Projection Development

National Donor Rates Projections

Available liver grafts under each regional model was projected from 2016 to 2025 first by calculating the national population based rate of donation (donors transplanted/total population) per year and used the average donation rate from 2010 to 2014 stratified by age group (18-34, 35-49, 50-64, and 65-84 years old), race/ethnicity (white, black, Hispanic, and other), sex, and BMI (<30 or ≥30 kg/m^2). We then used the historic liver utilization rates (liver grafts used/total donors) to project future donor utilization. The national average liver utilization rate from 2010 to 2014 also stratified by age group, race/ethnicity, sex, and BMI was utilized to project liver donor availability.

Regional Donor Rates Projections

Donor availability was also projected from 2016 to 2025 using the regional donation (regional donors transplanted/regional population) and liver utilization (regional liver donors/regional total donors) rates under each regional model. Donors were localized based on their zip code, state, or city information recorded in the UNOS database. Donors with unavailable zip code information were localized according to their state and city information if the state was not split during the regional division. Donors with insufficient location information were excluded during the regional variation analysis. Since the stratified regional donation data was often insufficient to accurately estimate donation and utilization rates (ie, there were zero donors in some groups in some years), the stratification factors of sex and age groups were relaxed because sex and age groups were the least significant factors per the Wilcoxon rank sum test. The 4 age groups were combined into 2: 18-49 and 50-84 years old.

Given the uncertainty in LT demand, we used liver donors/100 000 population age 18-84 (D/100K) as a measure of equity. We determined the variation between regions, by calculating

the coefficient of variation (standard deviation/mean) per D/100K in each regional allocation model.

Historical Analysis by Organ Procurement Organization

Historical Population

We derived the population within each OPO using data by state and county from the datasets described in the Liver Donor Projections by District Model section. As county population data from 2002 to 2009 was not available, we approximated the 2002-2009 county population using the average proportion of the population (relative to the total state population), which lived in those counties from 2010 to 2014. To maintain consistency of our results, we first estimated the proportion of the population by OPO as the ratio of the population at each OPO service area and the state population estimates from the county dataset from the US Census Bureau. We then applied this proportion to the state estimates from the state dataset from the US Census to obtain the total population by OPO.

Historical Donors

The OPTN database from 2002-2014 was also used to calculate the donation and utilization rates of whole and split livers for all donors with at least 1 organ transplanted. These rates were stratified by age groups, BMI (<30 or >=30), sex, and race/ethnicity. We localized the donors geographically based on their registered zip code in the OPTN database. We also used D/100K as a measure of equity during this sub analysis. The national and regional OPO heterogeneity was estimated using the coefficient of variation.

Table S1: National Organ Procurement Organization Coefficients of Variation for Donation per Year. CV – coefficient of variation

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CV	27.06%	21.27%	24.02%	26.47%	30.41%	30.37%	28.90%	30.03%	23.24%	25.74%	27.59%	30.84%	26.73%

Table S2: Overall Donation and Utilization Rates of the Best and Worst Performing Organ Procurement Organization with Respect to Liver Donors/100K. OPO – organ procurement organization

Year	Best Performing OPO		Worst Performing OPO	
	Overall Donation Rate	Utilization Rate	Overall Donation Rate	Utilization Rate
2002	2.64	87.80%	1.87	83.61%
2003	3.16	90.91%	2.12	92.86%
2004	3.92	86.29%	2.16	93.06%
2005	3.97	91.34%	2.33	92.41%
2006	3.53	86.92%	2.57	95.51%
2007	4.05	89.60%	2.25	91.14%
2008	4.44	89.93%	1.51	88.89%
2009	4.34	94.93%	1.94	82.86%
2010	4.43	88.59%	1.77	86.57%
2011	3.92	91.73%	1.91	89.04%
2012	4.15	95.07%	1.57	91.80%
2013	3.81	95.42%	1.76	79.71%
2014	4.25	96.60%	1.93	72.73%
min	2.64	86.29%	1.51	72.73%
max	4.44	96.60%	2.57	95.51%
5-yr avg	4.11	93.48%	1.79	83.97%

Table S3: Beta regression of demographic variables accounting for Organ Procurement Organization*. BMI – body mass index

Donation			**Utilization**	
Donor Characteristics	Coefficient	95% confidence interval	Coefficient	95% confidence interval
Male	0.12	0.11 to 0.14	0.07	0.05 to 0.10
BMI>=30	-0.22	-0.23 to -0.20	-0.32	-0.34 to -0.30
Race				
White	Reference		Reference	
Black	-0.18	-0.20 to -0.16	-0.72	-0.76 to -0.69
Hispanic	-0.39	-0.41 to -0.37	-1.05	-1.09 to -1.02
Other	-0.61	-0.63 to -0.59	-1.40	-1.43 to -1.36
Age Groups				
18-34	Reference		Reference	
35-49	0.04	0.02 to 0.06	-0.02	-0.06 to 0.01
50-64	0.09	0.07 to 0.11	-0.09	-0.12 to -0.05
65-84	-0.23	-0.25 to -0.21	-0.40	-0.43 to -0.37

*OPO coefficients not shown