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自殺防治熱線年輕來電者立即自殺風險狀態相關因素之配對病例對照研究

A Matched Case-Control Study of Factors Associated with an Active State of Suicidality among Young Suicide Prevention Hotline Callers

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摘要

背景：在臺灣，自殺為年輕族群之主要死因之一。自殺防治專線為常見之自殺預防策略，惟過去研究較少運用其通話資料，深入分析年輕族群之自殺相關風險。本研究以全國自殺防治專線之年輕來電者為研究對象，分析其社會人口學特徵、語言情緒傾向及自殺風險，並探討與僅具自殺意念者相較下，上述因素與來電者是否屬於具立即自殺風險者之關聯性。

方法：本研究納入 2019 年 7 月 1 日至 2020 年 5 月 21 日期間撥打全國自殺防治專線小於 30 歲之來電者。研究對象須具有近期自殺意念，並進一步區分為具立即自殺風險者與僅具自殺意念者。其中，具立即自殺風險者定義為近期每週或每日具有自殺意念，且同時出現自殺準備行為或正在進行自殺行為。研究採 1:1 配對設計，依性別及年齡（±1 歲）與僅具近期自殺意念之對照來電者進行配對。使用由熱線志工編碼之通話資料進行描述性統計分析，以呈現研究對象之社會人口學特徵、心理健康狀況及通話特性之分布。此外，透過文本情感分析（sentiment analysis）及自殺風險進行編碼，以探討來電者情緒狀態及自殺風險於通話過程中之變化。最後，採用條件式羅吉斯迴歸分析（conditional logistic regression）評估各變項與自殺風險狀態之關聯性。

結果：由熱線志工編碼之社會人口學特徵、心理健康特徵及文本情感分析之分數等資料分析結果，在具立即自殺風險狀態者（病例組）與僅具自殺意念者（對照組）之間並無顯著差異。相較於對照組，病例組於通話歷程中呈現較高之整體自殺風險分數與自殺意念分數，並於通話開始時具有較高之自我傷害意念分數，且於通話結束時具有較高之自殺意圖程度。在條件式羅吉斯迴歸分析中，通話結束時之自殺意圖以及通話歷程中之自殺意念皆與較高立即自殺風險狀態之勝算比相關。同時，與他人同住與較低立即自殺風險狀態之勝算比相關。整體而言，病例組與對照組在通話進行過程中皆呈現語言情緒趨於正向、且自殺風險分數逐漸下降之趨勢，惟兩組於通話開始至結束之變化幅度上並未發現顯著差異。

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結論：自殺防治專線之通話資料，為理解其使用族群之自殺風險與相關因子提供重要之研究素材。對臺灣之年輕族群而言，本研究結果顯示自殺防治專線為具效果之自殺預防措施。後續研究需進一步釐清對話過程中情緒與自殺風險改善之機轉。此外，本研究期能協助自殺防治專線工作人員與志工更早期辨識具較高自殺風險之來電者，並作為未來訓練設計之參考。

關鍵詞：自殺、青少年、年輕族群、意念至行動（ideation-to-action）、自殺防治專線、情感分析

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Abstract

Background: In Taiwan, suicide continues to be a leading cause of death for children, adolescents, and young adults. Suicide crisis hotlines are a common strategy for suicide prevention, yet few studies have utilized their data to analyze adolescent and youth suicide. This study analyzed the socio-demographic characteristics, linguistic sentiment, and suicide risk of young callers to the National Suicide Prevention Hotline to assess their association with being a caller who is in an active state of suicidality versus callers who had only suicidal ideation.

Methods: Callers younger than 30 from July 1, 2019 through May 21, 2020 with a recent history of suicide ideation and in an active state of suicidality, defined as having both weekly or daily suicidal thoughts and either preparing for or having an ongoing suicide attempt, was matched 1:1 by sex and ±1 year of age with control callers who only had a recent history of suicide. Descriptive statistics were used to describe the distribution of socio-demographic, mental health status, and call characteristics using data coded by the hotline volunteer. Sentiment analysis and suicide risk were coded to investigate changes in caller emotion and suicide risk over the course of the call. Conditional logistic regression analysis was used to assess associations with suicide state.

Results: Demographic and mental health characteristics coded by the hotline volunteers and sentiment analysis scores were not different between callers who were in an active state of suicidality (i.e., cases) compared to controls. Cases were more likely to have higher overall suicide risk scores and suicidal ideation scores throughout the call, higher self-harm ideation scores at the beginning of calls, and higher suicidal intent at the end of calls. Suicidal intent at the end of the call and suicidal ideation throughout the call were found to be associated with higher odds of being in an active state of suicidality, while living with others was found to be associated with lower odds of active suicidality. Overall, there was a general trend toward

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more positive sentiment and lower suicide risk scores as calls progressed for both cases and controls, with no difference found in the level of changes from the start to the end of the calls.

Conclusion: Hotlines provide abundant data to understand suicide risk and the associated factors among the user population. For young people in Taiwan, our data suggest that hotlines are an effective prevention measure. Further research is needed to better understand the mechanisms underlying the improvement of sentiment and suicide risk during the hotline conversation. In addition, this research will hopefully help hotline workers and volunteers to better identify more severe callers and inform their training.

Keywords: suicide, adolescent, youth, ideation-to-action, hotline, sentiment analysis

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Chapter 1: Introduction

1.1 Global burden of suicide

Suicide represents a major global public health issue with an estimated 727,000 people dying by suicide each year (World Health Organization [WHO], 2025). To address this issue, the United Nations (UN) Mental Health Action Plan 2015-2030 and the WHO Sustainable Development Goals have set a goal to reduce suicide rates by one-third of 2015 levels by 2030 (WHO, 2021, 2025a). Although age-standardized global suicide rates have decreased significantly from 13.8 per 100,000 population in 1990 to 9.8 per 100,000 population in 2019 (Yip et al., 2022), crude suicide rates have slightly increased by 0.1 per 100,000 population as recently as 2021 (WHO, 2024). Although significant progress has been made deaths in many regions of the world in reducing suicide deaths within the past 20 to 30 years, the goal to cut global suicide mortality rates by one-third by 2030 is not on track to be met (WHO, 2025a).

1.2 Youth, adolescent, and young adult suicide in Taiwan

Suicide is especially concerning among youth and young adults as it is the third leading cause of death among individuals aged 15 to 29 years old (World Health Organization, 2025b). These figures likely to be an underestimation as suicide rates are generally underreported around the world (Snowdon & Choi, 2020). In addition to suicide, self-harm also represents the third leading cause of disability-adjusted life-years (DALYs) for individuals aged 10 to 24 years old (Vos et al., 2020). This highlights the need to prioritize suicide prevention efforts aimed toward youth, adolescents, and young adults.

Globally, there has been progress in reducing youth and adolescent suicide rates. For children and adolescents aged 5 to 19 years old, suicide mortality rates have decreased from 4.74 per 100,000 in 1990 to 2.70 per 100,000 in 2019 (Kim et al., 2024). However, this

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reduction in suicide rate is not uniform across all regions of the world. Despite an overall global decrease in youth and adolescent suicide mortality that period of thirty years, the regions of Asia and the Americas both saw increases in the suicide mortality rate of individuals aged 10 to 24 years old within the same time period (Bertuccio et al., 2024; Yan et al., 2024).

In Taiwan, youth and adolescent suicide is particularly concerning. Although suicide rates for individuals aged 10 to 24 had been steadily decreasing since 2005, suicide rates began increasing in 2014 (Chang et al., 2023). Although the suicide mortality rate of older adults and the elderly have steadily decreased between 2014 and 2024, the suicide mortality rate of individuals aged 15 to 29 has increased greatly (Ministry of Health and Welfare [MOHW], 2025b). In 2014, the suicide mortality rate of individuals aged 15 to 19 was 2.3 per 100,000, but quadrupled to 9.2 per 100,000 in 2024. For individuals aged 20 to 24, the suicide mortality rate nearly doubled from 7.8 to 14.0 per 100,000, as did the suicide mortality rate for individuals aged 25 to 29 from 10.3 to 18.7 per 100,000 within the same 10-year period (MOHW, 2025c).

Furthermore, in 2024, suicide was the second leading cause of death among adolescents aged 12 to 17 as well as the second leading cause of death for individuals 15 to 24 years old (MOHW, 2025a). As a result, youth, adolescent, and young adult suicide rates continue to be a major public health priority in Taiwan, particularly for individuals under the age of 30.

1.3 Suicide iceberg model

To better understand potential underlying causes for youth suicide, an iceberg model of youth suicide behavior has been proposed (Hawton et al., 2012). The iceberg model posits that suicide deaths represent only the most visible aspect of suicide and self-harm, the figurative tip of the iceberg (Figure 1). Aside from those who die by suicide, there are even more people who attempt suicide, some of whom seek clinical care, and even more who do

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not and remain unrecorded. In addition to these individuals, moving farther down the iceberg reveals individuals who may have suicide ideations but do not engage in suicidal behavior and even more people who experience mental health problems but may not contemplate suicide (Chang et al., 2024). Therefore, the suicide iceberg model helps to uncover the different levels of suicidality and to illustrate the relationship between them. In other words, the suicide iceberg model can serve as a useful guide for researching risk and protective factors for different levels and severity of suicidality by helping to conceptualize the transition between different levels (Chang et al., 2024). Using the suicide iceberg model, it is clear that in order to achieve the goal of reducing suicide deaths, one of the critical prevention points is the transition from suicide ideation to action. By understanding the risk and protective factors associated with this transition, it will be possible to prevent individuals from continuing to move upward in the model into suicide death.

1.4 Suicide ideation-to-action frameworks

Prior to 2005, research involving identifying and predicting suicide risk did not distinguish between suicide ideation and suicide attempt (Klonsky et al., 2018). As a result, many emotional or behavioral factors such as helplessness, depression, or bullying that have been shown to be predictors of suicide cannot distinguish between individuals who only contemplate suicide and those who will engage in suicidal behavior (Klonsky et al., 2017; Klonsky & May, 2014; May & Klonsky, 2016). Because of this, it is crucial to better understand factors that may influence the transition from suicide ideation to suicide action in order to improve current suicide prevention methods and develop more tailored resources.

To overcome these challenges, ideation-to-action theories have been developed to better distinguish between those who contemplate suicide but do not act on those thoughts and those who think about suicide and also engage in suicidal behavior. One theory is the Three-Step theory (3ST) that identifies three unique steps for the process of developing

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suicide ideation to engaging in suicidal behavior (Klonsky & May, 2015). The first step in the 3ST proposes pain and helplessness as risk factors for developing suicide ideation. The second step distinguishes between moderate and strong suicide ideation. Those with moderate suicide ideation can become more severe through the loss of connectedness, a protective factor for this step. Finally, the third step explains the transition from suicide to ideation to suicide action after one has developed the capacity to act. The capacity to act is further classified into three subfactors: dispositional (i.e. tolerance to pain), acquired (i.e. habituation to death), and practical (i.e. knowledge of or access to means). By distinguishing suicide ideation and suicide action as different states, the 3ST highlights broad factors that may influence a person to act on their suicidal thoughts.

In contrast to the 3ST, the integrated motivational-volitional (IMV) model offers a more detailed approach for the development of suicide ideation and suicidal behavior (O'Connor & Kirtley, 2018). First, a pre-motivational phase describes background and life events that may contribute to developing suicidal thoughts. Following this is the motivational phase during which suicidal ideation grows as a result of feelings of defeat and entrapment. Finally, eight volitional factors help to drive the transition from suicide ideation to suicide action: (1) Access to means, (2) Plans for suicide, (3) Prior encounters with suicide or suicide behavior, (4) Impulsivity, (5) Tolerance for physical pain, (6) Fearlessness about death, (7) Visualizes or imagines death, or (8) Has previously engaged in suicidal behavior (O'Connor & Kirtley, 2018). Frameworks for suicide ideation-to-action like the 3ST and the IMV model can help guide research to be clearer in defining the research outcome of interest. In combination with the suicide iceberg model, suicide ideation-to-action theory helps to emphasize the need to explore how different levels of severity of mental health issues and suicidality may be affected by different risk and protective factors. In addition to research,

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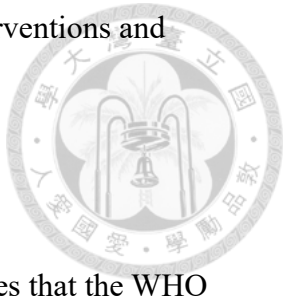
these theoretical frameworks can also help to inform more targeted interventions and approaches to prevent and reduce suicide.



1.5 Crisis support hotlines for suicide prevention

One of the major suicide prevention efforts to reduce suicide rates that the WHO recommends are suicide and crisis hotlines (WHO, 2014). In order to support the creation of sustainable and effective suicide and crisis hotline services, the WHO has released a guideline on how to establish and maintain such a hotline service (WHO, 2018). What began in the 1950s as a service primarily available in high-income countries, suicide and crisis hotlines are now one of the most accessible and cost-effective methods of suicide prevention available (Pil et al., 2013; Woodward & Wyllie, 2016). It is now estimated that there are over 1000 hotline services around the world, some of which are the only suicide prevention efforts in low-income settings (WHO, 2018).

1.6 Taiwan “1925” National Suicide Prevention Hotline

In Taiwan, there exists various suicide and crisis hotline services. One such hotline is the “1925” crisis hotline commissioned by the Ministry of Health and Wellbeing, but currently maintained and run by the non-governmental organization Taipei Lifeline Association (TLA). A free national hotline, any person within Taiwan would be able to dial “1925” to get connected with a call volunteer with the TLA based in Taipei City free of charge, thus reducing barriers to access and encouraging its use by the general population.

Although there are other free suicide and crisis hotline services in Taiwan, including a county-city region-specific “1995” hotline, the benefit of the “1925” National Suicide Prevention Hotline is the centralized storage of data. Callers to the “1995” hotline are automatically routed to the local county-city operator and the caller data is stored and managed by each operator. On the other hand, all callers to the “1925” hotline are received by

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the TLA in Taipei City. As a result, callers to the “1925” hotline are more representative of the national population, with the “1925” hotline receiving calls from every county-city in Taiwan (Shaw & Chiang, 2019).

In 2016, the TLA received 67,773 calls to the “1925” hotline. Since then, the annual number of callers to the hotline has increased every year, peaking in 2022 with 126,139 calls (Taipei Lifeline Association [TLA], 2024), indicating a continuing high demand for suicide and crisis support services in Taiwan.

One unique aspect of the “1925” hotline is the private and secure electronic information storage system eSOS implemented by the TLA. Call information such as phone number and the entire phone conversation are automatically recorded with the consent of the caller and stored within eSOS. Meanwhile, volunteers are trained to record additional information about the caller during and following the call based on the conversation such as age, occupation, suicide status, or help-seeking history (Shaw & Chiang, 2019).

Using this robust data, the TLA is able to offer an annual report and statistical analysis of crucial information regarding the characteristics of hotline users. In 2024, there were 110,804 calls made to the hotline (TLA, 2026). Of those calls, 84.5% (n = 94,597) were successful calls that resulted in a conversation. Of the successful calls, 22.3% (n = 21,116) were made by individuals aged 25 to 34, the most frequent callers of any age group. Individuals aged 15 to 24 represented 15.4% (n = 14,559) calls, the fourth most frequent callers out of seven age groups. However, the 15 to 24 age group had the longest average call length at 17.4 minutes, with individuals aged 25 to 34 having the second longest average call length at 16.6 minutes (TLA, 2026).

Out of the successful calls, 20.6% (n = 19,496) exhibited suicidal intent, which included exhibiting suicide ideation, individuals preparing for suicide, and individuals in active suicide. Of those callers, 42.0% (n = 8,181) were from individuals aged 25 to 44, again

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the most out of any age group. The next highest number of callers was from individuals aged 15 to 24, representing 25.8% (n = 5,031) of all suicidal callers. Furthermore, callers aged 24 and younger had the highest proportion of suicidal callers compared to all other age groups (TLA, 2026). Taken together, this data highlights the need to focus on youth and adolescent suicide prevention in Taiwan. Importantly, it also demonstrates the potential of suicide and crisis hotlines as a data source and means for researching suicide ideation-to-action factors among Taiwanese youth, adolescents, and young adults given the robustness and abundance of data collected.

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Chapter 2: Literature Review

2.1 Applications of ideation-to-action theory in suicide research

Many of the suicide ideation-to-action frameworks have been formulated only within the last decade. Studies on suicide risk factors are thus increasingly incorporating these models and frameworks. To assess the IMV model, a self-report survey of 1,288 university students in the United Kingdom classified as suicide attempters, suicide ideators, and those having no history of suicide found that the volitional factors fearlessness about death, impulsivity, and prior exposure to suicide were able to differentiate between suicide attempters and suicide ideators (Dhingra et al., 2015). However, when a separate study surveyed 1,809 students in the United Kingdom and utilized structural equation modeling to assess the relationship between volitional factors and suicide attempt, they found that impulsivity was not significantly associated (Dhingra et al., 2016). These mixed findings indicate that there may be other factors or relationships between factors that affect the transition from suicide ideation to action.

A meta-analysis of studies assessing pain tolerance and pain threshold found that those who had attempted suicide had a higher pain tolerance compared to those who had never attempted suicide (Chu et al., 2017). However, another meta-analysis of studies of individuals who had attempted suicide, individuals with psychiatric disorders, and healthy individuals but no history of suicide found that there was no significant difference in pain tolerance between people who had attempted suicide and those who did not. There were, however, differences in pain tolerance levels between those with a history of suicide and healthy individuals (Risch et al., 2024). These studies highlight a clear need to better assess and understand factors that may be associated with the transition from suicide ideation to suicide action. Furthermore, it is important to consider whether certain factors are more or less important in different individual personal and environmental contexts.

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2.2 Applications of ideation-to-action theory to adolescent suicide research

One context that requires further attention is the application of ideation-to-action theory and its components to youth and adolescent suicide research. Because ideation-to-action theories were developed based on adult populations, their applicability for other populations such as for youth and adolescents remain understudied (Kirshenbaum et al., 2024). Nevertheless, these theories have been increasingly applied to study and assess risk and protective factors for youth and adolescent suicide.

When looking at connectedness as a protective factor for suicide ideation, studies have shown that stronger connectedness with school and family is associated with lower suicidal ideation and likelihood of attempting suicide (Arango et al., 2019; Gunn et al., 2018). However, one study found that connectedness to school and adult support were not associated with suicide attempt history (Okado et al., 2021). This indicates that there might be other unique factors that affect the likelihood of suicide attempt. When looking at risk factors for suicidal behavior, one study showed that adolescents who had attempted suicide were more likely to have known friends or family members who have engaged in self-harm (Mars et al., 2019). In a study of adolescent psychiatric inpatients, it was found that the odds of attempting suicide increased with knowing a friend who had attempted suicide (Alqueza et al., 2023).

Research that applies components of ideation-to-action theory to adolescent and youth suicide research has been growing, and studies have consistency with parts of the theory. However, some results are mixed while other aspects of theories remain understudied within the context of youth and adolescent suicide (Kirshenbaum et al., 2024). Therefore, there remains a need to further investigate this population and to better understand their unique circumstances with regards to suicide risk and protective factors, especially given the burden of suicide on youth and adolescents.

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2.3 Using suicide and crisis hotline data to assess suicide risk factors

Given the increasing popularity of suicide and crisis hotlines around the world, they have the potential to be used for a targeted approach in studying certain populations. Unfortunately, however, because suicide and crisis hotlines were not created for the purpose of research, research that uses hotline data therefore usually require extra steps to obtain useful information. For example, to assess whether there is an association between suicide ideation among callers to the US Veterans Helpline and health seeking behavior, additional veteran health records were accessed through the Department of Veteran Affairs (Britton et al., 2024). In another study to assess whether changes in risk factors were associated with changes in suicide risk among high-risk youth and adolescent callers to the Beijing Psychological Support Hotline, callers were directly recruited by researchers to participate in a longitudinal study (Wu et al., 2024).

However, depending on the rules and regulations of each individual hotline and country of operation, this kind of data use may not be possible. For example, a study utilizing data from Lifeline Aotearoa in New Zealand did not have access to even basic demographic information such as gender and age because privacy regulations prevent the collection of such information (Shepherd et al., 2022). Nevertheless, there exists potential to use suicide and crisis hotline data should data be available and accessible. Due to the nature of suicide and crisis hotlines, they may provide crucial details and information regarding people at risk of suicide during a moment of crisis.

In Taiwan, despite the various suicide and crisis hotlines available, including the “1925” hotline, there is limited research using this kind of data. The “1925” hotline in Taiwan is particularly unique in that it is a national hotline with centralized storage of caller information, allowing for easy access to data compared to other national hotline services. Recent studies in Taiwan have utilized hotline data to investigate the effectiveness of the

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hotline service in improving emotional distress and suicide risk (Shaw & Chiang, 2019), as well as to better understand suicide risk during unique circumstances like during the COVID-19 pandemic (Althoff et al., 2016; Grimland et al., 2024; Hwang et al., 2023; Xu et al., 2021). However, Taiwanese hotline data has not yet been used to investigate and identify suicide risk factors. Furthermore, Taiwanese hotline data has not been used to explore a subgroup population such as youth, adolescents, and young adults, despite the high level of use of such services by this population.

2.4 Linguistic analysis tools for assessing suicide risk

Because of the conversational nature of suicide and crisis hotlines, it lends itself naturally to linguistic level analyses. In addition to suicide and crisis hotline phone services, suicide and crisis chatlines, a space where individuals converse with a chatline volunteer or medical professional through an online texting-based platform, are becoming increasingly common. However, in contrast to speaking on the phone for hotline callers, chatline volunteers and other health personnel may not receive natural feedback about the tone or emotional state of a help seeker using a chatline. As a result, researchers have capitalized on the written texting-based nature of chatlines. Recent studies have used linguistic analyses to analyze written chat conversations in order to assess mental health and predict suicide risk (Althoff et al., 2016; Grimland et al., 2024; Xu et al., 2021). These types of analyses have been effective in real-world settings, successfully helping to identify crisis chats and assisting chatline workers and health professionals with triaging patients and chatline users (Swaminathan et al., 2023). To obtain even more detail about the user, one study looked toward analyzing the sentiment of individual messages within chatline conversations (Fu et al., 2024). Performing analysis on a sentence or message level allows for the potential to gain insight about a chatter and how their sentiment changes throughout the conversation.

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Suicide hotline and phoneline services also offer similar opportunities for analysis. By transcribing the phone conversation, hotline and phoneline users can also be analyzed in a similar manner to identify suicide risk (Huang et al., 2024). Therefore, there is a strong potential for using text-based analytical methods to study crisis phoneline conversations.

2.5 Knowledge gap, research aims, and significance

Currently, there are mixed results or a lack of research on risk factors related to youth and adolescent suicide. This research aims to apply the suicide iceberg model and suicide ideation-to-action theory to better understand the relationship between potential risk or protective factors that may be associated with suicide risk. In particular, this research will investigate factors associated with different levels of suicide status and risk in order to better understand and identify differences between young individuals who engage in suicidal behavior and those who only think about suicide.

This research will use suicide and crisis hotline data to analyze call recordings and transcripts for more detailed assessment of emotional and behavioral factors associated with suicidal thought and action. This study aims to do so through the application of linguistic based analyses to understand and analyze caller sentiment and suicide risk. By doing so, this research hopes to highlight unique factors and characteristics associated with suicide in Taiwanese youth, adolescents, and young adults to potentially inform future research and suicide prevention efforts in Taiwan. As such, this study has the following research aims:

1. Identify potential risk factors associated with higher severity of suicide status (i.e. caller in an active suicide situation vs. caller who is only having suicidal thoughts)
2. Assess how caller sentiment changes over the course of the call and whether there are any differences for callers of different suicide statuses
3. Analyze the presence of suicide volitional factors and assess whether they change differentially over the course of a call for callers of different suicide statuses

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Chapter 3: Methodology

3.1 Data source

Commissioned by the Taiwan Ministry of Health and Welfare, the Taipei Lifeline Association operates the "1925" Suicide Prevention Hotline, a national helpline service that offers psychological intervention and support to Mandarin-speaking callers in Taiwan. Data and call recordings were extracted from centralized electronic records of telephone calls, counseling records, and call recordings maintained by the Taipei Lifeline Association (Shaw & Chiang, 2019).

For each call, the electronic system automatically recorded the incoming telephone number, date and time of call, and the entire phone conversation. Callers were notified of the recording at the beginning of the session and provided consent. During the call, the phoneline operator manually recorded into the system the caller's personal information, including age, gender, pre-existing mental health conditions, and suicide status using an internal recordkeeping codebook developed by Taipei Lifeline.

3.2 Study design, inclusion criteria, and case definition

This study utilized a matched case-control design with a 1:1 match by sex and ±1 year of age. All calls to the "1925" hotline from July 1, 2019 through May 21, 2020 were screened for inclusion based on the following criteria: (1) Caller was younger than 30 years old, (2) Birthyear and a complete phone number were recorded, (3) Was a first-time caller within the study time period, (4) Total call time lasted longer than five minutes, and (5) The conversation discussed caller suicidal ideation or behavior.

Calls deemed eligible for inclusion were then separated into cases and controls. Criteria were based on the hotline helper's classifications of i) frequency of suicidal thoughts as an indicator of suicide ideation and ii) current suicide status as an indicator of suicidal state. The frequency of suicidal thoughts variable included the following categories: no

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suicidal ideation, occasional (monthly), sometimes (at least once every two weeks), often (weekly), and always (daily). The current suicide status variable included the following categories: no suicidal intent, the presence of suicidal ideation, preparing for suicide, and ongoing suicide in progress.

Cases in an active state of suicidality were defined as callers who were coded by helpers as having both i) weekly or daily suicidal thoughts and ii) preparatory or ongoing suicidal acts, while controls were callers who exhibited only daily suicidal ideation but were not in an active state of suicidality. Cases were selected to include callers who exhibited either weekly or daily suicidal thoughts to maximize the number of included callers while controls were selected to only have daily suicidal ideation in order to have the highest baseline level of suicide ideation as a comparison. Callers who were classified as being in an active state of suicidality but had no data regarding recent history of suicide ideation were excluded.

Following screening, 53 callers were identified as case eligible, but only 52 matched controls were identified, resulting in 52 eligible matched pairs. Furthermore, although the TLA eSOS records system automatically identified first-time callers based on the phone number, upon further analysis of the content of all 104 conversations, it was evident that two case and four control callers were not first-time callers within the study period. As a result, five pairs (n = 10, 9.6%) were excluded from all analyses, resulting in a final 47 matched pairs (n = 94) (Figure 2).

3.3 Transcription of call recordings

All call recordings were transcribed verbatim in a two-step process. Call recordings were stored and processed on a secure local server using Whisper, an automatic speech recognition system created by OpenAI, to create initial drafts of call transcripts. Each transcript was then manually checked by a member of the research group to remove personal

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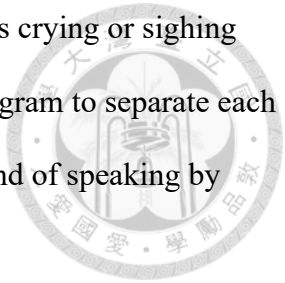
identifying information and make corrections. All verbal sounds, such as crying or sighing were also transcribed. All transcripts were then entered into a coded program to separate each utterance into sentences and turns, where one turn is defined as one round of speaking by both the caller and hotline volunteer.



3.4 Hotline volunteer-coded caller characteristics

Select socio-demographic and mental health characteristics of callers coded by the hotline volunteer were included for analysis. In order to increase statistical power, some characteristics were further collapsed together compared to the original codebook used by the hotline volunteers.

3.4.1 Socio-demographic characteristics

In addition to sex and age, the following socio-demographics were collected: education level (junior high or less, high school, associate's or bachelor's, unknown), occupation (student, employed, unemployed, unknown), living status (alone, with others, unknown), and marital status (single, not single, unknown). Callers classified as not single included being married, divorced, and cohabitating with a partner.

3.4.2 Mental health status characteristics

In addition to current suicide status and frequency of recent suicidal thoughts, the following call and mental health characteristics were collected: main reason for calling (family and relationships, mental health, physical health, work and finances, school, harassment, legal issues), volunteer assessment of the mental state of the caller (mental illness apparent, probable, or not present), and whether the caller is currently using psychiatric services (yes, no, unknown). Callers classified as not currently using psychiatric services also included those who discontinued use or expressed a refusal to seek treatment.

Mental health status was also assessed using the 5-item Brief Symptom Rating Scale (BSRS-5), a validated screening tool used to identify mood disorders (M. B. Lee et al., 2003).

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The questionnaire included five questions asking about different psychological symptoms experienced during the past week, including: insomnia (trouble falling asleep), anxiety (feeling tense), hostility (feeling easily annoyed or irritated), depression (feeling blue), and interpersonal sensitivity (feeling inferior to others). Each question was scored on a five-point Likert scale using 0 (not at all), 1 (a little bit), 2 (moderately), 3 (quite a bit), and 4 (extremely). The overall score was the sum of each individual score. Overall scores less than 6 were considered to be normal while scores greater than or equal to 6 were considered to be an indication of the presence of mood disorders or psychological distress (Chen et al., 2005).

3.5 Sentiment analysis annotation

Sentiment analysis attempts to identify the sentiment or emotion of an individual in a written text. A codebook was developed by members of the research group to systematically quantify and assess the verbal sentiment of the caller in a written conversation (Fu et al., 2024). The codebook contained instructions, definitions, tips, and examples to guide annotation (Appendix A). Sentiment analysis was performed on the sentence level, analyzing the content of the words spoken by the caller to identify the emotion or attitude of the caller. Each sentence was assigned a value of 1, 0, or -1 for expressing positive, neutral, and negative sentiment, respectively. Following completion of sentence level scoring, a turn score was assigned as the sum score of each sentence within the turn. When the turn score was 0 as a result of an equal non-zero number of positive and negative sentiment sentences, the sentence score of the final sentence within the turn was assigned to be the turn score. An average score was then calculated as the sum of the turn scores divided by the number of sentences.

3.5.1 Positive sentiment

Statements classified as positive included those describing or expressing a positive emotion (laughter, excitement, etc.), positive changes in emotion (decreased anxiety,

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increased calmness, etc.), descriptions of positive facts or events (having a good job, being able to speak freely, etc.), positive perceptions or thoughts (finding comfort in another individual receiving karma etc.), expressing motivation and intention to change for the better (scheduling an appointment with the doctor, hoping for happiness, etc.), and expressing gratitude (expressing thanks, wishing the volunteer safe travels going home, etc.).

3.5.2 Negative sentiment

Statements classified as negative included those describing or expressing a negative emotion (annoyance, disappointment, etc.), psychological distress (stress, anxiety, etc.), negative facts or events (parents got into a car crash, failed exams, etc.), negative perceptions or thoughts (calming exercises not working, speaking to a counselor not helping, etc.), and feelings of uncertainty or helplessness (not knowing what to do to make things better, unable to make a decision, etc.)

3.5.3 Neutral sentiment

All other sentences were coded as neutral. All classifications were made from the perspective of the caller. Therefore, statements made by the caller that described the words, actions, emotions, or sentiment of another individual were also coded as neutral.

3.6 Suicide risk annotation

A codebook to systematically quantify and assess suicide risk based solely on the content of a written conversation was also developed by members of the research group. The creation of this codebook was guided by existing surveys and protocols for assessing suicide risk (Fernandez et al., 2008; Jaycox et al., 2015), previous research regarding identifying suicide risk factors in users of suicide prevention hotlines (Gould et al., 2016; King et al., 2003; Mishara et al., 2007; Shaw & Chiang, 2019), and the suicide ideation-to-action theoretical framework (O'Connor & Kirtley, 2018). The codebook contained seven categories, including ambivalence toward suicide, psychological pain, self-harm ideation,

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suicide ideation, access to lethal means, prior history of suicide or self-harm, and prior exposure to suicide, each with definitions, scoring criteria, and examples for guidance (Appendix B). Possible scores ranged from 0, representing the absence of the category, up to a maximum score of 1, 2, or 4 depending on the category and severity. Following completion, an overall sum suicide risk score was calculated. However, because the category of ambivalence toward suicide allowed a score of 9 to represent insufficient information to make a judgement, ambivalence toward suicide was modified into suicide intent in order to calculate a meaningful overall score. Under this modified suicide intent category, a score of 1 or 2 in ambivalence toward suicide was reclassified as 1 indicating the presence of suicide intent and a score of 0 or 9 reclassified as 0 representing the absence of suicide intent.

3.7 Codebook use training

To practice using the two codebooks, separate phoneline and chatline transcripts were coded and scores were compared with that of the creator of the codebook using Cohen's kappa. Sentences within the first and last 10 turns of five different call and chat transcripts were annotated for sentiment analysis with a κ agreement of 0.79, indicating a high moderate level of agreement. For suicide risk, the beginning and ends of 20 different call and chat transcripts were annotated with a κ agreement ranging from 0.69 to 1.00 for six of the seven categories, indicating a moderate to very high level of agreement. Agreement for self-harm ideation was 0.47, indicating low moderate agreement. Following the annotation, all discrepancies were discussed until differences in interpretation were resolved. Because of the lower κ for self-harm ideation, the codebook definition was updated to address ambiguity.

In this study, sentiment analysis and suicide risk annotations were each performed for the beginning and end of each call, represented by the first and last five minutes of the transcript, respectively. For calls shorter than 10 minutes, the total time was divided equally into two as the beginning and end of the call. Callers were included for analysis if there were

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at least 10 turns in each beginning and end segment. No callers were excluded as a result of this criterion.

3.8 Statistical analysis

Socio-demographic and mental health characteristics as rated by the phoneline volunteer were reported as counts and percentages and compared using the Stuart-Maxwell test. For living status, because only three callers had an unknown living status, those three pairs were dropped for analysis in order to use the McNemar exact test for greater statistical power without significantly reducing the sample size. Continuous variables, including call length and sentiment analysis scores, were summarized using mean and standard deviation and compared using two-tailed paired t-tests. Suicide risk scores for all seven individual categories and the overall sum score were compared using Wilcoxon signed-rank tests. Conditional regression analyses were conducted to estimate the odds ratio (OR) and 95% confidence interval (CI) for each characteristic to identify factors associated with more severe suicidal states. Due to some response categories having zero observations and being unable to further consolidate the categories, each individual response category for living status and main reason for calling was entered separately into the conditional regression analysis as binary predictors. All analyses were conducted using R software version 4.5.2.

3.9 Ethics

This study falls under the jurisdiction of a larger project previously approved by the National Taiwan University Research Ethics Committee (202004065RINC). Lifeline data were extracted, stored, and used in accordance with the contract signed between Taipei Lifeline and the principal investigator, Professor Shu-Sen Chang.

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Chapter 4: Results

4.1 Socio-demographic, mental health, and call characteristics

Of the 94 callers, 46 were males (48.9%) and 48 were females (51.1%) with an average age of 21.3 years (sd = 4.0). Most callers were within the 20-24 years old age group (n = 41, 43.6%), followed by the 15-19 years old age group (n = 25, 26.6%), the 25-29 years old age group (n = 23, 24.5%), and the 10-14 years old age group (n = 5, 5.3%). Consistent with the age distribution, most callers were students (n = 34, 36.2%) while 29 callers were employed (30.9%) and 23 unemployed (24.5%). Although education level and the number of students remained largely consistent between the two groups, there were more callers who were unemployed in the active suicide group (n = 14, 29.8%) compared to the ideation only group (n = 9, 19.1%). Also consistent with the age range is marriage status with most callers being single (n = 63, 67.0%). For living status, 64 callers were living with others (68.1%) while 27 lived alone (28.7%). Between the active suicide and ideation only groups, more callers who had less severe suicide states were living with others (n = 36, 76.6%) compared with callers who were actively suicidal (n = 28, 59.6%). However, despite these observations, there were no evidence of differences in socio-demographic characteristics between the callers who had more severe suicide states and those less severe (Table 1).

For mental health characteristics, there was also no evidence of differences between callers who were actively suicidal compared to those who only exhibited suicidal ideation (Table 1). However, there was an interesting pattern in the number of observations for current suicide status, the case inclusion criteria. Within the case definition of suicidal behavior, the callers in an active state of suicide had 29 callers (61.7%) that were reported to be a suicide in progress while 18 callers (38.3%) were reported to be making preparations for suicide. Meanwhile, although the control criteria for suicidal behavior included both having only

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suicidal thoughts or no suicide risk at the time of the call, all 47 callers (100.0%) in the control group were reported to have no suicide risk at the time of calling.

Among the total sample, there were an equal number of callers who scored above (≥6) and below (<6) the threshold for mental stress on the 5-item Brief Symptom Rating Scale (BSRS-5) (n = 47, 50%). However, more callers in a more active state of suicide were found to have mental stress (n = 28, 59.6%) while more callers who only exhibited suicidal ideation were found to not have mental stress (n = 28, 59.6%). This is in contrast to the assessment of the mental state the caller by the volunteer. More callers who exhibited only suicidal ideation were classified as having either apparent or probable mental illness (n = 42, 89.4%) compared to callers in an active state of suicide (n = 40, 85.1%). Among mental health help-seeking behavior, most callers were using psychiatric services at the time of the call (n = 58, 61.7%) and numbers were relatively similar between the two groups.

Although presence of suicidal behavior did not differ by any socio-demographic or mental health characteristics, they did differ by call length (Table 1). Calls with individuals that were actively suicidal generally were longer than their matched controls (32.1 minutes vs. 29.0 minutes, p = 0.020). Aside from call length, the main reason for calling was generally similar between the active suicide and ideation only callers, with most people calling because of family or relationship issues (n = 33, 35.1%) or mental health issues (n = 44, 46.8%). Of the remaining reasons, both active suicide callers and ideation only callers reported issues with work and finances (n = 7, 7.4%) and school (n = 6, 6.4%). Only callers who were actively suicidal called for problems related to physical health (n = 2, 4.3%), harassment (n = 1, 2.1%), and legal issues (n = 1, 2.1%).

4.2 Sentiment analysis

During the beginning of the call, the average sentiment analysis scores were nearly identical for active suicide callers (mean = -0.22, sd = 0.15) and ideation only callers (mean =

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-0.21, sd = 0.12) (Figure 2). There was no evidence of differences between active suicide and ideation only callers in average sentiment analysis scores during the beginning of the call, the end of the call, nor for the change in scores over the call period (Table 2). Although average sentiment scores remained negative for the entire call, within each group, there was strong evidence of more positive sentiment scores at the end of the call compared to the beginning of calls for both active suicide callers (-0.11 vs. -0.22, $t = 6.35$, $p < 0.001$) and ideation only callers (-0.07 vs. -0.21, $t = 9.30$, $p < 0.001$) (Figure 3 and Table 3).

4.3 Suicide risk

Out of the seven individual suicide risk categories, there was strong evidence of differences between the active suicide and ideation only callers in three of them: suicide intent, self-harm ideation, and suicide ideation (Table 4). Among those criteria, suicide ideation was more likely to be higher in the active suicide callers during both the beginning (1.11 vs. 0.47, $V = 262.0$, $p = 0.026$) and the end of the call (0.94 vs. 0.15, $V = 190.5$, $p = 0.001$). For self-harm ideation, strong evidence of differences was found only at the beginning of calls. At the beginning of the call, active suicide callers were more likely to exhibit self-harm ideation compared to ideation only callers (0.36 vs. 0.09, $V = 56.5$, $p = 0.033$). At the end of the call, active suicide callers were more likely to have higher levels of suicidal intent compared to ideation only callers (0.53 vs. 0.17, $V = 88.0$, $p = 0.015$). Although individual suicide risk scores for were generally higher for active suicide callers except for psychological pain at the beginning of calls, there was no evidence of differences between active suicide and ideation only callers for many risk characteristics at different time points (Table 4).

In addition to the individual characteristic scores, there was also strong evidence of differences between the overall sum scores between the active suicide and ideation only groups during both the beginning and the end of the call (Figure 4). Overall sum scores were

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generally higher in active suicide callers at the beginning (4.81 vs. 3.55, V = 657.0, p = 0.026) and at the end of calls (3.57 vs. 1.94, V = 655.6, p < 0.001).

There was strong evidence that overall suicide risk was lower by the end of the call for both active suicide and ideation only callers (Figure 5 and Table 5). In addition to overall suicide risk, there was also strong evidence of lower scores for suicidal intent, psychological pain, and history of suicide or self-harm by the end of the call for both groups. Interestingly, there was only evidence of reduced scores for suicidal ideation over the course of the call for suicide ideation only callers and not active suicide callers (Table 5).

4.4 Factors associated with an active suicidal state

Among socio-demographic characteristics, there was moderate evidence of an association between callers who lived with others and decreased odds of being an active suicide caller (OR = 0.25, 95% CI 0.07-0.89, p = 0.032), but no evidence of an association between suicide status and living alone (Table 6). Among call characteristics, there was very limited evidence for an association between a longer call and increased odds of being an active suicide caller (OR = 1.14, 95% CI 0.99-1.31, p = 0.060).

None of the mental health characteristics, call characteristics, nor sentiment scores had any evidence of association with suicide status. In contrast to the socio-demographic characteristic of living with others, suicide risk characteristics were generally associated with increased odds in being a caller in an active state of suicide, although evidence of association was found for only three characteristics (Table 6). A higher level of suicidal intent at the end of the call was associated with greater odds of being an active suicide caller (OR = 2.13, 95% CI 1.06-4.29, p = 0.033). On the other hand, an increase in suicidal ideation was associated with greater odds of being an active suicide caller during both the beginning of the call (OR = 1.54, 95% CI 1.04-2.30, p = 0.032) and at the end of the call (OR = 2.67, 95% CI 1.21-5.90, p = 0.015). Aside from the scores of the individual suicide risk characteristics, there was also

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evidence of association between the overall suicide risk score at the beginning at the call (OR = 1.21, 95% CI 1.02-1.44, p = 0.030) and at the end of the call (OR = 1.53, 95% CI 1.14-2.05, p = 0.005) with greater odds of being an active suicide call (Table 6). There was no evidence of an association between the change in sentiment or suicide risk scores over the course of the call and suicide status.

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Chapter 5: Discussion

Using call data and conversation recordings of callers to the Taiwan "1925" National Suicide Prevention Hotline, this studied aimed to identify any factors associated with callers who engaged in suicidal behavior either as an active suicide case or by preparing for suicide compared to callers who only thought about suicide.

5.1 Caller demographics and call characteristics

In this study, there was no evidence of differences in the number of observations for any demographic characteristics between callers who were actively suicidal and those who only exhibited suicidal ideation. However, there were still some noticeable trends within the number of observations for some demographics.

Because this study was matched by age, statistical analyses were not performed for the distribution of observations for age. Nevertheless, it is noticeable that our sample had a roughly equal number of male and female active suicidal callers (Table 1). Historically, men have higher rates of suicide while women have higher rates of utilizing psychological resources such as suicide and crisis hotlines (Krishnamurti et al., 2022; Rickwood et al., 2007). Crucially, this finding is also in contrast to a previous study that also analyzed the "1925" hotline caller data where they also found a higher number of female callers (Shaw & Chiang, 2019). This may indicate that among young individuals or among individuals with at least suicide ideation, there may be greater gender equality in the number of users of the hotline service. This may be due to greater mental health literacy and willingness among men to use the service or possibly an unwillingness by women to use the service.

Given the sample of young children, adolescents, and young adults, apart from sex, it was not surprising to have a relatively even spread across education level and a skew toward being single and a student (Table 1). However, although there were no significant differences in the overall spread of observations for occupation, the data does appear to have a higher

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number of unemployed individuals in the acutely suicidal group. This observation is consistent with the literature as the relationship between unemployment and suicide risk have been well-documented (Cunningham et al., 2021; Skinner et al., 2023). This is especially important as the association between unemployment and suicide was found to be stronger at younger ages (Gunnell et al., 1999).

Among the demographic characteristics, living with others was the only characteristic that had evidence of association with severity of suicidality from the conditional regression analysis. Our study found that living with others was associated with a decreased odds of being an acutely suicidal caller (Table 3). However, there was no evidence of the converse, that those living alone are more likely to have a higher severity of suicidality. This would indicate that living with others functions as a protective factor against suicide while living alone does not necessarily indicate more severe suicidality. This is in contrast with many studies that have shown living alone and loneliness are associated with an increased risk of suicide ideation, suicidal behavior, and death from suicide (Alothman et al., 2024; Luo et al., 2024). Meanwhile, a study of Korean adolescent students found that living away from family was predictive of suicidal ideation in boys but not girls (Lee & Choi, 2015). Nevertheless, one study that looked at adults over the age of 18 found that living in a shared household was associated with lower risk of suicide ideation for men but not for women (Ernst et al., 2021). Therefore, it may be that there are other factors involved with between living status and suicide risk. For example, rather than considering loneliness as a single concept, identifying the form of loneliness would be beneficial as loneliness from friends, family, and romantic partners are all associated with depression and suicidal ideation to varying degrees (McClelland et al., 2023). Within the context of this study's results, further research would benefit from investigating with whom the individuals were living with.

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In addition to further assessing what kind of relationships and living arrangements callers have, the quality of those relationships should further be assessed. Our data shows that while the most frequent reason for calling the hotline was due to mental health issues, the second most common reason was due to family and relationship issues (Table 1). This observation is consistent with other studies investigating reasons why young people call into hotlines (Ohtaki et al., 2019; Watling et al., 2021; Xie et al., 2026). Within the Asian cultures, family may be an even stronger risk factor. One study studying students aged 15 to 24 from Taipei, Shanghai, and Hanoi found that family structure and parental support were significantly associated with suicide ideation (Blum et al., 2012). Another review article found that family relationship issues were also a common suicide risk factor for children and adolescents in Hong Kong (Siu, 2019). Yet at the same time, it has also been shown that family support for adolescents was also associated with decreased suicidal ideation (Nakano et al., 2022). Therefore, further investigation regarding the quality of relationships with family and the people with whom adolescents and young individuals live in Taiwan would be especially beneficial.

Although there were a lot of calls related to family and relationship issues, there surprisingly were very few calls related to school issues (Table 1). Within the East Asian context, school and academic pressure has been well-documented as a risk factor for suicide among students and adolescents (Guo et al., 2025; J. Lee et al., 2019; Nakano et al., 2022; Okada et al., 2023; Xie et al., 2026). One potential explanation for this observation is simply the lack of use of the phoneline service by people with these problems. When studying a nationwide survey of individuals aged 15 to 19 in Taiwan, it was found that although use of psychological services was higher among adolescents experiencing suicidal ideation and psychological issues compared to those without. Nevertheless, there was still a general underuse of mental health services (Pan et al., 2021). However, this also contradicts our study

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sample in which nearly 60% of both acutely suicidal and non-acutely suicidal callers were using psychological services. It may be possible that due to the nature of a suicide hotline, users of such a service would already tend to have greater mental health literacy as compared to the general adolescent and young adult population.

Among call characteristics, call length was found to be able to distinguish between active suicide and ideation only callers (Table 1). Although evidence for an association between longer calls and an increased odds of active suicide was very weak, this is consistent with a previous study of callers aged 10 to 19 to a municipal crisis hotline in China that found call length to be associated with higher odds of active suicidality in a dose-dependent manner (Xie et al., 2026). Although there was no evidence of BSRS-5 scores being able to distinguish between active suicide and ideation only callers, there were still a greater number of active suicide callers having higher BSRS-5 scores indicating the presence of mental stress (Table 1). Taken together, this would indicate that the hotline volunteers are able to effectively and correctly identify callers with greater suicide risk and keep them speaking on the line longer in a testament to the quality of the phoneline volunteers and service. This would be consistent with a previous study finding that high risk callers spoke more words per sentence as well as spoke more words overall throughout the entire conversation (Huang et al., 2024). Future studies may benefit from investigating whether call length is also associated with active suicidality in a dose-dependent manner. Similarly, future studies should also investigate whether there is a plateau at a certain call length in terms of added benefits for a longer call in order to benefit balancing the needs of addressing the issues of active suicide callers and also the human and time resources available to address other incoming callers.

5.2 Sentiment analysis

Sentiment analysis and analyzing the emotions and attitudes of people through written text increased in popularity following the rise of social media and an increase in written

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content on the internet (Denecke & Reichenpfader, 2023). Since then, sentiment analysis has also begun to be used within medical and clinical settings, including in suicide research. For example, one study analyzed the sentiment of past suicide notes to better understand and identify individuals susceptible to engaging in suicidal behavior or to be able to predict individuals who will repeat an attempt at suicide (Pestian et al., 2012). Other examples include analyzing clinical notes to predict suicidality or analyzing the written free response answer of psychiatric outpatients to a simple check-up question (George et al., 2021; Sedano-Capdevila et al., 2023). Many studies show promise in using sentiment analysis to make clinical predictions, though one study found that in order to better capture suicide risk and suicide related factors, a suicide-specific word must be developed, rather than using general lexicons that currently exist (Bittar et al., 2021). By developing our own codebook to analyze sentiment analysis among suicidal hotline callers, this study circumvents this issue. To our knowledge, this study is the first to apply sentiment analysis to hotline call data.

Although there was no evidence of differences in sentiment analysis scores between active suicide and ideation only callers, nor for an association with active suicidality (Figure 3 and Table 2), the general trend was that scores increased over the course of the call (Table 3). Although sentiment analysis would not be able to distinguish between severity of suicidality, it would still indicate that the suicide hotline is effective in reducing negative sentiment of callers throughout the course of a call. Furthermore, the data shows that hotline calls are nearly equally as effective at reducing negative sentiment in both active suicide and ideation only callers (Figure 4). Nevertheless, given the promising application of sentiment analysis in clinical settings in potentially differentiating between suicidal and non-suicidal patients, it may be that sentiment analysis is associated with the presence of suicide ideation, which this study would not have detected. Therefore, future studies would benefit from evaluating this relationship with hotline data. Furthermore, there may be an age effect

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associated with sentiment analysis, as it was found that younger individuals wrote longer suicide notes and used more emotional language in their writing (Pestian et al., 2012). Therefore, future studies should also apply sentiment analysis to a wider age range of hotline users to assess this relationship in hotline conversations.

5.3 Suicide risk factors within the context of suicide ideation-to-action theory

Of the suicide risk characteristics that described the mental state of the caller, only psychological pain was found to not be able to distinguish between active suicide and ideation only callers (Table 4). Similarly, there was no evidence of association between psychological pain and suicide status (Table 5). The absence of a significant association for psychological pain during both the beginning and of the call is consistent with a previous similar study of hotline calls in the United States (Gould et al., 2007). The lack of evidence for an association between psychological pain and acute suicidality is consistent with the 3ST model of ideation-to-action theory. The 3ST model posits that pain, whether physical, emotional, or psychological, helps to develop suicide ideation while loss of connectedness as a protective factor helps to facilitate a stronger feeling of suicide ideation (Klonsky & May, 2015). Therefore, it would be possible that in our study where every individual has had a history of recent suicide ideation, psychological pain scores are high. Therefore, psychological pain itself may not be a risk factor for progressing from moderate to strong ideation and ultimately from ideation to attempt.

Interestingly, however, there have been findings in the literature, although rarer, regarding a closer connection between psychological pain and suicidal behavior. Previous clinical research suggests that making the decision to engage in suicidal behavior and carrying out that goal may associated with decreased mental pain (Reisch et al., 2010). Although our data did not find evidence of differences between psychological pain scores between active suicide and ideation only callers for neither the beginning nor the end of calls,

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it was notable that psychological pain scores during the beginning of the call was the suicide risk characteristic and timepoint in which active suicide callers had a lower average score compared to ideation only callers (Table 4). This finding is partially consistent with a previous study among general callers to a crisis hotline showing that emotional pain was lower in callers with an ongoing suicide attempt compared to callers with only suicidal thoughts during both the beginning and at the end of calls (Shaw & Chiang, 2019). Given that there was evidence of a decrease in psychological pain scores over the course of the call for both active suicide and ideation only callers (Table 5), this would indicate that although psychological pain did decrease for all callers, there might have been less room for improvement for active suicide callers. Due to the conflicting data and literature, further research should continue to explore the effect of psychological pain to assess whether it is more associated with the development of suicidal ideation or transition to suicidal action.

In addition to psychological pain, it was surprising to find no evidence of differences in the number of observations for a history of suicide or self-harm between active suicide and ideation only callers (Table 4), as well as no evidence of their association with suicide status (Table 5). Both of these characteristics are posited to be volitional factors that are associated with the transition from suicide ideation to suicide action in the IMV model (O'Connor & Kirtley, 2018). In particular, a history of self-harm and suicide has been well-documented as one of the best predictors of suicide attempt (Cantor et al., 2023; Etherson et al., 2025; Horwitz et al., 2015). Given the low scores in our data, it may simply be due to the fact that these topics were not asked or brought up during the conversation. However, given the focus on youth and adolescent population, it may also be possible that younger individuals may not have had as much prior exposure to suicide or may not have engaged in suicide or self-harm before. This potentially highlights the success of the hotline as a suicide and crisis prevention

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resource, where many of these young callers are accessing and reaching out to the hotline before they have ever engaged in self-harm or suicidal behavior.

Among the suicide risk characteristics that was found to be able to distinguish between active suicide and ideation only callers, all of them except self-harm ideation at the beginning of calls also had evidence an association with increased odds of being an active suicide caller (Table 3). Our finding that suicidal intent at the end of the call was associated with 2.13 times greater odds of acute suicidality is consistent with a previous study of hotline callers in the United States. Following up with callers after an initial call session, they found that intent to die at the end of the call was also the most significant predictor of suicidality with 1.7 greater odds of suicide (Gould et al., 2007). With regards to suicide ideation and overall suicide risk score, it was not surprising that these scores would be most associated with greater odds of being an acutely suicidal caller. Furthermore, for both characteristics, the score at the end of the call was found to have a stronger association compared to the beginning of the call. This would make sense given that the mental state of the caller at the end of the call, that is at the end of the help-seeking behavior, would be more closely associated with the overall suicide risk of the caller.

5.4 Effectiveness of the "1925" National Suicide Prevention Hotline

Overall, the data from this study show that the Taiwan "1925" National Suicide Prevention Hotline is an effective psychological intervention and support system for its users. For sentiment scores and every suicide risk characteristic score, there was a similar improvement decrease in scores over the course of the call, indicating more positive sentiments and lower suicide risk by the end of the call. These findings are consistent with that of the previous study that found this hotline reduced psychological distress and suicide risk over the course of the call (Shaw & Chiang, 2019). This finding further highlights the effectiveness of the hotline service in being able to help callers. Importantly, it also speaks to

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the ability of the hotline volunteers. Although the data shows similar improvements in sentiment and suicide risk scores between active suicide and ideation only groups, it is likely that each volunteer has his or her own helping style and also adapts the call to the different needs of each individual caller. Therefore, the overall success of the hotline relies on the flexibility and strength of its volunteers. Future efforts may look into volunteer helping styles and their effectiveness with certain presenting issues by applying sentiment analysis or other linguistic analysis techniques on the words of the volunteer as well as the caller.

5.5 Limitations

The largest limitation of this study is the sample size. Originally there were 52 matched pairs included for this study. While 52 is already a small sample size, the final included sample was reduced to 47 pairs due to the realization that a few calls were not the first time that someone had called into this hotline during the period of this study. As a result, some characteristics were unable to have statistical calculations performed due to lack of observations within our sample. Furthermore, during conception of this project, it was intended that there would be a 1:3 or a 1:4 case to control matching. However, in order to maintain the strict age matching requirement, there were only enough controls for a 1:1 match, which resulted in low statistical power and the wider confidence intervals seen throughout our results. Future studies or adaptations of this study could potentially loosen the age matching requirements to ±2 or even potentially ±3 years of age in order to increase the matching ratio. That way the statistical power would increase without having to significantly increase the overall sample size. In all, these limitations could potentially affect the reliability of our findings.

In addition to sample size, another limitation is the reliance on secondary data. As a suicide prevention hotline, the purpose of this hotline is to assist the caller and to guide the conversation in a way that best meets the need of the caller. Furthermore, the purpose of data

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collection by TLA is not for research purposes but administrative. Therefore, a major limitation of analysis is the information that is given within the context of the call conversation as well as the information coded by the phoneline volunteers. Although intense training is required to become a phoneline volunteer with the TLA, there may still be differences in how each individual volunteer codes critical characteristics of the caller, including suicide risk and mental state.

This limitation is most prominent in the characteristic describing the main reason for calling. Initially, there was a third codebook developed by the research group that would have allowed for the classification of multiple different reasons for calling that were brought up throughout the entire conversation. However, due to time and manpower constraints, as well as low κ scores with the codebook developers, the third codebook was ultimately dropped from this study. Instead, the singular main reason for calling as coded by the phoneline volunteer was used instead. While still insightful, only considering the main reason for calling might have resulted in a narrower understanding of caller issues by not catching other issues a caller may have brought up.

5.6 Further implications and future directions

This study demonstrates the use and effectiveness of performing a linguistic and content analysis of phoneline conversations. Although it requires a lot of time and manpower to perform manually, this study demonstrates the potential to automate transcription and possibly the coding of suicide risk and caller sentiment in the future. For research purposes, this will allow for a more systematic and nuanced assessment of various factors that were unable to be performed in this study, such as assessing the various reasons for why a caller is calling into the phoneline service. For clinical purposes, this will allow the hotline volunteer to simply focus on the caller and the conversation rather than have to worry about writing and documenting this critical information while simultaneously conversing with the caller.

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Chapter 6: Conclusion

Although not without its limitations, suicide prevention and crisis hotlines provide an abundance of data with which to understand and assess suicide risk among youth, adolescents, and young adults. Given the nature of crisis hotlines, there will need to be additional preparation to analyze the available data. Overall, this study found that caller suicide risk scores were higher for callers who were in active or preparatory suicide states while caller sentiment was similar between the two groups of callers. However, there were similar marked improvements in both measurements for all callers. There were no differences in demographics, sentiment scores, as well as many of the suicide risk scores between callers who were in active or preparatory suicide compared to those who were ideational only, but calls from more severe call cases were generally longer. This study did identify a temporal effect on severity of call cases, with self-harm ideation being associated with more severe callers only at the beginning of calls only at the end of calls. Future studies should further investigate this temporal effect, and hotline volunteers should focus on targeting these factors throughout the call.

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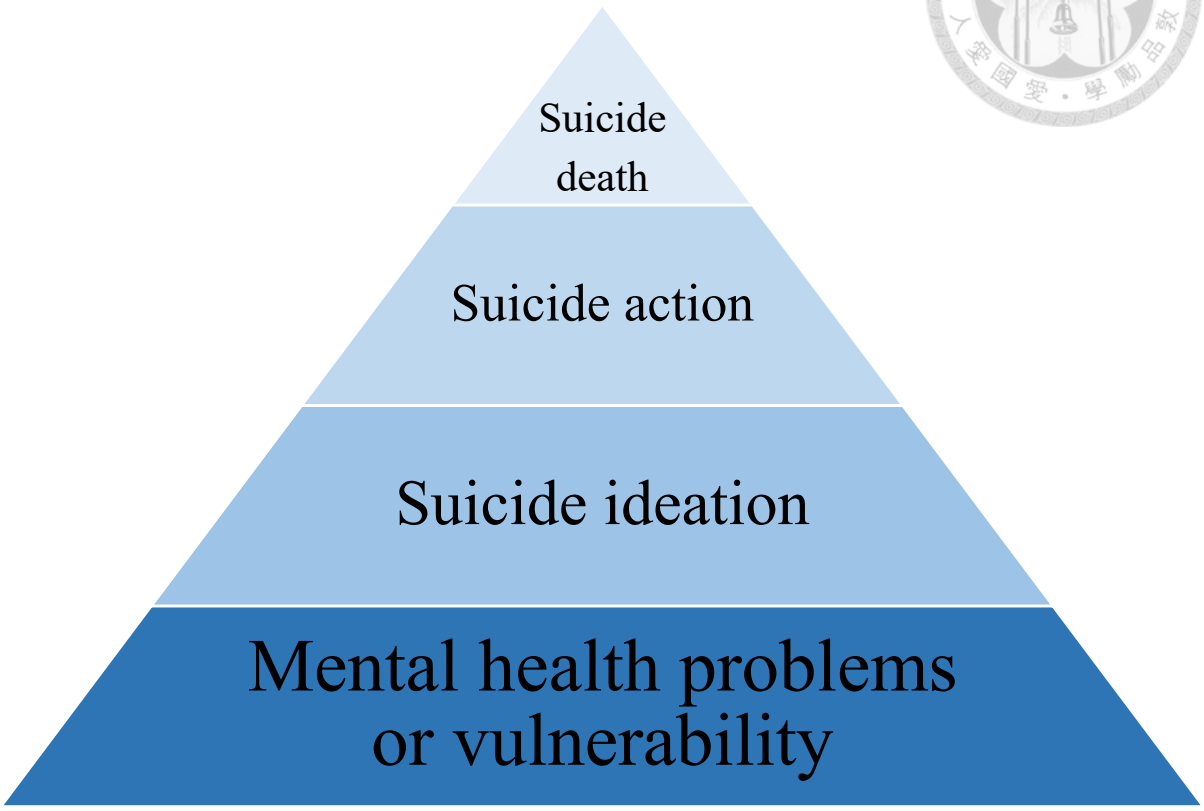
Figures

Figure 1 Suicide iceberg model



Adapted from (Chang et al., 2024)

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Figure 2 Flowchart of case inclusion criteria

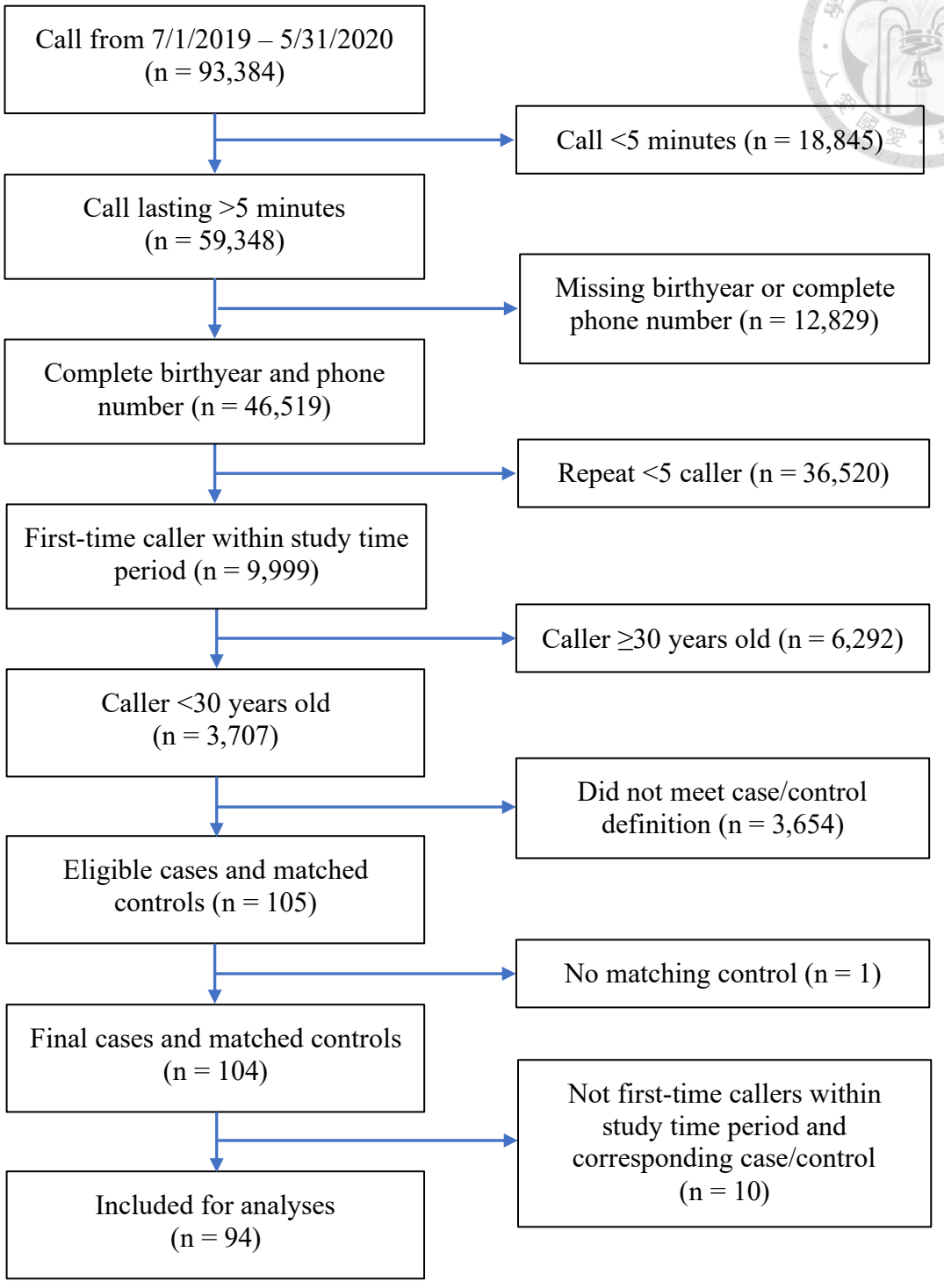

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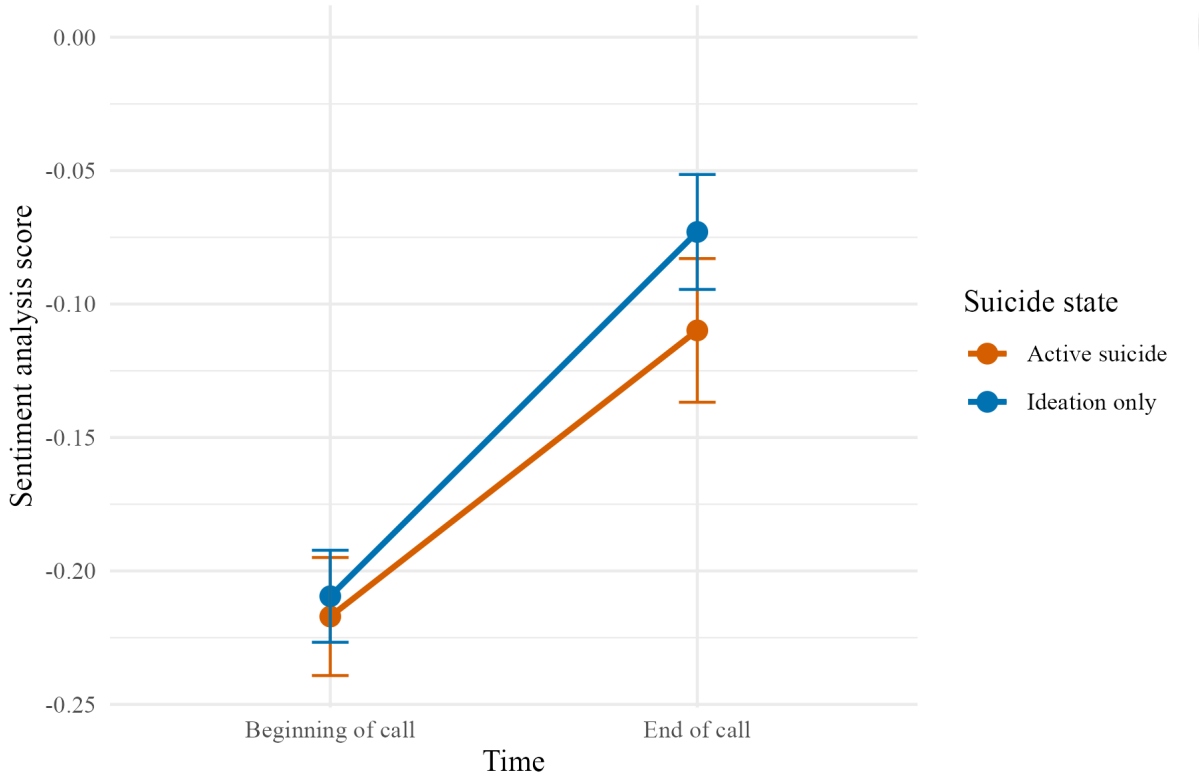
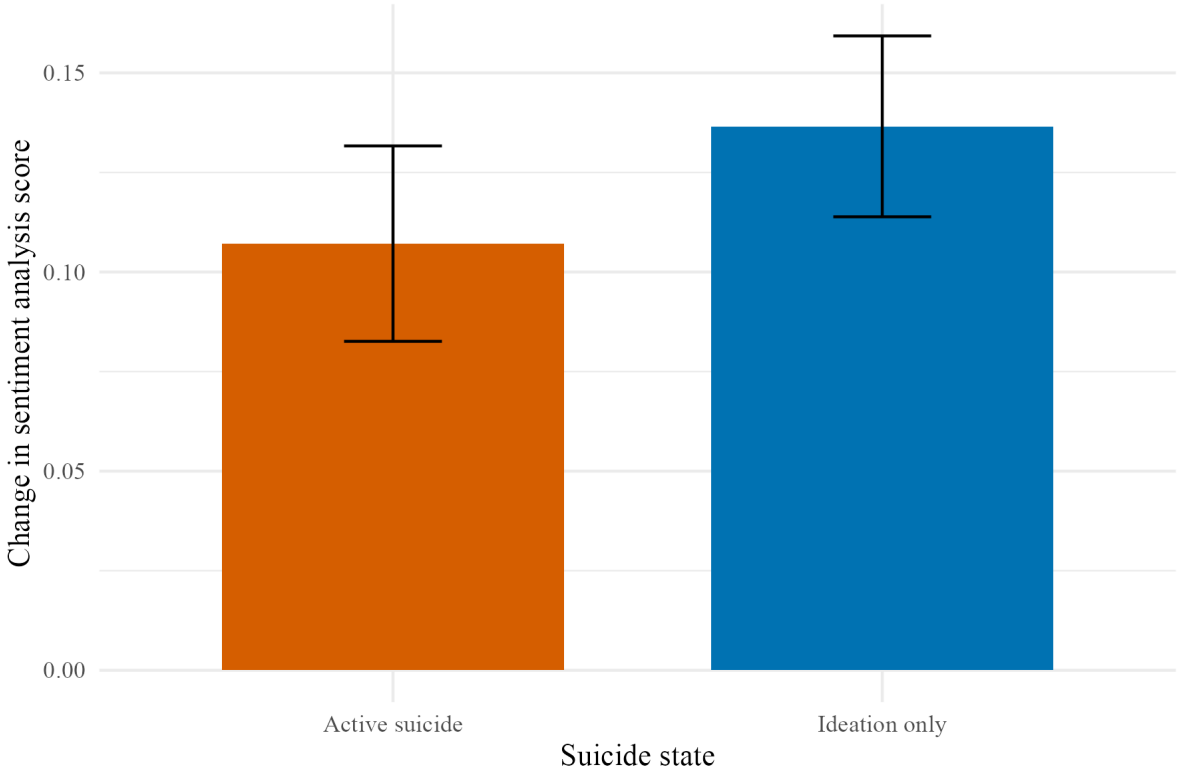
Figure 3 Averages of sentiment analysis scores of callers from the beginning to the end of the call



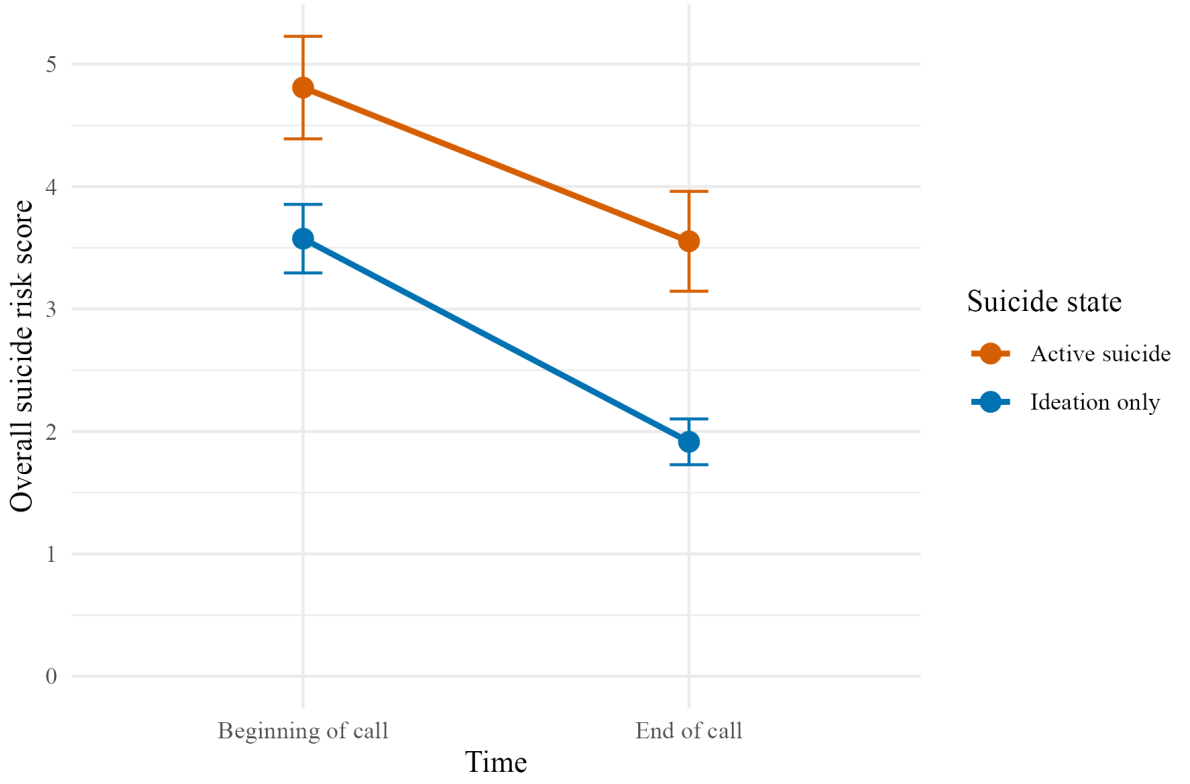
doi:10.6342/NTU202600727

Figure 4 Average change in sentiment analysis scores of callers from the beginning to the end of the call



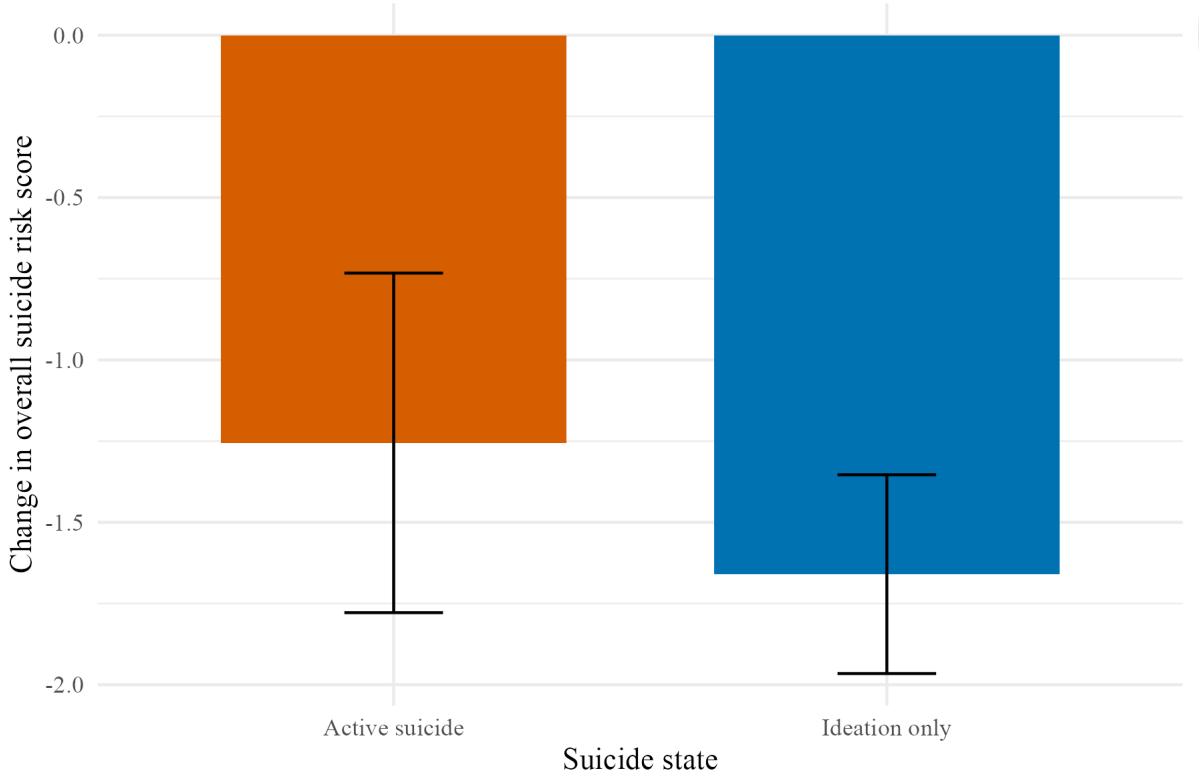
doi:10.6342/NTU202600727

Figure 5 Averages of overall suicide risk scores of callers from the beginning to the end of calls



doi:10.6342/NTU202600727

Figure 6 Average changes in overall suicide risk scores of callers from the beginning to the end of the call



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Tables

Table 1 Socio-demographic, mental health, and call characteristics of callers based on hotline volunteer assessment

Characteristic	Total (*n* = 94)		Active suicide (*n* = 47)		Ideation only (*n* = 47)		Stuart-Maxwell test	df	p-value
	n	%	*n*	%	*n*	%			
Sex							--	--	--
Male	46	(48.9%)	23	(48.9%)	23	(48.9%)			
Female	48	(51.1%)	24	(51.1%)	24	(51.1%)			
Age group							--	--	--
10-14 years	5	(5.3%)	2	(4.3%)	3	(6.4%)			
15-19 years	25	(26.6%)	12	(25.5%)	13	(27.7%)			
20-24 years	41	(43.6%)	20	(42.6%)	21	(44.7%)			
25-29 years	23	(24.5%)	13	(27.7%)	10	(21.3%)			
Current suicide status							--	--	--
Active suicide	29	(30.9%)	29	(61.7%)	0	(0.0%)			
In preparation	18	(19.1%)	18	(38.3%)	0	(0.0%)			
Thoughts only	0	(0.0%)	0	(0.0%)	0	(0.0%)			
No risk	47	(50.0%)	0	(0.0%)	47	(100.0%)			
Unknown	0	(0.0%)	0	(0.0%)	0	(0.0%)			
Frequency of suicidal thoughts							--	--	--
Always/Daily	67	(71.3%)	20	(42.6%)	47	(100.0%)			
Often/Weekly	27	(28.7%)	27	(57.4%)	0	(0.0%)			
Sometimes/Biweekly	0	(0.0%)	0	(0.0%)	0	(0.0%)			
Rarely/Monthly	0	(0.0%)	0	(0.0%)	0	(0.0%)			
Never	0	(0.0%)	0	(0.0%)	0	(0.0%)			
Unknown	0	(0.0%)	0	(0.0%)	0	(0.0%)			
Education level							1.04	3	0.79
Junior high or less	15	(16.0%)	8	(17.0%)	7	(14.9%)			
High school	28	(29.8%)	12	(25.5%)	17	(34.0%)			
Associate's/Bachelor's	30	(31.9%)	15	(31.9%)	14	(31.9%)			
Unknown	21	(22.3%)	12	(25.5%)	9	(19.1%)			
Occupation							2.16	3	0.54
Student	34	(36.2%)	17	(36.2%)	17	(36.2%)			
Employed	29	(30.9%)	13	(27.7%)	16	(34.0%)			
Unemployed	23	(24.5%)	14	(29.8%)	9	(19.1%)			
Unknown	8	(7.4%)	3	(6.4%)	5	(10.6%)			

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Characteristic	Total (n = 94)		Active suicide (n = 47)		Ideation only (n = 47)		Stuart-Maxwell test	df	p-value
	n	%	*n*	%	*n*	%			
Living status[a]							NA[b]	NA[b]	0.090
Alone	27	(28.7%)	16	(34.0%)	11	(23.4%)			
With others	64	(68.1%)	28	(59.6%)	36	(76.6%)			
Unknown	3	(3.2%)	3	(6.4%)	0	(0.0%)			
Marital status							2.77	2	0.25
Single	63	(67.0%)	29	(61.7%)	34	(72.3%)			
Not single[c]	5	(5.3%)	2	(4.3%)	3	(6.4%)			
Unknown	26	(27.7%)	16	(34.0%)	10	(21.3%)			
Main reason for calling							4.15	6	0.66
Family and relationships	33	(35.1%)	16	(34.0%)	17	(36.2%)			
Mental health	44	(46.8%)	21	(44.7%)	23	(48.9%)			
Physical health	2	(2.1%)	2	(4.3%)	0	(0.0%)			
Work and finances	7	(7.4%)	3	(6.4%)	4	(8.5%)			
School	6	(6.4%)	3	(6.4%)	3	(6.4%)			
Harassment	1	(1.1%)	1	(2.1%)	0	(0.0%)			
Legal issues	1	(1.1%)	1	(2.1%)	0	(0.0%)			
BSRS-5[d] total score							NA[b]	NA[b]	0.096
<6	47	(50.0%)	19	(40.4%)	28	(59.6%)			
≥6	47	(50.0%)	28	(59.6%)	19	(40.4%)			
Mental state							1.55	2	0.46
Mental illness apparent	67	(73.1%)	31	(66.0%)	36	(76.6%)			
Mental illness probable	15	(16.0%)	9	(19.1%)	6	(12.8%)			
Not present	12	(12.8%)	7	(14.9%)	5	(10.6%)			
Using psychiatric services							1.64	2	0.44
Yes	58	(61.7%)	28	(59.6%)	30	(63.8%)			
No[e]	22	(23.4%)	10	(21.3%)	12	(25.5%)			
Unknown	14	(14.9%)	9	(19.1%)	5	(10.6%)			
	Mean	sd	Mean	sd	Mean	sd	t	df	p-value
Age	21.3	4.0	21.4	4.0	21.1	3.9	--	--	--
Call length (minutes)	30.5	15.8	32.1	18.1	29.0	13.2	**2.42**	**46**	**0.020**

[a]Unknowns excluded for analysis because <5 total observations

[b]McNemar's exact test

[c]Including married, divorced, and cohabitating

[d]Five-item Brief Symptom Rating Scale

[e]Including discontinued and refused treatment

p-values <0.05 highlighted in bold

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Table 2 Average sentiment analysis scores and average change in scores over time of call between active suicide and ideation only callers

	Active suicide			Ideation only					
	Mean	sd	Cohen's *d*	Mean	sd	Cohen's *d*	t	df	p-value
Beginning of call	-0.22	0.15		-0.21	0.12		-0.25	46	0.80
End of call	-0.11	0.18		-0.07	0.15		-1.01	46	0.32
Change over call	0.11	0.17	0.64	0.14	0.16	0.88	-0.91	46	0.37

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Table 3 Paired t-test of within-group changes in sentiment scores over the course of call

Active suicide change in sentiment over call			Ideation only change in sentiment over call		
t	df	p-value	t	df	p-value
6.35	**46**	**<0.001**	**9.30**	**46**	**<0.001**

p-values <0.05 highlighted in bold

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Table 4 Suicide risk scores during the beginning of calls, end of calls, and change in scores over time of call between active suicide and ideation only callers

	Active suicide			Ideation only				
Risk characteristics	Mean	sd	Cohen's *d*	Mean	sd	Cohen's *d*	V	p-value
Overall								
Beginning	4.81	2.87		3.55	1.92		**629.0**	**0.026**
End	3.57	2.81		1.94	1.28		**655.0**	**<0.001**
Change over call	-1.12	3.62	-0.34	-1.62	2.09	-0.77	514.0	0.62
Suicidal intent								
Beginning	1.09	1.54		0.77	0.98		172.5	0.246
End	0.53	0.88		0.17	0.56		**88.0**	**0.015**
Change over call	-0.55	1.56	-0.40	-0.60	1.01	-0.58	174.0	0.75
Psychological pain								
Beginning	1.74	0.44		1.83	0.98		66.5	0.36
End	1.51	0.51		1.43	0.56		175.0	0.42
Change over call	-0.23	0.56	-0.36	-0.60	1.01	-0.59	310.0	0.17
Self-harm ideation								
Beginning	0.36	0.76		0.09	0.35		**56.5**	**0.033**
End	0.28	0.68		0.09	0.28		54.0	0.061
Change over call	-0.09	0.75	-0.11	0.00	0.42	-0.00	27.0	0.62
Suicidal ideation								
Beginning	1.11	0.56		0.47	0.75		**262.0**	**0.026**
End	0.94	0.47		0.15	0.42		**190.5**	**0.001**
Change over call	-0.17	0.77	-0.10	-0.32	0.84	-0.38	255.0	0.62
Access to lethal means								
Beginning	0.13	0.34		0.02	0.15		24.0	0.073
End	0.13	0.34		0.02	0.15		24.0	0.073
Change over call	0.00	0.42	0.05	0.00	0.00	NA[a]	18.0	1.00
History of suicide or self-harm								
Beginning	0.38	0.49		0.36	0.49		175.5	1.00
End	0.17	0.38		0.06	0.25		48.0	0.15
Change over call	-0.21	0.57	-0.36	-0.30	0.51	-0.59	195.0	0.32
Prior exposure to suicide								
Beginning	0.00	0.00		0.02	0.15		0.0	1.00
End	0.00	0.00		0.00	0.00		NA[a]	NA[a]
Change over call	0.00	0.00	NA[a]	-0.02	0.15	-0.15	1.0	1.00

[a]Statistical results unavailable due to zero observation counts
p-values <0.05 highlighted in bold

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Table 5 Wilcoxon signed-rank test of within-group changes in suicide risk scores over the course of call

	Active suicide change over call		Ideation only change over call	
Characteristic	V	p-value	V	p-value
Sum	**197.5**	**0.020**	**53.0**	**<0.001**
Suicidal intent	**55.0**	**0.022**	**8.5**	**0.001**
Psychological pain	**40.0**	**0.012**	**22.0**	**<0.001**
Self-harm ideation	12.5	0.46	7.5	1.00
Suicidal ideation	97.0	0.52	**18.5**	**0.015**
Access to lethal means	18.0	1.00	NA[a]	NA[a]
History of suicide or self-harm	**38.0**	**0.020**	**9.0**	**<0.001**
Prior exposure to suicide	NA[a]	NA[a]	NA[a]	NA[a]

[a]Statistical results unavailable due to zero observation counts
p-values <0.05 highlighted in bold

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Table 6 Conditional logistic regression analysis of caller characteristics, sentiment analysis, and suicide risk scores

Characteristic	OR	(95% CI)		p-value
Education level				
Junior high or less	ref			
High school	0.62	(0.12	, 3.07)	0.56
Associate's/Bachelor's	0.80	(0.16	, 3.99)	0.79
Unknown	1.07	(0.19	, 6.12)	0.94
Occupation				
Student	ref			
Employed	0.63	(0.14	, 2.83)	0.55
Unemployed	1.29	(0.35	, 4.76)	0.70
Unknown	0.40	(0.06	, 6.17)	0.36
Living status[a]				
Alone	2.50	(0.78	, 7.97)	0.12
With others	**0.25**	**(0.07**	**, 0.89)**	**0.032**
Unknown	--	--	--	--
Marital status				
Single	ref			
Not single[b]	0.67	(0.11	, 3.99)	0.66
Unknown	2.50	(0.78	, 7.97)	0.12
Main reason for calling[a]				
Family and relationships	0.91	(0.39	, 2.14)	0.83
Mental health	0.85	(0.38	, 1.89)	0.68
Physical health	0.75	(0.17	, 3.35)	0.71
Work and finances	--	--	--	--
School	1.00	(0.20	, 4.95)	1.00
Harassment	--	--	--	--
Legal issues	--	--	--	--
BSRS-5[c] total score				
<6	ref			
≥6	2.60	(0.93	, 7.29)	0.069
Mental state				
Mental illness present	ref			
Mental illness probable	2.12	(0.52	, 8.58)	0.29
Not present	1.62	(0.45	, 5.84)	0.46
Ever used psychiatric services				
Yes	ref			
No[d]	0.91	(0.35	, 2.37)	0.85
Unknown	2.27	(0.57	, 9.03)	0.25
Call time (minutes)	1.14	(0.99	, 1.31)	0.060
Sentiment analysis				
Beginning of call	0.70	(0.04	, 11.27)	0.80
End of call	0.29	(0.02	, 3.36)	0.32
Change over call	0.29	(0.02	, 4.32)	0.37
Suicide risk				
Overall score				
Beginning of call	**1.21**	**(1.02**	**, 1.44)**	**0.030**
End of call	**1.53**	**(1.14**	**, 2.05)**	**0.005**
Change over call	1.04	(0.91	, 1.20)	0.54
Suicidal intent				
Beginning of call	1.27	(0.87	, 1.84)	0.22
End of call	**2.13**	**(1.06**	**, 4.29)**	**0.033**
Change over call	1.03	(0.73	, 1.45)	0.86
Emotional pain				
Beginning of call	0.64	(0.25	, 1.64)	0.35
End of call	1.40	(0.62	, 3.15)	0.42
Change over call	1.62	(0.81	, 3.26)	0.18

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Characteristic	OR	(95% CI)		p-value
Self-harm ideation				
Beginning of call	2.54	(0.99	, 6.50)	0.053
End of call	2.03	(0.84	, 4.92)	0.12
Change over call	0.79	(0.39	, 1.58)	0.50
Suicidal ideation				
Beginning of call	**1.54**	**(1.04**	**, 2.30)**	**0.032**
End of call	**2.67**	**(1.21**	**, 5.90)**	**0.015**
Change over call	1.08	(0.81	, 1.44)	0.51
Access to lethal means				
Beginning of call	6.00	(0.72	, 49.84)	0.097
End of call	6.00	(0.72	, 49.84)	0.097
Change over call	1.00	(0.29	, 3.45)	1.00

[a]Regression analysis run based on binary yes/no of each variable to obtain statistical results due to zero observances of some variables
[b]Including married, divorced, and cohabitating
[c]Five-item Brief Symptom Rating Scale
[d]Including discontinued and refused treatment
p-values <0.05 highlighted in bold

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Appendices

Appendix A Sentiment analysis codebook

Sentiment analysis is performed at the sentence level to assess the emotion of each sentence based on its content. Sentences are scored either (+1) for positive, (0) for neutral, and (-1) for negative sentiment. When analyzing a sentence, only the content of the sentences of the caller within that turn shall be considered. The content of other turns and the content of the helper's sentences should not be taken into consideration. The following examples are the rules for semantic analysis:

1. If the caller's sentence is in response to the helper's previous statement or question, do not consider the helper's sentence to assess the caller's emotion and sentiment.
   Example:
   H: You're feeling very sad right now.
   C: Yes. → Coded as 0 (helper's sentence not considered when assessing caller)
2. If the meaning of each individual sentence is incomplete, and there are other sentences within the same turn that can form a complete meaning (or the incomplete sentence extends into another sentence to form a complete phrase), the score of the overall meaning or phrase should be used for all sentences.
   Example:
   C: Who told them → Scored as -1
   C: to always be so loud in the room → Scored as -1
   (The complete phrase is *"Who told them to always be so loud in the room,"* so both sentences are coded as negative sentiment.)
3. If there are no other sentences within the turn to help supplement the meaning, or if the emotion and sentiment cannot be discerned even following supplementation, then the sentence is marked as 0.
4. If a single sentence contains a significant proportion of both positive and negative sentiment, then they cancel each other out and the sentence is coded as 0.
   Example:
   Even though I was initially very flustered (-1)*, but my senses told me I needed to calm down.* (1) → Coded as 0.

Following completion of sentence-level scoring, the sentence scores will be summed into a turn score using the following rules to determine the overall turn's sentiment:

- If the number of positive and negative sentences are not equal, then the turn will be sum of all the sentence scores.
- If the number of positive and negative sentences are equal, then the turn will be scored the same as the last sentence within the turn.
  Ex:

turn	sentence_ score	turn_score
I believe what goes around comes around ☺	1	-1
I was so upset with what they did.	-1	
I found comfort in thinking that it was their karma.	1	
We can only endure it. They're use to it, so we can only slowly accept it. (Final sentence within the turn)	-1	

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Sentiment analysis codebook

Sentiment	Definition	Tips
Positive	From the speaker's perspective, the content primarily conveys positive emotions, attitudes, standpoints, or expectations. Or the speaker expresses an intention to improve a negative situation, a motivation to cope with it, or expresses a tone of blessing. Includes stickers, emojis, and emoticons.	**Positive emotion** Expresses happiness, content, approval, etc. Ex: *Haha.* *Wow, the call went through.* *I've been happy, even excited to start school for the past three or so days.*
		Positive changes in emotion Descriptions of positive changes in one's situation emphasize relief, improvement, and betterment. Ex: *But my anxiety decreases a bit when I'm at work.* *My mind is a little calmer now.*
		Positive facts or events States a positive fact or experience. Ex: *My dad is actually really impressive.* *Right now, I have a really good job.* *Speaking with them feels like I'm talking to a friend that I can say anything with.*
		Positive perceptions or thinking Expresses a positive interpretation of negative facts from the speaker's perspective. Ex: *I find comfort in thinking that it was their karma.* *I believe that what goes around, comes around ☺.*
		Motivation for change Expresses a motivation and intention to "want to change", a willingness to confront the issue, or a desire to try and seek help or other coping mechanisms, even if no concrete action has been taken yet. Or expresses a positive view of coping mechanisms. Ex: *I hope that I can truly smile happily.* *I'll talk about what I should do to move forward.* *When I go to my therapist appointment next month, I'll try and write it.* *How can I overcome this?*

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Sentiment	Definition	Tips
		Gratitude Expresses gratitude or thanks, or gives a blessing or encouragement to another person. Ex: *Thank you.* *I really appreciate it.* *Be safe going home when you get off of work.*
Neutral	The content of sentences does not convey, or makes it impossible to identify, any obvious emotion, attitude or standpoint.	**Neutral emotions** Ex: *I can't believe it.*
		Neutral facts or events Statements in which the speaker's emotional inclination cannot be discerned or inferred. Includes neutral facts related to negative events that return to a state of normalcy, including being discharged from the hospital, released from prison, or returning to school following a leave of absence. Ex: *We have to split into groups to make a final group presentation for class.* *He said I didn't prepare to discuss with him.* *He said he wants to stop counseling.* *They even asked me if I passed my exam.* *Even if it was something in the past that affected me, they told me to try and think more positively.*
Negative	From the speaker's perspective, the content primarily conveys negative emotions, attitudes, or standpoints, or explains content related to negative experiences, psychological distress, feelings of powerlessness, or experiences of loss. Includes {crying} sounds recorded, stickers, emojis, and emoticons.	**Negative emotions** Expresses negative emotions such as rejection, disappointment, distress, or worry, etc. Includes stickers, emojis, and emoticons. Ex: *When have I ever not dealt with the situation properly?* *I don't think I'll call this hotline again.* *But there isn't anyone I know there.* *I only want her to love me.* *But I don't really have any other choice.*
		Psychological distress States of psychological distress, discomfort, etc. Ex: *I've been feeling really stressed lately.* *I get anxious really easily.*

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Sentiment	Definition	Tips
		Negative facts or events Describes an experience generally considered to be negative. For example, illness, suicide, car accidents, unemployment, failure, death of a loved one, bullying, demerits, and being held back academically. (Seeking medical treatment, medication history, surgery, rehabilitation, counseling, etc. should be coded depending on the context of other sentences within the turn.) Or situations where an individual's poor mental health leads to a departure from normal life, including missing classes, taking a week off, or taking a leave of absence from school. Ex: *I have a history of depression.* *I didn't pass one of my exams.* *My parents got into a car accident.*
		Negative perceptions or thinking Expresses a negative interpretation of positive facts from the speaker's perspective. Ex: *He would ask me to do deep breathing exercises, but when I do them, it doesn't really help much.*
		Uncertainty, helplessness Feeling lost or directionless about one's future, current situation, self-image, or self-worth to the point of being unsure or uncertain about what to do. Does not include: 1. Uncertainty about one's own feelings or emotions 2. Confusion about specific facts 3. Unclear meanings or statements with multiple plausible interpretations Ex: *I don't know what I should do.* *I don't know how to make a decision.*

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Appendix B Suicide risk codebook

Suicide risk is assessed based on the content of five-minute turns. Only content during the five-minute turn is taken into consideration, information from other turns are excluded.

Characteristic	Description	Score	Scoring criteria
Prior history of self-harm or suicide	User mentions history of self-harm or suicide	□(0) No □(1) Yes	Determine past history of self-harm or suicide through the conversation. Requires sufficient information to confirm an actual self-harm or suicide attempt, or presence of indirect information such as a evidence of a suicide report, dispatched suicide prevention caregiver, or case manager, etc. Ex: *I've been hospitalized over eight times, self-harmed countless times, and have attempted suicide four times. I know it's not good to do so, but I want to harm myself. The suicide prevention caregiver started calling up on me starting last year.*
Ambivalence toward suicide	User expresses that **at the time of the conversation**, they want to die, want to live, or is hesitant between the two.	□(0) Wants to live/does not want to die	User conveys a desire to live through explicit or implicit means. Or the individual has a concrete plan to seek mental health or police/fire service resources, or schedules a follow-up call with the volunteer. Ex: *I think that having one more chance isn't such a bad thing. These past few days I've been allowing myself to rest up. I'm going to the doctor on Monday.*

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Characteristic	Description	Score	Scoring criteria
		□(1) Alternates between the two	User exhibits suicidal thoughts but still has a desire to live, hesitation, or verbal expressions of uncertainty or "don't know," or shows signs of suicide risk but promises to make a non-suicide safety contract, or expresses feelings of hopelessness, meaninglessness, or a lost sense of belonging. Lost sense of belonging: User feels disconnected from others, family, or society, possibly due to lack of care from others or the feeling of not being needed by others or their environment. Ex: *When my emotions become extreme, I want to cut my throat, but I'm always too scared to do it.* *I really want to swallow the pills… but every time in order to prevent myself from doing so, I just hurt myself to direct my attention away.* *What's the point of living until I'm 50? (Meaninglessness)* *I've tried so hard, but I still can't see a stable future… (hopelessness)* *This time was really painful. There's no place for me here. This world can't accept me. (Lost sense of belonging)*
		□(2) Wants to die/does not want to live	User conveys a suicidal ideation or a desire to die through explicit or implicit means. Ex: *I want to kill myself.* *I want to die.* *I want to disappear.* *Sometimes I want to… you know what I mean? Sometimes I feel like I don't know why I keep holding on.*

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Characteristic	Description	Score	Scoring criteria
		□(9) Not enough information	Does not mention the topic of suicide, or text too short to be able to assess user's ambivalence.
Level of psychological pain	User's level of psychological pain **at the time of the conversation**. (Assessment is based on the user's subjective feelings. If the text is too short, then the volunteer's response and overall situation should be taken into consideration.)	□(0) **None** User has no psychological pain or distress	User does not exhibit any obvious psychological distress or pressure. User's psychological state appears at ease and stable.
		□(1) **Partially** User experiences some psychological pain, but currently finds it to still be manageable.	Classify at this level or higher as long as the user appears to not be at ease. User experiences psychological pain, but can still maintain daily functioning.
		□(2) **Significant** User experiences significant psychological pain, and feels unable to tolerate the current situation.	User repeatedly mentions psychological pain and stress during the conversation, or the level of psychological pain is so high that the user feels they cannot continue to live any longer, wants to harm themselves/end their life, or exhibits self-harm or suicidal behavior at the time of the conversation.
Non-suicidal self-harm ideation	User **at the time of the conversation** has the idea or intention of using any method of harming one's own physical/mental health, but not for the purpose of ending their own life.	□(0) No self-harm ideation	User does not mention any thoughts related to self-harm. Or when the volunteer asks the user how they *usually* cope with suicide risk/emotional distress and the user answers with self-harm. Ex: *H: When you're feeling down, what do you do to cope?* *C: I would harm myself.*

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Characteristic	Description	Score	Scoring criteria
	Mutually exclusive with suicidal ideation for *each individual harming event*. 1. If the user mentions a single action or thought, it should be coded as either self-harm or suicidal ideation and not both at the same time. 2. If the user mentions multiple instances of behavior or ideation, each individual instance should be coded separately as either suicidal ideation or non-suicidal self-harm ideation.	□(1) Self-harm ideation present	User has thoughts or intention of self-harming during the conversation but has not yet carried out the action. Ex: *Recently I've really been wanting to hurt myself.* *I want to swallow the pills to become hospitalized so that people will care about me.*
		□(2) Self-harming in progress	User is using any method of self-harming during the conversation, but the intent is not to end their own life. Ex: *I have about 200 pills with me right now that I want to take… but every time in order to prevent myself from doing so, I just hurt myself to direct my attention away.* *H: I saw that you mentioned that you're currently engaging hurting yourself?* *C: I only ate a couple of extra pills, maybe 10 max that'll only make me sleepy*
Suicidal ideation	User **at the time of the conversation** has thoughts, plans, or preparations to end their own life. Mutually exclusive with self-harm ideation for each individual event.	□(0) No suicidal ideation	No clear information expressing that the user has the intention to end their own life. Ex: *I only made a small cut, it won't kill me.* *I want to swallow the pills.* *(Does not mention the purpose of taking pills is to die.)*
		□(1) Suicidal ideation present but no suicide plan	User expresses suicidal thoughts at the time of the conversation, or mentions a desired method of suicide or tool for suicide, but does not yet have specific detailed plans. Ex: *I want to disappear.* *I want to die. (Active)* *I've always wanted to just be hit by a car. (Passive)* *I want to just take a knife and cut myself.* *H: Have you thought about how you might kill yourself?* *C: Jump off a building.*

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Characteristic	Description	Score	Scoring criteria
		□(2) Suicide plan present, but no preparations made	User expresses suicidal thoughts at the time of the conversation, and has created a detailed plan in part or in whole (i.e. time, place, tool, excluding previous or ongoing attempts), and has at least some motivation for carrying out plans. Ex: *I want to go to _____ Beach and kill myself.*
		□(3) Suicide plan present and has begun preparing action	User has suicidal thoughts, has created a detailed plan in part or in whole, and has taken actions or made plans to be able to quickly attempt suicide at any time (such as purchasing tools, scouting out a location, giving away items, or writing a suicide note). Ex: *I want to hang myself. I've already bought the rope.* *I've recently really wanted to kill myself. A few days ago, I took 50 pills but I still didn't die. I have 200 pills with me right now that I want to take.*
		□(4) Suicide in progress	User is engaging in suicidal behavior either at the time of the conversation or shortly beforehand. Requires sufficient information to determine suicide currently in progress. Ex: *I've already hung the rope up on the light, and I'm about to kick away the chair.* *I've constantly been wanting to kill myself. I had some prescription pills that I had left over from before and I just swallowed them all.* *I just took sleeping pills 10 minutes ago. I want to just die like that right now.*
Access to lethal means	User indicates that they are able to access any of the five lethal means of suicide **at the**	□(0) No	No clear information and details to determine whether user has access to lethal means at the time of the conversation.

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Characteristic	Description	Score	Scoring criteria
	time of the conversation: hanging, jumping from a high-rise building, burning charcoal, pesticides, or drowning.		Ex: *I want to jump out of a window. (Unclear).*
		□(1) Yes	Conversation provides clear details and information to determine that the user has access to lethal means of suicide at the time of the conversation. Does not include descriptions of methods of previous suicide attempts. Ex: *I've already looked at the building.* *I want to go to _____ Beach. (Drowning)* *I've already hung the rope up on the light.*
Prior exposure to suicide	User mentions that family/friend/colleague had previously exhibited suicidal behaviors.	□(0) No □(1) Yes	

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