High-Functioning Deceased Donor Kidney Transplant System Characteristics: The British Columbia Experience With an Opt-In System

Lachlan C. McMichael, Jagbir Gill, Matthew Kadatz, James Lan, David Landsberg, Olwyn Johnston, Sean Keenan, Edward Ferre, David Harriman, and John S. Gill

Rationale & Objective: A high level of cooperation between organ procurement organizations and transplant programs may help maximize use of deceased donor kidneys. The practices that are essential for a high functioning organ donation and transplant system remain uncertain. We sought to report metrics of organ donation and transplant performance in British Columbia, Canada, and to assess the association of specific policies and practices that contribute to the system's performance.

Study Design: A retrospective observational study.

Setting & Participants: Referred deceased organ donors in British Columbia were used in the study from January 1, 2016, to December 31 2019.

Exposures: Provincial, organ procurement organization, and center level policies were implemented to improve donor referral and organ utilization.

Outcomes: Assessment of donor and kidney utilization along steps of the critical pathway for organ donation.

Analytical Approach: Deceased donors were classified according to the critical pathway for organ donation and key donation and transplant metrics were identified.

Results: There were 1,948 possible donors referred. Of 1,948, 754 (39%) were potential donors. Of 754 potential donors, 587 (78%) were consented donors. Of 587 consented donors, 480 (82%) were eligible kidney donors. Of 480 eligible kidney donors, 438 (91%) were actual kidney donors. And of 438 actual kidney donors, 432 (99%) were utilized kidney donors. One-year all-cause allograft survival was 95%. Practices implemented to improve the system's performance included hospital donor coordinators, early communication between the organ procurement organization and transplant nephrologists, dedicated organ recovery and implant surgeons, aged-based kidney allocation, and hospital admission of recipients before kidney recovery.

Limitations: Assignment of causality between individual policies and practices and organ donation and utilization is limited in this observational study.

Conclusions: In British Columbia, consent for donation, utilization of donated kidneys, and transplant survival are exceptionally high, suggesting the importance of an integrated deceased donor and kidney transplant service.

A high level of cooperation between organ procurement organizations (OPOs) and transplant programs may help maximize the use of the limited supply of deceased donor kidneys. However, the practices that are essential for a high functioning organ donation and transplant system remain uncertain. The province of British Columbia, Canada, has a population of 5 million people. In 2021, the deceased organ donor rate was 28.5 per million population, and the deceased donor kidney transplant rate was 51 per million population, among the highest in the world.[1,2] In Canada, deceased donor kidneys are allocated within provinces unless candidates are enrolled in the highly sensitized national program, which is limited to candidates with a calculated panel reactive antibody ≥95%.[3] Canada has an established organ procurement and transplant opt-in system of deceased donation, with policies set provincially. One province, Nova Scotia, recently moved to an opt-out system of donation.[4,5] Allocation policies are similar between Canadian provinces, but there is provincial variation and policies have not been formally reviewed nationally since 2006.[6] In British Columbia, deceased donation and adult kidney transplant services are delivered by a single OPO and a single university affiliated kidney transplant program providing a unique opportunity to determine the association of specific policies and practices with the system's performance.

In British Columbia, policies and practices involving the public, donor hospitals, the provincial OPO, and transplant centers that may contribute to the system's performance are summarized along with their year of implementation in Table S1. Provincial policies implemented include an organ donor registry and mandated reporting of in-hospital deaths to the OPO. The OPO level policies implemented include designated on-site donation coordinators in donor hospitals and early ongoing communication between donor coordinators and transplant physicians beginning at the time of referral of a potential donor along with a quarterly review of all deceased donors and transplant outcomes. Transplant center level policies include dedicated recovery and implant surgeons, hospital admission of intended recipients before kidney recovery, and strict adherence to an age-based kidney allocation

PLAIN-LANGUAGE SUMMARY

Optimization of all possible opportunities for deceased donor kidney donation and transplantation is essential to meet the need for transplantation. We examined the performance of organ procurement and transplant in a deceased organ donor system in British Columbia, Canada, and reviewed policies and practices that may contribute to the system's performance. We found a high level of donation, transplantation, and survival of donated kidneys and identified policies and practices that likely contribute to the system's performance.

algorithm. Kidneys from deceased donors aged < 35 years are allocated to candidates aged < 35 years; kidneys from donors aged > 60 years are only allocated to wait-list candidates aged > 60 years; and kidneys from donors aged 36-59 years are allocated to all candidates. Allocation is explained to candidates at the time of waitlisting, but consent to receive offers for transplantation from older donors is not required. A kidney accepted for transplantation is considered acceptable for all age-appropriate wait-list candidates, and doctors do not accept or decline kidneys for individual candidates aged ≥ 18 years. Kidneys offered to pediatric candidates are subject to acceptance by pediatric transplant nephrologists. Patients who decline an offer for transplantation are not penalized and retain their accrued wait time.

The purpose of this study was to report metrics of organ donation and transplant performance, and to assess the association of specific policies and practices that contribute to the organ donation and transplant rate in our provincial opt-in donation system.

METHODS

The study was approved by our hospital's research ethics board (H22-00498-A001). Informed consent requirements were waived by the ethics board.

Data Sources and Study Cohort

All in-hospital deaths referred to the provincial OPO from January 1, 2016, to December 31, 2019, were studied. This time frame was selected to exclude the COVID-19 pandemic. Donor and recipient-related information was obtained from provincial registries.

Study Definitions and Metrics

Feasible study definitions were adopted to align with those developed by the critical pathway for organ donation that are summarized in Fig S1.[7]

Study specific modifications to the critical pathway definitions are summarized in Table S2.

To determine the association of provincial practices and policies with system performance, study specific metrics were defined. The study metrics and the relevant policies

and practices they are intended to inform are summarized in Table S1.

Analytical Methods

The Kidney Donor Profile Index (KDPI) and Estimated Posttransplant Survival (EPTS) scores were calculated according to calculations by the Organ Procurement and Transplant Network (OPTN) and scores were mapped to the 2019 values.[8,9]

The time to graft loss from all causes, including death and the time to death censored graft loss, defined as return to long-term dialysis, an estimated glomerular filtration rate (eGFR) of <20 mL/min/1.73 m^2 or repeat transplantation, was determined with the Kaplan-Meier method with follow-up censored at the end of the follow-up (October 31, 2022). The eGFR was determined 1 year after transplantation using the 2021 CKD-EPI equation among patients who maintained allograft function and was described using the mean and standard deviation.[10]

RESULTS

Among the 1,948 possible organ donors referred to our provincial OPO during the study period, the majority (61%) were found to be medically unsuitable for donation leaving 754 (39%) potential organ donors without known contraindications to donation (Fig 1). Consent rates of potential organ donors were high. Of 754 potential organ donors, 587 (78%) were consented for donation.

Among the 587 consented donors, 107 (18%) were deemed ineligible to proceed with donation. Of the 107 consented potential donors that were declined, 51 patients (48%) had inadequate kidney function. This was determined at the discretion of the coordinating kidney transplant physician and was determined on a multidimensional assessment of the patient's age, medical comorbid conditions, kidney function, and age. Thirty-six consented potential donors were excluded because of the risk of infection including 21 Hepatitis C (HCV) positive donors that were excluded from January 1, 2016 to December 31, 2018. A policy change was implemented in 2019 to allow the use of donor kidneys from HCV-positive donors. HCV-positive donors are now routinely used within British Columbia. Eight consented donors were excluded because of suspected or confirmed malignancies diagnosed during the donor evaluation. Nine donors had a change in clinical status (ie, hemodynamic instability) that precluded organ donation.

Among 587 consented donors, 21 (4%) were excluded from kidney donation and donated extrarenal organs, including 18 of the 51 donors excluded for inadequate kidney function, 2 donors excluded for infection were accepted as lung donors, and 1 donor excluded for logistical reasons, donated his or her lungs.

Table 1[8] shows the characteristics of the 480 potential consented organ donors who were eligible kidney donors and the 51 consented donors who were ineligible because

Donor Categories   **Donor Exclusions**
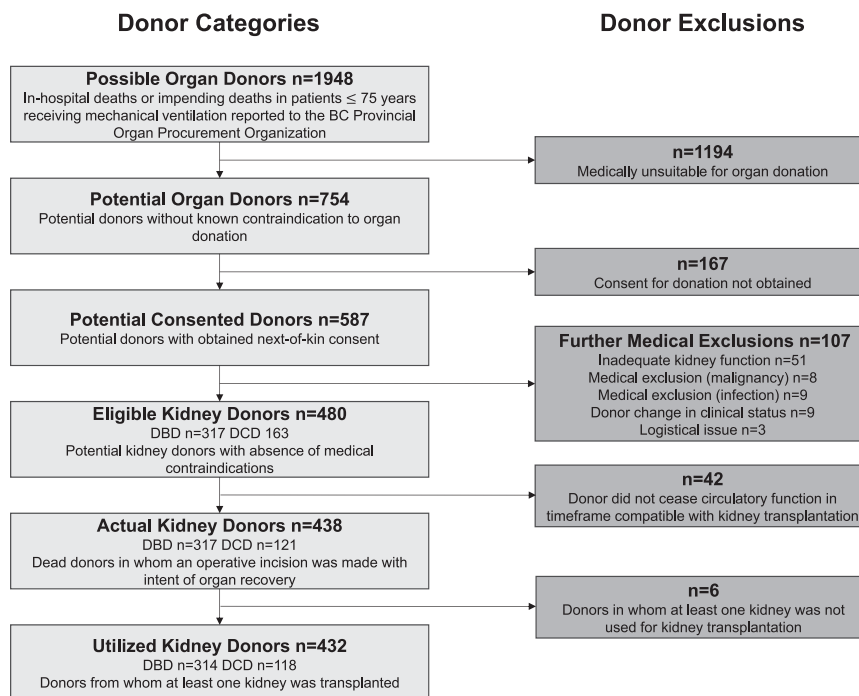
Figure 1. Flow chart of 1,948 referred possible deceased organ donors in British Columbia, Canada from January 1, 2016, to December 31, 2019. DBD, donation after brain death; DCD, donation after cardiovascular death.

the kidney function was considered inadequate. The ineligible donors were older, more frequently male, obese, had a KDPI ≥ 85%, and followed a donation after circulatory death (DCD) pathway. Among the 480 eligible kidney donors, 438 were actual kidney donors, and 42 eligible DCD donors did not have cessation of circulatory function in a time frame compatible with kidney transplantation (Fig 1). Among the 438 actual kidney donors, 432 were used for donation. Six additional donors did not donate any kidneys for reasons that were identified during or after donor recovery surgery. Fig 2 summarizes the utilization of the subset of potential consented donors of ≥60 years. Among the 129 potential consented donors, 92 (71%) were eligible kidney donors, 81 (88%) of the eligible kidney donors were actual donors, and 77 (95%) of the eligible kidney donors were utilized donors.

Table 2 summarizes the study metrics and shows that once donors are consented to and deemed medically suitable, utilization of donated kidneys is high. For example, the proportion of actual kidney donors among eligible kidney donors was 92%, with only eligible DCD donors who did not progress to donation (42 of 163, 26%) excluded. Among the 438 actual kidney donors, 432 (99%) were utilized kidney donors. Cold ischemic times were relatively short, but the delayed graft function rate was still 35%.

Fig 3 summarizes the utilization of the 872 kidneys available for transplantation from the 438 utilized kidney donors. Only 1 kidney was recovered from 4 deceased donors because of previous nephrectomy or trauma.

Thirteen kidneys were damaged during donor recovery surgery. Among the 859 recovered kidneys, 851 (99%) were utilized for transplantation, and only 8 recovered kidneys were discarded.

Transplant Characteristics and Outcomes

The characteristics of the 781 kidney-only transplant recipients performed in British Columbia are shown in Table 3.[8,9] Outcomes for the 55 kidneys shipped out of British Columbia could not be determined. The acute rejection rate at 1 year was 9%, and the mean eGFR at 12 months among patients with a functioning transplant was 66 ± 26 mL/min/1.73m^2. The time to allograft failure from any cause, including death, and the time to death censored graft loss are shown in Fig 4A and B. Overall, 1-year and 3-year all-cause allograft survival were 94.6% (95% CI, 93.1-96.2), and 88.1% (95% CI, 85.8-90.4), respectively.

DISCUSSION

Cooperation between donor and transplant service providers is important to maximize the use of scarce deceased donor kidneys.[11,12] Transplantation rates vary as much as 10-fold between transplant centers served by the same OPO, and a lack of cooperation between OPOs and transplant centers may contribute to kidney nonutilization.[13-15] Comprehensive descriptions of the collective performance of deceased kidney donation and transplantation services are surprisingly lacking in the literature.[16,17] In this study, we report

Table 1. Characteristics of 531 Consented Potential Kidney Donors Including Eligible Kidney Donors and Ineligible Donors for Inadequate Kidney Function

| Factor	Eligible Frequency (%), n = 480	Ineligible Frequency (%), n = 51
Donor age (y) (mean ± SD)	44 ± 16	49 ± 18
Sex (male)	309 (64)	35 (69)
Terminal creatinine (mg/dL) (median [IQR])	0.80 (0.62-1.14)	2.52 (0.94-4.03)
Kidney donor profile index[a]		
0-20	137 (29)	8 (16)
21-34	70 (15)	4 (8)
35-50	68 (14)	9 (18)
51-70	87 (18)	6 (12)
70-85	59 (12)	4 (8)
86-100	57 (12)	17 (33)
Unavailable	2 (0)	3 (6)
Body mass index[b]		
Underweight (<18.5)	18 (4)	1 (2)
Normal (18.5-24.9)	161 (34)	12 (24)
Overweight (25-29.9)	172 (36)	14 (27)
Obese (≥30)	126 (26)	21 (41)
Not recorded	3 (1)	3 (6)
Hypertension		
No	330 (69)	21 (41)
Yes	81 (17)	8 (16)
Unknown	69 (14)	22 (43)
Smoking history		
No	134 (28)	0 (0)
Yes	284 (59)	2 (4)
Unknown	62 (13)	49 (96)
Diabetes history		
No	388 (81)	26 (51)
Yes	31 (6)	3 (6)
Unknown	61 (13)	22 (43)
Donor type		
Donation after brain death	317 (66)	23 (45)
Donation after circulatory death	163 (34)	28 (55)
Cause of death		
Anoxia	241 (50)	24 (47)
Cerebrovascular accident	122 (25)	12 (24)
Trauma	81 (17)	2 (4)
Medical assistance in dying	2 (1)	1 (2)
Other	34 (7)	12 (24)

[a]Kidney donor profile index—numerical measure that combines 10 donor factors to summarize into a single number the quality of deceased donor kidneys relative to other recovered kidneys. Missing variables for diabetes, hepatitis C, and hypertension were assumed to be negative for KDPI calculations. Raw KDPI scores were mapped to 2019 scales.[8]
[b]Body mass index—weight (kilograms) divided by the square of height (meters).

the performance of our provincial deceased kidney donor transplant service and advance metrics to inform the relevance of policies and practices for overall system performance. We found that 39% of possible donors referred from hospitals were potential donors, a high consent rate for donation (78%) among potential donors, a high proportion of eligible kidney donors among consented potential donors (82%), and that 99% of actual donors were utilized donors. Furthermore, 98% of recovered kidneys were transplanted, cold ischemic times were short, but delayed graft function was still 35%. Despite the high rate of organ utilization and

delayed graft function, 1-year and 3-year allograft survival and 1-year kidney function exceeded Canadian outcomes.[18]

The findings related to organ donation exceed those reported from the province of Ontario during the period of April 2013, to July 2019.[19] In that study, 34,837 adults were referred to the Ontario OPO. Consent for donation was sought for 19% of all referrals in Ontario compared with 39% in British Columbia. Consent was obtained for 60% compared with 78% in British Columbia. Among consented donors, 48% donated at least 1 organ compared with 77% in British Columbia, including the 21 donors
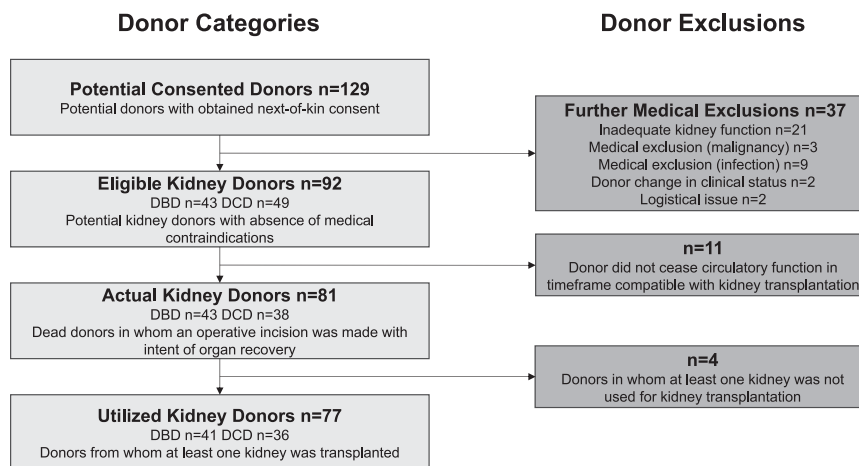
Figure 2. Flowchart of 129 potential consented donors ≥ 60 years of age in British Columbia, Canada from January 1, 2016, to December 31, 2019. DBD, donation after brain death; DCD, donation after cardiovascular death.

who donated extrarenal organs only. In comparison to British Columbia, Ontario's population is larger, transplant services are provided in 5 adult transplant centers, and a variety of physicians are responsible for the acceptance of kidneys for transplantation. We are unable to compare our findings with those of other provinces because of the absence of national data capture on deceased donor services.[3] Comparing our findings to other countries, consent for deceased organ donation in the United Kingdom in 2019 was between 64% and 71%, whereas the proportion of actual donors among consented donors was 65%.[20] Consent for organ donation in the United States from 2008 to 2011 was 69%, whereas the deceased donor realization rate, calculated as the number of donors with an organ utilized for transplantation divided by the number of estimated donors, was only 20%.[21,22] Although direct comparisons from other countries with our findings are challenging, these comparisons are significantly lower than the consent rate and donor and organ utilization rates in our study.

Table 2. Study Metrics

Study metrics	n (%)
Proportion of potential donors among possible donors	754/1948 (39)
Proportion of consented donors among potential donors	587/754 (78)
Proportion of eligible kidney donors among consented donors	480/587 (82)
Proportion of actual donors among eligible kidney donors	438/480 (92)
Proportion of used donors among actual kidney donors	432/438 (99)
Proportion of recovered kidneys used for transplantation	851/872 (98)
Cold ischemic time in hours (median [inter-quartile range])	9.1 (6.5-12.5)
Delayed graft function	271/781 (35)

The association of policies and practices with system performance was inferred by examination of study metrics and the timing of implementation of our policies and practices (Table S1). Importantly, given the complex nature of organ donation it is not possible to determine causality between individual policies and practices and system performance in this observational study. Legislated referral of all in-hospital deaths and impending deaths to the OPO in persons < 75 years was enacted in 1997, when the donor rate was under 15 per million population. The finding of a minority of possible donors who were potentially medically suitable is the result of this broad requirement for referral. All Canadian provinces except Saskatchewan and Newfoundland have mandatory referral requirements of possible donors.[23] Our OPO performs periodic audits of all in-hospital deaths to identify unreported possible donors.[24] Missed referrals are reviewed, but penalties have never been imposed. Information from audits performed during the study were not available for analysis. Although there is significant work involved with the triage of medically unsuitable donors, the broad requirement minimizes the potential for nonreferral of possible organ donors. Definitive conclusions regarding the value of legislated referrals are not possible without information about missed referrals and an audit of the referrals excluded from donation. Because this policy was in place when deceased organ donations in British Columbia were low, it is unlikely the policy in isolation significantly impacts organ donations.

Consent for donation was obtained in 78% of potential donors and is likely linked to the employment of hospital donor coordinators and the inclusion of consideration of organ donation in end-of-life care protocols for patients admitted to intensive care units.[25,26] The inclusion of hospital donor coordinators in multidisciplinary hospital critical care teams facilitates requests for organ donation and is reported to be beneficial in other studies.[27-29] Similarly, a recent systematic review reported that the
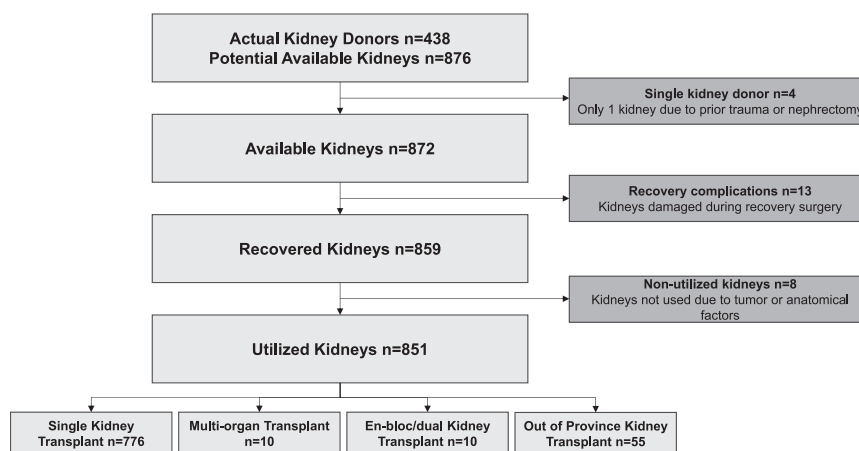
Figure 3. Flow chart of potential kidneys available for transplantation in British Columbia, Canada from January 1, 2016, to December 31, 2019.

engagement of donation physicians has the potential to significantly improve deceased donation.[30] The acceptance of donor coordinators reflects a culture change that has been enabled by the critical care leadership of our OPO and the implementation of Canadian best practices for organ donation.[31,32] The high consent rate is consistent with survey data that 81% of Canadians support organ donation.[33] The high consent rate validates the voluntary approach to organ donation in Canada and challenges the rationale for the recent change to an opt-out donation strategy in Nova Scotia.[5,34] Our findings demonstrate that with the provision of necessary resources to allow potential donor families to make an informed donation decision, most families consent to donation. By contrast, recent work reveals significant public concern with an opt-out system of donation in Canada.[35] The high consent rate in British Columbia, together with evidence that presumed consent will not affect organ donation rates unless deceased donor services are appropriately resourced to support best practices, may be useful to decision makers in other provinces considering a change to an opt-out system of donation.[25,36]

The high kidney utilization rates overall and among donors aged ≥ 60 years are related to early longitudinal communication between OPO staff and transplant nephrologists that begins before organ recovery. The responsibility for evaluation of deceased kidney donors is led by transplant nephrologists in British Columbia because the primary considerations are medical, and the significant competing obligations of our limited number of transplant surgeons, who are responsible for both organ recovery and transplantation. Transplant surgery support is obtained when potential donors have surgical considerations. In the absence of a control scenario of transplant surgery led donor evaluation, we are unable to make definitive conclusions regarding the importance of transplant nephrology led donor evaluation. Of note, we do not use

donor kidney biopsies to inform decision-making about donor acceptance. Reliance on donor biopsies has been identified as the key factor contributing to the nonutilization of deceased donor kidneys in the United States.[37-39]

Consistent with recent work calling for abandoning the term discard, we have used the term nonutilized when referring to recovered kidneys that were not transplanted.[40] A recent study from the Netherlands highlighted that the traditional definition of the kidney nonutilization rate, which is limited to recovered organs, underestimates nonutilization because nonrecovered kidneys are not considered.[17] The authors proposed including all kidneys reported for allocation in the denominator for calculating organ nonutilization. In our study, this would include kidneys from all 480 eligible kidney donors, for a total of 956 kidneys (4 donors were known to have only 1 kidney available for donation). Assuming all 55 kidneys exported out of the province were utilized, our nonutilization rate would be 11% (105 nonutilized of the 956 total kidneys) compared with 24% reported in Eurotransplant.[17] We do not favor the use of a metric of nonutilization that relies on allocation because we allocate eligible DCD kidneys before withdrawal of life support. Therefore, if there was consensus to use allocated kidneys as the denominator for the calculation of the nonutilization rate, we would propose to subtract that number of kidneys from DCD donors who did not progress to donation in systems that allocate DCD kidneys before withdrawal of life support. Using this approach, our overall nonutilization rate would be 3% (21 nonutilized of the 872 total kidneys).

Early and longitudinal communication between OPO staff and transplant nephrology also enables planning for transplantation. Transplant candidates are admitted to the hospital before the donor surgery, virtually eliminating the possibility that a suitable recipient will not be identified for a recovered kidney. In the case of DCD donors, our

Table 3. Baseline Characteristics of 781 Kidney Transplant Recipients in British Columbia, Canada, Between 2016 and 2019

Factor	Frequency (%), n = 781
Recipient age (y) (mean ± SD)	55 ± 15
Sex (male)	505 (65)
Blood group	
A	272 (35)
AB	28 (4)
B	127 (16)
O	354 (45)
Primary kidney disease	
Glomerulonephritis	230 (29)
Polycystic kidney disease	59 (8)
Hypertension	90 (12)
Diabetes mellitus	220 (28)
Other	182 (23)
Estimated posttransplant survival[a]	
0-20	213 (27)
21-40	164 (21)
41-60	163 (21)
61-80	137 (18)
81-100	83 (11)
Pediatric patient	21 (3)
Kidney donor profile index[b]	
0-20	239 (31)
21-34	112 (14)
35-50	115 (15)
51-70	134 (17)
70-85	85 (11)
86-100	96 (12)
Dialysis duration (y) (median [IQR])	3.0 (2.0-4.4)
Pre-emptive	0 (0)
Body mass index[c]	
Underweight (<18.5)	37 (5)
Normal (18.5-24.9)	296 (38)
Overweight (25-29.9)	241 (31)
Obese (≥30)	207 (27)
Previous kidney transplants	
0	700 (90)
1	72 (9)
2 or more	9 (1)

[a]Estimated posttransplant survival—numerical measure that combines 4 recipient factors to summarize into a single number the expected recipient longevity. Raw EPTS values mapped to 2019 values.[9]
[b]Kidney donor profile index—numerical measure that combines 10 donor factors to summarize into a single number the quality of deceased donor kidneys relative to other recovered kidneys. Missing variables for diabetes, hepatitis C, and hypertension were assumed to be negative for KDPI calculations. Raw KDPI scores were mapped to 2019 scales.[8]
[c]Body mass index—weight (kilograms) divided by the square of height (meters).

practice of admitting candidates before withdrawal of life support leads to some waste of health care resources, candidate disappointment, and candidate travel cost when a DCD donor does not progress to donation. Further work to understand the perspective of affected transplant candidates and coverage of candidate travel costs are important considerations. Our rate of nonprogression among

DCD donors is consistent with that reported in other studies.[41,42] Communication between OPO staff and transplant nephrologists also contributes to the short cold ischemic times because donor and transplant surgeries are timed to minimize cold ischemic time. Despite the short cold ischemic time, our delayed graft function rate was still 35%, which may in part be because of the limited use of pulsatile perfusion in DCD donor kidneys with an anticipated cold ischemic time of ≥12 hours in our practice and the fact that all recipients were dialysis-dependent as we do not perform pre-emptive deceased donor transplants. In addition, there is clinical practice variation in the use of dialysis after transplantation. Transplant nephrologists in British Columbia oversee dialysis care after transplantation. As such, the threshold to initiate dialysis may be lower than in other centers.

Our allocation policy, based on donor and recipient age matching and strict adherence to the allocation algorithm obviates the need for acceptance of individual kidney offers for wait-list candidates at the time a donor kidney becomes available. This contrasts with the system in the United States, which requires transplant centers to accept or decline individual kidney offers. Kidney offers for pediatric recipients are subject to acceptance by our pediatric program but do not result in organ nonutilization because kidneys declined by the pediatric program are utilized in the adult program. Our policy may be criticized for not incorporating patient choice and limiting individual physician decision-making. However, the high transplant success rate suggests these considerations do not significantly affect the overall system's performance.

The study findings may prompt further discussion of optimal strategies to integrate deceased donor and transplant services and to advance metrics that promote system wide improvements in other regions. We attempted to align the evaluation of our deceased donor services within the framework established by the critical pathway but encountered some challenges with applying those definitions to our study.[7] Specifically, the critical pathway does not consider consent for donation among potential donors, which is a prerequisite for donation after brain death and DCD donation in most of Canada and is an important consideration in evaluating deceased donor services in regions with opt-in systems of organ donation. It is notable that the critical pathway was based on procedures from Spain, which has an opt-out system for donations.[7]

There are limitations when interpreting the results of this study. Our study is observational. In the context of multiple factors that contribute to donor and organ acceptance, and the absence of prospective comparator data from other provinces, definitive conclusions regarding the effect of individual policies and practices on system performance are not possible. However, given that it is unlikely that controlled studies will be undertaken, the provision of implementation dates of policies and practices in British Columbia allows inferences about the relative importance of these interventions in our system. We
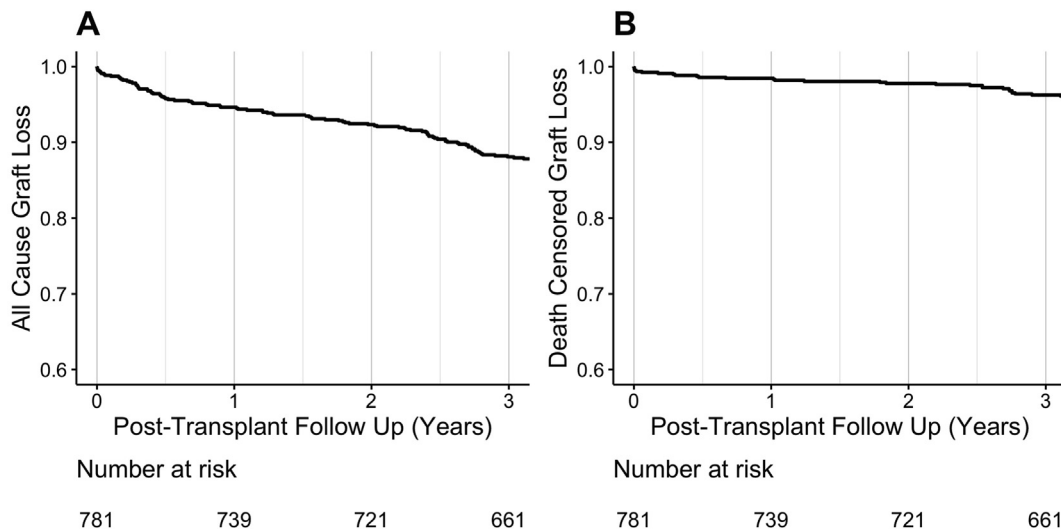
Figure 4. (A) Time to graft loss from any cause including death and (B) Time to graft loss not including death, among 781 kidney transplant recipients in British Columbia, Canada.

recognize that some practices from our provincial system will not be generalizable to other nationally administered systems.

In summary, we report a high rate of kidney donation and utilization in an opt-in integrated provincial deceased donor transplant system. The findings validate the opt-in model in Canada and suggest efforts to integrate donation and transplant services, which may increase deceased donor kidney transplants.

SUPPLEMENTARY MATERIALS

Supplementary File (PDF)

Figure S1: The critical pathway for deceased organ donation.

Figure S2: Actual deceased organ donors by year, British Columbia.

Table S1: Policies and practices with associated metrics and year of implementation.

Table S2: Study specific modifications to critical pathway definitions.

ARTICLE INFORMATION

Authors' Full Names and Academic Degrees: Lachlan C. McMichael, MBBS, MMed, Jagbir Gill, MD, MS, Matthew Kadatz, MD, MS, James Lan, MD, David Landsberg, MD, Olwyn Johnston, MD, MHSc, Sean Keenan, MD, Edward Ferre MBA, David Harriman, MD, and John S. Gill, MD, MS

Authors' Affiliations: Division of Nephrology, Kidney Transplant Program, University of British Columbia, Vancouver, Canada (LCM, JG, MK, JL, DL, OJ, JSG); Transplant Epidemiology Group, Australia and New Zealand Dialysis and Transplant Registry, South Australian Health and Medical Research Institute, Adelaide, Australia (LCM); Adelaide Medical School, Faculty of Health & Medical Sciences, The University of Adelaide, Adelaide, Australia (LCM); Centre for Advancing Health Outcomes, Faculty of Medicine, University of British Columbia, Vancouver, Canada (JG, JSG); Vancouver Coastal Health Research Institute, Vancouver,
Canada (MK, JL); Department of Pathology and Laboratory Medicine, University of British Columbia, Vancouver, Canada (JL); British Columbia Transplant, Vancouver, Canada (SK, EF); Department of Urologic Sciences, University of British Columbia, Vancouver, Canada (DH); and Tufts Medical Center, Boston (JSG).

Address for Correspondence: John S. Gill, MD, MS, University of British Columbia, Division of Nephrology, St. Paul's Hospital, Providence Building, Ward 6a, 1081 Burrard Street, Vancouver, British Columbia, Canada V6Z 1Y6. Email: jgill@providencehealth.bc.ca

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What is the performance of the opt-in deceased donor kidney transplantation system in British Columbia?

Retrospective observational study

British Columbia, Canada
Jan 2016 – Dec 2019

Examination of provincial, organ procurement and center level policies

Donor assessment and kidney utilization

Referred deceased organ donors	**1,984**
Potential donors	**754** (39%)
Consented donors	**587** (78%)
Eligible kidney donors	**480** (82%)
Actual kidney donors	**438** (91%)
Utilized kidney donors	**432** (99%)

Contributions to system performance

- Hospital donor coordinators
- Early communication between organ procurement organization and transplant nephrologists
- Dedicated organ recovery and implant surgeons
- Aged-based kidney allocation
- Hospital admission of recipients prior to kidney recovery

Conclusion: In British Columbia, consent for donation, utilization of donated kidneys, and transplant survival are high, suggesting the importance of an integrated kidney transplant service.

McMichael LC, Gill J, Kadatz M. High-functioning deceased donor kidney transplant system characteristics: the British Columbia experience with an opt-in system. *Kidney Medicine*, 2024.

VA by Corina Teodosiu, MD **@CTeodosiu**