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Letter to the editor

## Life expectancy after liver transplantation: Compendium of results



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We have recently reported on life expectancy after first-time single-organ liver transplant for patients aged 35 to 75 in the U.S. OPTN population [1] according to disease etiology and additional risk factors. Results were given separately for HCC with cirrhosis [2], HCC without cirrhosis [3], alcohol-related liver disease (ALD) [4], NASH [5], Hepatitis C [6], and several less common etiologies: Primary Biliary Cirrhosis (PBC) [7], Primary Sclerosing Cholangitis (PSC) [7], Hepatitis B Cirrhosis (Hep B) [7], Metabolic Disease (Alpha-1-Antitrypsin Deficiency [AAT], Wilson's Disease, or Hemochromatosis) [8], and Acute Hepatic Necrosis (AHN, aka Acute Liver Failure, due to causes such as Drug Toxicity, Hepatitis Type C, or Hepatitis Type B) [9].

The purposes of the present short communication are twofold: firstly, to provide in one place the age- and sex-specific life expectancies for each of the aforementioned groups; and, secondly, to discuss material reasons for any differences by etiology.

Table 1 and Table 2 show the computed life expectancies by age, sex, and etiology group. These results are mirrored by those shown in Supplemental Table 1 and Table 2, which document the mortality effects of age, sex, transplant year, and etiology.

As can be seen in Table 1 and Table 2, the values vary significantly by age and etiology though less so by sex. By age, we see that the life expectancies at age 70 are often only two-thirds of their values at age 40. By contrast, with respect to sex we see that the values are often identical when rounded to the nearest integer.

For etiology the picture is more complex. For example, at age 40 the life expectancies range from 15 to 24 for males, compared with the general population (GP) value of 39. For females they range from 14 to 26, compared with the GP of 43. The shortest life expectancies were observed in persons with HCC, HCC-NC, ALD, Hemochromatosis, or AHN: Drug; intermediate were patients with NASH, Hep C, AAT/Wilson's or AHN: All Others; and the longest were those with PBC/PSC/Hep B, or AHN: Type B.

The relatively poor prognosis for the cancer groups (HCC, HCC-NC) may well be associated with the risk of recurrence, development of second primary cancer, and possible long-term sequelae of the

treatments (e.g., radiation, chemotherapy, ablation). It is also no surprise that the ALD group has a relatively poor prognosis, as many such patients relapse into alcohol use [10] or have significant comorbidities (such as those due to cigarette smoking, which is disproportionately prevalent amongst this group). Similarly, AHN due to drug toxicity can be related to use of prescription or over-the-counter medications, illicit drugs, or herbal supplements. Therefore individuals who receive a transplant for this indication are likely to have comorbid health conditions which may negatively affect their long-term prognosis.

The longer survival of the PBC/PSC/HepB, and AHN:Type B groups may be due to their decreased risk of recurrent liver problems. In particular, anti-viral medications for HBV have dramatically decreased the recurrence of HBV [11]. In addition, PBC and PSC patients generally have fewer comorbid conditions, transplantation tends to cure the underlying condition, and graft survival is known to be good [12].

Prior researchers have also investigated the effect of etiology on survival after liver transplantation [13,14,15,16,17,18]. Most found that NASH and cryptogenic cirrhosis had the best prognosis, and ALD and HCC the worst, much as we found here, though their ordering varied somewhat, likely due to their more modest sample sizes.

In general, the need for liver transplant is a negative prognostic indicator of the severity of liver disease. On the other hand, graft recipients are carefully selected within each etiology to be those with the most favorable medical characteristics and long-term prospects.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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**Table 1**  
Life expectancies, Males.

| Starting Time | Current Age | Hemo-chromatosis | HCC-NC | HCC | ALD | AHN: Drug / Type C | AAT/ Wilson's | NASH | Hep C | AHN: All Others | PBC/ PSC/ Hep B | AHN: Type B | GP |
|---------------|-------------|------------------|--------|-----|-----|--------------------|---------------|------|-------|-----------------|-----------------|-------------|----|
| From tx       | 40          | 15               | 15     | 16  | 17  | 17                 | 19            | 20   | 20    | 21              | 23              | 24          | 39 |
|               | 50          | 13               | 14     | 14  | 15  | 14                 | 17            | 16   | 20    | 18              | 19              | 20          | 30 |
|               | 60          | 11               | 12     | 12  | 13  | 12                 | 14            | 13   | 18    | 15              | 16              | 17          | 22 |
|               | 70          | 9                | 10     | 11  | 11  | 10                 | 12            | 10   | 16    | 13              | 13              | 14          | 15 |
| 1-yr post     | 41          | 15               | 15     | 17  | 18  | 18                 | 19            | 20   | 16    | 22              | 22              | 25          | 38 |
|               | 51          | 13               | 14     | 15  | 15  | 16                 | 17            | 17   | 14    | 19              | 18              | 21          | 29 |
|               | 61          | 12               | 12     | 13  | 13  | 14                 | 15            | 13   | 13    | 16              | 15              | 18          | 21 |
|               | 71          | 10               | 11     | 11  | 11  | 12                 | 13            | 11   | 13    | 14              | 13              | 16          | 14 |
| 5-yrs post    | 45          | 13               | 13     | 15  | 16  | 16                 | 16            | 18   | 11    | 20              | 19              | 22          | 34 |
|               | 55          | 11               | 12     | 13  | 13  | 14                 | 14            | 14   | 10    | 17              | 16              | 19          | 26 |
|               | 65          | 9                | 11     | 12  | 11  | 12                 | 12            | 11   | 10    | 14              | 13              | 16          | 18 |
|               | 75          | 8                | 10     | 10  | 9   | 10                 | 10            | 9    | 8     | 12              | 10              | 13          | 11 |

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**Table 2**  
Life expectancies, Females.

| Starting Time | Current Age | Hemo-chromatosis | HCC-NC | HCC | ALD | AHN: Drug / Type C | AAT/ Wilson's | NASH | Hep C | AHN: All Others | PBC/ PSC/ Hep B | AHN: Type B | GP |
|---------------|-------------|------------------|--------|-----|-----|--------------------|---------------|------|-------|-----------------|-----------------|-------------|----|
| From tx       | 40          | 14               | 16     | 17  | 18  | 19                 | 19            | 20   | 20    | 23              | 25              | 26          | 43 |
|               | 50          | 12               | 14     | 15  | 15  | 16                 | 16            | 16   | 20    | 20              | 20              | 22          | 33 |
|               | 60          | 10               | 12     | 13  | 13  | 13                 | 14            | 13   | 18    | 17              | 17              | 19          | 25 |
|               | 70          | 9                | 11     | 11  | 11  | 11                 | 12            | 10   | 16    | 14              | 14              | 16          | 17 |
| 1-yr post     | 41          | 15               | 16     | 17  | 18  | 21                 | 19            | 20   | 16    | 25              | 24              | 27          | 42 |
|               | 51          | 13               | 14     | 15  | 15  | 18                 | 16            | 16   | 14    | 21              | 20              | 23          | 33 |
|               | 61          | 11               | 12     | 13  | 13  | 15                 | 14            | 13   | 13    | 18              | 16              | 20          | 24 |
|               | 71          | 10               | 11     | 12  | 11  | 13                 | 13            | 11   | 13    | 15              | 13              | 17          | 16 |
| 5-yrs post    | 45          | 12               | 14     | 16  | 16  | 19                 | 16            | 17   | 11    | 22              | 21              | 25          | 38 |
|               | 55          | 10               | 12     | 14  | 14  | 16                 | 14            | 14   | 10    | 19              | 17              | 21          | 29 |
|               | 65          | 9                | 11     | 12  | 11  | 13                 | 12            | 11   | 10    | 16              | 14              | 17          | 21 |
|               | 75          | 8                | 10     | 10  | 10  | 11                 | 10            | 9    | 8     | 13              | 11              | 14          | 13 |

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None.

## Disclaimer

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## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.liver.2022.100082](https://doi.org/10.1016/j.liver.2022.100082).

## References

- [1] Organ Procurement and Transplantation Network (2019). About Data: OPTN Database. Accessed November 23, 2021. Available at <https://optn.transplant.hrsa.gov/data/about-data/optndatabase/>.
- [2] Kwak JH, Shavelle R, Brooks J. Life expectancy after liver transplantation for hepatocellular carcinoma with cirrhosis. *Prog Transplant* 2021;31(1):62–71.
- [3] Shavelle RM, Kwak JH, Saur R, Brooks JC, Rosenthal P. Life expectancy after liver transplantation for non-cirrhotic hepatocellular carcinoma. *Prog Transplant* 2021;31(2):117–25.
- [4] Shavelle RM, Saur RC, Kwak JH, Brooks JC, Hameed B. Life expectancy after liver transplantation for alcoholic cirrhosis. *Prog Transplant* 2021;31:345–56.
- [5] Shavelle RM, Saur RC, Kwak JH, Brooks JC, Hameed B. Life expectancy after liver transplantation for NASH. *Prog Transplant* 2021 in press.
- [6] Saur RC, Kwak JH, Shavelle RM, Brooks JC (2021). Life expectancy after liver transplantation for hepatitis C cirrhosis. Manuscript under review.
- [7] Shavelle RM, Saur RC, Kwak JH, Brooks JC, Hameed B. Life expectancy after liver transplantation for primary biliary cirrhosis, primary sclerosing cholangitis, or hepatitis B cirrhosis. *J Liver Transplant* 2021;5:100052.
- [8] Shavelle RM, Kwak JH, Brooks JC, Saur RC. Life expectancy after liver transplantation for metabolic disease: Alpha-1-antitrypsin deficiency, wilson's disease, or hemochromatosis. *J Liver Transplant* 2022;5:100062.
- [9] Shavelle RM, Saur RC, Kwak JH, Brooks JC. Life expectancy after liver transplantation for acute hepatic necrosis. *J Liver Transplant* 2021 in press.
- [10] Skladany L, Adamcova Selcanova S, Koller T. Alcohol use relapse following liver transplantation for alcoholic liver disease. *Ann Transplant* 2019;24:359–66 Published 2019 Jun 18. doi: [10.12659/AOT.914690](https://doi.org/10.12659/AOT.914690).
- [11] Hofer D, Berg T. Prevention of hepatitis B recurrence after liver transplantation. *Transplantation* 2005;80:S120.
- [12] Singal AK, Guturu P, Hmoud B, Kuo YF, Salameh H, Wiesner RH. Evolving frequency and outcomes of liver transplantation based on etiology of liver disease. *Transplant J* 2013;95(5):755–60 March 15. doi: [10.1097/TP.0b013e31827afb3a](https://doi.org/10.1097/TP.0b013e31827afb3a).
- [13] Thuluvath PJ, Hanish S, Savva Y. Liver transplantation in cryptogenic cirrhosis: outcome comparisons between NASH, alcoholic, and AIH cirrhosis. *Transplantation* 2018;102(4):656–63.
- [14] Wong RJ, Chou C, Bonham CA, Concepcion W, Esquivel CO, Ahmed A. Improved survival outcomes in patients with non-alcoholic steatohepatitis and alcoholic liver disease following liver transplantation: an analysis of 2002–2012 United Network for Organ Sharing data. *Clin Transplant* 2014;28(6):713–21. doi: [10.1111/ctr.12364](https://doi.org/10.1111/ctr.12364).
- [15] Haldar D, Kern B, Hodson J, et al. Outcomes of liver transplantation for non-alcoholic steatohepatitis: A European liver transplant registry study. *J Hepatol* 2019;71(2):313–22. doi: [10.1016/j.jhep.2019.04.011](https://doi.org/10.1016/j.jhep.2019.04.011).
- [16] Burra P, Senzolo M, Adam R, et al. Liver transplantation for alcoholic liver disease in Europe: a study from the ELTR (European liver transplant registry). *Am J Transplant* 2010;10(1):138–48. doi: [10.1111/j.1600-6143.2009.02869](https://doi.org/10.1111/j.1600-6143.2009.02869).
- [17] Filali Bouami S, Gwiasda J, Beneke J, et al. Prognostic factors for long-term survival after adult liver transplantation. *Langenbecks Arch Surg* 2018;403(4):495–508.
- [18] Nagai S, Collins K, Chau LC, et al. Increased risk of death in first year after liver transplantation among patients with nonalcoholic steatohepatitis vs liver disease of other etiologies. *Clin Gastroenterol Hepatol* 2019;17(13):2759–68 e5. doi: [10.1016/j.cgh.2019.04.033](https://doi.org/10.1016/j.cgh.2019.04.033).

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