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Short communication

The interpersonal-psychological theory of suicide and the role of psychological pain during the COVID-19 pandemic: A network analysis

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ABSTRACT

Introduction: Among the most investigated theories explaining suicidal behavior there are the interpersonal-psychological theory of suicide (IPTs) by Thomas E. Joiner and the one focused on the construct of psychological pain (or psychache, or mental pain).

Objective: Since it remains unclear whether these two different theories correlate with each other in the explanation of suicidal risk, we used a network analysis approach to investigate the complex interplay between both IPTs and psychological pain theories and history of suicidal planning and/or suicide attempt (SP/SA).

Methods: A sample of 1,586 university students from various Italian universities was recruited between April 24th, 2020 and February 23rd, 2021, hence during the COVID-19 pandemic. To be included subjects should have been university students and aged between 18 and 35 years old.

Results: Within a network that included the core factors from both models (IPTs and psychological pain), higher fearlessness about death (Acquired Capability for Suicide Scale-Fearlessness About Death, ACSS-FAD) and higher psychological pain (Psychache Scale) were the variables most strongly associated with history of SP/SA.

Conclusions: Considering a large number of variables, history of SP/SA was explained in particular by fearlessness about death and psychological pain in university students. Hence these aspects should be targeted in the treatment for suicide prevention.

1. Introduction

During 2020–2021, the COVID-19 pandemic (severe acute respiratory syndrome coronavirus 2, SARS-CoV-2) violently impacted the health of the world. The North of Italy, in particular, faced one of the highest rates of COVID-19-related contagions and deaths. In university students, COVID-19 was associated with higher prevalence of depressive symptoms, anxiety symptoms, and sleep disturbances (Deng et al., 2021); moreover, students reporting suicidal ideation doubled in 2020 (Brailovskaia et al., 2021). Taking into account that suicide was the fourth leading cause of death among 15–29 year-olds in 2019 (World Health Organization, 2021), the understanding and prevention of suicide in youngsters is a priority.

The interpersonal-psychological theory of suicide (IPTs) by Thomas

E. Joiner was extensively used to explain suicidal risk (Chu et al., 2017). It posits that three constructs interact with each other to explain suicidal risk (Van Orden et al., 2010): thwarted belongingness (TB) and perceived burdensomeness (PB) would predict suicidal ideation, while the acquired capability (AC) for suicide would be linked to suicidal behavior. Another construct extensively used to understand suicidal behavior is the one of psychological pain (or psychache, or mental pain) (Ducasse et al., 2018), that conceptualizes an aversive feeling experienced as a lasting and unsustainable negative state, resulting from the negative appraisal of the self (Meerwijk and Weiss, 2014; Shneidman, 1998).

Considering that it remains unclear whether these two different theories correlate with each other in the explanation of suicidal risk, and that a network perspective may be extremely useful if we consider the

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complexity of suicidal behavior (de Beurs et al., 2021), we decided to perform a network analysis, considering the complex interplay between IPTS and psychological pain theories. In particular, we used a network analysis approach to investigate both IPTS and psychological pain theories and history of suicidal planning and/or suicide attempt (SP/SA) in a sample of 1,586 Italian university students recruited during the COVID-19 pandemic. The analysis will provide insight into which of the core components of the theories inter-relate and directly relate to the history of SP/SA, after partially out all other variables.

2. Materials and methods

2.1. Sample

A sample of 2,351 Italian university students was recruited at the Universities of Milan-Bicocca, in Milan, and of Eastern Piedmont, in Novara, Italy, during the COVID-19 pandemic, between April 24th, 2020 and February 23rd, 2021. The data collection was carried out through Qualtrics, with an online survey. The test battery, of about 30 min time, was disseminated through social networks and mailing lists associated with students of both universities. ECTS (0.1) were awarded to students of Psychology at the University of Milan-Bicocca. Each participant gave informed consent and the study was approved by the Internal Review Board of the Universities of Milan-Bicocca and of Eastern Piedmont. The research was conducted ethically in accordance with the World Medical Association Declaration of Helsinki.

Included subjects should have been university students aged between 18 and 35 years old. We considered only subjects who completed at least 95% of the questionnaire (a total of 1,606 subjects), and we removed 20 subjects after a data quality check. The final sample consisted of 1,586 subjects.

Since we considered only subjects who completed at least 95% of the questionnaire ($N = 1,586$), we preliminarily checked the total sample ($N = 2,351$) (descriptive analyzes available upon request), using survival analysis, to explore if the students had different dropout behavior according to the group (i.e. our outcome of interest, history of suicidal planning (SP) and/or suicide attempt (SA) versus no history of SP/SA). The survival analysis showed an overall lower risk of dropout in the group of students with a history of SP/SA in comparison with students without a history of SP/SA (Model Metrics: Number of total events = 769, R-squared = 0.043, Likelihood ratio test ($df = 1$) = 104.08, $p < 0.001$). The Hazard Risk is 0.37 (95% Confidence Intervals 0.29–0.46), meaning that the probability of dropping out being a student with a history of SP/SA is 0.37 times than those of students without a history of SP/SA. Notably, there was not any single loss among subjects with a history of SP/SA until they were near the battery's end (~75%). Differently, students without a history of SP/SA dropped out since the very beginning of the survey progress (see [Supplementary Fig. 1](#), SF1).

2.2. Assessment measures

This study was primarily developed to validate in Italian two scales associated with IPTS in university students: the Interpersonal Needs Questionnaire (INQ) and the Acquired Capability for Suicide Scale-Fearlessness About Death (ACSS-FAD) (unpublished). Socio-demographic and clinical information were collected. Included measures, selected due to their correlation (previously reported in literature or hypothesized) with both INQ and ACSS-FAD, were: (1) psychological/psychiatric measures: state and trait anxiety (State-Trait Anxiety Inventory, STAI); depressive symptoms (Beck Depression Inventory-II, BDI-II); self-esteem (Rosenberg Self-Esteem Scale, RSES); reasons for living (Reasons For Living Inventory, RFLI); psychological pain (Psychache Scale, Mental Pain Questionnaire (MPQ), visual analogue scale (VAS)); (2) somatic pain measures: VAS; Pain Vigilance and Awareness Questionnaire (PVAQ); interoceptive awareness (Self-Awareness Questionnaire, SAQ); (3) social measures: UCLA Loneliness Scale;

Multidimensional Scale of Perceived Social Support (MSPSS). To investigate suicidal risk, we created two ad hoc dichotomous items investigating both lifetime history of SP and SA, and we pooled them in a single outcome, assigning 1 (history of SP/SA) to subjects who reported SP and/or SA, and 0 (no history of SP/SA) to those who did not report any. Among all the collected variables (known or hypothesized to correlate with both the INQ and the ACSS-FAD), we identified a single scale for each construct to run a network analysis without redundant measures. In detail, we included both IPTS-related measures (INQ and ACSS-FAD, measures of current features) and a single measure of psychological pain (Psychache Scale, lifetime measure). In addition we included: (1) psychological/psychiatric measures: STAI trait (lifetime measure); BDI-II (current measure); RSES (lifetime measure); (2) somatic-pain measures: VAS (current measure); PVAQ (lifetime measure); SAQ (lifetime measure); (3) social measures: UCLA Loneliness Scale (lifetime measure); MSPSS (lifetime measure).

2.3. Statistical analyzes

Network analysis is useful to explore complex patterns of relationships. The principle behind the networks is simple: take a set of variables of interest (nodes) and identify their direct and indirect relationships (edges). In psychology, edges are typically estimated through the Gaussian Graphical Model, which estimates regularised partial correlations. The regularization was carried out using the graphical “least absolute shrinkage and selection operator” (LASSO) algorithm. The LASSO is tuned by selecting the best operator through the extended Bayesian Information Criterion (eBIC), which is regulated by a parameter γ that we set at 1, a value that optimizes sensitivity and specificity of edges estimation given our sample size. The networks were estimated with JASP 0.16.

We assessed through standard tests (Chi-square or Mann-Whitney *U* test) whether students with a history of SP/SA were different from students without this history in socio-demographic, clinical, psychological/psychiatric, somatic pain and social features. All *p* values were two-tailed, and statistical significance set at the 0.05 level. In case of normality assumption violation (tested with Shapiro–Wilk test), non-parametric procedures were adopted. Statistical analyzes of the comparison of the means were performed using SPSS 27.0.1.0.

Survival analysis was performed using Jamovi 1.2, which calls the R package survival. Survival analysis results report the Kaplan-Meier curve and the Hazard Risk estimated with a Cox regression model. We coded a dropout as events; time is expressed as a percentage of questionnaire completion.

3. Results

Socio-demographic, clinical, psychological/psychiatric, somatic pain and social features of the sample are shown in [Supplementary Material 1](#) (SM1). Students with a history of SP/SA were 29.26% ($N = 464$) of the total (SP: $N = 462$; SA: $N = 82$) and they differed from those without this history (70.74% $N = 1,122$) in some variables. Comparing students without a history of SP/SA, students with it reported: higher sexual minorities' rates, lower education, lower belief in god, Catholic rates and religious practices, higher consultation with psychotherapists/psychiatrists rates, and higher psychotropic drugs' consumption.

Concerning the IPTS model, compared with students without a history of SP/SA, students with it reported higher TB and PB (INQ) and FAD (ACSS-FAD). In psychological/psychiatric measures, comparing students without a history of SP/SA, students with it reported higher state and trait anxiety (STAI), higher depressive symptoms (BDI-II), lower self-esteem (RSES), lower reasons for living (RFLI), and higher psychological pain (the three scales). Concerning somatic pain measures, students with a history of SP/SA, compared to students without it, reported higher pain (VAS), higher pain vigilance and awareness (PVAQ), and higher interoceptive awareness (SAQ). In social measures, students with

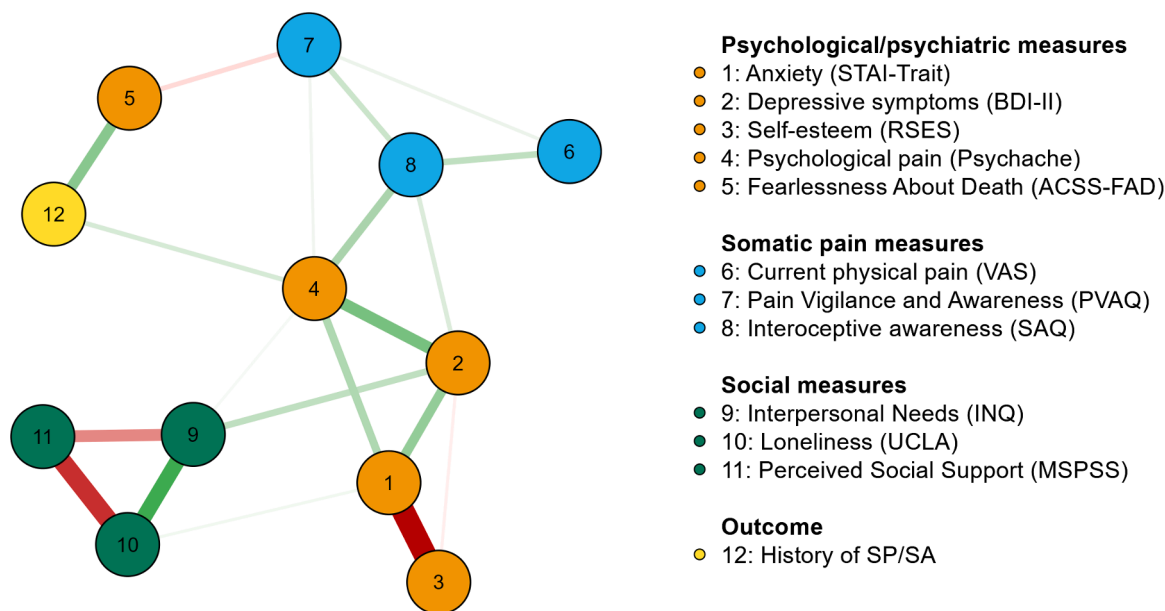


Fig. 1. Network analysis including psychological/psychiatric, somatic pain and social measures and the history of suicidal planning and/or suicide attempt of the sample ($N = 1,586$) (STAI-Trait: State-Trait Anxiety Inventory; BDI-II: Beck Depression Inventory-II; RSES: Rosenberg Self-Esteem Scale; ACSS-FAD: Acquired Capability for Suicide Scale-Fearlessness About Death; VAS: visual analogue scale; PVAQ: Pain Vigilance and Awareness Questionnaire; SAQ: Self-Awareness Questionnaire; INQ: Interpersonal Needs Questionnaire; UCLA: UCLA Loneliness Scale; MSPSS: Multidimensional Scale of Perceived Social Support; SP: Suicidal Planning; SA: Suicide Attempt).

a history of SP/SA reported higher loneliness (UCLA) and lower perceived social support (MSPSS), compared to students without it.

In the network that included the core factors from both models (IPTs and psychological pain), history of SP/SA was most strongly associated with fearlessness about death (ACSS-FAD) and psychological pain (Psychache Scale) (shown in Fig. 1). Psychological pain also emerged to be the most central node (see Supplementary Material 2 (SM2) for the centrality graphs).

Comparing the network of subjects without a history of SP/SA (shown in Fig. 2, upper panel) versus subjects with it (shown in Fig. 2, lower panel), the edges strength changed while centrality indices (especially the expected influence) remained the same (see SM2). Considering the SP/SA group in comparison with the other, psychological pain was most strongly associated with PVAQ. Furthermore, while the negative relationship between loneliness and self-esteem disappeared, the strength of the relation between self-esteem and depression increased. The INQ was more strongly associated with depression in the case of history of SP/SA.

SM2 includes the estimation of edge stability, centrality indices, the simple correlation and the unregularized partial correlations tables.

4. Discussion/Conclusion

We used a network analysis to investigate the relationship between both IPTs and psychological pain theory of suicide in university students. Among psychological/psychiatric, somatic pain and social variables, fearlessness about death and psychological pain were most strongly and directly associated with a history of SP/SA, suggesting their crucial role in suicidal risk. Hence, both theories explaining suicidal risk, the IPTs and the psychache one, seem to be useful in the explanation of history of SP/SA.

In comparing university students with and without a history of SP/SA, differences were found in line with the literature (Li et al., 2020). In fact, belonging to a sexual minority (Guz et al., 2021), and being less religious (Lawrence et al., 2016) are risk factors for suicide. Religious affiliation seems to be protective against SA but not against suicidal ideation (Lawrence et al., 2016). Students with a history of SP/SA had

frequently consulted a mental health specialist and were taking psychotropic drugs, although this aspect is debated. Further features associated with increased suicide risk are the presence of anxiety, depressive symptoms, low self-esteem, loneliness, TB, PB (i.e., the absence of perceived social support) and no reasons for living (Gselamu and Ha, 2020; Li et al., 2020; Soto-Sanz et al., 2019).

The expected influence centrality score highlights a central role for psychological pain and an important role for psychiatric variables like depressive symptoms (BDI-II). This result may be useful for the improvement of targeted interventions for university students. We should notice that the expected influence is similar when splitting the group according to the history of SP/SA variable. An interpretation for a similar pattern could be that we did not include a clinical sample in the study, hence the group with a self-reported history of SP/SA might be more similar to the other one than what we would expect in a clinical context. Additionally, network results suggest that what differentiates the two networks is not a general effect of connectivity but specific edge differences.

A further important note relates to both psychological and physical pain to suicide (Calati et al., 2015; Ducasse et al., 2018), which are processed in partially overlapping neurocircuits (Eisenberger, 2012; Meerwijk et al., 2013). In the network of students with a history of SP/SA, compared to the one without it, psychological pain was not particularly associated with somatic pain (VAS) but with the other pain-related measures, pain vigilance and awareness (PVAQ) and interoceptive awareness (SAQ). Hence, these could be the specific somatic pain-related features that are nearer than others to the feeling of psychological pain. Moreover, the hypervigilance towards pain and bodily sensations could increase the cortical processing of painful stimuli (van Laarhoven et al., 2010), and the pain implicated in suicidal risk.

Considering the network of students with a history of SP/SA, fearlessness about death was more negatively associated with pain vigilance and awareness (PVAQ) in comparison with the network of students without it. This could be reconducted to the acquired capability for suicide, construct of the IPTs, which implies not only fearlessness about death but also higher pain tolerance, probably linked to decreased pain

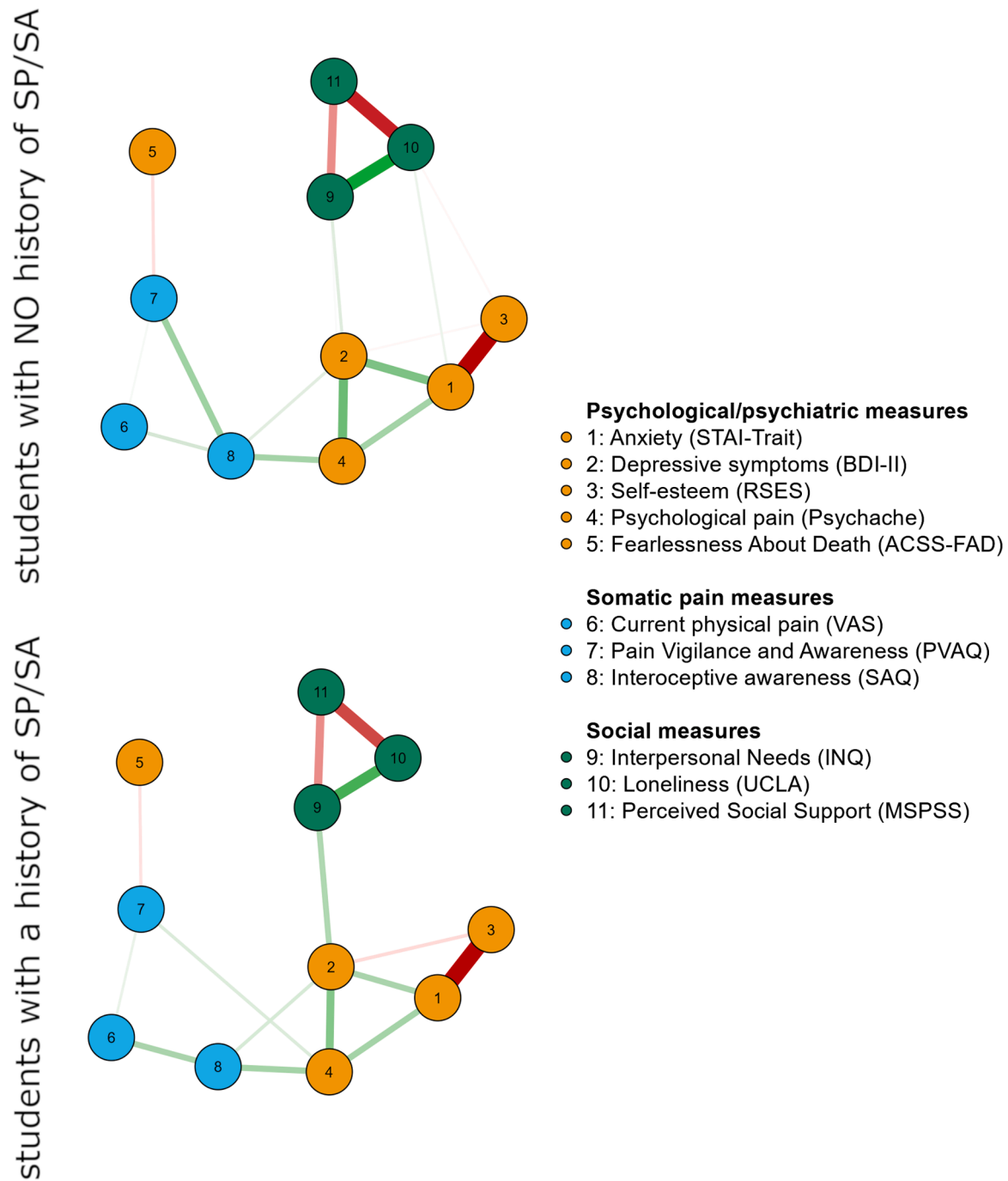


Fig. 2. Separate network analyses of students without a history of suicidal planning and/or suicide attempt ($N = 1,122$) versus students with such a history ($N = 464$), including psychological/psychiatric, somatic pain and social measures (STAI-Trait: State-Trait Anxiety Inventory; BDI-II: Beck Depression Inventory-II; RSES: Rosenberg Self-Esteem Scale; ACSS-FAD: Acquired Capability for Suicide Scale-Fearlessness About Death; VAS: visual analogue scale; PVAQ: Pain Vigilance and Awareness Questionnaire; SAQ: Self-Awareness Questionnaire; INQ: Interpersonal Needs Questionnaire; UCLA: UCLA Loneliness Scale; MSPSS: Multidimensional Scale of Perceived Social Support; SP: Suicidal Planning; SA: Suicide Attempt).

vigilance and awareness (Vossen et al., 2018).

The survival analysis showed that students with a history of SP/SA had a lower risk of dropout, indicating again to be different from the students without it. Also the timing of dropout is different, since students with a history of SP/SA were lost at 75% of battery completion, while students without it left before. Students with a history of SP/SA probably felt particularly involved and motivated to complete the measures, but this was not enough for some of them at a certain moment, not too far from the end, to reach the completion. These results just allow inferring that students with a history of SP/SA are different from students without

it, also concerning the modality of withdrawal from the study. However, the curve of withdrawal and both motivation and attention may be evaluated in future similar studies, since we know that suicidal behaviors are associated with altered decision-making or poor cognitive control (Gifuni et al., 2020; Richard-Devantoy et al., 2014), but the results on attentional bias are mixed (Richard-Devantoy et al., 2016). The main strengths of this study were the large sample and the network approach. Limitations should also be acknowledged: 1) the history of SP/SA was self-reported; 2) SP and SA were pooled to increase the power of the sample, so in future studies, it would be interesting to consider

these two phenotypes separately; 3) some of the assessment measures investigated current features instead of lifetime ones (in particular, INQ, ACSS-FAD, BDI-II, half of the STAI, and the VAS for physical pain). In conclusion, considering a large number of variables, history of SP/SA was associated in particular with fearlessness about death and psychological pain in university students. These aspects should be targeted in the assessment and treatment for suicide prevention.

CRedit authorship contribution statement

Raffaella Calati: Conceptualization, Project administration, Supervision, Writing – original draft. **Daniele Romano:** Conceptualization, Formal analysis. **Sara Magliocca:** Investigation, Resources, Formal analysis, Writing – original draft. **Fabio Madeddu:** Supervision. **Patri-zia Zeppugno:** Supervision, Resources. **Carla Gramaglia:** Supervision, Resources.

Declaration of Competing Interest

The authors have no conflicts of interest to declare.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.jad.2022.01.078](https://doi.org/10.1016/j.jad.2022.01.078).

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