



Analysis Report

Data request from the OPTN Liver and Intestinal Organ Transplantation Committee

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Prepared By: David Schladt, MS; Joshua Pyke, PhD; Jessica Zeglin, MPH; John R. Lake, MD; Ajay K. Israni, MD; Bertram L. Kasiske, MD

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Background

The Committee is developing as much evidence-based guidance as possible for the National Liver Review Board. Historically, some requests for encephalopathy have been submitted to the Regional Review Boards. Under what circumstances should candidates who are experiencing encephalopathy be awarded additional points? Since encephalopathy is an element that has been collected on the liver waiting list for several years, there should be sufficient evidence to address this question for adult and adolescent candidates.

Strategic Goal or Committee Project Addressed

Develop a National Liver Review Board.

Data Request

Determine the association between encephalopathy grade and other pertinent factors for adult (18+) candidates and separately for adolescent (12-17) candidates that are independent of MELD in predicting waiting list mortality.

Study Population

The study population included adolescent and adult candidates who were active on the liver waiting list on eight dates in 2014 and 2015, each date separated by 91 days (January 1, 2014; April 2, 2014; July 2, 2014; October 1, 2014; December 31, 2014; April 1, 2015; July 1, 2015; September 30, 2015). Candidates on the waiting list on more than one date were included for each date they were listed. The sample include 102,724 candidates with an average of 12,840.5 individual candidates on each sampled date; 101,956 were adults, with an average of 12,744.5 on each sampled date; 768 were adolescents, with an average of 96 on each sampled date. Age was determined at the start of each status history update. Death on the waiting list before removal or transplant and within 90 days of the sampled date indicates waitlist mortality.

Analytical Approach

Assess the study population to show the relationship of laboratory MELD/PELD and encephalopathy with the outcomes of: total counts, counts of deaths within 90 days on the waiting list, and percentages of deaths within 90 days on the waiting list. Data output includes 1-way tables of laboratory MELD/PELD quartile (<10, 10-12, 13-16, >16) and encephalopathy status (no exceptions, other exception, encephalopathy score 1-2, encephalopathy score 3-4) and 2-way tables of laboratory MELD/PELD quartile by encephalopathy status. Because available OPTN data are grouped as encephalopathy score 1-2 and 3-4, we cannot provide more granular divisions. Laboratory MELD/PELD quartiles were assigned by splitting the waitlist population into four approximately equal parts (for the full population, approximately 25,000 per quartile), and then determining which MELD/PELD values were associated with those quartiles. Two more sets of tables show the age subgroups of: adults (age 18+ years) and adolescents (age 12-17 years).

Results

Tables show the number of deaths on the waiting list within 90 days/the number of candidates on the waiting list in that period and category, followed by the percentage of those candidates who died. For example, a notation of 300/5000 (6.0%) indicates that 5000 candidates were on the waiting list and 300 of them (6%) died within 90 days.



Adults and Adolescents

This section provides data on all adult and adolescent candidates, aged 12 years or older, active on the waiting list during the sampled dates.

Table 1: 90-day waitlist mortality by laboratory MELD/PELD quartile

Lab M/P < 10	Lab M/P 10-12	Lab M/P 13-16	Lab M/P > 16
178/25540 (0.7%)	290/24867 (1.2%)	501/27952 (1.8%)	1206/24365 (4.9%)

As lab MELDs increased (Table 1), 90-day waitlist mortality percentages increased from 0.7% for the lowest MELD quartile to 4.9% for the highest.

Table 2: 90-day waitlist mortality by encephalopathy status

No Exceptions	Other Exception	Enceph 1-2	Enceph 3-4
585/39500 (1.5%)	131/11512 (1.1%)	1279/49165 (2.6%)	180/2547 (7.1%)

Ninety-day waitlist mortality percentages were lowest for candidates with other exceptions (meaning exceptions for reasons other than encephalopathy) and with no exceptions (1.5% and 1.1%). The mortality percentage was higher for candidates with encephalopathy scores of 1 or 2 (2.6%), and highest for candidates with encephalopathy scores of 3 or 4 (7.1%).

Table 3: 90-day waitlist mortality by laboratory MELD/PELD quartile and encephalopathy status

	No Exceptions	Other Exception	Enceph 1-2	Enceph 3-4
Lab M/P < 10	62/11059 (0.6%)	29/5725 (0.5%)	81/8538 (0.9%)	6/218 (2.8%)
Lab M/P 10-12	81/9701 (0.8%)	32/2773 (1.2%)	165/12051 (1.4%)	12/342 (3.5%)
Lab M/P 13-16	118/10237 (1.2%)	28/1729 (1.6%)	324/15278 (2.1%)	31/708 (4.4%)
Lab M/P > 16	324/8503 (3.8%)	42/1285 (3.3%)	709/13298 (5.3%)	131/1279 (10.2%)

After accounting for lab MELD quartile, 90-day waitlist mortality percentages were lowest for candidates with no exceptions or other exceptions. Mortality percentages were slightly higher for candidates with encephalopathy scores of 1 or 2 across lab MELD quartiles. At each level of lab MELD, mortality percentages were highest for candidates with encephalopathy scores of 3 or 4.

Adults

This section provides data on all adult candidates, aged 18 years or older, active on the waiting list during the sampled dates.

Table 4: 90-day waitlist mortality by laboratory MELD/PELD quartile

Lab M/P < 10	Lab M/P 10-12	Lab M/P 13-16	Lab M/P > 16
178/25281 (0.7%)	289/24692 (1.2%)	499/27797 (1.8%)	1202/24186 (5.0%)

Most candidates aged 12 years or older were adults. Therefore, the counts and percentages for the adult subgroup are almost identical to the above results for adults and adolescents combined. As lab MELDs increased, 90-day waitlist mortality percentages increased from 0.7% for the lowest MELD quartile to 5.0% for the highest.



Table 5: 90-day waitlist mortality by encephalopathy status

No Exceptions	Other Exception	Enceph 1-2	Enceph 3-4
582/39043 (1.5%)	129/11274 (1.1%)	1277/49101 (2.6%)	180/2538 (7.1%)

Ninety-day mortality percentages were similar for candidates with other (non-encephalopathy) exceptions and with no exceptions (1.5% and 1.1%). Mortality percentages were higher for candidates with encephalopathy scores of 1 or 2 (2.6%), and highest for candidates with encephalopathy scores of 3 or 4 (7.1%).

Table 6: 90-day waitlist mortality by laboratory MELD/PELD quartile and encephalopathy status

	No Exceptions	Other Exception	Enceph 1-2	Enceph 3-4
Lab M/P < 10	62/10908 (0.6%)	29/5630 (0.5%)	81/8525 (1.0%)	6/218 (2.8%)
Lab M/P 10-12	80/9581 (0.8%)	32/2724 (1.2%)	165/12045 (1.4%)	12/342 (3.5%)
Lab M/P 13-16	118/10143 (1.2%)	27/1691 (1.6%)	323/15259 (2.1%)	31/704 (4.4%)
Lab M/P > 16	322/8411 (3.8%)	41/1229 (3.3%)	708/13272 (5.3%)	131/1274 (10.3%)

After accounting for lab MELD quartile, 90-day mortality percentages were lowest for candidates with no exceptions and other exceptions. Mortality percentages were slightly higher for candidates with encephalopathy scores of 1 or 2. At each level of lab MELD, mortality percentages were highest for candidates with encephalopathy scores of 3 or 4, up to 10.3% for lab MELD/PELD > 16.

Adolescents

This section provides data on all adolescent candidates, ages 12 to 17 years, active on the waiting list during the sampled dates.

Table 7: 90-day waitlist mortality by laboratory MELD/PELD quartile

Lab M/P < 10	Lab M/P 10-12	Lab M/P 13-16	Lab M/P > 16
0/259 (0.0%)	1/175 (0.6%)	2/155 (1.3%)	4/179 (2.2%)

Similar to adults, as lab MELDs increased for adolescents, 90-day mortality percentages increased. However, at each lab MELD quartile, mortality percentages were lower than for adults.

Table 8: 90-day waitlist mortality by encephalopathy status

No Exceptions	Other Exception	Enceph 1-2	Enceph 3-4
3/457 (0.7%)	2/238 (0.8%)	2/64 (3.1%)	0/9 (0.0%)

Ninety-day mortality percentages were higher for candidates with encephalopathy scores of 1 or 2 than for candidates with no or other exceptions. As none of the 9 candidates with encephalopathy scores of 3 or 4 died within 90 days on the waiting list, the 90-day mortality percentage is 0%. However, the estimate is unreliable due to low sample size.



Table 9: 90-day waitlist mortality by laboratory MELD/PELD quartile and encephalopathy status

	No Exceptions	Other Exception	Enceph 1-2	Enceph 3-4
Lab M/P < 10	0/151 (0.0%)	0/95 (0.0%)	0/13 (0.0%)	N/A
Lab M/P 10-12	1/120 (0.8%)	0/49 (0.0%)	0/6 (0.0%)	N/A
Lab M/P 13-16	0/94 (0.0%)	1/38 (2.6%)	1/19 (5.3%)	0/4 (0.0%)
Lab M/P > 16	2/92 (2.2%)	1/56 (1.8%)	1/26 (3.8%)	0/5 (0.0%)

Due to small sample size, it is difficult to identify any patterns in mortality across adolescent candidates with varying lab MELD and encephalopathy status.

Conclusions

Overall, higher lab MELD/PELD scores and higher encephalopathy rankings are associated with increased 90-day waitlist mortality.

For the population of adults and adolescents aged 12 years or older:

- Ninety-day waitlist mortality increases as lab MELD/PELD score increases.
- Ninety-day waitlist mortality is slightly higher for candidates with encephalopathy scores of 1-2 than for candidates with no exceptions or non-encephalopathy exceptions.
- Ninety-day waitlist mortality is notably higher for candidates with encephalopathy scores of 3-4 than for other candidates.
- Ninety-day waitlist mortality is highest of any measured group for candidates in the highest quartile of lab MELD/PELD scores with encephalopathy scores of 3-4. Within each lab MELD/PELD quartile, comparative 90-day waitlist mortality is highest for candidates with encephalopathy scores of 3-4.

Trends within the population of adults aged 18 years or older mirror those described for the full population. This is expected, as adults make up 99% of the sampled population.

For the population of adolescents aged 12 to 17 years:

- Similar to mortality in adults, 90-day waitlist mortality increases as lab MELD/PELD score increases. However, at each lab MELD/PELD quartile, mortality percentages are lower than for adults.
- Ninety-day waitlist mortality appears to be slightly higher for adolescent candidates with encephalopathy scores of 1-2 than for those without encephalopathy. However, the sample size is very small, so this estimate may be inaccurate.
- The sample size was insufficient to make a determination about the relationship between 90-day waitlist mortality, lab MELD/PELD, and encephalopathy status for adolescent candidates.