Healthcare Professionals’ Understandings of the Definition and Determination of Death: A Scoping Review

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Background. During the 1950s, advances in critical care, and organ transplantation altered the relationship between organ failure and death. There has since been a shift away from traditional cardiocirculatory based to brain-based criteria of death, with resulting academic controversy, despite the practice being largely accepted worldwide. Our objective is to develop a comprehensive description of the current understandings of healthcare professionals regarding the meaning, definition, and determination of death. Methods. Online databases were used to identify papers published from 2003 to 2020. Additional sources were searched for conference proceedings and theses. Two reviewers screened papers using predefined inclusion and exclusion criteria. Complementary searches and review of reference lists complemented the final study selection. A data extraction instrument was developed to iteratively chart the results of the review. A qualitative approach was conducted to thematically analyze the data. Results. Seven thousand four hundred twenty-eight references were identified. In total, 75 papers met the inclusion criteria. Fourteen additional papers were added from complementary searches. Most were narratives (35%), quantitative investigations (21%), and reviews (18%). Identified themes included: (1) the historical evolution of brain death (BD), (2) persistent controversies about BD and death determination, (3) wide variability in healthcare professionals’ knowledge and attitudes, (4) critical need for BD determination revision. Conclusions. We concluded that although BD is widely accepted, there exists variation in healthcare providers’ understanding of its conceptual basis. Death determination remains a divisive issue among scholars. This review identified a need for increased opportunities for formal training on BD among healthcare providers.

INTRODUCTION

During the 1950s, advances in technology within critical care medicine, particularly mechanical ventilation and circulatory resuscitation, and innovations in organ transplantation together altered the relationship between organ failure and death.1-3 By supporting, repairing, or replacing organ function, these technologies eliminated the necessity of the traditional “vital signs”: respiratory, cardiac, and neurological function in sustaining life. For example, mechanical ventilation replaced respiration and supported heart function to prevent cardiac arrest, which interrupted the way death occurred. The boundaries between being alive, dying, or being dead became blurred.

In 1968, the Ad Hoc Committee of the Harvard Medical School developed a landmark document for defining and determining death, thereby declaring brain death (BD) to be a biological event, and introduced the concept of whole BD.4
However, this shift away from the traditional circulatory determination of death to a brain-based definition and determination of death has continued to spark controversy and debate in the literature among ethicists, scholars, and clinicians.

Brain death refers to the irreversible cessation of neurological function. Circulatory death refers to the permanent loss of circulatory function, which ultimately results in loss of circulation to the brain and BD. Because of advances in organ transplantation, the concept of permanent and irreversible loss of function came to the forefront of defining death. This had significance for both donation after neurological determination of death and donation after circulatory determination of death (DCDD). In context, permanent refers to loss of function that will not resume spontaneously and will not be restored through intervention. Meanwhile, irreversible refers to a situation or condition that will not or cannot return or resume.3 Functions that cease permanently will almost inevitably cease irreversibly without intervention,4 however, this distinction is especially important in DCDD to uphold the dead donor rule, which states that the act of donation must not cause the donor’s death. Although the dead donor rule was previously held as a nearly sacrosanct rule in the transplant community, it is increasingly scrutinized by scholars with many proponents for the loosening of its definition in practice. Although death is largely a clinical diagnosis, there is significant variation in the guidelines for determination of both death by neurological and circulatory criteria.7,10

Much of the academic literature has been dedicated to the controversy surrounding the definition and determination of BD. Yet both legally and clinically, the determination of BD in critically ill patients is practiced and highly accepted by clinicians worldwide. The laws and practice surrounding BD determination have also remained largely unchanged since inception. Little is known about the perspectives of key stakeholders, that is whether the types and extent of controversies among healthcare professionals (HCPs) are representative of those in the literature. The goal of this scoping review is to describe the current understanding(s) of HCPs regarding the meaning/definition of death and its determination, and analyze the extent, range, and nature of the evidence in this area. A separate scoping review (underway) will describe the perspectives of the public on this same topic.

MATERIALS AND METHODS

This review was undertaken in accordance with the Joanna Briggs Institute methodology for scoping reviews11 and the PRISMA-ScR checklist.2 As a scoping rather than a systematic review, study inclusion was not limited by quality or methodology, and all aspects of HCPs’ understanding of death definition and determination were included.

Literature Search

We used a 2-step process for this review. The first step was to identify similar systematic or scoping reviews on the topic of BD meaning, definition, and determination. We searched online databases Ovid MEDLINE and PsychINFO to identify a known set of studies relevant to the topic. The topic was refined based on identification of research gaps in the systematic review literature. Two independent reviewers (S.S. and L.H.) screened titles and abstracts in duplicate.

We used key search terms identified from the systematic reviews to refine the search strategy for a second search of online databases and gray literature sources (see Appendix S1, SDC, http://links.lww.com/TXD/A410 for the search strategy). An information specialist (R.F.) searched Ovid MEDLINE, Ovid PsychINFO, and CINAHL using controlled vocabulary and text words for concepts: death, organ donation, determination, and attitudes. R.F. also searched Conference Proceedings Citation Indices, ProQuest Dissertations & Theses Global, and Google Scholar for any additional results. Search results were limited to studies published post-2003 in English or French. The search was updated July 2021. Duplicates were removed.

We included studies that explicitly discussed healthcare provider attitudes around BD or circulatory death. We defined “healthcare providers” to include medical and nursing students, physicians, and nurses involved in caring for either adult or pediatric populations. Our search yielded many articles that described people’s understanding of death/determination of death within the context of organ donation. We excluded those focused primarily on organ donation and transplantation, definitions of a “good death,” which referred to papers focused on experiences of around palliation and end of life care.

Screening

Two independent reviewers (S.S. and K.Z.) screened titles and abstracts using predefined inclusion and exclusion criteria. Articles were divided by 2 stakeholder groups, healthcare providers, and the public. The focus of this scoping review is on the healthcare workers subset of the search. Both reviewers extracted data for specific content variables and performed the descriptive examination. The full text of selected citations was then retrieved and assessed in detail against the criteria by the 2 independent reviewers. Any disagreements were resolved through discussion.

Data Extraction and Synthesis

A data extraction instrument was developed to iteratively chart the results of the review. Extracted fields included authors, year of publication, country of origin, type of text, language, aims/purpose, study population, methodology, and key findings. S.S. and K.Z. extracted data and undertook thematic analysis of included studies. Additional papers identified from review of the reference lists of included papers and hand searches of the literature were included for data extraction. All data were extracted in duplicate (S.S. and K.Z.).

RESULTS

Of a total of 4935 search results, 64 met the inclusion criteria initially. The updated search done July 2021 captured 1042 additional abstracts, of which a further 11 were included. Fourteen papers were added from hand searches, resulting in 89 total papers included for data extraction (see Figure 1 for the PRISMA diagram). Appendix S2 (SDC, http://links.lww.com/TXD/A410) provides a complete list of all included studies, their characteristics, and main findings. Table 1 provides a listing of the characteristics of included papers. The most common study type was narratives (35%), followed by quantitative studies (21%) and reviews (18%), and most studies originated from North America (64%) and Europe (18%). The papers meeting inclusion criteria pieced together the historical evolution of the death definition, from the traditional circulatory criteria, to the nuanced concepts
of BD and circulatory death, to the more recent initiative to achieve uniformity in the BD definition.

**A Brief History of Brain Death**

To understand the current state of BD, it is imperative to understand the historical context, which gave rise to contemporary definitional issues. The precise history of defining BD and death determination dates back centuries and is beyond the scope of the current review. Our historical starting point begins in the 1950s with the innovations such as mechanical ventilation, and the practice of transplantation thereby altering the relationship between organ failure and death. The climate of the BD controversy necessitated the publication of the landmark document, Report of the Ad Hoc Committee of the Harvard Medical School to produce a brain-based definition of death, followed in 1976 by the Conference of Medical Royal Colleges, which defined brainstem death. BD gained worldwide acceptance, but there

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**FIGURE 1.** PRISMA flow diagram for included studies.
To address the ongoing controversy, the first phase in the
reinvigoration of BD and death determination controversies. 21-25
BD, like the Jahi McMath case, have served to renew and
professional society guidelines.

FIGURE 2. A brief timeline review of major historical events in brain death.

lacked consensus on diagnostic criteria. To rectify growing
certainty, the Uniform Determination of Death Act was
legislated in 1981 in the United States, 14 which specified 2
criteria for determining death: cardiorespiratory and
neurological. For most of the 1980s and 1990s the BD controversy
focused on the biological concept of death versus the medical
standards of death, and much of the scholarly literature was
consumed by answering 2 questions: Are brain-dead donors
dead? Are DCDD donors dead?

Ongoing efforts to clarify and establish BD guidelines
included the 1995 American Academy of Neurology
Guidelines,15 the 1999 Canadian Neurocrit Care Group
guidelines,16 the 2006 Canadian neurological determination
of death and DCDD Guidelines,17 and the 2013 Australia and
New Zealand Intensive Care Society statement.18 The 2008
report, published in 2020, provides recommendations for the
development of international guidelines for death determina-
tion took place in 2014 to develop a single operational
definition of human death.5 The World Brain Death Project
report, published in 2020, provides recommendations for the
minimum clinical standards for determination of BD in adults
and children, based on review of the literature and an interna-
tional, multidisciplinary expert panel.26

Controversies Around Brain Death

A closer look at the historical evolution and persistent
controversies revealed several key themes around death, espe-
cially BD. Table 2 outlines 6 key controversies in the literature.
Perhaps the most debated is whether BD is a manifestation of
biological death. Scholars who view BD as a manifestation of
biological approach appear on the left of Table 2,27-35 whereas
those in disagreement appear on the right.2,36-43 Another
domain of controversy is whether current whole-brain con-
cepts of death should be favored over some version of a circulatory
or higher brain concept.39,46-52

The basis of BD definitions continues to be questioned
by some as being unscientific, or illogical, and contrived to
facilitate organ donation.2,39,42,53-55 Others have suggested that
BD determination criteria are not measuring loss that is truly
irreversible.53,54,64,65,66,68 More recently with the rise of DCDD,
controversy over whether DCDD donors are really dead has
become an increasing issue of debate. This issue has plagued
the practice of donation since its inception.54 The central
argument here focuses on Bernat’s distinction between the con-
cepts of permanence and irreversibility.2 Joffe provides several
arguments for why the permanence standard is conceptually
flawed, and thus states DCDD donors cannot be presumed
death at the time their organs are surgically recovered. On
the other hand, Bernat’s 2018 paper argues the answer to the
fundamental question of whether the donor is dead when
declared dead within a DCDD protocol is yes because the
donor’s cessation of circulation and respiration is perma-
nent.58 Those who advocate a single brain-based definition of
death emphasize that the permanent loss of circulation results
in the irreversible loss of brain function.5 Disagreement also
persists regarding whether current criteria and tests used for
the determination of BD are appropriate and sufficient to
determine loss of function.5,17,36,38,61-63,66,67

Healthcare Provider Knowledge and Attitudes
of Death Determination

Without question, there are ongoing controversies among
scholars regarding the definition of BD and its determination,
but there also exists considerable variation between healthcare
providers, between medical institutions, and even within pro-
viders at the same institution.69 Table 3 illustrates 25 empiri-
cal studies retrieved that examined HCP understanding of BD.
Twenty studies used a quantitative approach51,69,70 and 3 used
a qualitative approach.57,87,88 Only 2 studies reported conduct-
literature reviews to illustrate gaps in HCPs understanding

| TABLE 1. Characteristics of included papers (n=89) |
|-----------------------------------------------|
| Descriptor | N (%) |
| Source | Initial search 64 (72) |
| Complimentary searches 14 (16) |
| Updated search 11 (12) |
| Type of paper | Narrative/opinion 32 (35) |
| Quantitative 19 (21) |
| Review 16 (18) |
| Policy papers 6 (7) |
| Book chapter 5 (6) |
| Panel report 5 (6) |
| Qualitative 4 (4) |
| Mixed-methods 1 (1) |
| Case report 1 (1) |
| Country of publication | United States 45 (51) |
| Europe 16 (18) |
| Canada 12 (13) |
| Asia 6 (7) |
| Oceania 3 (3) |
| South America 3 (3) |
| Other 4 (4) |
| Language | English 89 (100) |
| Publication Date | Pre-2013 33 (37) |
| 2013–2021 56 (63) |

*Country where the study was conducted or when not available, the country of the lead author.
of death and death determination. Most studies focused on the perspectives of physicians, nurses, and trainees and had global and cultural variation.

The vast majority of HCPs supported the BD concept. However, the prevalence of the understanding of BD and its diagnosis ranges widely from <50% to 94.7%. Studies identified that knowledge of BD correlated significantly with the level of training, role within the healthcare team and formal training on BD. The majority of attending staff understand BD compared with as little as half of residents and medical students. Many medical students and interns are uncertain about the concept of BD or do not accept its definition. Several studies focused specifically on the perceptions and knowledge of nurses. These studies highlight that although most nurses felt they understood BD, experienced nurses had better knowledge, whereas there was more uncertainty among nursing students.

Years of experience correlated positively with BD knowledge. The majority of attending staff understand BD compared with as little as half of residents and medical students. Many medical students and interns are uncertain about the concept of BD or do not accept its definition. Several studies focused specifically on the perceptions and knowledge of nurses. These studies highlight that although most nurses felt they understood BD, experienced nurses had better knowledge, whereas there was more uncertainty among nursing students.

Greater exposure and role in the healthcare team are also associated with increased knowledge of BD. Several studies focused solely on the perspectives of physicians within specialties that directly related to organ donation (eg, intensive care units [ICUs], anesthesiology, neurosurgery). Clinicians with greater exposure to BD determination such as those working in ICU and anesthesia were more comfortable and knowledgeable, for example, intensivists were more knowledgeable than emergency and internal medicine physicians, and ICU nurses more knowledgeable than non-ICU nurses. University-affiliated physicians were also more knowledgeable than non–university-affiliated physicians.

However, despite an overall understanding and acceptance of the concept and application of BD in clinical practice, many HCPs also held contradictory beliefs that BD was not equivalent to real death, did not result in complete loss of brain function’ or was not irreversible. Several studies identified a lack of formal training on BD, whether within the academic training process or as continuing education. The amount of training appeared to correlate with the role within the healthcare team, with attending staff reporting more formal training than nurses, and trainees reporting the least amount of formal training. The vast majority of healthcare providers expressed interest in and a need for formal training, as well as for incorporation of BD training into the academic curriculum for trainees.

Several studies identified a specific gap in knowledge among HCPs is regarding the institutional and regional protocols and policies surrounding BD diagnosis. For example, although most clinicians believed in the moral equivalence of BD to circulatory death,
### TABLE 3
Empirical studies examining HCPs understanding of death and determination of death (n = 25)

| Study reference  | Country        | Study design | Method of data collection | Study population                                      | Aim                                                                                           | Findings                                                                                                                                 |
|------------------|----------------|--------------|----------------------------|-------------------------------------------------------|---------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Alnajjar et al82 | Saudi Arabia   | Quantitative | Cross-sectional questionnaire | 113 through sixth year medical students and interns    | To assess knowledge of BD, among medical students and interns                               | There was a low level (59.2%) of understanding of the BD concept and significant uncertainty around the concept. Many were uncertain that it meant the patient's demise and few knew it was a terminal event. Education around BD should be incorporated into the medical school curriculum. |
| Bijani et al84   | Iran           | Quantitative | Pre- and posttesting         | 50 head nurses and clinical supervisors                | To evaluate the effect of workshops and rethinking on the knowledge and attitude of HCPs toward BD and organ donation. | Intervention group (reflective thinking and clinical scenario-based educational program) had a significant improvement in attitude and knowledge after training compared with the control group (P < 0.05) regarding BD and organ donation. |
| Chatterjee et al83| United States  | Quantitative | Before and after online survey | 118 (pre) and 62 (post) HCPs with increased exposure to brain injury | To assess HCP knowledge and attitude procedural criteria for BD and potential change after an educational intervention | There was broad and unchanging support (86.8%) for concept of BD among HCPs, but confusion persists over whether the loss of consciousness and spontaneous breath are truly sufficient for death. |
| Cohen et al71    | Israel         | Quantitative | Attitudinal survey           | Physicians and nurses in ICUs, emergency wards, and internal medicine departments in 21 hospitals (organ and nonorgan procurement centers) | To analyze the attitudes of HCPs to BD and related to this to obtain their level of comfort with performing key donation-related tasks | Seventy-nine percent of respondents had a positive attitude toward BD. This was significantly associated with increasing age and higher professional status and was most prevalent in the ICU. |
| Dubois and Anderson89 | United States | Review       | Literature review of empirical studies | N/A                                                   | To examine attitudes of HCP and the public toward death criteria and their relation to attitudes and behaviors regarding organ donation | A review of major studies showed high levels of support for the BD concept and organ donation but lower levels of knowledge of BD and why it is equivalent to death. |
| Edwards and Forbes64 | United Kingdom | Narrative    | N/A                         | N/A                                                   | Aims to highlight the gap in nursing literature of the discussion of the definition of human death—to show that nurses should engage in such discussion | The definition of human death that guides practice in the United Kingdom and elsewhere is fundamentally flawed. Instead of suppressing their own intuitions, and the intuitions of patients’ relatives in the management of patients diagnosed as brainstem dead, nurses should critically examine the definition of death, which currently informs clinical practice. |
| Ferhatoglu and Gurkan81 | Turkey        | Quantitative | Survey                      | 244 surveys of ICU clinicians in Turkey               | To assess attitude and knowledge of ICU clinicians on determination and barriers to BD diagnosis | Most ICU clinicians felt confident diagnosing BD, although many did not correctly answer all questions relating to BD diagnosis. University or university-affiliated ICU clinicians were both more knowledgeable on BD and more interested in additional training. |
| Floden et al87   | Sweden         | Qualitative  | Interviews                  | 15 ICU nurses from 6 hospitals in Sweden              | To get to get ICU nurses’ perception and experiences of organ donation and BD               | There is ambiguity and variation in the perception of ICU nurses on the BD diagnosis that is not found in circulatory death. However, nurses trust physicians to make the diagnosis and generally believe in the diagnosis. There is greater trust in the diagnosis if the nurse is present, and if there is use of cerebral angiography to confirm the diagnosis. |
| Hot et al63      | Turkey         | Quantitative | Questionnaire               | 401 responses from physicians from Turkey randomly selected from 6 cities in Turkey                 | To determine the attitudes among Turkish physicians toward BD and to examine the effect of religion and education on the issue | Of the physicians who responded (50% response rate), 76% reported they regarded BD as real death, whereas 24% did not perceive BD as real death. Ninety-five percent viewed death as the stopping of heartbeat and breathing, and 77% of relatives of brain-dead patients have difficulty understanding BD. |
| Author(s)          | Country        | Study Design       | Sample Size | Objective                                                                 |
|-------------------|----------------|-------------------|-------------|---------------------------------------------------------------------------|
| Joffe and Anton   | Canada         | Quantitative      | 64          | To determine whether pediatric intensivists in Canada are aware of the controversies regarding BD. |
| Joffe et al.      | Canada         | Quantitative      | 128         | To determine the understanding of the conceptual basis and diagnostic tests used for BD by neurosurgeons in Canada. |
| Lawson et al.     | USA            | Quantitative      | 217         | To evaluate understanding of BD among HCPs within ICUs at a single institution. |
| Lewis et al.      | North America | Quantitative      | 49          | To evaluate how Muslim allied HCPs view death by neurologic criteria.       |
| Lomero et al.     | Spain          | Quantitative      | 236         | To determine attitudes and knowledge of medical and nursing staff on organ donation. |
| Marck et al.      | Australia      | Quantitative      | 599         | To assess Australian emergency department clinicians’ acceptance and knowledge regarding BD. |
| Martinez-Alarcon  | Spain          | Quantitative      | 721         | To determine the knowledge of nursing students about the concept of BD.     |
| Mikla et al.      | Spain          | Quantitative      | 492         | To analyze the knowledge and acceptance of the BD concept among nursing students. |
| Mutlu and Utku     | Turkey         | Quantitative      | 564         | To determine the knowledge, tendency, and attitude about BD and organ transplantation among anesthesiology and reanimation professionals who are the major influencers and have responsibility about this subject. |
| Rydzewska-Rosolowska et al | Poland       | Quantitative      | 273         | To evaluate attitudes toward organ transplantation among students in healthcare. |
| Rios et al.       | Spain and Latin America | Quantitative Survey | 4378     | To analyze the level of understanding of the BD concept among personnel in Spanish and Latin American healthcare centers and to determine the factors affecting this attitude. |
### TABLE 3. (Continued)

**Empirical studies examining HCPs understanding of death and determination of death (n = 25)**

| Study reference | Country  | Study design | Method of data collection | Study population | Aim | Findings |
|-----------------|---------|--------------|---------------------------|------------------|-----|----------|
| Rodriguez-Arias et al<sup>91</sup> | Spain   | Qualitative  | Interviews to discuss clinical scenarios | 587 HCPs likely to be involved in the process of organ procurement across 14 hospitals with transplant programs in France, Spain, and the United States | To examine HCP experience, beliefs, and attitudes toward BD, cDCD, and uDCD. | Healthcare personnel believe BD is a more reliable standard than circulatory criteria at determining death. Most healthcare personnel find it morally acceptable to retrieve organs from brain-dead donors but less so in DCD patients. Potentially, this is because of the lack of a rigorous brain exam in DCD or the belief that irreversibility is not proven with the loss of circulatory function. |
| Sheerani et al<sup>70</sup> | Pakistan | Quantitative | Survey | 259 questionnaires were analyzed, of physicians at different levels of training and final year students from 5 major tertiary care centers at Karachi and Hyderabad, and involved in making decisions about BD and related issues | To find the opinions and awareness of physicians regarding issues surrounding BD | Fifty-four percent did not have a clear idea of the BD definition. Additionally, 47% would not turn off the ventilator in a brain-dead patient, and 26% actually considered it euthanasia. Physicians tended to favor the use of confirmatory tests to confirm BD. |
| Victorino et al<sup>73</sup> | Brazil  | Qualitative  | Structured interviews | ICU nurses and physicians in 1 hospital | To identify and discuss the different meanings and experiences of nurses and physicians from and adult ICU in relation to the diagnosis of BD and the maintenance of potential organ donors | Brain death understanding varies according to the personal beliefs, culture, and educational background of individuals, especially understanding of BD diagnosis as a tool to aid decision-making, diagnosis as guarantee of rights, difficulties encountered in establishing the diagnosis, clinical criteria adopted in Brazil, and its ethical-legal aspect. Overall, there is a lack of formal education in BD diagnosis. |
| White<sup>88</sup> | Australia | Qualitative/descriptive | Structured interviews | 40 Australian ICU nurses from 7 metropolitan ICUs | To investigate the extent to which a sample of 40 Australian intensive care nurses regarded BD as a meaningful conception of death | Analysis revealed 5 categories of perception constituting a spectrum ranging from complete acceptance to complete rejection, with almost half (48%) of the sample believing that the brain-dead patient as less than completely meaningfully dead. |
| Yang et al<sup>74</sup> | China   | Quantitative | Survey and clinical knowledge assessment | 476 medical providers (72 attendings, 84 residents, 210 medical students, 110 nurses) from 2 academic hospitals in Hunan, China. | To explore reasons for the failure of BD legalization in China. | Almost all (92%) of the HCPs (attending physicians, residents, medical students and nurses) have heard the term “brain death.” When given a description of a brain-dead patient 50% considered the patient dead, 52% would withdraw life support, and 41% would allow organ procurement. Ethical acceptance was the most important independent predictor for BD acknowledgment, followed by high knowledge scores, and the belief that the soul lives in the brain. |

BD, brain death; cDCD, controlled donation after circulatory death; DCD, donation after circulatory determination of death; HCP, healthcare professional; ICU, intensive care unit; uDCD, uncontrolled donation after circulatory death.
fewer understood their legal equivalence.69 Several studies commented on the lack of uniformity and understanding the conceptual basis and diagnostic tests used for BD, and concluded there is significant variability in understanding of the tests that are compatible with the criterion of BD.65,75 The determination protocols and the need for ancillary testing vary between and within countries, leading to a lack of consistency for the BD diagnosis worldwide.97,98

In total, only 2 Canadian studies were identified, and both took a narrow participant focus, one on pediatric intensivists,99 and the other on neurosurgeons.60 The main objective of these 2 studies focused on examining the variability in the understanding of tests that are compatible with the criterion of BD.

Eight studies focused on DCDD2,6,29,42,57,58,91,99 with some expressing concerns that the period after circulatory death in DCDD may be inadequate for irreversibility and may allow for the rare possibility of autoresuscitation, the spontaneous unassisted resumption of heart function after cardiac arrest.27 On the contrary, other studies noted that without additional intervention, brain functions would cease irreversibly,57,91 and this declaration of death was consistent with medical practice.58,92

The Future of Death Determination

It appears much of the space within the literature devoted to death determination is occupied by persistent academic controversies, with a relative paucity of articles focusing on practicing HCPs’ understanding of death determination and related domains. Common ground can be found in calls for improvement-oriented changes from a need for uniformity and standardization in death determination.100 Other authors state the need for new legislation to ratify religious exemption to death determination by neurologic criteria.65 Many studies call for increased education to address deficits in HCPs’ understanding of death determination and particularly BD.53,68,69,75,77,101 Likewise, many studies state the need for increased dialogue and even open public debate62,93 to ensure the trustworthiness and satisfaction of the general public. The call for improvements in uniformity have been focused on both the cardiorespiratory and BD determinations should be formulated on a coherent definition and criterion of death.5,31,102

More recently, steps have been taken in drafting an international guideline for the determination of death.5,27,29 During an invitational forum of international content experts and representatives of several professional societies,1 a single operational definition of human death was developed: “the permanent loss of capacity for consciousness and all brainstem functions, as a consequence of permanent cessation of circulation or catastrophic brain injury.”

The next step in this process will be to hold a broader group of international stakeholders to develop clinical practice guidelines, based on comprehensive reviews and grading of the existing evidence.5

DISCUSSION

This scoping review of 89 papers revealed important themes and highlighted considerable variability in HCP knowledge of the BD construct. Controversies over the definition and determination of death have evolved in the last 70 yrs. Capron’s statement, “well settled yet still unresolved” remains well-suited to capture the climate of these ongoing debates.103 Previous circulatory-based criteria of death determination are no longer sufficient in a time when circulation can be maintained for extended periods despite permanent cessation of brain function. This review highlights the fact that current controversies over BD definition are primarily academic; most physicians who pronounce BD in daily practice are unaware of them.99 There have been criticisms that the previous decades of intense philosophical analysis of BD have been misdirected in so far as it has neglected the concerns and perspectives of caregivers, families, and clinicians.104 Only 25 studies empirically examined HCPs’ knowledge and understanding of death and death determination, with only 2 studies focused on Canadian HCPs’ knowledge and attitudes.66,75

Studies of HCP perspectives are underrepresented but suggest that neurological determination of death is not as controversial in practice as in the literature. Clinically, most physicians feel confident in the diagnosis of BD and are comfortable with the concept especially with greater exposure and experience. However, the knowledge and rationale behind why this is equivalent to death are where there is inconsistency. This uncertainty about BD determination is especially prevalent among less experienced HCPs. This suggests there is a need and a desire for ongoing and formal education in this area. Variability in the criteria and test for the diagnosis of death between and within countries leads to confusion among HCPs, who often do not understand the requirements, especially surrounding the need for ancillary testing. These inconsistencies can propagate confusion among HCPs but also to a deterioration of public trust in the diagnosis. Clarity and uniformity are needed in both the definition and determination of death. It appears that medicine is evolving toward a single unified determination of death.31 A key question to be addressed is can our society evolve toward accepting the movement away from heart-based definitions of death toward single central unifying determination of death based on the complete and permanent cessation of brain function?15

Limitations

Though comprehensive in scope, the review was limited to English and French language publications, and no French studies were included. We may not have included articles published after our updated search (July 2021).

CONCLUSIONS

This review provides a comprehensive understanding of the current climate regarding HCPs’ understanding and knowledge of the meaning/definition of death and its determination. There is a paucity in the literature of practicing HCPs’ perspectives on this topic, particularly from Canada. Studies identified reveal considerable variation in BD understanding between HCPs and institutions; as such there is a need for more education and training, especially among HCPs who must facilitate difficult conversations with families. Instead, much of the literature is crowded with persistent controversies over BD and its determination. More research needs to focus on empirical studies of practicing HCPs’ attitudes and knowledge regarding death, particularly BD. Revisions should be undertaken if public trust in the medical system is to remain intact. Positive steps have been taken toward the development of an international guideline for the determination of death whereby a single operational definition of human death.
was developed. A critical final step in a scoping review is to broadly engage relevant stakeholders in the findings to better understand perceptions of death and death determination on a national landscape.

ACKNOWLEDGMENTS
This study would not have been possible without the support of the Canadian Blood Services. A special thanks to Robin Featherstone, an information specialist, for her expertise in crafting and executing search strategies.

REFERENCES
1. Bacigalupo F, Huerta D, Montefusco-Siegmund R. The debate about brain death at fifty: exploring a national landscape. 2018;30:71–89.
2. Crippen D. Changin interpretations of death by neurologic criteria: the McMath case. J Crit Care. 2014;29:870–871.
3. Lewis A, Pope TM. Physician power to declare death by neurologic criteria threatened. Neurocrit Care. 2017;26:446–449.
4. Wu DG, Chang C, Hsu CC. Defining death: lessons from the case of Jahi McMath. Pediatrics. 2020;146:S75–S80.
5. Greer DM, Shemie SD, Lewis A, et al. Determination of brain death/ death by neurologic criteria. JAMA. 2020;90033:1–20.
6. Shemie SD, Gardiner D. Circulatory arrest, brain arrest and death determination. Front Cardiovasc Med. 2018;5:15.
7. Shemie SD. Life, death, and the bridges in-between. Ann N Y Acad Sci. 2014;1330:101–104.
8. Shemie SD, Baker AJ, Knoll G, et al. National recommendations for donation after circulatory death in Canada: donation after circulatory death in adults. Canadian Med Assoc J. 2008;175:S1.
9. Burke CM, Sharp RR. Wijdicks EF. Why brain death is considered death and why there should be no confusion. Neurology. 2014;83:1464–1469.
10. Bernat JL. Contemporary controversies in the definition of death. Prog Brain Res. 2009;177:21–31.
11. Wijdicks EF. Pitfalls and slip-ups in brain death determination. Neuro R. 2013;35:169–173.
12. Wijdicks EFMM. The case against confirmatory tests for determining brain death in adults. Neurology. 2010;75:77–83.
13. Wijdicks EMF. Who improves from coma, how do they improve, and then what? Nat Rev Neurol. 2014;10:694–696.
14. Shemie SD, Baker A. Uniformity in brain death criteria. Semin Neurol. 2015;35:162–168.
15. Triggle J. Commentary: defining death: definitions, criteria, and tests. Camb Q Healthc Ethics. 2019;28:642–647.
16. Mageu A. Towards a holistic definition of death: the biological, philosophical and social deficiencies of brain stem death criteria. New Bioeth. 2019;25:172–184.
17. Joffe AR. The neurological determination of death: what does it really mean? Issues Law Med. 2007;23:119–140.
18. Shewmon DA. Constructing the death elephant: a synthetic paradigm shift for the definition, criteria, and tests for death. J Med Philos. 2010;35:256–298.
19. Whetstone LM. Biophilosophical criticisms of brain death: the need for a new paradigm. J Crit Care. 2014;29:878–880.
20. Racine E, Jox RJ, Bernat JL, et al. Determination of death: a discussion on responsible scholarship, clinical practices, and public engagement. Perspect Biol Med. 2015;58:444–465.
21. Miller FG, Truog RD. Brain death in adults: report of the Quality Standards Subcommittee of the American Academy of Neurology. Practice parameters for determining brain death after cardiac arrest: a review of guidelines and statements. J Intensive Care Med. 2012;27:238–252.
22. Weiss MJ, Hornby L, Witteman W, et al. Pediatric donation after circulatory determination of death: a scoping review. Pediatr Crit Care Med. 2016;17:e87–e108.
23. Peters MD, Godfrey CM, Khalil H, et al. Guidance for conducting systematic scoping reviews. Int J Evid Based Healthc. 2015;13:141–146.
24. The President’s Council on Bioethics. The President’s Council on Bioethics; 2008. Determination of Death. A White Paper by the President’s Council on Bioethics. 2008;48(suppl 4):S49–S52.
25. Truog RD. Changing interpretations of death by neurologic criteria: the McMath case. J Crit Care. 2014;29:870–871.
26. Lewis A, Pope TM. Physician power to declare death by neurologic criteria threatened. Neurocrit Care. 2017;26:446–449.
27. Truog RD. Defining death: lessons from the case of Jahi McMath. Pediatrics. 2020;146:S75–S80.
28. Greer DM, Shemie SD, Lewis A, et al. Determination of brain death/ death by neurologic criteria. JAMA. 2020;90033:1–20.
29. Shemie SD, Gardiner D. Circulatory arrest, brain arrest and death determination. Front Cardiovasc Med. 2018;5:15.
30. Shemie SD. Life, death, and the bridges in-between. Ann N Y Acad Sci. 2014;1330:101–104.
31. Shemie SD, Baker AJ, Knoll G, et al. National recommendations for donation after circulatory death in Canada: donation after circulatory death in adults. CMAJ. 2008;175:S1.
32. Burke CM, Sharp RR. Wijdicks EF. Why brain death is considered death and why there should be no confusion. Neurology. 2014;83:1464–1469.
33. Bernat JL. Contemporary controversies in the definition of death. Prog Brain Res. 2009;177:21–31.
34. Wijdicks EF. Pitfalls and slip-ups in brain death determination. Neuro R. 2013;35:169–173.
35. Wijdicks EFMM. The case against confirmatory tests for determining brain death in adults. Neurology. 2010;75:77–83.
36. Wijdicks EMF. Who improves from coma, how do they improve, and then what? Nat Rev Neurol. 2014;10:694–696.
37. Shemie SD, Baker A. Uniformity in brain death criteria. Semin Neurol. 2015;35:162–168.
38. Triggle J. Commentary: defining death: definitions, criteria, and tests. Camb Q Healthc Ethics. 2019;28:642–647.
39. Mageu A. Towards a holistic definition of death: the biological, philosophical and social deficiencies of brain stem death criteria. New Bioeth. 2019;25:172–184.
40. Joffe AR. The neurological determination of death: what does it really mean? Issues Law Med. 2007;23:119–140.
41. Shewmon DA. Constructing the death elephant: a synthetic paradigm shift for the definition, criteria, and tests for death. J Med Philos. 2010;35:256–298.
42. Whetstone LM. Biophilosophical criticisms of brain death: the need for a new paradigm. J Crit Care. 2014;29:878–880.
43. Racine E, Jox RJ, Bernat JL, et al. Determination of death: a discussion on responsible scholarship, clinical practices, and public engagement. Perspect Biol Med. 2015;58:444–465.
44. Miller FG, Truog RD, Dying, and Organ Transplantation: Reconstructing Medical Ethics at the End of Life, OUP; 2012.
45. Miller FG, Nair-Collins M, Truog RD. It is time to abandon the dogma that brain death is biological death. Hastings Cent Rep. 2021;51:18–21.
46. Bernat JL, Larriviere D. Areas of persisting controversy in brain death. Neurology. 2014;83:1394–1395.
47. Laureys S. Brain death. In: Neuroethics in Practice: Medicine, Mind, and Society. Vol 15. Oxford University Press; 2013:149–161.
48. Chong W. Brain death without definitions. Hastings Cent Rep. 2005;35:20–30.
49. Truog RD, Miller FG. Changing the conversation about brain death. Am J Bioeth. 2014;14:9–14.
50. Veatch RM. The death of whole-brain death: the plague of the disaggregators, somaticists, and mentalists. J Med Philos. 2005;30:353–378.
51. Linuma SH, DeMarco JP. Revealing brain death: a functionalist view. J Bioeth Inq. 2013;10:383–392.
52. Hamdy S. Not quite dead: why Egyptian doctors refuse the diagnosis of death after cardiac arrest: a review of guidelines and statements. European J Neurology. 2010;35:20–25.
53. O’Keeffe FJ, Mendz GL. The definition and criterion of death. Handbook of Bioethics. 2010;74:1911–1918.
54. Racine E, Jox RJ, Bernat JL, et al. Determination of death: a discussion on responsible scholarship, clinical practices, and public engagement. Perspect Biol Med. 2015;58:444–465.
55. Miller FG, Truog RD, Dying, and Organ Transplantation: Reconstructing Medical Ethics at the End of Life, OUP; 2012.
56. Miller FG, Nair-Collins M, Truog RD. It is time to abandon the dogma that brain death is biological death. Hastings Cent Rep. 2021;51:18–21.
57. Shemie SD, Baker A. Uniformity in brain death criteria. Semin Neurol. 2015;35:162–168.
58. Joffe AR. The neurological determination of death: what does it really mean? Issues Law Med. 2007;23:119–140.
59. Shewmon DA. Constructing the death elephant: a synthetic paradigm shift for the definition, criteria, and tests for death. J Med Philos. 2010;35:256–298.
60. Whetstone LM. Biophilosophical criticisms of brain death: the need for a new paradigm. J Crit Care. 2014;29:878–880.
56. Belkün G. A path not taken: beecher, brain death, and the aims of medicine. Hastings Cent Rep. 2018;48(suppl 4):S10–S13.
57. Bernat JL, Black TP, Blosser SA, et al. Circulatory death determination in uncontrolled organ donors: a panel viewpoint. Ann Emerg Med. 2014;63:384–396.
58. Bernat JL. Conceptual issues in DCDD donor death determination. Hastings Cent Rep. 2018;48(suppl 4):S26–S28.
59. Bernat JL. Death by neurologic criteria 1968-2014: changing interpretations. Forward. J Crit Care. 2014;29:671–672.
60. Academy of Medical Royal Colleges. A code of practice for the diagnosis and confirmation of death. 2008.
61. Demarin V, Arjona-Lovençu-Huzjak, Vesna Varegk-Solter, et al. Consensus opinion on diagnosing brain death–Guidelines for use of confirmatory tests. Acta Clinica Croata. 2005;44:5–79.
62. Drake M, Bernard A, Hessel E. Brain death. Surg Clin North Am. 2017;97:1255–1273.
63. Markert L, Bockholdt B, Verhoff MA, et al. Renaissance of criticism on personnel in Spanish and Latin-American healthcare centers.
64. Edwards SD, Forbes K. Nursing practice and the definition of human death.
65. Verheijde JL, Rady MY, Potts M. Neuroscience and brain death concept by personnel in Spanish and Latin-American transplant. Proc.
66. Bernat JL. Death by neurologic criteria in Latin American and Caribbean countries. Neurocrit Care. 2012;19:322–330.
67. Chatterjee K, Rady MY, Verheijde JL, et al. Consensus opinion on diagnosing brain death–Guidelines for use of confirmatory tests. Acta Clinica Croata. 2005;44:5–79.
68. Drake M, Bernard A, Hessel E. Brain death. Surg Clin North Am. 2017;97:1255–1273.
69. Lawson MM, Mooney CJ, Demme RA. Understanding of brain death amongst health professionals in province of Sindh, Pakistan. J Pak Med Assoc. 2008;58:352–356.
70. Lewis A, Kitamura E, Padela AI. Allied muslim healthcare professionals’ and nurses’ perceptions of responsibilities and organization in relation to organ donation–a phenomenographic study. Intensive Crit Care Nurs. 2011;27:305–316.
71. White G. Intensive care nurses’ perceptions of brain death. Aust Crit Care. 2003;16:7–14.
72. DuBois JM, Anderson EE. Attitudes toward death criteria and organ donation among anesthesiology and reanimation professionals. Transplant. 2013;48(suppl 4):S10–S13.
73. Rios A, López-Nava A, Ayala-Garcia MA, et al. Spanish-Latin American multicenter study of attitudes toward organ donation among personnel from hospital healthcare centers. Cir Esp. 2014;92:393–403.
74. Rodríguez-Arias D, Tortosa JC, Burant CJ, et al. One or two types of death? Attitudes of health professionals towards brain death and donation after circulatory death in three countries. Med Health Care Philos. 2016;19:457–467.
75. Rodríguez-Arias D, Vélez C. The death debates: a call for public deliberation. Hastings Cent Rep. 2013;43:34–35.
76. Rios A, López-Nava A, Ros-Martinez A, et al. Dominicans resident in spain and the United States faced with deceased organ donation. Transplant Proc. 2015;47:2575–2577.
77. Marck CH, Weiland TJ, Neate SL, et al. Personal attitudes and beliefs regarding organ and tissue donation: a cross-sectional survey of Australian emergency department clinicians. Transplant Proc. 2012;44:317–322.
78. Romero MDM, Jimenez-Herrera MF, Rasero MJ, et al. Nurses’ attitudes and knowledge regarding organ and tissue donation and transplantation in a provincial hospital: a descriptive and multivariate analysis. Nurs Health Sci. 2017;19:322–330.
79. Pock M, Brewer AC, Pressman M, et al. Hot tap water legislation in the United States. J Burn Care Res. 2010;31:918–925.
80. Lewin A, Kreiger-Benson E, Kumpfbeck A, et al. Determination of death by neurologic criteria in Latin American and Caribbean countries. Clin Neurol Neurosurg. 2020;197:105953.
81. Greer DM, Shernie SD, Lewis A, et al. Determination of brain death/ death by neurologic criteria: the world brain death project. JAMA. 2009:324:1078–1097.
82. Whestine L, Streit S, Darwin M, et al. Pros/con ethics debate: when is dead really dead? Crit Care. 2005;9:538–542.
83. Wang HH, Varelas PN, Henderson GV, et al. Improving uniformity in brain death determination policies over time. Neurology. 2017;88:562–568.
84. Joffe AR, Anton NR, Duff JP, et al. A survey of American neurologists about brain death: understanding the conceptual basis and diagnostic tests for brain death. Ann Intensive Care. 2012;2:1–8.
85. Baron L, Shernie SD, Teitelbaum J, et al. Brief review: history, concept and controversies in the neurological determination of death. Can J Anaesth. 2006;53:602–608.
86. Capron AM. Brain death–well settled yet still unresolved. N Engl J Med. 2001;344:1244–1246.
87. Tominson T. Misunderstanding death as a respirator. Bioethics. 1990;2:253–264.