

Attaining specific donor management goals increases number of organs transplanted per donor: a quality improvement project

Most organ procurement organization professionals and transplant surgeons intuitively know that meeting donor management goals improves organ allocation and transplant outcomes. In this era of evidence-based medicine, it is important to know whether the data support this assumption. All 6 organ procurement organizations in the United Network for Organ Sharing's region 10 agreed on 6 specific donor management goals. The organ procurement organizations then compared the number of organs transplanted per donor when goals were met with the number when goals were not met. Results were broken down by donor type: standard-criteria donation, expanded-criteria donation, and donation after cardiac death. For all 6 organ procurement organizations combined, the data for all of 2008 show a substantial and statistically significant improvement in number of organs transplanted per donor for standard criteria donation and total donors when goals are met, with a smaller degree of improvement (although not statistically significant) in the number of organs transplanted per donor for expanded-criteria donation and donation after cardiac death when goals are met. (*Progress in Transplantation*. 2009;19:227-231)

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Every year the disparity grows between the number of patients waiting for a transplant nationally, now more than 100,000, and the number of organ donors, now at slightly over 8,000.^{1,2} The US Department of Health and Human Services, through the Health Resources and Services Administration, has initiated a series of national quality improvement collaboratives to increase the number of organ donors, to increase the number of organs transplanted, and to increase the capacity of transplant centers to perform these additional transplants.³

The 6 organ procurement organizations (OPOs) that comprise the United Network for Organ Sharing (UNOS) region 10 initiated a 3-state collaborative quality improvement project to study the relationship between attaining specific organ donor management goals and

the number of organs transplanted per donor. The group decided on the same method used in the collaborative, which is the Plan, Do, Study, Act (PDSA) model.⁴ The Plan stage involved designing the study, the data elements, data collection points, and duration. The Do stage was to collect the data for a 1-year period for all donors within the region. The Study stage was the data analysis to determine any correlations. The Act stage is to publish our findings and expand the scope of the project.

Objective

The objective of the study was to determine if there is a correlation between meeting specific donor management goals and the number of organs transplanted per donor. If a positive correlation were found,

Table 1 Region 10 donor management goals

Mean arterial pressure ≥ 60 mm Hg
Central venous pressure ≤ 10 mm Hg (or serum osmolality 285-295 mmol/kg)
Sodium ≤ 155 mmol/L
pH 7.25 to 7.5
Pressors: 1 or none (1 pressor plus vasopressin to treat diabetes insipidus is okay)
Po ₂ ≥ 300 mm Hg while on 100% oxygen (or a PaO ₂ /FiO ₂ ratio >3)

we would promote active donor management to attain these goals and increase the number of organs transplanted per donor.

Design

Several consensus meetings were held in person and via the Internet. These meetings established the outline of the project and the timeline, who would collect and report the data, and who would do the data analysis within each of the OPOs.

The first decision was to determine what data would be collected. A large volume and variety of data were available on each donor. One approach would be to do a detailed analysis of all of these data elements to determine which ones would affect the number of organs recovered and transplanted. This analysis would take some time and effort, so to expedite this quality improvement project, the group decided to use a consensus method to determine the data that would be collected and analyzed.⁵

The next decision was to determine what value or range of values to set as a donor management goal for that item. Again, to expedite this quality improvement project, the group decided to use a consensus method. So after this process, a donor management goal set was developed that included 6 elements and the target value for each element⁶⁻⁹ (Table 1).

For some of the OPOs, the resulting donor management goal differed from what the OPO was currently using. Some of those OPOs were reluctant to change their standard donor management procedures without significant evidence from the literature. OPOs that decided not to change their donor management procedures did agree to report all of the data elements each month so that we could have a significant number of donors in each category. They agreed that if the final analysis showed a positive correlation between meeting donor management goals and the number of organs transplanted per donor, then in the second PDSA cycle, they would actively manage their donors to achieve the donor management goal targets.

Additional decisions had to be agreed upon concerning the methods. One consideration was when

during the donor management process the data were collected. Because this was an initial study, it was decided that the measuring point would be the final value of each item before the recovery surgery. Later PDSA cycles could also be used to evaluate the values upon admission to the hospital and also at the beginning of the OPO's donor management.

Another decision was whether to consider the 6 items of the donor management goals as 1 single bundle or as 6 separate items. The group decided to consider the 6 items as a single bundle. Thus, if the management of the donor met all 6 of the goals, that donor would be recorded as a yes. If 5 or fewer of the donor management goals were met, that donor would be recorded as a no.

Outcome Measures

Another factor was whether to consider the donors from all 6 OPOs as 1 large group or to break the donors into the various types. Since the Health Resources and Services Administration collaboratives were looking at donors by type, and regulations from Center for Medicare and Medicaid Services also were considering donor type,¹⁰ the group decided that the data would be aggregated according to donor type: standard-criteria donor (SCD), expanded-criteria donor (ECD), and donation after cardiac death (DCD). A category for all donors combined was also created, called "total donors." Each donor would be grouped by type, by whether the donor management goals were met, and by the number of organs transplanted from that donor. A private Web site was created, where each OPO could record its data each month. The outcome measures are listed in Table 2.

Table 2 Outcome measures

No. of SCD cases meeting all criteria
No. of organs transplanted from those cases
No. of SCD cases not meeting all criteria
No. of organs transplanted from those cases
No. of ECD cases meeting all criteria
No. of organs transplanted from those cases
No. of ECD cases not meeting all criteria
No. of organs transplanted from those cases
No. of DCD cases meeting all criteria
No. of organs transplanted from those cases
No. of DCD cases not meeting all criteria
No. of organs transplanted from those cases

Abbreviations: DCD, donation after cardiac death; ECD, expanded-criteria donation; SCD, standard-criteria donation.

Table 3 Results for donor management goals

Group	No. of organs transplanted per donor			P
	Goals met	Goals not met	Gain	
SCD	4.87	3.10	1.77	<.001
ECD	2.16	1.57	0.59	.30
DCD	1.90	1.75	0.15	.77
Total	3.87	2.51	1.36	<.001

Abbreviations: DCD, donation after cardiac death; ECD, expanded-criteria donation; SCD, standard-criteria donation.

The group decided that the first cycle of this PDSA would last 1 year. At that point, the data would be analyzed for statistical significance of any correlation between meeting donor management goals and the number of organs transplanted per donor. Then subsequent more elaborate PDSA cycles could be initiated on the basis of the results. This method is explained in “out of the crisis,” the classic textbook on quality improvement by W. Edwards Deming.¹¹

Results

For the 1-year period, the 6 OPOs in 3 states combined for a total of 774 organ donors. Of these, 264 (34%) met donor management goals while 510 (66%) did not. When donor management goals were met, the number of organs transplanted per donor was 3.87, whereas the number of organs transplanted per donor when goals were not met was 2.51. This difference is statistically significant ($P < .001$).

The difference in number of organs transplanted per donor was equally pronounced for the SCD category. This category had 474 donors; 171 (36%) met

donor goals and 303 (64%) did not meet goals. When donor management goals were met, the number of organs transplanted per donor was 4.87, compared with 3.10 when goals were not met. This difference is statistically significant ($P < .001$).

In the ECD and DCD categories, the number of organs transplanted per donor increased when management goals were met, but the difference was not as great as in the total and SCD categories. For the ECD category, 31% of donors met goals and had 2.16 organs transplanted per donor. In comparison, ECD donors who did not meet the goals had 1.57 organs transplanted per donor. This difference was not statistically significant ($P = .30$). Likewise, for the DCD category, the increase was not as great: 1.90 organs were transplanted per donor when goals were met, and 1.75 organs per donor were transplanted when goals were not met. This increase was not statistically significant ($P = .77$). Overall group results are listed in Table 3.

Bar charts were created to show more clearly the gain for each of the categories (SCD, ECD, DCD, and total). Overall gain for each of the categories is shown in Figure 1.

Further analysis was done to control for the possibility that 1 very high performing OPO or 1 very poor performing OPO might skew the results for the whole group. Similarly, smaller sample sizes could make the results of the study more difficult to interpret for OPOs that handle fewer donors. Therefore, an analysis of variance was performed to adjust for the effect of variable OPO performance. Although the resulting P value of .02 shows that the number of organs transplanted per donor is significantly related to OPO, the gain in organs transplanted per donor was still statistically significant ($P < .001$) when donor management goals

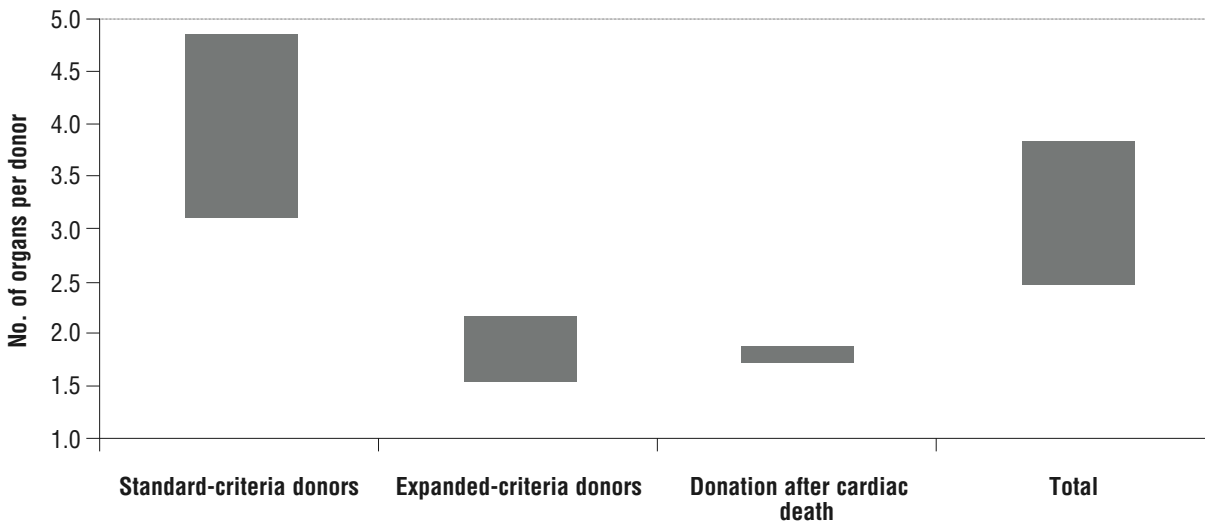


Figure 1 Increase in number of organs transplanted per donor when donor management goals are met, sorted by donor type for United Network for Organ Sharing region 10.

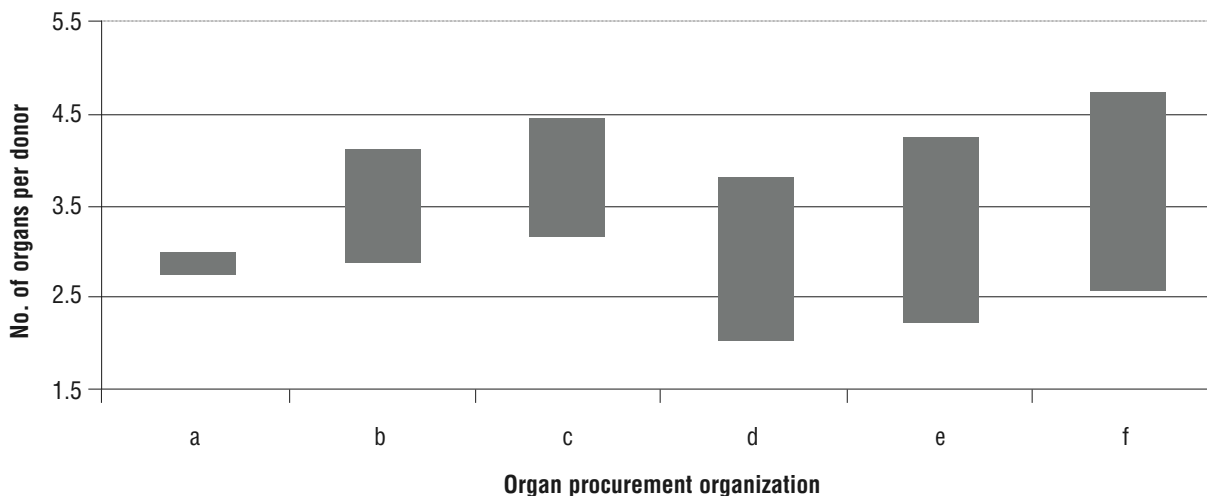


Figure 2 Increase in number of organs transplanted per donor when donor management goals are met by organ procurement organizations (a-f) in United Network for Organ Sharing region 10 for all donors.

were met. This significant gain was seen again in the SCD category ($P < .001$) after the effect of OPO was adjusted for. Although not statistically significant, an increase in the number of organs transplanted per donor was again observed in the ECD ($P = .17$) and DCD ($P = .83$) categories. Figures 2 and 3 illustrate the increases in number of organs transplanted per donor in each category for each OPO when donor management goals were met.

Conclusion

Analysis of the data demonstrates that when a specific donor management goal set is met, the number of organs transplanted per donor increases significantly for all donors as a group and for SCDs in particular. Although this conclusion is statistically valid, it is broad in nature and is the result of multiple factors and conditions that interact simultaneously. Further study is warranted to evaluate these factors individually and to analyze the effect of time on the various factors.

Further studies indicated include evaluating each of the 6 parameters individually, as well as a multivariate analysis of the factors to evaluate the effects of interactions among them. Further analysis should include analysis of the effect of meeting 5 of the 6 goals or 4 of the 6 goals, and so forth. It might be discovered that a certain subset is more effective in improving the medical status of the donor than other subsets of the goals.

Time is another factor that should be evaluated. In addition to measurement of donor management goals at the final endpoint before the recovery surgery, donor management goals could be measured when the donor patient is admitted to the hospital and when the OPO's

donation coordinator arrives. The initial interval would evaluate the effectiveness of hospital donor management, whereas the latter interval would evaluate the effectiveness of the OPO's donor management.

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None reported.

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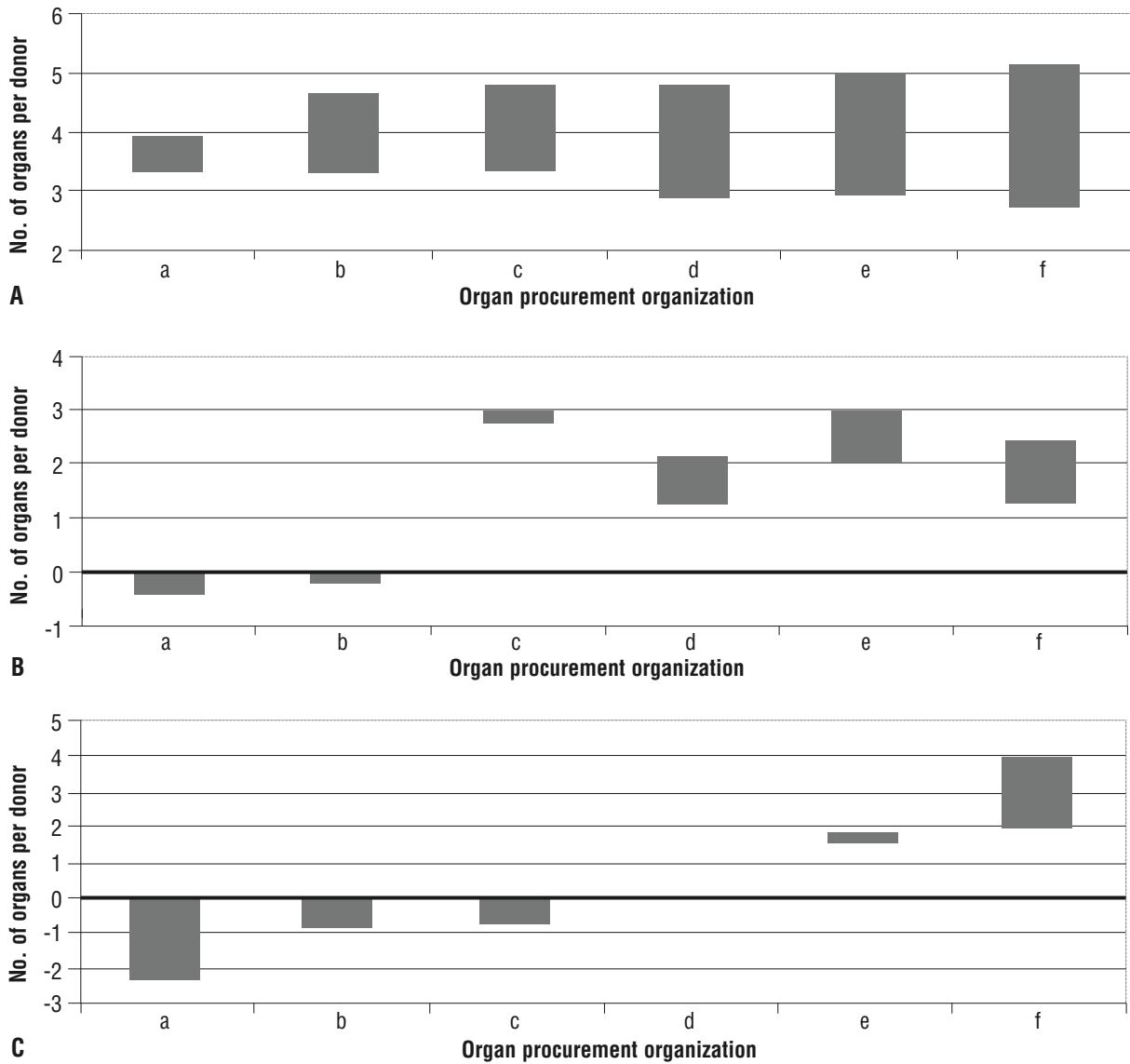


Figure 3 Increase in number of organs transplanted per donor when donor management goals are met by organ procurement organizations (a-f) in United Network for Organ Sharing region 10 for (A) standard-criteria donors, (B) expanded-criteria donors, and (C) donors after cardiac death.

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