



Research paper

Perceived burdensomeness and suicidal ideation in cancer patients: A theoretical network perspective

Judith Hirschmiller^{a,*}, Tamara Schwinn^a, Derek de Beurs^b, Jörg Wiltink^{a,c}, Rüdiger Zwerenz^a, Elmar Brähler^{a,d}, Manfred E. Beutel^a, Mareike Ernst^{a,e}

^a Department of Psychosomatic Medicine and Psychotherapy, University Medical Center of the Johannes Gutenberg-University Mainz, Mainz, Germany

^b Faculty of Social and Behavioural Sciences, University of Amsterdam, Amsterdam, Netherlands

^c University Cancer Center Mainz (UCT), University Medical Center of the Johannes Gutenberg-University Mainz, Mainz, Germany

^d Department of Medical Psychology and Medical Sociology, University Medical Center Leipzig, Leipzig, Germany

^e Department of Clinical Psychology, Psychotherapy and Psychoanalysis, Institute of Psychology, University of Klagenfurt, Klagenfurt am Wörthersee, Austria

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ABSTRACT

Objective: Although cancer is associated with elevated rates of suicidal ideation, not all individuals affected by this disease are equally vulnerable. This heterogeneity suggests other, including psychological factors may play a critical role in shaping risk. However, research has rarely examined suicidal ideation in cancer patients through the lens of established suicide theories. This study addresses this gap by investigating theory-derived psychological risk and protective factors, which are derived from the *Interpersonal Theory of Suicide (ITS)*, the *Integrated Motivational-Volitional Model of Suicidal Behavior (IMV)* and cancer-specific suicide theories.

Methods: In total, 618 cancer patients from various settings completed questionnaires assessing sociodemographic and cancer-associated characteristics as well as perceived burdensomeness/thwarted belongingness (ITS), defeat/entrapment (IMV), primary and secondary control. Multiple network analyses were conducted, exploring the structure and interplay of these factors and their relation to suicidal ideation – independently for each theory as well as a combined overall network.

Results: Suicidal ideation was reported by 11.74 % of participants. All core risk factors of the ITS and IMV were (indirectly) associated with suicidal ideation, with perceived burdensomeness being the only variable with a direct link. Perceived burdensomeness also accounted for most of suicidal ideation's variance (44.63 %; 95 %CI: 17.87, 68.57). Primary and secondary control acted as protective factors.

Conclusion: Perceived burdensomeness forms the bridge between the psychological burden of cancer and suicidal ideation and should therefore be assessed in routine screenings and targeted in psychosocial interventions. Secondary control strategies hold great potential to buffer against adverse emotional states and dysfunctional cognitive biases.

1. Introduction

Cancer is not only associated with physical complaints but also imposes significant challenges on an individual's coping processes. Prevalence rates for psychological distress (Kuhnt et al., 2016; Singer et al., 2010) as well as manifest mental disorders (Kuhnt et al., 2016) are substantially increased compared to the general population; potentially leading to mental health crises such as suicidal thoughts (and behaviors). Individuals with cancer may experience suicidal thoughts even

while wishing to live and engaging in life-preserving treatments. Suicidal thinking can be ambivalent (Ernst et al., 2024a) and emerge within a state of 'double awareness', where both the fight for life and the wish for relief from existential distress coexist (Monforte-Royo et al., 2012). In fact, previous studies have demonstrated that substantial proportions of individuals with cancer (IWC) suffer from suicidal ideation (SI) (Favril et al., 2023; Kolva et al., 2020; Robson et al., 2010), but also that these rates vary greatly (0.7 %–46.3 %). While cancer itself has been identified as a risk factor for SI, by no means does every individual affected by the

* Corresponding author at: Department of Psychosomatic Medicine and Psychotherapy, University Medical Center of the Johannes Gutenberg-University Mainz, Untere Zahlbacher Str. 8, 55131, Mainz, Germany.

E-mail address: Judith.hirschmiller@unimedizin-mainz.de (J. Hirschmiller).

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disease become suicidal. Thus, additional risk and protective factors seem to shape heterogeneity in vulnerability. As SI indicates tremendous psychological burden, and is, among others, a risk factor for suicidal behaviour (O'Connor and Kirtley, 2018), understanding the determinants of SI in the context of cancer is highly relevant to inform screening and intervention efforts to identify and treat the most vulnerable. To this aim, potentially modifiable, psychological variables are particularly relevant.

Up until now, research has focused heavily on investigating socio-demographic (e.g., gender, age) and cancer-related risk factors (e.g., cancer stage, treatment, time since diagnosis) rather than psychological ones, and research designs favored direct effects of single psychological risk factors (above all, the presence of a manifest mental disorder) over models including several risk and protective factors or modeling their interplay (Ernst et al., 2024b; Rogers et al., 2021). While cancer-related risk factors have been shown consistent associations with suicidal thoughts and behaviors (Kolva et al., 2020), the extent of research on these oftentimes fundamentally unchangeable variables contrasts with contemporary suicide theories: Both the *Interpersonal Theory of Suicide (IPTS)* (Van Orden et al., 2010) and the *Integrated Motivational-Volitional Model of Suicidal Behaviour (IMV)* (O'Connor and Kirtley, 2018) emphasize that SI emerges from the complex interplay of primarily psychological variables. The *IPTS* proposed that suicidal thoughts emerge when individuals perceive themselves as a burden (i.e., *perceived burdensomeness*) as well as disconnected from others (i.e., *thwarted belongingness*), and at the same time feel hopeless about these states. The model is displayed in Fig. 1.

The *IMV*, on the other hand, describes suicidal thoughts (and behaviors) as a result of a complex interplay of bio-psycho-social variables. The emergence of SI is described by the *motivational phase*, which mostly relies on psychological risk and protective factors. Among moderating variables (e.g., coping, perceived control), *defeat* (i.e., perception of being humiliated/brought down) and *entrapment* (i.e., feeling as if there is no way of escaping the situation) are highlighted as the core components explaining SI (O'Connor and Kirtley, 2018).

Both models have received general support from previous empirical research (Brown et al., 2021; De Beurs et al., 2019; Robison et al., 2024; Souza et al., 2024). However, as described above, they have not been widely applied in the context of cancer. Within their scoping review, Schomberg et al. (2021) found four articles that investigated variables associated with the *IPTS* in this population. Among those, both perceived burdensomeness and thwarted belongingness were associated

with higher rates of SI. Findings of a recent theoretically oriented survey among cancer patients also highlighted both variables as risk factors for SI (Schomberg et al., 2025). Both variables were associated with passive ("I wish I were dead"), their interaction with entrapment with active SI ("I want to kill myself") in 199 female cancer patients. However, this study sample contained only a small proportion of participants who affirmed SI and only women; the statistical analyses are therefore limited in their power, and generalizability to other IWC is also restricted.

Regarding the *IMV*, previous research has mainly found single variables (e.g., entrapment) to be associated with SI in cancer patients (Bobevski et al., 2022; Zhang et al., 2023). For example, Bobevski et al. (2022) applied a network approach investigating demoralization and its link with depression and suicidality in cancer patients. They found that symptoms closely associated with entrapment (e.g., isolation, feeling stuck/trapped) were indirectly associated with SI and variables that revolve around loss of hope (e.g., hope-/helplessness, pointlessness) were more directly affecting SI in cancer patients. While these findings provide fundamental information about the link between single motivational factors and SI, to the best of our knowledge, there is no study yet investigating the complex interplay of both motivational factors in the context of cancer. Ernst et al. (2024b) systematically reviewed all research examining risk and protective factors for suicidal thoughts and behaviors in cancer patients and adapted the original *IMV* to the specific circumstances of IWC. Following the pathway structure of the original *IMV*, a differentiation was added of risk and protective factors that are *directly* related to the illness in the sense that they could emerge from it (e.g., defeat, entrapment) and factors that are *not directly* related to the illness, but instead reflect stable individual differences (e.g., perceived control, resilience). These moderators are posited to act as potential protective factors enhancing the coping processes when confronted with cancer. The adapted *IMV* is displayed in Fig. 2.

Perceived control - which goes beyond the main constructs of the *IPTS* and the *IMV*, but is still closely related to them (i.e., hopelessness, entrapment) - has repeatedly been identified as such a potential personality-related factor facilitating adequate coping (Hirschmiller et al., 2024; Hirschmiller et al., 2025c). Following the *Two-Process Model of Perceived Control* (Rothbaum et al., 1982), the differentiation between primary (i.e. the ability to adapt external circumstances to internal needs and values) and secondary control strategies (i.e., the ability to internal needs and values to external circumstances) is suggested as particularly helpful for understanding (un)successful coping processes in the context of limited ability to achieve primary control (Heckhausen and Schulz, 1995). As cancer and its treatment limit an individuals' ability to achieve primary control (due to e.g., strict treatment procedures, limited social life and career options), secondary control strategies may play a central role in protecting against SI. Hirschmiller et al. (2025c) compared the relevance of primary and secondary control for SI in cancer patients and the general population. While cancer patients reported higher levels of secondary control strategies, no differences were found in primary control. Interestingly, while both perceived control strategies showed independent associations with SI in each sample, the protective effect of primary control was *weaker* in cancer patients (Hirschmiller et al., 2025c). These results highlight that underlying (coping) mechanisms and pathways leading to SI may differ in IWC (when comparing with the general population).

Building on these previous findings, the present work aims to investigate interrelations of risk and protective factors for SI within IWC in a theory-driven manner. By conducting a novel statistical technique called network analyses, the structure behind the key variables of the most influential modern suicide theories (*IPTS*, *IMV*) and additional risk/protective factors will be analyzed. Network modeling is a statistical method that examines and visualizes the connectivity of variables; bearing great promise in investigating (potentially strongly associated) theory-derived risk and protective factors for suicidal thoughts, especially in populations in which they are understudied and their relations



Fig. 1. Visualization of the core components for suicidal ideation based on the Interpersonal Theory of Suicide. The figure illustrates the core risk factors for suicidal ideation according to the Interpersonal Theory of Suicide. According to the theory, the desire for suicide arises if an individual simultaneously experiences high levels of thwarted belongingness and perceived burdensomeness and also feels hopelessness about these states.

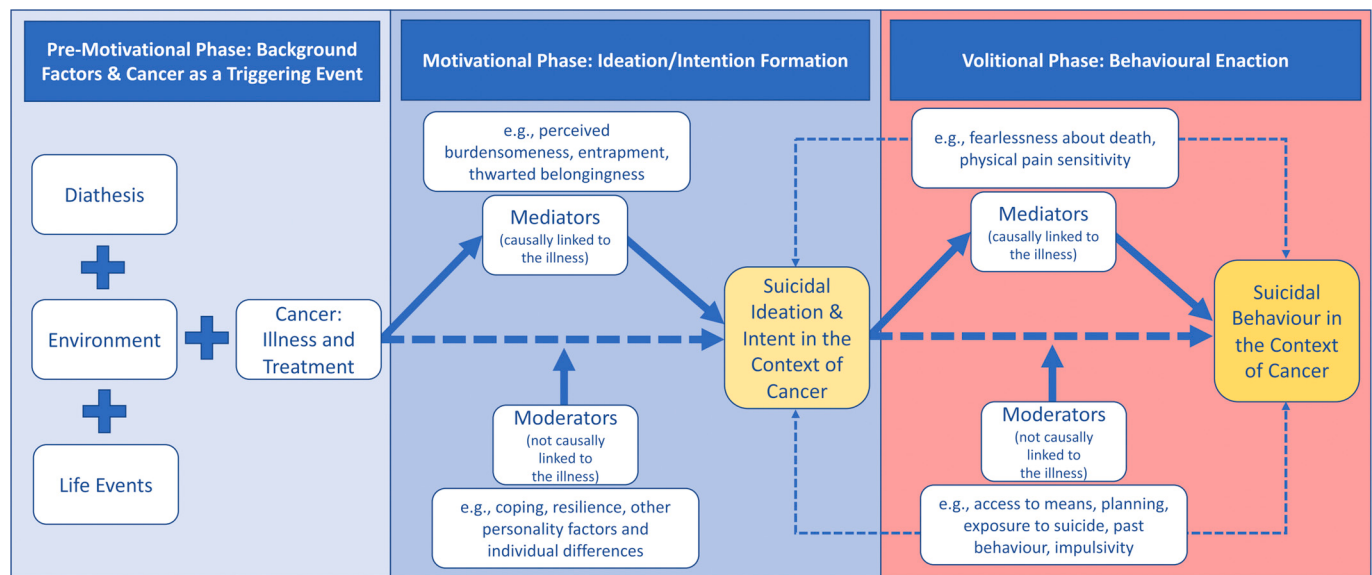


Fig. 2. The *Integrated Motivational-Volitional Model of Suicidal Behaviour* adapted to the oncological context. The figure illustrates the adapted Integrated Motivational-Volitional Model of Suicidal Behaviour by Ernst et al. (2024b), which describes the emergence of suicidal thoughts and behaviors as a pathway model. The adapted version differentiates between mediators that are causally linked to the illness and moderators that are not causally linked to the illness (here: cancer).

thus not known, such as cancer patients. De Beurs et al. (2019) previously applied this method to investigate the interplay of theoretically derived risk and protective factors for SI and behaviour in a representative sample of young adults (18–34 years). They explored the key variables of the IPTS and the IMV, both separately and combined, and additionally included other potential risk and protective factors (e.g., depressive symptoms, optimism, resilience). Here, (internal) entrapment and perceived burdensomeness were most strongly associated with SI. The other key components (defeat, thwarted belongingness) of the suicide theories were more strongly associated with other risk factors. These findings align with those of an examination of the structure and interrelation of suicidal ideation and the key variables of the IPTS (thwarted belongingness, perceived burdensomeness) among 402 psychiatric inpatients by Brown et al. (2021). Here, perceived burdensomeness demonstrated the strongest and most central link to suicidal ideation, whereas thwarted belongingness showed weaker, primarily indirect associations with suicidal ideation.

While these findings provide first insights into the network structure revolving around suicidal ideation, there is evidence that variable networks might differ between IWC and other at-risk populations, necessitating a separate, specific investigation (Hartung et al., 2017). Furthermore, previous network analyses in IWC mostly focused on symptoms rather than risk/protective factors (Doppenberg-Smit et al., 2025).

By applying this approach to IWC, we therefore intend to gain actionable insights into the most relevant variables associated with SI within this vulnerable population, which can also inform prevention and intervention efforts.

2. Methods

2.1. Participants and procedure

Participants were recruited at the University Medical Center Mainz and clinics of its network (e.g., HSK Wiesbaden). The study procedure and contents were performed in accordance with relevant guidelines and approved by the Ethics Committee of the Federal State of Rhineland-Palatine (nb. 2023–16,975). Paper-pencil questionnaires were distributed by project members and local staff (medical, nursing, and administrative), between 08/2023 and 11/2024. In- and outpatients from

different clinics were assessed to achieve a broad representation of patients treated. Individuals were included if they were adults (≥ 18 years), diagnosed with any type of cancer, and had sufficient German language skills. Acute suicidality necessitating hospitalization was an exclusion criterion. No restrictions were made regarding cancer entity or time since diagnosis. Before handing out the questionnaire, participants were informed about the study contents and provided informed consent. If participants voiced interest but were not able to fill out the questionnaires by themselves (due to physical limitations), they received assistance. The resulting sample consisted of $N = 618$ individuals.

2.2. Information and instruments

Sociodemographic characteristics. Participants reported their gender (choosing between male, female, or diverse, complying with Germany's civil status act), age, nationality, relationship status, employment status, and socio-economic status.

Cancer-related characteristics. These characteristics were relying on participants' self-report. They indicated the diagnosis, localization (localized, metastasized), cancer stage (I–IV), treatment objectives, and treatments (surgery, chemotherapy, radiation, immunotherapy) or whether they did not know each of the above-mentioned information. Additionally, participants rated their subjective prognosis on a scale from 1 = 'not good at all' to 10 = 'very good'.

Perceived burdensomeness & Thwarted belongingness. The interpersonal needs questionnaire (INQ) (Forkmann and Glaesmer, 2013) assessed perceived burdensomeness and thwarted belongingness by 15 items. Responses were rated on a scale ranging from 1 = 'does not apply to me at all' to 7 = 'applies to me completely'. For each scale, the mean score is calculated (range: 1–7). Reliability of the INQ was good (perceived burdensomeness: $\alpha = 0.85$; thwarted belongingness: $\alpha = 0.83$).

Defeat & Entrapment. Defeat and entrapment were assessed using the German version of the Short Defeat and Entrapment Scale (SDES) (Höller et al., 2024). The questionnaire assesses defeat and entrapment by four items, respectively, ranging on a scale of 0 = 'never/not at all' to 4 = 'every time/ very strong'. For each facet, a mean score is calculated (range: 0–4). The reliability of the SDES was acceptable to good (defeat: $\alpha = 0.81$; entrapment: $\alpha = 0.71$).

Perceived control. To assess primary and secondary control, we used the Perceived Control Short Scale – 6 items (PCSS-6). Both facets of

perceived control were assessed by three items (Hirschmiller et al., 2025b). Each item was introduced by ‘When something bad happens to me...’ followed by the respective item wording (e.g., primary: ‘I ask others for help and advice’; secondary: ‘I remind myself I am better off than others’). Ratings were conducted on a scale between 0 = ‘strongly disagree’ to 10 = ‘strongly agree’. Each subscale’s sum score ranges from 0 to 30. Reliability of the PCSS-6 was acceptable in this sample (primary: $\alpha = 0.76$; secondary: $\alpha = 0.77$).

Suicidal Ideation. SI was measured by a single item of the PHQ-9 (item 9) (Kliem et al., 2024; Kocalevent et al., 2013). This item assesses whether an individual thought that they were better off dead or of hurting themselves within the previous two weeks. The response options ranged from 0 = ‘not at all’ to 3 = ‘almost every day’.

2.3. Data analysis

Data were analyzed using R version 4.3.1. To report sociodemographic and cancer-related characteristics, as well as mental health outcomes, descriptive statistics were calculated. Due to technical challenges in the data collection, values of entrapment were missing completely at random until a certain time point ($n = 265$, 42.88 %). Entrapment values were imputed by applying multiple imputation of the *mice* library (Van Buuren (Van Buuren and Groothuis-Oudshoorn, 2011) using predictive-mean-matching, which has been proven to allow stable predictions even under a large proportion of missing data (Madley-Dowd et al., 2019). Specifically, we imputed 20 datasets for the four entrapment items and calculated the mean score in each dataset. To test the plausibility and stability of the imputation, we compared the correlation between entrapment and defeat in the original dataset (pairwise complete cases) with the average correlation across the 20 imputed datasets using the package *cocor*. Additionally, we assessed the similarity between the original and the averaged imputed entrapment scores per dataset. Results indicated a successful and unbiased analysis. For all subsequent analyses involving entrapment, a pooled composite score was used.

For the network analyses, we defined four variable sets: 1) *IPTS* (perceived burdensomeness, thwarted belongingness), 2) *IMV* (defeat, entrapment), 3) *IPTS + IMV*, 4) *IPTS + IMV + Two Process Theory of Perceived Control + age and prognosis* (included as potential confounding variables). As all variables of interest showed relevant skewness, a nonparanormal transformation was applied using the *huge* package. To calculate the networks, we estimated regularized Gaussian-Graphical-Models (Epskamp and Fried, 2018) using the *mgm* package (Haslbeck and Waldorp, 2020). The model selection was based on the L1-regulation (Extended Bayesian Information Criterion) with a parameter of $\gamma = 0.25$ by using graphical LASSO algorithm of the *qgraph* package (version 1.9.8) (Epskamp and Fried, 2018). This regulation shrinks weak, non-informative edges to zero, resulting in a regularized matrix with conditional dependence associations. This matrix and visualization support the identification of meaningful risk and protective factors by not including non-informative variables (Costantini et al., 2015; De Beurs et al., 2019). To visualize the network structures, the Fruchterman-Rheingold algorithm (Jones et al., 2018) was applied. Here, variables appear as nodes and partial correlation coefficients as edges connecting the nodes. In this visualization, highly correlated nodes are placed more closely together and more central, and less correlated nodes are in the periphery. Node predictability (i.e., a node’s amount of variance explained by all other nodes in the network) was calculated using the *mgm* package (Haslbeck and Fried, 2017). Predictability is displayed as the amount of the ring-shaped pie chart that is filled around each node. A completely filled-out chart would indicate that 100 % of the node’s variance is explained by all other nodes. Relative importance (RI) was calculated using the *relaimpo* package (Grömping, 2007) to further examine the contribution of each variable to the explained variance of SI. To test for statistical differences in the contribution, bootstrapped confidence intervals were calculated

(Grömping, 2007).

3. Results

3.1. Sample characteristics

The present sample consisted of 231 women (37.38 %), 378 men (61.17 %) and nine persons who did not indicate their gender (1.46 %), with a mean age of 63.04 years (range:19–94). Most participants reported having a localized disease, with hematological cancers being the most frequent diagnosis. The time since diagnosis ranged from 0 to 468 months. The sociodemographic and disease-related characteristics are displayed in Table 1.

3.2. Theory-derived variables associated with suicidal ideation and their partial correlations

In total, 70 IWC reported SI (11.74 %). The mean score for defeat was 0.65 ($SD = 0.80$, range: 0–4), for entrapment 0.63 ($SD = 0.71$, range: 0–4), for perceived burdensomeness 1.37 ($SD = 0.71$, range: 1–7) and for thwarted belongingness 2.28 ($SD = 1.12$, range = 1–6.78). Regarding

Table 1
Sociodemographic and disease-related characteristics of cancer patients.

	Total (N = 618) N (%)
Sociodemographic characteristics	
Age	63.04 (13.58)
Partnership (yes)	456 (73.79)
Education ^a	
High school	241 (39.00)
Other	368 (59.55)
Disease-related characteristics	
Entity ^b	
BTSTS cancers	28 (4.53)
Breast cancers	52 (8.41)
CPNS cancers	19 (3.07)
Dermatological cancers	48 (7.77)
Gastrointestinal cancers	35 (5.66)
Head and Neck cancers	25 (4.05)
Hematological cancers	170 (27.51)
Thoracic cancers	75 (12.14)
Urogenital cancers	126 (20.39)
Others	8 (1.29)
Localization ^c	
Local	249 (40.29)
Metastasized	216 (34.95)
Don't know (yet)	99 (16.02)
Stage ^d	
Stage I	56 (9.07)
Stage II	52 (8.41)
Stage III	45 (7.28)
Stage IV	73 (11.81)
Unknown (yet)	296 (47.90)
Cancer treatment ^e	
Cure/curative	397 (64.24)
Palliative	79 (12.78)
Unknown (yet)	99 (16.02)
Cancer treatment (yes) ^f	
Surgery	300 (48.54)
Chemotherapy	356 (57.61)
Radiation treatment	338 (54.69)
Immunotherapy	195 (31.55)
Other	95 (15.37)
Time since diagnosis (in months)	26.68 (39.68)
Subjective prognosis ^g	7.45 (2.26)

Note. M = mean; SD = standard deviation; BTSTS = Bone Tumors and Soft Tissue Sarcomas; CPNS = central and peripheral nervous system cancers; Missing: ^a $n = 9$, 1.46 %; ^b $n = 32$, 5.18 %; ^c $n = 54$, 8.74 %; ^d $n = 96$, 15.53 %; ^e $n = 43$, 6.96 %.

^f Multiple indications possible.

^g Range of subjective prognosis: (1) “not good at all” to (10) “very good”.

perceived control, participants rated their primary control with a mean sum score of 23.32 ($SD = 5.71$, range: 0–30) and secondary control with 21.38 ($SD = 6.61$, range: 0–30). Their regularized partial correlations (adjacency matrices depending on the network model) and the respective heatmaps are reported in Suppl. Table 1 and Suppl. Fig. 1.

3.3. Model 1 - network analysis of the core components of the IPTS

The network that included the core components of the IPTS indicated that both factors (i.e., thwarted belongingness and perceived burdensomeness) were directly associated with SI as well as with each other. The network is displayed in Fig. 3, Model 1. The core components of the IPTS explained 15.85 % of SI's variance, with perceived burdensomeness accounting for 86.01 % of it (95 %-CI: 56.91; 96.83).

3.4. Model 2 - network analysis of the core components of the IMV

The network that included the core components of the IMV indicated that both factors (i.e., defeat and entrapment) were directly associated with SI as well as with each other. The network is displayed in Fig. 3, Model 2. In total, the core components of the IMV explained 11.97 % of SI's variance, with defeat accounting for 54.38 % of it (95 %-CI: 34.14; 73.33).

3.5. Model 3 - network analysis of the core components of both suicide theories (IPTS, IMV)

The network that included the core components of the IPTS and the IMV indicated that perceived burdensomeness was directly associated with SI. Thwarted belongingness, defeat, and entrapment were indirectly associated with SI via perceived burdensomeness. The network is displayed in Fig. 3, Model 3. In total, 18.31 % of the variance in SI was explained by the core components of both theories, with perceived burdensomeness, defeat and entrapment contributing the most, with a relative proportion of 44.63 (95 %-CI: 17.87; 68.57), 27.14 % (95 %-CI: 11.99; 46.67) and 20.89 %, (95 %-CI: 9.35; 38.76), respectively. Thwarted belongingness (RI: 7.34 %, 95 %-CI: 2.11; 21.67) accounted

for significantly less of SI's explained variance than perceived burdensomeness (95 %-CI: -64.28; -5.09). Fig. 4 shows the RI of the theory-derived core components.

3.6. Model 4 - network analysis of the core components of both suicide theories (IPTS, IMV), the Two Process Theory of Perceived Control, as well as sociodemographic and cancer-related variables

The network that included all variables indicated that age was not associated with any other variable (for the full report of the model incl. adjacency matrix and visualization of the network structure, see Suppl. Table 1, and Suppl. Fig. 2). Age was therefore excluded in the following analysis. The resulting network indicated that perceived burdensomeness was the only variable directly linked to SI, and simultaneously directly associated with thwarted belongingness, entrapment and subjective prognosis. Primary and secondary control, as well as subjective prognosis, were negatively associated with several core components of the suicide theories. The network is displayed in Fig. 3, Model 4.

In total, 19.31 % of the variance in SI was explained by the variables of model 4. Again, perceived burdensomeness (RI: 38.85, 95 %-CI: 13.693; 62.61) and defeat (RI: 22.74, 95 %-CI: 9.82; 39.43) explained the most relative variance of SI, followed by entrapment (RI: 17.13, 95 %-CI: 7.75; 31.67) and primary control (RI: 9.29, 95 %-CI: 1.21; 24.41). Perceived burdensomeness explained significantly more variance than thwarted belongingness (RI: 5.87, 95 %-CI: 1.83; 18.27; 95 %-CI difference: 5.05; 58.84), subjective prognosis (RI: 3.87, 95 %-CI: 0.88; 11.47; 95 %-CI difference: 9.43; 59.55), and secondary control (RI: 2.26, 95 %-CI: 0.95; 5.24; 95 %-CI difference: 11.07; 61.00). Defeat accounted for more of SI's variance than secondary control (95 %-CI difference: 7.47; 37.33) and subjective prognosis (95 %-CI difference: 3.54; 36.61) as did entrapment (secondary control, 95 %-CI difference: 5.18; 29.48; subjective prognosis, 95 %-CI difference: 0.73; 28.64). Fig. 4 shows the RI of all variables of interest.

4. Discussion

This study applied network analyses to investigate how core

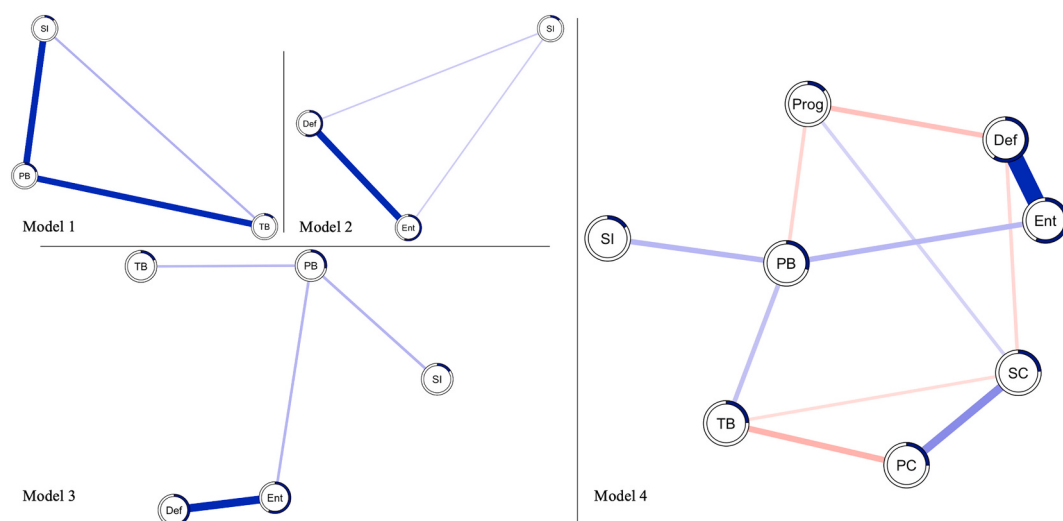


Fig. 3. Models 1, 2, 3, and 4 - Network structure of both suicide theories (*Interpersonal Theory of Suicide*, *Integrated Motivational-Volitional Model of Suicidal Behaviour*) separated (1, 2), combined (3), and including all additional risk and protective factors (4). The figure illustrates the network structure of the *Interpersonal Theory of Suicide*, the *Integrated Motivational-Volitional Model of Suicidal Behaviour*, combining both theories as well as including all theory-derived risk and protective factors. While all variables are linked to each other in the single networks, the network structures of Model 3 and 4 show that suicidal ideation is only directly associated with perceived burdensomeness. All other risk factors are associated with suicidal ideation indirectly via perceived burdensomeness. In Model 4, primary and secondary control were negatively associated with thwarted belongingness, and defeat. Blue lines indicate positive relations; thicker lines indicate stronger associations; the purple part of the ring around the nodes represents the explained variance; Ent = entrapment; Def = defeat, SI = suicidal ideation; PB = perceived burdensomeness; TB = thwarted belongingness; PC = primary control; SC = secondary control, Prog = subjective prognosis (1 = 'not good at all', 10 = 'very good'). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

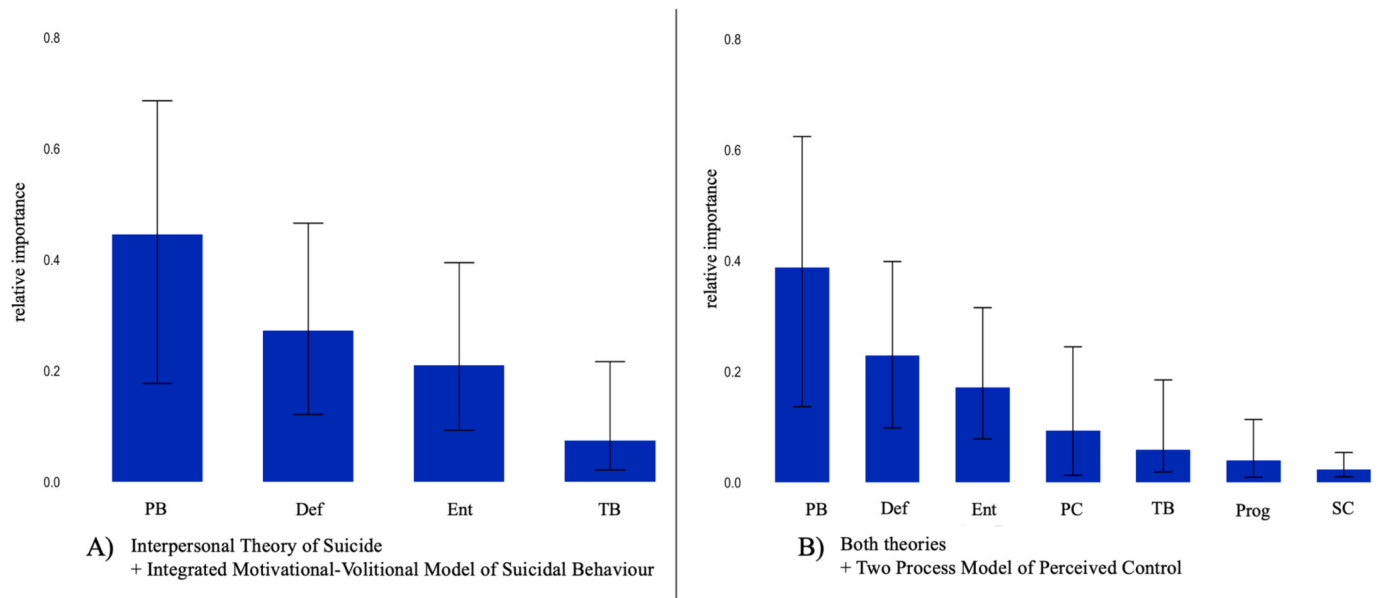


Fig. 4. Relative importance of the core components of the *Interpersonal Theory of Suicide*, the *Integrated Motivational-Volitional Model of Suicidal Behaviour*, and the *Two-Process Model of Perceived Control* for suicidal ideation. The figure illustrates a bar chart for the relative importance for A) the *Interpersonal Theory of Suicide* and the *Integrated Motivational-Volitional Model of Suicidal Behaviour*, and B) both theories + *Two Process Model of Perceived Control* + subjective prognosis. Values are indicated in percentage of the relative contribution of variance in suicidal ideation. PB = perceived burdensomeness; Def = defeat; TB = thwarted belongingness; Ent = entrapment; PC = primary control; SC = secondary control, Prog = subjective prognosis (1 = ‘not good at all’, 10 = ‘very good’).

components of influential, contemporary suicide theories – the *Interpersonal Theory of Suicide* and the *Integrated Motivational-Volitional Model of Suicidal Behaviour* – relate to SI in IWC and how they interact with each other. By also including additional theory-derived protective factors (i.e., primary and secondary control, subjective prognosis), it aimed to gain knowledge about the structure behind suicidal crises in IWC and thus identify key targets for screening and intervention efforts.

The present findings demonstrate that, within IWC, all core components of the *IPTS* and *IMV* – thwarted belongingness, perceived burdensomeness, defeat, entrapment – were (at least indirectly) associated with SI; in both, the sole as well as the overall network(s). Moreover, each theory-derived variable independently contributed to SI's variance above and beyond all other factors. These findings highlight the theories' strengths in explaining SI across different (vulnerable) populations by building on core risk factors that also shape suicidal crises in IWC. This aligns with previous studies demonstrating the generalizability of both, the *IPTS* and the *IMV*'s assumptions across different samples (Brown et al., 2021; Chu et al., 2017; De Beurs et al., 2019; Souza et al., 2024) as well as with the initial conclusions of the few studies that have already examined single relations of these core risk factors with SI in IWC (Bobevski et al., 2022; Schomberg et al., 2025). The findings also fit well with the conclusions of the adapted *IMV* by Ernst et al. (2024b). As described above, this conceptualization understands cancer as a potential triggering life event causing adverse emotional and cognitive states (mediators) such as perceived burdensomeness, thwarted belongingness, defeat and entrapment, which again may result in SI in the context of cancer. While the present findings support this notion, they also extend it by highlighting perceived burdensomeness as a potential key mediator variable for SI in IWC.

Perceived burdensomeness was the only variable directly linked to SI in the present network analyses, and it also accounted for most of the observed variance in SI. All other core risk factors – thwarted belongingness, defeat and entrapment – were associated with SI only indirectly via perceived burdensomeness; highlighting its pivotal role as a key variable to aggravate SI in this population. While the direct and strong link of perceived burdensomeness with SI has also been found in the network analysis of young adults (De Beurs et al., 2019) and psychiatric

inpatients (Brown et al., 2021), its particular role was not as dominant as in the present study. Here, all core risk factors were directly associated with and also relatively equally contributing to SI's variance (3.3–7.6 %). In IWC, perceived burdensomeness therefore appears to be a particularly important risk factor for SI. Although yet insufficiently studied in IWC, perceived burdensomeness's specific role has been identified before in other vulnerable populations, such as individuals who are older, ill or suffering from chronic pain. For example, Cukrowicz et al. (2011) demonstrated perceived burdensomeness's independent effect on SI's variance, even when controlling for depressive symptoms, hopelessness and functional impairment. Moreover, perceived burdensomeness has been identified as the sole predictor for SI in individuals with chronic pain, independently of the severity of the pain (Kanzler et al., 2012; Wilson et al., 2013).

Thwarted belongingness, on the other hand, explained the least of SI's variance. While this aligns with findings of Brown et al. (2021), it contrasts those of De Beurs et al. (2019), where all core risk factors accounted for relatively equal variance in SI. Within IWC, thwarted belongingness may thus still be associated with great psychological distress, but be comparatively less important than perceived burdensomeness. This interpretation was further supported by the observation that primary and secondary control were directly linked with thwarted belongingness, but not with perceived burdensomeness. Thwarted belongingness might be buffered by active as well as cognitive control strategies (including, for example, cognitive reattribution in the sense that one is not “at fault” for the feeling of disconnection as it is brought on by extraordinary circumstances, or by adapting one's current values/goals in the sense that treatment adherence and survival is more important than social interaction, at least for now). By applying these coping strategies, adverse effects of thwarted belongingness might be attenuated in IWC. This fits well with the adapted *IMV* (Ernst et al., 2024b) which suggests coping strategies (that are not directly linked to the illness, but can rather be understood as more stable individual difference/dispositions) to modify the link between the experience of the illness and SI. By contrast, emotional and cognitive states that arise causally due to cancer (e.g., thwarted belongingness) are conceptualized as mediators of the link between the illness and SI. The present findings

mostly align with the core risk factors of the *IMV* (defeat, entrapment) (O'Connor and Kirtley, 2018): A report of employing more secondary control strategies was associated with a less pronounced experience of defeat, which, in turn, was (indirectly) associated with SI. Interestingly, defeat was not directly linked with perceived burdensomeness (and thus SI) - but there was an association via entrapment. This follows the *IMV*'s pathway structure (O'Connor and Kirtley, 2018). Additionally, defeat showed an indirect association with perceived burdensomeness via subjective prognosis. Both indirect pathways suggest that the mere experience of defeat does not necessarily lead to SI. Rather, it is the cognitive appraisal that one's situation is unlikely to improve over time that may increase the likelihood of perceiving oneself as a burden to others; which in turn can foster SI. This mirrors the central suicidogenic role of hopelessness as described within the *IPTS*.

The protective effect of secondary control strategies may thus be particularly important in those with actual advanced-stage cancer as well as in those who have a poor *perception* of their prognosis (e.g., possibly due to depression-related cognitive biases) (Yun et al., 2024). These findings are in line with the theoretical ideas of Balen and Merluzzi (2021), who investigated the maintenance of hope in the face of uncertainty due to serious illness. According to the authors, secondary control strategies may support coping with uncertain or adverse future outlooks in the light of serious illness (e.g., poor prognosis) and hence protect against psychological distress and even SI – suggesting secondary control strategies as a potential essential target for psycho-social interventions.

When analyzing the present study's findings, one must critically note that the core risk factors of the *IPTS* and *IMV* accounted for (only) 18.31 % of SI's variance (compared to 26 % in the network analysis by De Beurs et al. (2019) among young adults). This could suggest that the most pertinent influencing factors of SI in this vulnerable population may not be as well represented in contemporary suicide theories as they are for young adults drawn from the general population. Following Ernst et al. (2024b) adaptation of the *IMV*, the inclusion of additional, theory-driven risk and protective factors that are not directly related to the illness, but rather reflect stable individual differences, may help to understand how IWC cope with their disease; but also how they cope with heightened core risk factors (e.g., perceived burdensomeness, defeat) which potentially arise through the experience of the illness itself. Building on Ernst et al. (2024b) distinction, the inclusion of the Two

Process Theory of Perceived Control's facets (primary and secondary control) expanded the suggested positive impact of these protective strategies (e.g., primary and secondary control) on SI (Hirschmiller et al., 2024; Hirschmiller et al., 2025c) by visualizing the complex interplay of illness-related risk and more stable personality protective factors. The present findings and the theoretical conclusions are visualized in Fig. 5.

Interestingly, age did not show a direct link to any of the studied variables; potentially indicating that the challenging experiences due to cancer are rather influenced by contextual and individual coping mechanisms that may be valid over the whole life span. While the present sample's mean age was relatively high (reflecting the increasing risk of cancer with age), the age range was also very broad and thus covered all possible ages of illness in adulthood. Thus, there was a great heterogeneity within the present sample with regard to participants' life stages and circumstances, which might also have contributed to a comparatively higher proportion of variance that could not be explained by the main psychological constructs of interest.

5. Limitations & future directions

When interpreting these findings, the following limitations must be considered: First, despite a large and rather heterogeneous sample, only a small proportion of participants reported SI. While this prevalence is in line with previous findings (Kolva et al., 2020), this means that even in large samples, the number of individuals reporting SI remains relatively low. However, as a consequence of such low base rates, risk/protective factors with comparatively weak associations might go undetected. Future studies should aim to replicate the present findings building on larger samples. Adding to this, suicidal ideation was assessed using item 9 of the PHQ-9. Although previous research has demonstrated good sensitivity and specificity of this item for detecting suicide risk (O'Connor et al., 2023; Simon et al., 2013), it remains a single indicator capturing a broad spectrum from passive death wishes to suicidal thoughts. Importantly, passive death wishes themselves are associated with a substantial psychological burden and are particularly relevant in the oncological context. Still, the use of a single item limits the granularity of the construct and does not allow differentiation between distinct suicide-related outcomes (e.g., passive death wishes, suicidal thoughts, suicide intent). Future research should therefore replicate

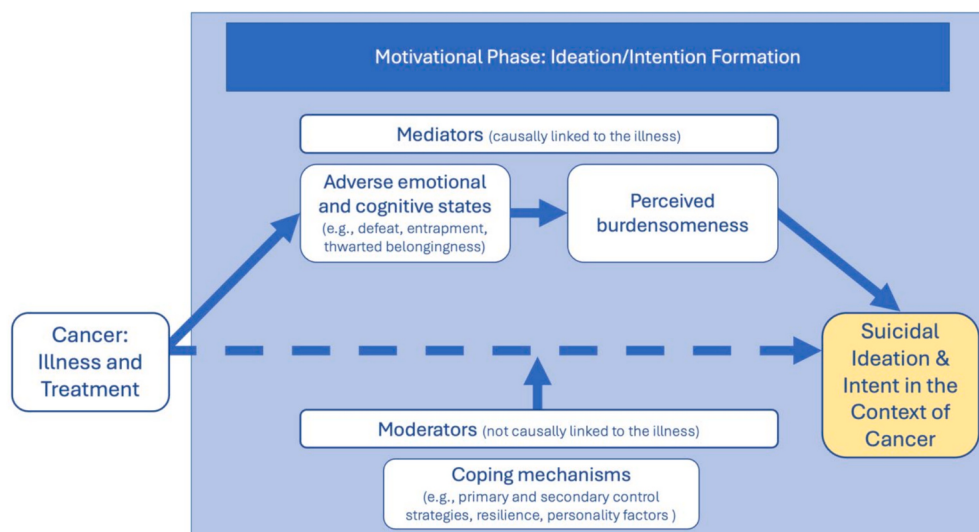


Fig. 5. Adapted motivational phase of the *Integrated Motivational-Volitional Model of Suicidal Behaviour*, emphasizing the role of perceived burdensomeness in suicidal ideation among individuals with cancer. The figure integrates the present findings of the network analyses of the *Interpersonal Theory of Suicide*, the *Integrated Motivational-Volitional Model of Suicidal Behaviour* and the *Two-Process Model of Perceived Control*. The central role of perceived burdensomeness is emphasized in the pathway structure.

these findings using a more fine-grained suicide-specific assessment to examine whether the network structure varies across different forms of suicidal ideation. Second, the variable *entrapment* had a substantial proportion of missing values, which occurred completely at random due to technical issues in data collection. To address this, we applied multiple imputation using predictive-mean-matching. This method has been shown to yield to robust and stable estimates even under a large proportion of missing data (Madley-Dowd et al., 2019). Additionally, we compared the imputed and the non-imputed data to preclude statistical deviations. This technique enabled the inclusion of entrapment as an important risk factor in the present analysis, but nonetheless, imputation methods remain associated with a certain level of uncertainty. Third, the analysis was based on cross-sectional data, estimating undirected networks. Consequently, no conclusions about causal associations can be drawn. While contemporary theories suggest a directionality of the variables, they also emphasize the cyclical nature of SI (De Beurs et al., 2021; O'Connor and Kirtley, 2018). Future studies should harness longitudinal designs to ascertain the direction of effects; particularly as the *IMV* suggests a sequential development. Fourth, although our heterogeneous sample allows for a theory-driven exploration of suicidal ideation across a broad range of oncological experiences, this approach also entails methodological constraints. The diversity of diagnoses and illness trajectories means that no cancer-type-specific or individually nuanced conclusions can be drawn. Due to limited statistical power, we were unable to conduct sub-analyses for specific diagnostic groups. Building on this foundational work, future studies should recruit more targeted and diagnostically homogeneous samples to replicate and extend these findings, and to evaluate whether the identified patterns generalize to more narrowly defined patient groups.

Generally, future studies may want to build on present findings by applying theory-driven analyses to investigate SI in IWC. Following the present findings, investigations on a potential gender effect on the link between core risk factors (particularly perceived burdensomeness and thwarted belongingness) and SI could be helpful; particularly as previous studies have found gender differences in coping pathways in IWC (Hirschmiller et al., 2025a) but also in psychological risk factors that predict SI (Donker et al., 2014) (possibly due to gender-related stereotypes and internalizations). Additionally, future research should further explore the weaker link of thwarted belongingness with SI (compared to the general population) and whether IWC perceived this disconnection as less burdened due to external attribution.

6. Conclusion

This study contributes to a deeper understanding of the structure behind SI in IWC. The findings underscore the relevance and applicability of contemporary suicide theories (e.g., the *Interpersonal Theory of Suicide* and *Integrated Motivational-Volitional Model of Suicidal Behaviour*) in explaining SI – even in vulnerable populations such as IWC. Notably, perceived burdensomeness emerged as a central risk factor and may function as a cognitive-emotional “gatekeeper” for SI in the light of adverse emotional and cognitive experiences. These results highlight the need to incorporate perceived burdensomeness into routine psychosocial screenings and to target it in psycho-social interventions for IWC.

Moreover, the findings support the distinction between illness-related risk factors (e.g., perceived burdensomeness, defeat) and more stable, illness-independent coping strategies, such as suggested by Ernst et al. (2024b). Specifically, primary and secondary control strategies – as described in the *Two Process Model of Perceived Control* – may influence the broader network of SI and its associated emotional and cognitive risk factors by buffering against their adverse impact. Particularly secondary control strategies – such as adapting personal values and goals to external circumstances – may serve as a promising intervention target. Strengthening such strategies could be especially beneficial for those perceiving their prognosis as poor; mitigating feelings of defeat and reducing the perception of being a burden to others.

CRedit authorship contribution statement

Judith Hirschmiller: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Tamara Schwinn:** Writing – review & editing, Project administration, Conceptualization. **Derek de Beurs:** Writing – review & editing, Methodology, Formal analysis. **Jörg Wil-tink:** Writing – review & editing, Funding acquisition. **Rüdiger Zwer-enz:** Writing – review & editing, Funding acquisition. **Elmar Brähler:** Writing – review & editing, Funding acquisition. **Manfred E. Beutel:** Writing – review & editing, Resources, Funding acquisition. **Mareike Ernst:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Funding acquisition, Conceptualization.

Statement of ethics

Informed consent was obtained from all individual participants included in the study. The study procedure and materials for the cancer sample were approved by the Ethical Committee of the Statutory Physician Board of the State Rhineland Palatinate (Reference number 2023–16975).

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Declaration of competing interest

The authors have no competing interests to report. The work is part of the first author's dissertation.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jad.2025.120908>.

Data availability

The authors confirm that, for approved reasons, some access restrictions apply to the data underlying the findings. Due to ethical restrictions, the data cannot be made publicly available, but the pertinent data are available upon reasonable request. The request should be directed to the corresponding author. The R code for the underlying data is provided alongside supplement material.

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