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## Addressing fear of death and dying: traditional and innovative interventions

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### ABSTRACT

The fear of death and dying is a multifaceted and prevalent source of human distress that can cause significant psychological and existential distress, especially at the end of life. Analysing current therapeutic approaches to this issue to identify promising modalities and knowledge gaps could improve end of life experiences and reduce human suffering. In this systematically constructed review, we analyse recent literature to explore treatments for thanatophobia. Effective intervention strategies for fear of death and dying do exist, but all have practical and therapeutic limitations. Psychotherapy appears to be an effective tool at reducing death anxiety. Mindfulness exercises are able to reduce anxiety as well but are not often associated with a change in afterlife belief. Psychedelics dissociate mind from body, causing a mystical experience that has been shown to reduce death anxiety, but restrictions on their use limit their availability for therapy. Virtual reality appears to have the potential to reduce death anxiety, possibly by simulating an out-of-body experience and strengthening belief in an afterlife. Although some interventions appear to have a positive impact on fear of death and dying, the literature does not support a clearly superior therapeutic approach.

### KEYWORDS

Thanatophobia; mindfulness; psychotherapy; psychedelics; virtual reality; out-of-body experience

## Introduction

Thanatophobia is synonymous with death anxiety and is defined as the apprehension and fear of annihilation that comes with a physical awareness of the loss of existence, frequently indescribable by language or imagery (Carpenito-Moyet, 2008). Death anxiety prevalence is estimated to reach approximately 80% of advanced stage cancer patients (Cherny et al., 1994). It has been theorised that death anxiety may be common in part due to the strain between knowledge of the human condition as a biological being with a definitive lifespan and human higher-level cognitive structures that enable anticipation and prediction of death, along with a desire for immortality (Becker, 1973; Lonetto & Templer, 1986; Panksepp, 1998; Yalom, 1980).

Cognitive beliefs about death include thoughts regarding a premature death, the state of being dead, fear of the unknown, images of significant others' bereavement, and the

concept of no longer physically existing (DePaola et al., 2003; Lehto & Stein, 2009; Panksepp, 1998). Lehto and Stein (2009) contend that death anxiety is not typically a part of conscious experience, and they propose that self-regulation processes such as self-control and inhibitory capacity help defend against the fear of death. Yet, some propose that the emotional strain of managing thoughts of death hinders the self-regulation process, potentially intensifying death anxiety over time (Gaillet et al., 2006).

Thanatophobia presentation and intensity may vary across ethnicities, gender, cultures, and over time. DePaola et al. (2003) support this claim by demonstrating that the concerns of death among African Americans were different from White Americans when surveyed. Another study found that Japanese males endorsed higher death anxiety levels than Australian males (Schumaker et al., 1988). Numerous researchers have explored samples of adolescent and older-age females and found them to have higher levels of death anxiety than males of comparable ages (Abdel-Khalek, 2005; Cotter, 2003; Hickson et al., 1988; Pierce et al., 2007; Singh Madnawat & Singh Kachhawa, 2007). In many Western cultures, the elderly and sick may be less visible in their communities, due to living out of sight of the public in nursing homes, hospitals, and other facilities. This may intensify death anxiety in others, because ageing and dying become perceived as an unusual phenomenon (Schumaker et al., 1988). Similarly, researchers have found that many Americans tend to deny death by avoiding societal reminders of disability, ageing, and illness (Martz & Livneh, 2003).

Individuals confronted with their own mortality by receiving a diagnosis of a life-threatening illness, for example, may suffer from thanatophobia (Grossman et al., 2018). One in three palliative care patients experience clinically significant depression and anxiety symptoms, and often, even when they attempt to distract themselves, somatic symptoms activate death anxiety (Berdine, 2009). The context of chronic illness, such as witnessing a loved one's death or thoughts of leaving loved ones behind, is also associated with increased death anxiety (Cella & Tross, 1987). However, a study involving terminally ill patients found low levels of death anxiety among those with a strong belief in an afterlife of reward, suggesting that terminal patients may accept their own mortality due to an assumption of a positive realm outside of the physical body (Smith et al., 1983–1984).

Below we review the current literature on four interventions currently used to decrease thanatophobia and related symptoms of anxiety and depression. This review evaluates more traditional treatment methods, including psychotherapy and mindfulness, while exploring the potential of innovative treatments, such as the use of psychedelic drugs and virtual reality (VR) versions of out-of-body (OBE) experiences. We review the relative efficacy of each of these interventions and the impact of each on afterlife beliefs in order to propose ideas for future research and therapeutic approaches addressing thanatophobia and related symptoms in patients, specifically those living with chronic health conditions.

## Materials & methods

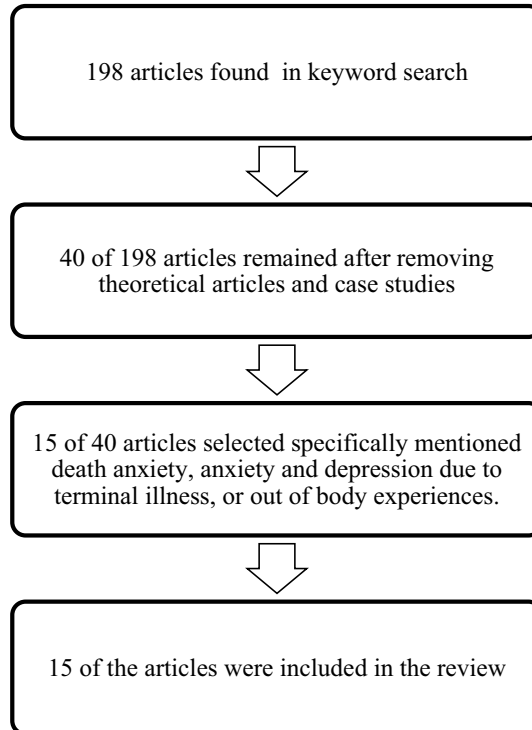
This systematically constructed review analysed research literature from 2009 to 2019 regarding treatments for death anxiety as part of a larger study approved by the University of Virginia Institutional Review Board. No participants were involved in this study, so consent forms were unnecessary. No funding was used for this project and it was conducted as part of the work of each author, thus no additional funding sources were

obtained for this work. There are no conflicts to disclose. Electronic searching was conducted with the parameters of published peer-reviewed journals within the past 10 years that had full-text access and were available in English. Databases searched were as follows: PsycINFO, PubMed, and Ovid. Keywords used were death anxiety, fear of death, thanatophobia, psychotherapy, mindfulness, psychedelics, virtual reality, and out-of-body experience. One hundred and ninety-eight articles were originally produced from the search. Theoretical articles and case studies were not included in this review, reducing the number of studies to 40. The review was finalised in July 2019 and condensed to 15 studies that consisted of randomised control trials (RCTs), cohort studies, single-arm pilot studies, and meta-analysis systematic reviews. These manuscripts are grouped by intervention type and include psychotherapeutic interventions, such as psychotherapy and mindfulness meditation, as well as psychedelic drugs and virtual reality experiences. Due to limited specific death anxiety research, studies using anxiety and depression levels as measured correlates of death anxiety were included to best understand the potential of these therapies to manage thanatophobia through their impact on related symptoms.

## Results

### *Psychotherapy*

For patients with a terminal illness, psychotherapy has been shown to reduce anxiety and depression, improve quality of life (QOL) and interpersonal relationships, and enhance an



**Figure 1.** Selection process.

individual's sense of purpose. The theoretical construct of psychotherapy in this domain is called terror management theory (TMT). TMT proposes that individuals faced with their impending mortality feel less threatened when they are able to construct purpose and meaning in their life (Solomon et al., 1991).

Using TMT as a basis, Meaning-Centred Psychotherapy (MCP) was designed to help advanced stage cancer patients sustain or enhance a sense of meaning, peace, and purpose in their lives (Frankl, 1984). Rosenfeld et al. (2017) developed Meaning-Centred Psychotherapy-Palliative Care (MCP-PC) to maintain the original premise of MCP while focusing on the most pertinent aspects of the treatment in a short period of time. In Rosenfeld et al.'s (2017) study, the first session of MCP-PC addressed participant understanding and experience of meaning in their life. Session 2 addressed sources of meaning including experiential, creative, and attitudinal. The final session addressed meaning through courage and commitment, living one's legacy, and finding peace. At the conclusion of the final session, participants evaluated MCP-PC. Four of the eight patients who completed the study indicated that the MCP-PC treatment was 'quite a bit' or 'very much so' helpful in finding a sense of meaning. There was, however, great disparity among patients depending upon which element of treatment was most helpful, suggesting the need for an individualised approach. This study was weakened by a small and non-randomised sample limiting its statistical significance especially given that the results were highly dependent on the individual. Another limitation was the lack of systematic outcome data on changes in psychological distress that would have been a stronger indicator of effects on death anxiety.

Breitbart et al. (2018) adapted MCP into Individual Meaning-Centred Psychotherapy (IMCP). To assess the efficacy of IMCP, an RCT was conducted comparing IMCP with supportive psychotherapy (SP) and enhanced usual care (EUC). Advanced stage cancer patients were assigned to either IMCP ( $n = 109$ ), SP ( $n = 108$ ), or EUC ( $n = 104$ ). The assessments administered throughout 16 weeks were the Functional Assessment of Chronic Illness Therapy Spiritual Well-Being Scale (FACIT-Sp), the Personal Meaning Index of Life Attitude Profile-Revised (LAP-R), the McGill Quality of Life Questionnaire (MQOL), and Hospital Anxiety and Depression Scale-Anxiety (HADS-A). Significant treatment effects were observed for IMCP, in comparison with EUC for quality of life, sense of meaning, spiritual well-being, anxiety, and desire for hastened death. The effect of IMCP was significantly greater than that of SP for quality of life and sense of meaning. The study was limited by confounding concurrent mental health or palliative care interventions and overrepresentation of women limiting its generalisability to a wider population of individuals with chronic health conditions.

Another method of psychotherapy is life review therapy (LRT), defined as 'the progressive return to consciousness of prior experience, which can be re-evaluated with the intention of resolving and integrating past conflicts' (Butler, 1963 page number available?). LRT can lead to increased ego-integrity, which is associated with a reliable sense of self, and is assumed to be associated with a decrease in death anxiety (Fishman, 1992). In their 2018 study, Kleijn et al. combined LRT and Memory Specific Training (LRT-MST) to create an intervention named 'Dear Memories'. The LRT-MST focuses on the retrieval of positive memories during different lifetime periods to improve autobiographical memory (AMT) and analyse the effects on ego-integrity in terminal cancer patients. Ego-Integrity (NEIS) was found to improve significantly over 1 month in the intervention group ( $n = 38$ )

compared to the control group (n = 39). Results are limited by a lack of qualitative data on the effects of LRT-AMT and a high drop-out rate of 28%. Additionally, the assumption that ego-integrity is inversely related to death anxiety is culture dependent, preventing this study from being generalisable to a broad population without further research.

Grossman et al. (2018) conducted a systematic review in order to identify interventions with a significant effect on death anxiety. Of the nine studies reviewed, two found a positive relationship between psychotherapy intervention and death anxiety. One study implemented Managing Cancer and Living Meaningfully (CALM) intervention over a 6-month period to 50 patients with incurable cancer. CALM consisted of 3–8 sessions that addressed change in four categories: self and relationships, spiritual well-being, preparing for the future, and sustaining hope and mortality. Participants were assessed with the FACIT-Sp, Death and Dying Distress Scale (DADDS), and Patient Health Questionnaire-9 (PHQ-9). Results found significant improvements in death anxiety, depressive symptoms, and spiritual well-being (Lo et al., 2014). The second study used an intervention focusing on couple's therapy at the end of life. The intervention was administered to nine patients with incurable cancer once a week for 8 consecutive weeks. The psychotherapy aimed to reduce distress, improve communication, and increase intimacy between terminal patients and their partners. Participants were assessed with the Death Anxiety and Quality of Life, Beck Depression Inventory-II (BDI-II), and Relationship Quality. The authors reported a significant reduction in patient 'distress about dying', a reduction in 'worry about dying' for their partner, and a significant positive relationship outcome for the patient (Mohr et al., 2003). The systematic review ignored qualitative, subjective data and lacked generalisability from an unrepresentative population of various terminal illnesses.

Future studies implementing psychotherapeutic interventions should require a large, representative sample with a low drop-out rate, unconfounded control groups, and inclusion of qualitative data to assess subjective effects. Systematic outcome data on psychological distress should also be included for a more conclusive understanding of the results in the context of death anxiety.

### ***Mindfulness/meditation***

Mindfulness has been found to help manage cognitive symptoms by separating bodily sensations from cognition and emotion, and reducing perceived severity of events. This technique has been effective in treating depression among chronic heart failure (CHF) patients (Rosamond et al., 2008). Depression is related to a 2.5-fold increase in mortality and a 3-fold increase in hospitalisation among CHF patients (Jiang et al., 2001).

Sullivan et al. (2009) designed the Support, Education, and Research in CHF (SEARCH) study to assess the impact of a mindfulness-based psychoeducational intervention on depression and quality of life in CHF patients. One hundred control patients received usual care treatment and 108 treatment patients were randomised to a mindfulness-based psychoeducational treatment group. The mindfulness-based psychoeducational treatment group attended a weekly group for 8 consecutive weeks and were provided with audiotapes and workbooks for home use. The intervention featured three main components: Mindfulness-Based Stress Reduction (MBSR), coping skills training, and expressive support group discussion. The measurements included: depression symptoms,

**Table 1.** Overview of psychotherapy studies.

Authors	Description	Intervention	Results	Evaluation
Breitbart et al. (2018)	RCT comparing effectiveness of IMCP vs SP & IMCP vs EUC	IMCP	IMCP vs SP: significant increase in life attitude ( $p = .014$ ) and QOL ( $p = .018$ ) IMCP vs EUC: significant increase in spiritual well-being ( $p = .02$ ), life attitude ( $p < .0001$ ), QOL ( $p = .007$ ), anxiety ( $p = .05$ ) Ego-integrity improved significantly over time ( $p = .007$ )	Modest difference between IMCP and SP; did not control for concurrent mental health or palliative care interventions
Kleijn et al. (2018)	RCT assessing benefits of LRT and MST to ego-integrity and despair in cancer patients	LRT-MST "Dear Memories"		Despair, distress, depression, QOL, anxiety, and AMT all assessed with no significant differences;
Grossman et al. (2018)	Meta-analysis systematic review comparing psychotherapy interventions for death anxiety in advanced cancer patients	CALM [42] Couples Therapy and Facilitating at the end of life [43]	CALM: significant improvements in death anxiety ( $p < .009$ ), depressive symptoms ( $p < .019$ ), spiritual well being ( $p < .017$ ) Couples Therapy and Facilitating at the end of life: significant reduction in patient "distress about dying" ( $p = .04$ ), "worry about dying" for partner ( $p = .049$ ), significant positive outcome for patient ( $p = .049$ )	9 of 232 articles assessed met inclusion criteria; intervention studies analysed limited to interventional therapies used to target existential concerns with possibility of significant relationship with death anxiety
Rosenfeld et al. (2017)	Recruited palliative patients to assess the impact of MCP on meaning at the end of life	MCP-PC	50% of patients indicated that MCP-PC treatment was "quite a bit" or "very much so" helpful; large variability in ratings of sessions	Different elements of MCP-PC reported as beneficial stressing need for individualised approach; only 8 participants fully completed study

the Centre of Epidemiology–Depression (CES-D), disease health status, Kansas City Cardiomyopathy Questionnaire (KCCQ) and psychological distress, Profile of Mood States (POMS). Data were collected throughout 12 months. The treatment group's depression symptoms, KCCQ results, and POMS tension-anxiety subscale were significantly impacted at the 3 and 6 month follow-ups. The decrease in depression symptoms and improvement in KCCQ results sustained significance over the 12 month period. Additionally, there was a significant and sustained improvement of physical symptoms in the treatment group. The study was limited by a non-randomised sample and a multifactorial intervention where component effects could not be isolated.

Mindfulness exercises have also played a role in amyotrophic lateral sclerosis (ALS) patients whose life expectancy is only 2–4 years after onset (Burke et al., 2010). Pagnini et al. (2017) designed a specific protocol, MBSR-ALS, to test the effects of mindfulness on QOL. Researchers randomly assigned 100 ALS patients into a group receiving usual treatment and a group joining an 8-week MBSR-ALS meditation programme. Participants were assessed over the course of 12 months. QOL was assessed using the ALS-Specific Quality of Life Revised scale (ALSSQoL-R). Results showed a statistically significant increase in QOL over time in the treatment group. MBSR-ALS participants also reported more functional coping strategies, improvement in resilience, reduction in judgemental attitude, and increasing disposition to acceptance of their mortality. Major limitations to this study included not having a control group and finding it difficult to recruit and retain participants because ALS patients were uninterested or doubtful of the intervention demonstrating a need for patient support prior to initiation of new treatments.

High levels of anxiety and depression have been associated with high levels of mortality salience and can lead to proximal (consciously ignoring thoughts on mortality) and distal (subconsciously changing behaviours to ignore these thoughts) defence mechanisms (Burke et al., 2010; Florian & Mikulincer, 1997; Greenberg et al., 1992; Kesebir, 2014). Schultz and Arnau (2017) study randomly assigned 77 participants into three experimental groups (mindfulness, mind-wandering, worrying) followed by a mortality salience induction exercise where participants wrote about their own death. This study analysed the experimental conditions' impact on proximal and distal defence mechanisms and negative affect. Proximal defence mechanisms were measured by a word fragment task, distal defence mechanisms were measured by the Multidimensional Social Transgression Scale (MSTS), and negative affect was measured by the Positive Affect Negative Affect Schedule (PANAS). Fewer proximal defence mechanisms were found in the mindfulness and mind-wandering groups supporting lower mortality salience and therefore stress. A lower negative affect was found in the mindfulness group compared to the worrying group. This study was limited by a small sample size, the unvalidated use of the MSTS for the measurement of distal defence mechanisms in short-term experimental conditions, and the inability to demonstrate evidence that supported the efficacy of mindfulness over mind-wandering to manage mortality.

Stress and anxiety are reported in as many as 45% of cancer patients and mindfulness has been demonstrated to successfully ameliorate these symptoms in this population (Carlson et al., 2004; Piet et al., 2012; Zabora et al., 2001). Atreya et al. (2018) focused on patients suffering with colorectal cancer, the second leading cause of cancer deaths in the United States. They were also interested in studying the efficacy of audio-based mindfulness exercises as most mindfulness procedures involve in-person facilitation which have more barriers to use. The authors coordinated a 2-part study that started with a focus



group to develop mindfulness treatment acceptable to participants. This was followed by a single-arm pilot study that used an 8-week audio-based mindfulness programme with 33 metastatic colorectal cancer patients. Their study found that the mindfulness programme reduced distress and anxiety and increased non-reactivity and the prevalence of feeling at peace. This study was weakened by a small, homogenous sample that was unrepresentative of the population and an absence of a control group for comparison.

Future mindfulness studies should include larger, representative samples, another intervention as a means of comparison, validated measures, and more conclusive component effect relationships.

### **Psychedelic drugs**

Existential and spiritual well-being in cancer patients has a positive effect on QOL and decreases anxiety and depression. Research on the utility of psychedelic drugs for the treatment of psycho-spiritual distress in terminal cancer patients began in the 1950s but was terminated in the mid-1970s as a consequence of the Controlled Substance Act of 1970.

There are no U.S. Food and Drug Administration approved pharmaceutical medications specifically for cancer-related psychological distress. Antidepressants are generally not efficacious, relapse rates are high, and there are significant side effects (Freedman, 2010; Li et al., 2012). However, in recent years, clinical trials utilising psychedelic drugs as a therapeutic intervention have been conducted. The primary drugs, lysergic acid diethylamide (LSD) and psilocybin, are 5-HT<sub>2A</sub> receptor antagonists that produce increased sensory perception, enhanced mental imagery, and accelerated thought with broadened scope to allow new interpretations and meanings of relationships and objects (Griffiths et al., 2016; Grob et al., 2010).

A double-blind, placebo-controlled study was conducted by Gasser et al. (2014) to examine the safety and efficacy of LSD-assisted psychotherapy in 12 patients with anxiety due to a life-threatening disease. Participants were randomly assigned to the experimental group receiving 200 µg of LSD (n = 8) or the active placebo group receiving 20 µg of LSD (n = 4) with an open-label crossover to 200 µg of LSD after the initial blinded treatment was masked. The treatment and active placebo were administered on two different days and scheduled 2 to 3 weeks apart followed by three psychotherapy sessions. Experimental groups experienced a significant reduction in state and trait anxiety. Seven patients reported sustained reductions in anxiety and fear of death and an improved QOL. There were no adverse health effects throughout the duration of the study. Limitations to this study included a small sample size and the possibility that the active placebo included enough LSD to cause effects resulting in limited statistical significance and a potential diminished treatment effect.

In a study by Grob et al. (2010), 12 subjects with advanced-stage cancer and an anxiety disorder participated in a within-subject (individuals participate in both treatment conditions), double-blind, placebo-controlled study to test the safety and efficacy of psilocybin in the treatment of psychological distress associated with the existential crisis of terminal disease. Subjects participated in two treatment sessions spaced weeks apart. They would either receive a 0.2 mg dose of psilocybin or a 250 mg dose of niacin, the placebo. The Beck Depression Inventory (BDI) and State-Trait Anxiety Inventory (STAI) were administered throughout the study and at monthly intervals for 6 months after the

**Table 2.** Overview of mindfulness studies.

Authors	Description	Intervention	Results	Evaluation
Atreya et al. (2018)	Focus group followed by single arm pilot study to evaluate audio-based mindfulness as anxiety intervention for metastatic colorectal cancer patients	8-week audio-based mindfulness programme	Reduced distress ( $p = .01$ ), anxiety ( $p = .03$ ); increased non-reactivity ( $p < .01$ ), feeling at peace ( $p < .01$ )	Audio-based mindfulness acceptable, manageable, and effective stress management strategy; small sample size; no control group
Pagnini et al. (2017)	RCT to assess effectiveness of MBSR-ALS on promoting QOL for ALS patients	MBSR-ALS	Statistically significant increase in QOL over time ( $p < .0149$ )	Significant increase in depression and anxiety in both groups, but treatment group had lower levels; high attrition rate
Schultz and Arnau (2017)	Three armed study to evaluate the efficacy of mindfulness as intervention for mortality salience	Three conditions (mindfulness, mind-wandering, worrying); mortality salience induction; evaluation of proximal and distal defence mechanisms and negative affect	Fewer proximal defence mechanisms in mindfulness ( $p = .017$ ) and mind-wandering groups ( $p = .007$ ); no differences in distal response; lower negative affect in mindfulness group compared to worrying group ( $p = .003$ )	MSTS not well-validated as measure of distal defence responses in experimental conditions; small sample size; insufficient evidence regarding the efficacy of mindfulness over distraction
Sullivan et al. (2009)	Cohort study to assess the impact of mindfulness-based psychoeducational intervention on depression and QOL for CHF patients	MBSR, coping skills training, expressive support group discussion	Treatment groups had lower anxiety ( $p = .003$ ) and depression ( $p = .05$ ); improved symptoms ( $p = .033$ )	Multifactorial study, so component effects cannot be isolated

final session. Anxiety was significantly reduced at the 1 and the 3-month follow-up. Depression was significantly reduced at the 6-month follow-up. Both Gasser et al. (2014) and Grob et al. (2010) had imperfect double-blind procedures in which participants and therapists were likely to identify their experimental or control status.

Ross et al. (2016) performed a double-blind, placebo-controlled, crossover trial focusing upon psilocybin as a treatment for cancer-related anxiety and depression. Twenty-nine subjects were randomly and blindly assigned two oral dosing session sequences: 0.3 mg/kg of psilocybin followed by niacin ( $n = 15$ ) or niacin followed by 0.3 mg/kg psilocybin ( $n = 14$ ). There was a 7 week wait period between session 1 and session 2. The total duration of the study was 9 months with data assessments completed throughout. The primary outcome variables were anxiety and depression, measured by HADS, BDI, and STAI. The psilocybin group compared to the active control group demonstrated immediate, substantial, and sustained reduction of anxiety and depression. There were no significant adverse health effects. The generalisability of the efficacy of psilocybin among patients who have never used hallucinogenic drugs is limited because half the participants had prior experience with this drug class.

In another study by Griffiths et al. (2016), 51 individuals with life-threatening cancer and anxiety or mood disorder were randomised into either a low (1 or 3 mg/70 kg) or high (22 or 30 mg/70 kg) psilocybin dose group. The study was conducted over 2 sessions and had a double-blind cross-over design. Study measures included depressed mood, anxiety, QOL, and short-term/enduring attitude/behaviour changes. Measures were assessed by participants, clinicians, and community observers. Study participation lasted about 9 months as measurements were taken up to 6 months following the second session. Higher doses of psilocybin were found to decrease depression, anxiety, and death anxiety as well as increase QOL, life meaning, and optimism. Ninety-two per cent of the high dose group experienced a clinically significant decrease in depression levels after 5 weeks and 76% of the high dose group experienced a clinically significant decrease in anxiety levels. Eighty per cent of participants sustained these results 6 months after the psilocybin exposure. This study demonstrated that a high dose of psilocybin had a significant effect on 11 measures of mood, anxiety, and QOL among patients with life-threatening cancer. These conclusions are limited by the unvalidated nature of some of the questionnaires, and the impact of the psilocybin may be reduced by the possibility that the low dose of psilocybin may have been pharmacologically active.

All the psychedelic drug studies had subjects act as their own control and had a small, unrepresentative sample. Studies lacked validity and generalisability. Future studies testing the efficacy of psychedelic drugs should include larger sample sizes, inactive placebos, independent control groups, and long term follow-up.

### **Virtual reality**

VR is a relatively new and popular technology that has provided an opportunity to study thanatophobia in innovative ways (Barberia et al., 2018). Studying the experience of mortality through death is challenging as individuals cannot be surveyed after death and individuals who report near-death experiences (NDEs) are limited (Parnia et al., 2014). VR experiences allow researchers to better control participant environments and simulate many experiences, including experiences commonly associated with death and dying (Barberia et al., 2018).

**Table 3.** Overview of psychedelic drugs studies.

Authors	Description	Intervention	Results	Evaluation
Griffiths et al. (2016)	Double-blind crossover RCT to evaluate impact of psilocybin on depressed mood, anxiety, QOL, short-term and enduring attitude and behaviour changes. Population?	1 or 3 mg/70 kg and 22 or 30 mg/70 kg of psilocybin	92% of high dose group experienced significant decrease in depression after 5 weeks (32% of low dose group); 76% of high dose group experienced significant decrease in anxiety (24% of low dose group) and increase in QOL, life meaning, and optimism	Unvalidated questionnaires; half of subject population had prior experience with hallucinogens; homogenous sample; low dose of psilocybin may have been pharmacologically active
Ross et al. (2016)	Double-blind crossover RCT to assess the effects of psilocybin paired with psychotherapy on anxiety and depression in cancer patients	0.3 mg/kg of psilocybin	One day post dose 1, psilocybin first treatment group experienced significant decrease in anxiety ( $p \leq .001$ ), depression ( $p \leq .01$ ), state anxiety ( $p \leq .05$ ), and trait anxiety ( $p = .05$ ); psilocybin first treatment sustained decrease in anxiety ( $p \leq .001$ ), depression ( $p \leq .05$ ), state anxiety ( $p \leq .01$ ), and trait anxiety ( $p \leq .01$ )	Homogenous sample (90% caucasian, 62% female); half of population had prior experience with hallucinogens
Gasser et al. (2014)	Double-blind crossover RCT to examine the safety and efficacy of LSD paired with psychotherapy in treating anxiety associated with life-threatening disease	200 µg LSD	Treatment groups had significant reduction in state anxiety ( $p = .033$ ) and trait anxiety ( $p = .021$ ); sustained for 12 months	First study to examine LSD in conjunction with psychotherapy since 1971; small sample size
Grob et al. (2010)	Within-subject double blind study to examine the safety and efficacy of psilocybin. Population?	0.2 mg/kg psilocybin	Anxiety significantly reduced at 1-month ( $p = .001$ ) and 3-month ( $p = .03$ ) follow-up; depression significantly reduced at 6-month follow-up ( $p = .03$ )	Verified safety of psilocybin; no independent control group

A study by Higgins et al. (2019) examined the efficacy of VR for managing anxiety among nonmelanoma skin cancer patients, which is the most common cancer in the United States. They used a highly immersive VR experience of 3 relaxing scenarios among 109 out-patient skin cancer surgery recipients on the day of surgery. Subjects completed a survey measuring their anxiety before and after a 10 minute VR experience. Thirteen out of 15 survey questions asking about anxiety demonstrated improvement after the VR experience with the following four being statistically significant: are you currently feeling unable to relax, feeling fear of the worst happening, feeling terrified or afraid, feeling nervous. Consolidating the anxiety question responses together showed a statistically significant decline in anxiety levels among participants following the VR experience. This study's conclusions are limited by the absence of a control group and its relevance is limited by focusing on general anxiety as opposed to specifically the fear of death.

VR technology can additionally be used in novel ways to help patients cope with anxiety, including death anxiety. For instance, VR has been successful at allowing individuals to control life-sized virtual bodies from a first-person perspective. Studies have even shown that this control has elicited the perception of virtual body ownership among participants. The success of this perception allows researchers to then use VR to simulate out-of-body experiences (OBEs), NDEs, and even death (Barberia et al., 2018). OBEs are defined as states of consciousness or perceptions of 'self' that exist outside the physical body (Irwin, 1985). An NDE is defined as a profound psychological experience which deviates from the norms of reality due to the transformation of perceptual boundaries (Tassell-Matamua, 2014; Van Lommel, 2013).

A study by Bourdin et al. (2017) used a 2-factor between-groups experimental design to explore how participants' fear of death was influenced by 2 different types of OBEs. In both conditions, 16 females completed an initial in-body phase where they learned and practised a mental ball-dropping task that required them to click a wand to drop a VR apple and click again to indicate when it hit the ground. This task was followed by an out-of-body phase where the viewpoint was lifted up and behind the virtual body. In the experimental condition, there was no further connection with the virtual body. In the control condition, visuomotor and visuo-tactile synchrony continued.

In the study, both groups scored high on out-of-body illusion demonstrating a successful simulation of an OBE. Using a 7 point Likert scale to measure out-of-body illusion, 50% of participants scored at least a 6, while 75% scored at least a 5. The experimental group reported a greater sense of being out of their body during the OBE as well as a lower fear of death. These results suggest that the loss of visuomotor and visuo-tactile synchrony are essential components of the OBE that influence the sense of being out of body, as well as the reduction in fear of death that occurs.

Researchers continue to advance the use of VR to maximise its potential, especially with respect to mortality research. Barberia et al. (2018) used an immersive lifecycle-based VR experience to study mortality as an independent variable. Fifteen female participants in the experimental group took control of humanoid bodies on a tropical island with two companions. They explored and completed tasks as they aged through the lifespan and eventually observed the death of their companions and self. During their own death, they experienced an OBE, life review, tunnel to a light, and observation of the virtual world without them in it. Sixteen females were controls who did not complete the VR experience. The experimental group completed six sessions on six consecutive work days. The

following variables were analysed: death anxiety, TMT effects, and life attitude changes. Questionnaires that looked at participant virtual body ownership/agency were completed by both experimental and control groups after each session and were then followed by an interview. Participants completed a daily diary at home to record their feelings and thoughts about the experience. After session 6, there was an additional measurement looking at mortality salience manipulation. Once all virtual sessions were completed, a seventh session had participants complete a questionnaire on their fear of death, a life-change inventory, and an implicit association test.

The VR group had a significantly greater change in life attitude. This group was found to be more concerned with others as well as more interested in global issues (as opposed to material issues). Participants were found to have a strong sense of body ownership, place illusion (being on the virtual island), plausibility (events really happening), and being with others. Major limitations to the VR studies by Bourdin et al. (2017) and Barberia et al. (2018) are their small sample size as well as the samples' homogeneity. Barberia et al. (2018) had additional limitations regarding the humanoid nature of their virtual bodies controlled by participants. They hypothesised that the use of more human-like virtual bodies would increase the connection of the VR experience to the real world leading to a greater reduction in death anxiety caused by a greater belief in an afterlife. This research is just the beginning of the opportunities to study mortality and patient thanatophobia through VR and future studies should use VR to test its impact among a larger, more diverse population.

## Discussion

Researchers propose that the belief that life is bound within a physical being perpetuates thanatophobia because there is no hope of further existence which is distressing to humans. Naturally occurring OBEs are often an aspect of NDEs and have been shown to increase participant belief in a life after death which is often associated with decreased levels of death anxiety (Blanke et al., 2004; Van Lommel et al., 2001). A survey found that 63% of those who experienced an OBE said the experience increased their belief in an afterlife. Researchers hypothesise that this change in belief is caused by the OBE providing evidence that one's consciousness can exist outside of the body. Thus, simulating this experience would be hypothesised to yield similar results (Barberia et al., 2018; Twemlow et al., 1982). Surveys on NDEs and OBEs have demonstrated this reduction in death and dying anxiety in as many as 100% of surveyed individuals (Flynn, 1986). This astounding finding is reported to be due to the prominent presence of an afterlife that is elicited through the extraordinary experience. Four key elements of an NDE directly associated with the loss of thanatophobia include disembodiment, positive emotional content, spiritual encounter, and exposure to a bright otherworldly light (Tassell-Matamua, 2014).

Frequently, people who experience an NDE or OBE also experience conscious thought outside of the physical body. This phenomenon has been recounted during surgical procedures with cessation of brain activity, comatose and cyanotic states, resuscitation, and cardiac arrest. Patients are able to recall specific elements such as doctors, equipment, procedures, and sounds of these events from positions external to their body verified by their respective surgeons and records (Beauregard et al., 2012; Parnia et al., 2014; Sabom, 1998; Van Lommel, 2013). The continuum of consciousness during

**Table 4.** Overview of virtual reality studies.

Authors	Description	Intervention	Results	Evaluation
Higgins et al. (2019).	Evaluating VR as a tool to alleviate anxiety during surgery	Highly immersive VR experience with pre- and post-experience survey	Overall decrease in anxiety following VR experience ( $p < .0001$ )	Large sample size; no control group
Barberia et al. (2018).	Using VR to understand mortality, NDEs, death anxiety, and life-attitude	Immersive lifecycle based VR experience	VR group had greater positive life-attitude change; no significant effect on death anxiety	Made mortality an IV; interacting with others; small, homogenous sample size; humanoid virtual bodies
Bourdin et al. (2017)	Two-factor between-groups experiment to analyse association between two VR simulations of OBEs and fear of death	2 phase VR experience: in-body and out-of body	Both groups scored high on out of body illusion; using 7 point Likert scale to measure out of body illusion, 50% of participants scored at least 6, while 75% scored at least 5; experimental group reported greater disownership during out of body experience and lower fear of death	Small sample size; homogenous sample

temporary death or severe impairment may suggest the existence of a consciousness beyond permanent death and the physical body.

Positive emotions such as peace, serenity, bliss and love are reported to have been intensely experienced by 80–100% of NDErs (Schwaninger et al., 2002; Tiberi, 1993). Effects of these emotions are unique because experiencers describe them to be of a ‘profound nature, outside the realms of ordinary emotional experience’ (Tassell-Matamua, 2014). Tiberi (1993) deems these positive affects to be ‘extrasomatic’ emotions in which emotional intensity is heightened due to the awareness of experiencing something extraordinary. The compelling nature of these emotions may suggest that death or dying is a psychologically enriching experience outside of normal constructs.

Spiritual encounters occur in 50% of NDEs (Kelly, 2001; Sutherland, 1989). Those encountered are usually deceased relatives, loved ones, holy figures, or a spirit guide which is a figure the NDEr does not recognise but is intimately attached to (Tassell-Matamua, 2014). The presence of a bright light is often interpreted as symbolic of the passing into an afterlife. NDErs describe this light as an all-encompassing, almighty entity that elicits feelings of unconditional love and comfort (Tassell-Matamua, 2014; Von Haesler & Beauregard, 2013). Those feelings are often linked to the positive emotions previously mentioned. The light is commonly perceived as contact with a divine power that establishes universal order and allows for transformation (Morse, 1992; Ring, 1984).

### ***Limitations and future research***

The four therapies reviewed (psychotherapy, mindfulness, psychedelics, VR) have been shown to assist in alleviating patient anxiety to some extent but vary in their effectiveness in simulating OBEs and alter belief in the afterlife. Psychotherapy is unable to create an OBE; however, it is a useful tool to reduce death anxiety through a strengthened belief in an afterlife. Mindfulness exercises have been demonstrated to reduce anxiety and those who have extensive mindfulness training are even able to dissociate the mind from the body, but these exercises do not tend to be associated with a change in belief in an afterlife. Psychedelic medications have also been shown to have an impact on dissociating the mind from the body and may cause a mystical experience that has assisted with thanatophobia; however, there are more limitations to the use of this therapy due to government regulations. VR experiences of simulated OBEs appear to have potential in reducing thanatophobia due to the ability of VR experiences to simulate an actual OBE and strengthen belief in an afterlife. None of the four approaches appear to have a distinct advantage over the others with respect to efficacy or effectiveness, but some may have limitations such as being less accessible or acceptable to patients. Determining the acceptability of different therapeutic approaches for individuals trying to manage their thanatophobia is important. Such research may be best explored prior to conducting additional research on these interventions in order to garner maximum support from potential subjects during the study as well as increase the chance of patient adherence to potential future treatments. Future research combining all four treatment methods (psychotherapy, mindfulness, psychedelics, virtual reality) in a within-subject design could be problematic due to the effects of one treatment confounding others. Another limitation would be recruiting participants willing to test each method. However, a match-subject design that



compares individuals with similar characteristics such as ethnicity and socio-economic backgrounds would be a better fit to test the efficacy of all four treatments. Additionally, further research is needed to explore the potential interaction of the described interventions with each other as well as uncover the mechanisms of action in alleviating thanatophobia so that even more effective treatments can be developed and evaluated.

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The authors have no financial disclosures to make.

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