

**Supplemental Table 1. Baseline Characteristics at Re-LT by Graft Failure Etiology in Patients with PSC.**

	<b>VT</b> <b>(n=194)</b>	<b>REC</b> <b>(n=178)</b>	<b>PNF</b> <b>(n=128)</b>	<b>BC</b> <b>(n=121)</b>	<b>CR</b> <b>(n=83)</b>	<b>AR</b> <b>(n=48)</b>	<b>Other</b> <b>(n=46)</b>	<b>INF</b> <b>(n=42)</b>	<b>Unknown</b> <b>(n=63)</b>
<b>Days between transplants</b>	59 (14-336)	2,519 (1,523-3,513)	28 (6-482)	504 (101-1,713)	1,670 (424-2,636)	54 (20-302)	48 (16-369)	208 (50-1,088)	2,211 (556-3,578)
<b>Age at re-LT</b>	46 (35-54)	47 (38-56)	44 (37-56)	48 (38-57)	45 (37-53)	42 (36-54)	40 (34-48)	44 (34-56)	47 (50-55)
<b>Male sex</b>	147 (75.8)	134 (75.3)	90 (70.3)	89 (73.6)	59 (71.1)	31 (64.6)	30 (65.2)	28 (66.7)	47 (74.6)
<b>Race/ethnicity</b>									
White	171 (88.1)	140 (78.6)	105 (82.0)	105 (86.8)	62 (74.7)	41 (85.4)	33 (71.7)	35 (83.3)	49 (77.8)
Black	17 (8.8)	28 (15.7)	18 (14.1)	12 (9.9)	17 (20.5)	5 (10.4)	9 (19.6)	6 (14.3)	10 (15.9)
Hispanic	3 (1.6)	8 (4.5)	5 (3.9)	2 (1.6)	4 (4.8)	2 (4.2)	4 (8.7)	1 (2.4)	2 (3.2)
Asian	2 (1.0)	1 (0.6)	0	1 (0.8)	0	0	0	0	2 (3.2)
Other	1 (0.5)	1 (0.6)	0	1 (0.8)	0	0	0	0	0
<b>Location</b>									
In ICU	65 (33.5)	21 (11.8)	70 (54.7)	24 (19.8)	12 (14.5)	18 (37.5)	24 (52.2)	8 (19.0)	13 (20.6)
Hospitalized	68 (35.0)	44 (24.7)	26 (20.3)	42 (34.7)	27 (32.5)	18 (37.5)	12 (26.1)	19 (45.2)	16 (25.4)
Ambulatory	61 (31.4)	113 (63.5)	32 (25.0)	55 (45.4)	44 (53.0)	12 (25.0)	10 (21.7)	15 (35.7)	34 (54.0)
<b>Mechanical ventilation</b>	32 (16.5)	10 (5.6)	52 (40.6)	7 (5.8)	7 (8.4)	14 (29.2)	12 (26.1)	6 (14.3)	6 (17.0)

<b>MELD score<sup>a</sup></b>	20 (12-27)	25 (20-34)	31 (20-36)	23 (17-30)	31 (24-36)	30 (22-36)	29 (18-36)	20 (13-29)	25 (21-33)
<b>Total bilirubin</b>	5.4 (1.7-13.1)	13.3 (5.4-26.5)	1.45 (7.4-26.5)	10.4 (3.8-26.0)	24.8 (11.5-36.5)	16.0 (8.0-31.4)	9.1 (3.1-26.8)	4.9 (1.8-20.3)	12.7 (4.6-24.5)
<b>Creatinine</b>	1.1 (0.8-1.8)	1.4 (0.9-2.5)	1.6 (1.0-3.3)	1.3 (0.9-1.9)	1.6 (1.0-2.4)	1.3 (0.8-2.2)	1.3 (0.9-2.7)	1.0 (0.7-1.7)	1.3 (1.0-2.4)
<b>Albumin</b>	2.8 (2.3-3.2)	2.8 (2.3-3.4)	3.0 (2.3-3.4)	2.9 (2.5-3.4)	2.7 (2.4-3.3)	2.7 (2.4-3.1)	2.7 (2.3-3.3)	2.7 (2.2-3.2)	2.8 (2.3-3.2)
<b>Living donor</b>	3 (1.6)	4 (2.2)	1 (0.8)	3 (2.5)	0	0	0	2 (4.8)	0
<b>DCD donor</b>	1 (0.5)	2 (1.1)	3 (2.4)	0	1 (1.2)	2 (4.3)	0	0	0
<b>Donor age ≥60</b>	20 (10.3)	14 (7.9)	10 (7.8)	11 (9.1)	5 (6.0)	2 (4.2)	4 (8.7)	4 (9.5)	1 (1.6)
<b>Split graft</b>	4 (2.1)	4 (2.2)	2 (1.6)	4 (3.3)	0	1 (2.1)	0	2 (4.8)	10 (15.9)

Data are presented as n (%) or median (IQR). Abbreviations: AR, acute rejection; BC, biliary complications; CR, chronic rejection; DCD, donation after cardiac death; INF, infection; IQR, interquartile range; LT, liver transplantation; PSC, primary sclerosing cholangitis; MELD, Model for End-Stage Liver Disease; PNF, primary nonfunction; PSC, primary sclerosing cholangitis; REC, recurrence; VT, vascular thrombosis.

<sup>a</sup> Available for transplants performed after 2/27/2002 (n=442/629).

**Supplemental Table 2. Predictors of Graft Failure and Mortality in Patients with PSC after Primary LT and Re-LT for Disease Recurrence.**

	Graft Failure		Mortality	
	Univariate	Multivariate	Univariate	Multivariate
	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)
<b>At 30 Days</b>				
Re-LT status	1.32 (0.74-2.36)		2.04 (1.00-4.18) <sup>a</sup>	
Contemporary era <sup>b</sup>	0.67 (0.53-0.85)	0.64 (0.50-0.83)		
Age <sup>c</sup>			1.14 (1.06-1.23)	1.14 (1.06-1.29)
In ICU	2.15 (1.54-3.01)	1.98 (1.37-2.87)	3.97 (2.62-6.03)	2.68 (1.67-4.28)
Mechanical ventilation	2.63 (1.54-4.51)		5.37 (2.96-9.75)	
Total bilirubin	1.01 (1.00-1.02)	1.01 (1.00-1.02)	1.03 (1.02-1.05)	1.02 (1.01-1.04)
Creatinine	1.14 (1.03-1.25)		1.31 (1.19-1.45)	
Split graft	1.42 (1.03-1.96)	1.74 (1.25-2.42)		
<b>At Five Years</b>				
Re-LT status	1.13 (0.82-1.55)		1.38 (0.95-2.00)	
Contemporary era <sup>b</sup>	0.79 (0.70-0.89)	0.72 (0.63-0.81)		
Age <sup>c</sup>			1.12 (1.08-1.15)	1.11 (1.07-1.14)
In ICU	1.69 (1.40-2.04)	1.45 (1.18-1.78)	2.20 (1.77-2.74)	
Mechanical ventilation	1.73 (1.24-2.41)		2.41 (1.67-3.48)	1.76 (1.20-2.58)
Total bilirubin	1.01 (1.01-1.02)	1.01 (1.01-1.02)	1.02 (1.01-1.02)	1.02 (1.01-1.02)
Creatinine	1.12 (1.07-1.18)		1.21 (1.14-1.27)	1.09 (1.02-1.17)
Albumin			0.82 (0.74-0.92)	0.88 (0.78-0.98)
Living donor			0.67 (0.50-0.90)	
DCD donor	1.57 (1.13-2.16)	1.88 (1.36-2.62)		
Donor age ≥60	1.46 (1.25-1.71)	1.50 (1.27-1.76)	1.44 (1.17-1.77)	1.30 (1.05-1.60)
Primary liver malignancy	1.52 (1.07-2.16)	1.88 (1.32-2.69)	2.41 (1.67-3.48)	3.09 (2.13-4.49)
UNOS region				

	Reference	Reference	Reference	Reference
1				
2	0.96 (0.68-1.34)	0.91 (0.64-1.29)	0.96 (0.62-1.49)	0.95 (0.60-1.51)
3	0.88 (0.63-1.21)	0.83 (0.59-1.16)	0.88 (0.58-1.35)	0.86 (0.55-1.34)
4	1.04 (0.73-1.49)	1.05 (0.73-1.51)	1.21 (0.77-1.90)	1.31 (0.82-2.08)
5	0.90 (0.65-1.26)	0.83 (0.59-1.18)	1.05 (0.68-1.60)	1.00 (0.65-1.56)
6	0.77 (0.50-1.19)	0.75 (0.48-1.17)	0.88 (0.51-1.52)	0.86 (0.49-1.50)
7	0.73 (0.52-1.02)	0.68 (0.48-0.96)	0.69 (0.44-1.07)	0.66 (0.42-1.05)
8	0.80 (0.57-1.13)	0.80 (0.56-1.14)	0.70 (0.44-1.10)	0.73 (0.46-1.16)
9	1.03 (0.72-1.48)	0.98 (0.67-1.43)	1.09 (0.68-1.74)	1.08 (0.67-1.76)
10	0.79 (0.56-1.10)	0.81 (0.57-1.14)	0.86 (0.56-1.33)	0.93 (0.60-1.45)
11	1.07 (0.77-1.50)	1.12 (0.79-1.59)	1.17 (0.76-1.80)	1.32 (0.85-2.06)

Cohort included all primary LTs (n=5,080) and re-LTs for disease recurrence (n=178). Only covariates significant ( $p < 0.05$ ) in univariate analyses and included in multivariate models are shown. Non-significant covariates included: sex, race/ethnicity, and IBD diagnosis. Re-LT status was considered for inclusion in each multivariate model. Abbreviations: CI, confidence interval; DCD, donation after cardiac death; HR, hazard ratio; IBD, inflammatory bowel disease; ICU, intensive care unit; PSC, primary sclerosing cholangitis; re-LT, liver retransplantation; UNOS, United Network for Organ Sharing.

<sup>a</sup>  $p = 0.051$

<sup>b</sup> Transplants performed from 2005-2015 vs. 1987-2004.

<sup>c</sup> Per five-year increase.

**Supplemental Table 3. Risk Factors for Graft Failure and Mortality after Re-LT for Disease Recurrence in Patients with PSC.**

	Graft Failure		Mortality	
	Univariate	Multivariate	Univariate	Multivariate
	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)
<b>At 30 Days</b>				
Mechanical ventilation	6.29 (1.70-23.26)	6.29 (1.70-23.26)	11.54 (2.75-48.36)	11.54 (2.75-48.36)
<b>At Five Years</b>				
Mechanical ventilation	3.94 (1.65-9.40)	2.97 (1.18-7.48)	4.76 (1.81-12.50)	2.90 (1.03-8.17)
Total bilirubin	1.03 (1.01-1.05)	1.02 (1.00-1.04)	1.04 (1.02-1.06)	1.04 (1.02-1.06)
Creatinine	1.28 (1.05-1.55)	1.26 (1.01-1.57)	1.32 (1.06-1.65)	
Living donor	4.86 (1.49-15.84)	8.95 (2.60-30.82)	4.55 (1.08-19.22)	7.64 (1.74-33.50)
Donor age ≥60	3.60 (1.66-7.82)	3.81 (1.72-8.41)	4.68 (2.00-10.99)	4.80 (2.00-11.50)

Only covariates significant ( $p < 0.05$ ) in univariate analyses and included in multivariate models are shown. Non-significant covariates included: age, sex, race/ethnicity, IBD diagnosis, UNOS region, primary liver malignancy, time to re-LT, time period of re-LT, ICU status, albumin, DCD donor, and other etiologies of graft failure. All split/partial grafts in this cohort were living donor transplantations, so only living donor was included. Abbreviations: CI, confidence interval; DCD, donation after cardiac death; HR, hazard ratio; IBD, inflammatory bowel disease; PSC, primary sclerosing cholangitis; re-LT, liver retransplantation; UNOS, United Network for Organ Sharing.