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Sequence and timing of organ donation discussions in brain-dead donors: a subanalysis of the J-RESPECT study

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Abstract

Background The optimal timing of organ donation discussions in patients with catastrophic brain injury remains unclear. In Japan, national guidance recommends providing information after recognition of a state compatible with brain death; however, real-world practice has not been well characterized. This study aimed to evaluate the sequence of organ donation option presentation relative to clinical determination of a brain death-compatible state and to assess option presentation timing.

Methods We conducted a multicenter retrospective cohort study using data from the J-RESPECT study, including adult brain-dead donors from 16 institutions in Japan between 2010 and 2023. Donors were classified as brain death-first (option presented after clinical determination of a brain death-compatible state) or option-first (option presented before such determination). Mixed-effects logistic and linear regression models with random intercepts for institution were used to examine factors associated with presentation sequence and timing.

Results Among 190 donors, 76 (40%) were classified as brain death-first and 114 (60%) as option-first. In mixed-effects logistic regression, age was the only independent factor associated with presentation sequence (adjusted OR 1.03 per year, 95% CI 1.00–1.07), while substantial between-institution variability was observed (intraclass correlation coefficient = 0.32). Institutional timing policy was not significantly associated with presentation sequence. The median interval from admission to option presentation was 5 days in the brain death-first group and 2 days in the option-first group ($p < 0.001$).

Conclusions Substantial inter-institutional variability exists in the sequence and timing of organ donation discussions in Japan. Further studies are needed to determine optimal approaches to organ donation communication and timing in clinical practice.

Keywords Brain death, Communication, Decision-making, End-of-life care, Intensive care, Organ donation

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Background

Organ donation remains a critical yet challenging component of contemporary critical care medicine. Despite advances in transplantation, the demand for donor organs continues to far exceed supply, resulting in potentially avoidable mortality worldwide [1]. Improving organ donation practices requires careful consideration of ethical, legal, and clinical factors, particularly in the context of end-of-life care [2, 3].

In patients with catastrophic brain injury who may progress to a state compatible with brain death, organ donation can be considered one of the options within end-of-life care [4]. However, initiating discussions about organ donation with families is inherently difficult. The timing of information provision must balance medical indications and disease progression with families' understanding, emotional readiness, and acceptance of the patient's prognosis [5, 6]. Inappropriate timing may lead to misunderstanding, distress, or missed opportunities for informed decision-making [7]. Importantly, organ donation should only be considered after appropriate life-saving treatment has been fully pursued.

Organ donation processes and practices are influenced by country-specific legal and institutional frameworks [1]. In Japan, organ donation after brain death follows an opt-in system, and national guidance recommends that discussions occur after recognition of a brain death-compatible state [8]. Although the rate of deceased organ donation in Japan has shown a modest increase in recent years, it remains markedly lower than in many other countries, with 1.13 deceased donors per million population reported in 2024 [9]. Several factors have been proposed to explain this discrepancy. Although family-centered decision-making and concerns regarding end-of-life discussions may contribute to clinicians' hesitancy, recent reports indicate that healthcare system failures—such as physician workload, limited coordinator support, and legal constraints—play a central role [10, 11]. As a result, discussions regarding organ donation may be delayed or not offered at all, contributing to substantial institutional variability, with many authorized hospitals having limited experience in legal brain death determination or systematic confirmation of donation intentions [12]. Because national guidance explicitly addresses the sequence and timing of organ donation discussions in relation to brain death-compatible states, understanding how these recommendations are implemented in practice is particularly important in Japan.

Although previous studies have examined organ donation discussions and family decision-making [5–7], the sequence and timing of these discussions in Japan remain insufficiently characterized despite existing national frameworks. Understanding the sequence and timing of

these discussions may be particularly relevant in Japan, where the interval from hospital admission to organ procurement is often prolonged, potentially reflecting the complexity of end-of-life decision-making and family-centered communication [13]. In particular, the timing of information provision relative to key clinical milestones—such as the recognition of a state potentially compatible with brain death—has not been systematically examined in real-world intensive care settings.

Given the limited empirical data on bedside practice, this study aimed to clarify the sequence and timing of organ donation information provision after brain death in Japan and to identify factors associated with its sequence relative to clinical judgment.

Methods

Study design, participants, and ethics

We conducted a subanalysis within the Japan Comprehensive Process for End-of-Life Care and Organ Donation after Brain Death (J-RESPECT) study, a multicenter retrospective cohort designed to capture hospital-level practices, donor management, and procedural workflows associated with organ donation after brain death in Japan [13]. The J-RESPECT study accounted for 21.8% of all brain-dead organ donations nationwide in Japan, encompassing 204 of the 934 cases recorded between July 17, 2010, and December 31, 2023. The present study included all patients aged 18 years or older from whom at least one organ was procured following brain death at any participating center between July 17, 2010, and December 31, 2023. The study protocol was approved by the Ethics Committee of Okayama University Hospital (Approval Number: K2604-030). Given the retrospective nature of the study, the requirement for written informed consent from patients' families or legal representatives was waived by the ethics committee.

Organ donation process after brain death in Japan

Details of the organ donation process after brain death in Japan have been described elsewhere [8, 14]. In the Japanese clinical setting, organ donation after brain death may be considered in patients with devastating brain injury who are identified as potential donors. According to national regulations, once clinicians determine that a patient has reached a state potentially compatible with brain death, organ donation may be discussed as part of end-of-life care, and relevant information is provided to the family [8].

If the family consents to organ donation, brain death is legally determined through two independent examinations performed by qualified physicians at intervals of at least six hours (24 h are required in children younger than six years). These examinations comprise

standardized neurological assessments, including evaluation of brainstem reflexes, an apnea test, and electroencephalography, which is required under Japanese regulations.

Data collection

In addition to donor demographic characteristics, we collected data on the primary cause or condition leading to brain death, including the presence or absence of cardiac arrest. We also collected family-related variables, including the primary family decision-maker, the presence of prior organ donation preferences, and communication-related indicators. To characterize the clinical timeline, we recorded the intervals from hospital admission to clinical determination of a state consistent with brain death, from admission to organ donation option presentation, and from admission to organ procurement. We also documented whether information regarding organ donation was provided before or after clinical recognition of a brain death-compatible state. These data were retrospectively collected from detailed medical records and institutional databases at each participating center. Presentation sequence classification (brain death-first vs. option-first) was determined based on the documented chronological order of clinical events and communication records. In cases where both events occurred on the same calendar day, sequence classification was based on the documented order in the medical record.

Facility-level characteristics included ICU type (closed, semi-closed, or open), institutional policies regarding the timing of organ donation information provision (after recognition of a brain death-compatible state, as soon as possible, or no specific policy), and physician continuity in organ donation option presentation (categorized as mostly fixed or less fixed). These facility-level characteristics were obtained through a survey conducted as part of the J-RESPECT study and reflected institutional practices and policies as of 2023 rather than those in place at the time of each donor case.

Outcomes and grouping

The primary outcome was the sequence of organ donation option presentation relative to the clinical determination of a brain death-compatible state. Donors were classified as 'brain death-first' if clinical determination of a brain death-compatible state preceded option presentation, and as 'option-first' if option presentation occurred before such determination. As a secondary outcome, we evaluated the timing of organ donation option

presentation, defined as the interval from hospital admission to option presentation.

Statistical analysis

Continuous variables were summarized as medians with interquartile ranges (IQRs), and categorical variables as counts and percentages. Group comparisons between brain death-first and option-first donors were performed using the Mann–Whitney U test for continuous variables and the chi-square test for categorical variables. Differences in relative timing across institutions were assessed using the Kruskal–Wallis test.

To examine factors associated with presentation sequence (brain death-first vs option-first), which was the primary outcome, mixed-effects logistic regression models with a random intercept for institution were fitted. Models were adjusted for age, sex, primary diagnosis, ICU type, institutional timing policy, and physician continuity. Covariates were not formally pre-specified because this study was conducted as a retrospective subanalysis of the J-RESPECT study. Variables were selected from those available in the dataset based on their clinical relevance and potential association with organ donation discussions and institutional practice patterns. Family donation offers before organ donation option presentation and documented patient willingness for organ donation were not included in the adjusted models because the temporal sequence between these factors and option presentation could not be established from the available data. Adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were reported. As a secondary analysis, mixed-effects linear regression models with a random intercept for institution were used to evaluate factors associated with the interval from admission to organ donation option presentation, adjusting for the same covariates. All donors were included in this analysis, regardless of presentation sequence. The interval from admission to deep coma was additionally included in the timing model as a clinically relevant temporal factor closely related to option presentation timing. Because time intervals were right-skewed, the dependent variable was log-transformed ($\ln[\text{days} + 1]$), and β coefficients with 95% CIs were reported. Likelihood-ratio tests were used to compare mixed-effects models with corresponding single-level models, and intraclass correlation coefficients (ICCs) were calculated to quantify between-institution variability. As a sensitivity analysis, models were repeated after exclusion of the highest-volume institution.

Statistical significance was defined as a two-sided P value < 0.05 . All analyses were performed using Stata/SE version 19.5 (StataCorp, College Station, TX, USA).

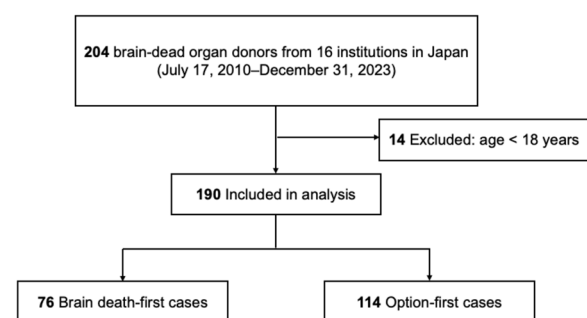


Fig. 1 Study flow diagram

Results

Between July 17, 2010, and December 31, 2023, a total of 204 brain-dead donors were identified across 16 institutions. After excluding 14 patients younger than 18 years, 190 donors were included in the analysis. Of these, 76

donors were classified into the brain death-first group, and 114 into the option-first group (Fig. 1).

Baseline characteristics are summarized in Table 1. Donors in the brain death-first group were younger than those in the option-first group (median age, 46 vs. 50 years; $p=0.021$), whereas other baseline characteristics were generally comparable between the groups.

Timing of organ donation option presentation

The distributions of time from admission to brain death-compatible state and to organ donation option presentation are shown in Fig. 2. The median time from admission to brain death-compatible state was 4 days (IQR, 2–6), and to option presentation was 3 days (IQR, 1–5).

Clinical timelines are shown in Table 2. No significant differences were observed in the intervals from admission

Table 1 Baseline characteristics of brain-dead organ donors according to the sequence of option presentation

Variables	Overall <i>n</i> = 190	Brain death-first <i>n</i> = 76	Option-first <i>n</i> = 114	<i>p</i> value
Age, median (IQR), years	48 (40, 57)	46 (39, 54)	50 (41, 59)	0.021
Female sex, <i>n</i> (%)	80 (42.1)	31 (40.8)	49 (43.0)	0.88
Body mass index, median (IQR)	23.2 (20.8, 26.1)	22.9 (20.3, 25.5)	23.4 (21.2, 26.9)	0.18
Past medical history, <i>n</i> (%)				
Hypertension	21 (11.1)	10 (13.2)	11 (9.6)	0.49
Diabetes	5 (2.6)	2 (2.6)	3 (2.6)	> 0.99
Any psychiatric disease	38 (20.0)	16 (21.1)	22 (19.3)	0.85
Primary disease or injury, <i>n</i> (%)				
Stroke including subarachnoid hemorrhage	91 (47.9)	34 (44.7)	57 (50.0)	0.75
Traumatic brain injury	39 (20.5)	16 (21.1)	23 (20.2)	
Others	60 (31.6)	26 (34.2)	34 (29.8)	
Out-of-hospital cardiac arrest, <i>n</i> (%)	94 (49.5)	37 (48.7)	57 (50.0)	0.88
Glasgow Coma Scale score on admission, median (IQR)	3 (3, 4)	3 (3, 4)	3 (3, 4)	0.97
Right pupil diameter on admission, median (IQR), mm	5 (3, 6)	5 (3, 6)	5 (3, 6)	0.11
Left pupil diameter on admission, median (IQR), mm	5 (3, 6)	5 (3, 6)	4 (3, 6)	0.10
Right pupillary reflex: absent on admission, <i>n</i> (%)	137 (72.1)	53 (69.7)	84 (73.7)	0.62
Left pupillary reflex: absent on admission, <i>n</i> (%)	136 (71.6)	53 (69.7)	83 (73.7)	0.74
SOFA score on admission, median (IQR)	8 (6, 10)	8 (6, 10)	8 (6, 11)	0.78
Primary family decision-maker, <i>n</i> (%)				
Spouse	88 (46.3)	37 (48.7)	51 (44.7)	0.42
Father	32 (16.8)	9 (11.8)	23 (20.2)	
Mother	28 (14.7)	15 (19.7)	13 (11.4)	
Child	12 (6.3)	4 (5.3)	8 (7.0)	
Sibling	28 (14.7)	10 (13.2)	18 (15.8)	
Other	2 (1.1)	1 (1.3)	1 (0.9)	
Family donation offer before organ donation option presentation, <i>n</i> (%)	41 (21.6)	14 (18.4)	27 (23.7)	0.47
Presence of patient documentation of organ donation willingness, <i>n</i> (%)	36 (18.9)	11 (15.9)	25 (23.8)	0.26
Number of multidisciplinary team meetings, median (IQR)	0 (0, 2)	1 (0, 2)	0 (0, 2)	0.61
Number of informed consent discussions, median (IQR)	5 (4, 7)	5 (4, 7)	5 (4, 7)	0.52

Missing data were present for Glasgow Coma Scale score, pupillary diameter, pupillary reflex, and SOFA score on admission in one patient in the option-first group, and for documentation of organ donation willingness in 14 patients (brain death-first, $n=5$; option-first, $n=9$). Percentages were calculated based on available data

IQR interquartile range, SOFA Sequential Organ Failure Assessment

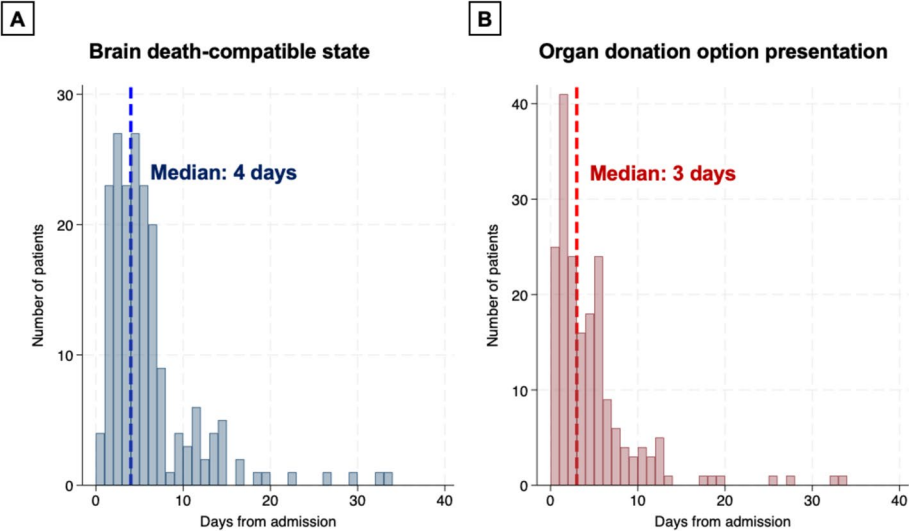


Fig. 2 Distribution of time from admission to brain death-compatible state and organ donation option presentation. Histograms showing the distribution of time intervals (in days) from hospital admission to **A** determination of a brain death-compatible state and **B** organ donation option presentation among 190 donors. Dashed vertical lines indicate the median values: 4 days (IQR, 2–6) for brain death-compatible state and 3 days (IQR, 1–5) for option presentation. *IQR* interquartile range.

to mydriasis, deep coma, or determination of a brain death-compatible state. In contrast, the intervals from admission to organ donation option presentation (5 vs. 2 days; $p<0.001$) and from admission to organ procurement (11 vs. 9 days; $p=0.018$) were significantly longer in the brain death-first group than in the option-first group.

Institutional variation in presentation sequence and timing
Institutional characteristics are summarized in Table 3. Substantial heterogeneity in the sequence of organ donation option presentation was observed across centers. Institutional timing policy was not associated

with presentation sequence, with similar proportions of brain death-first cases across policy categories (after brain death-compatible judgment: 40/98 [41%]; as soon as possible: 14/27 [52%]; no specific policy: 22/65 [34%], $p=0.27$). In contrast, physician continuity in option presentation was associated with presentation sequence in unadjusted analyses, with option-first presentation more frequent in less fixed settings (86/127 [68%] vs. 28/63 [44%], $p=0.002$).
The relative timing between brain death-compatible determination and option presentation across institutions is illustrated in Fig. 3. Substantial inter-institutional

Table 2 Clinical timeline from admission according to the sequence of option presentation

Clinical timeline from admission, median (IQR), days	Overall <i>n</i> = 190	Brain death-first <i>n</i> = 76	Option-first <i>n</i> = 114	<i>p</i> value
Mydriasis	0 (0, 1)	0 (0, 1)	0 (0, 2)	0.11
Deep coma	1 (0, 3)	1 (0, 2)	1 (0, 3)	0.99
Family notification of potential brain death	1 (0, 3)	1 (0, 3)	1 (0, 3)	0.85
Clinical determination of a brain death-compatible state	4 (2, 6)	4 (2, 5)	5 (2, 7)	0.092
Organ donation option presentation	3 (1, 5)	5 (2, 6)	2 (1, 4)	<0.001
Notification to the Japan Organ Transplant Network	4 (2, 7)	5 (3, 10)	3 (2, 6)	0.018
Family consent to donation	6 (4, 11)	8 (4, 15)	6 (3, 10)	0.011
First legal brain death diagnosis	7 (5, 13)	8 (5, 15)	6 (4, 11)	0.012
Second legal brain death diagnosis	8 (5, 14)	9 (6, 16)	8 (5, 12)	0.021
Organ procurement	9 (7, 15)	11 (7, 18)	9 (6, 14)	0.018

No missing values were observed for variables included in this table
IQR interquartile range

Table 3 Institutional characteristics ordered by the proportion of brain death-first cases

Institution ^a	No. of cases	Brain death-first case	Brain death-first proportion (%)	Annual ambulance admissions ^b	ICU beds under management ^c	ICU type	Timing policy for option presentation	Attending physician continuity ^d	ICU multidisciplinary conference frequency ^e
1	23	19	82.6	4,228	12	Closed	After brain death-compatible judgment	Mostly fixed	Weekdays
2	9	7	77.8	6,271	0	Open	No specific policy	Mostly fixed	Weekdays
3	12	9	75.0	10,801	0	Open	After brain death-compatible judgment	Less fixed	Daily
4	7	4	57.1	7,454	15	Semi-closed	No specific policy	Less fixed	Weekdays
5	11	6	54.5	1,929	69	Semi-closed	As soon as possible	Less fixed	Daily
6	16	8	50.0	1,927	5	Closed	As soon as possible	Less fixed	Daily
7	8	4	50.0	3,273	8	Semi-closed	No specific policy	Less fixed	2–4 times/week
8	11	5	45.5	7,452	8	Semi-closed	After brain death-compatible judgment	Mostly fixed	None
9	9	4	44.4	5,684	10	Semi-closed	After brain death-compatible judgment	Mostly fixed	Weekdays
10	12	4	33.3	1,394	12	Closed	No specific policy	Less fixed	Weekly
11	14	3	21.4	2,341	19	Semi-closed	No specific policy	Less fixed	2–4 times/week
12	20	2	10.0	5,947	12	Semi-closed	After brain death-compatible judgment	Less fixed	Weekdays
13	14	1	7.1	4,350	8	Semi-closed	After brain death-compatible judgment	Less fixed	Weekdays
14	11	0	0.0	5,926	9	Open	No specific policy	Mostly fixed	None
15	9	0	0.0	3,689	12	Closed	After brain death-compatible judgment	Less fixed	Weekdays
16	4	0	0.0	1,503	60	Closed	No specific policy	Less fixed	Daily

^a Institutions are ordered by the proportion of brain death-first cases^b Annual ambulance admissions represent the number of ambulance transports accepted in 2023^c ICU beds under management indicate the number of ICU beds for which the emergency and critical care department has primary responsibility^d Attending physician continuity reflects the consistency of the physician(s) responsible for organ donation option presentation and is categorized as fixed, mostly fixed, less fixed, or not fixed. Timing policy refers to institutional policy regarding the timing of option presentation^e ICU multidisciplinary conference frequency is shown as none, weekly, 2–4 times/week, weekdays, or daily

All facility-level characteristics reflect institutional practices and policies as of 2023

variability was evident in both the direction and magnitude of timing differences (Kruskal–Wallis test, $p < 0.001$).

Factors associated with presentation sequence and timing

In mixed-effects logistic regression accounting for institutional clustering, age was the only variable independently associated with presentation sequence (OR 1.03 per year, 95% CI 1.00–1.07, $p = 0.023$). The association observed for physician continuity in unadjusted analyses was not significant after adjustment, nor were any other covariates. The likelihood-ratio test supported inclusion of a random intercept ($\chi^2(01) = 18.64$, $p < 0.001$), and the ICC was 0.32, indicating substantial between-institution variability (Table 4). The mixed-effects models included 16 institutions, with cluster sizes ranging from 4 to 23 patients per institution (mean 12). All models converged successfully without optimization warnings.

In mixed-effects linear regression accounting for institutional clustering and admission-to-deep coma interval, physician continuity and institutional timing policy were not independently associated with time to option presentation. A longer admission-to-deep coma interval was associated with a longer time to option presentation

($\beta = 0.12$ per day, 95% CI 0.10–0.14, $p < 0.001$). The likelihood-ratio test supported inclusion of a random intercept ($\chi^2(01) = 15.31$, $p < 0.001$), and the ICC was 0.19, indicating moderate between-institution variability (Supplemental Table 1). The linear mixed-effects model likewise converged successfully without optimization warnings.

Sensitivity analysis

Sensitivity analyses excluding the highest-volume institution yielded similar results, with persistent between-institution variability (Supplemental Table 2 and 3).

Discussion

In this multicenter study of brain-dead donors in Japan, 40% of donors (76/190) underwent organ donation option presentation after clinical determination of a brain death-compatible state, whereas option presentation preceded such determination in 60%. Substantial inter-institutional variability was observed in both the sequence and timing of option presentation. These findings provide multicenter evidence regarding real-world organ donation discussions in Japan. However, institutional timing

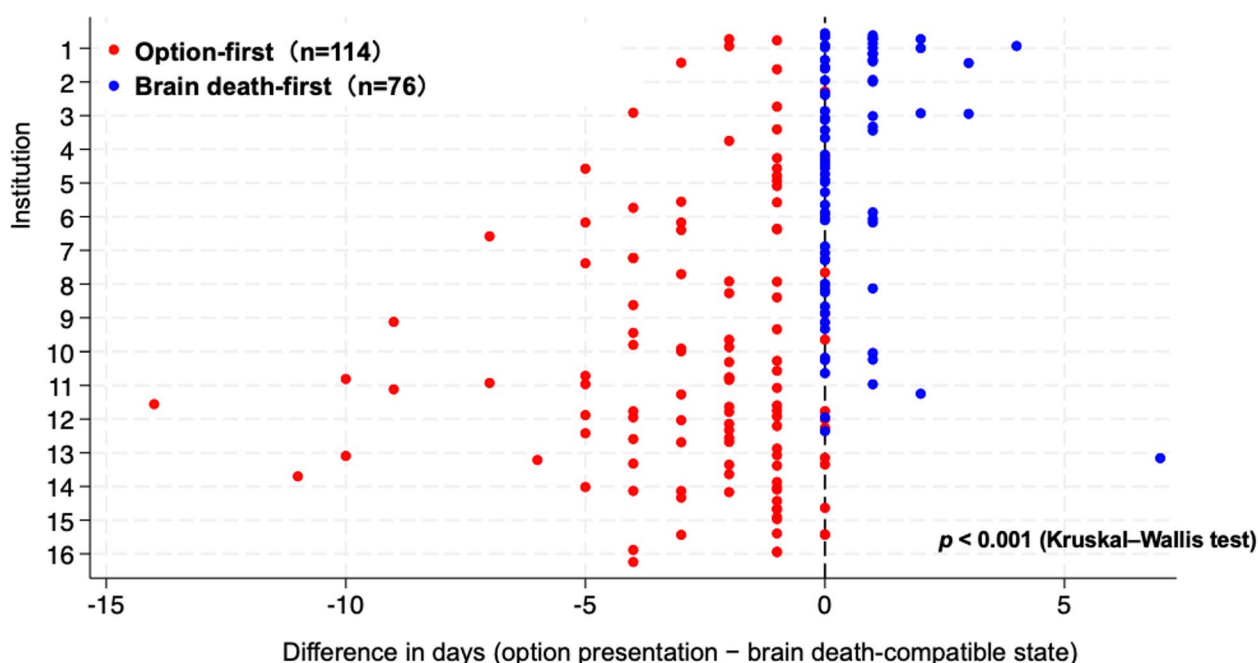


Fig. 3 Relative timing between brain death-compatible determination and organ donation option presentation across institutions. Each point represents an individual donor ($n = 190$), visualizing the patient-level relative timing between brain death-compatible determination and organ donation option presentation. The x-axis shows the difference in days calculated as the interval from admission to option presentation minus the interval from admission to brain death-compatible determination. Negative values indicate option-first presentation, whereas positive values indicate brain death-first presentation. Cases in which both events occurred on the same calendar day are plotted at zero; these cases were classified as brain death-first or option-first according to the documented chronological order in the medical record. Points are grouped by institution (16 centers). Institutions are ordered from 1 to 16 according to the proportion of brain death-first cases, consistent with Table 3. Substantial inter-institutional heterogeneity was observed (Kruskal–Wallis test, $p < 0.001$).

Table 4 Mixed-effects logistic regression analysis of factors associated with option-first presentation

Variables	OR (95% CI)	p value
Age (per year)	1.03 (1.00–1.07)	0.023
Male (vs. Female)	1.09 (0.52–2.27)	0.81
Primary disease or injury		
Others	Reference	
Stroke including subarachnoid hemorrhage	0.83 (0.35–1.94)	0.66
Traumatic brain injury	1.01 (0.34–2.96)	0.99
ICU type		
Open	Reference	
Closed	2.00 (0.20–19.75)	0.55
Semi-closed	1.81 (0.22–14.68)	0.58
Physician continuity for organ donation option presentation		
Mostly fixed	Reference	
Less fixed	3.07 (0.55–17.00)	0.20
Institutional timing policy		
After brain death-compatible judgment	Reference	
As soon as possible	0.24 (0.02–2.54)	0.24
No specific policy	1.14 (0.22–5.75)	0.88

Estimates were obtained from a mixed-effects logistic regression model with a random intercept for institution. The likelihood-ratio test supported inclusion of institutional-level clustering (chibar²(01) = 18.64, $P < 0.001$). The intraclass correlation coefficient was 0.32

OR odds ratio, CI confidence interval

policies were not significantly associated with presentation sequence, and the factors underlying the observed inter-institutional variability could not be determined from the present data.

In Japan, national guidance recommends that organ donation be discussed after clinical determination of a state consistent with brain death, providing a structured framework for organ donation discussions [8]. However, our findings suggest that real-world practice varies substantially across institutions. This discrepancy may reflect the complexity of organ donation decision-making in Japan, where the opt-in system, prolonged end-of-life processes, variable institutional experience, and limited coordinator or staffing resources may influence bedside practice [10, 15]. In addition, clinicians must balance organ donation discussions with ongoing life-saving treatment and communication regarding prognosis and end-of-life care.

Previous studies have shown that timing alone does not determine consent, and that communication quality, family understanding, and contextual factors may influence decision-making [16, 17]. Inadequate timing or insufficient explanation has been associated with decisional conflict and refusal, whereas clear and repeated communication may support decision stability [18–20]. These

observations from prior studies may partly help explain the substantial variability in organ donation discussions observed across institutions in the present study.

The substantial inter-institutional variability observed in this study may reflect differences in contextual and organizational factors that were not captured in the present dataset. Previous work has shown that organ donation practices are influenced by staffing, communication structure, and other organizational factors rather than policy alone [19]. Although physician continuity was associated with presentation sequence in unadjusted analyses, this association was not independently significant after adjustment for patient- and institution-level covariates. Healthcare professionals must navigate complex boundaries between end-of-life care and donation discussions, with no single optimal approach applicable across all settings [21, 22]. Therefore, the observed variability may reflect broader contextual and organizational influences rather than any single measured institutional characteristic. However, these interpretations remain speculative because relevant institutional-level variables were not directly measured in the present study.

Importantly, families play a central role in organ donation decision-making, particularly in opt-in systems such as Japan [23]. Family refusal remains a major barrier to donation worldwide and is strongly influenced by emotional burden, understanding of brain death, and communication processes [17]. Taken together, these findings demonstrate substantial inter-institutional variability in the sequence and timing of organ donation discussions. However, because this study included only cases in which organ donation was ultimately performed and did not evaluate family-centered outcomes, the present findings should not be interpreted as supporting a specific communication strategy or timing approach. Further studies including non-donor cases and family-centered outcomes are needed to determine optimal approaches to organ donation communication and timing in clinical practice.

There are several limitations to this study. First, the analysis included only brain-dead donors from whom at least one organ was procured, and therefore did not capture patients in whom organ donation was considered but not performed, including cases where the option was declined by families or deemed medically unsuitable. This may introduce substantial selection bias and limit the generalizability of the findings to the broader population of potential donors. Families who consented to organ donation may represent a highly selected population with different attitudes, preferences, or levels of readiness regarding organ donation compared with families who declined donation. Second, the sample size was relatively limited, which may have reduced statistical

power, particularly for subgroup and institutional-level analyses. In addition, some categories contained relatively small numbers of patients, resulting in wide CIs; therefore, these findings should be interpreted cautiously. Third, the retrospective design limits the ability to infer causal relationships and may be subject to unmeasured confounding. In addition, the long study period (2010–2023) encompassed changes in the Japanese organ donation environment, including evolving institutional experience and continued development of donation-related systems and support structures. These secular changes may have influenced communication practices and the timing of option presentation over time but could not be fully accounted for in the present analysis. Moreover, facility-level characteristics were assessed as of 2023 and therefore may not have reflected institutional practices and policies in place at the time of individual donor cases. Consequently, temporal changes in institutional practices and policies during the study period could not be assessed. Furthermore, because timing data were retrospectively collected from medical records, some recorded timestamps may have been affected by delays or inaccuracies in clinical documentation, which could have influenced the timing analyses. Finally, detailed information on the content and quality of communication with families, as well as psychosocial factors influencing decision-making, was not available, which may play an important role in the sequence and timing of organ donation discussions.

Conclusions

This multicenter study demonstrated substantial inter-institutional variability in the sequence and timing of organ donation option presentation in Japan. Institutional timing policies were not significantly associated with presentation sequence. Further studies including non-donor cases and family-centered outcomes are needed to better understand optimal approaches to organ donation communication and timing in the ICU.

Abbreviations

CIs	Confidence intervals
ICCs	Intraclass correlation coefficients
IQR	Interquartile ranges
ORs	Odds ratios

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s40560-026-00905-3>.

Supplementary Material 1.
Supplementary Material 2.
Supplementary Material 3.

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Author contributions

Conceptualization: TYu, HNai, MH, SY, KN, TA, OT, AN. Methodology: TYu, HNai, MH, SY, KN, TA, OT, AN. Data curation: TYu, JT, MHayam, SM, MHayas, TN, YG, HNar, AM, MM, JS, TM, NS, KD, HNak, HK. Formal analysis: TYo. Investigation: TYu, JT, MHayam, SM, MHayas, TN, YG, HNar, AM, MM, JS, TM, NS, KD, HNak, HK. Writing—original draft: TYu. Writing—review and editing: all authors. Supervision: AN. Project administration: TYu, AN. All authors read and approved the final manuscript.

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Data availability

The datasets of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Ethics Committee of Okayama University Hospital (Approval Number: K2604-030). The requirement for written informed consent from the patient's family or legal representative was waived by the ethics committee.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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