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Review

To what extent are psychological variables considered in the study of risk and protective factors for suicidal thoughts and behaviours in individuals with cancer? A systematic review of 70 years of research

Mareike Ernst [a,b,c,*], Tamara Schwinn [c], Judith Hirschmiller [c], Seonaid Cleare [b], Kathryn A. Robb [d], Elmar Brähler [c,e], Rüdiger Zwerenz [c], Jörg Wiltink [c], Rory C. O'Connor [b,1], Manfred E. Beutel [c,1]

[a] Department of Clinical Psychology, Psychotherapy and Psychoanalysis, Institute of Psychology, University of Klagenfurt, Klagenfurt am Wörthersee, Austria
[b] Suicidal Behaviour Research Laboratory, School of Health and Wellbeing, University of Glasgow, Glasgow, United Kingdom
[c] Department of Psychosomatic Medicine and Psychotherapy, University Medical Center of the Johannes Gutenberg-University Mainz, Mainz, Germany
[d] Cancer Behaviour Research Group, School of Health and Wellbeing, University of Glasgow, Glasgow, United Kingdom
[e] Department of Medical Psychology and Medical Sociology, University Hospital Leipzig, Leipzig, Germany

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ABSTRACT

Psychological variables substantially shape the risk of suicidal thoughts and behaviours (STBs). However, it is unclear to what extent they are considered in individuals with cancer. We synthesized the quantitative research landscape concerning psychological risk/protective factors of STBs in the (psycho-) oncological context.

This pre-registered review (PROSPERO-ID CRD42022331484) systematically searched the databases PubMed/Medline, CINAHL, PsycInfo, Cochrane Library, and Web of Science (as well as the grey literature and preprints). Risk of bias (RoB) was estimated using the ROBINS-I tool.

Of 11,159 retrieved records, 319 studies were eligible for inclusion. Of those, 163 (51.1%) had investigated psychological factors (affective: $n = 155$; social: $n = 65$; cognitive: $n = 63$; personality/individual differences: $n = 37$; life events: $n = 6$), in a combined 3,561,741 participants. The most common STBs were suicidal ideation ($n = 107$) or death wishes ($n = 20$) rather than behaviour (suicide deaths: $n = 26$; attempts: $n = 14$). Most studies had a serious RoB. Thus, a large body of research investigated STBs in cancer patients/survivors, but it rarely aligned with the theoretical or clinical developments in suicide research. We propose a conceptual model of STBs in cancer delineating moderation and mediation effects to advance the integration of the fields, and to inform future research and practice.

1. Introduction

A cancer diagnosis can trigger a psychological crisis and great despair. Empirical studies have found significantly elevated rates of suicidal thoughts and behaviours (STBs) in individuals with cancer, most recently a twice as high standardized mortality ratio (Favril, Yu, Geddes, & Fazel, 2023). Besides deaths by suicide (Amiri & Behnezhad, 2019; Heinrich et al., 2022), similar findings applied to suicide attempts (McFarland, Walsh, Napolitano, Morita, & Jaiswal, 2019) and suicidal ideation (Kolva, Hoffecker, & Cox-Martin, 2020). However, it is unclear which individuals affected by cancer are most vulnerable: For instance, suicide risk was especially high in men compared to women (Amiri & Behnezhad, 2019; Parpa, Tsilika, Gennimata, & Mystakidou, 2015) and shortly after (six to twelve months) rather than a longer time after diagnosis (Du et al., 2020; Ravaioli et al., 2020). However, gender differences were not found in studies assessing suicidal ideation (Du, Shi, Yu, et al., 2020; Kolva et al., 2020), and elevated rates of suicidal ideation were also reported in long-term survivors (e.g., survivors of childhood cancer >25 years after diagnosis) (Burghardt et al., 2019).

Highlighting the importance of distinguishing between suicidal

* Corresponding author at: Department of Clinical Psychology, Psychotherapy and Psychoanalysis, Institute of Psychology, University of Klagenfurt, Universitätsstr. 65-67, 9020 Klagenfurt am Wörthersee, Austria.
E-mail address: mareike.ernst@aau.at (M. Ernst).
[1] Joint last authors

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ideation and behaviour, these findings also underscore the impact of other risk or protective factors. The empirical investigation of risk and protective factors is a bedrock of suicide prevention efforts (World Health Organization, 2014). As noted by Kraemer et al. (1997), the term risk factor is used broadly to encompass characteristics of a person or population associated with an unwelcome outcome, whereas protective factors implicate prevention and/or recovery. As such, the latter particularly come to bear in the context of resilience, i.e., the capacity for successful adaptation to adverse circumstances (Masten & Reed, 2002). These factors can be of different types (see also Glenn, Franklin, Kearns, Lanzillo, & Nock, 2016), some are mere correlates, whereas others are fixed markers (that cannot be changed) or variable risk factors (that can potentially be altered, including *causal* risk factors).

Within the context of cancer, studies have often focused on socio-demographic characteristics such as age and gender, and treatment and disease-related characteristics such as type of diagnosis and stage. Furthermore, suicidal ideation has been conceptualized as a direct side effect of particular treatment types, for example, with corticosteroids; while specific tumors, for example, adrenal and testicular cancer, have been linked to risk factors of suicidal ideation and behaviours such as irritability and agitation (for an overview, see Pitman, Suleman, Hyde, & Hodgkiss (2018)). By comparison, knowledge about psychological factors is scarce, and the extant evidence has not yet been summarized by comprehensive reviews/meta-analyses of STBs in cancer patients and survivors (Calati et al., 2021). For instance, a large, recent meta-analysis of suicide mortality risk in individuals with cancer that pooled data from >46 million patients statistically tested eight risk factors, but none of them were psychological in nature (Heinrich et al., 2022). Therefore, the present findings from cancer populations are hard to integrate with the large body of research that has previously highlighted the importance of *psychological* risk factors for suicide (O'Connor & Nock, 2014; Turecki et al., 2019).

This constitutes a research gap as a suicidal crisis is still a psychological event – even when considered against the background of serious and/or chronic physical illness (Rogers, Joiner, & Shahar, 2021). Although the role intense mental distress plays in shaping the suicide risk of individuals affected by cancer has recently received more attention (Bergerot & Pal, 2022), previous research has also shown that depression does not completely account for the elevated suicide risk in those with chronic illness (Ahmedani et al., 2017). It has been argued that psychological factors constitute a link (in the sense of mediating or moderating variables) (Van Orden et al., 2010) between chronic illness and STBs, i.e., that these variables determine how well a person can adapt to or cope with the disruption of life brought on by the illness and/or ongoing pain/discomfort, and losses and challenges associated with it, which ultimately shapes their risk of suicide. From a clinical perspective, these are particularly interesting because they not only inform the risk-based stratification of screening efforts but also highlight potentially modifiable factors that can be targeted by psychotherapeutic interventions (e.g., coping styles).

The present *systematic review* builds on the taxonomy used by O'Connor and Nock (2014) to synthesize the psychological factors derived from influential theories of suicide and on a recent conceptual outline of the affective, cognitive, and interpersonal-behavioural variables particularly pertinent to the relationship between chronic illness and STBs (Rogers et al., 2021). Integrating them, our classification system harnesses five categories to reflect the breadth of the field: personality and individual differences (e.g., impulsivity), cognitive (e.g., problem-solving and coping), social (e.g., exposure to suicide), and affective factors (e.g., pain), and negative life events (e.g., childhood adversities). As such, they address all elements of Lewin's foundational eq. $B = f(P, E)$ (Lewin, 1936) in which behaviour B varies as a function of both the person P and their environment E (over the life course). In a more differentiated sense, the most influential models of suicidal behaviour comprise (while assigning different weights) internal and external stressors, capacities to cope, the subjective experience, and individual differences (including those acquired in the course of development) while acknowledging their dynamics and interactions. Theories within the ideation-to-action framework advance the notion that suicidal desire is not sufficient for suicidal behaviour to occur; but that there are other, specific risk factors for the transition from thoughts to behavioural actions (Klonsky, Saffer, & Bryan, 2018). As the first theory of this kind, Joiner's Interpersonal Theory of Suicide (IPTS) posited that suicidal desire arises from the simultaneous occurrence of perceived burdensomeness (to others) and thwarted belongingness (i.e., feelings of being left out/unconnected to others), and hopelessness with regard to whether these states will change. The risk of serious suicidal behaviour then increases significantly if the person *also* has acquired the capability for suicide (defined as the desensitization to pain and fearlessness of death) (Van Orden et al., 2010). More recently, the Integrated Motivational-Volitional (IMV) Model of Suicidal Behaviour provided a detailed framework in which suicidal ideation emerges against the background of a diathesis-stress model (the pre-motivational phase). Suicidal ideation and intent are primarily driven by unbearable feelings of defeat and entrapment (in the motivational phase), and further exacerbated by threat-to-self (TSM) and motivational moderators (MM), before volitional moderators (VM), including acquired capability, govern the transition to suicidal behaviour (in the volitional phase) (O'Connor & Kirtley, 2018).

While chronic illness can be understood as a triggering event or a sum of them, respectively, from which the processes assumed by the respective conceptualizations unfold, they are no specific models of *STBs within chronic illness*. Therefore, they cannot highlight illness-related or -unrelated variables of particular importance for prevention within this vulnerable group. At the same time, it is unclear the extent to which suicide prevention considerations in oncological settings have even engaged with psychological factors more broadly, and theory-derived factors more specifically. Therefore, our research question was: To what extent are psychological variables considered in original research of risk and protective factors of STBs in individuals with cancer? We address this question in both a quantitative (by counting what percentage of relevant studies included psychological variables of interest and which of the five categories are most commonly tested) and a narrative way (by summarizing the findings and integrating them with the state-of-the-science psychological theories of suicide). Going from there, we propose a conceptual model from which we derive recommendations for directions in future research and clinical practice.

2. Methods

2.1. Search strategy and selection criteria

Throughout this work, we followed the current PRISMA guidelines (Page et al., 2021). Study materials are available via the Open Science Framework (OSF): OSF folder containing all study materials In preparation for the search the PICO/PECOS (Guyatt et al., 2011; Morgan, Whaley, Thayer, & Schunemann, 2018) schema was defined as follows:

Participants/population: We considered reports on people of all ages with all types of cancer diagnoses and all stages, including acute illness and (long-term) survivors. We did not consider studies of STBs in family members, caregivers, or healthcare professionals.

Intervention/Exposure: As we did not focus on interventional studies, we conceived of the studied risk and protective factors as any of the potential modifiers of outcomes that were statistically tested. For the systematic search, we placed no restrictions on the types of factors assessed by the studies (however, after data extraction, we categorized them into psychological and other factors as described below).

Control: We did not place any restrictions on the original research regarding control groups. For data extraction, we considered comparisons to individuals without cancer or comparisons *within* cancer populations (e.g., of men and women, or individuals with different malignancies).

Outcome: As the main outcome, we considered all types of STBs (e.g., suicidal ideation, suicide attempts, and suicide deaths) in individuals affected by cancer. However, we specified that studies investigating *physician-assisted* suicide (other terms used in original studies: death preferences, "euthanasia") were not eligible as we considered assisted dying to be distinct from suicide/suicide prevention in the context of a psychological crisis, also because studies stated that in some cases, the affected individuals were not competent to make this decision themselves.

Setting/time: We placed no restrictions on the context, but we extracted this information: Both regarding both a) the setting (e.g., whether the study was carried out in a hospital, whether it was a population survey) and b) the broader context (e.g., in which country it was conducted).

Study type/further in- and exclusion criteria: We considered observational as well as intervention studies (as long as they considered other modifiers of STBs or changes in STBs than the interventions themselves) and studies using different methods of participant recruitment/data collection (e.g., registry-based, community studies, hospital settings) and assessing the outcome of interest (e.g., individuals' self-reports or data drawn from death registries). We also included studies that reported on other physical health conditions as well, as long as they reported specifically about (the risk of) STBs in a population affected by cancer. As our research question concerned the variables investigated in association with STBs by means of statistical tests, we included only quantitative original research. We did not include qualitative research, case reports or summary/review papers (but we used them for citation searching), or comments/opinion pieces that did not report original data. Studies had to be published in English, French, or German, and the full text had to be available.

The following electronic databases were searched: PubMed/Medline, CINAHL, PsycINFO, the Cochrane Library/Cochrane Central Register of Controlled Trials, and Web of Science. The search strategy was developed by expanding and specifying the search term provided in the PROSPERO registration of a previous, comprehensive review performed by Calati et al. (2018). It is included in the PROSPERO registration (CRD42022331484) submitted on May 09, 2022, before we conducted the main search and provided via the OSF as well. The systematic search (cut-off date: November 03, 2023) was supplemented by other sources including preprint servers, government and health authority websites, citation searching, and hand-searching Google Scholar (in particular to find relevant grey literature).

2.2. Study selection

Articles that did not meet the inclusion criteria after screening the abstract and title were excluded. Full-text records of the eligible type (original, quantitative research) and languages were exported from the systematic database search and supplemented by searches from other sources. All records were included in an EndNote library. Following the procedure described by Bramer et al. (2016), duplicates were removed. The remaining full texts were assessed by two members of the research group who independently screened all records against exclusion/inclusion criteria and documented their decisions using the same excel sheet (while blinded to each other's decisions). They noted whether studies investigated STBs as a main outcome and statistically tested at least one factor (i.e., within a sample of individuals with cancer or as a modifier of the risk of STBs with cancer as part of an investigation including both individuals with and without cancer). The sheets were then merged, and disagreements were resolved through discussion including another senior member of the research group.

2.3. Data collection

Data from eligible full texts were first extracted independently by several members of the research group and then reviewed for its accuracy and comprehensiveness by other members. Data was extracted in two steps. First, the following data were extracted: (1) authors; (2) title; (3) year of publication; (4) DOI; (5) variables tested as risk or protective factors of STBs. Data extracted under (5) was coded with respect to whether they included psychological factors. If so, the psychological factors were summarized in a separate column. As a basis for classification, we primarily drew on the relevant previous synthesis articles (O'Connor & Nock, 2014; Rogers et al., 2021). By contrast, for instance, sociodemographic information and "objective" health data such as the presence of metastases or time since cancer diagnosis were not considered psychological variables. Uncertainties related to this categorization were resolved through discussion, with a senior group member guiding the decisions. If a study *did not* test any psychological factors, we checked whether it reported any (6) psychological variables (e.g., as part of the sample characteristics) that could potentially have been tested.

If a study tested at least one psychological factor, we extracted further information: (7) country/region; (8) study design (longitudinal or cross-sectional); (9) study type (e.g., survey, registry-based study); (10) setting; (11) descriptor of the cancer sample (e.g., patients or survivors); (12) sample size (of the cancer sample); (13) age of the cancer sample (as range, mean, and standard deviation); (14) gender/sex proportions of the cancer sample; (15) main types of cancer included; (16) disease stage; (17) STBs studied (e.g., suicidal ideation, attempt, death by suicide); (18) if applicable, the instrument used to assess the outcome (e.g., PHQ-9, Beck Scale for Suicide Ideation); (19) if applicable, the prevalence of STBs within the cancer sample. For psychological factors, we also extracted (20) what kind of analysis was conducted (e.g., group comparisons, correlations, tests of predictors within regression models, etc.); (21) the association of the respective factor(s) with STBs (positive/negative/not statistically significant). (Note: we use the term "cancer sample" to refer to those study participants who had cancer; as many studies compared individuals with and without cancer.)

2.4. Methods for assessing risk to internal validity/risk of bias

Two members of the team independently rated the studies' Risk of Bias (RoB). In case of disagreements, a senior team member additionally rated the respective paper/domain. Following the Cochrane recommendations, bias was rated outcome- and not study-specific. According to Cochrane Recommendations, we used the ROBINS-I tool (Higgins et al., 2022). For each of the following domains, the RoB was rated as "low", "moderate", "serious", or "no information": Bias due to confounding, bias in the selection of participants into the study, bias in the classification of exposure (the ROBINS-I tool originally concerns intervention studies, however, the present study focuses on exposure in terms of being affected by cancer), bias due to missing data, bias in the measurement of the outcome, and bias in the selection of the reported result. A study's overall RoB corresponded to its most critically assessed individual category (i.e., if one domain was rated as "serious", the overall RoB was coded as "serious" as well).

2.5. Methods of synthesis

Data are summarized narratively and quantitatively: In the following, we first report how many studies tested any psychological factors, both in terms of their overall number and their proportion of the total number of studies. Secondly, we created a taxonomy by taking the categories 1) personality and individual differences, 2) cognitive factors, 3) social factors, 4) negative life events from O'Connor & Nock, 2014 and adding the category 5) affective factors from Rogers et al. (2021) to summarize the types of psychological factors addressed by the different studies. This allowed for an overview as to which categories and single factors were best and worst represented in the research landscape. Before coding, we critically reviewed the conceptualization of the respective variables as included in the two guiding synthesis papers as

well as other seminal work (including operationalisations such as questionnaire measures) defining the constructs of interest, if necessary. While many factors can arguably fit in more than one category, we aimed for a restrictive coding scheme in which, where possible, a single factor was assigned to the most pertinent category to allow for meaningful differentiation. However, we also defined cases in which factors could receive more than one classification if their reduction to only one would constitute an undue misrepresentation of the construct. For instance, entrapment was defined as having both a cognitive (O'Connor and Nock (2014) list it as such) and an affective component (a category not included in O'Connor and Nock (2014)): while the perceived inability to escape from unbearable circumstances and/or inner turmoil can be understood as a cognitive evaluation, it is a distressing subjective experience at the same time; commonly measured using items such as "I feel trapped inside myself" and referred to as "feelings of entrapment" by leading experts (De Beurs et al., 2019). The same was true for fear of cancer recurrence, with e.g., Simard, Savard, and Ivers (2010) defining it as multidimensional because the emotional reaction is contingent on interpretations of/cognitions relating to both internal and external stimuli. As before, in cases of uncertainty, decisions were resolved through discussion.

3. Results

The process of study search and selection is visualized as a flowchart in Fig. 1. The initial search resulted in 11,159 records through database and register searching (PubMed/MEDLINE: n = 2689; CINAHL: n = 1287; PsycInfo: n = 2308, Web of Science Core Collection: n = 4608, Cochrane Library = 267). We removed duplicate records following the steps outlined by Bramer et al. (2016). Steps 1 and 2 were conducted automatically using Endnote version 20.4. For the next steps, one author manually checked for duplicate records. After the removal of duplicate records (n = 3382), and records not matching inclusion criteria or fulfilling exclusion criteria, respectively, in the title and abstract screening (n = 6974), the full texts of 803 remaining records were assessed for eligibility.

We coded the following exclusion criteria: 1) The publication did not include/report about individuals with cancer; 2) The publication did not include STBs/report about STBs specifically; 3) The publication's format was not eligible (e.g., it did not report original data; 4) The publication did not test at least one risk/protective factor (as a modifier of the association of cancer with STBs, or within a cancer sample). Multiple criteria could apply to the same record. The results of the full-text screening (listing all assessed records and, if applicable, reasons for exclusion) are provided as part of the study materials (OSF, "report_fulltext_screening.csv"). In summary, 486 records were excluded at this stage. Seventeen fulfilled the first exclusion criterion; 215 fulfilled the second exclusion criterion; 72 fulfilled the third exclusion criterion; and 308 fulfilled the fourth exclusion criterion. As a result of the grey literature search, an additional 172 records were screened. Of those, 12 full-texts were assessed for eligibility which led to the inclusion of 2 more studies. Thus, 319 papers were eligible for inclusion in the systematic review.

All 319 studies and the extracted risk/protective factors as well as their coding into psychological and other factors is provided via the OSF ("data_extraction_coded.csv"). Of the 319 studies, 163 (51.1%) had empirically tested psychological factors. Another 20 (6.3%) studies had included psychological factors, but not tested them in association with STBs. In the following sections, we describe the characteristics and contents of the 163 studies that empirically tested psychological factors. Table 1 presents a summary. (The full-size table with all extracted information is provided via the OSF: "data_extraction_full.csv"). Taken together, they included >3,561,741 participants from six continents. Most were based on samples from Asia (n = 60), followed by North America (n = 53), Europe (n = 43), Australia and Oceania (n = 10), Africa (n = 4), and South America (n = 2) (some studies included

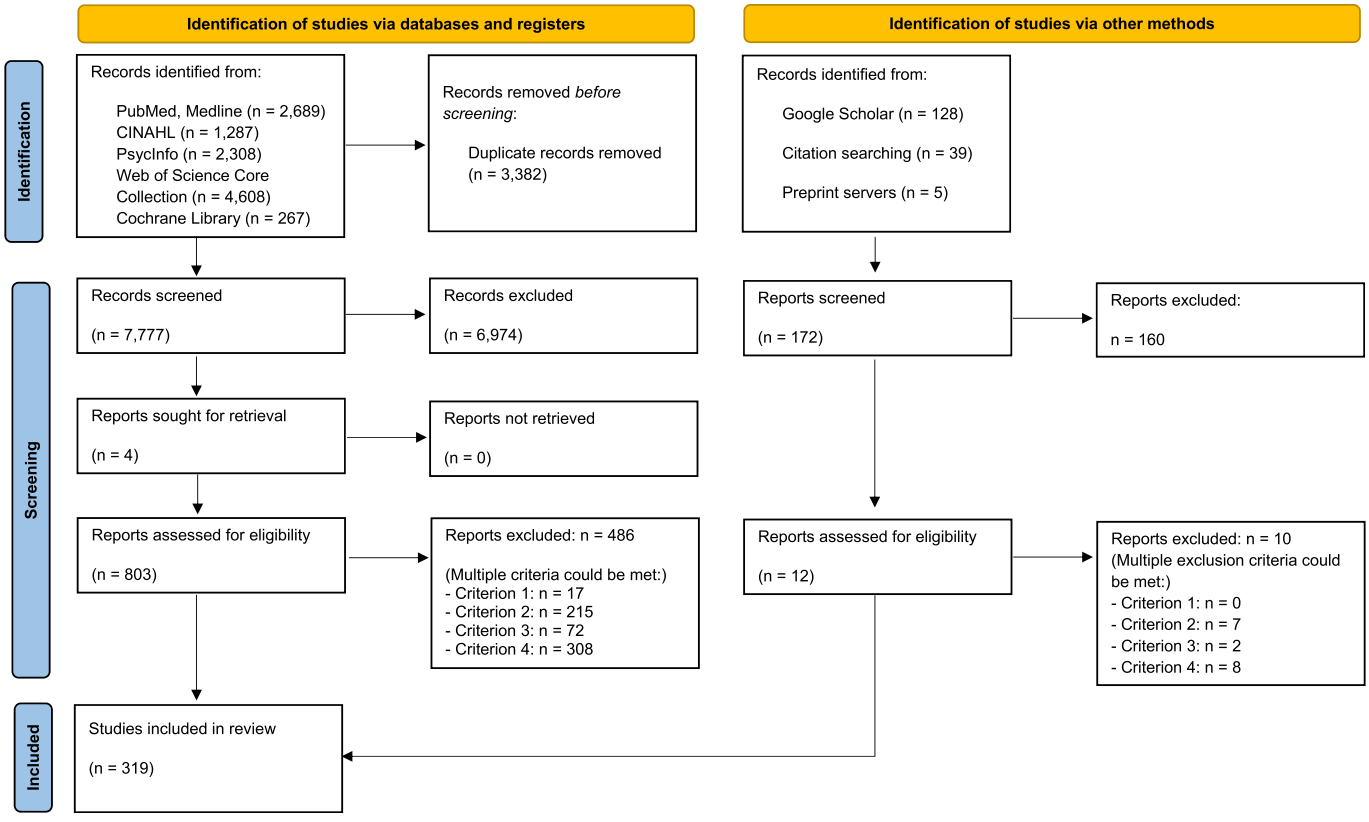

Fig. 1. PRISMA flowchart.

Table 1
Overview of the 163 studies that tested psychological risk/protective factors associated with suicidal thoughts and behaviours.

Authors, Year	Country / region	Sample size (*N*)	Main disease entities / sites	Suicidal thought / behaviour	Personality and individual differences	Cognitive factors	Social factors	Negative life events	Affective factors
Abdel-Rahman (2020)	USA	3034	Not reported	Suicidal ideation					x
Abdel-Rahman et al. (2020)	Canada	867	Not reported	Suicidal ideation			x		x
Aboumrad et al. (2021)	USA	214,649	Prostate	Suicide deaths					x
Akechi et al. (2000)	Japan	114	Lung, breast, head and neck	Suicidal ideation					x
Akechi et al. (2001)	Japan	220	Lung, breast, head and neck	Suicidal ideation					x
Akechi et al. (2004)	Japan	140	Lung, colon, other	Suicidal ideation	x	x	x		x
Akechi et al. (2010)	Japan	5431	Lung, head and neck, esophagus, breast, stomach	Suicidality					x
Akechi et al. (2020)	Japan	79	Multiple myeloma	Suicidal ideation					x
Akechi et al. (2002)	Japan	1713	Lung, head and neck, colon	Suicidality					x
Akechi, Okamura, et al. (2002)	Japan	89	Lung	Suicidal ideation			x		x
Andersen et al. (2020)	USA	186	Lung	Suicidal ideation					x
Bagur et al. (2015)	France	130	Lung, colon, gastric, pancreas, other	Suicidality					x
Balci Sengul et al. (2014)	Turkey	102	Breast, lung, head and neck, gynecological, stomach, colorectal, other	Suicidal ideation; suicide attempts			x		x
Bobevski et al. (2022)	Germany	1463	Breast, prostate, lung	Suicidal ideation	x	x			x
Breitbart et al. (2000)	USA	92	Not reported	Death wishes	x	x	x		x
Brinkman et al. (2013)	USA	319	Brain	Suicidal ideation		x			x
Brinkman et al. (2014)	USA	9128	Leukemia, CNS, Hodgkin's disease, Non-Hodgkin lymphoma, nephroblastoma, neuroblastoma, soft tissue sarcoma, osteosarcoma	Suicidal ideation					x
Chae et al. (2019)	South Korea	320	Breast	Suicidal ideation			x		x
Chang et al. (2019)	Taiwan	286	Head and neck	Suicidal ideation					x
Chang, Huang, et al. (2022)	Taiwan	155	Mouth, lips, other	Suicidal ideation	x	x			x
Chang, Huang et al. (2022)	Taiwan	121	Breast	Suicidal ideation		x			x
Chang and Lai (2022)	UK	459,542	All sites	Suicide deaths; Self-harm		x			x
Chen et al. (2023)	China	213	Ovarian	Suicidal ideation					x
Cheng et al. (2014)	China	41	Not reported	Suicidality		x			x
Cheung et al. (2017)	New Zealand	23	Colorectal, lung, bladder, prostate, pancreas, liver, skin, other	Suicide deaths			x		x
Chiang et al. (2022)	Taiwan	260	Gastric, esophagus, breast, lymphoma, lung, gynecologic, colon, pancreatic, head and neck, leukemia, hepatoma, bladder, other	Suicidal ideation					x
Chochinov et al. (1998)	Canada	196	Lung, gastrointestinal, genitourinary, breast	Suicidal ideation	x	x			x
Choi et al. (2014)	South Korea	378	Stomach	Suicidal ideation			x		x
Choi et al. (2020)	South Korea	36,220	Bladder, breast, CNS, colorectal, cervical, Hodgkin's and non-Hodgkin lymphoma, head and neck, kidney, urinary, liver, leukemia, lung, mesothelioma, melanoma, multiple myeloma, esophagal, ovary, pancreas, prostate, sarcoma, stomach, testicular, uterine, other	Suicide deaths					x

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Table 1 (*continued*)

Authors, Year	Country / region	Sample size (*N*)	Main disease entities / sites	Suicidal thought / behaviour	Personality and individual differences	Cognitive factors	Social factors	Negative life events	Affective factors
Choi and Park (2020)	South Korea	64,570	Not reported	Suicide deaths					x
Choi and Park (2021)	South Korea	39,027	Not reported	Suicide deaths					x
Choudhury and Shahsavar (2023)	USA	202	Gastrointestinal	Suicidal ideation			x		x
Ciaramella and Poli (2001)	Italy	100	Gastrointestinal, genito-urinary	Suicidal ideation					x
Costantini et al. (2014)	Italy	136	Gastrointestinal, breast, lung, other	Suicidal ideation	x	x			x
Diaz-Frutos et al. (2016)	Spain	202	Lung, colon-rectum, male and female genito-urinary	Suicidal ideation					x
Diaz-Frutos et al. (2016)	Spain	202	Lung, colon-rectum, male and female genito-urinary	Suicidal ideation	x	x	x	x	x
Du et al. (2022)	China	390	Not reported	Suicidal ideation	x	x	x		x
Dwyer et al. (2019)	Australia	118	Not reported	Suicide deaths		x	x		x
Ernst et al. (2020)	Germany	916	Leukemia, CNS, lymphoma, sarcoma, other	Suicidal ideation		x	x		x
Ernst et al. (2021)	Germany	633	Leukemia, CNS, lymphoma, sarcoma, other	Suicidal ideation		x	x		x
Ernst et al. (2021)	Germany	144	Not reported	Suicidal ideation		x	x		x
Fadoir et al. (2021)	USA	133	Not reported	Suicidal ideation	x	x	x	x	x
Fall et al. (2009)	Sweden	168,584	Prostate	Suicide deaths					x
Fang et al. (2012)	Sweden	534,154	Prostate, breast, colorectal, melanoma or other skin cancer, lymphatic or hematopoietic, lung, CNS, esophagus, liver, pancreas, other	Suicide deaths					x
Fang et al. (2014)	China	200	Lung, leukemia, lymphoma	Suicidal ideation		x			x
Fekih-Romdhane et al. (2022)	Tunisia	52	Breast	Suicidality		x	x		x
Friberg et al. (2023)	Denmark	37,527	Prostate	Suicide deaths					x
Gascon et al. (2021)	Canada	14,517	Breast, CNS, colorectal, esophagus, liver, pancreas, head and neck, lung, lymphatic, hematologic, melanoma/ skin, prostate, other	Suicide deaths			x		x
Hagezom et al. (2021)	Ethiopia	410	Lung, colorectal, breast, cervical, prostate, blood, lymphoma, stomach	Suicidal ideation		x	x		x
Hatano et al. (2021)	Japan	971	Gastrointestinal, liver, pancreas, lung, other	Death wishes		x	x		x
Henriksson et al. (1995)	Finland	60	Not reported	Suicide deaths					x
Henry et al. (2018)	Canada	223	Head and neck	Suicidal ideation; suicide attempts; suicide deaths	x	x	x	x	x
Hickmann et al. (2016)	Switzer-land; Germany	83	Brain, intra- and extraaxial tumors	Suicidal ideation			x		x
Hoodin et al. (2013)	USA	101	Leukemia, non-Hodgkin lymphoma, multiple myeloma, other	Suicidal ideation					x

Authors, Year	Country / region	Sample size (*N*)	Main disease entities / sites	Suicidal thought / behaviour	Personality and individual differences	Cognitive factors	Social factors	Negative life events	Affective factors
Huang et al. (2019)	USA	2811	Leukemia, Hodgkin lymphoma, non-Hodgkin lymphoma, CNS, sarcoma, neuroblastoma, retinoblastoma, other	Suicidal ideation					x
Hultcrantz et al. (2015)	Sweden	47,220	Hematological malignancies	Suicide deaths;					x

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Table 1 (*continued*)

Authors, Year	Country / region	Sample size (*N*)	Main disease entities / sites	Suicidal thought / behaviour	Personality and individual differences	Cognitive factors	Social factors	Negative life events	Affective factors
				suicide attempts					
Hyer et al. (2021)	Australia	211,092	Colon, rectum, lung, pancreas, esophagus	Suicidal ideation					x
Jacobsen et al. (2010)	USA	123	Not reported	Death wishes					x
Johnson et al. (2020)	USA	175	Breast, head and neck, lymphoma, lung, prostate, other	Suicidal ideation					x
Jones et al. (2003)	Canada	224	Leukemia, gynecological, head and neck	Death wishes	x	x			x
Joshi et al. (2017)	Japan	1131	Gastric, colon, liver, lung, thyroid, breast, cervix	Suicidal ideation; suicide attempts					x
Jung and Yun (2022)	South Korea	612	Colon, breast, other	Suicidal ideation	x	x	x		
Kahn et al. (2023)	USA	3330	Head and neck, gastrointestinal, lung, musculoskeletal, melanoma, skin, breast, gynecological, genitourinary, central nervous system, endocrine, lymph/blood	Death by suicide					x
Kazlauskiene et al. (2022)	Lithuania	188	Breast	Suicidal ideation				x	x
Kelliher-Rabon et al. (2021)	USA	241	Not reported	Suicide attempts; suicidal ideation	x	x			x
Kelly et al. (2003)	Australia	252	Not reported	Death wishes		x	x		x
Kim et al. (2013)	South Korea	284	Breast	Suicidal ideation				x	x
Kittel et al. (2023)	USA	120	Breast, genitourinary, gynecological, hematological	Suicidal ideation					x
Klaassen et al. (2019)	Canada	676,470	Prostate, breast, colorectal, melanoma, lung, bladder, endometrial, thyroid, kidney, oral	Suicide deaths			x		x
Ko et al. (2018)	Taiwan	113	Colorectal, digestive, liver, head and neck, breast, gynecological	Suicidal ideation	x	x	x		x
Lai et al. (2022)	China	588	Nasopharyngeal, cholangiocarcinoma, lung, liver, colorectal, lymphoma, ovarian, breast, esophageal, stomach, thymus, pancreatic, cervical, other	Suicidal ideation		x			x
Latha and Bhat (2005)	India	54	Gastrointestinal tract	Suicidal ideation		x			x
Lee et al. (2014)	South Korea	2472	Not reported	Suicidal ideation					x
Lee et al. (2022)	Korea	60	Prostate, bladder, kidney, ureteral renal, other urologic	Suicidal ideation		x			x
Lehuluante and Fransson (2014)	Sweden	3165	Prostate	Suicidal ideation			x		x
Leung et al. (2013)	Canada	4775	Breast, head and neck, pancreas, sarcoma, gastrointestinal, genitourinary, gynecological, lung, hematological, melanoma, other	Suicidal ideation		x	x		x
Li et al. (2021)	China	566	Breast	Suicidal ideation					x
Lin et al. (2009)	Taiwan	311	All diagnoses	Suicide deaths					x
Liu et al. (2020)	China	244	Breast, lung, nasopharynx, gastrointestinal, gynecological, hematological, other	Suicidal ideation	x	x			x
Liu et al. (2023)	China	200	Ovarian	Suicidal ideation	x	x	x		x
Lowery et al. (2013)	USA	100	Colorectal	Suicidal ideation					x
Lu et al. (2013)	Sweden	12,669	Testis, melanoma, brain, Hodgkin's disease, cervix, thyroid, colon and rectum, breast, ovary	Suicide deaths; Suicide attempts					x
Luo et al. (2022)	China	820	Lung, colorectal, stomach, esophageal, liver, nasopharyngeal, bile duct, lymphoma, thymus, ovarian, pancreatic, breast, cervical, other	Suicidal ideation		x			x

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Table 1 (*continued*)

Authors, Year	Country / region	Sample size (*N*)	Main disease entities / sites	Suicidal thought / behaviour	Personality and individual differences	Cognitive factors	Social factors	Negative life events	Affective factors
Lubas et al. (2020)	USA	7312	Leukemia, Hodgkin lymphoma, non-Hodgkin lymphoma, CNS, other	Suicidal ideation; suicide attempts; suicide deaths					x
Ma et al. (2022)	China	5670	Nasopharyngeal, digestive, lung, nervous system, soft tissue sarcoma, bone, breast, skin, lymphohematopoietic, head and neck, genital, unknown	Suicidal ideation, Suicide attempts		x	x		x
Madeira et al. (2011)	Portugal	130	Breast, digestive, ear, nose, throat, other	Suicidal ideation; Death wishes	x	x	x		x
Maneeton et al. (2012)	Thailand	108	Gynecological, gastrointestinal, head and neck, other	Suicidality			x		x
Massetti et al. (2018)	USA	4182	Not reported	Suicide deaths			x		x
McClain et al. (2003)	USA	160	Lung, colon, breast, pancreas	Death wishes; suicidal ideation	x		x		x
McClain-Jacobson et al. (2004)	USA	276	Not reported	Death wishes; suicidal ideation	x	x			
Men et al. (2022)	China	152,061	Lung, other	Self-harm					x
Men et al. (2021)	China	1461	Not reported	Suicide deaths			x		x
Men et al. (2021)	China	383	Lung, colorectal, head and neck, liver	Suicide deaths					x
Mitchell et al. (2017)	Australia	486,269	Lung, genital, prostate	Self-harm					x
Mohammadi et al. (2014)	Sweden	46,309	Lymphoma, myeloma, leukemia, other	Suicide deaths; Suicide attempts					x
Molla et al. (2022)	Ethiopia	416	Breast, genitourinary, gastrointestinal, gynecological, hematological, head and neck, lung, pancreatic, sarcoma, liver, skin	Suicidal ideation, Suicide attempts					x
Moreno-Montoya et al. (2017)	Colombia	132	Not reported	Suicidality	x	x			x
Munson et al. (2020)	USA	174	Prostate, head and neck, lymphoma, leukemia, lung, breast	Suicidal ideation; suicide attempts; suicide deaths			x		x
Mystakidou et al. (2006)	Greece	106	Breast, gastrointestinal, lung, urogenital	Death wishes					x
Mystakidou et al. (2005)	Greece	120	Lung, breast, gastrointestinal, urogenital, melanoma, other	Death wishes					x
Mystakidou et al. (2005)	Greece	120	Lung, breast, gastrointestinal, urogenital, melanoma, other	Death wishes					x
Nanni et al. (2018)	Italy	195	Breast, gastrointestinal, genitourinary, respiratory, other	Suicidal ideation	x	x	x		x
Nigussie et al. (2023)	Ethiopia	358	Breast, genitourinary, gastrointestinal, gynecological, hematological, head and neck, lung, pancreatic, skin, sarcoma, liver	Suicidal ideation, Suicide attempts			x		x
Nikendei et al. (2018)	Germany	1758	Digestive organs, breast and female genital organs, skin, other	Suicidal ideation					x
Nissim et al. (2010)	Canada	406	Lung, gastrointestinal	Death wishes		x			
Nugent et al. (2021)	USA	72	Head and neck	Self-harm			x		x
O'Mahony et al. (2005)	USA	116	Not reported	Death wishes	x		x		x
Ozdemiroglu et al. (2017)	Turkey	117	Gastrointestinal, lung, liver, gynecological, hematological, breast	Suicidal ideation	x	x			x
Papini et al. (2023)	North America	9664	Leukemia, lymphoma, CNS, kidney, neuroblastoma, bone, soft tissue sarcoma	Suicidal ideation		x	x		x
Park et al. (2016)	South Korea	457	Colon, breast, cervical, lung	Suicidality					x

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Table 1 (*continued*)

Authors, Year	Country / region	Sample size (*N*)	Main disease entities / sites	Suicidal thought / behaviour	Personality and individual differences	Cognitive factors	Social factors	Negative life events	Affective factors
Perry et al. (2018)	USA	212	Prostate	Suicidal ideation	x				x
Pranckeviciene et al. (2016)	Lithuania	211	Brain	Suicidal ideation			x		x
Pukkila et al. (2000)	Finland	33	Not reported	Suicide deaths					x
Raghubar et al. (2022)	USA	175	Acute lymphoblastic leukemia	Suicidal ideation					x
Recklitis et al. (2006)	USA	226	Lymphomas, leukemias, sarcomas, nephroblastoma, other	Suicidality	x	x			x
Recklitis et al. (2010)	USA	9126	Leukemia, Hodgkin's disease, CNS, bone, soft tissue sarcoma, non-Hodgkin's lymphoma, nephroblastoma, neuroblastoma	Suicidal ideation					x
Recklitis et al. (2014)	USA	693	Prostate	Suicidal ideation					x
Rice et al. (2020)	Canada, Australia	100	Prostate	Suicidal ideation		x			x
Rice et al. (2021)	Canada	105	Prostate	Suicidal ideation		x	x		x
Rodin et al. (2007)	Canada	326	Not reported	Death wishes	x	x	x		x
Rodin et al. (2009)	Canada	406	Gastrointestinal, lung cancer	Death wishes	x	x	x		x
Rosenfeld et al. (2014)	USA	128	Lung, gastro-intestinal, breast, other	Death wishes	x	x	x		x
Ruiz-Marin et al. (2021)	Spain	130	Breast, colon, lung, other	Suicidal ideation			x		
Sauer et al. (2022)	Germany	4372	Breast, colorectal, skin, pancreas, gastrointestinal, genitalia, digestive organs, urinary, lip, oral cavity, pharynx, hematological and lymphatic, respiratory, bone and soft tissue, other	Suicidal ideation					x
Schneider and Shenassa (2008)	USA	980	Not reported	Suicidal ideation			x		x
Senf et al. (2022)	Germany	226	Breast, prostate, testicular, colon, rectum, stomach, esophagus, pancreatic, urological, lung, gynecological, hematological, other	Suicidal ideation			x		x
Shaheen Al Ahwal et al. (2016)	Saudi-Arabia	70	Colorectal	Suicidal ideation	x				
Sharkey et al. (2022)	USA	166	Brain, leukemia, other	Suicidal ideation		x			
Shim and Hahm (2011)	South Korea	121	Stomach, colorectal, other	Death wishes	x	x	x		x
Shim and Park (2012)	South Korea	400	Stomach, liver, lung, colorectal, breast, cervix, other	Suicidality			x		x
Sonmez et al. (2020)	Cyprus	80	Breast, gastrointestinal, head and neck, genital, brain, hematologic, lung	Suicidality					x
Spencer et al. (2012)	USA	700	Gastrointestinal, breast thorax, other	Suicidal ideation	x	x			x
Stanbouly et al. (2023)	USA	29,231	Head and neck	Suicidal ideation					x
Sun et al. (2011)	USA	1065	Leukemia, Hodgkin lymphoma, non-Hodgkin lymphoma, multiple myeloma, other	Suicidal ideation					x
Sun et al. (2018)	Taiwan	96,470	Colorectal	Suicide deaths			x		x
Sun et al. (2020)	Taiwan	66,931	Head and neck	Suicide attempts					x
Suppli et al. (2017)	Denmark	45,325	Breast	Suicide deaths					x
Tang et al. (2016)	China	579	Cervical, ovarian, endometrial	Suicidal ideation	x	x	x		x
Tang et al. (2020)	China	1045	Lung, gastrointestinal, breast cancer, other	Suicidal ideation					x
Tanriverdi et al. (2014)	Turkey	105	Breast, other	Suicidal ideation; subjective risk			x		x
Thapa et al. (2023)	Nepal	162	Lung, digestive, breast, gynecologic, head and neck, hematologic, genitourinary, bone and soft tissue sarcoma	Suicidal ideation					x

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Table 1 (*continued*)

Authors, Year	Country / region	Sample size (*N*)	Main disease entities / sites	Suicidal thought / behaviour	Personality and individual differences	Cognitive factors	Social factors	Negative life events	Affective factors
Trevino et al. (2014)	USA	93	Breast, lung, pancreas, colon, brain, stomach, esophagus, bone, soft tissue, leukemia, lymphoma, other	Suicidal ideation			x		x
Trevino et al. (2014)	USA	603	Breast, lung, gastrointestinal, other	Suicidal ideation	x	x	x		x
Tripp et al. (2020)	Canada	406	Prostate	Suicidality		x	x		x
Uchitomi et al. (2002)	Japan	24	Digestive tract, respiratory tract, head and neck, gynecological, breast	Suicidal ideation					x
Valikhani et al. (2018)	Iran	74	Breast, gastrointestinal, genital, other	Suicidal ideation	x		x		
Vehling et al. (2017)	Germany	430	Breast, prostate, hematological, gastrointestinal, gynecological, lung, other	Suicidal ideation		x			x
Vehling et al. (2021)	Germany	2141	Breast, prostate, colorectal, lung, gynecological, hematologic, stomach/esphagus, kidney/urinary tract, head and neck, bladder, pancreas, melanoma	Suicidal ideation; suicide attempts					x
Villavicencio-Chavez et al. (2014)	Spain	101	Lung, colon, gastric, pancreas, other	Death wishes					x
Walker et al. (2008)	UK	2924	Colorectal, gynecologic, genitourinary, sarcoma, melanoma, breast, other	Suicidal ideation					x
Walker et al. (2022)	UK	2217	Breast, colorectal, gynecological, lung, prostate	Suicidal ideation					x
Webb et al. (2012)	England	591	Not reported	Suicide deaths					x
Wilson et al. (2005)	Canada	69	Not reported	Death wishes; suicidal ideation		x	x		x
Wilson et al. (2016)	Canada	377	Not reported	Death wishes	x	x	x		x
Xu et al. (2019)	China	303	Head and neck, chest, abdomen, breast, genital, other	Suicidal ideation		x			x
Xu et al. (2020)	China	544	Digestive tract, lung, breast, gynecologic, head and neck, leukemia, lymphoma, other	Suicidal ideation		x			x
Zendron et al. (2018)	Brazil	250	Prostate	Suicidality			x		x
Zhang et al. (2017)	China	151	Stomach	Suicidal ideation	x	x			x
Zhang et al. (2020)	China	603	Breast, lung, colorectal, nasopharynx	Suicidal ideation		x	x	x	x
Zhang et al. (2023)	China	505	Ovarian	Suicidal ideation		x			x
Zhong et al. (2017)	China	517	Lung, digestive tract, breast	Suicidal ideation	x		x		x
Zhou et al. (2015)	USA	656	Prostate	Suicidal ideation; suicide attempts			x		x
Zhou et al. (2020)	China	357	Abdomen, head and neck, gynecological, thyroid, bone and soft tissue, other	Suicidal ideation		x	x		x

Note. If studies included multiple samples, the sample size, age, and gender proportions noted here refer to the subsample affected by cancer.

samples from multiple continents). Across all studies that reported gender proportions of participants, 52% were women. In most studies, participants' mean age was in the fifties or sixties. Eleven studies were prospective, longitudinal investigations. Not all studies specified the disease stage, but most which did so reported investigating mixed samples (including people at different stages of the disease as well as in remission). When studies focused on a specific phase, it was most often advanced cancer, terminal illness or palliative care. We observed a broad range of study settings, with information about suicide deaths usually coming from large-scale registry studies, whereas suicidal ideation was often assessed in hospitals. Only very few reports came from community-based assessments. Further, the overwhelming majority of investigations focused on cancer patients rather than (long-term) survivors. Not all original investigations reported participants' main diagnoses, but studies mostly investigated mixed samples, with only a few focusing on specific entities, e.g., prostate cancer.

A range of STBs were studied as outcomes, primarily suicidal thoughts: Suicidal ideation was the most common STB ($n = 107$). Most studies did not explicitly differentiate between active and passive suicidal ideation. The PHQ-9 (Löwe, Kroenke, Herzog, & Gräfe, 2004) was a common method of assessment (used in 24 studies) of suicidal ideation via the following single item: "Thoughts that you would be better off dead, or thoughts of hurting yourself in some way", thereby targeting passive death wishes (as well as thoughts of self-harm). In addition, a smaller number of studies, especially comparatively older ones, explicitly referred to and assessed death wishes ($n = 20$). Four studies tested associations with participants' subjective risk of suicide. Suicide deaths ($n = 26$) were studied more often than attempts ($n = 14$). Four studies

investigated self-harm (not differentiating/asking about intent). Twelve studies used a composite variable that combined suicidal thoughts and behaviours under the term "suicidality".

Comparing the five categories, most studies focused on affective factors. They were empirically investigated in 155 (95.1%) of the 163 original studies, followed by social (65 studies, 39.9%) and cognitive factors (63 studies, 38.7%), with personality and individual differences (37 studies, 22.7%) and negative life events (6 studies, 3.7%) receiving less attention.

The overwhelming majority of studies that looked at affective factors tested different kinds of distress as risk factors for STBs. More broadly defined, subjective distress as a patient-reported outcome was often operationalized using the established distress thermometer (e.g., Chiang, Couper, Chen, Lin, & Wu, 2022; Fang et al., 2014). Further, studies tested associations with internalizing symptoms, especially anxiety and depression (e.g., Abdel-Rahman, Salas, Watanabe, & Li, 2020; Hagezom, Amare, Hibdye, & Demeke, 2021; Sun, Lin, Shen, & Kao, 2020), pain and other Quality of Life (QoL) deficits (e.g., Maneeton, Maneeton, & Mahathep, 2012; Recklitis, Zhou, Zwemer, Hu, & Kantoff, 2014). A directly illness-related type of distress was captured in the form of fear of cancer recurrence (Zhang et al., 2020). The occurrence of STBs was also related to diagnoses of specific mental disorders/history of these disorders (e.g., Chang & Lai, 2022; Fang et al., 2012; Mohammadi et al., 2014), including drug and alcohol use disorders (e.g., Sun et al., 2020), especially in the context of registry-based studies that retrospectively analysed deceased individuals' medical and mental health records. Consideration of other affective states (e.g., in terms of negative or positive affect) was scarce, apart from a recent study that tested associations with anger (Rice et al., 2021).

Cognitive factors included different individual abilities including self-control (Valikhani, Sarafraz, & Moghimi, 2018) and coping (Tang et al., 2016), and also appraisals and subjective evaluations, such as treatment expectations (Nissim, Gagliese, & Rodin, 2009), confidence in the treatment (Zhou et al., 2020), and perceived control (Jung & Yun, 2022). Future-directed appraisals were only tested in the form of negative operationalizations such as hopelessness (e.g., Breitbart et al., 2000; Chochinov, Wilson, Enns, & Lander, 1998), and fear of cancer recurrence (already mentioned above for its affective component) (Zhang et al., 2020). Only a few studies investigated coping styles (Rice et al., 2020; Rodin et al., 2009) or self-related assessments such as self-efficacy (Spencer, Ray, Pirl, & Prigerson, 2012) as protective factors. Among the cognitive factors directly derived from current theories, entrapment (Bobevski et al., 2022; Zhang et al., 2023) and fearlessness about death (Fadoir et al., 2021) stood out as the ones without an interpersonal orientation (as opposed to perceived burdensomeness and thwarted belongingness), but they were only rarely investigated.

Loneliness (Du et al., 2022; Ernst et al., 2020; Rice et al., 2021) and related constructs such as thwarted belongingness were commonly investigated social factors. The latter was mostly assessed jointly with perceived burdensomeness (Fadoir et al., 2021; Tripp et al., 2020) using the Interpersonal Needs Questionnaire (Van Orden, Cukrowicz, Witte, & Joiner Jr, 2012). A social factor investigated as a protective influence was current emotional and tangible social support (Akechi et al., 2004; Chae et al., 2019; Fekih-Romdhane, Saadallah, Mbarek, Bouzaiene, & Cheour, 2022; Nigussie et al., 2023). Less often, studies tested relationship satisfaction and family cohesion (Fekih-Romdhane et al., 2022; Zhou et al., 2020), attachment (security) (Rodin et al., 2007; Valikhani et al., 2018), and exposure to suicide (Zendron, Zequi, Guimaraes, & Lourenco, 2018; Zhong et al., 2017). There were also investigations of contacts with health professionals/utilization of healthcare services (Abdel-Rahman et al., 2020; Spencer et al., 2012), the patient-doctor-relationship (Trevino et al., 2014) or shared decision-making (Hatano et al., 2021). Under the umbrella of personality and individual differences, several studies investigated the Big Five facets openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (not always including all of them) (Henry et al., 2018; Perry, Hoerger, Silberstein, Sartor, & Duberstein, 2018). Negative life events subsumed adverse childhood experiences (Henry et al., 2018; Zhang et al., 2020) and traumatic events over the lifespan (Kazlauskiene, Navickas, Lesinskiene, & Bulotiene, 2022).

More generally, we found that studies heavily focused on hypothesized psychological *risk* factors rather than *protective* factors, with only 37 studies (22.7%) investigating the latter (and mostly comprising social support).

The detailed ratings for every domain of bias for the 163 studies that tested psychological risk/protective factors are provided via the OSF, both as a table ("detailed_risk_of_bias.csv") and as a traffic light plot ("rob_traffic_light_plot.pdf"). They are also summarized in Fig. 2. Most studies ($N = 107$, 65.6%) had a serious overall RoB, i.e., at least one domain was rated as "serious". Regarding the single domains, bias due to selection of participants was most often rated as serious ($N = 86$, 52.8%). This RoB applied if participants were selected in a specific way that may lead to a biased association between risk/protective factors and STBs (e.g., if a sample was collected and the data to be analysed with respect to the research question was selected based on individuals' responses to screening questions indicating distress). This was followed by bias in the measurement of outcomes ($N = 30$, 18.4%), e.g., if STBs were assessed with non-validated/self-constructed item sets, and bias due to confounding ($N = 15$, 9.2%). An example of confounding in the present context would be if a study included only individuals with terminal cancer and the studied risk factor was hope/hopelessness (Rosenfeld et al., 2014).

4. Discussion

Against the background that cancer has been consistently associated with the full range of STBs, this study aimed to synthesize the extant research literature to answer the question of how well psychological risk and protective factors for STBs are represented in quantitative research in the oncological context. We found that in the past seven decades, there has been considerable research activity concerning suicide (prevention) in cancer patients and survivors. Roughly half of the eligible studies had investigated psychological factors – ranging from individual differences to negative life events – based on a combined sample of over three and a half million participants spanning diverse diagnoses and disease stages and addressing different STBs.

However, given that STBs constitute a manifestation of a psychological crisis, it is important that psychological factors are routinely addressed. Further, the original studies indicate several research gaps as well as key findings.

First, concerning the examined factors, affective variables were most common, especially in the form of different types of distress associated with a higher risk of STBs. This is perhaps unsurprising and echoes earlier reports (transcending the oncological context) of high prevalence rates of psychiatric diagnoses among those who die by suicide (Favril et al., 2023). However, as O'Connor and Nock (2014) note, the overwhelming majority of individuals with mental disorders do not become suicidal. As such, the strong focus on these types of factors is of limited benefit to identifying those at risk for suicidal thoughts or behaviour, especially as most of the tested affective factors were not derived from theories of suicide. Notable exceptions were psychache (Tripp et al., 2020) a specific conceptualization of psychological pain central to the Cubic Model of Suicide by Shneidman (1993), and entrapment, which the IMV Model posits to be the state from which suicidal thoughts first arise (O'Connor & Kirtley, 2018).

Hopelessness was another relevant factor (categorized as both affective and cognitive), driving the exacerbation of suicidal crises according to the IPTS (Van Orden et al., 2010); however, it was mostly not described or interpreted within this context. Perceived burdensomeness and thwarted belongingness, central constructs of the IPTS, were the theoretically derived concepts best represented in the literature. Their uptake in oncology was previously scrutinized by a scoping review that

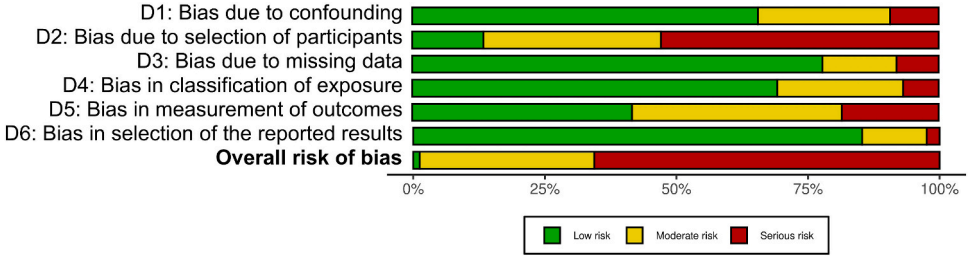

Fig. 2. Summary plot of studies' risk of bias in the different domains and overall risk of bias.
The majority of studies had a serious overall risk of bias. This was primarily due to participant selection and measurement of outcomes (here: the assessment of suicidal thoughts and behaviours).

found four studies (Schomberg et al., 2021). While these constructs were often discussed in relation to the IPTS, loneliness (which substantially overlaps with thwarted belongingness) and perceived burdensomeness were also investigated separately and without being integrated into any sort of theory, especially in older studies (e.g., Breitbart et al., 2000). By comparison, research paid the least attention to personality and individual differences and negative life events. Among the latter, studies addressed childhood adversity which has previously been shown to be a specific risk factor for self-harm, mediated through acquired capability for suicide (Sachs-Ericsson, Rushing, Stanley, & Sheffler, 2016). However, the respective studies made no mention of the concept of acquired capability, and they did not model any behavioural actions (self-harm, suicide attempts or deaths) as an outcome, focusing on suicidal ideation only (Henry et al., 2018; Zhang et al., 2020). Along the same lines, the studies testing associations with exposure to suicide made no mention of it as a volitional moderator, that is, a specific risk factor within the IMV model that is important in the transition from suicidal thoughts to suicidal acts. Finally, there was a study highlighting past attempts among veterans, however, it did not explore self-harm or suicidal behaviour as a dependent variable either (but instead investigated suicidal ideation) (Johnson, Phillips, & Miller, 2020).

Taken together, the findings underscore that each one of the five categories of psychological factors contributes to the understanding of cancer patients' susceptibility to suicidal crises, but that there is, so far, little implementation of the most influential theoretical models from suicide research into oncology. They further highlight that diverse psychological factors previously shown to be relevant among other clinical and population samples also shape the risk of STBs in individuals with cancer. This is, of course, not surprising as cancer and its treatment are life events that do not occur within a vacuum, but affect individuals who are subject to the same societal influences as others, and who do not differ fundamentally from others *without* cancer in all of their defining characteristics (e.g., in terms of personality). Thus, those variables are not causally linked to the illness or its treatment, but they come into play in this 'cancer' situation and alter their suicidogenic effects. However, there is a dearth of research investigating suicide risk in individuals with cancer through this lens while drawing on the substantial body of psychological research that has identified and theoretically integrated such factors.

Second, at the same time, there are psychological factors that may specifically be *brought about* by the experience of the illness and its treatment that confer an elevated risk for different kinds of STBs, some of which have also previously been included in relevant psychological models. By way of example, hopelessness or feeling trapped could be specifically induced by disease-related factors such as a poor prognosis. This illustrates that in contrast to a moderator, a mediator is not just some kind of background factor that contributes to a cancer patient's risk alongside or in interaction with the illness, but that is particularly relevant *because of* the illness.

We propose to conceive of these two types of variables as *moderators* and *mediators* of the link between cancer and STBs, respectively (Fig. 3). To do so, we describe their roles within a conceptual model, aligned with the IMV model, to map out the factors associated with the emergence of suicidal ideation and the transition to suicidal behaviour in the context of cancer. In this model, the illness and its treatment must be contextualized as the context has a bearing on the ways in which the disease and treatment - irrespective of their characteristics, such as the type of diagnosis and prognosis - affect the individual. The original IMV model

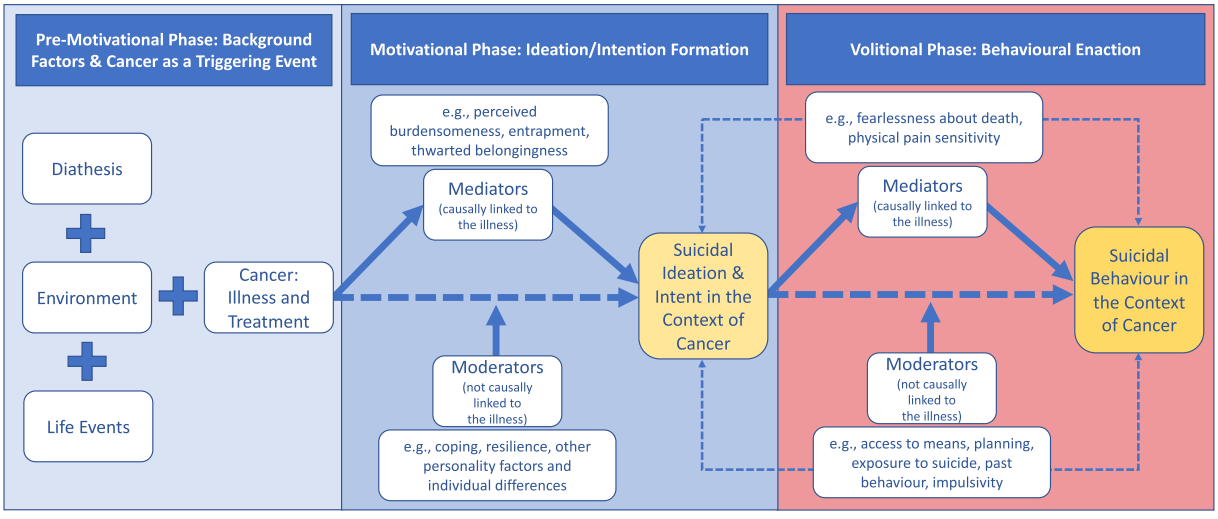

Fig. 3. A conceptual model integrating moderators and mediators of the association of cancer with suicidal thoughts and behaviours into an ideation-to-action framework, based on the Integrated Motivational-Volitional (IMV) Model of Suicidal Behaviour.

refers to the diathesis-stress model as "the backdrop" (O'Connor & Kirtley, 2018, p. 2), and it is against this backdrop that the illness and its treatment can become triggering life events. In this sense, the *context* refers to the actual situation the person finds themselves in; and locating the illness within the individual life course. Part of this relates to the previous experiences that confer vulnerability or resilience, from childhood adversities and formative relationship experiences more generally that are internalized and continuously updated and manifest as attachment styles, to more recent stressful/traumatic events. Furthermore, the developmental period itself has implications, not only because a person's age has significance for their overall physical health and fitness, but also for how "normative" cancer is: whether a diagnosis comes as a shock at a young age, or still constitutes a dire life event at an older age, but can then be connected to similar experiences of friends or family, i.e., of available (role) models with lived and living experience of the illness. By contrast, for younger people, cancer (survival) can be particularly hard to communicate and thus be an isolating experience, as e.g., childhood cancer survivors report (Ernst et al., 2021).

The conceptual model adopts the ideation-to-action framework (Klonsky et al., 2018), as it distinguishes the phase in which suicidal ideation and intent develop (the motivational phase) from the transition from suicidal thoughts to behaviours (the volitional phase). In the standard IMV model, the motivational phase is characterized by unbearable subjective experiences (defeat and humiliation) and the perception that there is no escaping them (entrapment), leading to an escalation of the crisis and to the development of suicidal thoughts. In the context of cancer, moderators of this association were consistent with the ones observed in other samples (e.g., coping, and social support). However, other variables found to be relevant could constitute mediators. Above, we mentioned hopelessness, but the disease and its treatment could also directly elevate perceived burdensomeness, both in an emotional sense and in a literal sense if the affected person has (new) functional limitations or other needs for which they have to rely on others. Since being seriously ill is a circumstance of life that cannot be changed at will, it is also understandable that the studies have confirmed entrapment as a relevant factor associated with STBs among people with cancer (Zhang et al., 2023). An individual may feel trapped by their illness. However, it is important to note that the moderators also have a bearing on the mediator paths as well - as the same circumstances of illness and treatment will not have the same implications on, for example, hopelessness for everybody, as people and their processing of the illness are more complex than that (Rodin et al., 2009).

Lastly, the volitional phase is the most critical part of the model with regard to the prevention of suicidal behaviour. Within the IMV model, volitional moderators are the variables that specifically govern the transition from thoughts and plans to behaviour; they comprise the aspects summarized under acquired capability, but also include the access to means and personality variables such as impulsivity. Here, the knowledge base with regard to the oncological context was particularly scarce, first, because fewer studies of psychological factors associated with suicide attempts and deaths were available, secondly, because (death-) registry-based types of studies often included only demographic or diagnostic information (e.g., limited to previous diagnoses), and thirdly, no study specifically differentiated individuals with ideation from those exhibiting behavioural enaction. Nonetheless, there was some evidence for potential moderators (such as drug- and alcohol-use disorders (Sun et al., 2020), which could be implicated in the disinhibition of impulses and foster dangerous, impulsive actions). A recent call which highlighted firearm safety, an important preventive measure for individuals with cancer, thus also addressed another volitional moderator (Williams, Tam, & Adjei Boakye, 2023). With regard to mediators, it is an open question whether repeated experiences of pain and discomfort due to illness and treatment might contribute to the acquired capability for suicide in similar ways that experiences of physical violence do. Therefore, the role of pain (Lubas et al., 2020) deserves more attention. Furthermore, levels of fearlessness about death might vary as a function of an individual's prognosis and quality of life, i.e., circumstances of the illness could lead someone in physical pain to fear death less than a continuation of their suffering or a worsening of their state. To summarize, while moderators and mediators can both be deemed important within the proposed framework, mediators should perhaps be primarily considered in research and practice because they are intimately linked to the experience of cancer, meaning cancer may specifically amplify them.

Several key directions for future research emerge from this model, the first one of which is the need to understand and characterise suicidal crises as a process within an ideation-to-action framework (which entails clearly distinguishing between thoughts and behaviours as the dependent variable). To capture within-person variability over time, study designs with more than one measurement point are needed. For instance, using an intensive longitudinal design, Kleiman et al. (2017) showed that suicidal ideation and related risk factors (including loneliness) were highly variable. This observation helps to explain why the prediction of STBs still presents a major challenge. In the oncological context, assessment with a high temporal resolution would shed light on vulnerable periods, which is important as cancer entails more than a singular life event, but rather phases (including recovery and survival) that can vary greatly depending on the type of cancer and treatment. Secondly, while most studies investigated a wide range of risk factors, there was usually no consideration of their interplay, i.e., when they were investigated alongside each other, for instance, in regression models, this did not include the modelling of interaction terms, and mediation models were rarer still. However, such models would be more in line with the state-of-the-science in suicide research which is that STBs unfold as the result of a complex interdependence of biopsychosocial factors within a developmental context (Turecki et al., 2019). They would also go further in modelling individually different algorithms of risk and resilience, which would help us to understand potential differential effects of the disease and its treatment in younger and older individuals, different genders, disease entities, etc. By way of example, studies found sex/gender-dependent effects of risk factors such as loneliness and social support on STBs (in individuals not affected by chronic illness) (Ernst, Klein, Beutel, & Brähler, 2021; Richardson, Robb, McManus, & O'Connor, 2022). Thirdly, based on the available evidence, we mostly summarized factors conferring *increases* in risk, as is common for systematic reviews in suicide research. Franklin et al. (2017) reported only 495 effect sizes (14.4% of overall 3428 effect sizes) that pertained to factors coded as protective. We also found that only a few research efforts were (partly) geared towards elucidating potential protective factors and yielded effects with negative signs, i.e., insights into resilience or recovery. Future research should endeavour to address protective as well as risk factors to inform resource-oriented prevention and intervention efforts. A dedicated focus on positive psychological constructs, in particular, would be helpful because the absence of distress does not, in itself, imply well-being. This is important as positive emotions foster mental flexibility, problem-solving and other capacities (see the Broaden-and-Build Theory (Fredrickson, 2013)) which are both relevant for mental health in general and suicide prevention specifically as they map onto motivational moderators within the IMV model (O'Connor & Kirtley, 2018). However, while we broadly refer to some factors as "risky" and others as "protective", it must be acknowledged that this classification is necessarily reductive, and might also be inaccurate because of their multidimensional embeddedness and interaction between factors (Shahar, Elad-Strenger, & Henrich, 2012). For instance, we understood previous diagnoses of mental disorders as an indication of risk because they signified the presence of serious mental distress (and they showed positive associations with STBs in the reviewed studies). However, there might be more to this variable as it also tells us about contact with the healthcare system. Compare, for example, two individuals with cancer who suffer from major depression, with one of them receiving the diagnosis and access to care, while the other does not - who would then be deemed more at risk?

This reductive approach is one of the limitations of this work, as is the classification of factors into five categories. While they were aligned with the most relevant theories and evidence and thus a helpful organizing framework, this taxonomy was not perfect as some constructs are more nuanced, not clearly protective or risky. There was also a preponderance of cross-sectional study designs, implicating that for many of the factors we extracted, their relationship with STBs remains opaque. Hence, it is not possible to determine whether they fulfil the precedence criterion to be described as a risk factor (instead of a correlate) (Kraemer et al., 1997). The focus on psychological factors further narrowed the scope, so that psychosomatic interdependencies and feedback loops were not represented (involving, for example, inflammatory processes that are implicated in depression (Miller & Raison, 2016)), and the psychological factors were not linked to the heterogeneity evident among the cancer patients/survivors. As part of this, we could not distinguish between the effects of the illness and those of the treatment. However, during the different phases of acute illness and (long-term) survival, they might be of varying significance to the affected person's mental health and well-being. While the original studies were very heterogeneous and included participants with a large range of cancer diagnoses and stages, some populations were underrepresented: STBs were, for the most part, investigated in patient samples rather than long-term survivors, although it is important to emphasize that an elevated risk for STBs persists decades after diagnosis (Barnes et al., 2022; Burghardt et al., 2019). Moreover, further attention to the (long-term) survival phase is also needed, especially in view of ageing populations and the ever-improving diagnosis and treatment options. The review also identified global gaps in our knowledge, with some geographic regions being underrepresented, especially South America and Africa. This is in line with Knipe, Padmanathan, Newton-Howes, Chan, and Kapur (2022)'s observation that low- and middle-income countries account for 80% of suicide deaths, but <15% of the research.

Further, this review provides a narrative and quantitative summary, but it did not pool effect sizes in terms of a meta-analysis. Future research focused on more thematically organized meta-analytic summaries would be helpful to guide clinical practice and to better understand which factors are more or less important (such as a recent research synthesis of the effects of social support (Du et al., 2020)). It also could not include qualitative research, thus neglecting a large body of work giving insight into the subjective experience of living with cancer as well as suicidal crises. However, as the goal of the present work was to summarize the empirically tested factors, thus also acknowledging researchers' decisions as to which variables to include, to investigate and to report on (in the sense of a deductive approach), it could not be aligned with qualitative research processes and reports. Finally, we aimed to summarize the current state of research within a rapidly evolving field. Thus, it may soon require updating. To this end, all processed data and materials are made available so that other researchers can directly build upon them.

Concluding, a large number of empirical studies have identified risk/protective factors for STBs in the context of cancer. Such investigations are located at the interface of disciplines, which gives rise to certain challenges. The present review highlights a need for better integration of psychologically oriented theories and findings into the medical context. This includes the conceptualization of suicidal crises in the context of cancer as a psychological phenomenon deserving of attention and commitment from the perspective of suicide prevention research. The proposed model included moderators and mediators and while they relate to different processes, addressing both of them could reduce STBs in individuals with cancer. In clinical practice, they could inform screening efforts as well as individual case formulations. Orienting future research towards them will advance our knowledge about the specific drivers of cancer patients' suicidal crises.

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Author contributions

Conceptualization: Mareike Ernst, Rory C. O'Connor, Manfred E. Beutel.

Writing - Original Draft: Mareike Ernst, Tamara Schwinn, Judith Hirschmiller.

Writing - Review & Editing: all authors.

Supervision: Rory C. O'Connor, Manfred E. Beutel.

Data curation, formal analysis, methodology, visualization: Mareike Ernst, Tamara Schwinn, Judith Hirschmiller.

All authors have access to the data gathered and analysed in the preparation of the manuscript. All authors have carefully read and approved the final version of the manuscript.

Declaration of competing interest

The authors have no conflicts of interest to declare.

Data availability

All data and materials are made available via the Open Science Framework (please see the links included in the manuscript).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cpr.2024.102413.

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