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# A Survey of Current Procurement Travel Practices, Accident Frequency, and Perceptions of Safety

Austin D. Schenk, MD, PhD,<sup>1</sup> William K. Washburn, MD,<sup>1</sup> Andrew B. Adams, MD, PhD,<sup>2</sup> and Raymond J. Lynch, MD<sup>2</sup>

**Background.** In 2018, 81% of the 36, 529 solid organs transplanted in the United States came from deceased donors. These organs were recovered through widespread use of aeromedical and emergency ground transportation systems. Urgently scheduled travel to remote hospitals at night and in varied weather conditions carries risk for the transplant professionals involved. A landmark survey conducted in 2007 demonstrated that 80% of respondents had experienced a “near-miss” event while on a procurement trip, and 15% had been involved in at least 1 accident. One decade later, we sought to revisit the issue of procurement related travel safety. **Methods.** A 32 question survey designed to interrogate travel practice, accident frequency, and perceptions of safety was sent to the American Society of Transplant Surgeons membership. **Results.** Our survey response rate was 20.6%. At least 1 travel accident with bodily injury was reported by 23% of respondents and yet only 7% of respondents reported feeling “unsafe” or “very unsafe” during procurement travel. Sixteen percent of respondents participated in a procurement at a dedicated organ procurement facility, and only 53% of procurement surgeons completed at least 1 deceased donor procurement at their own hospital facility within the preceding 12 months. **Conclusions.** In a field where increasingly aggressive organ utilization is the norm, the efficiency and safety of procurement travel merits ongoing consideration. Addressing these concerns takes on new significance as organ allocation policies change geographic distribution to expand the extent of travel required for surgical teams.

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Transplantation is unique among surgical specialties in that surgical transplant teams routinely travel by air and ground to perform organ procurement procedures at hospitals unaffiliated with the transplant center. According to 2018 SRTR data,<sup>1</sup> >50% of liver transplants involve air travel, and all models of proposed changes in liver allocation<sup>2</sup> show increases in the distances organs will travel and the fraction requiring

air transport. Extensive air travel is already commonplace in thoracic transplantation. While the commercial aviation industry is often celebrated for outstanding safety with a total accident rate of 0.17 accidents per 100,000 flight hours in 2016, unscheduled noncommercial air travel of the type typically used for organ procurement flights was substantially more hazardous with accident rates between 0.89 and 5.93 accidents per 100 000 flight hours in 2016 depending on the type of general aviation utilized.<sup>3</sup> In the 65 years since the first renal transplant, there have been 8 publicly reported fatal organ procurement accidents with 37 transplant team members lost.<sup>4,5</sup>

Discussions of procurement travel safety were uncommon within the transplant community before a fatal accident in 2007 that took the lives of 6 members of a University of Michigan transplant team. This tragic event motivated a first-of-its-kind retrospective cohort study<sup>4</sup> by Englesbe and Merion that quantitated travel risk, stimulated discussion, and awareness, and led to implementation of changes in travel practice<sup>6,7</sup> designed to increase safety. Over the subsequent decade, active discussion of procurement travel safety has waned. Simultaneously, the field saw a 28.7% increase in the number of transplants performed between 2007 and 2018 with 35% growth in the number of deceased donor organs used,<sup>8</sup> creating an ever-growing need for procurement related travel.

In an attempt to measure progress and reinvigorate discussion of procurement travel safety within the transplantation

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<sup>1</sup> The Ohio State University Comprehensive Transplant Center, Columbus, OH.

<sup>2</sup> Emory University Transplant Center, Atlanta, GA.

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Correspondence: Austin D. Schenk, MD, PhD, Department of Surgery, Division of Transplantation, The Ohio State University Wexner Medical Center, 395 W 12th Ave, Suite 168, Columbus, OH 43210. ([austin.schenk@osumc.edu](mailto:austin.schenk@osumc.edu)).

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community, we surveyed the American Society of Transplant Surgeons (ASTS) membership to determine current travel practices, accident frequency, and surgeon’s perception of risk. Our data show a self-reported accident frequency greater than that reported by Merion and colleagues in 2009 and a discordance between perceived and self-reported risk. We believe these data are timely in that current policy proposals intended to increase equity and maximize utility in organ distribution,<sup>9,10</sup> as well as OPTN liver allocation policy changes temporarily implemented in May 2019, have significant bearing on the type and volume of procurement travel that will occur.

**MATERIALS AND METHODS**

A 32-question survey (Appendix 1, SDC, <http://links.lww.com/TXD/A225>) was created to determine experiences and attitudes in relation to travel for organ procurement. Questions were adapted from published work,<sup>4</sup> and the survey was tested for time and content by 10 surgeons at 3 centers. The final survey was distributed to the ASTS mailing list in August 2017. Five subsequent reminder messages were periodically sent to validated member addresses for which there had not been a recorded response to the original invitation. The study was open for 8 weeks. Results were compiled using standard analytic methods.

**RESULTS**

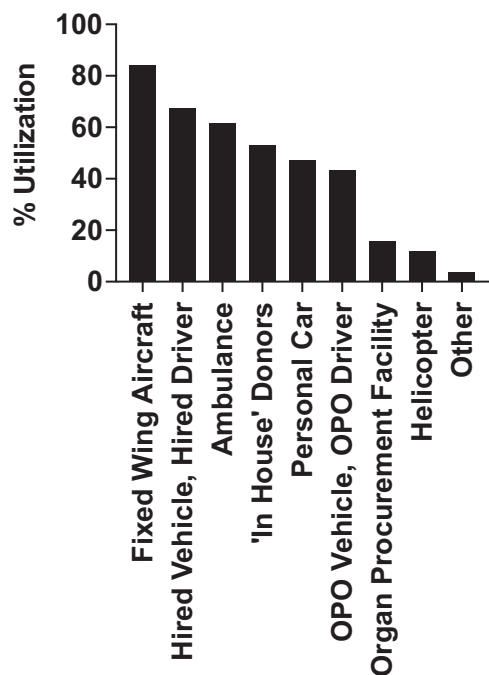
Among the 1272 ASTS members with a valid email address, 262 responses were received for an overall response rate of 20.6%. Respondents were from all 11 UNOS regions and were employed by 162 different transplant centers (Table 1). Data reflect practices within 53 of the nation’s 58 OPOs. Thirteen percent of respondents were current transplant fellows, and 87% were attending surgeons. Data reflect a total of 3167 practice-years for an average of 12.1 years per surgeon-respondent. Approximately 97% of respondents participate in abdominal transplant surgery, ~2% in cardiothoracic transplantation, and ~1% reported a procurement-only practice. Data reflect ~5240 procurement operations performed in the 12 months preceding this survey for an annual per-surgeon procurement volume of 20 operations per surgeon-respondent.

Fixed wing aircraft were utilized by 84% of respondents in their procurement practice, while only 12% reported helicopter use (Figure 1). Ambulance transport (62%), transport within OPO-owned vehicles (44%), and use of hired professional drivers (68%) were common. Forty-seven percent of respondents reported use of their own personal vehicles in their procurement practice. Only 16% of respondents participated in a procurement at a dedicated organ procurement facility and only 53% of procurement surgeons completed a deceased donor procurement at their own hospital facility within the preceding 12 months.

Additional personnel accompanying the primary surgeon on deceased donor organ procurements included OPO perfusionists, nonsurgical assistants, additional attending surgeons, fellows, residents, and medical students (Figure 2). OPO perfusionists were the most frequent additional participants (35% of procurements). It was extremely rare for >1 attending surgeon to travel on a procurement. Trainees (residents, fellows, and medical students) were very frequently

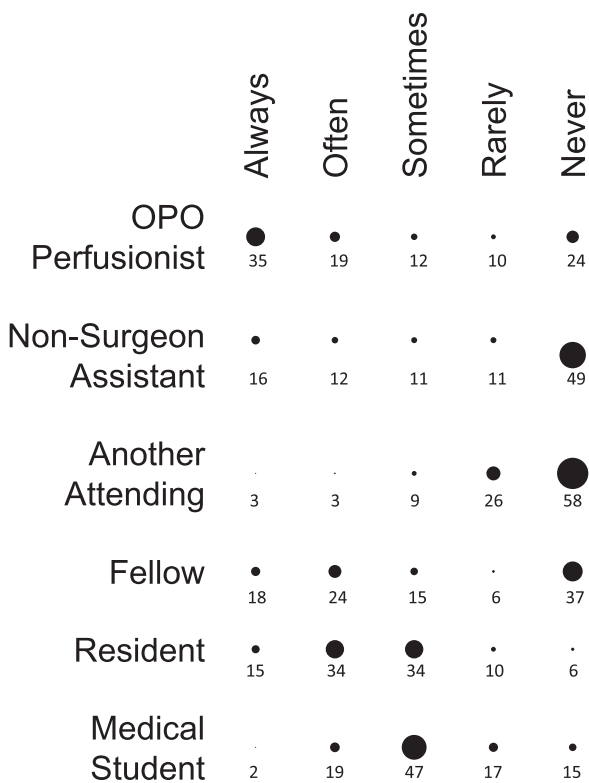
**TABLE 1.** Survey respondent demographics

	% of respondents
UNOS region	
-1 (CT, E VT, ME, MA, NH, RI)	6.9
-2 (DE, MD, NJ, PA, WV, Dist. Col.)	9.2
-3 (AL, AK, FL, GA, LA, MI, PR)	16.4
-4 (OK, TX)	9.2
-5 (AZ, CA, NV,NM, UT)	9.5
-6 (AL, HI, ID, MT, OR, WA)	3.4
-7 (IL, MN, ND, SD, WI)	12.2
-8 (CO, IA, KS, MO, NE, WY)	7.6
-9 (NY, W VT)	6.1
-10 (IN, MI, OH)	10.7
-11 (KY, NC, SC, TN, VA)	8.8
Fellow	13
Attending surgeon	87
Y practicing transplant surgery	
0–5	34.7
6–10	16.8
11–15	16
16–20	9.9
21–25	11.1
26–30	11.5
Surgical practice	
Kidney	91.6
Liver	82.4
Pancreas	73.3
Intestine	14.5
Heart	2.3
Lung	1.9
Procurement only	1.2



**FIGURE 1.** Modes of transportation utilized for organ procurement-related travel.

present. Fifty-seven percent of travel arrangements were made by the OPO and 37% by the transplant surgeon’s hospital.

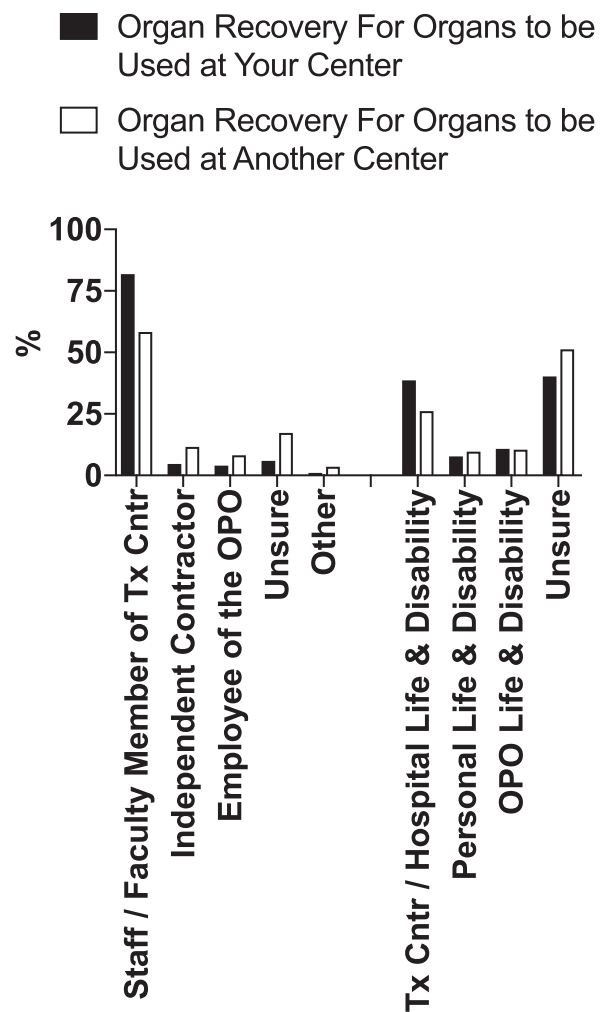


**FIGURE 2.** Additional personnel participating in organ procurement-related travel.

When procuring organs for use at the respondent’s own transplant center, most (82%) surgeons understood they were functioning as faculty at their own center, but 41% were unsure what entity was providing insurance coverage (Figure 3). When procuring organs for use at another transplant center, 18% of respondents were unsure whether they were working as faculty of their transplant center, as an employee of the OPO, or as independent contractors, and 52% were uncertain as to who was providing insurance coverage.

Survey questions #23 and #24 addressed personal experience with travel accidents, and 242 respondents provided complete responses. A total of 72 accidents with injuries (0 fatal, 2 serious, 70 minor) were reported utilizing ground transportation and a total of 27 accidents with injuries (3 fatal, 4 serious, 20 minor) were reported utilizing air transportation. Overall, at least 1 travel accident with bodily injury was reported by 23% of respondents and personal involvement in an air travel-related accident in which a death occurred was reported by 3 separate respondents. A total of 476 self-perceived ‘near misses’ were reported with 52% of respondents describing such an event. There was a trend toward decreased involvement in procurement surgery with increasing number of years in practice and a progressive increase in the risk of involvement in a procurement travel-related accident over the course of a career (Figure 4).

Respondents’ personal preferences for organ procurement were largely consistent with self-reported understanding of national preferences for organ procurement (Figure 5). These included preferences that DCD livers and intestines be procured by surgeons from the transplanting center. For non-DCD livers and pancreata, there was >50% acceptance of another center performing the procurement, and >60% of respondents reported no preference as to who procured both DCD and non-DCD renal allografts.

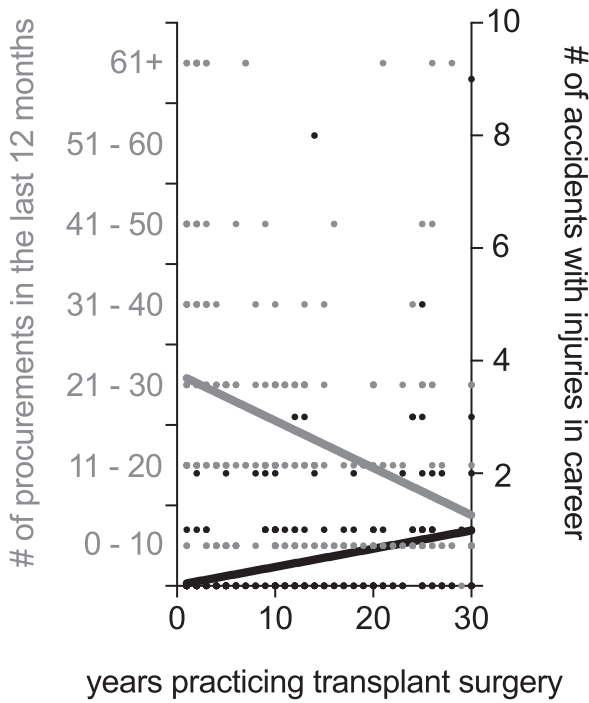


**FIGURE 3.** Employment status and insurance coverage during organ recovery.

Only 7% of respondents reported feeling “unsafe” or “very unsafe” during procurement travel (Figure 6). Fifty-eight percent of respondents felt that preservation of organ quality was a dominant consideration in making travel arrangements (Figure 7). Thirty-four percent of respondents felt that safety of the donor team was either not a consideration or was only a minor consideration. Travel cost was felt by 53% to be a moderate consideration, and 36%–42% of respondents felt that recipient-hospital, donor-hospital, and OPO schedules were moderate considerations in making procurement travel plans. Sources of anxiety reported (Figure 8) included weather, driver/pilot fatigue, and knowledge that a spouse or significant other was concerned about the surgeon’s travel. Sixteen percent of respondents were unsure how their procurement work contributed to their salary, and 37% reported that volume of procurement work made no defined contribution to their annual income.

## DISCUSSION

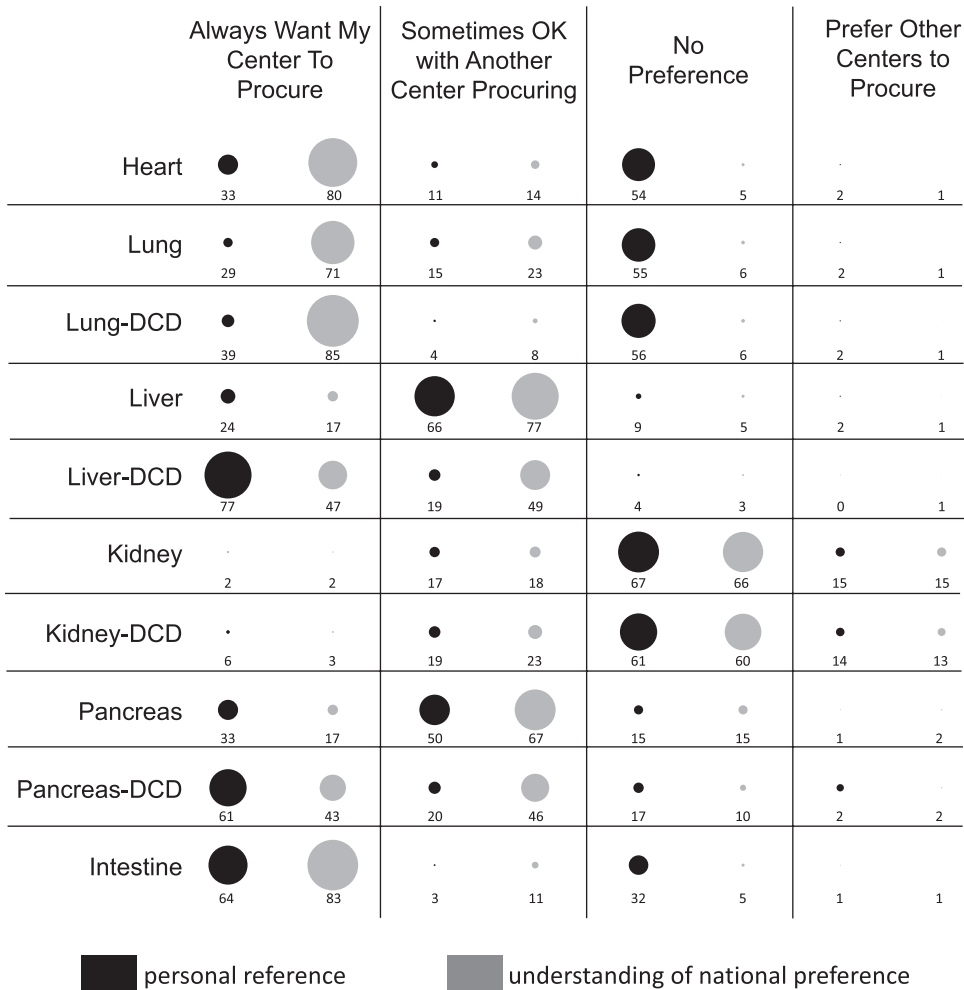
Our data reflect the cumulative experience and attitudes of a broad national cohort of abdominal transplant surgeons well distributed at early, mid, and late career stages. The hazards of aeromedical<sup>11</sup> and ambulance<sup>12</sup> transport are well described and affect large portions of the medical community



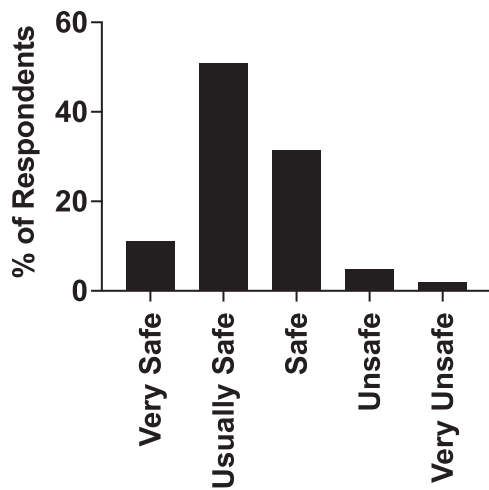
**FIGURE 4.** Procurement surgery volume and accident frequency by career stage.

including emergency medicine professionals, trauma responders, those active in critical care transport, and transplantation professionals. Although our data cannot predict actual risk, >1 in 5 respondents to our survey self-reported personal involvement in a procurement travel related accident in which bodily injury was incurred. An unexpected finding in the face of this reported risk is that our respondents reported an overall perception of feeling safe during organ procurement travel. We did not find large discrepancies between individual surgeon preferences and national procurement travel practices, and we discovered widespread uncertainty regarding insurance liability and coverage in the event of procurement travel related accidents.

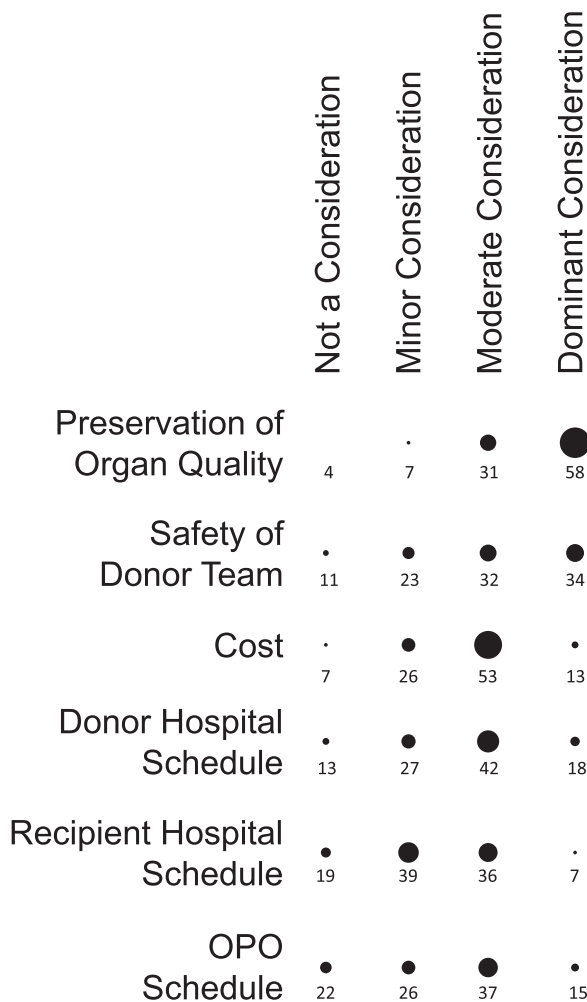
We intended for comparison of our study to the work of Englesbe and Merion<sup>4</sup> and hoped to measure progress in the last decade. In their work, 15% of respondents reported involvement in ≥1 procurement-related travel accident and only 16% of respondents reported feeling “very safe” during procurement travel. In our study, 23% of respondents reported involvement in ≥1 procurement-related travel accident and only 11% of respondents reported feeling “very safe” during procurement travel. We caution that these data most likely reflect little change in overall safety rather than a marked increase in risk. The Englesbe survey was administered just months after the Michigan tragedy and its impressive 38% response rate reflected a heightened, albeit



**FIGURE 5.** Personal preferences and national practices in organ procurement.

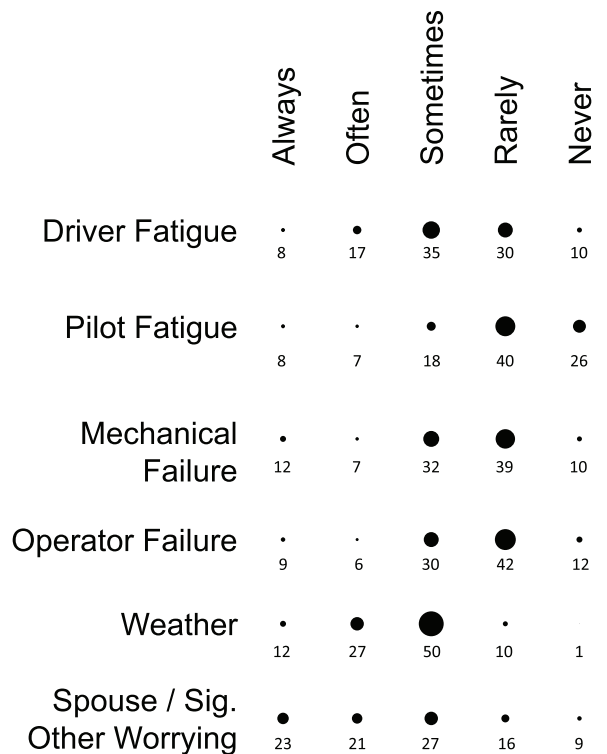


**FIGURE 6.** Perception of safety during organ procurement-related travel.



**FIGURE 7.** Considerations that shape organ procurement travel plans.

transient, interest in transportation safety. We speculate that our response rate of 21% reflects diminished interest in transportation safety within the community, and we acknowledge a potential bias toward participation by respondents who have had personal experience with a procurement travel-related accident.



**FIGURE 8.** Sources of anxiety during organ procurement-related travel.

The Gift of Life dedicated organ recovery facility in Ann Arbor was opened in 2016, nearly 9 years after, and partially as a response to, the tragic Survival Flight accident. Dedicated organ procurement facilities also exist in Missouri, Alabama, Ohio, Colorado, and Pennsylvania. Published outcomes from these facilities<sup>13</sup> highlight increased organ yield, increased efficiency, and reduced costs. Chapman et al<sup>14</sup> report a reduction in surgeon travel time from 8 to 2.7 hours and a 93% reduction in air travel. We found that only 16% of our respondents utilized a recovery center during the past year and we believe this represents massive underutilization of a resource likely to drastically improve safety within the field. A very recent report by Lindemann et al<sup>15</sup> highlights further advantages of daytime-operating enabled by organ procurement centers including increased rates of extubation in the operating room and decreases in postoperative transfusion. The authors speculate that organ procurement centers will reduce transplant surgeon burnout and enhance recruitment of young surgeons into the field. We believe that concentrating high volumes of procurements at regional recovery centers utilizing local teams that regularly work together will facilitate growth of high-functioning teams. This quality improvement, in turn, will allow recipient surgeons to opt for local recovery with greater confidence. While proliferation of donor centers would likely be the single most effective method of risk reduction, our survey also confirmed interest in other means of reducing travel including enhanced DCD prediction algorithms, increased utilization of bedside liver biopsy, and bedside liver assessment using ultrasound.

A discordance exists between our findings of 1 procurement-travel related accident per 5 survey respondents and only 5% of respondents reporting that they feel “unsafe” during travel. Because our data do not show significant discrepancies between

individual surgeon preferences and national travel practices, we hypothesize that most transplant surgeons view their travel as “necessary” which then encourages a psychology of risk minimization among surgeons who routinely tolerate working conditions that other professionals would consider untenable. We believe nearly all transplant surgeons would choose to risk additional travel rather than suffer an adverse patient outcome related to a procurement injury or oversight. In this context, willful inattention to the risks associated with procurement travel feels “dutiful” and is psychologically protective.

As the shift from donor service area-based allocation to broader distribution occurs across organ groups, the average distance between the site of organ procurement and the site of recipient surgery will increase. The simplest means of mitigating travel risk will be to transport organs rather than full recovery teams. Actionable measures the transplant community can take include (1) deliberately changing practice to request and utilize local procurement when available, (2) willingly provide local procurement services, (3) cooperate in the development of high-volume regional organ recovery centers, (4) lobby to ensure that the Medicare cost report does not financially disincentivize development of recovery centers, and (5) develop a mandatory accident-reporting system to provide clear data for monitoring of procurement travel safety.

In summary, we find little change in the self-reported frequency of travel accidents over the past decade. Expanded organ distribution and advances in ex vivo organ perfusion will impact frequency and modes of travel, as well as distances covered, and we hope that procurement travel safety will be a prominent variable as policy discussions occur. Transplant surgeons should be aware of the possibility that they will be involved in a procurement-travel related incident at some point in their career and leaders in the field need to develop best-practices that minimize risk. Individual transplant centers should take an important first step by educating transplant providers about their insurance liability and coverage. Lastly, we feel that procurement travel safety should be a dominant consideration driving the proliferation of dedicated organ recovery facilities. Travel will always be an inherent part of the work that we do as transplant surgeons, and provider safety should be addressed no less frequently than patient safety.

## REFERENCES

1. Scientific Registry of Transplant Recipients. Analysis Report: Data Request on Circle Based Allocation. 2018. Available at [https://optn.transplant.hrsa.gov/media/2640/li2018\\_01\\_analysis-report\\_20180924.pdf](https://optn.transplant.hrsa.gov/media/2640/li2018_01_analysis-report_20180924.pdf). Accessed August 22, 2019.
2. Bittermann T, Goldberg DS. Liver redistricting: what are the upcoming changes in liver allocation in the United States? *Curr Opin Organ Transplant*. 2017;22:112–117.
3. U.S. Department of Transportation Bureau of Transportation. National Transportation Statistics. 2018. Available at <https://www.bts.gov/topics/national-transportation-statistics>. Accessed August 22, 2019.
4. Englesbe MJ, Merion RM. The riskiest job in medicine: transplant surgeons and organ procurement travel. *Am J Transplant*. 2009;9:2406–2415.
5. Kay J. Mayo Clinic in the News. Helicopter Crash Kills 3, Puts Transplant on Hold. 2012. Available at [https://inthenews.mayoclinic.org/2012/01/19/helicopter-crash-kills-3-puts-transplant-on-hold-2/?utm\\_campaign=search](https://inthenews.mayoclinic.org/2012/01/19/helicopter-crash-kills-3-puts-transplant-on-hold-2/?utm_campaign=search).
6. Lynch RJ, Mathur AK, Hundley JC, et al. Improving organ procurement practices in Michigan. *Am J Transplant*. 2009;9:2416–2423.
7. Englesbe MJ, Shah S, Cutler JA, et al. Improving organ procurement travel practices in the United States: proceedings from the Michigan Donor Travel Forum. *Am J Transplant*. 2010;10:458–463.
8. Organ Procurement and Transplantation Network. National Data. 2019. Available at <https://optn.transplant.hrsa.gov/data/view-data-reports/national-data/#>. Accessed August 22, 2019.
9. Gentry SE, Massie AB, Cheek SW, et al. Addressing geographic disparities in liver transplantation through redistricting. *Am J Transplant*. 2013;13:2052–2058.
10. Snyder JJ, Salkowski N, Wey A, et al. Organ distribution without geographic boundaries: a possible framework for organ allocation. *Am J Transplant*. 2018;18:2635–2640.
11. Hon HH, Wojda TR, Barry N, et al. Injury and fatality risks in aeromedical transport: focus on prevention. *J Surg Res*. 2016;204:297–303.
12. Smith N. A National Perspective on Ambulance Crashes and Safety. Guidance from the National Highway Traffic Safety Administration on ambulance safety for patients and providers. *EMS World*. 2015;44:91–92, 94.
13. Doyle M, Subramanian V, Vachharajani N, et al. Organ donor recovery performed at an organ procurement organization-based facility is an effective way to minimize organ recovery costs and increase organ yield. *J Am Coll Surg*. 2016;222:591–600.
14. Doyle MB, Vachharajani N, Wellen JR, et al. A novel organ donor facility: a decade of experience with liver donors. *Am J Transplant*. 2014;14:615–620.
15. Lindemann J, Dageforde LA, Brockmeier D, et al. Organ procurement center allows for daytime liver transplantation with less resource utilization: may address burnout, pipeline, and safety for field of transplantation. *Am J Transplant*. 2019;19:1296–1304.