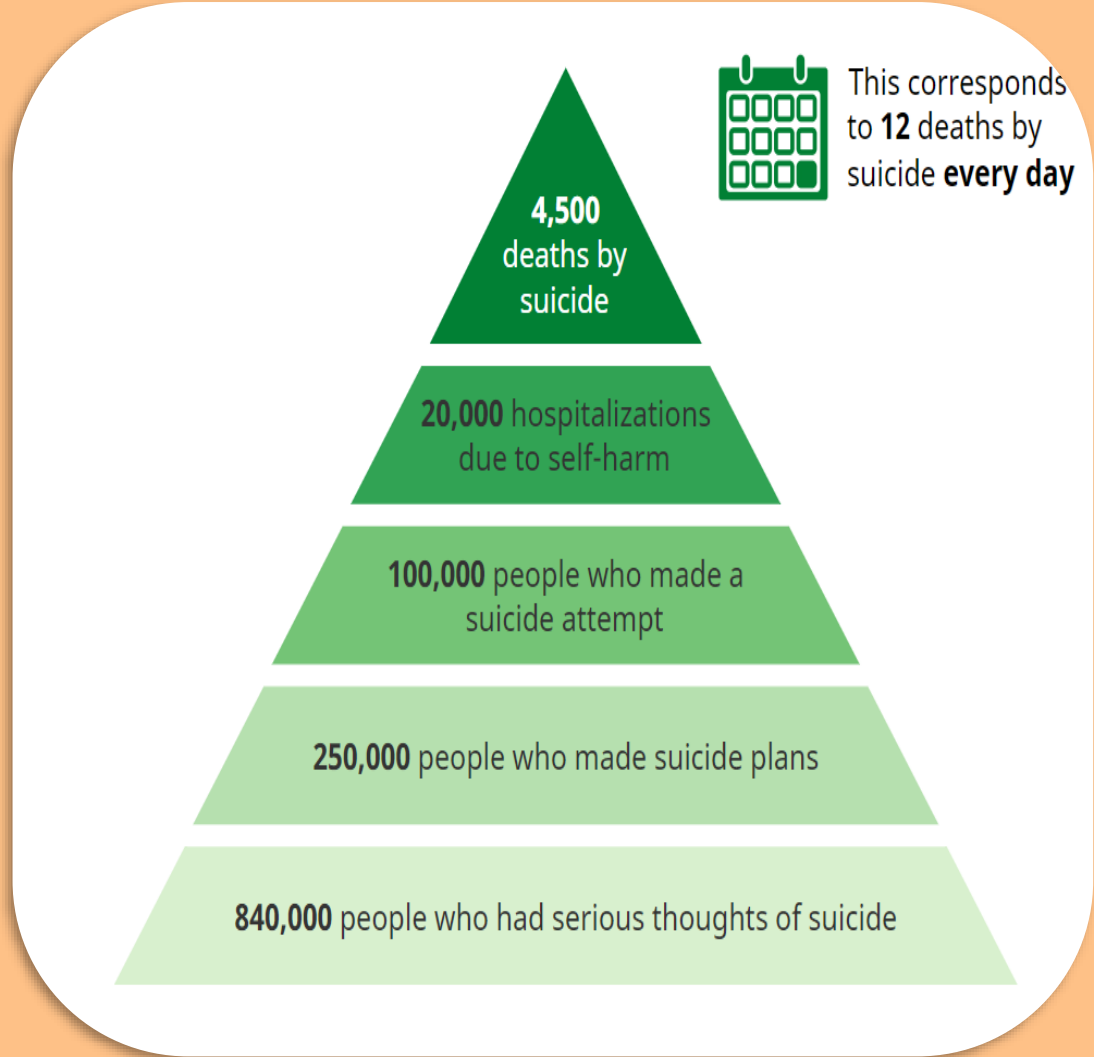
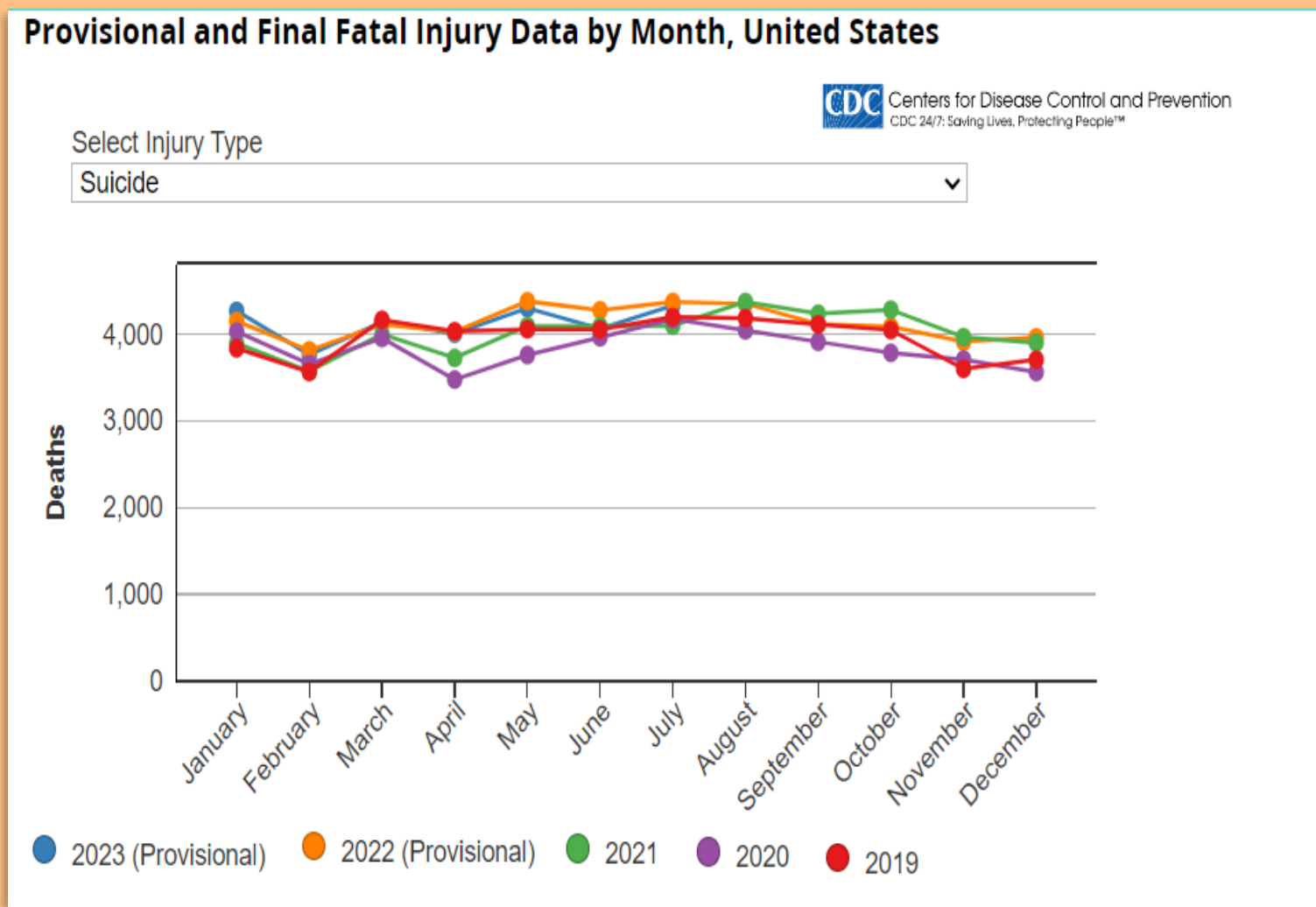
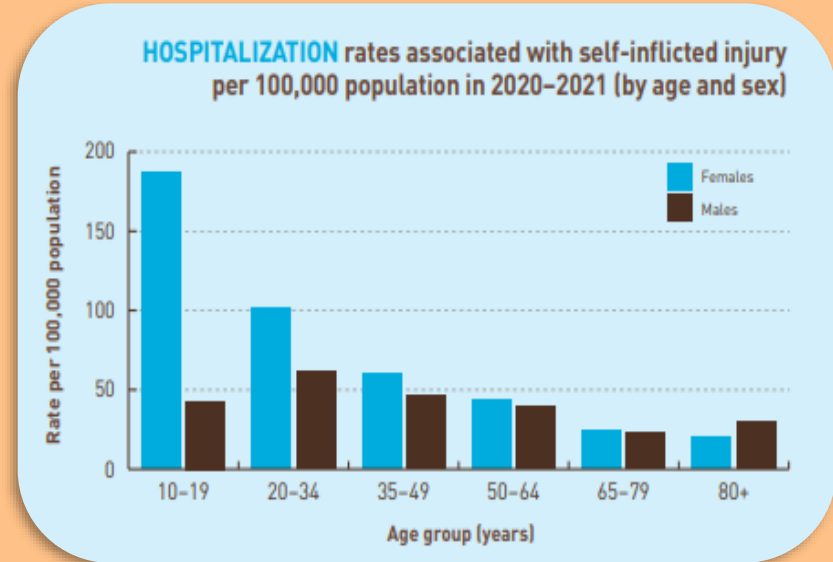
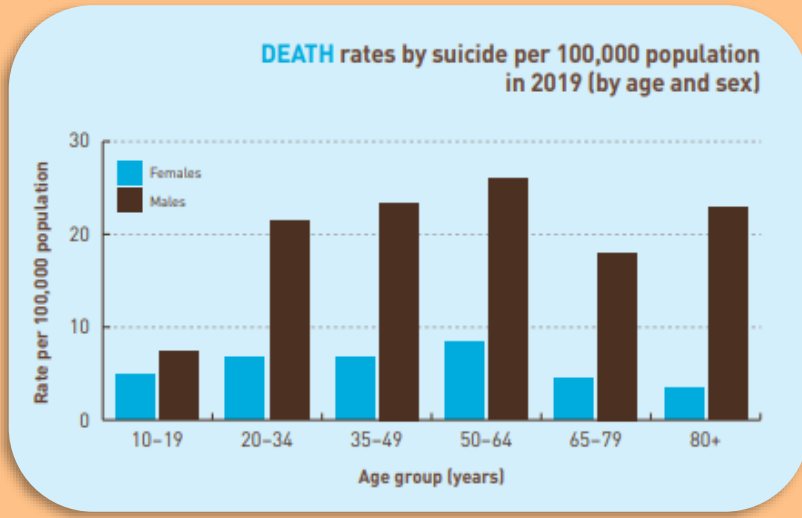
approx. **12** PEOPLE die by suicide EACH DAY

approx. **4,500** DEATHS BY SUICIDE PER YEAR

Suicide is the **SECOND** leading cause of death among youth and young adults (15–34 years)



Suicide rates are approx. **3x** higher among men compared to women

Defining Suicide among adolescents

- ★ Suicide is the act of **intentionally causing one's own death**.
- ★ It's a complex phenomenon with various factors contributing to it
- ★ An attempt is an indication that a person needs help and is at higher risk
- ★ Suicide-related behaviours can include:
 - Considering suicide
 - Planning suicide
 - Attempting suicide
- ★ Adolescence is a period of **significant emotional, social, and psychological development**, and it can be a challenging time for many young people as they navigate through various stressors and changes.
- ★ **People who die by suicide don't necessarily want to end their lives.** They often want to stop significant or unbearable mental, emotional or physical pain and want to end their suffering or situation that is overwhelming to them.
- ★ Addressing adolescent suicide requires a **multifaceted approach** to its detection and prevention.
- ★ It involves collaboration between families, schools, healthcare providers, policymakers, and communities to promote mental wellness and provide effective support systems for young people in crisis.

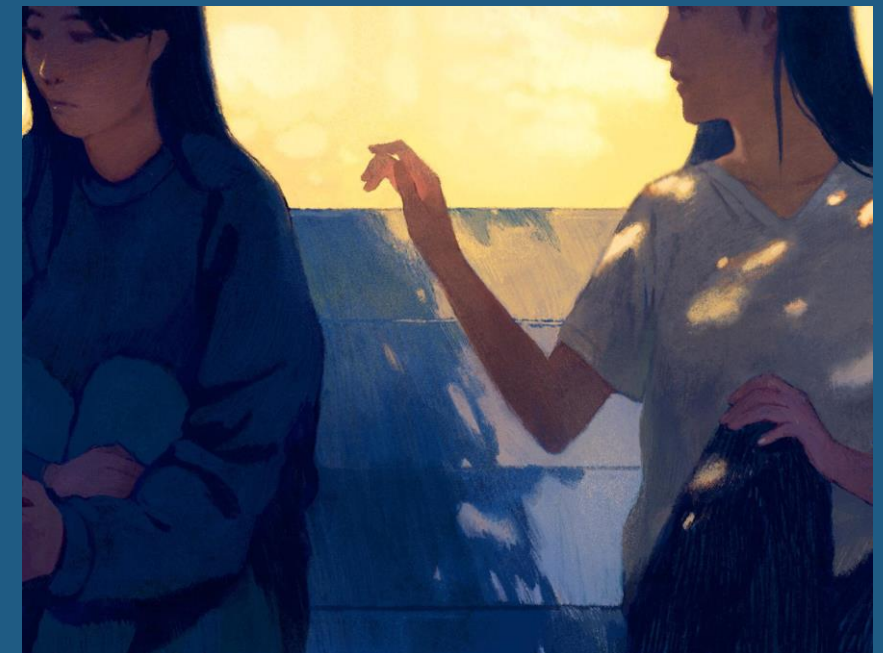


Purpose of the project

The project is an innovative research dedicated to addressing the critical issue of suicide detection, intervention and prevention among adolescents.

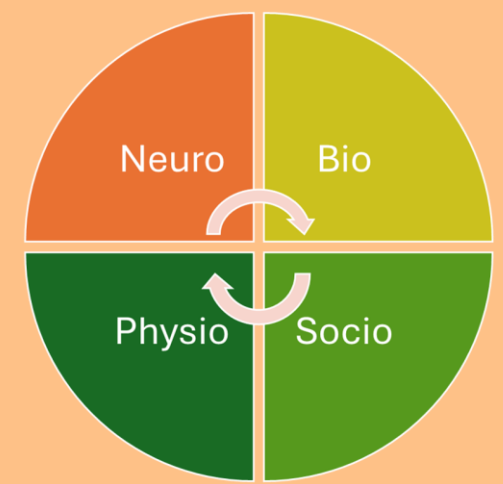
This multidisciplinary endeavor integrates insights from neuroscience, biology, psychology, and sociology to comprehensively understand the complex factors contributing to suicidal behaviors in this vulnerable population.

By examining the interplay of these various factors we can develop effective strategies for early detection, intervention, and support tailored to the specific needs of at-risk adolescent.



Why a Neuro-Bio-Psycho-Social model?

- ★ A **Neuro - Bio - Psycho - Social model** is an interdisciplinary approach that applies the interconnection between neurology, biology, psychology and socio-environmental factors in understanding health issues and for its treatment plans. These systems overlap and interact to impact each individual's well-being and risk for illness, and understanding these systems can lead to more effective treatment
- ★ Though Dr. George Engel and Dr. John Romano developed a basic model in the 1970s, the concept of this has existed in medicine for centuries. They asserted that biopsychosocial model reveals the development of illness through the interaction of biological factors: genetic, biochemical; psychological factors: mood, personality, behavior; and social factors: cultural, familial, socioeconomic, medical.
- ★ A Neuro-Bio-Psycho-Social study on the effects and causes of suicide can provide a **holistic understanding** of the identification of **key risk factors** underlying suicidal behaviours, and in the **development** of targeted prevention strategies aimed at reducing the incidence of suicidal ideation and self-harming behaviours among adolescents.
- ★ In clinical practice, the findings from this study can inform the development of comprehensive assessment tools to detect suicide risk in adolescents. Through comprehension of the intricate interplay of these factors, effective prevention measures and early identification protocols can be formulated to attenuate the prevalence of suicide within this vulnerable demographic.



Sociological Analysis

Sociological Factors

- ★ Minority groups
 - Among immigrant populations,
 - Lesbian, gay, and bisexual
 - Indigenous (especially youth)
- ★ Family history
 - Suicide by one family member increases the odds of suicide among others in the family.
- ★ Substance Abuse
 - Alcohol
 - Drug
- ★ Social Transmission and Grief
 - Death in the family
 - Abortion
- ★ Social Media and Networking
 - "contagion effect."
- ★ Social Isolation and Social Distancing
- ★ Negative Life Event
- ★ Childhood Adversities
 - Bullying
 - Child Abuse

Environmental Factors

- ★ Age
- ★ Gender
 - Women are more likely to experience suicidal thoughts,
 - Men are much more likely to take their own lives.
 - Suicide rates are approximately 3 times higher among men compared to women
- ★ Seasonal
 - Sunlight Exposures
 - Winters
- ★ Socio-economic situation
 - Marital status – young, unmarried
 - Socio-economic insecurity
 - Unemployment
 - Lower education
 - Family structure
 - Maternal emotional unavailability
 - Separated or divorced
 - Incarceration (imprisonment)
- ★ Occupation:
 - Physician,
 - Police & First responders
 - Military personnels etc



Psychological Analysis

Personality Risk Factors

- ★ Personality Traits
 - Hopelessness
 - Purposelessness
 - Trapped
 - Impulsivity
 - Aggression
 - Perfectionism
 - Self-Efficacy
 - Locus of Control
 - Neuroticism
- ★ Cognitive Factors
 - Rigidity
 - Thought Suppression
 - Fearlessness
 - Pain Sensitivity
 - Agitation
 - Implicit Associations

Mental Illness

- ★ Mood Disorders
- ★ Major Depressive Disorder and Dysthymia
- ★ Bipolar Disorder (children and youth)
- ★ Anxiety Disorders
- ★ Panic Disorder
- ★ Post-Traumatic Stress Disorder
- ★ Schizophrenic Disorders
- ★ Personality Disorders
- ★ Borderline Personality Disorder
- ★ Substance use disorders
- ★ Post-traumatic stress disorder
- ★ Bipolar disorder
- ★ Attention deficit hyperactivity disorder (ADHD; children and youth)
- ★ People receiving inpatient care



Biological Analysis

- ★ Suicidal crisis
- ★ External/internal destabilizing factors
- ★ Salutogenesis vs pathogenesis imbalance
- ★ Structural and functional neural circuitry dysfunction
- ★ Dysregulation of neurotrophic factories, inflammation, hpa axis
- ★ Acute /chronic stressful stimuli
- ★ Neuroendocrine Dysregulation
- ★ Neuroplasticity
- ★ Mitochondrial Dysfunction
- ★ Oxidative stress
- ★ Gut Microbiota
- ★ Sleep Disturbance
- ★ Endocrine System
- ★ Neurotransmitter Receptor Abnormalities
- ★ Nutritional Deficiencies
- ★ Mitochondrial Dysfunction
- ★ Endocrine disorders

- ★ Impulsive-aggressive behaviour
- ★ Congenital and acquired epigenetic modifications
- ★ Other Genetics
- ★ Hypothalamic-pituitary-adrenal (HPA) axis alterations
- ★ Pubertal Changes
 - Drenarche
 - Gonadarche
 - hypothalamic-pituitary-gonadal (HPG) axis, -> rising levels of luteinizing hormone (LH) and follicle-stimulating hormone (FSH)
- ★ Brain Development
- ★ Chronic illness or pain
- ★ Inflammatory Processes
- ★ Sleep Disturbance



Neurological Analysis

Cellular Impacts

- ★ Increased serotonin neurons in the brainstem
- ★ Increased tryptophan hydroxylase 2, gene expression and protein per neuron
- ★ Fewer mature granule neurons in the selective serotonin-reuptake inhibitors
- ★ Smaller volume of the dentate gyrus
- ★ Lesser angiogenesisAC
- ★ Deficient noradrenergic neurons in the locus coeruleus
- ★ Changes patterns of morphometric cellular changes are noted
 - Loss of glia
 - Cell atrophy(lower neuronal density)
 - Increased number of serotonergic cells
- ★ Other brain disorders
 - Traumatic brain disorder
 - Intellectual disabilities
 - Autism spectrum disorders
 - Multiple sclerosis > Epilepsy
 - Cognitive deficit or decline (elderly)

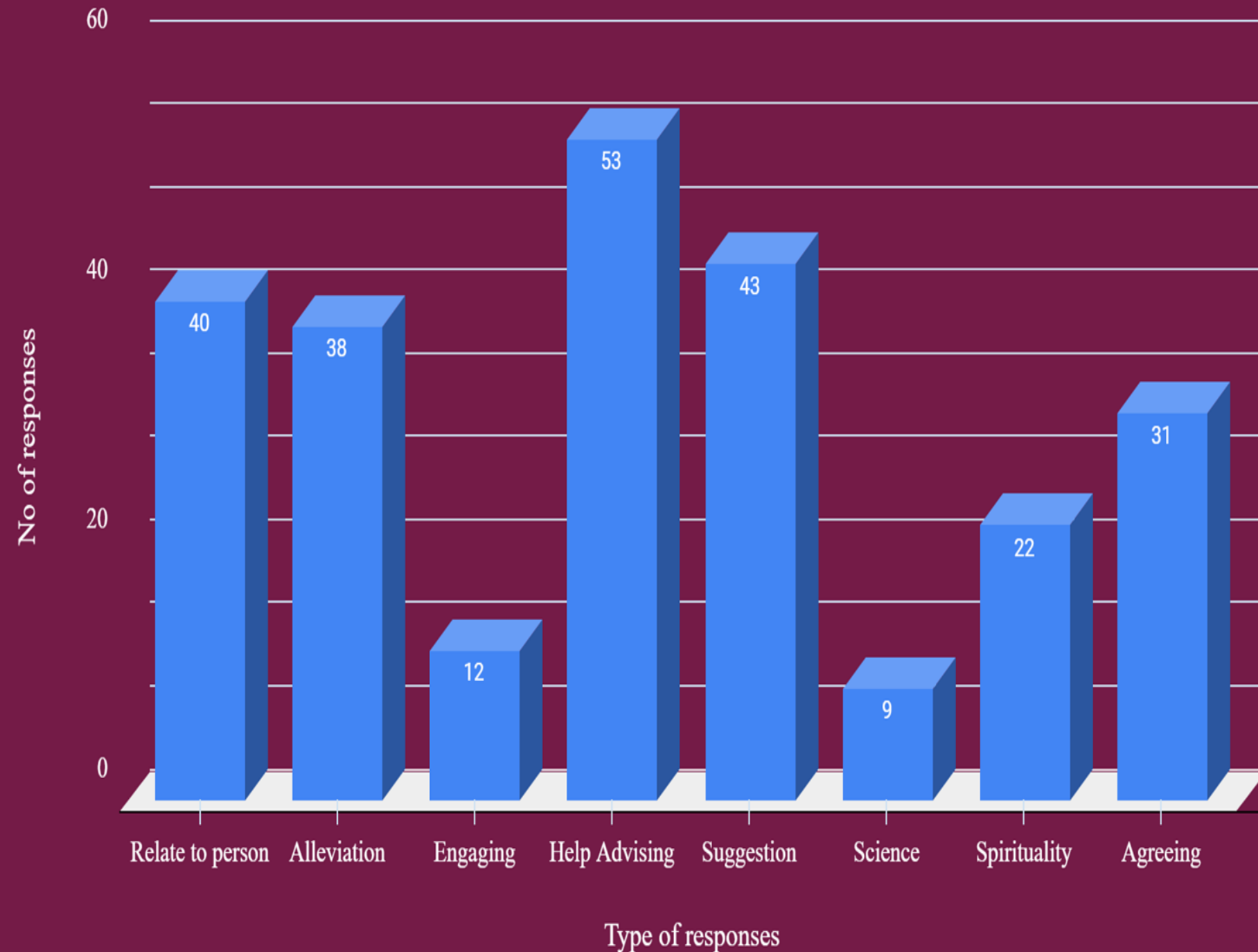


Neural Circuit Impacts

- ★ Most molecular studies have focused on the serotonin system. Two brain regions were shown to have activity that correlated with lethality
- ★ This relation, as measured by relative 18F-fluorodeoxyglucose(FDG) uptake on PET, was mediated by the degree of suicidal intent and severity of impulsive trait
- ★ Flenturamine in high lethality suicide attempts
- ★ Correlation between prefrontal localized hypofunction and impaired serotonin responsibility proportionate to lethality
- ★ Uptake of 11C-methyltryptophan is low in the orbital medial prefrontal cortex in proportion to the degree of suicide
- ★ Lower transporter binding and Higher brain stem 5-HT1A binding
- ★ Molecular imaging studies have begun to identify the neural circuitry of suicidal behaviour
- ★ Structural findings in MRI identify's of non-fatal suicidal behaviors include right-sided deficits in volumes of grey matter in cortical areas
- ★ The volumes of thalamus and right amygdala seem to be greater in suicide attempters
- ★ Findings of white matter hyperintensities, increased bilateral volumes of inferior frontal white-matter tracts
- ★ Lower anisotropy in the left orbitofrontal area indicating structural connectivity impairments linking to suicidal behaviour.
- ★ Deficits in serotonin-transporter expression and binding

Survey & Infographics

Social Media Support Responses



I investigated receiving data, through dataming from social media platforms , specifically Reddit and Quora. Through that, these are my findings.

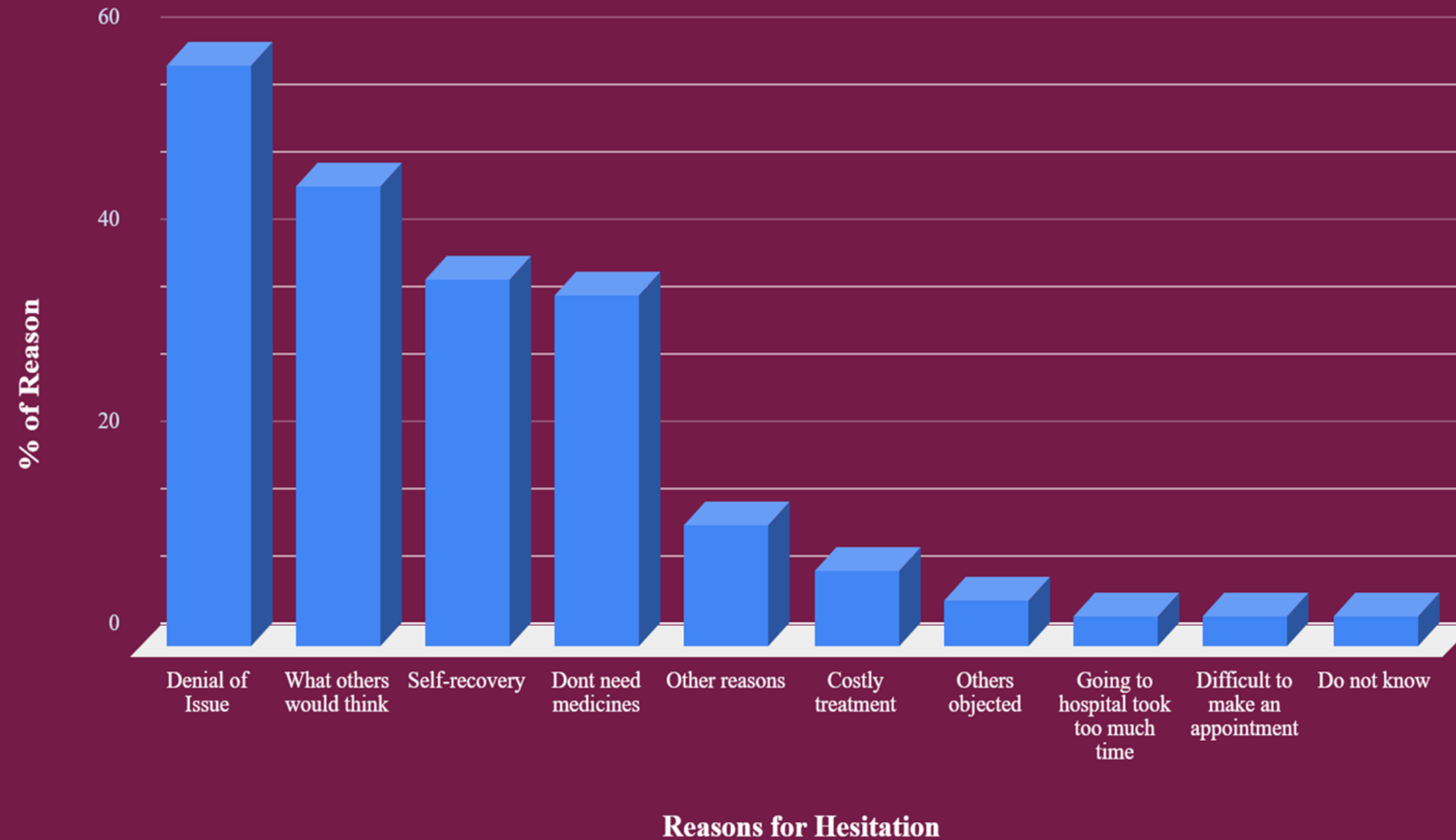
The responses that I found were for the question, “If someone tells others that they are thinking or planning suicide, what are people’s responses?”

1. Relating to Person: they themselves are thinking or wanting to commit suicide.
2. Alleviation: making them feel better as a person and attempting to alleviate negative emotions
3. Engaging: somehow extending the conversation so they can better understand the concept and give them tailored advice
4. Help Advising: telling them to go seek help in a professional medical setting
5. Suggestion: giving them essential home remedies to solve their ideations
6. Science: using science to help them figure out what is biologically happening and using that to help solve their issue
7. Spirituality: using religion or spiritual beliefs to help them overcome suicidal ideation
8. Agreeing: Essentially telling them that they should commit suicide.

Survey & Infographics

Hesitation to Consult Psychiatrist

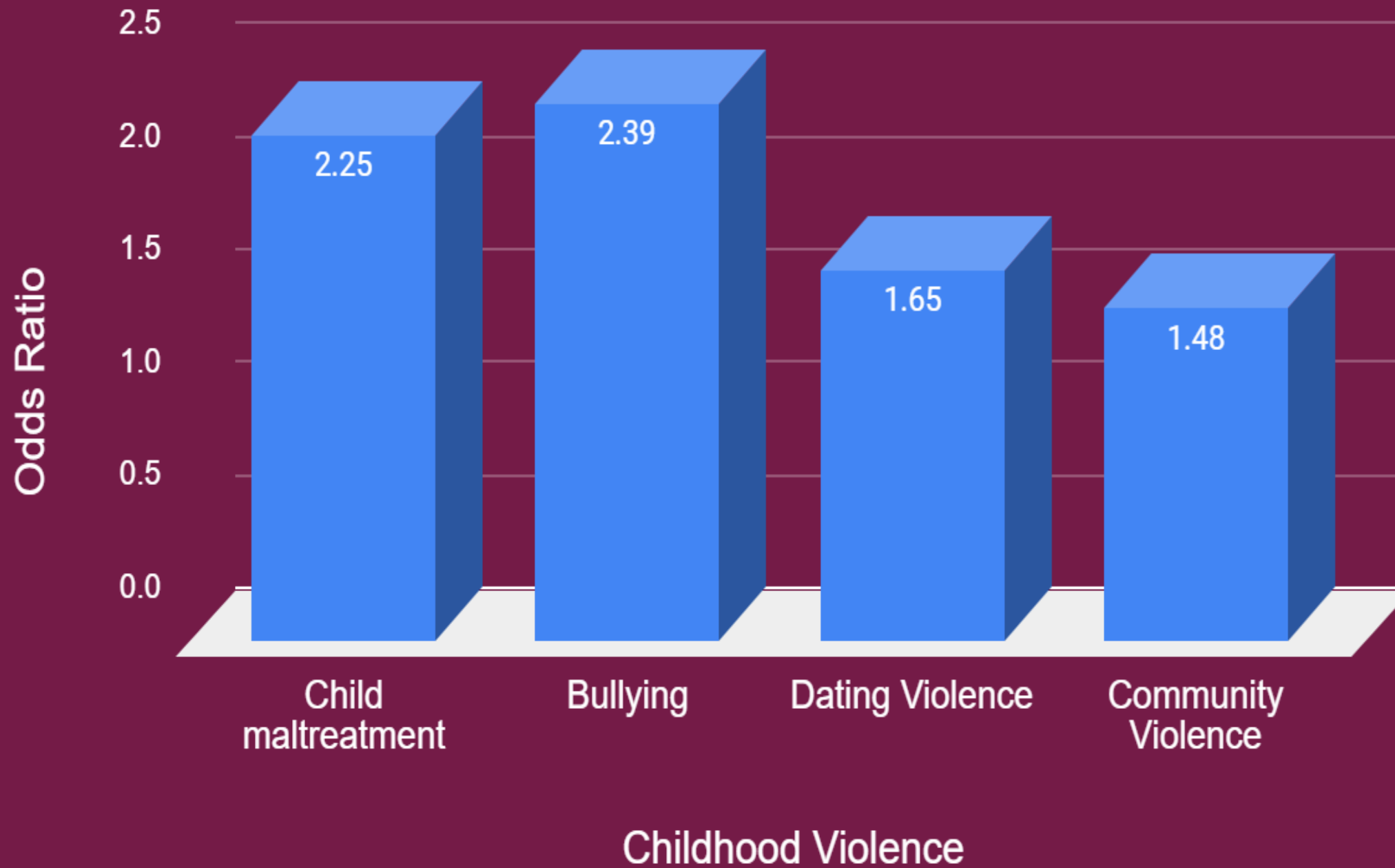
Demographic - 95 Male and 79 Female



This graph shows the reasoning behind a possible hesitation to consult psychiatrists. The demographics are 95 Males and 79 Females.

Survey & Infographics

Exposure to childhood violence and suicide



This graph shows the odds ratio of exposure to childhood violence and suicide. We can see that all of these have around two times higher likelihood of having suicide attempts, than their counterparts who have not gone through these things

Conclusion

In conclusion, the intricate and multifaceted nature of suicide demands a comprehensive approach that extends beyond relying solely on a single system for detection, identification, and prevention. The complexity of suicide, stemming from a myriad of interrelated factors including mental health conditions, social dynamics, economic stressors, and personal experiences, underscores the necessity of adopting holistic strategies within clinical settings to combat this pressing issue effectively.

A singular system, no matter how advanced, cannot adequately address the diverse array of risk factors and circumstances contributing to suicidal behavior. Instead, a holistic approach that integrates various disciplines, methodologies, and perspectives is essential. This approach should encompass not only clinical interventions but also community outreach, education, policy changes, and ongoing research efforts.

By embracing a holistic perspective, we recognize that suicide prevention is not a one-size-fits-all endeavor. It requires tailored interventions that acknowledge the unique needs and challenges faced by individuals at risk. Moreover, it emphasizes the importance of collaboration among mental health professionals, policymakers, educators, social workers, and other stakeholders to create a comprehensive network of support and resources.

Without a depth and variety of research into all aspects of suicide, our understanding remains incomplete, hindering our ability to develop effective prevention tactics. Every facet of this complex issue—from early warning signs and risk assessment to access to mental health services and societal stigma—must be thoroughly explored and addressed.

In essence, the prevention of suicide demands a concerted effort that transcends traditional boundaries and embraces a holistic understanding of mental health and well-being. A holistic approach that integrates various disciplines, methodologies, and perspectives is essential. This approach should encompass not only clinical interventions but also community outreach, education, policy changes, and ongoing research efforts.

Citations

- ★ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6165520/>
- ★ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10046421/>
- ★ <https://nap.nationalacademies.org/read/10398/chapter/6#:~:text=The%20most%20common%20disorders%20associated,%3B%20McGuffin%20et%20al.%2C%201991>
- ★ <https://www.nature.com/articles/s41380-021-01171-5>
- ★ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7405877/>
- ★ <https://www.sciencedirect.com/science/article/pii/S0165032713005272>
- ★ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7405877/#bib88>
- ★ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6458543/>
- ★ https://journals.sagepub.com/doi/10.1177/00030651221086622?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%20pubmed
- ★ <https://link.springer.com/article/10.1007/s40473-019-00185-2>
- ★ <https://pubmed.ncbi.nlm.nih.gov/35451317/#:~:text=Central%20to%20the%20psychoanalytic%20approach,self%2Dhate%2C%20and%20rage.>
- ★ https://journals.sagepub.com/doi/10.1177/00030651221086622?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%20pubmed
- ★ [https://www.thelancet.com/journals/lanpsy/article/PIIS2215-0366\(14\)70220-2/abstract](https://www.thelancet.com/journals/lanpsy/article/PIIS2215-0366(14)70220-2/abstract)
- ★ <https://pubmed.ncbi.nlm.nih.gov/35451317/#:~:text=Central%20to%20the%20psychoanalytic%20approach,self%2Dhate%2C%20and%20rage.>
- ★ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3749837/>
- ★ <https://www.ncbi.nlm.nih.gov/books/NBK220933/>
- ★ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7405877/>
- ★ [About suicide - Canada.ca](https://www.aboutsuicide.ca/)

Acknowledgements

Dr.Meadow Schroeder(Mentor and Consultant)

Ms.Rheinstein & Mr.Lahoda (Science Fair Co-ordinators)

My Parents

Help is Available

- ★ If you or someone you know is in immediate danger, please call 9-1-1.

- ★ Help is available 24/7 for suicide prevention and mental health. Here are some resources:
 - Talk Suicide Canada: 1-833-456-4566 (or text 45645 from 4pm to midnight ET)
 - Kids Help Phone: 1-800-668-6868 or text CONNECT to 686868
 - Hope for Wellness Helpline for Indigenous peoples: 1-855-242-3310
 - Trans Lifeline: 1-877-330-6366
 - Wellness Together Canada
 - Preventing suicide: Warning signs and how to help



Thank you

Natania Mathew Varghese
Grade 09
Queen Elizabeth High School
Calgary AB