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Research Progress on Suicide Literacy

Wenqian Cheng[1], Li Zhu[2]*

[1]School of Public Health and Nursing, Hangzhou Normal University, Hangzhou 311121, Zhejiang, China

[2]Hangzhou Traditional Chinese Medicine Hospital Affiliated to Zhejiang Chinese Medicine University, Hangzhou 310007, Zhejiang, China

**Author to whom correspondence should be addressed.*

Abstract: Suicide is a major and urgent issue in the field of mental health, and the United Nations has set "reducing global suicide mortality by one third by 2030" as one of its sustainable development goals. Suicide literacy refers to an individual's ability to recognize, manage, and prevent suicide-related problems. This article offers a comprehensive review of the concepts, assessment tools, factors, and interventions of suicide literacy, with the goal of helping individuals to better understand suicidal behaviors and providing a scientific basis for developing effective suicide prevention strategies and measures to advance the progress of suicide prevention.

Keywords: Suicide literacy; Measurement tools; Interventions; Research progress; Mental health promotion

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1. Introduction

Suicide is a major global public health concern. According to the latest statistics from the World Health Organization (WHO), the global suicide mortality rate is 9.2 per 100,000 population [1]. The "China Health Statistics Yearbook 2022" reported that, compared to 2020, the suicide mortality rate among urban residents in 2021 increased from 4.16 to 4.31 per 100,000, while that among rural residents rose from 7.04 to 7.09 per 100,000. Each year, more than 100,000 people die by suicide in China [2, 3]. Individuals who harbor misconceptions about the risk factors, treatment options, and symptoms of suicidal behavior are more likely to experience suicidal ideation or engage in suicidal acts. In addition, limited knowledge about suicide can serve as a barrier to accessing professional mental health services [4, 5]. Studies have shown that nearly 70% of adolescents and adults with suicidal ideation do not seek help from others, which may be attributed to inadequate understanding of suicide and the stigma surrounding it [6].

Suicide literacy encompasses a multidimensional construct that includes individuals' knowledge, attitudes, and behaviors related to suicide. Current research on suicide literacy has primarily focused on various populations, such as students, community residents, individuals with mental disorders, and nurses, aiming to comprehensively

assess their levels of suicide literacy [7–10]. In addition, related studies have examined the complex relationships between suicide literacy, suicide stigma, and attitudes toward help-seeking. Multiple studies have confirmed a correlation between low levels of suicide literacy and higher levels of suicide stigma [11–13]. Aldalaykeh *et al.* suggested that improving suicide literacy may enhance early recognition of warning signs and reduce suicide-related stigma [14]. Ji *et al.* found that suicide literacy not only directly influences individuals' attitudes toward seeking professional psychological help, but also indirectly through the mediating role of suicide stigma [15]. Lowering suicide stigma may thus promote professional help-seeking behaviors. Therefore, enhancing suicide literacy may contribute to reducing suicide stigma and increasing help-seeking behavior.

The "Healthy China 2030" plan clearly emphasizes the goal of "preventing and reducing suicide." A key foundation for suicide prevention lies in individuals' awareness and concern regarding suicidal behavior, which is significantly influenced by their level of suicide literacy. This review thus aims to summarize the conceptual development, measurement tools, influencing factors, and intervention strategies related to suicide literacy, to provide recommendations for suicide prevention efforts in China.

2. Conceptual development

At present, there is no universally accepted definition of suicide literacy. International scholars generally consider the concept to have originated from mental health literacy, which refers to an individual's ability to recognize specific mental disorders, access information about mental illnesses, understand risk factors and causes, adopt self-help strategies or seek professional help, and hold appropriate attitudes toward recognition and help-seeking behaviors [16]. Unlike mental illnesses, suicide is not a psychiatric disorder per se, but rather a behavioral manifestation that may result from underlying conditions or other contributing factors. Due to the unique nature of suicidal behavior, some researchers argue that suicide should be distinguished from general mental health literacy, leading to the development of the concept of suicide literacy.

Batterham *et al.* emphasized that a lack of accurate public understanding of suicidal behavior and the presence of stigma are key issues to be addressed in improving suicide literacy [17]. Chan *et al.* defined suicide literacy primarily in terms of knowledge and attitudes, referring to an individual's understanding of the causes, risk factors, warning signs, treatment options, and prevention of suicide [18]. Fitzpatrick *et al.*, on the other hand, emphasized the behavioral dimension of suicide literacy, defining it as the ability to acquire, understand, and apply suicide prevention-related knowledge and to seek help when needed [10].

In summary, suicide literacy encompasses individuals' knowledge about suicide, attitudes related to suicide stigma, and help-seeking capabilities.

3. Assessment tools for suicide literacy

3.1. Multidimensional assessment instruments

3.1.1. Literacy of Suicide Scale (LOSS)

The Literacy of Suicide Scale (LOSS) was developed by Calear *et al.* in 2012 to evaluate individuals' levels of suicide literacy, encompassing knowledge of suicide, attitudes toward stigma, and help-seeking literacy [7]. The scale includes 26 items across four dimensions: signs, causes, risk factors, and prevention and treatment of suicide. The LOSS uses a three-point scoring system: 0 = correct, 1 = incorrect, and 2 = don't know. Only

correct responses receive 1 point, while incorrect and "don't know" responses score 0. Higher total scores indicate higher levels of suicide literacy. This tool has been applied across various populations, including community members, university students, healthcare professionals, and psychiatric patients [7–10]. As the first multidimensional assessment instrument specifically targeting suicide literacy, the LOSS has been introduced and validated in multiple countries, including China, Iran, Germany, and Spain. Studies have confirmed that the LOSS demonstrates good reliability and validity across different cultural and linguistic contexts, making it a robust tool for assessing suicide-related knowledge [4, 19, 20].

3.2. Unidimensional assessment tools

3.2.1. The Suicide Knowledge and Skills Questionnaire (SKSQ)

The Suicide Knowledge and Skills Questionnaire (SKSQ) was developed by Smith *et al.* in 2014 to assess healthcare professionals' knowledge of suicide and their perceived competence in managing patients with suicidal behaviors [21]. The SKSQ comprises two subscales: the Suicide Knowledge Subscale and the Suicide Skills Subscale.

The Suicide Knowledge Subscale consists of nine true/false items. Each correct answer is scored as 1 point, and each incorrect answer is scored as 0. Total scores are calculated by summing all items, with higher scores indicating greater knowledge of suicide. The Suicide Skills Subscale includes four declarative items rated on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Higher scores reflect greater perceived competence in suicide-related skills. The Cronbach's α for the Suicide Knowledge Subscale was reported as 0.44, whereas the Suicide Skills Subscale demonstrated a higher internal consistency with a Cronbach's α of 0.84. Despite the relatively low reliability of the knowledge subscale, studies by Smith and Silva have shown that it effectively differentiates between healthcare professionals who have received formal suicide prevention training and those who have not [21, 22].

The SKSQ has been used internationally to evaluate the outcomes of suicide prevention training programs [22–24]. However, due to the low internal consistency of the knowledge subscale, caution is advised when adapting and applying this instrument in the Chinese context.

3.2.2. The Stigma of Suicide Scale (SOSS)

The Stigma of Suicide Scale (SOSS) was developed by Batterham *et al.* in 2013 as an instrument to measure public attitudes and stigma toward individuals who die by suicide [25]. The SOSS assesses three key dimensions: stigmatization, attribution to isolation or depression, and normalization or glorification of suicide. The full version of the scale consists of 58 items, while a short-form version (SOSS-SF) contains 16 items.

Both versions use a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with no reverse scoring. Higher scores indicate a greater level of stigmatizing attitudes toward individuals who die by suicide. The full version of the SOSS has demonstrated excellent internal consistency, with an overall Cronbach's α of 0.90, and subscale values of 0.95 (stigmatization), 0.88 (isolation/depression), and 0.86 (glorification/normalization). The short form (SOSS-SF) has an overall Cronbach's α of 0.70, with subscales ranging from 0.80 to 0.88. All factor loadings in both the full and short forms exceed 0.67, indicating strong structural validity. Han *et al.* translated and culturally adapted the SOSS for Chinese university students in 2016 [19]. The Chinese version also demonstrated strong psychometric properties, with an overall Cronbach's α of 0.90, and subscale values of 0.72 (stigmatization), 0.77 (isolation/depression), and 0.85 (glorification/normalization).

The SOSS-SF has been adapted and validated in various countries, including China, Germany, Spain, and Bangladesh, all showing good reliability and validity [19, 26–28]. Large-scale studies further support the robustness of the SOSS across cultures: Batterham *et al.* in a sample of 1,286 Australian community members [17], Julia *et al.* in 2,002 German adults [20], and Fong *et al.* in 2,022 young adults in Hong Kong all reported excellent psychometric performance [29]. These findings confirm that the SOSS is a reliable tool suitable for cross-cultural and multilingual applications.

3.2.3. Public stigma Family Suicide Stigma Assessment Scale (F-SASS)

The Family Suicide Stigma Assessment Scale (F-SASS) was developed by Corrigan *et al.* in 2018 based on qualitative findings from focus group interviews with bereaved family members of suicide victims [30]. This self-report instrument assesses public stigma toward suicide survivors and includes 41 items divided into three subscales: family stereotypes, family prejudice, and family discrimination. Each item is rated on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree), with higher scores indicating greater perceived stigma. The family stereotypes subscale includes two dimensions—dysfunctional family and responsibility for the suicide. The family prejudice subscale focuses on fear and distrust, while the family discrimination subscale encompasses exclusion, secrecy, and avoidance. Cronbach's α values for these subscales ranged from 0.88 to 0.90, 0.90, and 0.84 to 0.88, respectively, with factor loadings above 0.5, indicating good internal consistency and construct validity. It is worth noting that the validation of F-SASS was based on a sample recruited through Amazon Mechanical Turk (MTurk), which may not fully represent the general U.S. population. Therefore, broader validation in more representative samples is recommended before widespread application.

3.2.4. Suicide Attitude Questionnaire (QSA)

The Suicide Attitude Questionnaire (QSA) was developed by Xiao *et al.* to assess individuals' attitudes toward suicide [31]. The scale consists of 29 items across four dimensions: cognition of suicide, attitudes toward individuals who die by suicide, attitudes toward the families of those who die by suicide, and attitudes toward euthanasia. Each item is rated on a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). Dimension scores are calculated as the average of the corresponding items. Based on the average score, attitudes toward suicide are categorized into three levels: scores ≤ 2.5 indicate an understanding and tolerant attitude; scores between 2.5 and 3.5 reflect a neutral or ambivalent attitude; and scores > 3.5 represent a rejecting, exclusive, or stigmatizing attitude. Higher scores reflect more negative attitudes toward suicide. The QSA has been widely used in China among various populations, including secondary school students, university students, and healthcare professionals [32–34].

4. Factors influencing suicide literacy

4.1. Age

Alison *et al.* found in a survey of 1,019 adolescents that they were able to correctly answer only 46% of questions related to suicide literacy, a rate significantly lower than that of adults [35]. This may be due to adolescents receiving insufficient suicide education and lacking relevant personal experiences [30]. Calear *et al.* also reported that older adults tend to have lower levels of suicide literacy compared to younger individuals [7]. This may reflect generational differences, as suicide was a taboo subject in past decades and rarely discussed in public discourse.

4.2. Gender

Research consistently shows that males have lower levels of suicide literacy than females [14, 36, 37]. John *et al.* found that men are more likely to hold negative perceptions and rigid stereotypes about suicide, making them less willing to engage in conversations about it and less informed overall [38]. Furthermore, societal expectations often emphasize masculinity, strength, independence, and emotional restraint, which discourage men from expressing distress, seeking help, or acquiring suicide-related knowledge.

4.3. Educational level

Educational attainment plays a significant role in suicide literacy. Individuals with higher levels of education are more likely to understand suicide-related information and benefit from suicide prevention education. Calear *et al.* found that university students answered 63% of suicide literacy questions correctly, compared to 58% in the general community sample [7]. Similarly, a study by Zhang *et al.* in a Chinese community found that residents with a bachelor's degree or higher were more likely to express willingness to seek help when experiencing suicidal ideation [39].

4.4. Cultural background

Han *et al.* compared the levels of suicide literacy between Chinese and Australian university students and found that Chinese students scored significantly lower [40]. Likewise, a study by Nakamura *et al.* revealed that suicide literacy among Japanese community members was substantially lower than that of their Australian and German counterparts [41]. In collectivist cultures like China and Japan, suicide is often heavily stigmatized. Multiple studies have demonstrated a significant negative correlation between suicide-related stigma and suicide literacy [14, 20, 40]. In such cultures, mental illness is often perceived as a family issue rather than an individual challenge, which means stigma affects not only the person experiencing suicidal thoughts but also their family members [41].

4.5. History of mental illness

According to Batterham *et al.*, individuals with a history of mental illness tend to have lower levels of suicide literacy than those in the general population [8]. This gap is largely attributed to limited awareness of the risk factors and consequences of suicide. Individuals with mental health conditions are also more prone to romanticize or glorify suicide, viewing it as a sign of "bravery" or "strength," which may hinder accurate understanding and prevention efforts.

5. Intervention strategies for suicide literacy

5.1. Traditional intervention strategies

Traditional intervention strategies for suicide literacy refer to face-to-face approaches aimed at enhancing individuals' or groups' knowledge about suicide, reducing risk factors, strengthening protective factors, and providing crisis intervention and follow-up support. Perceval *et al.* developed a community-based health and suicide prevention workshop in rural Australia, named the SCARF Well-Being and Suicide Prevention Program [42]. SCARF is an acronym for Suspect, Connect, Ask, Refer, and Follow-Up, aiming to help participants identify and respond to suicide risks. The study found that participants showed significant improvements in suicide-related knowledge and confidence immediately after the workshop and at a 3-month follow-up. Improvements were also observed

in psychological well-being and reduced stigma toward suicide. The SCARF workshop is characterized by being brief, culturally tailored, health-focused, and informed by contemporary suicide theories and models.

Griksiene *et al.* implemented a 32-hour suicide prevention training program for emergency medical service (EMS) providers, including physicians and nurses [43]. The training covered topics such as attitudes toward suicide, causes of suicidal behavior, risk factors, suicide assessment, and stress management skills. Post-intervention results showed positive effects on participants' attitudes, confidence, and professional competence in suicide prevention and intervention.

5.2. Innovative intervention strategies

Innovative suicide literacy interventions refer to the integration of suicide prevention strategies with information and communication technology (ICT). ICT encompasses a broad range of digital tools such as the internet, telemedicine, and mobile technologies. Over the past decade, ICT has been increasingly applied in suicide prevention, with growing evidence supporting its potential to enhance suicide prevention practices [44, 45].

On one hand, ICT-based digital products can effectively improve public understanding of suicide-related knowledge. For example, Afsharnejad *et al.* developed an online suicide prevention program called "Talk-to-Me" targeting Australian university students [46]. This program consists of six modules covering the importance of mental health, self-management strategies, causes and interventions for self-harm and suicidal behaviors, and how to appropriately support oneself and others during a suicidal crisis. Delivered via the EdX platform, the program offers various learning resources, including videos, readings, and quizzes, allowing students to progress at their own pace and convenience. On the other hand, ICT digital products can be utilized for online screening of individuals at potential suicide risk; they can provide information and assistance regarding suicidal thoughts and behaviors, as well as offer web-based assessments, interventions, and follow-up care [47]. For instance, GKOTSIS *et al.* developed and trained a neural network model that screens Reddit posts for suicidal ideation, achieving an accuracy rate of 91.8% [48]. Similarly, Huang *et al.* created the "Tree Hole Robot," which intelligently monitors social network data combined with a suicide knowledge graph to timely detect and intervene with individuals at risk [49]. This system is both efficient and precise, offering an innovative solution for suicide prevention.

Moreover, digital tools enable continuous monitoring of patients' progress, allowing professionals to gain timely insight into patients' conditions and provide proactive support before crises occur, thus accelerating response times. Feltz-Cornelis *et al.* implemented the "SUPREMOCOL" regional system intervention for suicide prevention, which involves collaboration among five mental health institutions and their healthcare and community partners [50]. Supported by a digital decision-support and monitoring system, this intervention facilitates connection, treatment, and support for individuals at suicide risk. Findings demonstrated a 17.8% reduction in suicide rates in the North Brabant province of the Netherlands within the first year following implementation.

6. Implications and future directions

6.1. Application and recommendations for suicide assessment instruments

The choice of assessment tools should be aligned with the specific evaluation objectives. For a comprehensive assessment of suicide literacy, multidimensional instruments such as the Literacy of Suicide Scale (LOSS) are recommended. When measuring suicide knowledge literacy specifically, caution is advised in using the Suicide Knowledge Scale Questionnaire (SKSQ). For assessing attitudes toward suicide stigma, the Stigma of Suicide

Scale (SOSS) is recommended, as it has been introduced in multiple countries and validated with large samples. Currently, there is a lack of scales measuring suicide help-seeking literacy. Moreover, existing suicide literacy assessment tools were all developed by foreign researchers. Therefore, it is necessary to translate and validate reliable tools for use in China, as well as develop culturally appropriate instruments tailored to the Chinese context.

Research shows that adolescents have significantly lower suicide literacy compared to adults [35]. This difference partly arises from the unique developmental and cognitive characteristics of adolescents, which influence how they understand and respond to suicide. Additionally, existing suicide literacy scales are designed for adults and do not account for adolescent-specific features. Hence, there is a pressing need to develop suicide literacy scales specifically for adolescents to better assess and enhance their literacy levels.

Furthermore, current suicide literacy scales primarily rely on self-report methods, which only reflect participants' subjective perceptions. Such self-report instruments are vulnerable to biases such as social desirability, response tendencies, deception, or random answering, all of which may undermine their reliability and validity. Inspired by measurement approaches in mental health literacy, such as situational case interviews, it is advisable to design assessment tools that combine self-report with observer ratings [51]. This approach can capture not only subjective feelings and beliefs but also behaviors and responses in specific contexts.

In addition, measuring suicide stigma attitudes through self-report scales is often influenced by the prevailing social emphasis on reducing discrimination and prejudice. As a result, some respondents who hold strong negative attitudes toward individuals with suicidal behaviors may choose not to express them openly. Future research should consider integrating implicit association tests (IAT) or Go/No-go association tests, alongside behavioral experiments such as helping paradigms and social distance measures, to more accurately capture underlying stigma.

6.2. Integration of information and communication technology (ICT) with suicide literacy interventions

Traditional suicide literacy interventions have been widely applied in practice, accumulating extensive experience and forming a relatively mature and reliable foundation. These interventions emphasize face-to-face interpersonal interactions, focusing on direct, personal communication and humanistic care. Compared to traditional approaches, suicide prevention services delivered through ICT-based digital products offer several advantages:

(1) The use of internet technology breaks geographic barriers, enabling individuals living in remote or resource-limited areas to access timely assistance more conveniently.

(2) Through computers, mobile devices, or chatbots, individuals can express their emotions directly, avoiding the stigma that may arise from face-to-face communication. Studies have shown that online chatting reduces individuals' fear of self-disclosure and lessens stereotypes related to mental illness compared to interactions with clinical professionals [52]by using corpora and learning approaches, provides good performance in statistical tasks, such as text classification or sentiment mining.\nOBJECTIVE: The primary aim of this systematic review was to summarize and characterize, in methodological and technical terms, studies that used machine learning and NLP techniques for mental health. The secondary aim was to consider the potential use of these methods in mental health clinical practice.\nMETHODS: This systematic review follows the PRISMA (Preferred Reporting Items for Systematic Review and Meta-analysis.

(3) Intervention content and intensity can be adjusted in real time based on users' personal characteristics, environmental factors, and emotional states, thus providing more effective and tailored support to meet individual needs.

(4) The use of digital tools can streamline healthcare providers' routine work, reducing repetitive tasks and alleviating workforce pressure.

China can draw on the application of ICT in the mental health field by developing specialized suicide literacy applications that provide comprehensive information and skills training. Remote consultation services should be integrated to offer mental health support through video calls and online platforms. Leveraging intelligent technologies, such as artificial intelligence and big data analytics, can facilitate early suicide risk assessment and intervention. Additionally, promoting online self-help resources and establishing digital community support through social media and online forums can enhance peer support. Implementing extensive training programs is essential to cultivate proper use and understanding of digital suicide literacy tools across various sectors. Finally, fostering cross-sector collaboration among health authorities, technology companies, academia, and non-profit organizations is critical to driving innovative developments in the integration of ICT with suicide literacy interventions.

Despite the significant potential and value of ICT in suicide prevention, several challenges remain:

(1) A shortage of information scientists capable of collaborating with mental health professionals, alongside limited familiarity and proficiency of mental health practitioners with digital tools.

(2) Difficulties in safeguarding citizens' privacy. For example, research in the United States found that only 47% of telepsychology service websites mention measures to protect clients' personal health information and other data security, and merely 18% specify measures to ensure privacy and confidentiality [53].

(3) Existing legal and ethical frameworks are insufficiently adaptive to technological advances. Issues such as regulation and supervision of digital tools, ensuring their reliability and accountability, and balancing benefits and risks require urgent attention.

In summary, the application of ICT-based digital products in suicide literacy interventions represents a growing trend. Nonetheless, the role of traditional methods should not be overlooked. Combining these approaches in an integrated manner may more effectively enhance public suicide literacy.

7. Conclusion

Research on suicide prevention literacy by international scholars has been relatively comprehensive, offering valuable models and insights across areas such as assessment tools, influencing factors, and intervention strategies. However, current methods for evaluating suicide prevention literacy still primarily rely on self-report scales. Notably, there is a lack of approaches capable of measuring unconscious levels of suicide stigma attitudes. Regarding intervention approaches, traditional suicide prevention methods remain predominant. Looking ahead, it is essential to fully leverage information and communication technology (ICT) and integrate it effectively with conventional strategies to enhance public suicide prevention literacy. This integration is of great significance for achieving the goals outlined in the "Healthy China 2030" initiative.

Disclosure statement

The authors declare no conflict of interest.

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