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).

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 in the October 2018 PSRs using the EValue package for R.
• 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.

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.

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.

References

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