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Permalink

<https://escholarship.org/uc/item/0wx5g0xz>

Journal

Annals of the New York Academy of Sciences, 1511(1)

ISSN

0077-8923

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Publication Date


2022-05-01

DOI

10.1111/nyas.14740

Peer reviewed

Guidelines and standards for the study of death and recalled experiences of death—a multidisciplinary consensus statement and proposed future directions

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An inadvertent consequence of advances in stem cell research, neuroscience, and resuscitation science has been to enable scientific insights regarding what happens to the human brain in relation to death. The scientific exploration of death is in large part possible due to the recognition that brain cells are more resilient to the effects of anoxia than assumed. Hence, brain cells become irreversibly damaged and “die” over hours to days postmortem. Resuscitation science has enabled life to be restored to millions of people after their hearts had stopped. These survivors have described a unique set of recollections in relation to death that appear universal. We review the literature, with a focus on death, the recalled experiences in relation to cardiac arrest, post-intensive care syndrome, and related phenomena that provide insights into potential mechanisms, ethical implications, and methodologic considerations for systematic investigation. We also identify issues and controversies related to the study of consciousness and the recalled experience of cardiac arrest and death in subjects who have been in a coma, with a view to standardize and facilitate future research.

Keywords: death; cardiac arrest; resuscitation; death by brain death criteria; near-death experiences (NDEs); out-of-body experiences (OBEs); external visual awareness (EVA); recalled experience of death (RED) coma; cardiopulmonary resuscitation-induced consciousness (CPRIC); post-intensive care syndrome (PICS)

Part One. Introduction and purpose

Background

The question of what happens after death has intrigued humans throughout time. For centuries,

it had been considered impossible to explore death, but efforts in the 20th century, leading to the discovery of cardiopulmonary resuscitation around 1960, enabled the heart to be restarted in people

who would otherwise have been declared dead.¹ Now, in the 21st century, combined advances in stem cell research and other areas of neuroscience, together with critical care medicine and resuscitation science, have provided scientific insights regarding the pathophysiological processes that accompany death during the postmortem period, as well as what happens to the human brain, mind, and consciousness in relation to death. In particular, a major paradigm shift in the understanding of death has come from the observation that, in general, brain cells remain more resilient to the effects of anoxia in the postmortem period than traditionally thought.^{2,3} Studies have shown that brain cells left alone after anoxia become biologically damaged in an irreversible manner and hence die over hours and possibly longer, rather than just minutes, after blood flow and oxygen delivery to the brain have stopped with death.³⁻⁵ A major contributor to brain damage is the impact of secondary injuries following the restoration of blood flow and oxygen to the brain, which can be seen to start even after a few minutes of oxygen deprivation (see File S1, online only). Thus, from a scientific perspective, death remains potentially reversible for as long as the underlying cellular processes have not reached biological irreversibility, possibly hours to days into the postmortem period (see File S1, online only). As scientific knowledge and understanding increases, the timeframe to possibly resuscitate people and restore life processes has been pushed further back but it is currently only possible to repair damage occurring relatively early on in this process. While still in its infancy, this field has already enabled life to be restored to millions of people who would otherwise be declared dead.

One of the inadvertent consequences of advancements in resuscitation science during the past few decades has been the realization that many millions of people have come close to, or even entered, what is now considered a gray zone of death by cardiopulmonary criteria before being resuscitated back to life (see Files S1 and S2, online only). Interestingly, many of these survivors have consistently described an apparently universal and unique cognitive state, with paradoxical lucidity and a specific set of recollections, including conscious mental activity, while seemingly in a coma, in relation to their encounter with death.⁶⁻⁹ Although such recalled experiences of death can lead to a positive transformative change

in individuals, rigorous empirical studies of them remain limited.

Currently, barriers to the scientific study of these experiences include a lack of an overall research framework, as well as precise definitions and terminology. Additionally, there have not been any validated measures to help distinguish between experiences recalled in relation to death from a physiological perspective, and while in a coma, from other diverse human experiences. These include but are not limited to other coma-related experiences that occur during critical illness and post-intensive care syndrome (PICS),¹⁰ but also states during wakefulness, such as drug-related experiences.

A conference was held on October 26th, 2019, at New York University, New York, USA, followed by a symposium and panel discussion on November 19th, 2019 at the New York Academy of Sciences in New York City. These were attended by experts from the social sciences, resuscitation science, emergency and critical care medicine, neurology, and neuroscience, with the aim of exploring the current state of understanding regarding cardiac arrest resuscitation, as well as what happens when people die and during the initial postmortem period.

The primary purpose of this document is to establish current knowledge regarding death, consciousness, and the *recalled experience of death* (RED), and to propose an appropriate definition of, terminology for, and a research framework for the study of RED, which may be considered within the wider context of understanding cognitive experiences and psychological outcomes related to PICS.¹⁰ Additionally, we hope to identify important knowledge gaps that will help standardize current research and establish future work by physicians, scientists, philosophers, and social scientists engaged with understanding what happens to human consciousness in relation to death and to help them distinguish between these and other diverse experiences.

The contributors to this statement were selected from disciplines with relevance to exploring death and the RED to provide multidisciplinary input from emergency and critical care medicine, cardiac arrest resuscitation, neurology, neurological critical care, psychiatry, psychology, and the social sciences. This consensus document first provides the background needed to understand the subject (see Files S1 and S2 online only), followed by a summary of recommendations based on a review of the

literature (as summarized in Files S1 and S2, online only). As these reflect the current state of knowledge, they may need to be modified in the future.

Part Two: Establishing a research framework for the study of the RED

Establishing a definition and terminology for the RED

The lack of a definition or specific criteria has meant that different published studies often present phenomenologically different experiences described under different circumstances, all under the label of a so-called near-death experience (NDE). Today, many human experiences in relation to a heterogeneous and diverse group of medical and non-medical conditions with differing underlying pathophysiological states with no relation to physical illness, death, or each other are labeled “NDE” (File S2, online only). These issues make it particularly challenging, if not impossible, to compare different scientific publications in peer-reviewed journals that purport to be reporting on experiences related to death or that are labeled as so-called NDE. Thus, as science approaches 50 years since the initial widespread descriptions of recalled experiences in relation to death, much more evidence has emerged, the understanding of death has become more sophisticated, multiple fields of science have greatly advanced, and many shortcomings have been identified. These shortcomings will need to be rectified to standardize and provide common ground for future empirical research in this area.

Recalled experience of death (authentic NDE)

We aim to provide specific criteria and a definition to distinguish between the recalled experiences of death and what may be termed an authentic NDE (File S2, online only), from other diverse human experiences that may have also been labeled NDE due to the lack of precise standards. We propose that any report or recollection that purports to describe an experience in relation to death—whether referred to as a so-called NDE or otherwise—should include the following six components: (1) a relation with death, (2) a sense of transcendence, (3) ineffability, (4) positive transformative effects (related to meaning and purpose to life), and a (5) severity of illness that leads to loss of consciousness (LOC), together with the (6)

absence of features of other coma-related experiences (such as conventional dreams, delirium, and delusions, in the intensive care unit (ICU) or elsewhere). The first four conditions reflect the essence of the narrative arc of the original transcendent experiences described in 1975 (File S2, online only), and the final two points are critical and necessary for the correct identification of experiences in relation to death, while excluding other coma-related critical illness/life-threatening experiences, as well as diverse, nondeath-related human experiences (File S2, online only).

The consensus was to use the descriptively more accurate and broad term of RED instead of NDE to refer to the study of transcendent experiences in relation to an encounter with death. This approach provides several advantages. First, it avoids the limitations and ambiguities of the term “near-death” by encompassing life-threatening conditions in proximity to death (true critical illness/life-threatening conditions) from a pathophysiological perspective, as well as conditions that reflect the underlying pathophysiology that occurs with death itself—namely cardiac arrest and other cardiac standstill states. Second, the use of this new term circumvents the confusion and problems that have arisen after so many other diverse human experiences have been misattributed as NDE in the literature. Thus, simply modifying the term *NDE* (e.g., to *authentic NDE*) would not likely overcome this long-standing issue, in part because any such term will inevitably be abbreviated back to NDE. Third, over the past 50 years of research, many additional themes have been identified in relation to the experience of death, which were not part of Moody’s original descriptions (summarized in Table S1, online only). Although the term classical NDE should refer to Moody’s original descriptions (and not the other ill-defined and diverse concepts and experiences put forth as NDE later), it does not encapsulate the breadth of newer discoveries and themes (Tables 1 and 2). For one thing, Moody identified 11 themes related to survival from life-threatening disorders and four other themes that related to the longer-term impact of the experience (Table S1, online only). At present, at least 50 themes have been identified. Furthermore, even among the themes that Moody had described—for example, a life review or experiencing a light—many additional subthemes have now been identified (Tables 1

Table 1. Themes in relation to RED

Separation
1. Separating from the body
2. Paradoxical lucidity
3. Initial confusion
4. Realization of having died
5. A sense of liberation and weightlessness
6. Visual awareness: observing the body or events from above
7. A birds eye view: I felt like I could “see” in all directions (360 degrees)
8. Becoming detached from events below
9. “I,” myself remains
10. Shedding the body
11. Connected by a “cord”
12. Hovering or floating in the space
Heading to a “destination”
13. Being drawn toward a “destination”
14. Seeing or traveling through a tunnel
Reliving the recording of my life: actions and intentions matter
15. Review of the recording of my life: all my thoughts, intentions, and actions matter
16. The indescribable: a compassionate, loving, “perfect,” and luminous being
17. Not as good as I thought: judging my true worth as a human being
18. Reliving life events: I re-experienced each moment
19. Being in others’ shoes: experiencing the perspective of others
20. A glance at my past and prior past
21. The domino effect: impact and consequences of actions
22. Human dignity: importance of living with morals and ethics
23. There is a reason underlying it all: cause and effect rules
24. Embarrassment and shame: I could have done better
25. The education: need to evolve into a better human being
26. A higher purpose: I wish I had known
“Home” again
27. Returning “home”: a place I had known before
28. Time is not as it would seem
29. The atmosphere: permeated by benevolence, kindness, knowledge, and truth
30. Being assisted
31. Experiencing themselves or others: an image or a light (with differing intensity and magnitude).
32. Communication: thought is everything
33. Becoming detached
34. I suddenly knew so much
35. Life is like a dream by comparison: much more real than anything else
36. A hierarchy exists: layers of comprehension
37. My position in the hierarchy: a matter of comprehension and wisdom

Continued

Table 1. (Continued)

The return
38. An origin: a source
39. Reaching a point of no return
40. Really want to stay
41. Must return
42. Sensations during return
43. My mission
Reported effects after the experience
44. Ineffability
45. Forgetting so much
46. Overall positive experience despite errors
47. The challenge of personal interpretation
48. Seeking purpose and meaning in life
49. Loss of fear of death
50. Reappraising the role of hardships
51. Long-term positive effects

and 2). Consequently, a term such as authentic NDE would potentially encapsulate the classical NDE, while also acknowledging and incorporating additional themes and subthemes that have been discovered over the past 45 years since the original description of NDE. However, it would not accurately encapsulate the experiences that occur when the biological criteria for death have been met. Fourth, the use of a new term allows a more accurate definition at the outset, which should prevent its misuse in relation to recollections that do not relate to death in the future, as has plighted the term NDE.

A RED is defined as a specific cognitive and emotional experience that occurs during a period of LOC in relation to a life-threatening event, including cardiac arrest. The issue of LOC relates to assessments from the perspective of a clinician or other external observer, even though from the perspective of the person experiencing a RED, often there was no perception of any LOC. In fact, many report a heightened sense of consciousness. It includes multiple specific themes (at this time around 50 have been identified as summarized in Tables 1 and 2), which may be recalled only in fragments (in part due to the impact of brain insults and sedative drugs on memory circuits), but fall into and follow this specific narrative: perceived death and separation from the body (with lucid visual and auditory awareness), heading to a destination, reliving a recording of life that is purposeful, meaningful, and educational, being “home” again, and returning back to life (Tables 1 and 2 and Fig. 1). Aside

Table 2. Selected illustrative quotes related to RED

Separation	
1. Separating from the body	<p>"I left my body ... I remember being in the hospital room and realizing that I was not in my body." "I remember leaving my body and rising up to the ceiling of the room."</p>
2. Paradoxical lucidity	<p>"The thought was very lucid and came through immediate knowing. It was a different way of thinking from which I had experienced." "I still was completely lucid and aware of what was going on."</p>
3. Initial confusion	<p>"I was intrigued. I tried to find an explanation but I couldn't. I looked around stunned." "I didn't know why I was there...."</p>
4. Realization of having died	<p>"I knew that I had died and would be leaving behind a 5-6 month old infant and my husband." "I knew obviously my body still lay in bed, but I could not go back into it anymore. 'Is this death?' I contemplated."</p>
5. A sense of liberation and weightlessness	<p>"I felt wonderful and light where I was. I had no pain and no problems." "While I was in this place, I was weightless."</p>
6. Visual awareness: observing the body or events from above	<p>"I saw the whole room and everyone working on me from the ceiling of the room. I was watching the heart monitor machine and saw that my heart had flat-lined. I saw that the hospital staff were trying to get my heart to start again." "The first thing I experienced was that I could suddenly see my body from above."</p>
7. A birds eye view: I felt like I could "see" in all directions (360 degrees)	<p>"I could see from the top of the room in 360-degrees." "I perceived and saw everything around me, like in 360 degrees."</p>
8. Becoming detached from the events below	<p>"[I] recognized the body as mine but was no longer interested: I was not that body." "I didn't identify, in any way, with the body or the people in the room. I was instead, a detached observer."</p>
9. "I," myself remains	<p>"I was still alive but I didn't have my body. I know for a fact that I am, that I exist. I sensed that I had left my body ... I have died and left my body, yet I still exist." "I remember 'me' being pulled away, out of the bed, but my physical body was lying limp."</p>
10. Shedding the body	<p>"I had shed the sense of my body very quickly." "I was amazed... that body there was just a coat I had been wearing. It felt good to be out of it."</p>
11. Connected by a "cord"	<p>"I distinctly remember marveling at the thin, glowing, silver 'cord' leading ... to the body on the table. It was stretched very thin." "I did see a silver cord attached to my body which had a luminescence to it."</p>
12. Hovering or floating in the space	<p>"I hovered over the doctor who conducted the treatment." "I started floating. I barely glanced at the over packed surgery room, emergency bells were ringing for my doctor. I saw her looking at my body."</p>
Heading to a "destination"	
13. Being drawn toward a "destination"	<p>"I began rising... I continued [moving] for some time before I became aware of a small bright light in the distance in the direction I was headed." "I knew where I was headed and I wanted to get there, fast. I can't recall if I was moving myself towards it or if I was being 'drawn' to it somehow but it was a 'need/desire' within me."</p>
14. Traveling through a tunnel	<p>"I traveled through a kind of tunnel." "It appeared as though we were going through a tunnel of light."</p>

Continued

Table 2. (Continued)

Reliving the recording of my life: actions and intentions matter	
15. Review of the recording of my life: all my thoughts, intentions, and actions matter	<p>"I saw myself on the wrong side... I was not as good as I thought I was... I was also shown the good things I had done."</p> <p>"I did not know [the being] is aware of everyone and everything every minute of each day, that each act, word, intention is duly noted."</p>
16. The indescribable: a compassionate, loving, "perfect," and luminous being	<p>"[I saw a] ... very strong and powerful [being], but yet it was gentle and filled with love. I remember having the thought that I could linger here forever, and just experience this joy, this beauty, and this love."</p> <p>"I was not alone; I could sense a presence with me... I felt a presence, and also felt complete trust in this company."</p>
17. Not as good as I thought: judging my true worth as a human being	<p>"I was shown every time I had been selfish, choosing for my own interests. I was shown every time I had been divisive or manipulative for selfish gains. I then felt that pain several folds over."</p> <p>"My whole life was viewed, analyzed and judged."</p>
18. Reliving life events: I re-experienced each moment	<p>"[In my life review] not only was I viewing moments [of my life], I was feeling them happen again as if I were there."</p> <p>"[In my life review] I was able to re-experience myself in all events in my life."</p>
19. Being in others' shoes: experiencing the perspective of others	<p>"I could examine [my experiences] from multiple perspectives, such as the people they affected."</p> <p>"Many events in my life I experienced, but not from how I remembered it, but from the point of view, I experienced it from how the people ... experienced it around me."</p>
20. A glance at my past and prior past	<p>"My understanding is that we live numerous lives, each with a different 'purpose.'"</p> <p>"I knew this wasn't my first time here."</p>
21. The domino effect: impact and consequences of actions	<p>"I saw how my choices and behavior rippled through the lives of countless others. How the love I showed spread like wildfire. How the way I mistreated others, deeply hurt and affected them."</p> <p>"[I saw] how big an impact my seemingly small actions had on a large scale."</p>
22. Human dignity: importance of living with morals and ethics	<p>"I received such an applaud and joy for a simple [selfless] act, that is unbelievable."</p> <p>"[The being] saw all of the good I had done in my life and whether or not I was truly good or if I was doing good things to get something, and how I truly felt at the time. He weighed the good and the bad in my life."</p>
23. There is a reason underlying it all: cause and effect rules	<p>"[My life review] was like watching a mathematical equation, or sum, that makes perfect sense. Such event and such event create this kind of result. It was a simple portrayal of natural cause and effect, with a gentle understanding."</p> <p>"It was all there at the same time, all the details of all the cause and effect relations in my life, all that was good or negative, all of the effects my life ... had had on others, and all of the effects ... others that had touched me had had on me."</p>
24. Embarrassment and shame: I could have done better	<p>"I had done so little with my life! I had been selfish and cruel in so many ways! I was truly sorry I had done so little."</p> <p>"When [my life review was over] my head was hung in shame for [what the being] had seen too. I was not happy about many, many of my actions."</p>
25. The education: need to evolve into a better human being	<p>"I found out that... I had to improve as a human being."</p> <p>"I learned so many things about myself that I did not know."</p>
26. A higher purpose: I wish I had known	<p>"I felt that there was something at stake, that we have a very important job to do."</p> <p>"I saw that I alone am in charge of my destiny."</p>
"Home" again	
27. Returning "home": a place I had been before	<p>"The traveling began to slow, and I had a sense that I was arriving somewhere."</p> <p>"I knew I was home."</p>

Continued

Table 2. (Continued)**28. Time is not as it would seem**

“There was no time. Everything happened, but without a measure. I don’t know how to explain.”

“Time had lost its meaning.”

29. The atmosphere: permeated by benevolence, kindness, knowledge, and truth

“I was in a place of love, kindness, compassion, contentment, acceptance and joy - a place of ‘knowing.’”

“The first feeling [I had in this place] was a feeling of intense peace. It was so calm and serene with an incredible amount of tranquility. All of my ... worries, thoughts, fears, and opinions were gone.”

30. Being assisted

“I was surrounded by my deceased relatives. I was feeling so much joy and lightness from seeing them. I felt they were there to help me.”

“There was a stream of beings guided me. They affirmed my answers, clarified my confusions, and comforted my bewildered heart.”

31. Experiencing others: an image or a light (with differing intensity)

“I felt very comfortable and I was being approached by a being – a being of light. As he came to me, I recognized that it was my grandfather. He had passed away about five years prior to that.”

“I can’t really describe how awesome, calm, and perfect [my father] looked. When he passed, he was 73 years old and all grey beard and moustache. As he appeared before me, he was much younger.”

32. Communication: thought is everything

“No words were spoken and everything was communicated by thought.”

“[My mother and grandmother] communicated to me in some way, certainly without words or hearing, but clearly inside my mind.”

33. Becoming detached

“As strange as it may seem, the more away I was ... the more the existence of my family ceased to matter to me. I didn’t think of my son and that was very strange.”

“I thought of my family who I had left behind. But I didn’t feel upset or worry for them. I knew that they would be cared for in my absence, so much so, that I only thought about them briefly.”

34. I suddenly knew so much

“I knew that my awareness ... was growing exponentially moment by moment.”

“I had way more knowledge than I normally did.”

35. Life is like a dream by comparison: much more real than anything else

“Everything was hyper-realistic, perhaps more real than I have ever known reality to be.”

“Our daily life seems like a dream in comparison to my experience.”

36. A hierarchy exists: layers of comprehension

“I felt sure that the person made of love was much, much, much more superior to me.”

“I understood they were beings in a much higher level.”

37. My position in the hierarchy: a matter of comprehension and wisdom

“My own awareness of this new dimension seemed much more limited than their awareness.”

“I was taken before more beings which seemed to be wiser than [others].”

38. An origin: a source

“I saw the divine spark, that light that connects us to the creator, to the source where we return with unimaginable joy.”

“[I was going] back to my origin and the origin of everything.”

The return**39. Reaching a point of no return**

“At one point, [I was] ‘told’ I wasn’t allowed to pass yet and had to ‘go back.’”

“I knew that there was a boundary behind me as I was looking down. I knew that I could have passed through ... but crossing that ‘sensed’ boundary would have meant leaving my body permanently.”

40. Really want to stay

“I felt more joy and contentment than even the brightest moments in this life ever provided, and I didn’t want to return.”

“I wanted to stay in the world of love, peace, and light, but they reminded me of my responsibilities back.”

Table 2. (Continued)**41. Must return**

“Hard as it was to leave this place of overwhelming unconditional love and indescribable peace, I knew I had to return.”
 “I do remember that somehow it was conveyed to me that it was not my time yet, and I had to return.”

42. Sensations during return

“I was being sucked back into my body like it was a vacuum.”
 “Being dropped back into my body wasn’t pleasant. I felt my body bounce and I still could not breathe. My blood pressure had plummeted.”

43. My mission

“That it was not my time and that I needed to return to my body, to complete my life’s mission.”
 “I felt an obligation, a responsibility of sorts. I needed to finish what I had begun, to learn...”

Reported effects after the experience**44. Ineffability**

“There are no words to explain some of the things I saw, felt, experienced ... There are no words for the feelings I felt.”
 “It’s extremely difficult for me to find adequate words for those feelings and insights. It’s something which couldn’t, even remotely, be described or somehow explained with ... words.”

45. Forgetting so much

“I knew so much instantly, that I don’t remember anymore at this time. I can only speculate that I can’t know it in the physical state I’m in now. There was a flood of information, images, and knowledge.”
 “All I can say is I knew so much then that I don’t now.”

46. The challenge of personal interpretation

“There was a great Royal figure I’m assuming was Jesus Christ, who briefly came to see me, even though I didn’t deserve to take up His time.”
 “I believe this place was heaven.”

47. Overall positive experience despite errors

“It was the most positive feeling I have ever felt.”
 “I felt the most beautiful feeling of love and belonging.”

48. Seeking purpose and meaning in life

“I do not know what my work ... is. But, I am sure that I must do something. I believe that it is something important.”
 “I believe every single person presently here, has a ‘mission’, has opportunities to grow and learn and that we can alter our choices to better our own lives and the lives of the future generations.”

49. Loss of fear of death

“This experience has changed my life and my thinking. I am no longer afraid of dying, as I have experienced it once.”
 “Since [my experience], I have not been afraid of death.”

50. Reappraising the role of hardships

“All of life’s challenges have been chosen for a reason and each event teaches us something we need to learn in order to evolve to the next lesson.”
 “I feel that our suffering is the greatest of all blessings ... Each person’s hardships are directly related to the lesson that person must learn. It is our choice whether we accept the challenge or not.”

51. Long-term positive effects

“I have been much more mindful of others. It’s easier for me to put myself in other people’s shoes. It’s easier for me to act out of love and compassion. However, it’s still something I put work in.”
 “I’m more aware of how I affect those around me; I still get emotional, I still screw up, and I’m well aware that this experience has not made me perfect....it has driven home the point of trying to be more mindful.”

NOTE: Tables 1 and 2 represent data from an ongoing qualitative study of experiences in relation to life-threatening conditions. These recalled experiences of death comprise a specific narrative that can be broken down into six broad “parent” themes. Under these broad themes, 50 overall themes have been identified, which further illustrate the overall narrative of the RED. The order of the appearance of these themes is reported in an idealized manner for illustrative purposes.

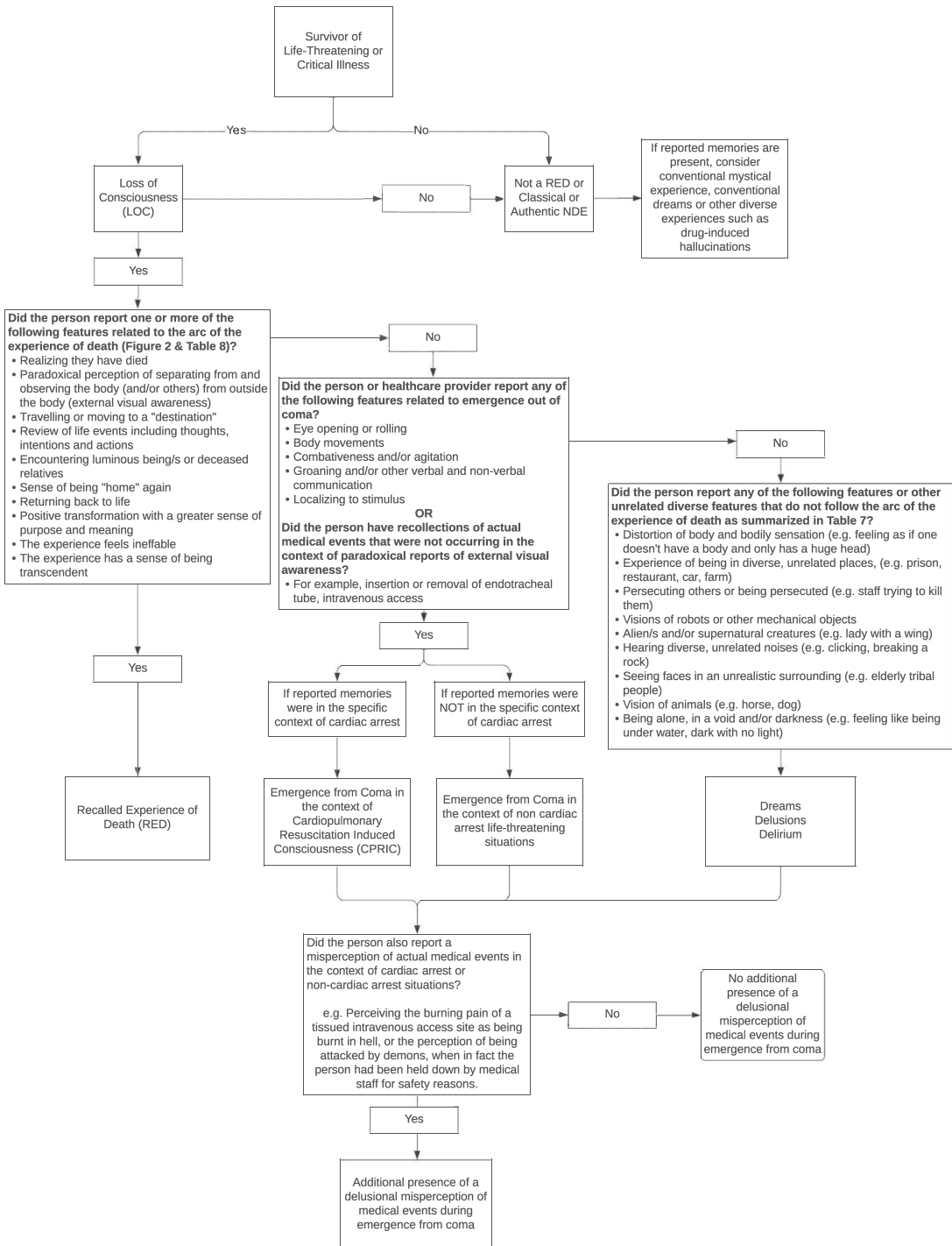


Figure 1. A proposed method to distinguish between the recalled experience of death (authentic NDE) and other experiences.

from its themes, a RED further includes ineffability and transcendence and leads to (7) a positive transformational change, as evidenced by greater interest in the meaning and purpose to life in those who have experienced it. Furthermore, it can be distinguished from other experiences during coma or emergence from coma, dreams, ICU delirium, and ICU delusions, as well as other broad human experiences during conscious (awakened) states or states of altered consciousness, through the specific recalled themes and narrative, as summarized in Figure 1 and Tables 1 and 2, as well as its overall positive effect and impact on the individual. These are unique and different to drug-induced experiences, dreams, delusions, or delirium-related experiences as summarized in Tables S3 and S7 (online only). The positive transformation is typically observed over the long term; however, from a pragmatic perspective, any observed positive effect, change, or transformation should be acceptable for inclusion for research purposes, without the need for a specific timeline. This will avoid challenges with the inclusion of experiences recalled after a relatively short period following a life-threatening event.

Specifically, the definition of an experience in relation to death means a condition that would ordinarily lead to death without timely life-saving critical care interventions. Because, in medical practice, being physiologically close to death leads to systemic derangements that lead to altered cerebral blood flow and/or other cerebral metabolic derangements and coma, a period of LOC is a prerequisite for reported memories that occur during life-threatening/critical care disorders. In other words, anyone with a preserved mental state (state of consciousness during wakefulness) cannot be considered to have had a severe enough life-threatening disorder, and their experiences cannot be considered in relation to death or critical illness. Consequently, their experiences cannot be labeled using the terms “near-death” or NDE. Finally, this last condition takes into consideration the fact that people may typically remain in a coma for days and weeks while in the ICU after any life-threatening condition, including cardiac arrest, and that during their coma, they are likely to form multiple phenomenologically different memories at different times. These include dreams

and misattributed memories formed during emergence out of coma. It is thus important to recognize and distinguish between these different experiences and the classical or authentic NDE, which exhibits a different narrative with very specific themes.

It has been recognized that documentation of loss of vital signs, presence of abnormal vital signs, or proximity to death (e.g., apnea, respiratory failure, shock, severe hypotension, etc.) may not always be available to survivors who are reporting their experiences, even when a condition that ordinarily leads to loss of vital signs had clearly been present (e.g., cardiac arrest). Therefore, a description of a life-threatening medical condition that required timely intensive/critical care interventions (including cardiac arrest) and had led to LOC is sufficient to meet the criteria of being related to death. Consequently, the experiences that some have labeled using the umbrella term of NDE in the past in the context of circumstances that are not near-death, or the new phrase of so-called “NDE like,”¹¹ experiences, while important, should be considered as fundamentally distinct experiences and conditions, with different underlying physiological and pathophysiological processes. They should be classified and investigated separately and should no longer be labeled as NDE or referred to using terms that relate to being “near-death” or “near-death like,” which are actually contradictory. These include the variety of human experiences that have no relation to death, are reported to occur during conscious states, and either have no shared themes or features with recalled experiences of death (narrative arc in Fig. 1), or may only share very superficial features (e.g., simply referring to an experience using religious symbols or terms, or using general and nonspecific terms, such as feeling peace). The limitations of relying on religious symbols in these circumstances are described in greater detail in the File S2 (online only). Importantly, such experiences typically lack any reference to transcendence, a purposeful and meaningful life review, and positive transformation leading to greater emphasis on meaning and purpose in life, and are phenomenologically different from the original descriptions and core meaning of classical or authentic NDE (Fig. 1; and File S2, online only).

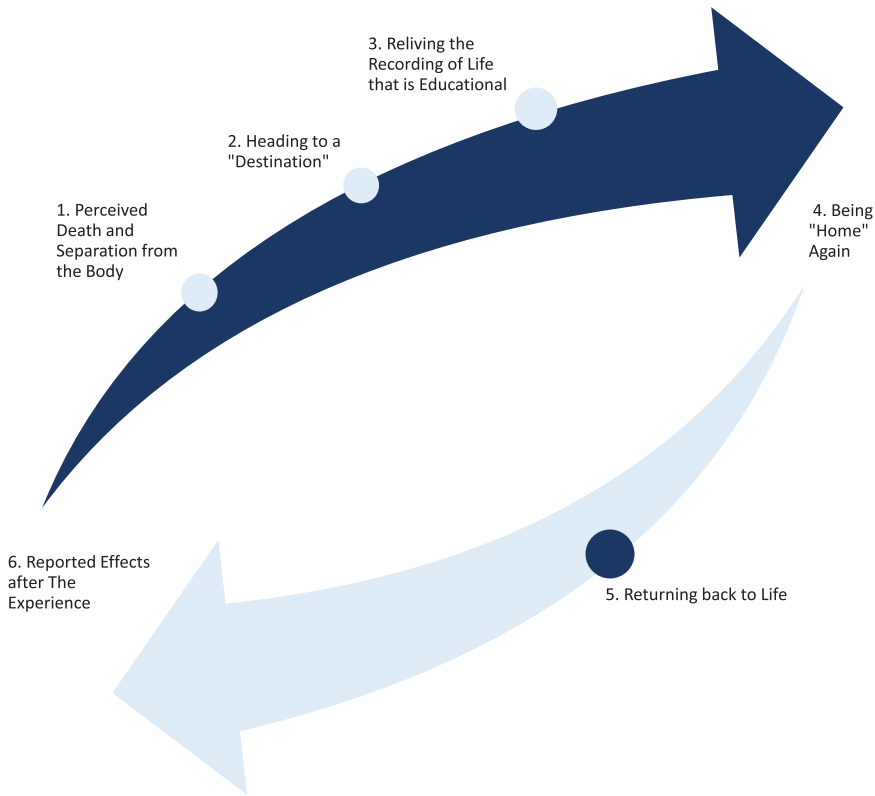


Figure 2. Proposed overall narrative of the recalled experience of death. The recalled experience of death comprises a specific narrative that can be broken down into six broad categories of themes in an idealized manner.

Overcoming challenges related to distinguishing RED from other related experiences

One of the challenges with the study of recalled experiences of death is deciphering them from the broad categories of other experiences that can also occur during unconsciousness and coma. These include (1) delirium/confusion related to underlying metabolic and electrolyte disturbances, including hypoxia and hypercarbia, (2) conventional dreams, (3) ICU delusions and (4) experiences formed during the period of entry and/or emergence out of coma, as well as (5) cardiopulmonary resuscitation-induced consciousness (CPRIC). Generally speaking, these broad experiences can be recognized and distinguished based on their features, phenomenology, narrative, and long-term effects as summarized in Figure 1. In brief, a RED (including the classical/authentic NDE) is characterized by memories that follow a specific narrative and limited number of broad

themes with other underlying subthemes summarized in Figure 2, and Tables 1 and 2. These include paradoxical lucidity and a heightened sense of consciousness, awareness, and well-structured thought processes, typically without external or visible signs of consciousness. Specifically, a RED (and the classical/authentic NDE) may contain features such as a detailed life review, visual and auditory awareness, and recollection of actual verifiable real events (consistent with external visual awareness (EVA) or so-called classical or authentic out-of-body experience (OBE) as detailed in Tables 1 and 2). These features make them inconsistent with hallucinations,¹² illusions,^{13,14} delusions,¹⁵ or conventional dreams^{16,17} that also occur in the context of ICU survival and PICS (see File S2, online only). This experience is further linked with ineffability, positive changes, and transformation. Hallucinatory experiences can be differentiated from a RED by the large series of unrelated and interspersed themes that

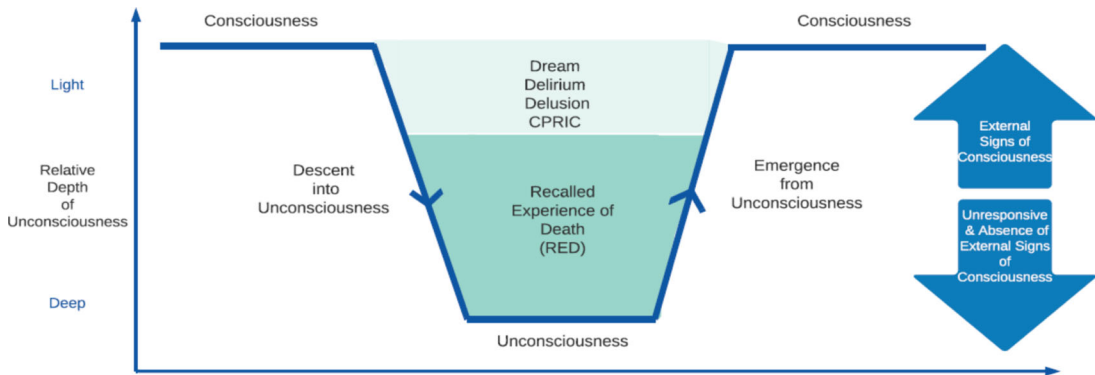


Figure 3. Proposed relationship between relative depth of unconsciousness and occurrence of different types of memories reported by intensive care unit (ICU) patients. A hypothesized relationship between relative depth of unconsciousness and the occurrence of different types of reported memories in ICU patients. The light green area represents lower depths of coma. This is where patients may respond to commands or show visual signs of consciousness. The deeper green area represents deeper depths of coma, where patients will not show external signs of consciousness (corresponding with a Glasgow Coma Score of around 3). It is proposed that some memories (such as CPRIC, delirium, dreams, and delusions) may form when patients are at lighter depths of unconsciousness. Here, information processing from the external environment is possible. However, other memories, such as the recalled experience of death, may occur at deeper levels of unconsciousness. CPRIC, cardiopulmonary resuscitation-induced consciousness. Glasgow Coma Score, a commonly used scoring system to measure the depth of coma in clinical practice. This is based upon an assessment of eye opening, verbal, and motor responses.³²

typically do not follow a specific narrative or are inconsistent with the broad narratives described during a RED as summarized in Tables 1 and 2, and Tables S3 and S7 (online only). Delirium (acute confusional state) involves confused memories with clouding of consciousness and themes that do not follow a specific narrative and are also inconsistent with the broad narratives described during a RED. Memories associated with emergence from a coma may incorporate elements that relate to actual ongoing medical events (such as the removal of an endotracheal tube) but may represent a misinterpretation (confused interpretation) of these events. Dreams are typically recalled as a variety of inconsistent and unrelated themes (Table S7, online only). Although past investigators have not focused on studying these experiences separately, future systematic research is needed to better understand the broad categories of experiences that occur in relation to death, as well as other comatose states. Nonetheless, a RED is distinguished by the specificity of its recalled themes and particular narrative, as well as its overall effect and impact on the individual, including ineffability and transcendence leading to positivity and transformation, as evidenced by seeking greater meaning to life beyond conventional measures of social success (Tables 1 and 2). Overall, based on the results of published

studies, during a RED, typically there may be no visible external signs of consciousness present,^{18,19} whereas during other coma-related experiences (such as CPRIC), there may be some visible signs of consciousness (such as moving, groaning, agitation, etc.) present or the experiences are occurring during sleep (e.g., dreams), where people are easily rousable. Based on the evidence so far and while recognizing the need for further research, it could be hypothesized that the RED may occur at a deeper level of unconsciousness compared to the other broad categories of coma-related experiences as visualized in Figure 3.

Overcoming challenges related to development of a measurement scale for RED

As summarized in File S2 (online only), in general, the challenges faced when attempting to create a research scale have included: (1) the lack of a universal definition for what constitutes a RED/classical or authentic NDE, (2) the means to distinguish this from other human experiences, including but not limited to experiences in relation to critical illness, (3) the multifaceted nature of an experience that is impacted by memory loss and may be recalled through fragmented memories, (4) the lack of language and terminology to describe the ineffable features of the experience, (5) the lack

of specific means to quantify and measure transcendence and (6) transformation, together with (7) the lack of objective means to define proximity to death. Furthermore, although factor analysis is often used for the development of measurement instruments and research scales, it may not be an optimal method for the study of RED, or classical or authentic NDE. This is because examining the frequency of a specific memory and its correlation with other memories is not an ideal method. This relates to the fact that, in this population, significant memory loss is expected by definition, and the absence of recall does not imply the absence of experience. Thus, the assumption that the reported frequency of recalled memories represents the true frequency of memories cannot be applied to people with conditions that have led to memory deficits, as occurs after life-threatening events and coma. Consequently, selecting recalled memories based on their frequency of recall and how well they correlate with each other, while excluding items that exhibit a lower frequency of recall and thus fail to show a correlation with other items, will inevitably lead to the exclusion of important themes and the inclusion of other unrelated recalled themes, such as conventional dreams. An alternative approach, which does not rely on the correlation between frequencies of different experiences, would be to use item response theory.²⁰ Future research is needed to develop and validate a research scale that is sensitive and specific enough to distinguish the recalled experiences of death from other diverse experiences. It should also be noted that during a coma, people may have multiple different experiences, while also losing memory of many aspects of their experiences, as well as a sense of time (related to when each had occurred) and perspective. Thus, whether researchers want to use conventional methods or machine learning for the identification of themes in qualitative studies, the subjects' recollections (which may reflect many different experiences over hours, days, or weeks while unconscious) should first be separated out (e.g., into RED, CPRIC, dreams, and emergence from coma). Otherwise, machine learning algorithms will not necessarily be able to discriminate between the different types of experiences and many unrelated "false" themes will likely emerge and be mistakenly labeled as being the same. Clearly, the importance of separating the different themes out also applies to nonmachine learn-

ing methods or other systems used for thematic analysis of post cardiac arrest and PICS-related recollections.

Part Three: Future directions

Scientific advances have increasingly challenged traditional societal views regarding death and what happens when people die. While understanding death and what happens when we die remain a mystery, this may now be a mystery that is amenable to unbiased and objective scientific scrutiny.

When close to death, people at the end of life have been observed to paradoxically demonstrate episodes of lucidity—including terminally ill people who have been in a coma without visible signs of consciousness for long periods or people who have suffered with end stage severe dementia.²¹ Furthermore, for many decades, patients who have been diagnosed with a persistent vegetative state (PVS) had been assumed to not have consciousness; however, recent data suggest that such patients paradoxically retain elements of consciousness.^{22,23} Thus, studies of consciousness and lucidity during cardiac arrest, PVS, and terminal lucidity during end of life experiences suggest that, paradoxically, people deemed to have irreversibly lost consciousness may in fact maintain a component of consciousness. Hence, by identifying the underlying processes that relate to lucidity, despite the loss of visible signs of consciousness, novel therapeutic avenues may be identified. To date, there has been research that could improve disorders of consciousness among patients with a PVS through the sleep-promoting drug zolpidem, which has been shown to enhance brain functioning in patients in a PVS.²⁴

Other promising avenues for future research involve systematic studies into important phenomenon such as transcendence and transformation. Furthermore, the positive transformational changes that people report after RED are consistent with themes established in the positive psychological literature—for example, optimism, gratitude, compassion, love, awe, and resilience—all constructs associated with well-being and flourishing.^{25–27} Further research is also needed into building consensus regarding the universality of spiritual and mystical experiences within the context of transcendence, ineffability, and positive transformation. The impacts of these categories of experience on the domains of well-being, which,

taken as a whole, comprise flourishing, have yet to be adequately investigated.²⁸ Furthermore, in order to assess the transformative impact of a RED on subsequent well-being domains, which taken together comprise human flourishing, it may be necessary to undertake a multidisciplinary appraisal of the most important aspects at the end of human life.²⁸ Some might suggest this could entail at least five domains: happiness and life satisfaction, physical and mental health, meaning and purpose, character and virtue, and close social relationships.^{29–31} The inclusion of additional domains may vary across cultural groups.

Finally, we suggest that although systematic studies have not been able to absolutely prove the reality or meaning of patients' experiences and claims of awareness in relation to death, it has been impossible to disclaim them either. Clearly, the recalled experience surrounding death now merits further genuine empirical investigation without prejudice.

Summary and key recommendations

1. The cessation of heartbeat rapidly leads to the loss of respiration and brain stem activity. This is referred to as "cardiac arrest" when attempts at resuscitation are made to restart the heart, and "death by cardiopulmonary criteria" when attempts are not made, when resuscitation is deemed futile, or when it is unsuccessful.
2. Most people (~98%) are declared dead by cardiopulmonary criteria and the remaining 2% are declared dead by brain death criteria.
3. Brain cells do not become irreversibly damaged within minutes of anoxia. Instead, they become irreversibly damaged and "die" over hours (and possibly longer). Thus, although the irreversible loss of vital organ function remains the hallmark of the definition of death, irreversibility progresses through two phases in a cadaver over many hours—namely, first relative (medical) irreversibility and, second, absolute (cellular) irreversibility (see File S1, online only).
4. The period of relative (medical) irreversibility, which precedes the onset of absolute (cellular) irreversibility of death, reflects a "gray zone," in which the potential to resuscitate remains. This period provides a possible opportunity for treatments directed at saving lives and brains, as well as the possibility to scientifically study what happens during the initial period of death.
5. Due to advances in resuscitation and critical care medicine, millions of people have survived encounters with death or being near-death. These survivors have consistently described a unique and specific set of cognitive recollections with seemingly universal themes that includes paradoxical lucidity, consciousness, awareness, and recall. Unlike ICU dreams, delusions, and delirium, or drug-induced hallucinations, these recalled experiences of death follow a specific narrative and are associated with transcendence, ineffability, and positive transformation.
6. Although recalled experiences in relation to death were originally labeled NDEs in the 1970s, this term was not formally defined. Consequently, over the years, it has been used unsystematically to refer to an assortment of unrelated heterogeneous human experiences, often with no relation to death, critical and life-threatening illnesses, or each other.
7. We propose to use the term of EVA in place of OBE. This reflects a specific and lucid state of visual (with and without auditory) awareness of one's own body and its surroundings, which is paradoxically perceived through an external view of oneself.
8. There are insufficient data to support the theory that EVA and autoscapy, somatosensory, and visual illusions are the same. Systematic studies are needed to determine whether stimulation of a focal point or multiple foci in the brain may trigger the occurrence of an EVA (classical or authentic so-called OBE).
9. A variety of potential intermediaries have been proposed to account for recalled experiences in relation to death as either hallucinations, delusions, or illusions in response to a disordered brain; however, data from high-quality studies are missing to support these theories. No specific neuromodulators have been identified to account for recalled experiences of death, including the so-called NDE or OBE reports.
10. The identification of a brain modulator(s) in association with any experience (whether in relation to death or otherwise), including

so-called NDE or OBE, can neither establish nor refute the reality of the experiences, just as the identification of brain modulators that underlie other human experiences, such as love or religious experiences, cannot establish or refute their reality.

11. Children have described similar recalled experiences to adults, often using children's terminology and during play, sometimes over months. However, studies in this area are limited to case reports and case series.
 12. The literature that cites NDEs can now be divided into the following three categories: (1) classical, (2) authentic, and (3) mislabeled NDEs. The term classical NDE refers to the original experience described in 1975. The term authentic NDE refers to the classical NDE but with the addition of newer categories and themes that have been discovered since 1975. These two are distinguished from mislabeled NDE, which refers to a heterogeneous group of experiences that have no relation to death or life-threatening illness but have also been labeled NDE.
 13. Experiences in relation to death (including a classical or authentic NDE) should include: (1) a relation with death as evidenced by the presence of a life-threatening illness, (2) a sense of transcendence, (3) ineffability, (4) positive transformation, and (5) a severity of life-threatening illness that leads to LOC, together with the (6) absence of features of other coma- and noncoma-related experiences (including conventional dreams, ICU delirium, and delusions).
 14. Being physiologically close to death leads to systemic derangements that alter metabolic brain activity and lead to LOC, a prerequisite for reported memories that occur during life-threatening/critical care disorders. Anyone with a preserved mental state cannot be considered to have had a severe life-threatening disorder that could be considered in relation to death. Therefore, terms such as near-death, NDE, or NDE like cannot be applied to such people.
 15. Documentation of loss of vital signs, the presence of abnormal vital signs, or documentation of proximity to death (e.g., apnea, respiratory failure, shock, severe hypoten-
- sion, etc.) may not be available to survivors who are reporting their experiences. Therefore, a life-threatening medical condition that required timely intensive/critical care interventions and which led to LOC is sufficient to meet the criteria of being related to death for research purposes when confirmatory medical records are unavailable.
 16. Many of the experiences labeled as NDE should be considered fundamentally different experiences with different underlying physiological and pathophysiological processes and should be classified and investigated separately.
 17. We propose the use of RED instead of NDE in reference to the study of experiences in relation to death. This term, therefore, allows a more accurate definition at the outset, with the aim of preventing future misuse in relation to recollections that do not relate to death.
 18. A RED is defined as a specific cognitive experience occurring during a period of LOC in relation to a life-threatening event, including cardiac arrest.
 19. Frightening or distressing experiences in relation to medical disorders and critical illness often share neither the same themes as RED (or classical or authentic NDE), nor the same narrative, transcendent qualities, ineffability, and positive transformative effects. In many instances, these likely reflect ICU delirium and delusions.
 20. Researchers should take into consideration the fact that people may remain in a coma for days and weeks after any life-threatening condition, including cardiac arrest. Thus, aside from a RED (or classical or authentic NDE), they can form multiple phenomenologically distinct memories at different times, including dreams, ICU delirium and delusions, as well as experiences related to emergence from coma. However, while recalling their experiences, they may often describe them all together. It would be important to separate these out for research purposes.
 21. When studying the experiences of death, explicit recall of memories may not fully reflect the totality of the experience. In particular, brain insults, including ischemia,

- reperfusion injury, and inflammation, can adversely impact memory circuits and recall. These may in part provide an explanation for why memories may be absent or recalled only in fragments.
22. Overall, a host of phenomenologically diverse experiences, including hallucinogenic drug-induced experiences, have been loosely labeled by some as “NDE,” despite the obvious lack of any relation with death (mislabelled NDE). Experiences and their meanings should be considered within the overall context of the science of language and linguistics, rather than simply based on superficial assumptions.
 23. The Weighted Core Experience Index and the Greyson NDE Scales cannot distinguish between an NDE (classical or authentic) and a broad range of other heterogeneous human experiences that occur in non “near-death” circumstances. The newer Near-Death Experience Content (NDE-C) scale, derived from the original Greyson NDE scale, has been proposed but retains the same limitations of the original NDE scale.
 24. New research measures are needed to distinguish experiences recalled in relation to death from other coma-related experiences, such as emergence out of coma, critical illness-related experiences (including ICU dreams, delirium, and delusions), conventional dreams, CPRIC, drug-related hallucinatory experiences, and other human experiences.
 25. The accumulating reports of conscious awareness, which are phenomenologically different to CPRIC, have raised several interesting and perplexing questions regarding the nature of human consciousness and its relationship with the brain.
 26. When reporting a RED (or a so-called NDE or OBE), researchers should include the detailed narratives reported by study subjects, rather than relying only on the labels and interpretations given to the experiences (e.g., NDE and OBE). This is particularly important in the absence of a standard definition of an NDE or OBE and will provide greater transparency for exploration by the scientific community.
 27. While in a coma, people may have multiple different experiences over the course of hours, days, and weeks. They typically also lose memory of many aspects of their experiences, as well as a sense of time and perspective. Thus, when using conventional methods or machine learning for the identification of qualitative themes from people’s recollections after being in a coma, it is recommended that the subjects’ recollections first be separated out into specific categories (e.g., into RED, CPRIC, dreams, and emergence from coma) and analyzed separately. This will provide some protection against potential “false positives” and cases being mislabeled the same.
 28. Although systematic studies have not been able to absolutely prove the reality or meaning of patients’ experiences and claims of awareness in relation to death, it has been impossible to disclaim them either.

Acknowledgments

Special thanks to Julie Exline at Case Western University, Ohio and David Myers at Hope College Michigan for their expertise and comments during the discussions and with the review of the draft of the manuscript. We would also like to sincerely thank Basil El Dadah from the National Institutes of Health for his suggestions and recommendations, as well as Ebby Elahi at the Icahn School of Medicine at Mount Sinai, New York, USA for his insights, comments, and discussions.

Supporting information

Additional supporting information may be found in the online version of this article.

File S1. Understanding death

File S2. Understanding consciousness in relation to death and the recalled experience of death

Table S1. The classical/original NDE themes described in relation to proximity to death

Table S2. Experiences labeled as “NDE” during events unrelated to death or life-threatening illness

Table S3. Experiences recalled in relation to the use of N,N-dimethyltryptamine (DMT) and ketamine

Table S4. Diverse experiences labeled as “out of body experiences”

Table S5. Themes related to classical/authentic “out of body experiences” in the context of life-threatening illness

Table S6. Children’s classical/authentic near-death experiences

Table S7. Themes related to the experience of ICU delirium, delusion, and dreams

Competing interests

The authors declare no competing interests.

Peer review

The peer review history for this article is available at: <https://publons.com/publon/10.1111/nyas.14740>

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