SCIENTIFIC REGISTRY OF TRANSPLANT RECIPIENTS

Sensitivity of 5-Tier System to Unadjusted Confounding

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Introduction

- The Scientific Registry of Transplant Recipients (SRTR) fits risk-adjusted models for its semiannual program-specific reports (PSRs). Although SRTR adjusts for as many important risk factors as possible, data for some may not be available. Confounding could occur if unadjusted risk factors are associated with transplant programs.
- If data for a true risk factor are not collected, and some programs perform transplants in more candidates with the risk factor than other programs, this could produce confounding, since the unadjusted risk factor would be associated with both the program and the outcome.
- If data were available for the unadjusted risk factors, their effect on program evaluations could be directly measured by adding the risk factors to the models and measuring how program evaluations changed. The effect is impossible to quantify without data.
- The E-value is the minimum strength of association of a confounder with either the treatment or outcome needed to explain the apparent relationship between treatment and outcome (VanderWeele and Ding, 2017). Regarding PSRs, the E-value for a program's hazard ratio (HR) is the minimum association of the confounder with either the program or the outcome. The E-value, therefore, provides context for interpreting the HR.

Methods

- E-values were calculated for the posttransplant HRs for each heart, kidney, liver, and lung program in the October 2018 PSRs using the EValue package for R.

Results

- The upper-left quadrant of Figure 1 shows boxplots of E-values for adult 1-Year graft survival for all heart, kidney, liver, and lung programs, with smaller organ-specific plots below. Similar plots for adult 1-year patient survival, pediatric 1-year patient survival, and pediatric 1-year graft survival are found in the upper-right, lower-right, and lower-left quadrants, respectively.
- Figure 2 shows the relationship between the maximum possible prevalence of a confounder with the E-value for several HRs. If it is possible for all the recipients at a program to have the unadjusted risk factor, then the E-value is minimized. If only a fraction of recipients could possibly have the confounder, the E-value necessary to explain the apparent HR must be larger, since fewer recipients are affected by the confounder.

References

- VanderWeele TJ, Ding P. Sensitivity analysis in observational research: Introducing the E-Value. Ann Intern Med. 2017;167(4):268-274. doi: 10.7326/M16-2607

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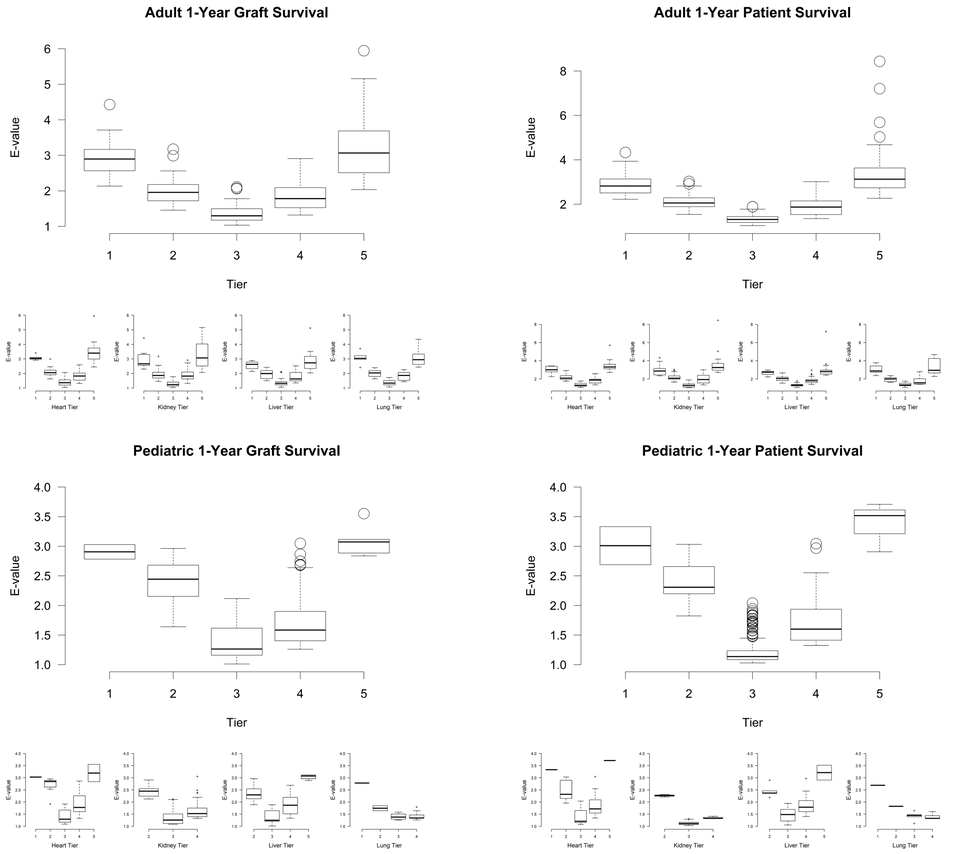

Figure 1
Boxplots of E-values based on the hazard ratios for posttransplant outcomes by outcome, tier, and organ from the October 2018 PSRs.

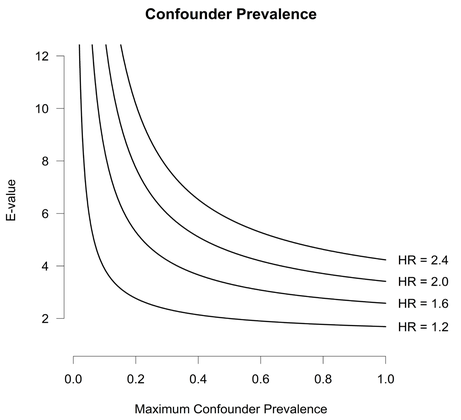

Figure 2
The necessary E-value increases as the potential prevalence decreases.

Conclusions

- For programs in tier 1, the smallest E-values are greater than 2, so a confounder twice as likely to be found among the program's recipients and associated with twice the risk of graft failure or death would not explain the program's HR. Alternatively, the association between the confounder and the program could be weaker if the HR for the confounder were higher, or the HR for the confounder could be lower if the association between the confounder and the program were stronger, but at least one measure of association must be greater than 2.
- In general, the E-values for programs in tiers 1 and 5 suggest that only a fairly common confounder with a strong effect on outcomes that is also strongly associated with the program could completely explain the program HRs. For programs in tiers 2 and 4, the necessary strength of association is weaker but not trivial.

The authors have no conflicts to disclose.