

Defining Death in Theory and Practice

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In July 1981, the President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research published its first report, *Defining Death: Medical, Legal, and Ethical Issues in the Determination of Death.* The Commission made this subject one of its first studies primarily because of a legal interest: there has been recent disagreement about how best to translate the current physiological understanding of death into acceptable statutory language. But the Commission was also interested in reviewing the dispute between "whole brains" and "higher brain" formulations of death and appraising currently used brain-based tests for death, which have become increasingly varied and sophisticated.

During its meetings, the Commission heard testimony from a variety of experts. Philosophers testified on the conceptual issues involved in defining death; theologians spoke about traditional religious concepts; and neurologists described the most valid tests for determining cessation of functioning of the brain.

Much of the Commission's report consists of a thorough summary of current knowledge of the physiology of death and how this knowledge has altered understanding of the concept of death itself. Although this presentation is excellent, we believe the model statute that the Commission recommends should not be adopted because there are significant flaws in it, as well as in the Commission's supporting arguments.

There are two distinct though related, problems in constructing a statutory definition of death. The first is a theoretical concern-providing the correct physiological standard. The second is the practical difficulty of reconciling this standard, which includes a new understanding of death. With the more popular conception of death.

The new understanding of death is largely a consequence of technological advances in life-support systems. Some severely brain-injured patients who have suffered permanent cessation of functioning of the entire brain can be given circulator and respiratory support such that:

. . . Their appearance resembles that of the dead as traditionally perceived: they no longer respond to their environment by sensate and intellectual activity. But their appearance also differs from that traditionally associated with the dead because mechanical support generates breathing. Heartbeat and the associated physical characteristics (e.g. warm, moist skin) of life (p. 21)

These patients present problems of labeling, for they have some, but not all of the traditional characteristics that lead one to call a person "dead." Until recently this was rarely, if ever, the case: patients who had some of these characteristics also had all the others. It is not that new technology has changed the concept of death; rather, this

technology has made it apparent that previously there had been no clear precise definition of death.

In his book *Pragmatism*, William James provided a useful example of this kind of definitional problem with regard to the phrase "going around." A squirrel was on the trunk of a tree, and a hunter was on the opposite side. Wishing to see the squirrel, the hunter proceeded to go around the tree: the squirrel, not wishing to be seen, also went around the tree, always facing the hunter but keeping the trunk between them. Had the hunter "gone around" the squirrel or not? James correctly noted that the phrase "going around" was ambiguous: to one sense (going around from north, to west, to south, to east, and back to north) the hunter did go around the squirrel, and in the other sense (going around from front, to left, to back, to right, and to front again) he did not. The old sense of "going around" was gone forever. Indeed, there never really was an old unambiguous sense.

Similarly, one regarded a man as dead if the organism as a whole had permanently ceased to function, if he had permanently stopped breathing, and if his heart had permanently stopped beating. All these usually happened at the same time or within a few minutes of one another, so that people did not consider how they would describe the person if one phenomenon occurred but the other two did not. However, because of modern technology, there are patients whose organism as a whole has permanently ceased to function, but whose respiration and circulation do function through mechanical support systems.

In James's case, there seems no reason for choosing either sense of "going around" as the more important and basic. However, in the case of death clearly the permanent cessation of the organism as a whole is far closer to what has always been meant by death than is permanent absence of breathing and heartbeat. Recognizing this point, the Commission states:

Although absence of breathing and heartbeat may often have been spoken of as "defining" death, review of history and of current medical and popular understanding makes clear that these were merely evidence for the disintegration of the organism as a whole as discussed in Chapter Three (p. 58).

Thus, the Commission defined the concept of death as the permanent cessation of functioning of the organism as a whole, and developed a statutory definition or standard of death on this basis. We believe that this is the correct approach, and that the report should be judged on how well it has carried out this intention.

The second practical problem that a new statutory definition must confront results from the rapid increase in the medical understanding of the physiology of death. There is a considerable gap between the understanding of most physicians—who have come to accept the centrality of the functioning of the brain in defining death—and most laypersons who, along with a few practicing physicians, continue to regard the functioning of the heart and lungs as central. Informed medical opinion is now virtually unanimous that a person is dead when and only when the entire brain, including the brainstem, has

permanently ceased to function. However, most laypersons continue to believe that the permanent cessation of heartbeat and breathing determines death.

As the Commission acknowledges, the problem lies in incorporating the new medical understanding in a statute without unduly disturbing those who still regard cardiopulmonary function as central.

The Origin of the Problem

After reviewing the anatomy of the brain, and citing clinical examples of individuals with only partial brain damage, the Commission concludes:

The President's Commission, as subsequent chapters explain more fully, regards the cessation of the vital functions of the entire brain-and not merely portions thereof, such as those responsible for cognitive functions-as the only proper neurological basis for declaring death. This conclusion accords with the overwhelming consensus of medical and legal experts and the public (p. 18).

A neurological standard actually lay behind past as well as present tests used by the medical profession for declaring death. Physicians traditionally have determined death by examining patients for total unresponsiveness: lack of any spontaneous movements, including breathing: absence of papillary light reflexes, and absence of heartbeat. Of these signs, only the last is not directly a sign of cessation of brain functioning. The value of the commonly known tests of death-which detect the permanent absence of spontaneous heartbeat and breathing-depends upon their producing irreversible cessation of functioning of the whole brain.

The Commission traces the history of the use of brain-based tests in death determinations. One landmark was the 1959 description by French neurophysiologists of the characteristics of patients with gross brain damage who have been maintained on respirators, a condition that they aptly termed coma depasse (beyond coma); another was the 1968 report by the Ad Hoc Committee of the Harvard Medical School to Examine the Definition of Brain Death, which listed criteria for diagnosing a permanently nonfunctioning brain. These criteria have since been overwhelmingly validated; no person known to have met them has survived. The Commission also reviews the status of confirmatory tests of permanent cessation of whole brain functioning, including tests of cerebral blood flow and electroencephalography, and points out some of their limitations.

The Commission discusses the role of cessation of ventilation and circulation in the cessation of functioning of the organism as a whole:

For patients who are not artificially maintained, breathing and heartbeat were and are reliable signs either of systemic integration and/or of continued brain functioning (depending on which approach one takes to the "whole brain" concept). To regard breathing and respiration as having diagnostic significance when the brain of a respirator-supported patient has

ceased functioning, however, is to forget the basic reasoning behind their use in individuals who are not artificially maintained (p. 37).

The Commission considers and rejects the "higher brain" formulation of death, which depends upon a concept of death defined as "loss of personhood," or in the words of Robert Veitch, its major proponent, "the irreversible loss of that which is essentially significant to the nature of man." By this definition, permanent loss of consciousness and cognition would count as death; thus patients in persistent vegetative states (Karen Ann Quinlan, for example) would be considered dead. These patients have normally functioning brainstems despite severe damage to, or complete loss of, their neocortex. They are permanently comatose but maintain spontaneous respiration and heartbeat have intact brainstem reflexes such as pupillary constriction to light, and maintain the complex array of neuroendocrine regulatory mechanisms subserved by the brainstem and hypothalamus. While such patients have lost their personhood, they are not dead because they have retained most of the functions of the organism as a whole.

An important weakness of the higher brain formulation of death is the "slippery slope" problem. Just how much neocortical damage is necessary for death? By this definition, would not severely demented patients also be considered dead? Then what about those somewhat less severely brain damaged? Because personhood is an inherently vague concept, strict criteria for its loss are difficult to identify.

The Commission might also have pointed out that the higher brain formulation is unacceptable because it applies only to human beings and not to related species. By the traditional concept of death, we mean the same thing when we say, "Mr. Jones died last night" as when we say, "My dog died last week." Death is a biological concept, so an acceptable definition should be applicable to related species. Such is the case when death is defined as the permanent cessation of functioning of the organism as a whole.

The higher brain formulation is not acceptable as the definition of death. It does have a place in determining possible grounds for nonvoluntary euthanasia that is, allowing an organism to die when that organism is no longer a person. But the major question-is nonvoluntary euthanasia desirable for patients in persistent vegetative status-should not be answered by blurring the distinction between loss of personhood and death of the organism.

The Commission rightly points out that the problem of formulating a precise statutory definition goes beyond the boundaries of medical authority. They also reject a judicial solution because specifying a standard of death is too fundamental to rely purely on retrospective determination. Furthermore a judicial solution would require too much time expense and psychological trauma for those involved. Favoring a legislative solution, they point out that:

A statute on death ought to guide physicians and others in decision making about respirator-maintained patients; it ought also to educate those who must make legal and policy decisions. Legislation will not remove the need for reasoned interpretation-first by physicians and perhaps then by judges-but it can restrict the

compass within which they make their choices to one which has been found acceptable by the public. Furthermore, if legislators are guided by a single model bill, the likelihood of statutory law that is uniform in language and intent is greatly increased (pp. 50-51).

In Chapter five of the report, "What 'Definition' ought to be adopted?" the Commission confronts the main problem in devising an adequate statutory definition of death. (When the Commission puts the word "definition" in quotation marks, as in this title, it is usually referring to a statutory definition, not an account of the ordinary meaning of the word "death.") The problem is to include in the statute the theoretically correct standard of death-irreversible cessation of all brain functioning-but also allow, for practical purposes, irreversible cessation of cardiopulmonary functions to be used as a test of death in the overwhelming majority of cases. We do not think the Commission's solution to this problem-the Uniform Determination of Death Act (UDDA)-is successful. The UDDA provides:

An individual who has sustained either (1) irreversible cessation of circulatory and respiratory functions. Or (2) irreversible cessation of all functions of the entire brain, including the brainstem, is dead. A determination of death must be made in accordance with accepted medical standards (p. 73).

The Commission rightly notes that "the statute must address the right question" (p. 57). It then states: "The Commission conceives the question to be, 'How, given medical advances in cardiopulmonary support, can the evidence that death has occurred be obtained and recognized?' "We do not think this is the right question at all. Indeed, the UDDA statute does not even attempt to answer this question, which sounds much more like a medical query than one that should be addressed by a statute. The basic question that a statute should address, we believe, is: given medical advances in the understanding of death, what general physiological standards should be used to "define" death" Another question that might be addressed by a statute is: what practical guide should be given to physicians concerning application of this standard? Note that these are two separate questions: the Commission fails to recognize fully that two distinct questions have to be answered, leading to some of the confusion in its report.

When dealing with the conceptual and theoretical bases of the proper standard of death, the report is clear:

In setting forth the standards recommended in this Report, the Commission has used the "whole brain" terms to clarify the understanding of death that enjoys near universal acceptance in our society. The Commission finds that the "whole brain" formulations give resonance and depth to the biomedical and epidemiological data presented in Chapter Two . . . the "whole brain" formulations provide a theory that is sufficiently precise, concise and widely acceptable (p. 16). -

The Commission also acknowledges, as noted above, that the heart and lungs play only a subsidiary role:

Although absence of breathing and heartbeat may often have been spoken of as "defining" death, review of history and current medical and popular understanding makes clear that these were merely evidence for the disintegration of the organism as a whole, as discussed in Chapter Three (p. 58).

However, the Commission does not seem to realize that something that is "merely evidence" should not be presented as a standard of death, for it presents a statute that includes two equal standards of death: (1) "irreversible cessation of circulatory and respiratory, and (2) "irreversible cessation of all functions of the entire brain, including the brainstem."

The clearest statement of the Commission's problem in separating conceptual and theoretical considerations from practical ones comes in its discussion of the statute drafted by the Law Reform Commission of Canada:

It would be possible, as in the statute drafted by the Law Reform Commission of Canada, to propound the irreversible cessation of brain functions as the "definition" and then to permit that standard to be met not only by direct measures of brain activity but also "by the prolonged absence of spontaneous cardiac and respiratory functions." Although conceptually acceptable (and vastly superior to the adoption of brain cessation as a primary standard conjoined with a nonspecific reference to other apparently unrelated "usual and customary procedures"), the Canadian proposal breaks with tradition in a manner that appears to be unnecessary (p. 74).

Here the Commission seems to be claiming that the only flaw in the Canadian account is that it "breaks with tradition in a manner that appears to be unnecessary." But this is a very surprising claim. Almost half the state statutes adopted since 1970 use only the brain standard and do not even mention circulation and respiration. Indeed, this is also true of the earlier statutes endorsed by the American Bar Association and the Uniform Brain Death Act put forward by the National Conference of Commissioners on Uniform State Laws.

Since it is hard to take at face value the claim that the Canadian proposal unnecessarily breaks with tradition, it is worth examining how the Commission supports this claim. It correctly points out:

For most lay people-and in all probability for most physicians as well-the permanent loss of heart and lung function (for example, in an elderly person who has died in his or her sleep) clearly manifests death (p. 74).

But the Canadian statute acknowledges that this is true. The Commission then alludes to the brain's special role:

As previous chapters in this Report recount, biomedical scientists can explain the brain's particularly important-and vulnerable-role in the organism as a whole and show how temporary loss of blood flow (ischemia) becomes a permanent cessation because of the damage that it inflicts on the brain (p. 74).

This is also compatible with the Canadian statute. Then comes the crucial step in the argument:

Nonetheless, most of the times people do not and need not, go through this two step process. Irreversible loss of circulation is recognized as death because setting, aside any mythical connotations of the heart-a person without blood flow simply cannot live. Thus, the Commission prefers to employ language which would reflect the continuity of the traditional standard and the newer, brain-based standard (p. 74).

The Commission's reasoning seems to be as follows: if people do not and need not think about the cessation of brain function in recognizing death from loss of heart and lung function, then cessation of heart and lung function is an independent stand and of death. But this reasoning is fallacious. Consider the following parallel argument. If people do not and need not think about cessation of brain function (or of heart and lung function) in recognizing death from someone being smashed flat by a steamroller, then being smashed flat by a steamroller is an independent standard of death. Even if people were commonly smashed flat by steamrollers, it would still not be a standard of death. For a standard of death is not merely that by which we can recognize that someone is dead; it is, based on all of our medical understanding, that which is both a necessary and sufficient condition for death. If the standard is fulfilled, the person is dead; if it is not fulfilled, the person is not dead. Irreversible cessation of all brain functions is such a standard. If it has occurred, the person is dead; if it has not occurred, the person is not dead, no matter what has happened to the heart, lungs, or any other organ.

Let us now see why "irreversible cessation of circulatory and respiratory functions" is not a standard of death. First, this phrase is ambiguous (recall the parallel problem with "going around"). It can mean either "irreversible cessation of spontaneous circulatory and respiratory functions" or "irreversible cessation of artificially supported circulatory and respiratory functions." No such ambiguity exists with regard to cessation of brain functions, for there are no artificially supported brain functions, in the relevant sense. No one would want to call a man in an iron lung and wearing a pacemaker dead, especially if he were still talking to us. Thus, irreversible cessation of spontaneous cardiopulmonary function may be a necessary condition for death, but it is certainly not sufficient. And irreversible cessation of artificially supported circulatory and respiratory functions is also not a standard of death, for though it may be a sufficient condition of death, it is not a necessary condition; it is one of the key points of the Commission's report that when circulation and respiration are being artificially maintained, but all brain functions have irreversibly ceased, the person is dead.

The report does not explain the ambiguous phrase "irreversible cessation of circulatory and respiratory functions"-all the more surprising for the Commission explains almost all the words in the statute, even why it uses "individual" rather than "person" and "is dead" rather than "will be considered dead." Possibly it would have required far more explanation than the Commission was prepared to offer.

There is no acceptable understanding of the phrase "irreversible loss of circulatory and respiratory functions" that provides a genuine standard for death. The Commission failed to realize this difficulty or perhaps it did partly realize it, and for that reason failed even to mention "spontaneous" or "artificially maintained." We think the Commission did not distinguish carefully enough between a *standard*, which must be a necessary and sufficient condition of death if it is to "define" it, and a *test*, which is merely a way of determining death.

No doubt some of the Commission's problems were brought on by its concern with avoiding radical change:

The conservative nature of the reform here proposed will be more apparent if the statute refers explicitly to the existing cardiopulmonary standard for determination of death. The brain-based standard is, after all, merely supplementary to the older standard, which will continue to be adequate in the overwhelming number of cases in the foreseeable future (p. 59).

However, any standard of death must be adequate in all cases, not merely the overwhelming number. Here is another instance in which the term "spontaneous" becomes important. For the "older standard" was for "irreversible cessation of *spontaneous* circulatory and respiratory functions," and the Commission rightly recognizes that this standard is no longer universally adequate. What it does not seem to realize is that this means it is not really a standard but merely a test. Cardiopulmonary tests may be adequate in the overwhelming number of cases, and brain-based tests may be used in only a small portion of cases. but this belongs in the practical pan of the statute, not in the statutory definition of death.

The Commission has thus created a statutory definition of death that is seriously misleading and that contains the most serious flaw that the Commission finds in previous statutes: it provides two independent standards of death, without explaining the relationship between them.

A Modified Solution

The Commission strived to produce a statute that would be adopted by all jurisdictions in the United States, and it presents good arguments for uniform legislation. Since 1970, twenty-seven states have adopted determination-of-death statutes: though the statutes appear to have similar intent, they are confusingly diverse in form and many are ambiguously worded.

The U DDA statute is not desirable, we believe, because it too is ambiguous and it elevates the irreversible cessation of cardiopulmonary functioning to the level of a standard of death, when it is really only a test, although a test that may be used in most circumstances. Permanent cessation of spontaneous cardiopulmonary functioning works as a test of death only in the absence of artificial cardiopulmonary support because only

there does it produce the true standard of death—the irreversible cessation of all brain functions. A conceptually satisfactory statute would not need to mention cessation of cardiopulmonary function at all. It would be sufficient to include only irreversible cessation of whole brain functioning and allow physicians to select validated^s and agreed-upon tests (prolonged absence of spontaneous cardiopulmonary function would be one) to measure irreversible cessation of whole brain function. However, the Commission felt, and we agree, that a statute that included cessation of cardiopulmonary function would be more broadly acceptable and useful.

The solution is to reconcile the claims of conceptual clarity and practical utility. In order to produce a more conceptually acceptable statute of death that would also be useful, we have incorporated into the UDDA statute the distinction between a standard and a test that was recognized by the model statute provided by the Law Reform Commission of Canada, and by the statute we recently proposed. Our proposed statute reads:

An individual, who has sustained irreversible cessation of all functions of the entire brain, including the brainstem, is dead

(a) In the absence of artificial means of cardiopulmonary support, death (the irreversible cessation of all brain functions) may be determined by the prolonged absence of spontaneous circulatory and respiratory functions.

(b) In the presence of artificial means of cardiopulmonary support, death (the irreversible cessation of all brain functions) must be determined by tests of brain function.

In both situations, the determination of death must be made in accordance with accepted medical standards.

We believe that this statute is conceptually clearer than the UDDA statute. It identifies the irreversible cessation of all functions of the entire brain, including the brainstem, as the standard of death, thus making clear that death is a single phenomenon. It also provides a guide to the practicing physician, pointing out that he or she may continue to declare death by cardiopulmonary tests in the majority of deaths uncomplicated by artificial cardiopulmonary support. And in the presence of cardiopulmonary support, the physician must directly measure the functioning of the brain. Thus this statute is both practical and conceptually clear.

REFERENCES

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President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research. *Defining Death: Medical, Legal, and Ethical Issues in the Determination of Death* (Washington, DC, July 1981), 84 pp. plus six appendices.

Five appendices were prepared by the staff of the President's Commission, but were not formally adopted by the Commission. These include "Glossary of Terms," "Studies in Outcome in Comatose, Artificially-Respirated Patients," "Statutes on the Determination of Death," "Judicial Developments in the Definition of Death," and "International Rules." A sixth appendix, "Guidelines for the Determination of Death," is a statement prepared and endorsed by a group of expert physician consultants to the Commission, but also not formally adopted by the Commission. This document is the most notable of the appendices because it provides the current specific guidelines by which physicians should determine death.

Specific tests and procedures are described for the determination of death. This guide stipulates which "functions of the entire brain" are referred to in the UDDA statute, and shows how they should be measured. The description of the tests and procedures is exceedingly authoritative and represents the state-of-the-art as of 198). The guide has been published in the *Journal of the American Medical Association* (246 (1981] 2184-86) and will serve as an important reference for physicians. As new developments in future technology permit simpler and more rapid means for determining death, these guidelines will need to be updated. For the present, they are the most authoritative death determination guidelines available to physicians.

James L Bernat, Charles M. Culver, Bernard Geri, "On the Definition and Criterion of Death," *Annals of Internal Medicine* 94 (1981). 389-394.

Robert M. Veitch. *Death, Dying and the Biological Revolution* (New Haven; Yale University Press, 1976).

Law Reform Commission of Canada, *Criteria for the Determination of Death* (Ottawa, Law Reform Commission of Canada, March, 1981).

"House of delegates redefines death, urges redefinition of rape, and undoes the Houston amendments-" *American Bar Association Journal* 61 (1970, 463-4.

Uniform Brain Death Act 1. 12 *Uniform Laws Annotated* 15 (supplement, 1980).

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