



A mixed-methods study of organ donation in the intensive care unit: 22 actionable practices to improve organ donation

Une étude par méthodes mixtes du don d'organes à l'unité de soins intensifs : 22 gestes concrets pour améliorer le don d'organes

Simon J. W. Oczkowski, MD, MHSc, MSc · Emmy Arnold, MA ·
John Centofanti, MD · Pamela Durepos, RN, PhD · Aimee Sarti, MD ·
Erika Arseneau, MSc · Sonny Dhanani, MD · Deborah J. Cook, MD, MSc ·
Maureen O. Meade, MD, MSc

Received: 15 November 2018 / Revised: 23 December 2018 / Accepted: 1 January 2019 / Published online: 26 February 2019
© Canadian Anesthesiologists' Society 2019

Abstract

Purpose Rates of organ donation vary between otherwise comparable intensive care units (ICUs) suggesting that the process of donation must vary between ICUs. The purpose of this study was to describe the process of organ donation from the perspective of ICU staff, identify important drivers of successful donation, and develop strategies to improve the process of donation.

Electronic supplementary material The online version of this article (doi:<https://doi.org/10.1007/s12630-019-01332-9>) contains supplementary material, which is available to authorized users.

S. J. W. Oczkowski, MD, MHSc, MSc (✉)
Division of Critical Care, Department of Medicine, McMaster University, Hamilton, ON, Canada
e-mail: oczkwosj@mcmaster.ca

Hamilton Health Sciences, Hamilton, ON, Canada

Department of Health Research Methods, Evidence, and Impact, McMaster University, Hamilton, ON, Canada

Juravinski Hospital, Room A3-20, 711 Concession St, Hamilton, ON L8V 1C3, Canada

E. Arnold, MA
Division of Critical Care, Department of Medicine, McMaster University, Hamilton, ON, Canada

J. Centofanti, MD
Division of Critical Care, Department of Medicine, McMaster University, Hamilton, ON, Canada

Hamilton Health Sciences, Hamilton, ON, Canada

Methods We conducted qualitative interviews with 32 ICU staff, including physicians, nurses, and respiratory therapists, using an interview guide developed from previous studies on organ donation. Using a qualitative descriptive approach, we coded interviews using qualitative content analysis. We integrated findings from the interviews in a mixed-methods analysis with previously published data from a document analysis and cross-sectional survey to identify practices that may enhance organ donation in the ICU.

Results Five major themes important to the organ donation process emerged from the interviews: i) staff relationship with organ donation coordinators; ii)

P. Durepos, RN, PhD
Hamilton Health Sciences, Hamilton, ON, Canada

School of Nursing, McMaster University, Hamilton, ON, Canada

A. Sarti, MD
Department of Critical Care, The Ottawa Hospital, Ottawa, ON, Canada

E. Arseneau, MSc
Department of Health Research Methods, Evidence, and Impact, McMaster University, Hamilton, ON, Canada

S. Dhanani, MD
Division of Critical Care, Children's Hospital of Eastern Ontario, Ottawa, ON, Canada

D. J. Cook, MD, MSc
Division of Critical Care, Department of Medicine, McMaster University, Hamilton, ON, Canada

standardized processes; iii) ICU staff beliefs; iv) integration of donation and high quality end-of-life care; v) feedback and staff support. In the mixed-methods analysis, we identified 22 actionable practices to enhance the process of organ donation in the ICU.

Conclusion Incorporating the perspectives of ICU staff, we were able to identify 22 practice changes that may have a significant cumulative impact on donation outcomes. Future research is required to evaluate whether these findings account for the variability of donation rates between otherwise comparable ICUs.

Résumé

Objectif Les taux de dons d'organes varient entre des unités de soins intensifs (USI) qui seraient autrement comparables, ce qui suggère que le processus de don doit varier entre les USI. Les objectifs de cette étude étaient de décrire le processus de don d'organes de la perspective du personnel de l'USI, d'identifier les éléments majeurs favorisant un don réussi, et de mettre au point des stratégies afin d'améliorer le processus de don.

Méthode Nous avons réalisé des entretiens qualitatifs avec 32 personnes travaillant dans des USI, y compris des médecins, des infirmières et des inhalothérapeutes, à l'aide d'un guide d'entrevues mis au point à partir d'études précédentes sur le don d'organes. À l'aide d'une approche descriptive qualitative, nous avons codé les entretiens en nous fondant sur une analyse qualitative du contenu. Nous avons intégré les résultats des entretiens dans une analyse de méthodes mixtes aux données publiées précédemment dans une analyse de documents et un sondage transversal afin d'identifier les pratiques qui pourraient améliorer le don d'organes à l'USI.

Résultats Cinq thèmes principaux et importants pour le processus de don d'organes sont ressortis des entretiens : i) la relation du personnel avec les coordonnateurs des dons d'organes; ii) les processus standardisés; iii) les convictions du personnel de l'USI; iv) l'intégration du don avec des soins de fin de vie de qualité élevée; et v) les rétroactions et le soutien du personnel de l'USI. Dans

l'analyse par méthodes mixtes, nous avons identifié 22 gestes concrets permettant d'améliorer le processus de don d'organes à l'USI.

Conclusion En incorporant les perspectives du personnel de l'USI, nous avons pu identifier 22 changements de pratique qui pourraient avoir un impact cumulé significatif sur les issues des dons. Des recherches futures sont nécessaires afin d'évaluer si ces observations expliquent la variabilité des taux de dons entre des USI autrement comparables.

Organ donation rates vary across comparable intensive care units (ICUs),¹ suggesting that donation processes differ between ICUs, despite the existence of clinical guidelines for donor care,^{2,3} and the coordination efforts of organ donation organizations (ODOs). Aiming to improve donation rates, many studies have examined donor family⁴⁻⁹ and ICU staff¹⁰⁻¹² experiences with donation decision-making. Comparatively fewer studies have examined the wider process of donor care in the ICU.¹³⁻¹⁵ While a high donation rate is the most obvious measure of success in donor care, even the best donor management may not result in organs suitable for transplant (e.g., a substitute decision-maker (SDM) decides organ donation is not consistent with the patient's wishes). Research into the process of care for organ donors therefore requires a "program approach" that considers donation as a series of inter-related steps, in which "success" consists of the best possible outcome for an individual case at each step.¹⁶ The objective of this study was to describe the process of organ donation in the ICU, identify important drivers of successful donation, and to identify actionable practices that improve organ donation in the ICU.

Methods

We used a sequential mixed-methods design including: i) a qualitative document analysis of hospital policies and protocols,¹⁵ ii) a quantitative cross-sectional survey of ICU staff about facilitators and barriers to organ donation,¹⁶ and iii) qualitative interviews to investigate results from the document analysis and survey. Detailed reports of the document analysis and survey are published elsewhere.^{17,18} The culmination of this work is a mixed-methods analysis integrating data from all three studies reported herein (Fig. 1).^{19,20} This study was approved by the Hamilton Integrated Research Ethics Board.

Setting

Hamilton General Hospital is a tertiary care, university-affiliated hospital in Canada with a 32-bed neuro-trauma ICU that sees a high volume of deceased organ donation (> 25

Department of Health Research Methods, Evidence, and Impact, McMaster University, Hamilton, ON, Canada

St Joseph's Healthcare Hamilton, Hamilton, ON, Canada

M. O. Meade, MD, MSc
Division of Critical Care, Department of Medicine, McMaster University, Hamilton, ON, Canada

Hamilton Health Sciences, Hamilton, ON, Canada

Department of Health Research Methods, Evidence, and Impact, McMaster University, Hamilton, ON, Canada

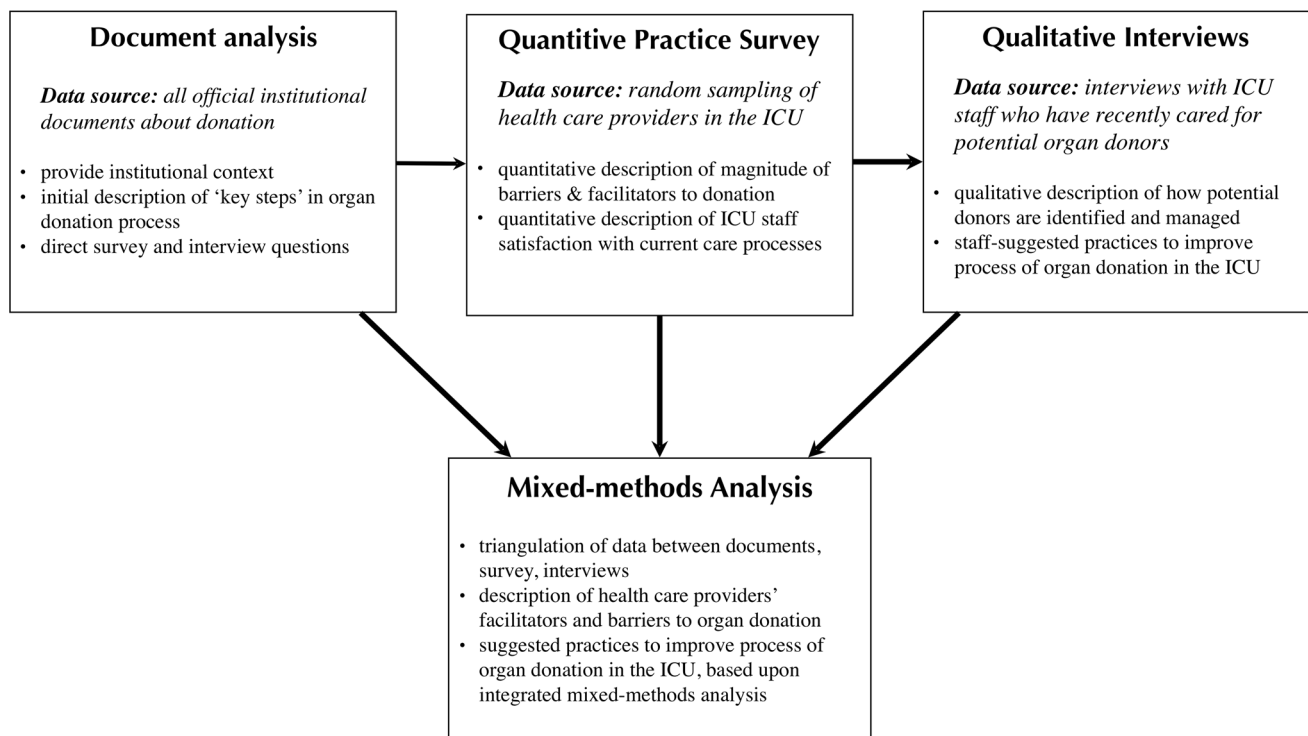


Fig. 1 Study design

completed donations/year). Patient care is provided by approx. 5 physicians (MDs), approx. 170 nurses (RNs), and approx. 50 respiratory therapists (RTs), and smaller numbers of allied health professionals. The regional ODO coordinates 24-hr on-call nurse specialists, generally stationed within the hospital, who solicit consent for organ donation and facilitate deceased donor care in partnership with ICU staff.

Qualitative interview data collection and analysis

Using purposive sampling over a 14 month period, we identified MDs, RNs, and RTs within one month of caring for a potential donor in the ICU. We classified “potential donors” as ICU patients for whom an SDM had been approached to consent for organ donation, either following cardiocirculatory death (DCD) or in a case of donation after brain death (DBD). Through email, a qualitative researcher invited eligible clinicians to participate. To maximize recall, we interviewed participants as soon as possible after they cared for the potential donor. We used a semi-structured interview guide to explore the facilitators and barriers to donation identified in the document analysis and survey^{17,18} (eTable 1, available as Electronic Supplementary Material [ESM]). Two investigators (E.A., S.O.) conducted 45 min one-on-one interviews in person or by phone, with audio recording. No follow-up was made with participants after the interviews. Interviews continued for each of the three groups until data saturation.²¹

De-identified transcripts were uploaded into NVivo for analysis.²² We used a qualitative descriptive methodology, coding each interview with conventional qualitative content analysis.²³⁻²⁵ Two investigators (S.O., E.A.) coded the first four interviews in duplicate and drafted an initial codebook, which was reviewed and revised with the complete investigative team. All subsequent interviews were coded by a single analyst according to the revised codebook. The two analysts met regularly to review newly coded interviews and to identify themes and relationships in the data.²⁵ All analyses were documented as an audit trail within NVivo.^{22,26}

Integrated mixed methods data analysis

After analyzing the qualitative interviews, we performed an integrative mixed-methods analysis, linking data from the document analysis, survey, and interviews. We used a joint display table, organized according to the interview themes, to contrast and compare findings across the studies.²⁷ We identified practices that improved organ donation in the ICU in three ways: firstly, from existing practices that survey and interview participants described as helpful; secondly, by direct suggestions from interview participants; and thirdly, by inferring solutions to problems identified in the three studies.

Table 1 Interview participant characteristics (*n* = 32)

Characteristic	Participants
Sex <i>n</i> (%)	Female 21 (68%), male 10 (32%), prefer not to say 1 (3%)
Age, mean (SD)	42 (9.1)
Role in ICU <i>n</i> (%)	Nurse 17 (53%), respiratory therapist 7 (22%), physician 8 (25%)
Years in ICU, mean (SD)	11.6 (7.8)
Estimated total number of organ donors cared for, mean (SD)	23 (20)
Weeks since most recent organ donation, mean (SD)	3.9 (3.7)
Most recent donor type DBD vs DCD vs both at same time <i>n</i> (%)	19 (59.4%) vs 11 (34.4%) vs 2 (6.3%)
Other role in organ donation	ODO coordinator (1); hospital donation lead (1); organ donation committee member (1); previously on donation committee (1)

In this table, we report the demographic characteristics of interview participants. DBD = donation after brain death; DCD = donation after cardiocirculatory death; ICU = intensive care unit; SD = standard deviation

Results

Qualitative interview results

We completed 32 interviews between February 2017 and March 2018 (Table 1). We invited 43 participants (of these, nine did not respond and two declined). Five major themes emerged from the interview data, each containing

four sub-themes (Fig. 2). Below, we present the themes and sub-themes with illustrative quotes.

Theme 1: Relationships between ICU staff and ODO coordinators

ICU unit staff described the availability of ODO coordinators as a facilitator in all steps of organ

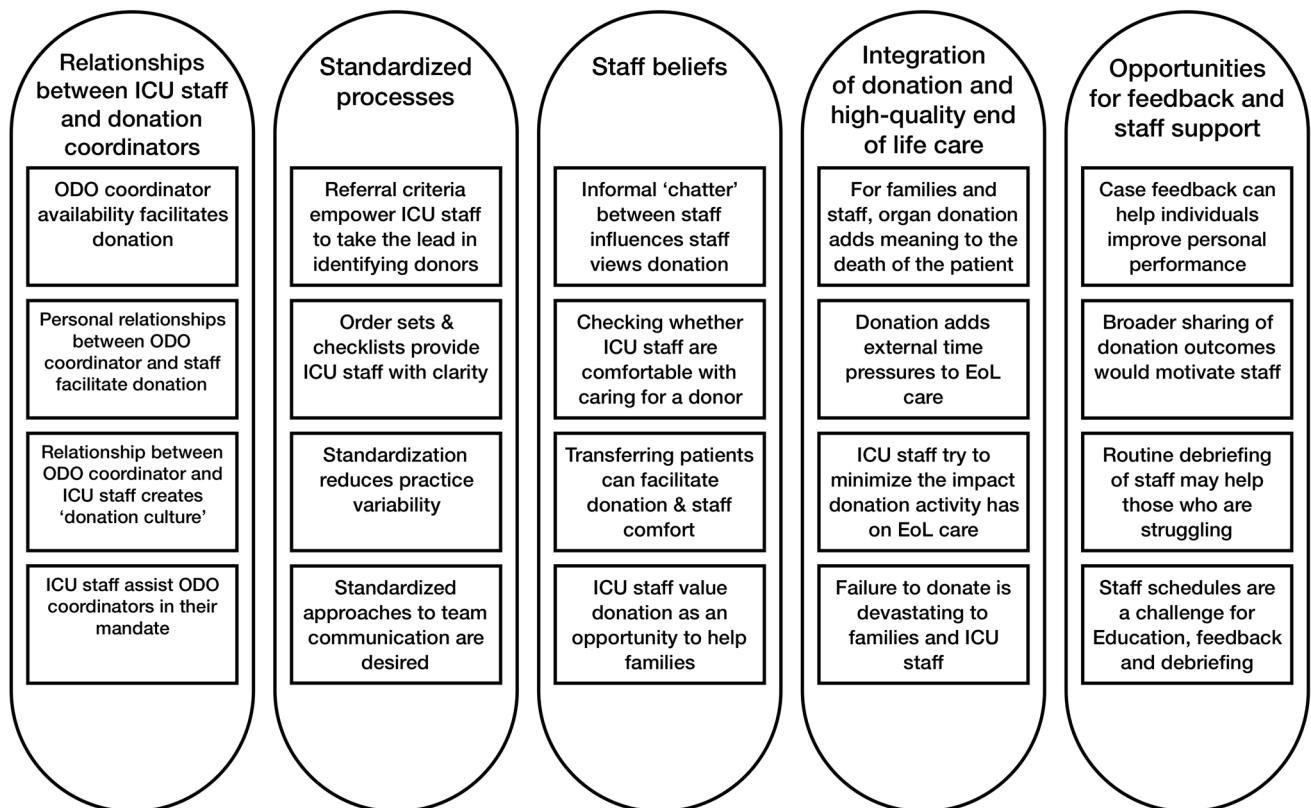


Fig. 2 Qualitative themes and sub-themes

Table 2 Joint display of subtheme 1: availability of ODO coordinators facilitates donor care

Survey item	% respondents rating “very” or “extremely” helpful	Qualitative interview examples
Availability of ODO coordinators in ICU during initial identification and referral of patients to ODO	81%	“I think it’s a team approach that people don’t think twice about referring to [the ODO] and it is just... everybody’s logical next step. I think we do it so well and so often that we don’t even think of it anymore.” (MD)
Availability of ODO coordinators in ICU to assist in medical management of potential organ donors	85%	“They’re the ones who organize all the tests... who let me know what blood work to send. They basically hold my hand through the process and tell me exactly what they need and when they need it done. So without them this process probably wouldn’t get done.” (RN)
Availability of ODO staff for discussions of organ donation	90%	“I don’t know that other hospitals necessarily have ‘in-house’ people but that definitely makes it easier... there’s no delay waiting for someone to come... the family is already is there and not waiting for too long.” (RN)
Availability of ODO coordinators in ICU to facilitate transition from ICU care to organ procurement	93%	The [ODO coordinator] comes with us to the location in the recovery room and then she follows the patient into the OR...So she’s giving the OR report and then she actually follows the patient into the OR and stays there while the organs are being [retrieved] (RN)

In this table, we report the mixed-methods analysis of subtheme 1, demonstrating how the availability of ODO staff facilitates donor care across a range of practices. ICU = intensive care unit; MD = medical doctor; ODO = organ donation organization; OR = operating room; RN = registered nurse

donation, This was a highly prominent sub-theme in many interviews (Table 2). Facilitation is enhanced when there is a personal relationship between ICU staff and the coordinator, allowing informal discussion of potential donors:

Some of the [ODO coordinators] are previous ICU nurses... So as soon as we see the signs we call because we know that one of our previous coworkers is going to answer the phone. (RN)

These personal relationships between ICU staff and ODO coordinators are identified as one of the drivers of a positive culture of donation:

I’ll have a coffee with [the ODO coordinator]. I think that helps the culture as opposed to it being a very sterile, formal process. (MD)

Organ donation organization coordinators also create a culture of donation through education sessions for ICU clinicians, highlighting the importance of donation in the hospital culture:

...as soon as a new group [of ICU staff] is coming through, the [ODO coordinators] talk to them, to get them on the ball. This is one of the expectations in the ICU. (RN)

Collaboration with the ODO coordinators is reciprocal. ICU staff describe assisting ODO coordinators to navigate family dynamics as one of their major responsibilities in donation:

I always take the discussion just as far as I need to understand where the family is at... So that I can prepare [the ODO coordinator] for their discussions and coach on an approach with their family. (MD)

Theme 2: Standardized processes

ICU staff describe the positive impact of standardization on almost every aspect of donor care. Standardized referral criteria empower staff to take the lead in identifying potential donors:

I make the call. I don’t wait for the family to tell me their loved one was a donor. (RN)

Procedural order sets and checklists are also described as beneficial, providing staff with clarity on current practices for donor management:

Things get checked off as [completed]...blood work, consent, the talk with the family, a debriefing with the physician and the [ODO] coordinator... It’s better because now you actually have an on-paper document to follow through. (RN)

Other effective standardized processes include worksheets for donor care; worksheets to document bronchoscopy findings; a life support withdrawal order set; and a process for re-intubating patients after DCD for lung recovery. Staff describe the need for a standardized communication “huddle” to ensure all team members are on the same page before approaching an SDM for discussions about donation:

[So] we have this huddle and we all discuss what we know about the family and the patient and make sure that we get all our facts together before we approach the family. (MD)

Theme 3: Staff beliefs

ICU staff describe informal “chatter” as a mechanism to work through contentious issues in donation. This allows individuals to acknowledge the existence of multiple viewpoints, and to determine their personal willingness to participate in specific donation-related activities. One strategy to support the diversity of staff beliefs is having charge nurses “check-in” to ensure individuals were comfortable with the treatment plans for donation, such as administering pre-mortem heparin in DCD:

It’s different for every nurse. Everyone comes at organ donation from a different moral standpoint, which is why.... there needs to be a sort of huddle prior to assigning the nurse a DCD patient. Are they comfortable with it? (RN)

While caring for donors is an expectation of staff in the ICU, informal arrangements are made to match staff assignments to donor types they are comfortable with—DBD, DCD, or both. Transferring care of patients is described as a way to maintain the comfort level of individual staff, while still providing care consistent with the patient’s wishes:

From a practical point of view, I actually have an ethical objection to [giving heparin in DCD]. So, based on that, I don’t get involved with the mechanics of DCD when the time comes and I would transfer the patient to one of my colleagues.... I’m very supportive of DCD and I think you have to choose a patient rightly. (MD)

While ICU staff are satisfied in knowing that donation will benefit organ recipients, their primary motivation in offering donation is that it can help families:

Organ donation is important to me because I see it as helping families deal with the tragedy of an incredible loss... the family was extremely

appreciative and involved. And that reinforced my motivation to support organ donation. (MD)

Theme 4: Integration of donation and high quality end-of-life care

The donation process can positively impact the end of life experience for families. ICU staff described it as beneficial because it adds meaning or purpose to the death of a loved one; that their death could have a positive impact on someone’s life:

I think it helped [the family] with their grief, because they knew their mother’s death was not in vain... she said “If we can save one life or help one person, my mom would not have died in vain.” She specifically said that to me. So when I heard we got three [organs] I was so happy because I knew the kids would feel better. In dealing with their grief, this would help them. (RN)

Donation procedures add external time pressures to end-of-life care, increasing stress for families and staff at several time points in the donation process: assessing the patient for suitability of donation, including cardiac angiography and bronchoscopy (DBD, DCD); waiting until the operating room is ready before withdrawal of life support (DCD); time from withdrawal of life support to cardiocirculatory death; and shortened time for families to be with the donor after the declaration of death (DCD):

...the heart stops and the family has no time to say goodbye.. you get those two minutes to say goodbye and the body is rushed out and taken to the OR... (RN)

The ICU staff report most deviations from “usual” end of life care in negative terms. For instance, in DCD, withdrawal of life support is often done in the postoperative recovery room rather than ICU, a situation described by one nurse as “awful”. Staff identified strategies to minimize the negative impacts of donation activity upon end of life care, such as having consistent ICU staffing and a private room for families to use.

While staff viewed organ donation as contributing to quality end of life care, many described the eventual inability to donate, especially in the context of DCD, as devastating:

...if you [miss] that two hour window... not only did the patient die, but their organs weren’t allowed to be donated as well, and that’s a double negative for the families and difficult for them to swallow. (MD)

Theme 5: Feedback and staff support

While the ODO provides feedback on unit-level indicators, such as the routine notification rate, staff identified individual performance feedback as an opportunity to enhance donor care:

Right now, I can't be told that I'm doing something incorrect. So it's very, very difficult to modify behaviour unless I know exactly what the behaviour is... (MD)

Intensive care unit staff identified feedback on the outcomes of donation as motivation for continued engagement in organ donation:

...we get personal letters back from [the ODO] letting us know that we were involved in a specific case and this resulted in x, y, and z... if you're having a bad day, you just pull up the [donation] files and look at all you've done to help. (MD)

While MDs often received letters, other ICU staff (RNs and RTs) had to actively seek information on the outcomes of the organ donors they had cared for.

Participants noted the emotional impact of caring for organ donors, and the need for a planned debriefing or other support post-donation:

I think it would be a good idea to provide some kind of support or counselling to staff members... if you're a more timid person, it might be better if the support was just provided without you actually having to come forward and ask for it. (RT)

ICU staff noted that support and debriefing are difficult given the nature of shift work. Several staff members suggested that sessions targeted at night-shift staff would be valuable.

Integrated mixed-methods results

Table 3 summarizes the results of the mixed-methods analysis in the form of 22 suggested practices to improve donation, arranged according to the interview themes. The joint display table of mixed-methods analysis is in ESM eTable 2.

Discussion

In this sequential, multiphase, mixed-methods study, we used multiple data sources to describe the process of organ donation in an academic tertiary-care ICU. Important insights from this study include: i) identification of 22 actionable practices to improve the practice of donation; ii)

recognition that ICU staff are highly concerned about the impact of donation upon families; and iii) ICU staff desire opportunities to improve team communication and receive feedback and support after caring for potential donors.

Suggested practices align with those reported elsewhere

The five key steps in organ donation in the ICU that were identified in the document analysis are consistent with those of other organizations, supporting the generalizability of our study findings.^{16,28,29} Similarly, several of the 22 practices we identified have been suggested elsewhere, indicating that they may be widely applicable,²⁸⁻³¹ while others are unique to our study. Results of this study parallel some of the best practices from the US Organ Donation Breakthrough Collaborative (integrating ODO staff, early referral to the ODO, ongoing staff education), which have been associated with measurable increases in organ procurement.^{29,30} This supports our hypothesis that small practice changes can have a significant cumulative impact on donation outcomes.

Intensive care unit staff are highly concerned about the impact of donation upon families and end of life care

Study participants identified DCD as more challenging than DBD, partly because they perceive families to be distressed when donation does not occur. This perception is consistent with results from interviews with donor families.^{32,33} Participants in the present study considered care of the patient and family an overriding priority and only saw donation as a positive outcome if it was consistent with patient values and preferences. This is a novel observation, but has been hinted at in existing research.³⁴ The current study supports the use of shared decision-making with ICU staff and families when considering donation,⁹⁻¹² and suggests that efforts to motivate and engage ICU staff in donation may be more effective if framed in terms of how it benefits families. Conversely, policies and practices that increase donation activity but negatively impact families (e.g., withdrawal of life support in the operating room to shorten ischemic time) are unlikely to receive support from ICU staff.

Opportunities to improve communication and feedback exist

ICU staff made suggestions to standardize communication with the donation team in a pre-meeting "huddle," consistent with findings from other studies.¹⁵ In the interviews, they noted a need for individual and unit-level feedback to improve practice and motivate ICU staff

Table 3 Results of mixed-methods analysis: 22 suggested practices for improving the organ donation process in the intensive care unit

Qualitative theme	Suggested practices
Theme 1: Relationships between ICU staff and ODO coordinators	<p>In-house ODO coordinators, or other local donation champions, may facilitate organ donation process</p> <p>Recruiting ODO coordinators from pool of local ICU clinicians may encourage personal relationships</p> <p>Ensure new staff are aware that ICU is “donation friendly” and they will be caring for deceased donors</p> <p>Clear policies describing donation-related responsibilities of ODO staff vs. ICU staff</p>
Theme 2: Standardized processes	<p>Develop and promote standardized ODO referral criteria, which can be activated by any ICU staff; educate that a referral to the ODO does not imply a change in management</p> <p>Checklist of tests and treatments required for donation based upon organs being considered for donation to facilitate continuity of care between staff during the organ donation process</p> <p>Standard approach to deciding approach to donation discussions, including huddle with MD, RN, RT, and ODO coordinator</p>
Theme 3: Staff beliefs	<p>Implement “debrief” sessions to provide staff with an outlet to discuss and learn about donation</p> <p>Ensure new staff are aware that ICU is “donation-friendly” and that they will be expected to provide care for donors; provide “debrief” sessions to enhance staff comfort</p> <p>Make a concerted effort to match ICU staff assignment to their comfort level with organ donation; otherwise consider a policy of letting staff change assignment so patients can receive the best care</p> <p>Frame burdensome donation activities as a way to honour patients’ wishes and to help families grieve. This may motivate ICU staff to be engaged in donation</p>
Theme 4: Integration of donation and high-quality end-of-life care	<p>Promote early referral as a mechanism to allow as many patients and families to have an opportunity for organ and/or tissue donation</p> <p>Clear expectation of donation roles of staff outside of ICU, including anesthesia (to assist with re-intubation in DCD, if necessary), cardiology (for echocardiograms, angiography), and radiology (ultrasounds) to avoid delays in care</p> <p>Private space for families to gather together, outside of ICU environment</p> <p>Withdrawal of life support for DBD in ICU when possible, or otherwise in a family friendly area (space to gather around the patient; quiet; clean and attractive; space to step out when ETT is removed)</p> <p>Recognize that families and staff involved in a case of unsuccessful donation may also need debrief and support</p>
Theme 5: Opportunities for feedback and staff support*	<p>Routine debrief with individual staff about their feelings and performance about specific donation cases</p> <p>Broad sharing of ICU unit statistics/performance with organ donation (e.g., tracker board)</p> <p>Broad sharing of donation/transplantation outcomes of organ donors for all ICU staff</p> <p>Routine feedback to ICU team about clinical aspects of donation cases to identify areas for improvement</p> <p>Larger, regular meetings with ICU staff to discuss and make suggestions on how to improve organ donation process</p> <p>Meetings, debriefings, and education should also be available to ICU staff who work evenings and weekends</p>

*These suggested practices are derived from the qualitative interviews only, without supporting evidence from the mixed-methods analysis
 DBD = donation after brain death; DCD = donation after cardiac death; ETT = endotracheal tube; ICU = intensive care unit; MD = medical doctor; ODO = organ donation organization; RN = registered nurse; RT = respiratory therapist

to participate in donation. This novel finding was limited to information given during interviews; there are no documents or survey items related to performance feedback. Though less robust than other themes that were supported by triangulation, this theme identifies a novel opportunity to improve donation practice by providing staff with feedback and support. Such practices should be

implemented cautiously, as feedback in team settings is not always associated with improved performance.³⁵

Strengths and limitations

Strengths of this qualitative study included its setting in a high volume donation center, whereby the ICU staff’s

experience contributes to the richness of the data. Our recruitment of ICU staff with recent experience caring for potential donors provided detailed illustrations of participants' viewpoints. We used multiple forms of triangulation to enhance the trustworthiness of study results¹⁹⁻²¹ (available as ESM eTable 3). Data triangulation was achieved by purposive sampling of ICU staff from multiple specialties across a variety of cases. Investigator triangulation was achieved by including physicians, nurses, and non-ICU personnel on the investigative team, and having two investigators interview and code in parallel: a male ICU clinician who has worked in this ICU (S.O.) and a female non-clinical, qualitative researcher (E.A.). We used methodologic triangulation, comparing results across qualitative and quantitative research methodologies. Lastly, we followed the Consolidated Criteria for Reporting Qualitative Research

(COREQ) guidelines for qualitative research to ensure transparency and completeness of reporting^{36,37} (available as ESM eTable 4).

This study is limited by its single-centre approach, which may reduce the generalizability of results, particularly to centres where potential donors are rare or to centres with contrasting laws and policies for deceased donation (e.g., "opt-out" consent). Nevertheless, these findings are consistent with other findings, which supports the transferability of these results. Through detailed descriptions included in the document analysis, survey, and interviews, readers can infer the applicability of the study findings and suggested practices to their local context.

Conclusions

Incorporating the perspectives of ICU staff, we were able to identify 22 practice changes to improve the process of organ donation in the ICU. Future research is required to evaluate whether these findings are transferrable across a wider range of ICU settings, and the extent to which they account for the variability of donation rates between otherwise comparable ICUs.

Competing interests None declared.

Editorial responsibility This submission was handled by Dr. Sangeeta Mehta, Associate Editor, *Canadian Journal of Anesthesia*.

Author contributions *Simon Oczkowski* contributed to all aspects of this manuscript, including study conception and design, acquisition, analysis and interpretation of data, and drafting the article. *John Centofanti*, *Pamela Durepos*, *Ericka Arseneau*, *Sonny Dhanani*, *Deborah J. Cook*, and *Maureen O. Meade* contributed to study conception and design, data analysis, data interpretation,

and drafting the article. *Emmy Arnold* and *Aimee Sarti* contributed to the acquisition, analysis and interpretation of data, and drafting the article.

Financial support This work was supported by Hamilton Health Sciences' Research Strategic Initiatives. Dr. Oczkowski is supported by a Canadian Critical Care Trials Group Research Fellowship Award and a career award from the McMaster Department of Internal Medicine. Dr. Cook is a Research Chair of the Canadian Institutes of Health Research.

References

1. *Trillium Gift of Life Network*. Conversion Rate for Deceased Organ Donation. Available from URL: <https://www.giftoflife.on.ca/en/publicreporting.htm#donors-cal> (accessed January 2019).
2. *Shemie SD, Ross H, Pagliarello J, et al.; Pediatric Recommendations Group*. Organ donor management in Canada: recommendations of the forum on Medical Management to Optimize Donor Organ Potential. *CMAJ* 2006; 174: S13-32.
3. *Shemie SD, Baker AJ, Knoll G, et al*. National recommendations for donation after cardiocirculatory death in Canada: donation after cardiocirculatory death in Canada. *CMAJ* 2006; 175: S1.
4. *Simpkin AL, Robertson LC, Barber VS, Young JD*. Modifiable factors influencing relatives' decision to offer organ donation: systematic review. *BMJ* 2009; 338: b991.
5. *Ralph A, Chapman JR, Gillis J, et al*. Family perspectives on deceased organ donation: thematic synthesis of qualitative studies. *Am J Transplant* 2014; 14: 923-35.
6. *Berntzen H, Bjørk IT*. Experiences of donor families after consenting to organ donation: a qualitative study. *Intensive Crit Care Nurs* 2014; 30: 266-74.
7. *de Groot J, van Hoek M, Hoedemaekers C, et al*. Decision making on organ donation: the dilemmas of relatives of potential brain dead donors. *BMC Med Ethics* 2015; 16: 64.
8. *de Groot J, van Hoek M, Hoedemaekers C, et al*. Request for organ donation without donor registration: a qualitative study of the perspectives of bereaved relatives. *BMC Med Ethics* 2016; 17: 38.
9. *Sque M, Walker W, Long-Sutehall T, Morgan M, Randhawa G, Rodney A*. Bereaved donor families' experiences of organ and tissue donation, and perceived influences on their decision making. *J Crit Care* 2018; 45: 82-9.
10. *de Groot J, Vernooij-Dassen M, de Vries A, et al*. Intensive care staff, the donation request and relatives' satisfaction with the decision: a focus group study. *BMC Anesthesiol* 2014; 14: 52.
11. *Sanner MA*. Two perspectives on organ donation: experiences of potential donor families and intensive care physicians of the same event. *J Crit Care* 2007; 22: 296-304.
12. *Thomas SL, Milnes S, Komesaroff PA*. Understanding organ donation in the collaborative era: a qualitative study of staff and family experiences. *Intern Med J* 2009; 39: 588-94.
13. *Moraes EL, Neves FF, Santos MJ, Merighi MA, Massarollo MC*. Experiences and expectations of nurses in caring for organ donors and their families. *Rev Esc Enferm USP* 2015; 49: 129-35.
14. *Keshkaran Z, Sharif F, Navab E, Gholamzadeh S*. Lived experiences of Iranian nurses caring for brain death organ donor patients: caring as "Halo of Ambiguity and Doubt". *Glob J Health Sci* 2015; 8: 281-92.

15. *Etheredge HR, Penn C, Watermeyer J.* Interprofessional communication in organ transplantation in Gauteng Province. South Africa. *S Afr Med J* 2017; 107: 615-20.
16. *Manzano A, Pawson R.* Evaluating deceased organ donation: a programme theory approach. *J Health Organ Manag* 2014; 28: 366-85.
17. *Oczkowski SJ, Centofanti JE, Durepos P, et al.* Organ donation in the ICU: a document analysis of institutional policies, protocols, and order sets. *Intensive Crit Care Nurs* 2018; 45: 58-65.
18. *Oczkowski SJ, Centofanti JE, Durepos P, et al.* Facilitators and barriers to successful organ donation in the intensive care unit: a multidisciplinary survey. *Prog Transplant* 2018, in press
19. *Creswell JW, Plano Clark VL.* *Designing and Conducting Mixed Methods Research.* Toronto, ON: Sage Publications; 2017 .
20. *Bryman A.* *Mixed Methods.* Toronto, ON: Sage Publications; 2006 .
21. *Brod M, Tesler LE, Christensen TL.* Qualitative research and content validity: developing best practices based on science and experience. *Qual Life Res* 2009; 18: 1263-78.
22. *NVivo Qualitative Data Analysis Software.* QSR International Pty Ltd. Version 11.1, 2015.
23. *Sandelowski M.* Focus on research methods-what happened to qualitative description? *Res Nurs Health* 2000; 23: 334-40.
24. *Sandelowski M.* What's in a name? Qualitative description revisited. *Res Nurs Health* 2010; 33: 77-84.
25. *Hsieh HF, Shannon SE.* Three approaches to qualitative content analysis. *Qual Health Res* 2005; 15: 1277-88.
26. *Rodgers BL, Cowles KV.* The qualitative research audit trail: a complex collection of documentation. *Res Nurs Health* 1993; 16: 219-26.
27. *Tashakkori A, Teddlie C.* Quality of inferences in mixed methods research: calling for an integrative framework. In: Bergman MM, editor. *Advances in Mixed Methods Research.* Toronto, ON: Sage Publications; 2008. p. 101-19.
28. *Wojda TR, Stawicki SP, Yandle KP, et al.* Keys to successful organ procurement: an experience-based review of clinical practices at a high-performing health-care organization. *Int J Crit Illn Inj Sci* 2017; 7: 91-100.
29. *Shafer TJ, Wagner D, Chessare J, Zampello FA, McBride V, Perdue J.* Organ donation breakthrough collaborative: increasing organ donation through system redesign. *Crit Care Nurse* 2006; 26(33-42): 44-8.
30. *Shafer TJ, Wagner D, Chessare J, et al.* US organ donation breakthrough collaborative increases organ donation. *Crit Care Nurs Q* 2008; 31: 190-210.
31. *Dominguez-Gil B, Murphy P, Procaccio F.* Ten changes that could improve organ donation in the intensive care unit. *Intensive Care Med* 2016; 2016(42): 264-7.
32. *Taylor LJ, Buffington A, Scalea JR, et al.* Harms of unsuccessful donation after circulatory death: an exploratory study. *Am J Transplant* 2018; 18: 402-9.
33. *Fernandes ME, Bittencourt ZZ, Boin Ide F.* Experiencing organ donation: feelings of relatives after consent. *Rev Lat Am Enfermagem* 2015; 23: 895-901.
34. *Macvean E, Yuen EY, Tooley G, et al.* Attitudes of intensive care and emergency physicians in Australia with regard to the organ donation process: a qualitative analysis. *J Health Psychol* 2018; DOI: <https://doi.org/10.1177/1359105318765619>.
35. *Hughes AM, Gregory ME, Joseph DL, et al.* Saving lives: a meta-analysis of team training in healthcare. *J Appl Psychol* 2016; 101: 1266-304.
36. *Lincoln YS, Guba EG.* *Naturalistic Inquiry.* Toronto: SAGE Publications; 1985 .
37. *Tong A, Sainsbury P, Craig J.* Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care* 2007; 19: 349-57.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.