Organ transplantation is well known to extend functional life and improve quality of life and has been demonstrated to be cost effective.1 Access to this effective treatment is limited because of the lack of transplantable organs nationwide. Nearly 119,000 patients are currently waiting for an organ transplant. In 2012, there were 28,051 transplants performed, 79% of them from deceased organ donors.2 Each year, 6% of patients waiting for an organ transplant die on the waitlist and another 4% are removed from the waitlist when they become too sick to undergo transplant surgery.1 Organ procurement organizations (OPOs), donor hospitals, transplant centers, and in the United States, the Organ Procurement and Transplantation Network are attempting to address the organ shortage on 2 fronts, by increasing the number of organ donors and by increasing the number of transplantable organs recovered from each donor.3

Most potential organ donors are referred from critical or ICUs.4 However, several studies have shown the importance of the emergency department (ED) as an underused source of potential donors. These studies have found that ED patients often were not identified as potential donors3–8 and that educating ED staff to recognize referral triggers increased the donation outcomes of these units.9

Michael and O’Connor9 compared donation outcomes after referral from the ED to donation outcomes after referral from
an inpatient unit (usually an ICU). In their 2009 study, they found that patients referred from the ED were significantly more likely to be organ donors than ICU-referred patients even after controlling for mechanism of injury, age, and race. They attributed the higher rate of ED donation to earlier identification and referral allowing earlier OPO involvement, more time for family decision making, and identification of potential donors with fewer comorbidities.

An unexplored question is whether the number of OTPD is affected by the unit the patient was in at the time of referral. Our hypothesis was that patients referred from the ED would be more likely to become organ donors than patients referred from ICU and would result in a greater number of OTPD.

**Methods**

A retrospective cohort analysis was performed of all patients referred to a single OPO, Pacific Northwest Transplant Bank (PNTB), for a period of 60 months. PNTB’s designated service area includes 81 hospitals in Oregon, southwest Washington, and southwest Idaho. The study population included all patients referred to PNTB for internal organ donation between July 1, 2007 and June 30, 2012.

PNTB’s electronic databases were queried to identify the patient cohort and study variables. The analysis included patient demographics, date and time of admission and referral, consent outcome, origin of referral (ED or ICU), mechanism of injury, and for those patients who became donors, number of organs donated. The primary outcome was donation. The probabilities of a subject being an organ donor were compared between groups using logistic regression. The number of organs recovered per donor was analyzed using Poisson regression. Statistical significance was established at the \( P \) less than .05 level. Statistical analyses were conducted using R.10

A secondary subgroup analysis was conducted with only those patients deemed medically suitable potential donors by PNTB. This secondary analysis, conducted using the same statistical methods as described earlier, enabled examination of consent rates and other factors associated with converting potential donors into actual donors.

This study was approved by the Legacy Health System institutional review board and conformed to the tenets of the Declaration of Helsinki.

**Results**

The cohort consisted of 7,437 patients with 243 patients referred from the ED and 7,194 referred from the ICU. Of the 7,437 patients referred, 557 (7.5%) were determined by PNTB to be medically suitable for donation and 420 (75.4% of potential donors, 5.6% of all referred patients) became internal organ donors.

The demographics of the patients referred from the ED did not differ from those referred from the ICU in age, sex, or race but did differ in injury type, as shown in Table 1.

Among all patients referred for organ donation, those referred from the ED were determined to be potential organ donors more frequently than those patients referred from the ICU (23.5% vs 6.9%, \( P < .01 \)) and were more likely to become organ donors (19.3% vs 5.2%, \( P < .01 \)). Trauma patients referred from the ED were more likely to become donors than trauma patients referred from an ICU (36.7% vs 17.0%, \( P < .01 \)). Among medically suitable potential donors only, ED-referred patients trended slightly toward being more likely to become donors, but the difference was not statistically significant (ED 78.3% conversion rate vs ICU 74.6% conversion rate, \( P = .20 \)). Emergency department referrals trended toward higher probability of consent being given (ED had a 64.9% consent rate and ICU had a 54.8% consent rate), but again, it was not found to be

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Cohort demographics and injury type by unit of referral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall (n = 7,437)</td>
<td>ED (n = 243)</td>
</tr>
<tr>
<td><strong>Age, y, mean (SD)</strong></td>
<td>54.74 (19.2)</td>
</tr>
<tr>
<td><strong>Sex, n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>2,933 (39.4)</td>
</tr>
<tr>
<td>Male</td>
<td>3,995 (53.7)</td>
</tr>
<tr>
<td>Not available</td>
<td>510 (6.9)</td>
</tr>
<tr>
<td><strong>Ethnicity, n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>6,252 (84.1)</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>370 (5.0)</td>
</tr>
<tr>
<td>Asian</td>
<td>170 (2.3)</td>
</tr>
<tr>
<td>Black or African American</td>
<td>164 (2.2)</td>
</tr>
<tr>
<td>Native American</td>
<td>42 (.6)</td>
</tr>
<tr>
<td>Middle Eastern</td>
<td>31 (.4)</td>
</tr>
<tr>
<td>Unknown</td>
<td>408 (5.5)</td>
</tr>
<tr>
<td><strong>Injury type, n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Trauma</td>
<td>886 (11.9)</td>
</tr>
<tr>
<td>Nontrauma</td>
<td>6,551 (88.1)</td>
</tr>
</tbody>
</table>

ED = emergency department; ICU = intensive care unit.
statistically significant on univariate analysis ($P = .15$). Potential donors with penetrating trauma were significantly more likely to be referred from the ED than those with blunt trauma ($P < .01$) and were significantly more likely to become donors ($P = .02$). Among nontrauma patients, admitting diagnosis was not associated with the likelihood of ED referral or likelihood of potential donors becoming donors. Among potential donors, the time elapsed between admission and referral was lower in the ED than in ICU (.25 days vs 1.23 days, $P = .02$), and the time elapsed between admission and consent was lower in the ED than in ICU (.87 days vs 2.51 days, $P = .04$).

Donors referred from the ED had a greater number of OTPD than those referred from the ICU (mean 3.79 vs 3.16, $P = .02$) (Fig. 1). Trauma patients had a greater number of OTPD than nontrauma patients (mean 3.70 vs 2.92, $P < .01$). Among all referred patients, unit of referral was a significant predictor of number of OTPD even after adjusting for the higher proportion of ED referrals who were trauma patients ($P = .01$). Among only those patients who were deemed to be potential donors, unit of referral was again a significant predictor of number of OTPD after adjusting for the higher proportion of ED referrals who were trauma patients ($P = .02$). Mechanism of injury did not impact number of organs per donor when comparing penetrating to blunt trauma ($P = .45$); among those with nontraumatic brain injury, there was a trend toward significance in number of organs per donor when comparing cerebrovascular accident to anoxic nontraumatic injuries ($P = .07$), with patients with anoxic injuries having more transplantable organs. Among actual donors, unit of referral was no longer a significant predictor of OTPD after adjusting for the higher proportion of ED referrals who were trauma patients ($P = .19$).

Among actual donors, adjusting for age ($P < .01$), the number of organs per donor is higher from the ED ($P = .05$).

### Comments

Our findings validate other studies showing that ED-referred patients are more likely to become donors than ICU-referred patients. We also found that ED-referred patients have a greater number of OTPD than patients referred from the ICU, in what we believe to be the first study addressing this question. These findings underscore the importance of early referral in potentially increasing the number of transplantable organs available.

Centers for Medicaid and Medicare Services regulations require hospitals to notify OPOs of all ventilator-dependent patients with severe brain injuries before discontinuing life support measures. In attempts to ensure all potential donors are referred and to increase early referrals, many hospitals and OPOs have broadened the clinical trigger for referral to include the absence of certain brain stem reflexes, a Glasgow Coma Score of 5 or less, the family’s asking about donation, or a plan to discuss withdrawing support as triggers for referral.

By design, clinical triggers for referral for donation evaluation are independent of clinical diagnoses and prognoses. Validated prognostic tools for survival after brain injury do not have the accuracy, on presentation to the ED, to predict outcome at the individual patient level. Clinical triggers have evolved and encourage referral of any patients exhibiting signs of a suspected neurologic injury. Early clinical opinion regarding survivability should not be used as a prerequisite for a referral. Conversely, an opinion that the injury may be survivable should not impede the referral of a patient who meets a clinical trigger.

Several authors have addressed the importance of, and appropriateness of, approaching families about donation early in the hospital course. Notwithstanding the imperfection of our available diagnostic tools, many ED patients have such extensive injuries that they are believed to be nonsurvivable. Medical ethics dictate discontinuation of support when care is futile unless organ donation may be possible. This difficult clinical situation is best addressed through a carefully timed and delivered approach to the family by the organ donation agency and/or designated requestor addressing organ donation opportunities.

Determining the patient’s care plan (continued support for organ donation vs withdrawal of support) requires giving the family time to understand and accept that their loved one has died or is dying. Providing this time necessitates maintaining organ function and patient stability, when possible, until the family can be located, notified of the death or impending death, and given time to understand their loss. Emergency providers’ responsibility to avoid doing harm extends to family members, making it clear that continuing even futile care to allow the family time to accept their loss and consider organ donation is ethically appropriate.

For legally registered donors, in most US jurisdictions, family consent is not required. Minors and nonregistered potential donors require written consent of a surrogate decision maker identified by each jurisdiction’s next-of-kin hierarchy. Studies of factors contributing to family consent for organ donation show consent rates are 2.5 times higher when made in a private setting, decoupled (the discussion of organ donation is separate from the notification of the grim prognosis or death), and involve OPO personnel in the consent process. One of the Donation and Transplantation Community of Practice strategies calls for rapid, early referral, and “linkage” of donation staff to the families of potential donors as soon as an approach is appropriate. This enables the OPO to interact early and spend more time with the families of potential donors, both strongly associated with families providing consent for donation. In an ED, decoupling is not always possible; for example, if the patient is unstable or if the family has expressed interest in withdrawing support rather than having the patient admitted to the ICU. Both these scenarios necessitate an early, non-decoupled approach about donation, making it even more important to ensure that the other controllable factors are optimized to increase the odds of family consent. Early
referral enabling early linkage and collaboration between the ED physician and staff and the OPO can set up the approach that will best serve these families.20

Michael and O’Connor hypothesized that consent rates would be lower among potential donors referred from the ED, but their results actually showed the opposite, although the association was not statistically significant after controlling for confounding factors on regression analysis. Similarly, our study showed a clinically but not statistically significant difference in consent outcomes based on unit of referral. Other studies have shown similar results: 1 study15 reported a 66% consent rate for families that approached about donation immediately after their loved ones’ circulatory deaths in the ED, a consent rate comparable with brain death (and therefore ICU based) consent rates at the time.22 It is important to carefully consider the timing of approaching a family about donation, but the location of the death appears to only moderately influence consent outcome.

Catastrophic brain injury guidelines (CBIGs) and donor management goals (DMGs) are a standardized set of critical care end points that serve as a set of goals for pre-brain death (CBIGs) or postbrain death (DMGs) patient management. These goals are designed to be used to bring the patient to normal renal function, volume status, ejection fraction, oxygenation, and electrolytes. The donor hospital’s use of CBIGs before brain death can improve the OPO’s ability to achieve DMGs postbrain death.23 Achieving a DMG “bundle” (any 8 of 10 DMGs) has been found to significantly increase OTPD.24

We attempted to determine whether earlier referral to the OPO, and therefore earlier institution of CBIGs and DMGs, influenced the finding that the number of OTPD was greater among ED referrals. The time elapsed between admission and referral, and between admission and consent, was significantly shorter in ED-referred patients. However, this shorter time was not associated with an increase in OTPD as we would have expected. A possible explanation for this is that the ED staff, recognizing the patient’s potential to donate, instituted more aggressive resuscitative measures than they might have done for a patient who did not “look” like a potential donor. These aggressive measures would naturally mirror the official CBIGs because CBIGs are simply goals for normalizing clinical parameters. By beginning CBIGs before the OPO’s involvement, hospitals may have increased OTPD in a way that we cannot measure without comparing ED interventions between potential donors and nonpotential donors, which was beyond the scope of this study.

Mechanism of injury and patient age directly affect OTPD. Trauma patients tend to be younger and often have fewer comorbidities than nontrauma patients and are, therefore, on average more likely to have transplantable thoracic organs, as are younger patients regardless of mechanism of injury. The fact that unit of referral remained a significant predictor of higher OTPD among potential donors even after adjusting for trauma status and patient age indicates that the location of referral, not just the patient’s age or trauma status, affects the number of organs that can be transplanted.

A potential barrier to early referral from the ED is the concern that referral would change the patient’s care or create the perception that the patient’s care is less aggressive once referred for organ donation.25,26 This perception could undermine public trust in both the emergency care providers and the organ donation system.27 Evidence does not support the concern that the level of care provided to the patient would decrease after referral: Michael and O’Connor found that patients referred from the ED were more likely to ultimately survive compared with patients referred from inpatient settings (14.9% survival rate in ED, 9.5% inpatient, P < .01). Considering donation as a potentially desirable outcome for the patient may lead to more aggressive care28 and may forestall withdrawal of support when care is deemed futile.

Another potential barrier to early referral is that organ preservation can be seen as interventions on an individual that are intended to benefit another party, thereby creating a conflict of interest.29 Addressing these issues, Michael and Jesus25 wrote that ethical boundaries require the patient to be treated without regard to the interests of any possible organ recipients until the patient is declared brain dead and consent is obtained. Other authors, however, have found that the patient’s potential interest in becoming an organ donor, even before donor registry status or family consent is known, is best promoted by maintaining the opportunity to donate viable organs.30 Provided futility of care is determined according to evidence-based guidelines, organ preservation to respect the patient’s supposed wishes can ethically proceed,31 with appropriate urgency to determine the patient’s actual wishes by determining donor registry status or their wishes via surrogate decision maker.

Aggressive resuscitation of a potential donor with a nonsurvivable injury has the potential to increase the total cost of care for that patient. That increased cost is far outweighed by the financial and clinical cost to society of losing potentially transplantable organs. Early referral from the ED enables the OPO to quickly make a determination as to donation potential and approach families as soon as is appropriate. Thus, patients with nonsurvivable injuries who are not potential donors for medical or lack of consent reasons, and whose families are inclined to withdraw support in the ED, can avoid unnecessary admission to the ICU. In the case of registered donors or consenting families, because OPOs assume costs for donors once death is declared and consent is present, the earlier the consent the lower the cost to the patient’s guarantor. These differences in a few days of ICU stay are costly, but they quickly become insignificant when compared with the quality of life each donated organ represents for a recipient and when compared with the societal savings in health care costs provided by each transplantable organ.1
which we attempted to mitigate by including as large a sample size as was available. Because the data were gathered retrospectively, we were not able to investigate the impact of donors’ comorbidities on their OTPD. In analyzing the impact of the potential confounding factor of time of admission, we relied on the referrer’s report of the patient’s time of admission, which may have been interpreted differently among different referrers. Additionally, our analysis of consent outcome among potential donors is limited by the lack of a nationally accepted definition of which patients are potential donors after circulatory death (DCD). Accordingly, our definition of potential donors includes only patients declared brain dead and donors who actually became DCD. Including “potential” DCD whose families declined consent may change the consent rates.

Future studies including potential DCD and, therefore, a more complete accounting of true donation potential, would provide insight into the consent differences that our study did not find to be statistically significant. An in-depth look at patient factors that affect OTPD (age, comorbidities, cause of death, implementation of CBIGs, and DMGs) would help clarify why ED-referred donors have more organs per donor. Because PTNB has begun educating ED staffs about the importance of referring from the ED, it will be interesting to see whether the difference in donation outcomes and OTPD persists when EDs begin referring more patients.

**Conclusions**

Referral for organ donation from the ED is associated with an increased likelihood of organ recovery and with an increased number of OTPD. Referring patients from the ED is ethically appropriate and enables a timely decision about pursuing organ donation. Increasing the number of donors, and the number of transplantable organs, is of clinical and economic value to society; many life-years are saved through transplant, and many transplant recipients are able to return to work and contribute to their community.

**References**

48. In this article, Miller et al present a retrospective study of patients referred for organ donation to a large OPO based in the northwestern United States. The authors’ work focuses on the efficiency of referrals of potential organ donors to produce actual donors, the number of organs that each person donated for transplantation, and whether the donors came from ICUs or EDs. They conclude that ED referrals are more efficient than ICU referrals regarding both the number of actual donors and the number of organs per donor obtained. They also make a case for the appropriateness of ED referral regarding the benefits obtained for increasing the number of organs for transplantation and briefly review the ethical concerns regarding referral for patients with nonrecoverable brain injuries.

In my opinion, the methodology used is not only sound but appropriate to answer the relevant questions of the study. The principal end points (organ donation efficiency) are not affected by the retrospective nature of the study because the selection criteria is in fact the end point of the study, and in this respect, no case was lost. As well, randomization has no role in this study. This removes two of the major limitations of a retrospective study.

The results reflect the dissimilar nature of the ICU and ED referral services. Because ED is the first contact point for patients with major brain injuries, it is natural that the diagnosis of non-recoverability is done at the early stage of the care process. Also this cohort of patients, as compared with ICU patients, was less at risk for infection exposure or multiorgan failure. This by itself can account for both the increased percentage of actual donors referred from EDs in comparison with referrals from ICUs and also for the increase in the number of organs obtained per donor.

One question, which this study does not address, is: what proportion of potential donors from the cohort of ED referrals would have become actual donors if there was no policy for organ donor referral in place? I venture to predict that the proportion would be smaller than that obtained in this study. This question needs to be taken seriously,
particularly in places where EDs do not have a policy to refer potential donors to local OPOs.

As convenient as it is for increasing the number of organs available for transplantation in a situation where the need outweighs the resource, referrals from EDs confront ethical problems, mainly concerning the issue of nontherapeutic intervention. One side rejects the treatment of patients not in their own interest, such as with nontherapeutic ventilation, without direct consent,1 and the other side argues that it is a pragmatic and ethical approach to do good for the patients waiting for an organ2 and that the best way to permit nontherapeutic procedures in these cases is to extend the power of proxies.3

I am of the opinion that in a medical community that has already departed from the Hippocratic “primum non nocere” (violated in the cases of cosmetic surgery and nontherapeutic nephrectomies of live kidney donors), we need to adopt the more Kantian concept of intentionality—of willing the good. We need to analyze nontherapeutic interventions not as pure pragmatism, where the end justifies the means and a human body is treated as a commodity, nor with the excuse of protecting the rights of the potential donor, which ignores the fact that patients die waiting for an organ and the medical community has the obligation to try to minimize these deaths and ignores the potential violation of the wishes of the potential donors, which might be determined by asking their relatives. As with most questions in life, the answers are not right or wrong. The solution may rest not in whether a nontherapeutic intervention is accepted or refused based on a particular ethical view but may lie in the way the nontherapeutic intervention is implemented. Ideally, the good is done when the donor is not considered merely a commodity, when the consequences of referring (or not referring) a donor are considered in terms of human lives and the quality of life of potential recipients, and when an attempt is made to determine the wishes of potential donors who are no longer capable of communicating their desire.

References