



Views of Pediatric Intensive Care Physicians on the Ethics of Organ Donation After Cardiac Death*

Ajit A. Sarnaik, MD; Jeff A. Clark, MD; Kathleen L. Meert, MD; Ashok P. Sarnaik, MD, FCCM

Objective: Donation after cardiac death has been endorsed by professional organizations, including the American Academy of Pediatrics as a means of increasing the supply of transplantable organs. However, ethical concerns have been raised about donation after cardiac death, especially in children. This study explores the views of pediatric intensive care physicians on the ethics of pediatric donation after cardiac death.

Design: Internet survey.

Subjects: Physician members of the American Academy of Pediatrics Section of Critical Care.

Interventions: Physicians were emailed an anonymous survey consisting of four demographic items and 16 items designed to assess their views on the ethics of pediatric donation after cardiac death. Responses to ethics items were rated on a 5-point scale ranging from strongly disagree to strongly agree. Physicians were also given the opportunity to provide free-text comments regarding their views.

Measurements and Main Results: Of the 598 eligible physicians, 264 (44.1%) responded to the survey. Of these, 193 (73.4%) were practicing in a transplant center and 160 (60.6%) participated in at least one donation after cardiac death procedure at the time of survey completion. Two hundred twenty (83.4%) agreed or strongly agreed that regarding donation after cardiac death, parents should be able to make decisions based on the best interests of their child. Two hundred twenty-two (84.1%) agreed or strongly agreed that it is not acceptable to harvest organs from a child before the declaration of death, consistent with the Dead Donor Rule. However, only 155 (59.1%) agreed or strongly agreed that

the time of death in donation after cardiac death can be conclusively determined. Twenty-nine (11.0%) agreed or strongly agreed that the pediatric donation after cardiac death donor may feel pain or suffering during the harvest procedure.

Conclusions: Most pediatric intensive care physicians agree that the Dead Donor Rule should be applied for donation after cardiac death and that donation after cardiac death can be consistent with the best interest standard. However, concerns about the ability to determine time of death for the purpose of organ donation and the possibility of increasing donor pain and suffering exist. (*Crit Care Med* 2013; 41:1733–1744)

Key Words: end-of-life care; ethics; non-heart-beating organ donor; organ donation; survey; withdrawal of life support

An increasing number of people die each year awaiting an organ transplant because the demand for organs is growing faster than the supply (1). In the past decade, efforts have been made at the national level to increase the supply of transplantable organs to partially bridge the gap between supply and demand. One such strategy is promoting the process of organ donation after cardiac death (DCD), also known as *non-heart-beating organ donation* or donation after circulatory determination of death (DCDD) (2). As opposed to heart-beating organ donation, in which donors have satisfied brain death criteria, DCD involves recovery of organs from donors after circulation stops and death is declared, usually in the context of withdrawal of support.

Prior to the establishment of brain death criteria in 1968 (3), the medical community defined death by the cessation of cardiopulmonary function. Nearly, all cadaveric organs for transplantation were recovered from people declared dead according to cardiopulmonary criteria (4). In 1981, the President's Commission released the Uniform Determination of Death Act (UDDA), which states that the criteria for satisfying the definition of death include irreversible cessation of either circulatory or respiratory functions or all functions of the entire brain, including the brain stem (5). The UDDA has been applied by the medical community to informally establish the "Dead Donor Rule," which provides that organs may be retrieved only after declaration of death. As a corollary, the Dead Donor Rule dictates that vital organs should only be

*See also p. 1819.

All authors: Department of Pediatrics, Children's Hospital of Michigan, Wayne State University School of Medicine, Detroit, MI.

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taken from dead individuals and death should not be caused by removal of organs. Since then, the majority of cadaveric organs for transplantation have been recovered from brain-dead donors.

Protocols for DCD were first developed in the early 1990s (6). Protocols involving children as DCD donors vary, but generally include the following (7):

- Eligibility includes patients with irreversible, end-stage illness for whom a decision to withdraw support has been made prior to the decision to donate organs, with informed written consent for DCD.
- Withdrawal of support occurs in the operating room, pre-op area, or ICU, and comfort medications are given as indicated for end-of-life care.
- If cardiac electrical activity and circulation stop within the period of observation (usually 60 to 120 min), death is declared and organs may be recovered after a waiting period (generally ranging from 2 to 5 min).
- If death does not occur in the specified observation period, the patient is no longer considered a DCD candidate and end-of-life care is continued.

DCD has been endorsed in policy statements by the American College of Critical Care Medicine, the Institute of Medicine, and the American Academy of Pediatrics (AAP) (8–10). However, several studies have identified complex ethical considerations in DCD, including pediatrics. The perspectives represented in these studies include multidisciplinary task forces and focus groups (11, 12), neurologists and perioperative personnel (13), and the general public (14). Although pediatric intensive care physicians often provide end-of-life care to children, their perspective on pediatric DCD is relatively under-represented in the literature. One prior study evaluated the knowledge, attitudes, and perceptions of pediatric intensive care nurses from a single center regarding DCD in children (15). The purpose of this study is to explore the views of pediatric intensive care physicians on the ethics of pediatric DCD.

MATERIALS AND METHODS

Participants and Survey Distribution

We administered an anonymous survey to pediatric intensive care physicians to assess their views on DCD in pediatrics. The sampling frame was chosen to target a large portion of the population of pediatric critical care physicians. Potential respondents were identified through a publicly available e-mail list of members of the AAP Section on Critical Care. The survey, shown in **Supplemental Figure 1** (Supplemental Digital Content, <http://links.lww.com/CCM/A629>), was sent by e-mail through the website, <http://www.surveymonkey.com>. It included an information sheet that briefly defined DCD and characterized the survey as voluntary and confidential. Responses to the survey were collected electronically by the website. Survey settings were chosen to exclude participant identifiers, to only allow one response per e-mail address, and to prevent the survey from being forwarded. One additional e-mail was automatically sent

through the website 3 weeks later to those who did not respond the first time. The study was approved by the Wayne State University Institutional Review Board.

Survey Development

Many aspects of survey design, such as item generation and face validity, were consistent with methods previously described (16). The survey was developed by the investigators, all of whom are pediatric intensive care physicians practicing at Children's Hospital of Michigan, a university-affiliated tertiary care hospital and transplant center that offers DCD. The survey consisted of four demographic items and 16 items designed to assess respondents' views on the ethics of pediatric DCD. Demographic items had a multiple choice response format and included gender, years of practice, approximate numbers of DCD procedures participated in, and whether the respondent practices in an institution that performs organ transplants. Ethics items had a 5-point Likert-type response format with choices of strongly disagree, disagree, neutral, agree, and strongly agree. To generate the ethics items, a literature search was undertaken, using search terms *DCD*, *pediatric DCD*, *DCDD*, *donation after cardiac death*, and *donation after circulatory determination of death*. Results of the literature search were reviewed, and ethical issues were discussed. Common themes identified through the literature search included informed consent issues specific to pediatrics, declaration of death, perception of pain, benefit to the donor, and benefit to society. The ethics items included in the survey were generated based on these common themes and through discussion with colleagues and were categorized using the four principles of biomedical ethics as outlined by Beauchamp and Childress (17), namely *autonomy*, *nonmaleficence*, *beneficence*, and *justice*. Autonomy items included those who should initiate discussion of DCD, eligibility criteria for donors, and informed consent issues in children. Nonmaleficence items covered timing of the declaration of death, perception of pain, and pre-mortem procedures for the purposes of organ preservation. Beneficence items included the potential for adding meaning or worth to the death of the donor and positive effects for the grieving family. Justice items covered obligations of the medical community and rights of patients on organ transplant lists. At the end of the survey, respondents were given the opportunity to provide free-text comments regarding their views on the ethics of DCD in children.

Pilot Testing

After generating an initial list of ethical items, the survey was pilot tested on eight pediatric critical care physicians from our institution. They were asked to review each item for relevance and clarity. Based on this feedback, items were revised or eliminated. Other measures of reliability and validity were not assessed prior to administering the survey to study participants, because there is no known "gold standard" of measuring ethical views in DCD against which to compare our survey instrument and because test-retest procedures were not conducted.

Data Analysis

Responses to survey items are expressed as the absolute count and percentage in each category or rank. Not all physicians responded to every item; therefore, the denominator for calculating percentages was equal to the number of responses obtained for the item. Responses to ethics items were compared between physicians practicing at a transplant center or not and between physicians with and without prior DCD experience using Pearson chi-square tests. To facilitate these comparisons, categories were combined such that “strongly agree” and “agree” comprised one category and “strongly disagree” and “disagree” comprised another category. “Neutral” responses remained a separate category. A *p* value of less than 0.05 was considered statistically significant. No adjustments were made for multiple comparisons due to the exploratory nature of the research. All quantitative analyses were conducted using IBM SPSS version 19.0 (SPSS, Chicago, IL).

Two investigators (A.A.S., J.A.C.) used an iterative process to identify themes within the free-text comments. This process included independent reading of the comments to identify themes, comparison of themes between investigators, and re-reading of the comments and discussion to refine themes and reach consensus on their meaning. The number of respondents expressing each theme is presented as the absolute count and percentage of all respondents providing free-text comments.

RESULTS

A total of 598 members of the AAP Section of Critical Care were sent electronic surveys. Of these, 264 (44.1%) responded to the survey items and 80 (30.3%) provided free-text comments. Demographic characteristics of the respondents are shown in **Table 1**. Respondents had a wide range of experience practicing pediatric critical care medicine. A total of 193 (73.4%) respondents were practicing in a transplant center, and 160 (60.6%) had participated in at least one DCD procedure at the time of survey completion.

Table 2 summarizes their responses to the ethics items. Two hundred twenty (83.4%) respondents agreed or strongly agreed that regarding DCD, parents should be able to make decisions based on the best interests of their child as they do with other medical decisions, such as clinical studies, operative procedures, and withdrawal of support. Two hundred twenty-two (84.1%) agreed or strongly agreed that it is not acceptable to harvest organs from a child before the declaration of death. One hundred fifty-five (59.1%) agreed or strongly agreed that the time of death during DCD can be conclusively determined. Twenty-nine (11.0%) agreed or strongly agreed that the pediatric DCD donor may feel pain or suffering during the harvest procedure. Two hundred fifty-seven (97.3%) agreed or strongly agreed that it is acceptable to recover organs from a brain-dead child.

Comparisons in responses to ethics items between physicians with and those without prior DCD experience are shown in **Table 3**. In general, physicians who had DCD experience viewed DCD more favorably than those who did not. Physicians with DCD experience were more likely to agree or strongly

TABLE 1. Demographics of American Academy of Pediatrics Section of Critical Care Survey Respondents (n = 264)

Characteristic	n (%)
Gender	
Male	161 (61.2)
Female	102 (38.8)
Number of years practicing pediatric intensive care	
0–5	37 (14.0)
6–10	53 (20.0)
11–15	57 (21.6)
16–20	77 (29.1)
> 20	40 (15.1)
Number of donation after cardiac death procedures participated in	
0	104 (39.4)
1–5	142 (53.8)
6–10	15 (5.7)
> 10	3 (1.1)
Practice in a transplant center	
Yes	193 (73.4)
No	70 (26.6)

agree that parents should be able to make decisions regarding DCD based on the best interest of their child as follows: 1) DCD should be offered to non-neurologically devastated children; 2) the potential to increase the meaning and worth of the DCD donor's death makes DCD a more ethically sound practice; and 3) that the medical community has an obligation to ensure that a discussion of DCD occurs with parents of children undergoing withdrawal of life-sustaining therapies. Physicians with DCD experience were less likely to agree or strongly agree that only parents should initiate discussion about DCD or that the pediatric DCD donor may feel pain or suffering during the harvest procedure. Physicians with DCD experience were also less likely to agree or strongly agree that children are capable of understanding the benefits of organ donation.

Comparisons in response to ethics items between physicians practicing at a transplant center and those not at a transplant center are shown in **Table 4**. In general, physicians practicing at a transplant center viewed DCD less favorably than those not at a transplant center. Physicians practicing at a transplant center were more likely to agree or strongly agree that the pediatric DCD donor may feel pain or suffering during the harvest procedure and less likely to agree or strongly agree that the medical community has an obligation to ensure that a discussion of DCD occurs with parents of children undergoing withdrawal of life-sustaining therapies.

TABLE 2. American Academy of Pediatrics Section of Critical Care Survey Responses to Ethics Items

Item	Strongly Disagree, n (%)	Disagree, n (%)	Neutral, n (%)	Agree, n (%)	Strongly Agree, n (%)
1. Regarding DCD, parents should be able to make decisions based on the best interests of their child, as they do with other medical decisions, such as clinical studies, operative procedures, and withdrawal of support	33 (12.5)	3 (1.1)	8 (3.0)	58 (22.0)	162 (61.4)
2. Nobody but parents should initiate discussion about DCD after the decision to withdraw life-sustaining therapies has been made for a child	79 (30.0)	125 (47.5)	30 (11.4)	18 (6.8)	11 (4.2)
3. If not already initiated by the parents, nobody but the Organ Procurement Organization should initiate discussion about DCD after the decision to withdraw life-sustaining therapies has been made for a child	71 (27.0)	102 (38.8)	27 (10.3)	42 (16.0)	21 (8.0)
4. If not already initiated by the parents, nobody but the primary medical team should initiate discussion about DCD after the decision to withdraw life-sustaining therapies has been made for a child	42 (16.0)	123 (46.8)	47 (17.9)	38 (14.4)	13 (4.9)
5. It is acceptable to harvest organs from a brain-dead child	5 (1.9)	0 (0)	2 (0.8)	46 (17.4)	211 (79.9)
6. It is NOT acceptable to harvest organs from a child before the declaration of death (i.e., "Dead Donor Rule")	6 (2.3)	19 (7.2)	17 (6.4)	57 (21.6)	165 (62.5)
7. Given that pediatric organ donors should be dead prior to harvest ("Dead Donor Rule"), the time of death and time at which a donor should be released for organ harvest can be conclusively determined	10 (3.8)	51 (19.5)	46 (17.6)	112 (42.7)	43 (16.4)
8. Since anesthesia is generally not administered during organ harvest, the pediatric DCD donor may feel pain or suffering during the harvest procedure	108 (40.9)	90 (34.1)	37 (14.0)	23 (8.7)	6 (2.3)
9. In pediatric DCD, medications and procedures before death used specifically for organ preservation (such as heparin, blood draws, and cannulation) are acceptable	10 (3.8)	36 (13.7)	48 (18.3)	118 (44.9)	51 (19.5)
10. DCD should be offered to any pediatric patient/family undergoing withdrawal of life-sustaining treatment even if they are not neurologically devastated, such as in end-stage cystic fibrosis	19 (7.2)	45 (17.0)	49 (18.6)	117 (44.3)	34 (12.9)
11. The potential to increase the meaning and worth of the pediatric DCD donor's death makes DCD a more ethically sound practice	18 (6.9)	42 (16.1)	71 (27.2)	105 (40.2)	25 (9.6)
12. The potential of a successful organ donation in pediatric DCD to positively affect the emotional state of a grieving family makes DCD a more ethically sound practice	17 (6.4)	33 (12.5)	71 (26.9)	119 (45.1)	24 (9.1)
13. Children are capable of understanding the benefits of organ donation and are therefore potentially able to derive benefits from donating their organs in DCD	20 (7.6)	61 (23.2)	107 (40.7)	67 (25.5)	8 (3.0)

(Continued)

TABLE 2. (Continued). American Academy of Pediatrics Section of Critical Care Survey Responses to Ethics Items

Item	Strongly Disagree, n (%)	Disagree, n (%)	Neutral, n (%)	Agree, n (%)	Strongly Agree, n (%)
14. Patients on a transplant list who are at risk of dying without a transplant have the right to receive transplantable organs that are no longer of benefit to their owners	40 (15.2)	56 (21.3)	44 (16.7)	79 (30.0)	44 (16.7)
15. Due to the potential benefits to organ recipients, the medical community has an obligation to ensure that a discussion of DCD with parents of children in whom withdrawal of life-sustaining therapies occurs	21 (8.0)	39 (14.8)	57 (21.6)	109 (41.3)	38 (14.4)
16. The minimum time after electrocardiographic silence and pulselessness after which a child should be released for organ harvest in DCD is	0 min 16 (6.1)	2 min 60 (22.7)	5 min 99 (37.5)	10 min 14 (5.3)	15 min 8 (3.0)

DCD = donation after cardiac death.

Table 5 shows the themes identified in physicians' free-text comments. The most frequently mentioned themes concerned who should initiate discussion of DCD, determination of death, and donor versus recipient's rights. Representative comments exemplifying each theme are shown in Supplemental Table 1 (Supplemental Digital Content, <http://links.lww.com/CCM/A630>). Of note, five (6.3%) of the physicians providing free-text comments were concerned about bias in the wording of the survey items. However, some indicated that the items were biased in favor of DCD, whereas others indicated that the items were biased against DCD.

DISCUSSION

An ever-widening gap has developed between the supply of transplantable organs and the demand. In the United States, more than 100,000 transplant candidates are on waiting lists, whereas about 30,000 transplants are performed per year (2). In the past decade, efforts at the national level to increase the supply of transplantable organs have included strategies to develop and encourage the practice of DCD. The National Organ Donation Breakthrough Collaborative (2003) targeted an increase in the percentage of DCD donors from 5% to 10% (2). Since January 1, 2007, the Joint Commission has required all hospitals to address, though not necessarily perform, DCD (18). In response to these efforts, the percentage of donated organs obtained from DCD increased from 2.0% in 2000 to 11.5% in 2009 (1). Outcomes from organs recovered by DCD have been promising, as renal graft function and recipient survival rates from DCD are comparable to those from brain-dead donors (19, 20).

Since the resurgence of DCD, there has been a lively and polarized debate on the ethics of DCD, especially in children. Proponents of DCD note the beneficial impact on a child's inevitable death by the altruistic act of donating organs, the benefit to society by increasing transplantable organs, as well as honoring the dying patient's wishes to donate, if possible (21). Concerns raised about DCD include uncertainty about the declaration

of death (22, 23), potential conflict of interest between dying patients and recipients (24–26), impact on end-of-life care (25, 27, 28), and the potential for autoresuscitation and/or perception of pain (29–31). Change in nomenclature from DCD (*donation after cardiac death*) to DCDD (*donation after circulatory determination of death*) liberalizes the eligibility of donors. For example, the report of a series of successful heart transplants from non-brain-dead donors was, by definition, not donation after cardiac death, because the hearts were not irreversibly dead (32). However, the practice has been justified by some, because as the name DCDD indicates, death was declared by an absence of circulation with an obligatory waiting period, in the context of a “do-not-resuscitate” status (33).

This study was undertaken to assess the views of pediatric intensive care physicians on the ethics of DCD in children. The views were explored from the perspective of prevailing ethical themes that were identified from the literature, namely informed consent, declaration of death, perception of pain, benefit to the donor, and benefit to society.

Informed Consent

With the exception of emancipated minors, children are legally incapable of providing informed consent. In some cases, children may reach the developmental stage to provide consent, but in the context of DCD, they are most likely too ill to do so. The best interest standard is the obvious surrogate for informed consent for treatment of such illnesses as appendectomy for acute appendicitis (universally accepted) or for small intestine transplant for short gut syndrome (widely debated). In both of these situations, direct benefit to the patient is the fundamental basis for such treatment approaches. It is debated whether DCD is consistent with the best interest standard because the only potential benefit to the donor is in the altruistic act of helping others. Some have questioned whether altruism can be presumed on behalf of a child (11). In this study, most respondents indicated that parents should be able to make decisions about DCD based on the best interest of their child although a

TABLE 3. Relationship of American Academy of Pediatrics Section of Critical Care Survey Responses to Donation After Cardiac Death Experience

Item	DCD Experience (n = 160)			No DCD Experience (n = 104)			p
	Strongly Disagree/Disagree	Neutral	Strongly Agree/Agree	Strongly Disagree/Disagree	Neutral	Strongly Agree/Agree	
1. Regarding DCD, parents should be able to make decisions based on the best interests of their child, as they do with other medical decisions, such as clinical studies, operative procedures, and withdrawal of support	16 (10.0)	3 (1.9)	141 (88.1)	20 (19.2)	5 (4.8)	79 (76.0)	0.033
2. Nobody but parents should initiate discussion about DCD after the decision to withdraw life-sustaining therapies has been made for a child	133 (83.1)	13 (8.1)	14 (8.8)	71 (68.9)	17 (16.5)	15 (14.6)	0.025
3. If not already initiated by the parents, nobody but the Organ Procurement Organization should initiate discussion about DCD after the decision to withdraw life-sustaining therapies has been made for a child	110 (68.8)	18 (11.3)	32 (20.0)	63 (61.2)	9 (8.7)	31 (30.1)	0.165
4. If not already initiated by the parents, nobody but the primary medical team should initiate discussion about DCD after the decision to withdraw life-sustaining therapies has been made for a child	100 (62.5)	30 (18.8)	30 (18.8)	65 (63.1)	17 (16.5)	21 (20.4)	0.875
5. It is acceptable to harvest organs from a brain-dead child	2 (1.3)	0 (0)	158 (98.8)	3 (2.9)	2 (1.9)	99 (95.2)	0.132
6. It is NOT acceptable to harvest organs from a child before the declaration of death (i.e., "Dead Donor Rule")	15 (9.4)	9 (5.6)	136 (85.0)	10 (9.6)	8 (7.7)	86 (82.7)	0.794
7. Given that pediatric organ donors should be dead prior to harvest ("Dead Donor Rule"), the time of death and time at which a donor should be released for organ harvest can be conclusively determined	31 (19.6)	27 (17.1)	100 (63.3)	30 (28.8)	19 (18.3)	55 (52.9)	0.175
8. Since anesthesia is generally not administered during organ harvest, the pediatric DCD donor may feel pain or suffering during the harvest procedure	129 (80.6)	18 (11.3)	13 (8.1)	69 (66.3)	19 (18.3)	16 (15.4)	0.031

(Continued)

TABLE 3. (Continued). Relationship of American Academy of Pediatrics Section of Critical Care Survey Responses to Donation After Cardiac Death Experience

Item	DCD Experience (n = 160)			No DCD Experience (n = 104)			p
	Strongly Disagree/Disagree	Neutral	Strongly Agree/Agree	Strongly Disagree/Disagree	Neutral	Strongly Agree/Agree	
9. In pediatric DCD, medications and procedures before death used specifically for organ preservation (such as heparin, blood draws, and cannulation) are acceptable	24 (15.1)	25 (15.7)	110 (69.2)	22 (21.2)	23 (22.1)	59 (56.7)	0.120
10. DCD should be offered to any pediatric patient/family undergoing withdrawal of life-sustaining treatment even if they are not neurologically devastated, such as in end-stage cystic fibrosis	31 (19.4)	26 (16.3)	103 (64.4)	33 (31.7)	23 (22.1)	48 (46.2)	0.012
11. The potential to increase the meaning and worth of the pediatric DCD donor's death makes DCD a more ethically sound practice	26 (16.4)	46 (28.9)	87 (54.7)	34 (33.3)	25 (24.5)	43 (42.2)	0.006
12. The potential of a successful organ donation in pediatric DCD to positively affect the emotional state of a grieving family makes DCD a more ethically sound practice	25 (15.6)	41 (25.6)	94 (58.8)	25 (24.0)	30 (28.8)	49 (47.1)	0.124
13. Children are capable of understanding the benefits of organ donation and are therefore potentially able to derive benefits from donating their organs in DCD	51 (32.1)	74 (46.5)	34 (21.4)	30 (28.8)	33 (31.7)	41 (39.4)	0.005
14. Patients on a transplant list who are at risk of dying without a transplant have the right to receive transplantable organs that are no longer of benefit to their owners	59 (36.9)	27 (16.9)	74 (46.3)	37 (35.9)	17 (16.5)	49 (47.6)	0.978
15. Due to the potential benefits to organ recipients, the medical community has an obligation to ensure that a discussion of DCD with parents of children in whom withdrawal of life-sustaining therapies occurs	30 (18.8)	30 (18.8)	100 (62.5)	30 (28.8)	27 (26.0)	47 (45.2)	0.021

DCD = donation after cardiac death.

TABLE 4. Relationship of American Academy of Pediatrics Section of Critical Care Survey Responses to Practice at a Transplant Center

Item	Transplant Center (n = 193)			Nontransplant Center (n = 70)			p
	Strongly Disagree/Disagree	Neutral	Strongly Agree/Agree	Strongly Disagree/Disagree	Neutral	Strongly Agree/Agree	
1. Regarding DCD, parents should be able to make decisions based on the best interests of their child, as they do with other medical decisions, such as clinical studies, operative procedures, and withdrawal of support	26 (13.5)	5 (2.6)	162 (83.9)	10 (14.3)	3 (4.3)	57 (81.4)	0.760
2. Nobody but parents should initiate discussion about DCD after the decision to withdraw life-sustaining therapies has been made for a child	145 (75.5)	23 (12.0)	24 (12.5)	58 (82.9)	7 (10.0)	5 (7.1)	0.394
3. If not already initiated by the parents, nobody but the Organ Procurement Organization should initiate discussion about DCD after the decision to withdraw life-sustaining therapies has been made for a child	126 (65.5)	19 (9.9)	47 (24.5)	46 (65.7)	8 (11.4)	16 (22.9)	0.917
4. If not already initiated by the parents, nobody but the primary medical team should initiate discussion about DCD after the decision to withdraw life-sustaining therapies has been made for a child	123 (64.1)	32 (16.7)	37 (19.3)	41 (58.6)	15 (21.4)	14 (20.0)	0.635
5. It is acceptable to harvest organs from a brain-dead child	4 (2.1)	2 (1.0)	187 (96.9)	1 (1.4)	0 (0)	69 (98.6)	0.653
6. It is NOT acceptable to harvest organs from a child before the declaration of death (i.e., "Dead Donor Rule")	18 (9.3)	12 (6.2)	163 (84.5)	7 (10.0)	5 (7.1)	58 (82.9)	0.947
7. Given that pediatric organ donors should be dead prior to harvest ("Dead Donor Rule"), the time of death and time at which a donor should be released for organ harvest can be conclusively determined	50 (26.0)	33 (17.2)	109 (56.8)	11 (15.9)	12 (17.4)	46 (66.7)	0.217
8. Since anesthesia is generally not administered during organ harvest, the pediatric DCD donor may feel pain or suffering during the harvest procedure	136 (70.5)	33 (17.1)	24 (12.4)	61 (87.1)	4 (5.7)	5 (7.1)	0.019

(Continued)

TABLE 4. (Continued). Relationship of American Academy of Pediatrics Section of Critical Care Survey Responses to Practice at a Transplant Center

Item	Transplant Center (n = 193)			Nontransplant Center (n = 70)			p
	Strongly Disagree/Disagree	Neutral	Strongly Agree/Agree	Strongly Disagree/Disagree	Neutral	Strongly Agree/Agree	
9. In pediatric DCD, medications and procedures before death used specifically for organ preservation (such as heparin, blood draws, and cannulation) are acceptable	37 (19.2)	40 (20.7)	116 (60.1)	9 (13.0)	8 (11.6)	52 (75.4)	0.073
10. DCD should be offered to any pediatric patient/family undergoing withdrawal of life-sustaining treatment even if they are not neurologically devastated, such as in end-stage cystic fibrosis	51 (26.4)	34 (17.6)	108 (56.0)	13 (18.6)	15 (21.4)	42 (60.0)	0.397
11. The potential to increase the meaning and worth of the pediatric DCD donor's death makes DCD a more ethically sound practice	50 (26.2)	51 (26.7)	90 (47.1)	10 (14.5)	20 (29.0)	39 (56.5)	0.135
12. The potential of a successful organ donation in pediatric DCD to positively affect the emotional state of a grieving family makes DCD a more ethically sound practice	42 (21.8)	53 (27.5)	98 (50.8)	8 (11.4)	18 (25.7)	44 (62.9)	0.115
13. Children are capable of understanding the benefits of organ donation and are therefore potentially able to derive benefits from donating their organs in DCD	65 (33.9)	79 (41.1)	48 (25.0)	16 (22.9)	28 (40.0)	26 (37.1)	0.095
14. Patients on a transplant list who are at risk of dying without a transplant have the right to receive transplantable organs that are no longer of benefit to their owners	77 (39.9)	28 (14.5)	88 (45.6)	19 (25.3)	15 (21.7)	35 (50.7)	0.134
15. Due to the potential benefits to organ recipients, the medical community has an obligation to ensure that a discussion of DCD with parents of children in whom withdrawal of life-sustaining therapies occurs	52 (26.9)	40 (20.7)	101 (52.3)	8 (11.4)	17 (24.3)	45 (64.3)	0.030

DCD = donation after cardiac death.

TABLE 5. General Themes Identified in Free-Text Responses in American Academy of Pediatrics Section of Critical Care Survey

Theme	n (%)
Who should initiate discussion	16 (20.0)
Determination of death	15 (18.8)
Donor vs recipient rights	12 (15.0)
Consent issues	5 (6.3)
Concerns about wording/bias of survey items	5 (6.3)
Alterations in end-of-life care	4 (5.0)
Benefits of DCD in increasing organ supply	4 (5.0)
Pain surrounding death	3 (3.8)
Viability of organs	3 (3.8)
Organ Procurement Organization interaction	2 (2.5)
Dead Donor Rule not necessary	2 (2.5)
Parental right to consent for DCD	2 (2.5)
Offer DCD to everyone to remove bias/ conflict of interest	2 (2.5)
Parents' altruism in helping others	2 (2.5)
Public education is important	1 (1.3)
Other	20 (25.0)

DCD = donation after cardiac death.

minority disagreed. Without the ability to appreciate an altruistic act, there may be no potential benefit to the donor, and it is uncertain at which age or developmental state this can occur. On the other hand, in circumstances where children are capable of appreciating altruism, withholding DCD becomes a violation of autonomy (21).

Declaration of Death

Findings of our study show a more even distribution of physicians' views regarding whether the time of death can be conclusively determined in DCD and when to release a donor for organ recovery after loss of circulation. Optimally performed DCD requires an accurate determination of death. If death is declared too early, the "Dead Donor Rule" is violated, and the donor may perceive pain and suffering; if death is declared too late, organ ischemia may occur. The phenomenon of autoresuscitation, in which circulation resumes after failed cardiopulmonary resuscitation (CPR) (30), has been used as a criticism of the practice of DCD. Recently, intensive care physicians from Canada reported practice variability in determining death after cardiac arrest, as well as the occurrence of autoresuscitation (34). However, it should be noted that resuscitation medications remain in the system after failed CPR and create a physiological milieu different from that during withdrawal of support, increasing the potential for autoresuscitation. The worthiness of the Dead Donor Rule has also been debated

(35). Because of the arbitrary nature of declaring death, waiting periods can lead to the decay of the gift of donation, therefore undermining the donor's altruism. Indeed, 9.5% of respondents in our study disagreed that it was unacceptable to recover organs from a child before the determination of death. By definition, the recent series of successful heart transplants from non-brain-dead donors did not satisfy the criterion of irreversibility of cardiorespiratory death stated in the Dead Donor Rule. Although cessation of circulatory function in withdrawal of life-sustaining therapies is often not irreversible, it is indeed permanent because circulation will be restored neither spontaneously nor as a result of a medical intervention because resuscitation will not be attempted (36). It has been suggested by some that permanence can be a valid substitute for irreversibility in determining when organs can be recovered in DCD (33).

Perception of Pain

Eleven percent of physicians participating in our study agreed that pediatric DCD donors may feel pain or suffering during organ recovery. This finding is similar to that of a previous study in which 11% of pediatric intensive care nurses reported fearing DCD donors felt pain or suffering (15). Auyong et al (31) described a series of processed electroencephalography readings obtained during DCD procedures, which showed a surge of brain activity after withdrawal of support, followed by a decrease in activity as cardiac output decreased and zero activity when death was declared. The subjects in this series were neurologically devastated adults. Further study of the time course of brain activity during pediatric DCD is warranted.

Benefit to the Donor

About half of the physicians in our study agreed that DCD has the potential to have a positive impact on the emotional state of the grieving family and to increase the meaning and worth of the DCD donor's death. Through its proven capacity to increase the supply of transplantable organs, there is not much debate that DCD greatly benefits recipients. However, a central question surrounding pediatric DCD concerns its benefit to the donor. The extent to which benefits to donor families, society, and recipients should be considered in the context to potential risks to the donor is an important issue in DCD ethics. Only 28.5% of physicians agreed that children are capable of understanding the benefits of organ donation and therefore potentially able to derive benefits from donating their organs in DCD. Several free-text comments indicated physicians' desire to consider the benefits to the family when making decisions about DCD. For example, "The most convincing argument for DCD derives from the decades of requests made by parents of children from whom life-sustaining technologies were being removed begging that their child might help another child." This sentiment is also expressed in the literature; for example, data from focus groups intended to inform DCD policy at Children's Hospital Boston identified "making it happen for families" who desire to participate in organ donation as the primary reason for establishing a DCD program (11).

Benefit to Society

Distributive justice is defined as fair and equitable treatment in light of what is due to persons (17). In this study, about half of physicians agreed that patients on a transplant list who are at risk of dying without a transplant have the right to receive transplantable organs that are no longer of benefit to their owners. This may however violate the autonomy of potential donors in making their own decisions regarding the disposition of their organs after death. Also, about half of physicians agreed that due to the potential benefits to organ recipients, the medical community has an obligation to ensure that a discussion of DCD occurs with parents of children undergoing withdrawal of life-sustaining therapies. Such discussion however may present moral conflict for those health professionals opposed to DCD.

Findings from our study suggest that pediatric intensive care physicians are generally in favor of organ transplantation as a therapeutic option as almost all survey respondents found it acceptable to recover organs from a brain-dead child. Our findings also suggest that physicians who have experience with DCD view the practice more favorably than those without such experience. This could indicate that experience with DCD positively affects physicians' views, or, alternatively, that physicians with negative views of DCD avoid the procedure. In a study of pediatric critical care nurses' attitudes regarding DCD, confidence with knowledge, comfort in answering family questions, and comfort calling the organ procurement organization increased after an educational intervention. Knowledge deficits in DCD among physicians have not been addressed, and increasing awareness about DCD may influence physicians' acceptance of the procedure either way. Ironically, physicians in our study practicing at transplant centers generally viewed DCD less favorably than those at nontransplant centers. Conflict of interest was one of the earliest ethical concerns identified in DCD (23). The sooner organs are removed, the more the interests of recipients and transplant personnel are served because less warm ischemia time increases the chance of graft survival. However, if organs are removed prior to death, harm to the donor could result through pain and violation of the Dead Donor Rule. Also, procedures specifically intended for organ preservation (e.g., heparin, blood draws, and cannulation) serve only the interests of the recipient but offer no direct benefit to the donor. We expected that physicians practicing at transplant centers would view DCD more favorably than others, in part, because of their direct responsibility for patients waiting on transplant lists; however, this was not the case.

The most common free-text theme was regarding who should initiate discussion about DCD. Some participants believed that the organ procurement organization, rather than the primary medical team, should initiate discussion about DCD, because families may perceive a conflict of interest between the dying child and society. Others thought that there should be flexibility in how the families are approached, depending on the length and quality of relationship with the primary medical team. This range of views is similar to an analysis of focus group transcripts regarding pediatric DCD,

in which participants had varying opinions on which health-care professionals should initiate DCD discussions with families, or even if it should only be initiated by the families (11). Another common free-text theme is questions regarding the determination of death. Several respondents stated that since death can be viewed as a process, not a discrete event, the exact time in which death is declared is arbitrary. Some believed that in DCD, the declaration of death is motivated by organ procurement rather than the best interest of the dying patient. Also, some were concerned that with waiting periods of as short as 2 minutes after the cessation of circulation, neuronal death is unlikely and brain activity is possible. Another common free-text theme is regarding donor versus recipient rights. Many respondents commented that recipients do not have the right to receive organs, unless they are donated through the process of informed consent. That theme has not been specifically described in previous studies but indicates the view that a donated organ is given through the dying patient's free will but is not a resource that is owed to potential recipients.

Limitations of our study include the use of the AAP Section of Critical Care membership list to identify potential physician participants. Although the membership of the section comprised mostly of pediatric intensive care physicians, it also includes other physicians with interest in pediatric intensive care, such as pediatric surgeons and other subspecialists. Additionally, only 44.1% of those who were eligible responded to the survey. Finally, the possibility that the survey items reflected biases of the investigators cannot be excluded. Much care was taken to frame the items as neutrally as possible and from the standpoint of established principles of biomedical ethics, yet several free-text comments focused on bias of the items. However, respondents perceived investigator bias both in favor of DCD and against DCD.

CONCLUSIONS

The practice of pediatric DCD has been shown to increase the supply of transplantable organs, and promising rates of graft survival have been demonstrated using organs recovered from pediatric DCD donors. However, as evidenced by this study, many pediatric intensive care physicians have concerns regarding the ethics of DCD. Most agree with Dead Donor Rule during DCD, and that DCD can be consistent with the best interest standard. However, concerns about the ability to determine time of death for the purpose of organ donation, the possibility of increasing donor pain and suffering, and potential conflicts of interest between the dying patient and potential recipient exist.

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