Journal of Critical Care 29 (2014) 923–929

Contents lists available at ScienceDirect

Journal of Critical Care

journal homepage: www.jccjournal.org

Outcomes

Maternal organ donation and acute injuries in surviving children☆,☆☆,★,★★

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ARTICLE INFO

Keywords:
Brain death
Organ transplantation
Tissue and organ procurement
Wounds and injuries
Child welfare
Bereavement

ABSTRACT

Purpose: The purpose of this study is to test whether maternal deceased organ donation is associated with rates of subsequent acute injuries among surviving children after their mother's death.
Methods: This is alongitudinal cohort analysis of children linked to mothers who died of a catastrophic brain event in Ontario, Canada, between April 1988 and March 2012. Surviving children were distinguished by whether their mother was an organ donor after death. The primary outcome was an acute injury event in surviving children during the year after their mother's death.
Results: Surviving children (n = 454) had a total of 293 injury events during the year after their mother's death, equivalent to an average of 65 events per 100 children per year and a significant difference comparing children of mothers who were organ donors to children of mothers who were not organ donors (21 vs 82, $P < .001$). This difference in subsequent injury rates between groups was equal to a 76% relative reduction in risk (95% confidence interval, 62%-85%).
Conclusions: Deceased organ donation was associated with a reduction in excess acute injuries among surviving children after their mother's death. An awareness of this positive association provides some reassurance about deceased organ donation programs.

1. Introduction

Organ transplantation is a medical intervention, whereby a deceased person can help save the life of approximately 3 other people in the community on average [1-3]. One of the largest limitations of transplantation is a lack of donors because of an individual's preferences, religious beliefs, miscommunicated wishes, popular misconceptions, or other barriers toward organ donation [4-6]. Organ donation is similar to many other forms of altruism, where thoughtful adults need to have a meaningful rationale to guide their voluntary decisions [7,8]. These rationales include genuine heroism, norms of admiration, ideals of selfless charity, anticipated regret, or deterring transplant trafficking [9-12]. The ongoing shortfalls in deceased solid organ donation indicate that the currently prevailing rationales are insufficient [13-17].

☆ Financial disclosure: This project was supported by a Canada Research Chair in Medical Decision Sciences, the Canadian Institutes of Health Research (DAR) (Ontario, Canada); the Determinants of Community Health Research Experience of the University of Toronto (JDW)(Ontario, Canada); the Comprehensive Research Experience for Medical Students Program of the University of Toronto (JDW) (Ontario, Canada); and the Graham Farquharson Knowledge Translation Fellowship, Physicians' Services Incorporated Foundation (Ontario, Canada).
☆☆ Competing interests: The authors of this manuscript have no conflicts of interest to disclose. The funding organizations had no role in the design or conduct of the study; collection, management, analysis, or interpretation of the data; and preparation, review, or approval of the manuscript. All authors have no financial or personal relationships or affiliations that could influence the decisions and work on this manuscript.
★ Ethics statement: The study protocol was approved by the Research Ethics Board of the Sunnybrook Health Sciences Centre (Ontario, Canada). The views expressed are those of the authors and do not necessarily reflect the Institute for Clinical Evaluative Sciences (Ontario, Canada) or the Ontario Ministry of Health and Long-term Care (Ontario, Canada).
★★ Authorship contribution: All authors contributed to the design, analysis, and interpretation of the study. The lead author (DAR) had full access to all data and takes responsibility for the accuracy of the analysis. All authors were involved with drafting the manuscript and critical revisions.
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http://dx.doi.org/10.1016/j.jcrc.2014.07.017
0883-9441/

A parent's death is one of the most serious stresses that a child can experience [18,19]. The adverse consequences include complicated grief, prolonged depression, sleep disturbance, difficulty in school, posttraumatic stress disorder, and psychosocial disturbances [20-23]. The burden of suffering can be further exacerbated by self-perpetuating long-term errors including alcohol abuse, carrying a weapon, criminal convictions, and attempted suicide [24-28]. The extent of adverse outcomes is difficult to evaluate given the fallible nature of survey research, brief duration of most studies, small sample size of clinical research, and ethical barriers around contacting vulnerable populations [29,18]. A full understanding is also problematic because bereavement can lead to psychiatric distress and other factors influencing acute injury risks [30-36].

The literature provides little information on how deceased organ donation after a parent's death might influence the subsequent well-being of these surviving children [37-39]. Deceased organ donation, in theory, can create a positive legacy that directly bolsters the resilience and self-esteem of surviving children, helping them cope with loss, and reduce the risks of subsequent acute injury [40,5]. However, organ donation might also complicate the grieving process for these children and increase their risk of harm [41,38]. We conducted a population-based longitudinal cohort study using linked health databases to test whether maternal deceased organ donation was associated with increased or decreased rates of subsequent acute injuries among surviving children [42].

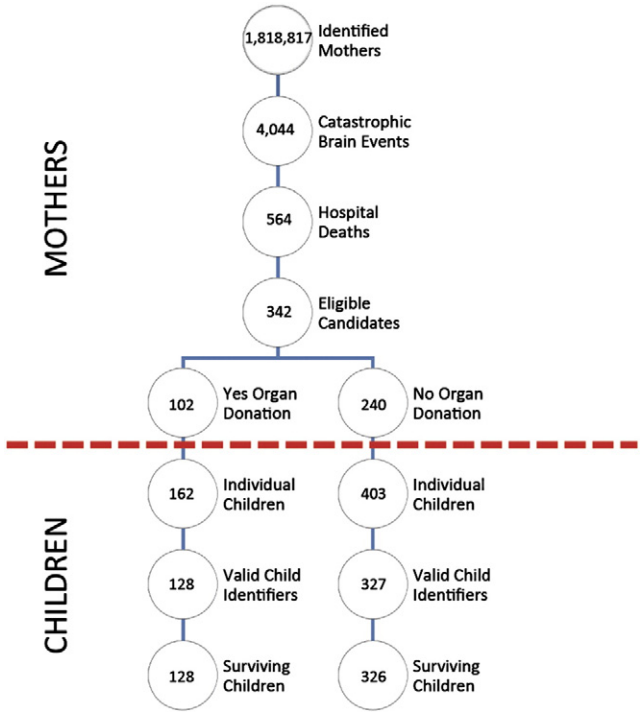

Fig. 1. Flow diagram of identified pairs of mothers and children during 24-year study interval. Circles above dashed line denote mothers, and circles below dashed line denote children. Values inside circle denoting count at corresponding point. Total study sample size of 454 children appears in bottom circles vertically aligned according to whether mother was or was not an organ donor (128 and 326, respectively).

2. Materials and methods

2.1. Population-based study setting

Ontario is Canada's largest region with a population of 11 683 290 in 2000 (study midpoint) and averaging approximately 12 deceased organ donors per million persons annually [43,44,3,45]. During the entire study interval, Ontario health insurance covered universal care with no financial barriers to outpatient, emergency, or hospital services for adults or children [46]. Organ donation and transplantation services were fully covered, financial incentives for organ donation were prohibited, and communication between donor and recipient families was strictly controlled [47,48]. Patterns of health care throughout the region could be analyzed using encrypted individual identifiers for comprehensive longitudinal patient data [49-51]. Our study protocol was approved by the Sunnybrook Research Ethics Board and included a waiver of individual consent.

2.2. Definitive identification of mothers

We identified new mothers by accessing population-based databases that spanned newborn births from April 1, 1988, to March 31, 2012, reflecting all data available [52,53]. These databases compiled all newborn deliveries in the region with computerized algorithms for pairing the correct mother to the correct newborn [54,55]. These algorithms have been validated in past research on maternal health and updated continuously for the last quarter century based on probabilistic matching in early years replaced by deterministic linking in later years [56-59]. Missing, faulty, incomplete, or uncertain individual mother-child pairings were excluded from analysis so that identification of mothers and newborns was exact but not fully comprehensive (Fig. 1). The available databases contained no algorithms for linking paternity status, thereby excluding all fathers from analysis.

2.3. Identification of subsequent catastrophic brain events

We identified subsequent deaths of mothers that were caused by a catastrophic brain event during any year after newborn birth. This approach encompassed every acute care hospital in the region and represented all data available. We focused on the 3 diagnoses most commonly causing brain death, namely, traumatic brain injury, subarachnoid hemorrhage, and intracerebral bleeding [60-62]. We then restricted the sample based on 4 further criteria validated in prior research to define those cases most eligible for deceased organ donation, namely, age 59 years or younger, no disqualifying medical conditions (cancer, tuberculosis, and human immunodeficiency virus), mechanical ventilation starting at admission, and death within 1 week of admission [63]. Throughout, we identified exact individual mothers who had previously given birth and who died years afterward from a catastrophic brain event (hereafter denoted as maternal deaths).

2.4. Determination of deceased organ donation

Each maternal death was defined as a potential opportunity for deceased organ donation that might have been realized depending on the patient's prior preferences, medical condition, and other factors [64-66]. We characterized the actual outcome in a binary manner so that mothers who donated a solid organ after death were defined as actual organ donors (regardless of total number of organs recovered). The remaining mothers were defined as not being organ donors. The determination of actual deceased organ donation was based on previously validated methods that have a sensitivity of approximately 75% and a specificity exceeding 99% [67]. This potential misclassification tended to bias correlations toward the null and was subjected to secondary analyses using methods validated elsewhere [68,69].

2.5. Identification of surviving children

For each maternal death, we identified surviving children through cross-linking to the exact pairings of mother to newborn that had been originally recorded years earlier at the time of newborn birth.