清華大學
万科公共卫生与健康学院
VANKE SCHOOL OF PUBLIC HEALTH
TSINGHUA UNIVERSITY

Structure and Connectivity of Suicide Literacy Subphenotypes in Suicide Prevention Gatekeeper Training

Bowen Liu[1], Yinzhe Wang[1], Diyang Qu[1], Runsen Chen[1]
1.Vanke School of Public Health, Tsinghua University, Beijing, China

Introduction

- Adolescent suicide remains a major global public health concern. In China, suicide ideation among adolescents remains alarmingly prevalent, with meta-analytic estimates reaching 15.4% [1]. However, persistent stigma toward suicide, limited school-based mental health resources, and low counselor-to-student ratios continue to impede early identification and intervention[2]. These challenges underscore the urgent need for culturally adapted, school-based prevention initiatives.
- Teachers play a pivotal role as frontline gatekeepers, capable of recognizing and referring at-risk students for timely support. Although international programs such as Question, Persuade, and Refer (QPR) and Applied Suicide Intervention Skills Training (ASIST) have shown effectiveness [3,4], their long-term impact and applicability to Chinese cultural and educational contexts remain unclear. To address these gaps, our team developed the Life Gatekeeper Training Program (LGTP), an eight-session, culturally tailored intervention for non–mental health professionals.
- This study aimed to examine how teachers' suicide prevention literacy evolves following LGTP participation and how literacy development relates to behavioral and attitudinal outcomes. Using latent class growth modeling and cross-lagged panel network analysis, we identified subphenotypes of literacy trajectories and explored item-level interconnections over time, thereby clarifying the mechanisms underlying sustained improvements in gatekeeping competence and suicide prevention practices.

Methods

- This study is a large-scale school-based randomized controlled trial conducted from December 2022 to March 2024, involving 84 schools randomly assigned to an intervention or waitlist control group. Informed consent was obtained from all participants. A total of 2,051 school teachers (74.9% female; mean age = 37.15 ± 8.84 years) from the intervention group were included in the analysis, with assessments conducted at baseline (T1), immediately after training (T2), and at 6 months (T3) and 12 months (T4) follow-up. The four primary outcomes included the stigma against suicide, literacy of suicide, perceived competence, and willingness to intervene against suicide. Gatekeeper behaviors were assessed at six- and twelve-months post-intervention to evaluate real-world application. Percentage scores (0–100%) were calculated for each intervention method (e.g., talking to students, engaging with parents, referring to professionals) by comparing the number of at-risk students identified to those receiving intervention, with higher scores indicating greater engagement.
- All analyses were performed in R 4.1.0. Latent class growth modelling was employed to identify distinct subphenotype trajectories of literacy development, while multinomial logistic regression examined baseline characteristics associated with these trajectories [5]. Cross-lagged panel network analysis was used to explore the dynamic relationships between the components of the training over time [6].

Results

- As shown in Figure 1, four distinct literacy trajectory groups were identified: Dip–Recovery (9.8%), Stable–Low (10.63%), Growth–Stable (66.16%), and Peak–Decline (13.41%). The Growth-Stable Group exhibited significantly higher levels of literacy (F = 67.41, p < 0.001), competence (F = 51.73, p < 0.001), and willingness to intervene (F = 49.60, p < 0.001) compared to other groups. They also demonstrated greater engagement in conversations with both students and parents compared to other trajectory groups (Cohen's d = 0.20–0.29, all p < 0.05).

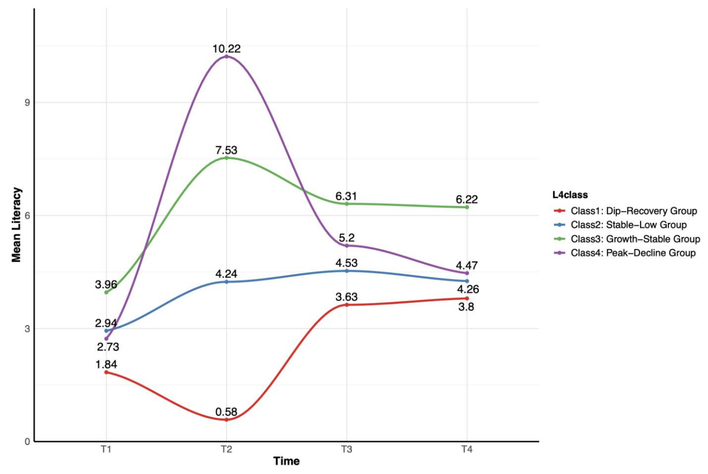

Figure 1. Four different developmental trajectories of literacy of suicide during four waves.

Note: T1: Baseline; T2: Post-test; T3: 6-month follow-up; T4: 12-month follow-up.

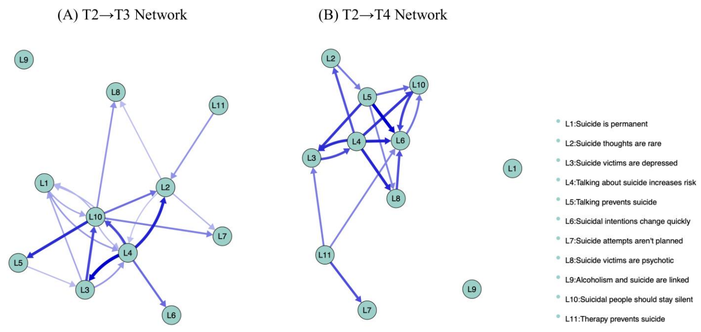

Figure 2. Cross-lagged panel network models

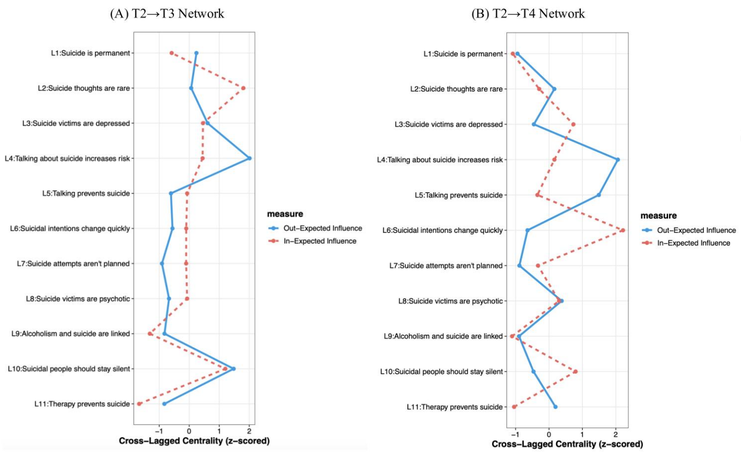

Figure 3. Centrality estimates for the networks.

- A total of 1,357 teachers from Group 3 were included in the cross-lagged network analysis. In the T2→T3 network (Figure 2A), the item "Talking about suicide increases risk" (L4) showed the strongest prospective influence, predicting both "Suicide victims are depressed" (L3) (OR = 2.09) and "Suicidal thoughts are rare" (L2) (OR = 1.94). As shown in Figure 3A, centrality analysis confirmed L4 as the dominant out-EI node (OEI = 2.01). The item "Suicidal people should stay silent" (L10) emerged as both an influential and receptive node (OEI = 1.48, IEI = 1.20).
- In the T2→T4 network (Figure 2B), the two strongest predictive paths involved L5: Talking prevents suicide (OR = 1.63) and L4: Talking about suicide increases risk (OR = 1.55), both predicting L6: Suicidal intentions change quickly. As shown in Figure 3B, L4 again showed the highest outflow centrality (OEI = 2.06), reinforcing its pivotal role over time, followed by L5 (OEI = 1.49). The node L6 exhibited the strongest in-EI centrality (IEI = 2.21).

Conclusion

- This study adopts a dual approach, examining both trajectory-based and item-level perspectives of suicide literacy to identify distinct literacy patterns and the most influential knowledge affecting long-term retention. Notably, teachers in the Growth-Stable Group exhibited sustained suicide literacy alongside higher perceived competence and willingness to intervene, underscoring the association between literacy retention and intervention readiness. Suicide literacy may strengthen teachers' confidence in their ability to respond effectively to at-risk students, better preparing them for challenging conversations, and reinforcing their proactive roles in suicide prevention.
- Misconceptions about discussing suicide and the necessity of silence had the strongest impact on sustained literacy, suggesting that addressing these early in training may drive broader conceptual shifts, reinforce adaptive beliefs, and enhance intervention efficacy. In addition, as teachers corrected misconceptions about open discussions, they developed a more nuanced understanding of the dynamic nature of suicide risk, which may in turn enhance their confidence in engaging in intervention efforts. Future efforts in gatekeeper training should prioritize tailored interventions and sustained support to enhance long-term literacy retention and intervention readiness among educators.

References

1.Chang, Q., Shi, Y., Yao, S., Ban, X. & Cai, Z. Prevalence of Suicidal Ideation, Suicide Plans, and Suicide Attempts Among Children and Adolescents Under 18 years of Age in Mainland China: A Systematic Review and Meta-Analysis. *Trauma, Violence, & Abuse* **25**, 2090–2102 (2024).

2.Gearing, R. E. *et al.* Suicide in China: Community Attitudes and Stigma. *Omega (Westport)* **86**, 809–832 (2023).

3.Isaac, M. *et al.* Gatekeeper Training as a Preventative Intervention for Suicide: A Systematic Review. *Can J Psychiatry* **54**, 260–268 (2009).

4.Tompkins, T. L. & Witt, J. The Short-Term Effectiveness of a Suicide Prevention Gatekeeper Training Program in a College Setting with Residence Life Advisers. *J Primary Prevent* **30**, 131–149 (2009).

5.Proust-Lima, C., Philipps, V. & Liquet, B. Estimation of extended mixed models using latent classes and latent processes: the R package lcmm. *Journal of statistical software* **78**, 1–56 (2017).

6.Friedman, J., Hastie, T. & Tibshirani, R. Regularization paths for generalized linear models via coordinate descent. *Journal of statistical software* **33**, 1 (2010).

Funding: Runsen Chen received funding support from the Research Fund of Vanke School of Public Health, Tsinghua University (100009001).
Conflict of interest statement: The authors declare that they have no conflict of interest.