Understanding suicidal ideation and behaviour in individuals with chronic pain: A review of the role of novel transdiagnostic psychological factors

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Summary

Individuals with chronic pain are at elevated risk of suicide, yet psychosocial factors that may be involved in increasing or decreasing vulnerability for suicidal ideation and behaviour have received little attention. Extant literature on the topic of suicide in individuals with chronic pain only incorporates a limited number of the wide array of known vulnerability and protective factors from the field of suicide research. The current review focuses on transdiagnostic psychological processes, i.e. processes of relevance for both chronic pain and suicide. We synthesize a selection of the previous literature on chronic pain and suicide, concentrating on previously unexplored and underexplored lines of research, including future orientation, mental imagery and psychological flexibility. A far greater degree of cross-pollination between the fields of chronic pain and suicide research is required if we are to progress in our understanding of why some people with chronic pain become suicidal and others do not.

Introduction

Individuals with chronic pain are a high-risk group for suicide[1]; lifetime prevalence is estimated to be 23% for suicidal ideation and 15% for suicide attempts[2], with other studies finding 5-23% of individuals with chronic pain have attempted suicide[3, 4]. A large register-based study from Denmark found the incidence rate ratio of suicide attempt in those with chronic pain to be almost fourfold higher than individuals in the general population without chronic pain.[5] Many individuals with chronic pain experience psychological distress, and/or have access to means (for example, via rising rates of prescription opioids[6, 7]), yet, only a proportion die by suicide. This raises questions about why some individuals with chronic pain think about suicide whereas others do not, and why amongst those who think about suicide, only some go on to take their lives.

Given the high comorbidity between chronic pain and mental distress, including suicidality, one largely unexplored area is the role of transdiagnostic psychological factors and processes. That is, common factors that underlie both issues[8]. Here, we specifically use the term to refer to factors and processes that contribute to chronic pain and suicidality independently, but that may also contribute to their comorbidity. Several previous reviews have begun to consider the role of psychological factors as they contribute to suicidality in those with chronic pain[4, 9-12]. This review expands on previous work, by drawing upon all three predominant "ideation-to-action" theoretical models of suicide: the Interpersonal Psychological Theory[13, 14], the Integrated Motivational-Volitional model[15, 16], and the Three Step Theory[17].

It is important to highlight that ideation-to-action models of suicide emerged from a shift in thinking around the role of psychiatric disorders as the central risk factor for suicidal behaviour. Indeed, recent research has demonstrated that depression does not differentiate between individuals with suicidal ideation and those who make attempts[18, 19]. Previous reviews have also highlighted the need to move beyond psychiatric disorder when seeking to explain the relationship between chronic pain and suicide[10, 11]. For this reason, in the current review we have focused on transdiagnostic psychological factors rather than psychiatric disorder.

First, we discuss these theories in relation to suicidal ideation and behaviour in chronic pain. We go on to highlight the potential for further cross-pollination between the fields of suicidology and chronic pain research, by focusing on previously under- and unexplored factors with transdiagnostic relevance for suicide and chronic pain. Finally, we consider the methodological challenges evident in this field and discuss the implications for future research and considerations for clinicians working with individuals with chronic pain.

Suicide and chronic pain: The theoretical context

Psychosocial models of chronic pain, such as the Fear-Avoidance Model[20], have said little to nothing on the topic of suicide, although recently the Psychological Flexibility model of chronic pain[21] has been specifically applied to the context of suicide in this population[22]. The three predominant, "ideation-to-action" psychological models of suicide, the Interpersonal Psychological Theory[13, 14], the Integrated Motivational-Volitional model[15, 16] and the Three Step Theory[17], have also been relatively silent on the topic of chronic pain. The Three Step Theory explicitly mentions the role of pain (either physical or emotional) in the suicidal process. The Interpersonal Psychological Theory includes elevated tolerance for physical pain under the umbrella of acquired capability, whereby repeated exposure to painful and provocative events increases an individual's tolerance for physical pain thus endowing an individual with the capability to withstand the pain of using lethal means in a suicide attempt. The updated Integrated Motivational-Volitional model now includes (reduced) physical pain sensitivity as a volitional phase variable in conjunction with acquired capability. See Panel 1 for a summary of the models. For further discussion and comparison of the models, see Klonsky et al.,[23].

Search strategy and selection criteria

To identify literature addressing relevant transdiagnostic psychological factors we first reviewed the Interpersonal Psychological Theory[13, 14], the Integrated Motivational-Volitional model[15, 16], and the Three Step Theory[17] in order to derive a list of search terms reflecting psychological factors linked to the development of suicidal ideation and behaviour in adults. These terms were then supplemented with a

parallel list of terms reflecting similar factors explored within the adult pain literature. Finally, these were combined with “chronic pain”, “persistent pain”, “pain” and “suicid*” to identify articles that explored the role of each of the potential psychological factor in people with chronic pain, and people with suicidal thoughts and behaviours, as well as literature exploring their role in the development of suicidal thoughts and behaviours in those with chronic pain specifically. See Panel 2 for further details. Our review includes studies of suicidal ideation, suicide intent, suicide attempts and suicide deaths, as well as studies of self-harm. The latter group may also include some individuals who engaged in non-suicidal self-harm, however, as motivation for engaging in self-harm is known to fluctuate, we have included these studies here. Due to space constraints, the current review does not contain an exhaustive discussion of all psychological variables that have been explored in each of these literatures, nor does it present a full systematic or scoping review. Rather, the aims were: 1) to highlight new research directions; 2) to generate new hypotheses; and 3) to stimulate discussion regarding potential targets for research and intervention development within the context of suicide and chronic pain. We have therefore focused only on factors represented in *both* the chronic pain and suicide literature. For example, the concept of future orientation (and overlapping constructs) has been investigated in relation to suicide and to chronic pain, and was included. Exposure to suicidal behaviour of others has been investigated only in relation to suicide, not chronic pain, so was not included. Other reviews have covered the topics of pain intensity, duration and type[4, 9, 10, 12]. As we focus on psychological factors, we have not included these within the current review. Please see Panel 2 for further details of our search strategy, including a link to our data and materials, available on the Open Science Framework (https://osf.io/6upka/).

Results

Our review highlights a number of transdiagnostic psychological factors that have been associated with both chronic pain and with suicidal ideation and/or behaviour. The first three: burdensomeness, belongingness, and mental defeat have been addressed in previous reviews of the pain and suicide

literature[2, 4, 9, 12], but are briefly discussed here to provide a context within which other emerging factors can be considered. See Panel 3 for a description of our newly proposed factors for future research and their theoretical context. Studies used a range of samples, drawing on data from population cohorts, clinical samples (including those attending chronic pain clinics, and those attending hospital following an episode of self-harm) as well as samples of university students and individuals drawn from the local community. Details of the sources from which participants in cited papers were drawn are provided in supplementary Table 1, available on our OSF page.

Perceived burdensomeness and thwarted belongingness

Suicidology: Two related constructs, emerging from the Interpersonal Psychological Theory model, and extensively researched within the field of suicidology are perceived burdensomeness and thwarted belongingness. Perceived burdensomeness refers to the belief that one is a burden on others and society at large, whilst thwarted belongingness refers to an unmet need for social connection. It is suggested that experiencing both of these factors leads to the emergence of suicidal ideation[8, 9]. Research findings confirm the associations between suicidal ideation and both perceived burdensomeness and thwarted belongingness individually[24], even when controlling for depression[25,26]. However, studies do not always provide support for the hypothesized synergistic relationship, thus whilst both factors appear to play a role in suicidal ideation their precise associations are complex and may differ according to the population in question.

Chronic pain: Thwarted belongingness and perceived burdensomeness are also potentially salient psychological factors for people with chronic pain. Indeed, research shows that whilst those with acute pain and chronic pain reported greater self-perceived burden than community non-patients without pain, these feelings were more pronounced in those with chronic pain [27]. However, despite their broader relevance to chronic pain, these constructs are most frequently used in relation to their associations with suicidality. For example, Fishbain et al[27] showed that in people with chronic pain self-perceived burdensomeness was associated with five types of suicidality (including suicidal ideation and attempts),

whilst Wilson and colleagues[25] found that perceived burdensomeness, but not thwarted belongingness, was cross-sectionally associated with suicidal ideation in individuals with chronic pain.

Defeat (*and Mental Defeat*)

Suicidology: Within suicide research, defeat is characterized as "failed struggle" and a loss of status[28]. Feelings of defeat have been shown to be significantly elevated in individuals with a history of self-harm thoughts or behaviours, relative to those without[29, 30], even when controlling for depressive symptoms and hopelessness[29]. However, feelings of defeat do not differentiate those who think of self-harm from those who act on their thoughts in multivariable analysis, suggesting that this construct is more important in motivating people to think about suicide, rather than in increasing their propensity to act on suicidal thoughts.

Chronic pain: To our knowledge, there has been no investigation of the general construct of defeat in individuals with chronic pain. However, a related, more context-specific construct, 'mental defeat', *has* been explored in chronic pain populations. In the pain field, mental defeat is defined as negative beliefs about the self which result from the experience of chronic or persistent pain[31, 25 32]. It is negatively associated with pain self-efficacy in individuals with chronic pain, when controlling for depression and anxiety symptoms, hopelessness and pain catastrophizing, but has only been associated with the affective component of pain symptomatology[33]. Mental defeat is also a strong correlate of pain interference, depression and psychosocial disability in people with chronic pain, with 44% of the variance in depression explained by mental defeat[32]. Additionally Tang et al[3], demonstrated that mental defeat was a stronger correlate of worst-ever suicidal intent among individuals with chronic pain, (compared to anxiety, depression and pain catastrophizing), and that the combination of mental defeat and pain intensity contributed more variance to worst-ever suicide ideation than pain intensity alone[3].

Given that mental defeat is associated with suicidal intent in individuals with chronic pain [3] and that numerous studies have demonstrated an association between defeat and suicidal behaviour[29, 30, 34], a

logical next step is to investigate whether individuals with chronic pain also exhibit elevated levels of general defeat, and whether general defeat is associated with suicidal ideation and/or behaviour in this population. Assuming at least a degree of overlap between mental defeat and defeat, (half the items in the Pain Self Perception Scale - the 24-item questionnaire used to assess mental defeat - are drawn from the defeat measure, the 'D-Scale'[28]) it would be expected that mental defeat would function in a similar way to the broader construct. Within the Integrated Motivational-Volitional model[16] this would suggest that mental defeat would act as a motivational phase variable, and that the relationship between mental defeat and suicidal ideation would be mediated by feelings of entrapment (see O'Connor & Kirtley [16]). These are empirical questions that should be directly tested, preferably in prospective studies.

Transdiagnostic factors involved in suicide in chronic pain

Having briefly outlined the three factors that have been addressed in previous reviews of the pain and suicide literature, we turn our attention to three novel factors: future orientation, mental imagery, and psychological flexibility. These represent new potential lines of inquiry, which have either been under- or completely unexplored in relation to suicidal thoughts, attempts or deaths in chronic pain.

Future Orientation

One of the areas that appeared to have the most significant overlap between the chronic pain and suicide literatures was that of future oriented constructs [35-37] and goal adjustment[38] in suicidology, and the literature on future thinking[39], possible selves and self-pain enmeshment[40], self-discrepancy and goal management[41, 42] from the chronic pain field.

Several studies suggest that individuals who have experienced suicidal ideation or self-harmed have difficulties in aspects of positive future thinking, relative to those who have no history of self-harm thoughts or behaviours, and that these difficulties are potentiated by negative mood[35, 37]. Likewise having a low belief in a changeable future (e.g. that things can change for the better) has also been associated with suicidal ideation[43]. The content of positive future thoughts is also crucial. *Inter-* as opposed to *intra-*personal positive future thoughts (e.g. 'to find a life-partner' versus 'to be less anxious') provide greater

protection against future self-harm behaviour[36], possibly because intra-personal positive future thoughts are often indicative of a desire to change aspects of self. Such an interpretation is consistent with the observation that higher levels of self-discrepancy (discrepancy between a person's current self-representation, and their ideal and ought self-representations) are associated with depression, hopelessness and, through these mechanisms, suicidal ideation in young adults[44].

Chronic pain frequently makes previously valued goals difficult to pursue, disrupts social role functioning and places huge challenges on people's self-regulatory abilities, their view of themselves and how they envisage the future. A number of studies have thus examined different aspects of future oriented thinking in those with chronic pain. For example, Rusu and Pincus[39], studied future thinking in patients with depression, pain, both conditions, or neither and showed that individuals with depression, with and without chronic pain, generated more negative and fewer positive future thoughts. Those with pain, with or without depression, generated more *positive health-related* future thoughts (for example related to future resolution of pain) than pain and depression-free controls.

Other research has explored aspects of current and future self-concepts or schemas in those with pain. For example, patients with chronic pain who show stronger implicit associations between their self and pain schemas also reported greater suffering, pain severity and anxiety[45]. Likewise, people with chronic pain whose hoped-for selves were highly contingent upon being pain-free (self-pain enmeshment), were also more depressed and less accepting of their pain[40]. These studies collectively suggest that both seeing pain as central to one's current self and wishing for that situation to be different in the future are associated with distress. Such beliefs may also be associated with persistence of pain. For example, alongside baseline pain intensity, a person's belief that their pain will continue in the future, predicts the continuation of that pain at six month and five-year follow-up[46]. In contrast, the greater a person's reported ability to flexibly adjust their personal goals, the weaker the relationship between their level of self-discrepancy (perceived distance between current self and desired self) and their depression symptoms[47], and the better their adaptation to arthritis[41].

Despite the interesting research being conducted independently in the suicide and chronic pain fields into the role of future oriented cognition and self-regulation, to the best of our knowledge no studies to date have explicitly examined the association between future oriented thinking, aspects of self-regulation and the occurrence of suicidality within chronic pain. The research above suggests that this may be a fruitful avenue for the future.

Mental imagery

Paralleling work in other disorders, research has demonstrated the presence of vivid multisensory suicide-related imagery in people with a history of suicidal ideation or behaviour[48, 49] commonly characterised by future-oriented cognitions focused on suicidal acts and their aftermath. Studies suggest that the 'realness' and preoccupation with suicide-related imagery at times of crisis, as well as levels of imagery-related distress and comfort are associated with the severity of 'worst ever' suicidality[48, 49]. Furthermore, the presence of future-oriented suicide-related images is associated with more severe current suicidal ideation in suicidal samples[50], and suicide-related imagery differentiates those who ideate about suicide from those who have attempted suicide[21].

Research has also explored the presence of mental imagery in people with chronic pain [51-53], considering both people's images of pain itself and the presence of a broader array of mental images experienced in the context of pain. For example, more than 80% of chronic pain patients describe vivid, frequent and distressing images of their pain[44]. Similarly, a high proportion of people experiencing pain reported frequently occurring, negative and catastrophic images of themselves in pain and of the circumstances around their pain (including, but not limited to, future-oriented images of worsening disability, incapacity, and burdensomeness)[52]. Research shows that induced recollection of these latter images leads to increases in anxiety, sadness, and anger, reductions in calmness and happiness, as well as an increase in the perception of pain.

In summary, extant research to date suggests that pain-related mental imagery increases both acute pain experience and distress, and the perceived probability of imagined future scenarios occurring. Such imagery may also exacerbate functional impairment and associated deleterious psychological factors, such as perceived burdensomeness, that have been associated with the development of suicidal ideation in chronic pain. To the best of our knowledge research has not examined the extent to which pain-related and suicide-related imagery co-occurs in individuals with chronic pain and suicidality, nor the degree of overlap between pain-related mental imagery and the other aspects of future-oriented thinking and self-regulation discussed above. Mental imagery has been proposed to function as an 'emotional amplifier' in bipolar disorder[54], and it is possible that the propensity to experience vivid mental imagery is a transdiagnostic factor that contributes both to the impact of pain and to the development of suicidality.

Psychological flexibility

The Psychological Flexibility model has produced a burgeoning literature in chronic pain research. In practice, it is often presented in the form of Acceptance and Commitment Therapy (ACT). Psychological flexibility refers to a functional contextual approach comprising six key elements: acceptance, cognitive defusion, self-as-observer, present-focused attention, values, and committed action. The cultivation of these skills and values is considered to characterise adaptive psychological functioning. See McCracken and Morley[21] for a comprehensive overview and discussion of psychological flexibility in chronic pain.

One of the core elements of the psychological flexibility model, acceptance, refers to the degree to which an individual is willing to remain present with their unwanted experiences rather than trying to eradicate or avoid them. Longitudinal research has found that higher levels of acceptance predict lower levels of depression and pain over time[55] and that general acceptance as opposed to pain-specific acceptance, significantly explains variance in patient functioning[56]. Ecological momentary assessment provides a method for assessing behaviours arising in individuals' daily-life context and one such study involving

individuals with a spinal cord injury has demonstrated that when pain intensity is high, momentary pain interference is greater in the context of low acceptance[57].

A number of the constructs within the psychological flexibility model are also present within other 'third wave' cognitive behavioural approaches that have been applied to people experiencing suicidal thoughts or behaviours (e.g. Dialectical Behaviour Therapy[58], Mindfulness-Based Cognitive Therapy[59]) and research is also beginning to explore the role of the psychological flexibility constructs as they relate to suicidality outside therapeutic contexts. These studies suggest that, as in the case of pain, aspects of psychological flexibility may be protective against suicidal ideation in individuals who are experiencing distressing emotions[60].

Recently the first study was conducted to directly investigate the role of psychological flexibility in the suicidal ideation – chronic pain relationship[22]. This study suggested that in multivariable analysis acceptance and committed action (a willingness to be with unwanted experiences such as pain and the capacity to continue to act in accordance with valued life goals, even in their presence) remained significantly associated with suicidal ideation even when controlling for depression, pain interferences and presence of widespread pain. These constructs are clearly linked to issues of future orientation, self-regulation and identity discussed earlier in this section[40, 41, 47, 61] and are likely to be key aspects of learning to live with chronic pain. Future research should consider exploring the role of psychological flexibility in relation to future orientated constructs in suicide, both in individuals with and without chronic pain.

Key directions for the future

Towards shared concepts and terminology

Our review focused on potential transdiagnostic psychological processes that are associated with both chronic pain, and suicidal ideation or behaviours. We have identified three promising areas for future research (see Panel 4 for a summary), but there is considerable conceptual overlap between them. There is clear commonality between future orientation, mental imagery and components of psychological

flexibility. Furthermore, defeat and mental defeat also overlap. The lack of cross-pollination between the fields of chronic pain and suicide research is evidenced by the fact that these undoubtedly overlapping research lines exist in parallel, but are progressing almost entirely independently. Furthermore, where factors share some higher order similarity but have been operationalised in different ways both within and across fields, it remains to be seen whether it is possible and useful to address higher order factors that may represent common processes across chronic pain and suicidal ideation/behaviour or whether context specific measures are more useful.

To be greater than the sum of its parts, research on suicide in people with chronic pain must bridge disciplinary boundaries and work towards common terminology, conceptual, theoretical, and methodological ground.

Investigating causality and capturing dynamic processes

One key finding from the literature review was that whilst there is a noticeable dearth of prospective research in both chronic pain and suicide research generally, this is perhaps even more apparent in the context of research on suicidal ideation and behaviour in chronic pain. The vast majority of the work in chronic pain and suicide research has employed cross-sectional, self-report designs, with variable levels of control for factors such as depression. Without prospective research, major questions regarding the causal role of potential psychological factors, and their predictive power after accounting for depressive symptoms, will remain unanswered. Indeed, as theoretical models of suicide propose specific temporal relationships between certain variables, it is vitally important that these be tested in prospective, longitudinal studies that enable hypothesized temporal relationships to be interrogated. In order to better assess context-specific effects of psychological factors on suicidal ideation and behaviour, the field would benefit from greater use of experience sampling methodology. Currently, however, this is an underused method in suicide research[62]. This technique enables investigation of dynamic psychological processes in individuals' everyday lives, including variability within as well as between participants[63]. For example, one could investigate whether greater within-participant variability in pain intensity was

predictive of higher levels of defeat and subsequently, suicidal ideation, after accounting for fluctuations in negative mood.

Ideation-to-action frameworks: Opportunities and challenges

A second key observation was that the majority of studies in this area have investigated suicide ideation, with fewer focusing on attempts and deaths, and few studies of people with chronic pain have *directly compared* individuals with ideation and those who have made attempts. Explicit adoption of ideation-to-action frameworks[23] is beginning to emerge[7] and could provide stronger and more comprehensive theoretical grounding for future research. Whilst ideation-to-action models of suicidal behaviour are a crucial advance in our conceptualization of suicide as a process, there may be specific challenges for their applicability in the context of chronic pain. In all three predominant models of suicidal behaviour acquired capability is a key differentiator between individuals who make a suicide attempt and those who do not. Limiting access to means of suicide is also one of the most well evidenced suicide prevention strategies[64, 65]. Not all individuals with chronic pain are prescribed analgesics, however, a recent study using data from the US National Violent Deaths Reporting System found that 51.9% of individuals with chronic pain who died by suicide tested positive for opioids[66]. Despite this, opioid overdose was used as a suicide method in only 16.2% of cases[66]. This suggests that whilst access to potentially lethal analgesic medication is greater among individuals with chronic pain than the general population, it is not the most frequently used suicide method, and as such is unlikely to be the key factor differentiating those who make a suicide attempt from those who do not. The normalizing of physical pain may lead to increased fearlessness about death[67], and thus an increased capability to engage in the pain of using lethal means to try to end their own lives[11]. However, it is also possible that the experience of chronic pain, leads to greater catastrophizing and fear of death. As such, the issue of acquired capability and fearlessness about death within chronic pain populations considering suicide remains unknown. Another important consideration is whether these and other psychological factors function similarly in isolation and when combined with other factors. This is an empirical question and should be investigated in multivariable studies that can

address the question of whether specific combinations of factors are more or less deleterious for suicidal ideation and behaviour.

In our review, we have focused on recent studies and factors that have received attention within both the chronic pain and suicide literatures. Our review therefore, is highly selective, which is a potential limitation. Catastrophizing, for example, was not covered in the review, and has received huge attention in relation to chronic pain, and some in relation to chronic pain and suicide[68, 69], but none in suicide research alone. Whilst this review focused on transdiagnostic psychological factors, pain is nevertheless a complex biopsychosocial issue, the management of which requires close multidisciplinary collaboration. Therefore a potential limitation of the current review is that we did not include other relevant social and biological factors. Consequently, in the future it might be beneficial to adopt a similar approach to explore shared social and biological factors in suicide and chronic pain, as has been the case for research on the role of endogenous opioids in non-suicidal self-injury[70-72]. Finally, ideation-to-action frameworks - and suicide research in general - privileges risk factors and so our search likewise under-emphasised potentially important protective factors. Exploring factors that might protect against the development of suicidal thoughts and behaviours in chronic pain and exploring the extent to which these are distinct from protective factors for suicide more broadly, is an important area for future research.

Clinical considerations

A critical frontier for research in chronic pain and suicide is to ensure that research is *translatable* into practice, i.e. that it is feasible for insights from research to work "on the ground", in the clinic, and for theories to be tested in naturalistic contexts as well as in surveys or tightly controlled laboratory conditions. In this review, we focused on identifying transdiagnostic psychological factors and processes that contribute to chronic pain and suicidality. We did not include treatment studies. Our ability to make clinical recommendations is therefore limited. However, we do wish to draw clinicians' attention to factors identified in the research literature that we consider have the potential to become important issues for clinicians. See also Panel 5.

Our review highlights that although people living with chronic pain have an increased vulnerability to suicidal thoughts and behaviour[2], increased vulnerability does not equate to inevitability. Health professionals should not assume that a person with chronic pain will experience an increased vulnerability, but at the same time, they should not shy away from raising the topic of suicidality. Indeed, a recent meta-analysis by Blades and colleagues[73] showed that asking about suicide does not increase risk but has the potential to become an opportunity for suicide prevention.

Given the high prevalence of suicidal ideation and attempts among individuals with chronic pain, clinicians and allied health professionals working within chronic pain services should receive suicide prevention training. Clinicians should also be alert to signs from patients that they are feeling a burden and disconnected from others and unable to pursue valued goals/activities, as these factors have been associated with suicidal ideation. Future studies of chronic pain could routinely include assessment of suicidal ideation and behaviour to further develop our understanding. The evidence that we explored, however, does not allow us to make concrete and specific recommendations regarding interventions for people with CP who may be feeling suicidal, nor what the relative importance is of each of the transdiagnostic psychological processes we have identified within our review.

Conclusions

Research on suicide in people with chronic pain has yet to fully harness the rich spectrum of evidence from either discipline. Future research should focus on transdiagnostic psychological processes and our review, whilst selective, has highlighted three promising areas for further study: future orientation, mental imagery and psychological flexibility. Greater cross-pollination between the chronic pain and suicide research fields is essential if we are to rapidly increase our understanding of why some people with chronic pain consider suicide and how their difficulties can most effectively be addressed.

Contributors

OJK conducted the database searches and initial screening of papers. OJK, KR and CC screened abstracts and full texts, and selected studies for inclusion. OJK, KR and CC wrote the manuscript.

Conflict of interests

OJK, KR and CC have nothing to disclose

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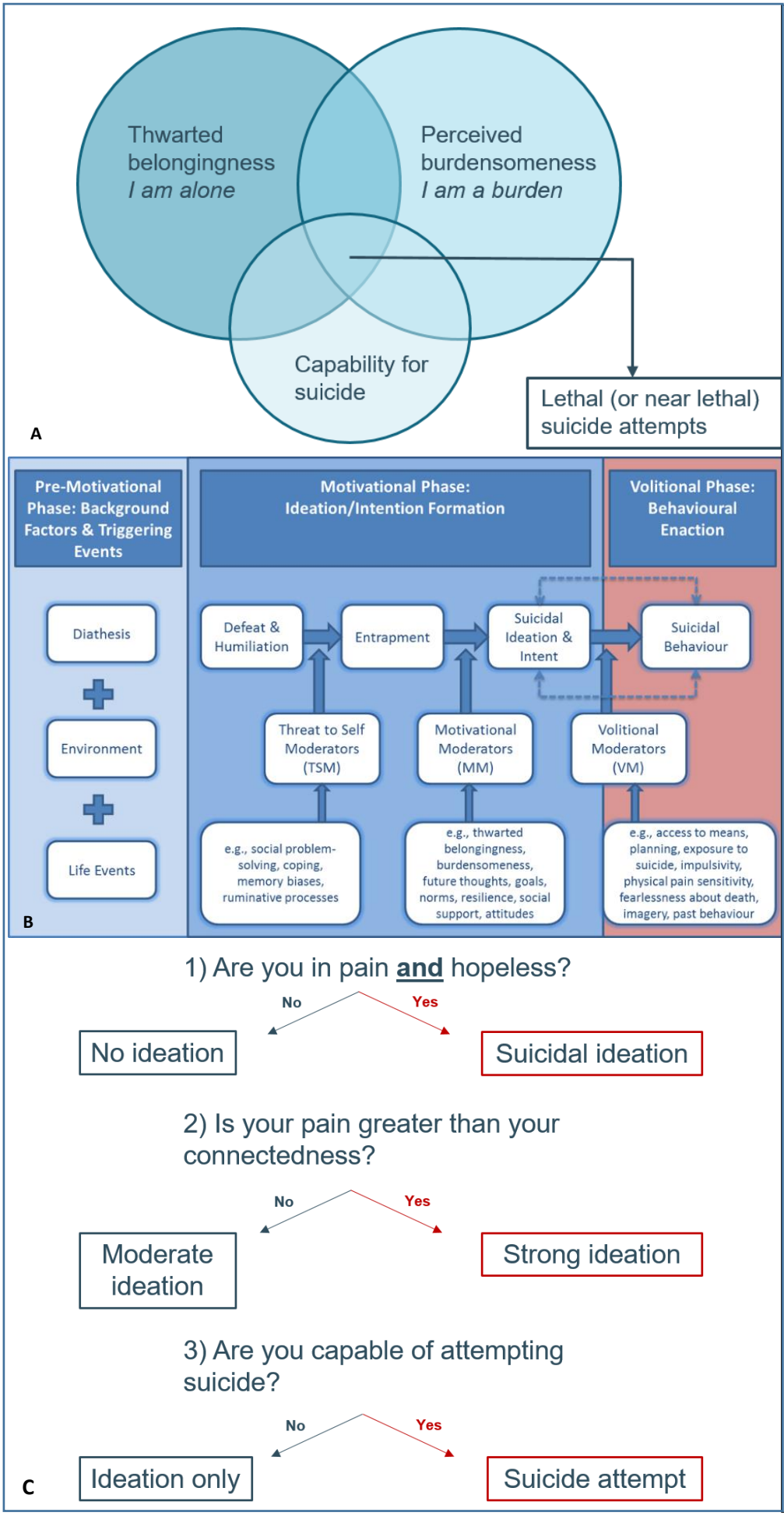

Panel 1. Ideation-to-action theoretical models of suicide

A) The Interpersonal Psychological Theory (Joiner, 2005; Van Orden et al., 2011)

B) The Integrated Motivational-Volitional model (O'Connor, 2011; O'Connor & Kirtley, 2018)

C) The Three Step Theory Klonsky & May, 2015)

Panel 2:

Search strategy

Studies were identified through a search of the Web of Science, EMBASE (including Medline), and PsycINFO databases for English language journal articles published within the last ten years (from 2008 – 2018). The search terms “chronic pain”, “persistent pain”, “pain” and “suicid*” were used to identify articles specifically relating to chronic pain and suicide. Our primary focus, however, was to conduct a broader search for studies that had investigated key variables which overlap with the fields of both chronic pain and suicide research. These variables (and search terms) were drawn from the three predominant contemporary theoretical models of suicide: the Interpersonal Psychological Theory[13], the Three Step Theory, and the Integrated Motivational-Volitional model[16]. The full list of search terms, database hits, and search dates is available on the Open Science Framework at https://osf.io/6upka/ alongside a summary of the included studies and the samples on which they drew. After duplicate removal, our search returned 21,392 hits. OJK screened these records to produce a short-list of 713 abstracts, which were then screened by all three authors, yielding 152 full texts, of which 52 were included. These were supplemented by a further 17 papers added during manuscript revision and the peer review process. Given the volume of search hits returned, we subsequently limited our focus to adults. We included studies without limitation to specific pain conditions, and based on their quality and the extent to which they cover topics of relevance to both chronic pain and suicide. We excluded treatment studies and studies of active duty or veteran military personnel, as this is a highly specific population, where chronic pain is commonly subsequent to polytrauma and accompanied by PTSD. Studies focusing exclusively on migraine were also excluded, as this condition is qualitatively different to other types of chronic pain, such as musculoskeletal pain.

Panel 3

New directions for research on chronic pain and suicide emerging from the review

Novel transdiagnostic psychological factors associated with suicide and chronic pain in the current review

• Future orientation
  ○ Future thinking
  ○ Possible selves
  ○ Self-discrepancy
  ○ Self-pain enmeshment
  ○ Goal adjustment
• Mental imagery
• Psychological flexibility
  ○ Acceptance
  ○ Values
  ○ Committed action
  ○ Self-as-observer
  ○ Present focused attention
  ○ Cognitive defusion

Panel 4

Key future directions for research

- Future research may benefit from a focus on transdiagnostic psychological processes that are common to both individuals with chronic pain and those experiencing suicidal ideation or behaviour.
- Perceived burdensomeness, thwarted belongingness, defeat/mental defeat, future orientation, mental imagery and psychological flexibility have been identified as promising lines for future research on chronic pain and suicide.
- Longitudinal research and research using emerging methods such as experience sampling methodology / ecological momentary assessment is crucial in order to make progress in understanding the complex nature of causal associations between chronic pain and suicidality, and the psychological processes that underpin these phenomena.
- Further applications of ideation-to-action frameworks to understand the evolution of suicidality in chronic pain may lead to substantial advances in our conceptualisation of this clinical problem. Cross-pollination of research between the fields of chronic pain and suicide research is urgently needed
- Recommendations emerging from future research should not lose sight of the psychosocial context of people living with chronic pain and the constraints facing clinicians who support them.

Panel 5

Clinical considerations

Important reminders of established clinical considerations

- Asking someone about suicide/suicidal behaviour will *not* act as a trigger for them to take their own life. At worst, the health professional shows that they care enough to ask and at best, a conversation opens up and creates an opportunity to interrupt the suicidal thought processes.
- People living with chronic pain have an increased vulnerability to suicidal thoughts and behaviours (though this is *not* inevitable), therefore clinicians and allied health professionals working in specialist pain services should receive training in suicide prevention.

Factors identified as part of this review that could translate from research to practice:

- ***Future Orientation:*** People who have experienced suicidal ideation or who have self-harmed and / or who are living with chronic pain have been shown to have difficulties with aspects of positive future thinking. There is evidence, not reported here, to suggest that talking therapies, (e.g. CBT) can help people to develop positive future thinking skills. For further discussion of future oriented treatments for suicide, see Yu, Cheavens, Vilhauer & van Beek (2018)[74].
- ***Mental Imagery***: People living with chronic pain often report (when asked) negative catastrophic images of themselves in pain; similarly, we know people with a history of suicidal ideation or behaviour also experience vivid imagery. Mental images can help with sense-making, but they can also increase a person's suffering[53] It is therefore potentially useful for clinicians to know whether patients are experiencing imagery and if so, to explore the content and impact of these images.
- ***Psychological Flexibility –***There is promising evidence to show that psychological flexibility may be a protective mechanism for both suicidal ideation and pain; in short, it may protect those experiencing distressing emotions. So called 'third-wave' cognitive behavioural approaches,

including Acceptance and Commitment Therapy (ACT), have been applied to people living with chronic pain and to those experiencing suicidal thought or behaviours.

Research in context

Evidence before this study

Individuals with chronic pain are a high-risk group for suicide. Since many more individuals with chronic pain experience psychological distress, and/or have access to means than go on to die by suicide, there is a pressing need to account for why some individuals with chronic pain consider suicide whilst others do not and why amongst those who think about suicide, only some go on to take their lives. Given the high comorbidity between chronic pain and mental distress, including suicidality, one largely unexplored possibility is that transdiagnostic psychological factors and processes that contribute to chronic pain and suicidality independently, may also contribute to their comorbidity. This review expands on previous work, by drawing upon all three predominant "ideation-to-action" theoretical models of suicide and focusing on previously under- and unexplored factors with transdiagnostic relevance for suicide and chronic pain

We identified relevant Studies through a search of the Web of Science, EMBASE (including Medline), and PsycINFO databases for English language journal articles published within the last ten years (from 2008 – 2018). The search terms "chronic pain", "persistent pain", "pain" and "suicid*" were used to identify articles specifically relating to chronic pain and suicide. Our primary focus, however, was to conduct a broader search for studies that had investigated key variables which overlap with the fields of both chronic pain and suicide research. These variables (and search terms) were drawn from the three predominant contemporary theoretical models of suicide. The full list of search terms, database hits, and search dates is available on the Open Science Framework (see Panel 2).

Added value of this study This invited review expands on the existing knowledge base by focusing on previously under- and unexplored factors with transdiagnostic relevance for suicide and chronic pain.

Implications of all the available evidence

Our review focused on potential transdiagnostic psychological processes that are associated with both chronic pain, and suicide. We have identified three promising areas for future research: future orientation, mental imagery and psychological flexibility, (see Panel 4 for a summary) but recognize that there is considerable conceptual overlap between them. The lack of cross-pollination between the fields of chronic pain and suicide research is evidenced by the fact that these clearly overlapping research lines exist in parallel, but almost entirely independently. To be greater than the sum of its parts, research on suicide in people with chronic pain must bridge disciplinary boundaries and work towards common terminology, conceptual, theoretical, and methodological ground.

References

1. Campbell G, Darke S, Bruno R, Degenhardt L. The prevalence and correlates of chronic pain and suicidality in a nationally representative sample. Australian and New Zealand Journal of Psychiatry. 2015;49(9):803-11.
2. Calati R, Bakhiyi CL, Artero S, Ilgen M, Courtet P. The impact of physical pain on suicidal thoughts and behaviors: Meta-analyses. Journal of Psychiatric Research. 2015;71:16-32.
3. Tang NKY, Beckwith P, Ashworth P. Mental defeat is associated with suicide intent in patients with chronic pain. Clinical Journal of Pain. 2016;32(5):411-9.
4. Tang NK, Crane C. Suicidality in chronic pain: a review of the prevalence, risk factors and psychological links. Psychol Med. 2006;36(5):575-86.
5. Stenager E, Christiansen E, Handberg G, Jensen B. Suicide attempts in chronic pain patients. A register-based study. Scandinavian Journal of Pain. 2014;5(1):4-7.
6. Braden JB, Edlund MJ, Sullivan MD. Suicide Deaths With Opioid Poisoning in the United States: 1999-2014. AMERICAN JOURNAL OF PUBLIC HEALTH. 2017;107(3):421-6.
7. Campbell G, Bruno R, Darke S, Shand F, Hall W, Farrell M, et al. Prevalence and correlates of suicidal thoughts and suicide attempts in people prescribed pharmaceutical opioids for chronic pain. Clinical Journal of Pain. 2016;32(4):292-301.
8. Linton SJ, Flink IK, Schrooten MGS, Wiksell R. Understanding co-occurring emotion and pain: The role of context sensitivity from a transdiagnostic perspective. Journal of Contemporary Psychotherapy. 2016;46(3):129-37.
9. Fishbain DA, Lewis JE, Gao J. The pain suicidality association: A narrative review. Pain Medicine. 2014;15(11):1835-49.
10. Hassett AL, Aquino JK, Ilgen MA. The risk of suicide mortality in chronic pain patients. Curr Pain Headache Rep. 2014;18(8):436.
11. Hooley JM, Franklin JC, Nock MK. Chronic pain and suicide: understanding the association. Curr Pain Headache Rep. 2014;18(8):435.
12. Racine M. Chronic pain and suicide risk: A comprehensive review. Progress in Neuro-Psychopharmacology and Biological Psychiatry. 2017.
13. Joiner Jr TE. Why People Die By Suicide. Boston: Harvard University Press; 2005.
14. Van Orden KA, Witte TK, Cukrowicz KC, Braithwaite SR, Selby EA, Joiner TE, Jr. The interpersonal theory of suicide. Psychol Rev. 2010;117(2):575-600.
15. O'Connor RC. Towards an Integrated Motivational-Volitional Model of Suicidal Behaviour. In: O'Connor RC, Platt, S., & Gordon, J. , editor. International Handbook of Suicide Prevention: Research, Policy and Practice Chichester: Wiley-Blackwell; 2011. p. 181-98.
16. O'Connor RC, Kirtley OJ. The integrated motivational-volitional model of suicidal behaviour. Philos Trans R Soc Lond B Biol Sci. 2018;373(1754).
17. Klonsky ED, May AM. The Three-Step Theory (3ST): A new theory of suicide rooted in the 'ideation-to-action' framework. International Journal of Cognitive Therapy. 2015;8(2):114-29.
18. Batterham PJ, Calear AL, Christensen H, Carragher N, Sunderland M. Independent Effects of Mental Disorders on Suicidal Behavior in the Community. Suicide Life Threat Behav. 2018;48(5):512-21.
19. May AM, Klonsky ED. What distinguishes suicide attempters from suicide ideators? A meta-analysis of potential factors. Clinical Psychology: Science and Practice. 2016;23(1):5-20.
20. Vlaeyen JWS, Linton SJ. Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. PAIN. 2000;85(3):317-32.
21. McCracken LM, Morley S. The psychological flexibility model: A basis for integration and progress in psychological approaches to chronic pain management. Journal of Pain. 2014;15(3):221-34.
22. McCracken LM, Patel S, Scott W. The role of psychological flexibility in relation to suicidal thinking in chronic pain. Eur J Pain. 2018;22(10):1774-81.
23. Klonsky ED, Saffer BY, Bryan CJ. Ideation-to-action theories of suicide: a conceptual and empirical update. Curr Opin Psychol. 2018;22:38-43.

24. Chu C, Walker KL, Stanley IH, Hirsch JK, Greenberg JH, Rudd MD, et al. Perceived problem-solving deficits and suicidal ideation: Evidence for the explanatory roles of thwarted belongingness and perceived burdensomeness in five samples. Journal of Personality and Social Psychology. 2018;115(1):137-60.
25. Wilson KG, Heenan A, Kowal J, Henderson PR, McWilliams LA, Castillo D. Testing the Interpersonal Theory of Suicide in Chronic Pain. Clinical Journal of Pain. 2017;33(8):699-706.
26. Wilson KG, Kowal J, Henderson PR, McWilliams LA, Peloquin K. Chronic pain and the interpersonal theory of suicide. Rehabil Psychol. 2013;58(1):111-5.
27. Fishbain DA, Bruns D, Bruns A, Gao J, Lewis JE, Meyer LJ, et al. The perception of being a burden in acute and chronic pain patients is associated with affirmation of different types of suicidality. Pain Medicine (United States). 2016;17(3):530-8.
28. Gilbert PA, S. The role of defeat and entrapment (arrested flight) in depression: an exploration of an evolutionary view. . Psychological Medicine. 1998;28(3):585-98.
29. Dhingra K, Boduszek D, O'Connor RC. Differentiating suicide attempters from suicide ideators using the Integrated Motivational-Volitional model of suicidal behaviour. Journal of Affective Disorders. 2015;186:211-8.
30. Wetherall K, Cleare S, Eschle S, Ferguson E, O'Connor DB, O'Carroll RE, et al. From ideation to action: Differentiating between those who think about suicide and those who attempt suicide in a national study of young adults. J Affect Disord. 2018;241:475-83.
31. Tang NKY, Salkovskis, P. M., Hanna, M. Mental Defeat in Chronic Pain: Initial Exploration of the Concept. Clinical Journal of Pain. 2007;23(3):222-32.
32. Tang NKY, Goodchild CE, Hester J, Salkovskis PM. Mental defeat is linked to interference, distress and disability in chronic pain. Pain. 2010;149(3):547-54.
33. Hazeldine-Baker CE, Salkovskis PM, Osborn M, Gauntlett-Gilbert J. Understanding the link between feelings of mental defeat, self-efficacy and the experience of chronic pain. British Journal of Pain. 2018;12(2):87-94.
34. O'Connor RC, Smyth R, Ferguson E, Ryan C, Williams JMG. Psychological processes and repeat suicidal behavior: A four-year prospective study. Journal of Consulting and Clinical Psychology. 2013;81(6):1137-43.
35. O'Connor RC, Williams JMG. The relationship between positive future thinking, brooding, defeat and entrapment. Personality and Individual Differences. 2014;70:29-34.
36. O'Connor RC, Smyth R, Williams JMG. Intrapersonal positive future thinking predicts repeat suicide attempts in hospital-treated suicide attempters. Journal of Consulting and Clinical Psychology. 2015;83(1):169-76.
37. Williams JMG, Van Der Does AJW, Barnhofer T, Crane C, Segal ZS. Cognitive reactivity, suicidal ideation and future fluency: Preliminary investigation of a differential activation theory of hopelessness/suicidality. Cognitive Therapy and Research. 2008;32(1):83-104.
38. O'Connor RC, O'Carroll RE, Ryan C, Smyth R. Self-regulation of unattainable goals in suicide attempters: A two year prospective study. Journal of Affective Disorders. 2012;142(1-3):248-55.
39. Rusu AC, Pincus T. Chronic pain patients' perceptions of their future: A verbal fluency task. Pain. 2017;158(1):171-8.
40. Sutherland R, Morley S. Self-pain enmeshment: Future possible selves, sociotropy, autonomy and adjustment to chronic pain. Pain. 2008;137(2):366-77.
41. Arends RY, Bode C, Taal E, Van de Laar MAFJ. The role of goal management for successful adaptation to arthritis. Patient Education and Counseling. 2013;93(1):130-8.
42. Crombez G, Lauwerier E, Goubert L, Van Damme S. Goal pursuit in individuals with chronic pain: A personal project analysis. Frontiers in Psychology. 2016;7.
43. Chang EC, Wan L, Li P, Guo Y, He J, Gu Y, et al. Loneliness and Suicidal Risk in Young Adults: Does Believing in a Changeable Future Help Minimize Suicidal Risk Among the Lonely? The Journal of psychology. 2017;151(5):453-63.
44. Cornette MM, Strauman TJ, Abramson LY, Busch AM. Self-discrepancy and suicidal ideation. COGNITION & EMOTION. 2009;23(3):504-27.

45. Van Ryckeghem DML, De Houwer J, Van Bockstaele B, Van Damme S, De Schryver M, Crombez G. Implicit associations between pain and self-schema in patients with chronic pain. Pain. 2013;154(12):2700-6.
46. Campbell P, Foster NE, Thomas E, Dunn KM. Prognostic Indicators of Low Back Pain in Primary Care: Five-Year Prospective Study. JOURNAL OF PAIN. 2013;14(8):873-83.
47. Goossens ME, Kindermans HP, Morley SJ, Roelofs J, Verbunt J, Vlaeyen JW. Self-discrepancies in work-related upper extremity pain: Relation to emotions and flexible-goal adjustment. European Journal of Pain. 2010;14(7):764-70.
48. Holmes EA, Crane C, Fennell MJ, Williams JM. Imagery about suicide in depression--"Flash-forwards"? J Behav Ther Exp Psychiatry. 2007;38(4):423-34.
49. Crane C, Shah D, Barnhofer T, Holmes EA. Suicidal imagery in a previously depressed community sample. Clinical psychology & psychotherapy. 2012;19(1):57-69.
50. Ng RMK, Di Simplicio M, McManus F, Kennerley H, Holmes EA. 'Flash-forwards' and suicidal ideation: A prospective investigation of mental imagery, entrapment and defeat in a cohort from the Hong Kong Mental Morbidity Survey. Psychiatry Research. 2016;246:453-60.
51. Gosden T, Morris PG, Ferreira NB, Grady C, Gillanders DT. Mental imagery in chronic pain: Prevalence and characteristics. European Journal of Pain (United Kingdom). 2014;18(5):721-8.
52. Philips HC. Imagery and pain: The prevalence, characteristics, and potency of imagery associated with pain. Behavioural and Cognitive Psychotherapy. 2011;39(5):523-40.
53. Berna C, Tracey I, Holmes EA. How a better understanding of spontaneous mental imagery linked to pain could enhance imagery-based therapy in chronic pain. Journal of Experimental Psychopathology. 2012;3(2):258-73.
54. Holmes EA, Geddes JR, Colom F, Goodwin GM. Mental imagery as an emotional amplifier: application to bipolar disorder. Behav Res Ther. 2008;46(12):1251-8.
55. Pinto-Gouveia J, Costa J, Maroco J. The first 2 years of rheumatoid arthritis: The influence of acceptance on pain, physical limitation and depression. JOURNAL OF HEALTH PSYCHOLOGY. 2015;20(1):102-12.
56. McCracken LM, Zhao-O'Brien J. General psychological acceptance and chronic pain: There is more to accept than the pain itself. European Journal of Pain. 2010;14(2):170-5.
57. Kratz AL, Ehde DM, Bombardier CH, Kalpakjian CZ, Hanks RA. Pain Acceptance Decouples the Momentary Associations Between Pain, Pain Interference, and Physical Activity in the Daily Lives of People With Chronic Pain and Spinal Cord Injury. Journal of Pain. 2017;18(3):319-31.
58. Linehan MM. Skills training manual for treating for treating Borderline Personality Disorder: Diagnosis and treatment of mental disorder. New York: Guildford Publications; 1993.
59. Williams JMG, Fennell, M., Barnhofer, T., Crane, R., & Silverton, S. Mindfulness-based cognitive therapy for people at risk of suicide. New York: Guildford Press; 2017.
60. Forkmann T, Wichers M, Geschwind N, Peeters F, van Os J, Mainz V, et al. Effects of mindfulness-based cognitive therapy on self-reported suicidal ideation: results from a randomised controlled trial in patients with residual depressive symptoms. Compr Psychiatry. 2014;55(8):1883-90.
61. Morley S. Psychology of pain. BRITISH JOURNAL OF ANAESTHESIA. 2008;101(1):25-31.
62. Davidson CL, Anestis MD, Gutierrez PM. Ecological Momentary Assessment is a Neglected Methodology in Suicidology. Arch Suicide Res. 2017;21(1):1-11.
63. Myin-Germeys I, Kasanova Z, Vaessen T, Vachon H, Kirtley O, Viechtbauer W, et al. Experience sampling methodology in mental health research: new insights and technical developments. World Psychiatry. 2018;17(2):123-32.
64. Zalsman G, Hawton K, Wasserman D, van Heeringen K, Arensman E, Sarchiapone M, et al. Suicide prevention strategies revisited: 10-year systematic review. The Lancet Psychiatry. 2016;3(7):646-59.
65. Hawton K, Bergen H, Simkin S, Dodd S, Pocock P, Bernal W, et al. Long term effect of reduced pack sizes of paracetamol on poisoning deaths and liver transplant activity in England and Wales: interrupted time series analyses. BMJ-BRITISH MEDICAL JOURNAL. 2013;346.

66. Petrosky E, Harpaz R, Fowler KA, Bohm MK, Helmick CG, Yuan K, et al. Chronic Pain Among Suicide Decedents, 2003 to 2014: Findings From the National Violent Death Reporting System. Ann Intern Med. 2018;169(7):448-55.
67. Ribeiro JD, Witte TK, Van Orden KA, Selby EA, Gordon KH, Bender TW, et al. Fearlessness About Death: The Psychometric Properties and Construct Validity of the Revision to the Acquired Capability for Suicide Scale. PSYCHOLOGICAL ASSESSMENT. 2014;26(1):115-26.
68. Noyman-Veksler G, Lerman SF, Joiner TE, Brill S, Rudich Z, Shalev H, et al. Role of Pain-Based Catastrophizing in Pain, Disability, Distress, and Suicidal Ideation. Psychiatry (New York). 2017;80(2):155-70.
69. Racine M, Sanchez-Rodriguez E, Galan S, Tome-Pires C, Sole E, Jensen MP, et al. Factors Associated with Suicidal Ideation in Patients with Chronic Non-Cancer Pain. Pain Med. 2017;18(2):283-93.
70. Bresin K, Gordon KH. Endogenous opioids and nonsuicidal self-injury: a mechanism of affect regulation. Neurosci Biobehav Rev. 2013;37(3):374-83.
71. Kirtley OJ, O'Carroll RE, O'Connor RC. The role of endogenous opioids in non-suicidal self-injurious behavior: methodological challenges. Neurosci Biobehav Rev. 2015;48:186-9.
72. Stanley B, Sher L, Wilson S, Ekman R, Huang YY, Mann JJ. Non-suicidal self-injurious behavior, endogenous opioids and monoamine neurotransmitters. J Affect Disord. 2010;124(1-2):134-40.
73. Blades CA, Stritzke WGK, Page AC, Brown JD. The benefits and risks of asking research participants about suicide: A meta-analysis of the impact of exposure to suicide-related content. Clin Psychol Rev. 2018;64:1-12.
74. Yu E, Cheavens J, Vilhauer J, van Beek W. Future-Oriented Treatments for Suicide: An Overview of Three Modern Approaches. In: Hirsch JK, Chang EC, Kelliher Rabon J, editors. A Positive Psychological Approach to Suicide : Theory, Research, and Prevention. Cham: Springer International Publishing; 2018. p. 183-208.