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REVIEW ARTICLE

Theoretical models of suicidal behaviour: A systematic review and narrative synthesis

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Abstract Background and objectives Suicide mortality has not decreased in recent decades, partly due to the lack of valid predictors. A small number of systematic reviews have been published on the different integrated theoretical models of suicide, although no attempts have been made to bring together the different perspectives into a single integrated model.
Methods: We performed a systematic search of the PubMed and EMBASE databases up to January 2020 to identify studies on integrated theoretical models of suicidal behaviour.
Results: Eleven articles met the selection criteria and were included in the review. Some of the key risk factors indicated by most of the models are traumatic events, childhood abuse, feelings of defeat and entrapment, emotional dysregulation, and social exclusion.
Conclusions: Suicidal behaviour remains a complex phenomenon involving multiple factors. The synergistic effect between all the factors involved should be considered.

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Introduction

Suicide is one of the main challenges facing global healthcare nowadays. Every year, over 800,000 people take their own lives.[1] Suicidal behaviour also represents a high economic burden for society.[2] Unlike other public health problems, the mortality and morbidity associated with suicidal behaviour have not decreased in recent decades. The lack of accurate predictors is one of the main reasons why suicidal behaviour is so difficult to predict and prevent.

Many promising studies have attempted to clarify the etiopathogenesis of suicide from different angles, including epidemiological,[3] sociocultural,[4] environmental,[5] psychological[6] and neurobiological[7] perspectives. Several factors have been associated with suicide, although none is strong enough to effectively predict suicidal behaviour on its own.[8,9]

As a result, some authors have created integrated models of suicidal behaviour that group together the different variables involved at different moments along the path to suicide. There are two basic kinds of theoretical models: predictive models and theoretical models. Predictive models use statistical analysis to generate a risk score based on a range of factors. Theoretical models aim to explain how these risk factors interact with each other and lead to suicide. The complex nature of suicide makes integrated models especially appropriate. However, there are still many gaps in research on suicidality. Current theories often study a single domain, such as psychological, biological, or environmental factors. As Klonsky et al.[10] point out, another issue to address is whether suicidality follows a linear trajectory, advancing from ideas to plans to attempts.

There are few systematic reviews of integrated theoretical models of suicide. Rothes et al.[11] carried out a survey to explore professionals' views on the adequacy of five theoretical models of suicide, while Klonsky et al.[12] reviewed a number of theories on the trajectory of suicide (interpersonal theory, three-step theory, fluid vulnerability theory, and the integrated volitional-motivational model). Finally, Rostami et al.[13] designed a protocol for a systematic review of current suicide models in the elderly. To our knowledge, no previous review has attempted to bring together the different perspectives under a single integrated model for suicidal behaviour.

We present a wide-scope review of the literature summarising the most relevant integrated theoretical models and perform a narrative synthesis of the evidence, proposing a unified theoretical model of suicidal behaviour.

Methods

This review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[14]

Terminology and definitions

Integrated theoretical suicide models: we understand a theoretical integrative model of suicide as one that presents at least three variables related to suicidality, and that considers at least two phases along the trajectory to suicide. These variables and trajectories are expected to vary between studies. We took an exploratory approach, accepting any variable and trajectory proposed by the models.

Suicide-related constructs: the suicide terminology used was based on the definitions standardised by O'Carroll et al.[15] and redefined by Silverman.[16] A suicide attempt is understood as any act of self-harm carried out with the intention of ending one's life. Suicidal ideation refers to undeveloped thoughts about ending one's life. A greater degree of development of suicidal ideation will result in suicide plans. The terms 'suicidality' or 'suicidal behaviour' will be used to refer to any kind of suicide construct.

Inclusion/exclusion criteria

To be included in the review, the articles had to meet the following criteria:

(1) Only those containing at least three variables of suicide risk were considered models;
(2) Only those accounting for at least two phases of suicide were considered models; and
(3) Studies containing modifications to an existing model (unless the original model only included two predictor variables) were not included.

We excluded articles referring only to discrete subpopulations, such as specific professions or ethnic minorities. We did include studies that focused on age-based subpopulations.

We limited our search to publications in English or Spanish. No specific date restrictions were used. The last search date was 30 January 2020. The articles were selected based on their relevance to the topic and methodological quality. We reviewed the findings of observational and experimental research published in the databases described below and other research-related journals; the study designs included cohort, cross-sectional, longitudinal, case–control, and quantitative studies including grounded-theory designs.

Search strategy and data extraction

We performed a systematic search of the PubMed and EMBASE databases up to January 2020 containing original studies published in peer-reviewed journals that presented integrated theoretical models of suicidal thoughts and/or behaviours. We adopted a non-specific approach to the search so as not to miss any relevant papers. The search string used was as follows: (suicid* AND model), both in PubMed and EMBASE databases, without restrictions applied to field, date, or language. The references of studies revealed by the search were also screened. Eligible studies were critically appraised. Data were identified, checked, and mined by two independent authors (ID and APS) using pre-made tables. We performed a search update on 1 January 2021 to identify potential additional records.

Results

The initial search yielded 20,361 results. Following an initial screening of the article abstracts, full-text review, and

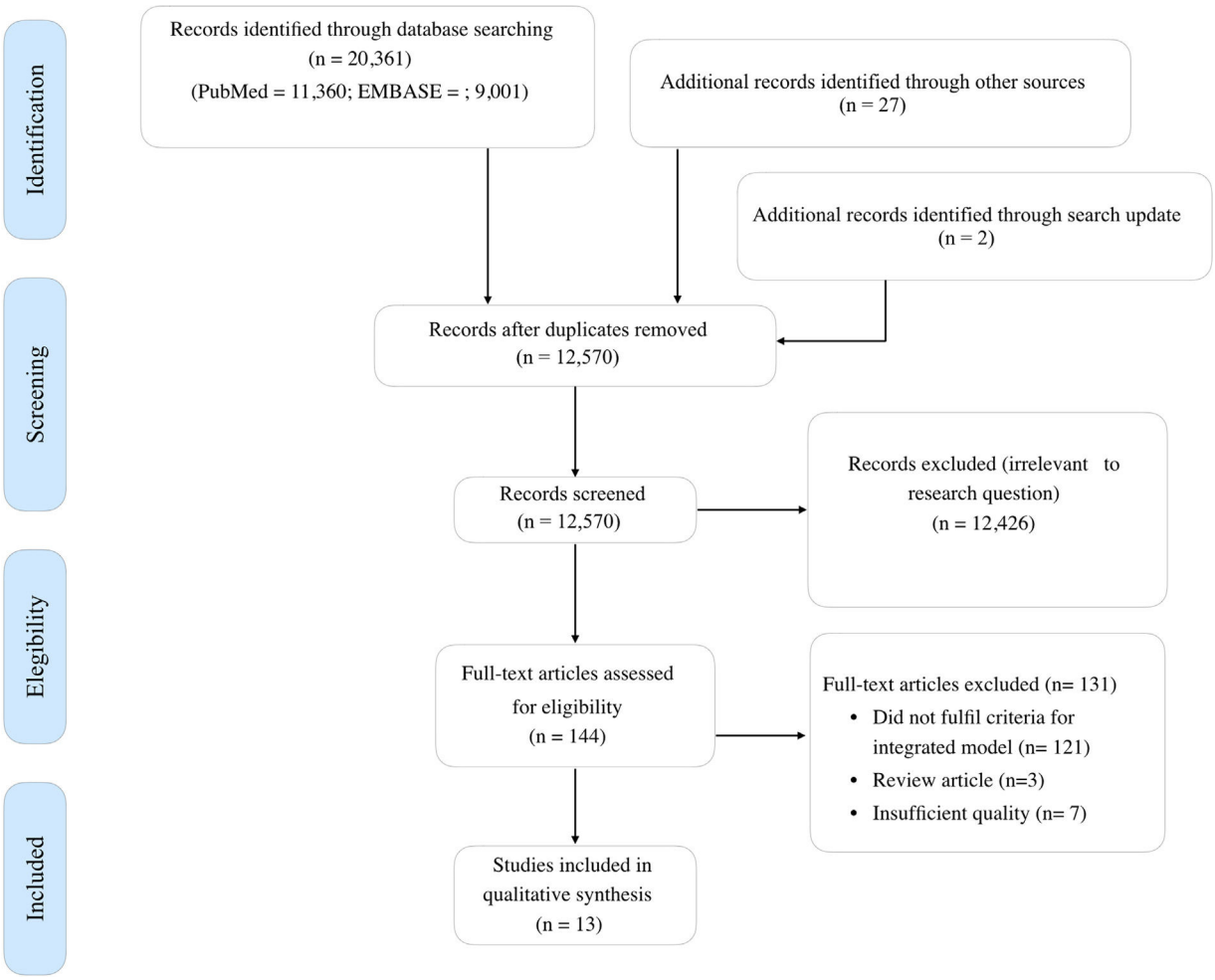

Figure 1 Flow chart of the bibliographical search.

selection as appropriate, 13 articles were included in the review (see Fig. 1).

Characteristics of the studies reviewed

All the models described in the publications presented at least three variables and two phases. All the models had three phases except the stress-diathesis model of suicidal behaviour, which has two phases, the cognitive-behavioural model of suicidality, which has six phases, and Stoeb et al.'s model, which has four phases. The number of variables described in each model ranged from three to ten. All models included psychological variables, while only some incorporated environmental, genetic, biological, and social variables. Table 1 shows the general characteristics of the models reviewed. Below, we present a brief description of the primary models reviewed by year of publication.

A process model for assessing adolescent risk for suicide

Stoeb et al.[17] presents a four-phase model. They refer to suicide generally, without differentiating between suicide ideation, suicide planning, or suicide attempt.

Phases 1 and 2 are independent from phases 3 and 4. Phase 1 is linked to phase 2. Relationships can be observed between primary risk factors, such as affective disorders or a previous attempt (phase 1) and suicide (phase 2). Phase 3 is linked to phase 4. Relationships can be observed between secondary risk factors, such as substance abuse or personality (phase 3) and environmental stressors, such as family functioning or social relationships (phase 4). As in the previous phases, if at least one of these previous factors is present, a suicide attempt may occur. Impulsivity is added as a moderating factor for suicide in phases 3 and 4.

The suicidal mode: a cognitive-behavioural model of suicidality

Rudd[18] proposed an integrative model of suicide comprising six phases. Predisposing factors such as previous psychiatric diagnoses of axis I and II or childhood trauma intervene in the first phase. In the second phase, internal and external stressors exert their influence. The third phase includes notable factors such as suicidal thoughts or hopelessness. These three phases can be sufficient to lead to a suicide attempt (phase 6). In phase 4 and 5 we find enabling factors, such as access to means of suicide or anger.

Table 1 Suicide integrated models: main findings.

Author(s), year	Suicide integrated models	Model phases	Suicidal outcome	Correlates			
				Biological	Psychological	Social	Others
Stoeb et al., 1998[17]	A process model for assessing adolescent risk for suicide	4	SR: low, moderate, and severe	NA	Hopelessness, affective disorders, substance abuse disorder, and personality disorders	Family functioning and history, social relationships, exposure to suicide, life stressors	Previous attempt and homosexuality
Rudd et al., 2000[18]	A cognitive-behavioural model of suicidality	6	SI & SA	Autonomic system, motor system, sensory system activation	Previous psychiatric diagnosis, Axis I and II, internal thoughts, images, feelings and physical sensations, suicidal thoughts, hopelessness, negative thoughts about self, others and future, conditional assumptions/rules, compensatory strategies, anger, guilt, anxiety, sadness...	Abuse and neglect, parental modelling, situations, circumstances, places, people	Prior suicidal behaviour, financial arrangements, insurance, acquiring means to suicide, planning, rehearsal behaviours, attempts
Joiner, 2005[19]	Interpersonal Psychological Theory of Suicide	2	SI & SA	NA	Thwarted belongingness, perceived burdensomeness, and acquired capability	NA	NA
Johnson et al., 2008[21]	The Schematic Appraisals Model of Suicide	2	SI & SA	NA	Emotional coping, situational coping, defeat, entrapment, and posttraumatic stress disorder	Social support	NA

Table 1 (*Continued*)

Author(s), year	Suicide integrated models	Model phases	Suicidal outcome	Correlates			
				Biological	Psychological	Social	Others
Soloff et al., 2008[22]	Theoretical Model of Suicidal Behaviour in Borderline Personality Disorder	3	SI & SA	HPA and 5HT dysregulation, brain volume loss	Impulsivity, aggression and poor social adjustment, borderline personality disorder, psychotic and schizotypal symptoms, posttraumatic stress disorder, and major depressive disorder	Childhood sexual abuse, physical abuse, separation from parents, recent life events, treatments, romantic relationships, children, and employment status	Risky suicidal ideation/behaviour in childhood and adolescence, head injury
Tailor et al., 2011[23]	The Role of Defeat and Entrapment in Depression, Anxiety, and Suicide	3	SI & SA	NA	Defeat, entrapment, maladaptive coping strategies, low personal adequacy/inferiority/low ability to succeed, Hypervigilance/behavioural inhibition and low positive affect, major depressive disorder, posttraumatic stress disorder, social anxiety and other anxiety disorders, and psychosis	Stressors (traumatic events)	NA
Leung et al., 2015[24]	An Integrated Model of Suicidal Ideation in Transcultural Populations of Chinese Adolescents	2	SI	NA	Emotional competence, social problem solving, and hopelessness	Family functioning	NA
Benson et al., 2016[25]	A model of the suicide process based on experiential accounts	3	SI & SA	NA	Lack of trust, lack of inherent worth, and suicidal exhaustion	NA	NA

Table 1 (*Continued*)

Author(s), year	Suicide integrated models	Model phases	Suicidal outcome	Correlates			
				Biological	Psychological	Social	Others
Lutz et al., 2017[7]	A biological model: circuits implicated in suicide	3	SB	HPA dysregulation, altered cortisol response, altered glutamate signalling, serotonin dysregulation	Anxiety, impulsivity, cognitive ability, social integration, and depressed mood	Neglect or physical or sexual abuse	NA
Klonsky et al., 2018[12]	The three-step theory of suicide	3	SI & SA	NA	Pain, hopelessness, connectedness, and suicide capacity	NA	NA
O'Connor et al., 2018[26]	The integrated motivational-volitional model of suicidal behaviour	3	SI & SA	Vulnerability: decreased serotonergic neurotransmission, prescribed perfectionism, etc.	Defeat and humiliation + entrapment Others: Impulsivity, fearlessness, thwarted belongingness, burdensomeness, future thoughts...	Traumatic life events	Access to means, exposure to suicide, imagery, past suicidal behaviour, etc.
Hennings, 2020[27]	The Reinforcement Model of Suicidality	3	SI & SA	Dysregulation in HPA	Surprise, fear, irrational beliefs/schemes, helplessness, hopelessness, panic, pain tolerance, fearlessness about death	Childhood abuse	History of previous SA
Mann et al., 2020[28]	The Stress-Diathesis Model of Suicidal Behavior	2	SA	HPA abnormalities, neurotrophic and apoptotic deficits, neuroinflammation, glutamate and opioid system abnormalities, etc.	Subjective distress, impaired decision-making, learning/memory deficits, social distortion	Childhood and adulthood stress	Financial or interpersonal problems, exacerbation of psychiatric illness

NA: not applicable; SR: suicidal risk; SI: suicidal ideation; SA: suicidal attempt; SB: suicidal behaviour; HPA: hypothalamic–pituitary–adrenal axis and polyamine system.

Interpersonal Psychological Theory of Suicide (IPTS)
Joiner et al.[19] described the Interpersonal Psychological Theory of Suicide. This theory considers three variables (i.e. thwarted belongingness, perceived burdensomeness, acquired capability) and two phases (i.e. suicide desire and suicide attempt). If thwarted belongingness or perceived burdensomeness are experienced separately, the patient may present with suicidal desire. A third variable, i.e. acquired capacity, is needed to progress from suicide ideation to a suicide attempt. Acquired capacity refers to the destruction of the survival instinct.[19,20]

The schematic appraisals model of suicide (SAMS)
The SAMS is a theoretical framework developed by Johnson et al.[21] The model consists of three phases. In phase 1, emotional coping, situational coping, and lack of social support correlate negatively with defeat and entrapment. In phase 2, defeat and entrapment are related to perceptions of loss, failure, and inability to escape. In phase 3, suicidal behaviour emerges as means of escaping from the increasingly severe feelings of defeat and entrapment. In addition, the effect of all the variables described above on suicidal behaviour was increased in people with posttraumatic stress disorder (PTSD).

Theoretical model of suicidal behaviour in borderline personality disorder (BPD)
Soloff et al.[22] propose a model in which different variables across three phases can cause the development of suicidal behaviour in people with BPD. In phase 1, childhood abuse, especially CSA, increases the prevalence of risky behaviours in childhood and adolescence and contributes to the development of BPD. In phase 2, if BPD is developed, suicidal behaviour could take place in adulthood. The suicide attempt may occur in phase 3 and is mediated by factors such as schizotypal symptoms or poor social adjustment. Furthermore, these factors are associated with CSA and, combined with a lack of social support, may lead to an increased likelihood of suicidal behaviour.

The role of defeat and entrapment in depression, anxiety, and suicide
Tailor et al.[23] propose an integrated suicide model with three phases. Defeat (phase 1) combined with entrapment (phase 2) may result in suicidal ideation/attempts (phase 3). According to the authors, defeat and entrapment have a much more powerful effect than other environmental stressors and psychological variables in the development of different mental disorders. For instance, defeat is strongly associated with major depressive disorder and PTSD.

A model of the suicide process based on experiental accounts
This model explains the trajectory from suicidal ideation to suicidal attempt considering several key factors throughout three phases. In phase 1, pain and hopelessness lead to passive suicidal ideation. In phase 2, the passive suicidal ideation will progress to a moderately structured suicidal ideation with increased planning if loss of connectedness occurs. In phase 3, the person has a high probability of attempting suicide if they have the capability.[10]

An integrated model of suicidal ideation in transcultural populations of Chinese adolescents
This model proposed by Leung et al.[24] describes three phases in which emotional competence, social problem solving, family functioning, and hopelessness interact and lead to suicidal ideation. The authors recruited 526 students aged 11–18 years from schools in Hong Kong and Shanghai to test this model.

A model of the suicide process based on experiential accounts
For Benson et al.,[25] suicide behaviour originates from a complex interaction between three factors across three phases. In the first phase of the model, the relevant factors considered were feelings of self-rejection, guilt, and uselessness. When painful events take place in this phase, the probability of suicide ideation/attempt increases. Another relevant factor in the initial phases is lack of trust. Lack of trust has to do with feelings of distrust or fear of rejection or abandonment. The next step is dominated by a phenomenon called suicidal exhaustion, a process of mental exhaustion in which the person feels resourceless and hopeless. This leads to isolation and an increasing justification of suicide ideation.

A biological model: circuits implicated in suicide
Lutz et al.[7] propose a biological model of suicidal behaviour that consists of three phases. The first phase is characterised by traumatic events in childhood. The second consists in factors such as anxiety or impulsivity and is closely related to suicidal behaviour. The suicide attempt can take place in the last phase. Around the first and second phases, there are mediating variables involved in the trajectory of suicidal behaviour such as neurotransmitter alteration. Also, the authors describe that overlapping phenotypes such as impulsive or aggressive personality are implicated in the increased likelihood of suicidal behaviour.

The integrated motivational-volitional model of suicidal behaviour (IMV)
This is one of the most recent and widely accepted theoretical models for suicidal behaviour. The model synthesises a large number of variables previously described in other models. According to the IMV, suicide is a process made up of three phases in which different mediating factors are involved. In this process, three phases are distinguished. In the premotivational phase, biology, genetics and early traumatic events play a role in predisposing the individual towards suicidal behaviour. In the motivational phase, suicide ideas and plans begin to develop due to the influence of negative feelings such as defeat, humiliation, and entrapment. Finally, in the volitional phase, precipitating factors such as access to means or impulsivity lead to a suicide attempt.[26]

The reinforcement model of suicidality
Hennings[27] proposes a three-phase model that explains the variables related to non-suicidal self-injury, suicidal ideation, and suicide attempts in BPD. In phase 1, stressful events occur and trigger surprise and fear. This activates irrational patterns and beliefs from childhood and causes feelings of hopelessness, helplessness, and fear/panic. In

phase 2, the negative reinforcement system triggers suicide as an escape to find peace and decrease pain. In the short term it increases control and a sense of calm, but in the long term it confirms childhood beliefs and patterns. Suicidal behaviour occurs in phase 3. Suicidal behaviour is related to a change in the activity of certain brain areas and hormones, fearlessness about death, and tolerance of pain.

The stress-diathesis model of suicidal behaviour

Mann et al.[28] designed a two-phase integrative model that explains suicidal behaviour. This model emphasises the power of epigenetics. Traumatic experiences in childhood and adulthood combined with the vulnerability of the patient's genome can cause impairment of brain and hormonal activity. In phase 1, internal triggers activate the patient's pathology and stressful events. The synergistic effect that occurs with other factors such as subjective stress and impaired decision-making can lead to the suicidal behaviour in phase 2. Among others, deregulation in HPA or noradrenergic and serotoninergic dysfunction contribute to the exacerbation of the previously mentioned factors.

Discussion

Summary of results

The theoretical models identified here are very diverse in nature, which makes it difficult to compare their conceptualisations of suicidal behaviour. Fig. 2 shows our unified theoretical model of suicidal behaviour, which groups the findings of the different models reviewed. In this unified model, we show three phases of suicidal behaviour and their corresponding groups of factors, i.e. predisposing factors (phase 1), precipitating factors (phase 2), and triggers (phase 3).

The suicidal trajectory

Factors associated with suicide can play their role in different phases of the suicidal trajectory. Few of the reviewed studies explore short-term risk factors of suicidal behaviour. In fact, one of the reported deficiencies in suicide research concerns the investigation of the precipitating factors of suicidal behaviour.[29] Most studies rather focus on long-term factors. In suicidal behaviour, which exhibits great variability and often requires acute intervention, this may not be an optimal approach. Different factors may play a predominant role in some of the phases along the suicidal trajectory and not in others. For example, the motivational-volitional[26] model explains the evolution of suicidal behaviour by referring to three phases. In the first phase, the authors highlight biology, genetics, and stressful events, and in the second and third phase the factors of defeat and humiliation and entrapment seem key.

Fig. 3 shows the classic trajectory of suicidal behaviour (passive suicidal ideation, active suicidal ideation, and suicide attempt) and the factors that are most prominently associated with each phase.

The possibility of a non-linear trajectory of suicidal behaviour should also be taken into account. Classically, suicide ideation is considered a requisite previous step to plan suicide, which, in turn, is a necessary precursor to a suicide attempt. However, the wish to be dead can be the only kind of ideation that precedes a suicide attempt, as these variables have been associated with an important risk for suicide attempt even without mediating active suicide ideation.[30]

Suicide phenotypes

Different kinds of suicidal behaviour are sometimes understood as steps along a linear path that begins with the desire to die and culminates with death by suicide. However, several authors consider the existence of subpopulations of suicidal patients, which may overlap but that are intrinsically different.

There may be important differences between attempters who complete suicide and those who carry out a non-fatal attempt. For example, DeJong et al.[31] found significant differences between suicide completers and non-fatal attempters in terms of risk factors such as drug abuse or financial problems. Joo et al.[32] found that suicide completers used more lethal methods and had a more severe clinical profile. There are few studies that focus on such differences, and it may be worthwhile to perform a more accurate analysis of the variables involved and introduce them in future models. Another relevant subtype is that of major repeaters, consisting of patients who attempt suicide multiple times, usually with methods of low lethality. This subtype has been associated with certain factors, such as female gender, diagnosis of a cluster B personality disorder, lower education, and a history of childhood abuse.[33,34]

Factors associated with suicidal behaviour

One common variable appearing in most models is that of traumatic childhood experiences. Traumas, such as neglect or physical and sexual abuse, have a great impact on the child's mental health, causing emotional dysregulation, low self-esteem, and perceived burdensomeness, among others.

Feelings of defeat and entrapment are also very relevant and can lead to the perception that suicide is the only escape. At the biological level, dysregulation in serotonin levels, as well as an imbalance in cortisol and glutamate levels, could be involved in the development of such negative feelings.[7,17,21,26]

Moreover, factors do not exert a single influence, but rather interact with each other. Authors have described a synergistic interaction between certain risk factors, such as childhood trauma and traumatic life events. Thus, people who have suffered some kind of childhood trauma would be much more vulnerable to the effects of traumatic life events in adulthood.[35] The theory of learned helplessness may help explain this interaction.[34] Additionally, genetic vulnerability has also been found to increase the effect of some risk factors, including childhood abuse.[36]

There may also exist a synergistic action between sleep disturbances and several other risk factors. If, in addition to a predisposing mental health state, the individual suffers from insomnia, their capability for suicide may be acutely increased, likely the effect of an increase in impulsivity and an impaired decision-making process.[37]

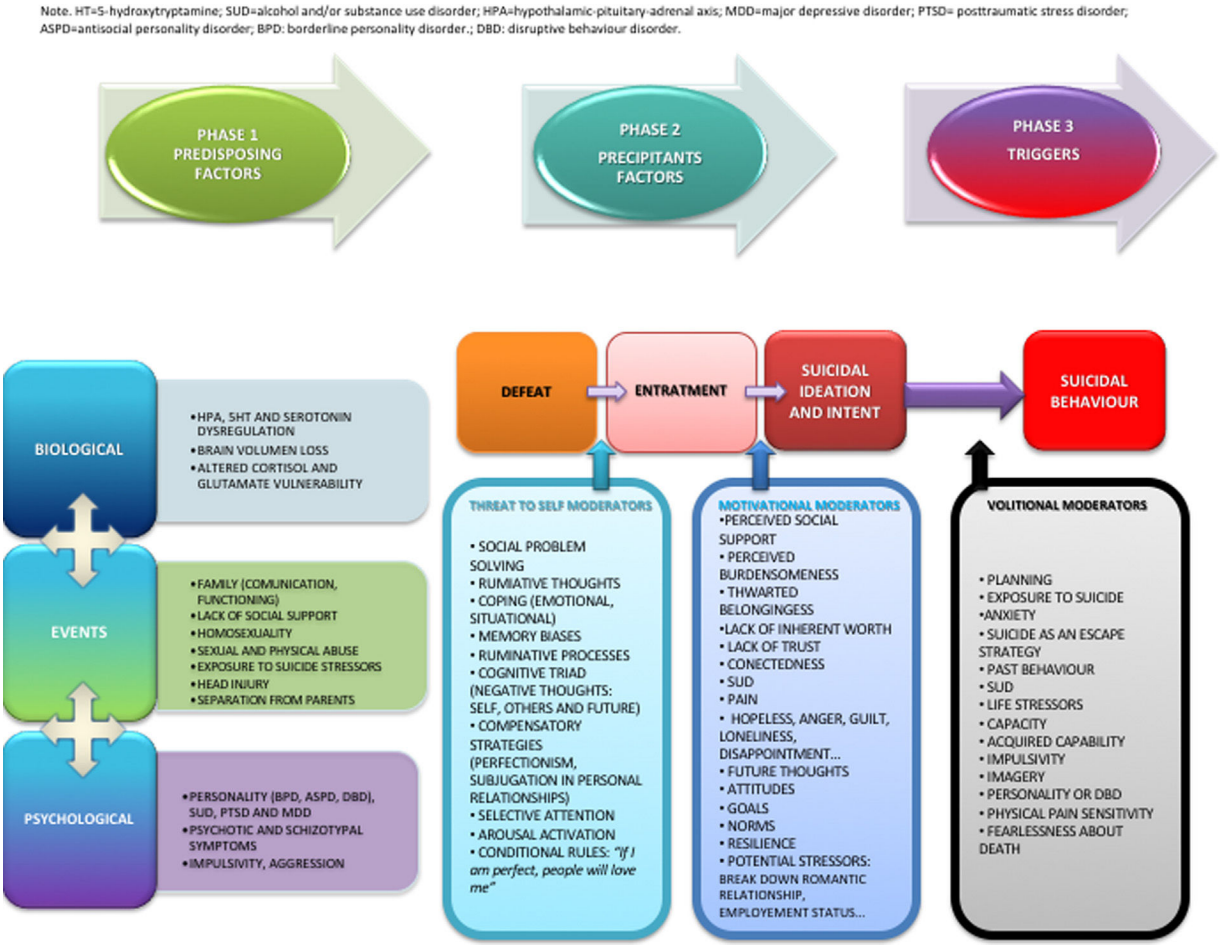

Figure 2 Unified theoretical model of suicidal behaviour.

Some of the studies discussed in this section focus on certain psychiatric diagnoses in particular. Soloff et al.[22] and Hennings et al.[27] explore the variables that determined suicidal behaviour in people with BPD. Others, while being models of a general scope, revealed particularities affecting certain psychiatric diagnoses. This is the case of the SAMS model by Johnson et al.,[21] which described how the study variables had a greater impact on people with PTSD. Both BPD and PTSD share a history of traumatic event, which in the case of PTSD is mandatory for diagnosis, while in BPD it is highly common.[38] These diagnoses are among those with the highest risk of suicide,[39,40] so the development of explanatory models of suicidal behaviour adapted to these conditions is of special interest for suicide prevention.

Future directions

Further studies should aim to clarify and refine existing models and the variables involved in suicidal ideation and attempt, which would lead to a more specific and concrete model of the psychological elements of the events and factors preceding suicidal behaviour. As De Leon et al.[8] pointed out, no single theory can explain this behaviour entirely, so future models should account for as many factors as possible. In our opinion, the revised framework that most closely achieves this aim is the motivational-volitional model.[26]

Although research continues to find more and more variables involved in the ideation of suicidal behaviour, it is imperative to examine the two-way and three-way interactions of theory constructs (e.g. psychological, biological), since the power of each association has not been sufficiently elucidated. In addition, there is a pressing need for longitudinal designs, since most of the original studies reviewed are cross-sectional studies, with the subsequent recall bias and difficulties establishing causality.

Implications for clinical practice

It is important for mental health professionals and clinicians to further assess patients who present posttraumatic psychopathology and distress. There are many risk factors associated with suicide, but not all of them are amenable to intervention. Through different psychotherapeutic approaches we can target some of these factors, such as the consequences of traumatic childhood experiences. Bryan et al.[39] found that rates of suicidal ideation decreased when patients received trauma-based therapy. Therefore, it is important to include therapy based on attachment and

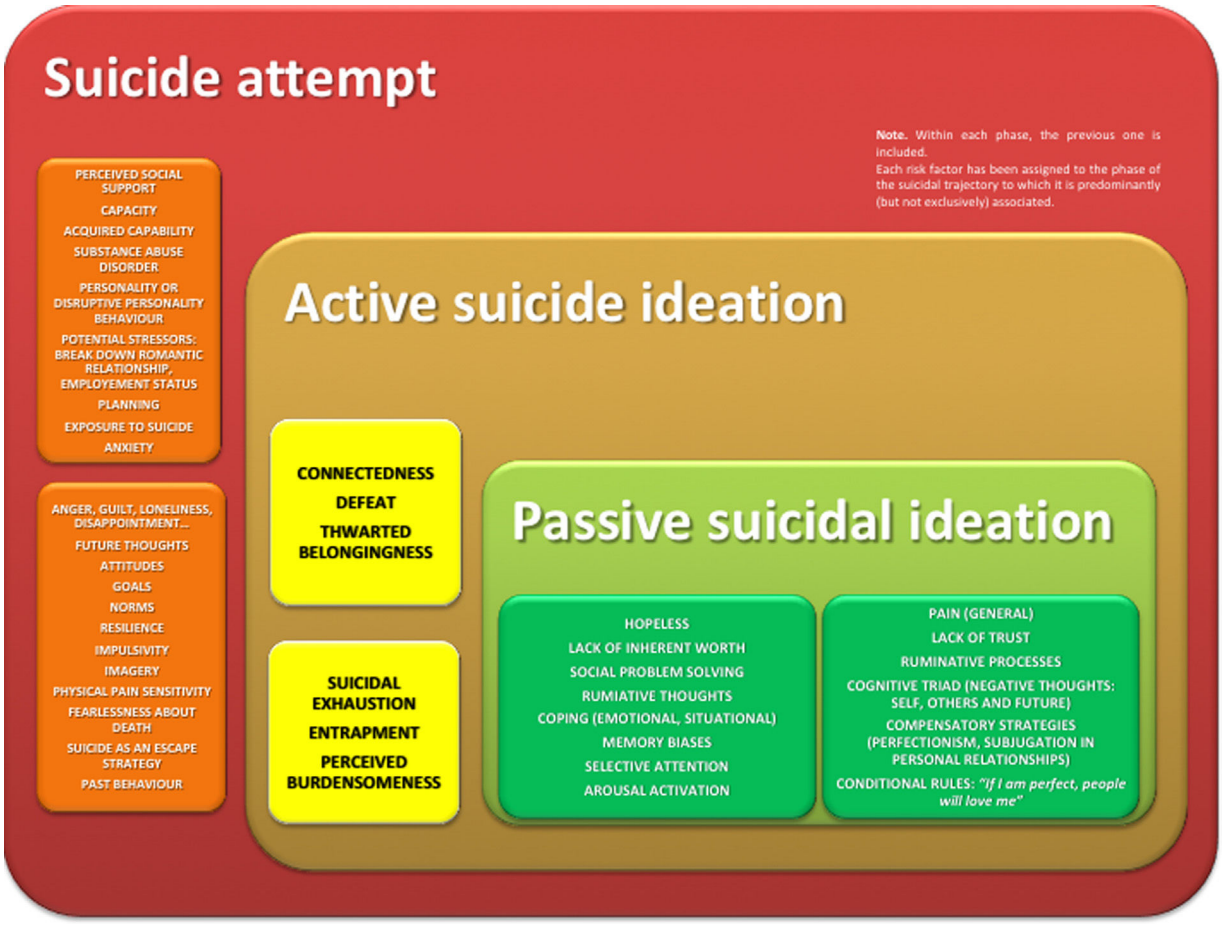

Figure 3 Classic trajectory of suicidal behaviour and factors most prominently associated with each phase.

trauma in this type of patients, in which the vast majority present complex trauma.

Finally, perceptions of defeat and entrapment are common to many models of suicide; perhaps these elements should be emphasised in therapy. For instance, a study explored the association between feelings of defeat and entrapment and the bond forged between nurses and mental health patients. Fifty inpatients were recruited. They completed questionnaires concerning demographics, feelings of defeat and entrapment, suicidality, and alliance with their nurse. The authors found a correlation between nurse-rated bond and external entrapment,[41] suggesting that it is crucial that clinicians forge a strong alliance with their patients.

Culture seems to play a fundamental role in suicidal behaviour. For example, in Chinese culture family is of utmost importance[23] as is perceived social status.[4] If patients present serious problems in these areas as well as other moderating variables, they may develop suicidal behaviour. Therefore, culture should be taken into account in future models of suicide, including different culturally specific variables in their studies.

Limitations

Our findings should be evaluated alongside certain limitations. Firstly, the concept of the theoretical model is not universally established in the scientific literature, so the definition used is not standardised. Also, the number of articles included is small and its design is heterogeneous, which precludes quantitative synthesis of the results. Finally, we have carried out the search in only two databases.

Conclusions

Suicide is a complex phenomenon involving many risk factors. Among the most relevant factors are childhood trauma and perceptions of defeat and entrapment. The synergistic effect between all the variables involved could be of significant importance.

Ethical considerations

Non applicable.

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Conflict of interest

None declared.

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