

The Nordic Liver Transplant Registry (NLTR)

Annual report 2022

Report prepared by Espen Melum June 2023

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1. Source of data

The numbers and graphs included in the present report are based on data extracted from the Nordic Liver Transplant Registry (NLTR) in April 2023. Prior to the export, data were subjected to extensive integrity and quality control. Entry of missing data and correction of all identified errors were performed at all centers prior to the final data extraction.

2. Data content NLTR 2022

The registry comprises complete data from the liver transplantation activity at all transplantation centers in Denmark, Sweden, Norway and Finland since 1982. Before 1990, only patients that were transplanted were registered. After 1990, the registry covers all patients entered to the liver transplantation waiting list, regardless of transplantation status. From September 1994, complete waiting list data are available from all patients in addition to the transplantation details. From October 1st 2017 data on patients transplanted in Estonia are prospectively included, patients transplanted in Estonia prior to this date have been retrospectively included. All data are stored securely at Scandiatransplant in Århus (www.scandiatransplant.org).

Up to December 31st 2022, data from a total of 9694 patients had been entered into NLTR. Of these, 8486 patients had received a first liver graft, 863 (10.2%) had been transplanted more than once, and 126 (1.5%) had been transplanted more than twice. Of the 863 patients receiving a second liver graft, 8 had received their first graft outside of the Scandiatransplant area. A total of 214 living donor transplantations had been performed. Children below 18 years constituted 896 (10.6%) of the transplanted patients in the registry.

3. Transplantation activity 2022

The total number of patients who received a first liver graft in 2022 was 342 (Figure 1). Of these, 7 were combined liver-kidney transplantations and one was multivisceral, this transplantation was performed in Gothenburg. Of the first liver transplantations performed in 2022 one was a living donor transplantation and none was a domino transplantation. The living donor transplantation was performed in Oslo. Fourteen patients received a DCD graft. In addition, 32 re-transplantations were performed (Table 2). The total number of liver transplantations was 374, which is a slight decrease compared to the 396 transplants performed in 2021. It is now clear that the transplantation activity has reached a plateau with a decrease since the record year in 2016.

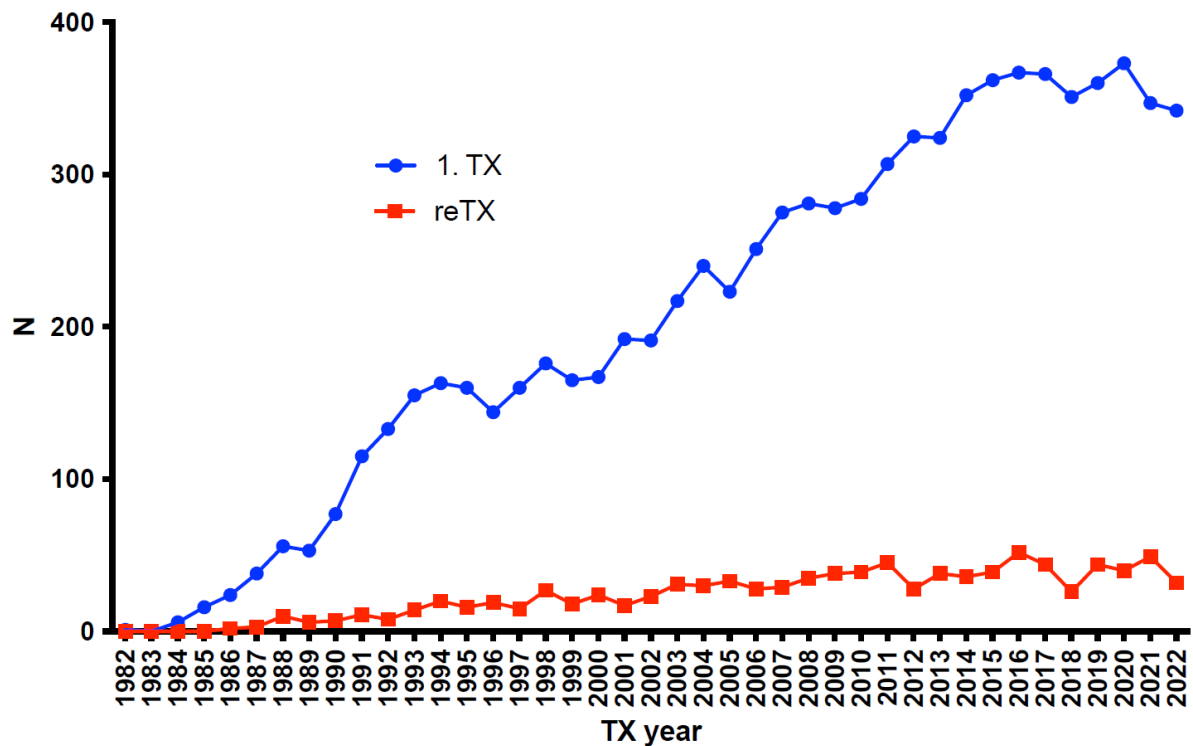


Figure 1. Number of patients receiving a liver allograft 1982-2022. The blue line represents the number of patients receiving a first liver graft while the red line represents the total number of re-transplantations.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Copenhagen	39	41	55	51	52	39	61	59	45	41
Gothenburg	72	89	86	88	84	83	80	73	87	80
Helsinki	44	56	70	54	57	60	56	71	65	55
Oslo	96	89	72	88	85	87	75	76	83	89
Stockholm	73	77	79	86	82	73	78	84	63	68
Tartu*					10	9	10	11	4	9

Table 1. Number of first liver transplantations performed at the individual centers during the last 10 years. *Data from Tartu are only included from the time they joined Scandiatransplant

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Copenhagen	3	6	3	9*	5	4	3	7	5	5
Gothenburg	9	8	8	17	10	3	15	8	11*	10
Helsinki	5	3	7	7	6	6	9	4	10	7
Oslo	14	11	14	12	17	8	19	12***	15	3
Stockholm	7	8	8*	7	5	4	9	8	8	7****
Tartu**					0	1	0	1	0	0

Table 2. Total number of re-transplantations performed at the individual centers during the last 10 years. * = 1 pts in 2015, 2016 and 2021 received their first graft outside SCTP **Data from Tartu are only included from the time they joined Scandiatransplant. ***One patient retransplanted in Oslo received the first graft in Stockholm. ****One patient originally transplanted in Uppsala received a second graft in Stockholm.

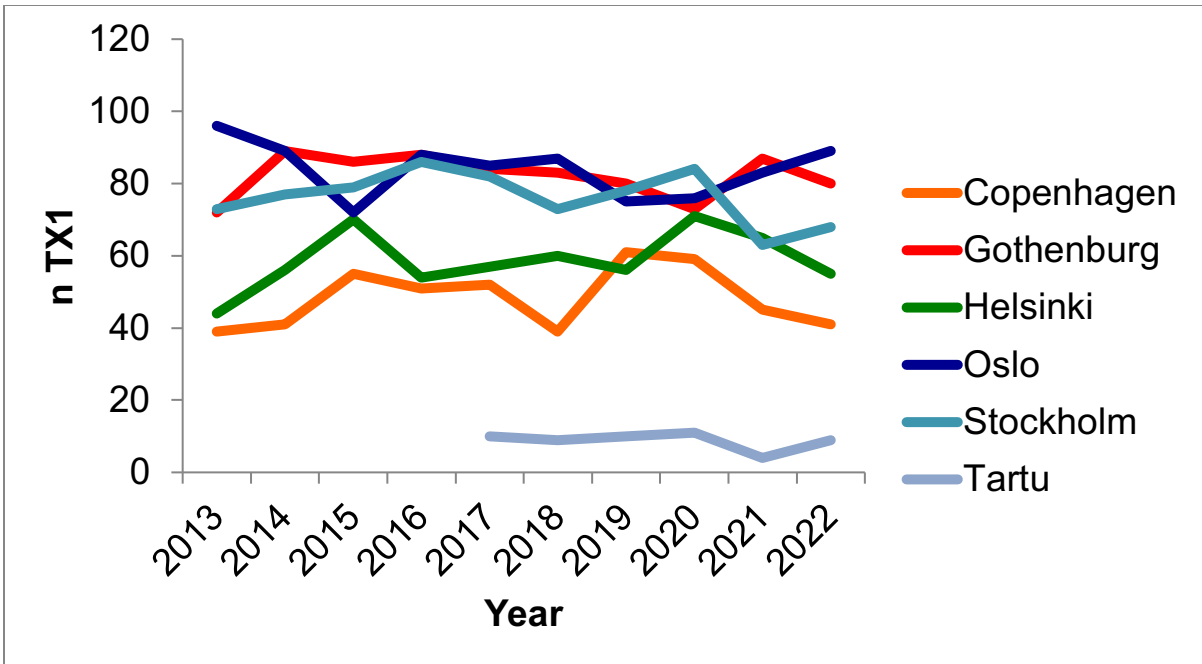


Figure 2. Number of first liver transplantations performed at the Nordic and Estonian centers that are currently performing liver transplantations.

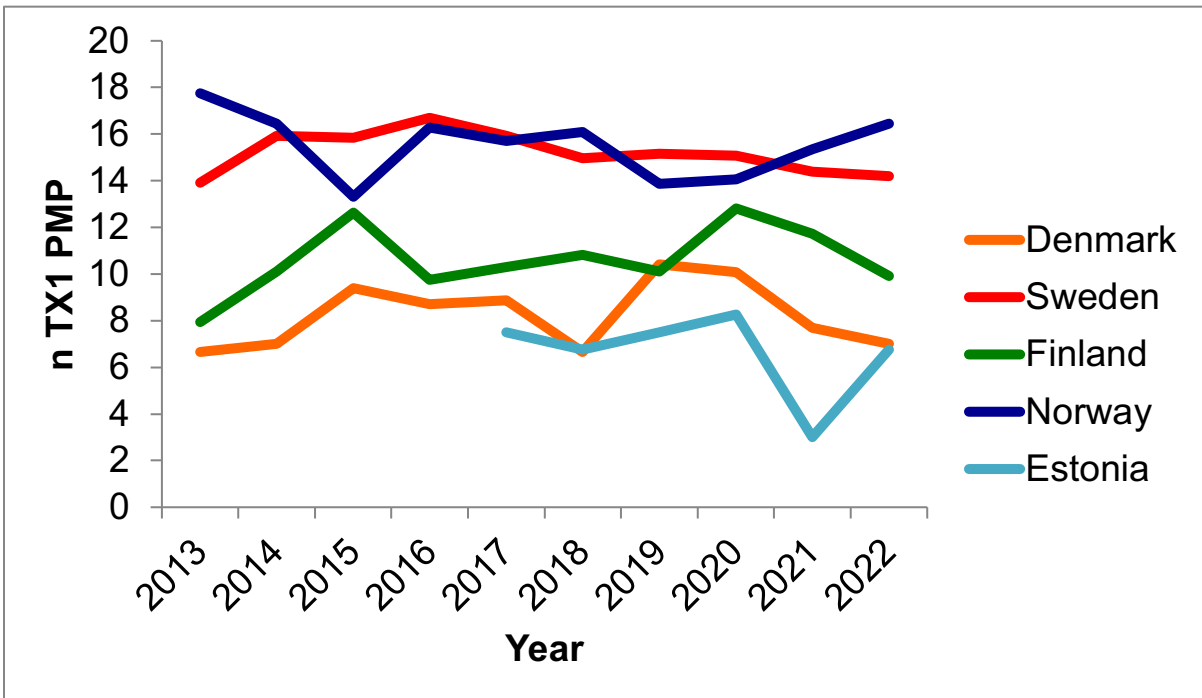


Figure 3. Number of first liver transplantations performed in the Scandi-transplant countries according to the country's population. PMP, per million population.

4. The waiting list 2022

In 2022, a total of 400 patients were entered on the waiting list for a first liver transplant (Table 3), this is a slight increase from the 395 entered in 2021 (Figure 4). Twelve of the patients listed for a first liver transplant in 2022 were listed as highly urgent. This a further slight decrease from the numbers in 2021 and 2020 which were markedly decreased compared to previous years.

Active on waiting list	Deceased donor	Living donor	Dead	Permanent withdrawal
122	257	1	8	12

Table 3. Patients entering the waiting list in 2022 classified by outcome as of December 31st 2022.

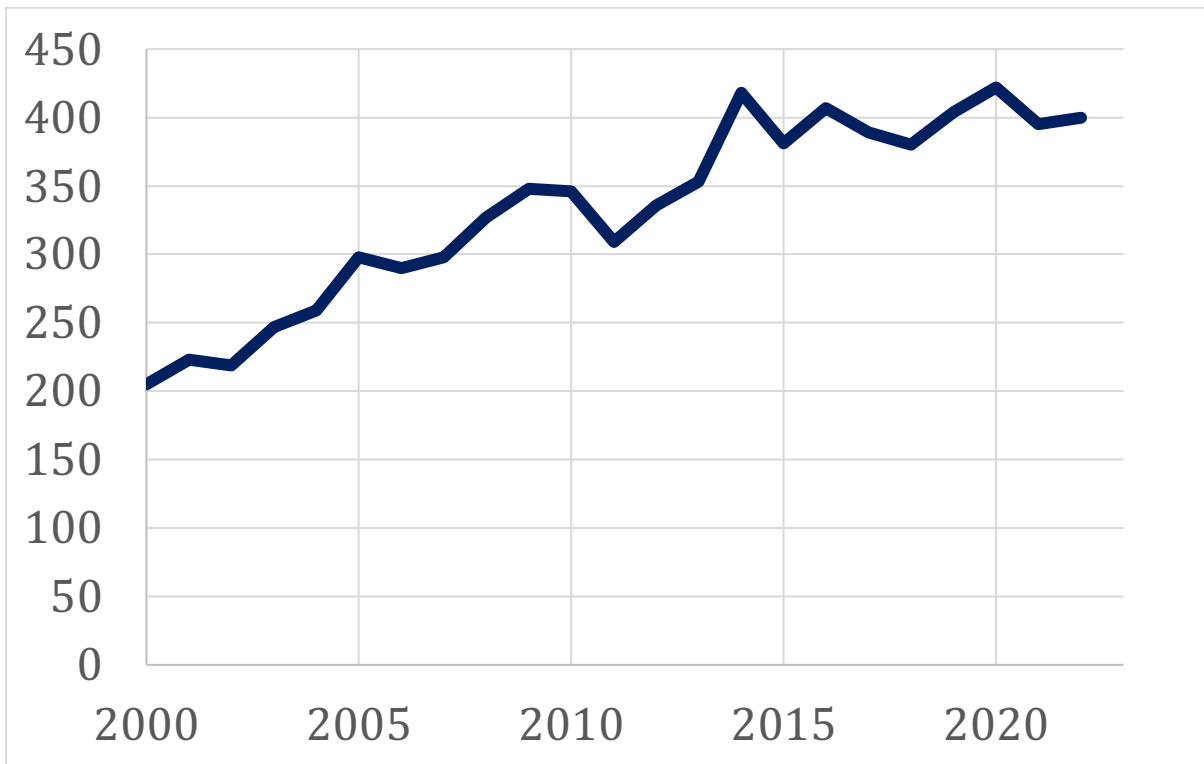


Figure 4. Number of patients entering the waiting list from 2000-2022.

The number of deaths among patients listed in 2022 for a first liver transplant was 8 (Denmark 1, Sweden 5 and Finland 2). The absolute number of deaths registered on the waiting list has remained rather stable since 1990 (Figure 5) with the lowest number recorded in 2022. When the deaths on the waiting list are evaluated in relation to the total liver transplantation activity the relative number of deaths on the waiting list remains low (Figure 6).

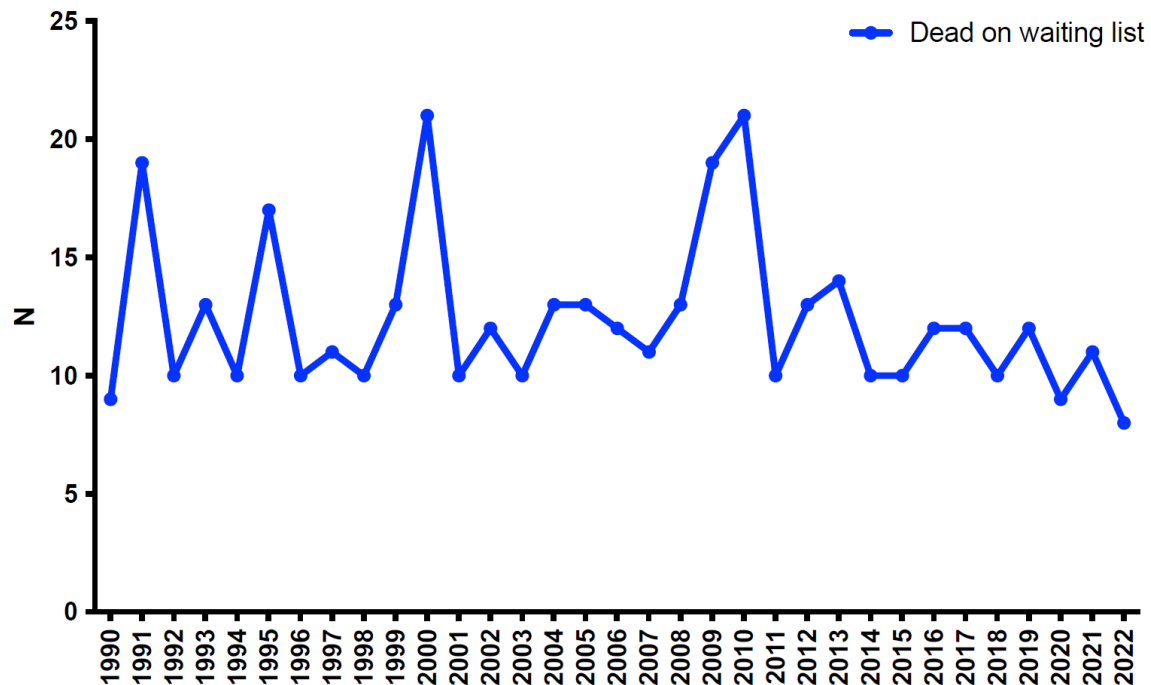


Figure 5. Number of patients registered as dead on the waiting list in the period 1990-2022.

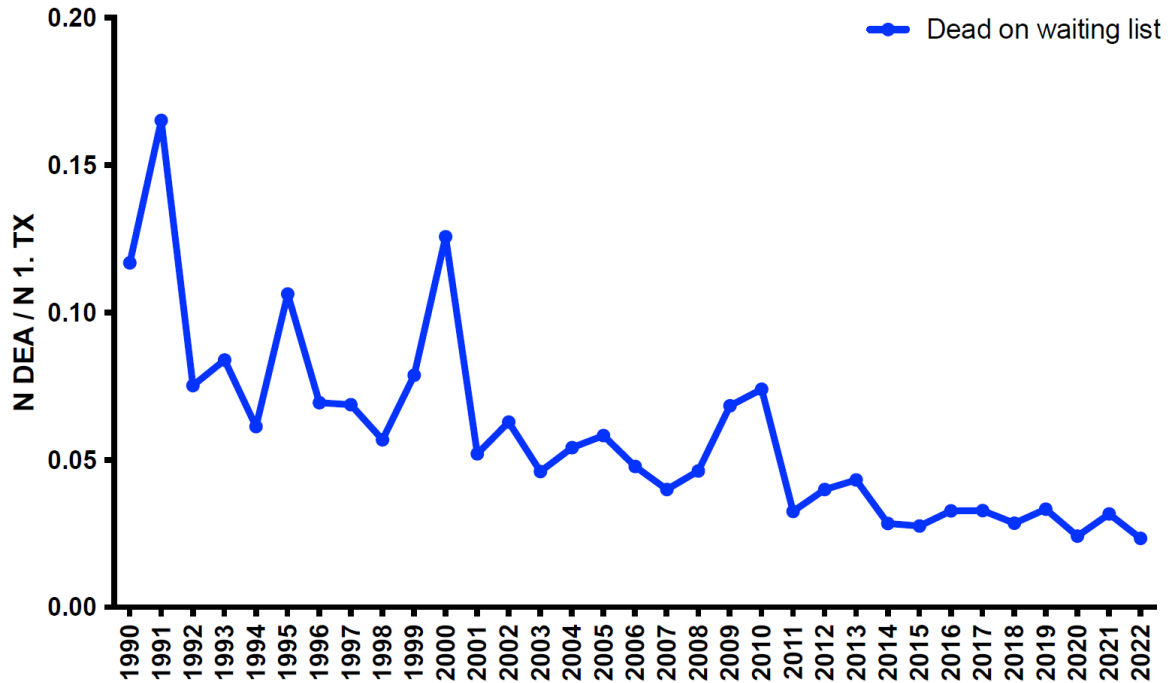


Figure 6. Number of patients registered as dead on the waiting list relative to the total transplantation activity in the period 1990-2022.

The median waiting time in 2022 was 60 days when excluding patients listed for a highly urgent liver transplantation. The differences according to different ABO blood types were as expected (Table 4) with largely similar numbers since 2010 (Figure 7).

O	A	AB	B
84.5 (1216)	44 (1359)	30.5 (221)	61.5 (847)

Table 4. Median time on waiting list (days) for patients receiving a first liver allograft in 2022 according to ABO blood type. The number in parenthesis represents the maximum waiting time for the indicated blood type in 2022. (Patients listed as highly urgent are excluded from the calculations).

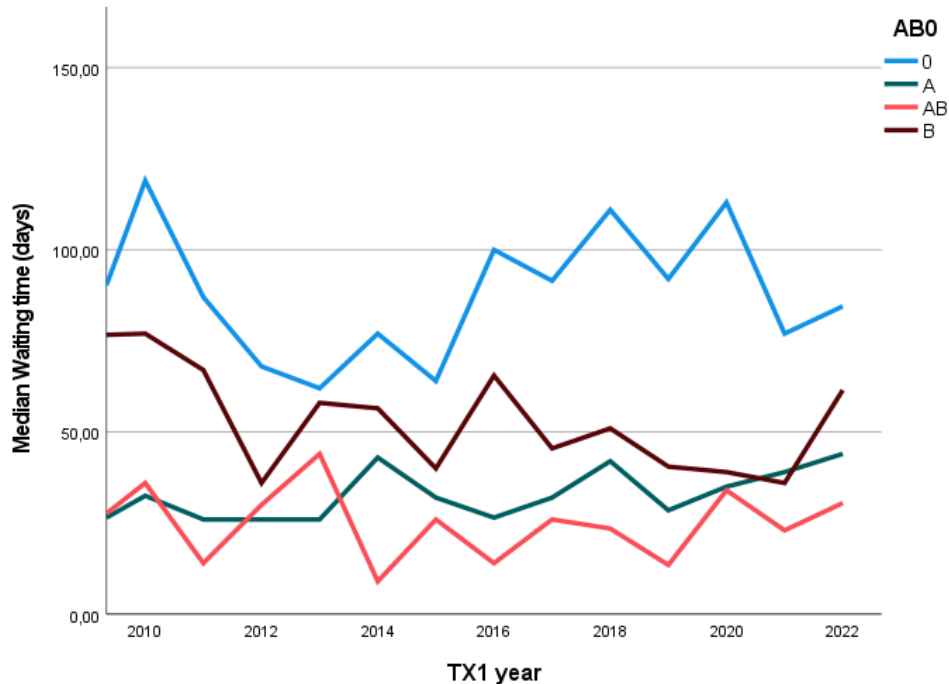


Figure 7. Median waiting time for first liver transplantation according to ABO blood type for 2010-2022. (Patients listed as highly urgent are excluded from the calculations).

Tartu had the lowest and Stockholm the longest waiting time in 2022 (Table 5). The waiting times in 2022 saw a marked decline in Tartu, but given the low number of transplants in 2021 that number was vulnerable to random variation, in the other centers the waiting times were rather stable (Figure 8). Nevertheless, the waiting times are remarkably low compared to other programs.

Copenhagen	Gothenburg	Helsinki	Oslo	Stockholm	Tartu
48 (328)	61 (705)	42 (847)	57 (552)	78.5 (1359)	37 (1216)

Table 5. Median time on waiting list (days) for patients receiving a first liver allograft in 2022 according to transplantation center. The number in parenthesis represents the maximum waiting time for the indicated center in 2022. (Patients listed as highly urgent are excluded from the calculations).

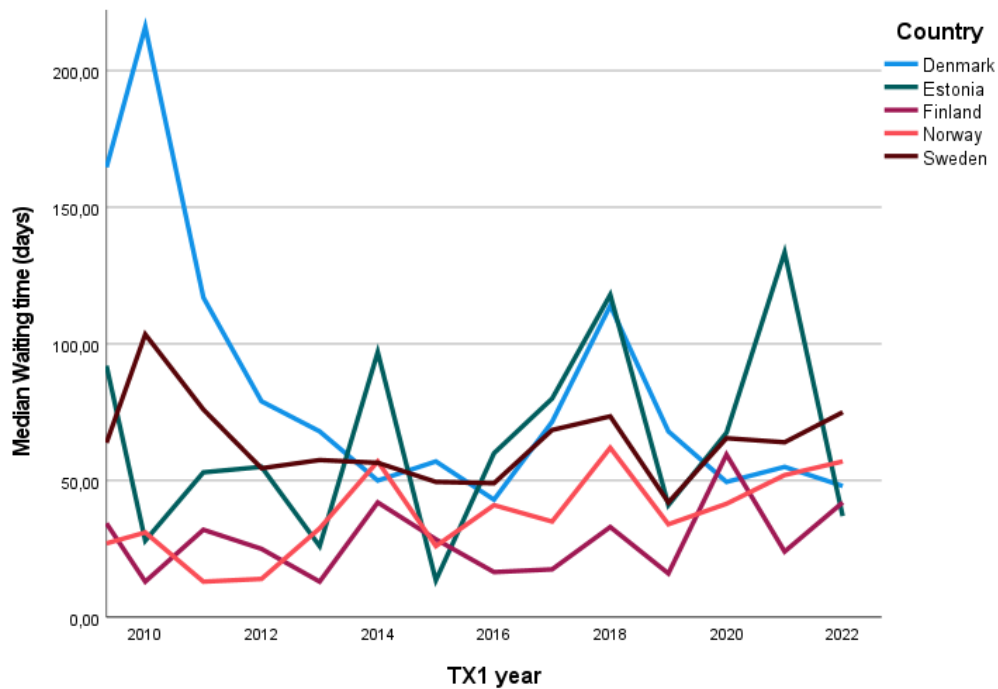


Figure 8. Median waiting time for first liver transplantation according to country for 2010-2022. (Patients listed as highly urgent are excluded from the calculations).

5. Age of recipients and donors

The mean age of adult liver recipients (>18 years, first liver transplantation) in 2022 was 53.7 years. Mean age of children (<18 years, first liver transplantation) in 2022 was 5.6 years. Since 1990 the proportion of recipients >60 years of age at the first transplantation has gradually increased, but with a slight decline in 2022 compared to 2021 with 33.6% of the patients transplanted in 2022 being above 60 years of age (Figure 9). The mean age of the donors has remained stable since 2010 with a median age of 57.5 years in 2022 (Figure 10).

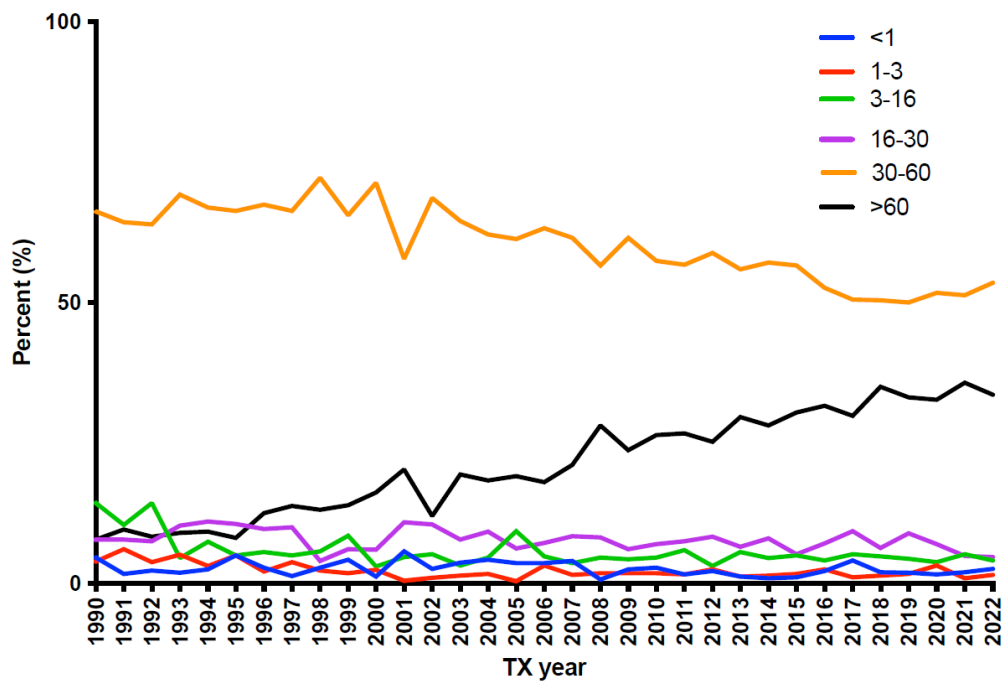


Figure 9. Proportion of liver transplants in the indicated age groups.

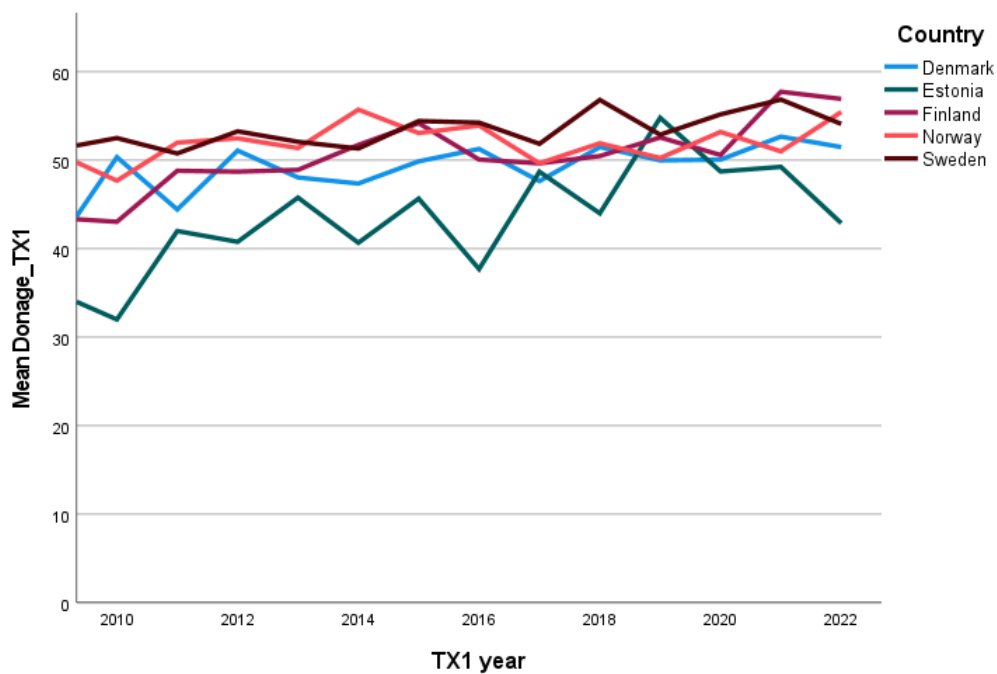


Figure 10. Mean age of donors utilized in the indicated years stratified for the different countries.

6. Diagnoses

In 2022, alcohol related cirrhosis was the leading indication for liver transplantation in Nordic countries (Table 6). Of the patients listed for transplantation with a primary diagnosis of hepatocellular carcinoma in 2022, 28 % were also anti-HCV positive. During the last 9 years the percentage of patients listed for transplantation with a diagnosis of HCV cirrhosis has dramatically declined (Figure 11). This decline coincides with the introduction of direct acting antiviral treatment and HCV cirrhosis has moved from being a major indication in our program to a rather rare indication.

	1982-90	1991-96	1998-02	2003-07	2008-12	2013-17	2018-22	2022
Alcohol related cirrhosis	1.9%	9.1%	12.4%	11.8%	11.6%	12.1%	15.4%	16.5%
Primary sclerosing cholangitis	11.1%	13.7%	15.3%	15.4%	16.4%	17.0%	15.7%	14.8%
Hepatocellular carcinoma and cirrhosis	10.8%	4.6%	5.8%	8.8%	12.2%	17.3%	14.9%	13.5%
Metabolic disease	9.3%	7.1%	6.0%	5.5%	7.2%	8.7%	8.9%	8.0%
Cirrhosis - unknown	0.6%	3.1%	2.5%	3.4%	6.5%	5.7%	6.9%	7.8%
Acute liver failure - other	8.7%	10.1%	6.8%	6.4%	5.0%	5.5%	6.5%	6.8%
Autoimmune cirrhosis	2.8%	3.8%	3.6%	4.7%	3.7%	4.8%	4.7%	5.0%
Primary biliary cholangitis	22.6%	13.1%	7.1%	7.3%	6.2%	4.4%	4.6%	4.3%
Secondary liver tumors	0.9%	0.4%	0.6%	1.3%	1.9%	1.9%	2.5%	3.5%
Extrahepatic biliary atresia	6.8%	5.0%	5.0%	3.9%	2.5%	2.4%	2.5%	3.0%
Post hepatitis B cirrhosis	0.9%	2.7%	3.3%	2.5%	1.2%	1.2%	1.2%	2.5%
Acute liver failure - toxic	0.6%	2.6%	5.1%	3.9%	3.2%	2.9%	2.4%	2.0%
Post hepatitis C cirrhosis		4.0%	9.1%	10.8%	9.9%	5.7%	2.2%	2.0%
Polycystic disease	0.3%	1.2%	1.0%	1.5%	1.5%	2.4%	2.7%	1.8%
Other	22.6%	19.6%	16.4%	12.8%	11.0%	8.2%	8.7%	8.8%

Table 6. Diagnoses of patients listed for a first liver transplantation in 2022 compared with previous time periods. In 2022 28% of HCC patients listed for a first liver transplantation were anti-HCV positive.

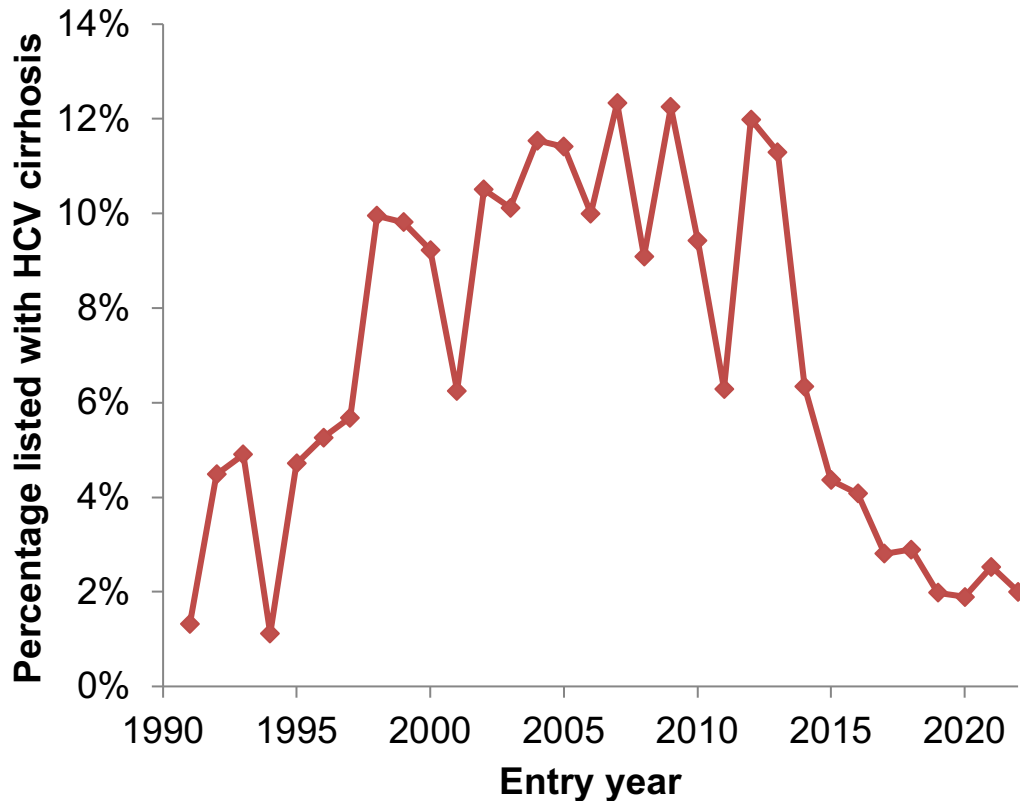


Figure 11. Percentage of patients listed with HCV cirrhosis from 1990-2022.

7. Patient and liver graft survival

When looking at 5-years intervals, patient survival (defined as time from the first liver transplantation until death) and graft survival (defined as time from the first liver transplantation until death or re-transplantation) were dramatically improving over the first years of the Nordic liver transplantation programs (Figures 12 and 13). For the two last 5-year periods the survival is quite similar. There are notable differences in the long-term patient and graft survival for different indications for transplantation (Figures 14, 15 and Table 7). The survival following retransplantation is reduced compared to the primary transplantation, this is particularly evident during the first months after the transplantation (Figure 16). Similar to the survival following the primary transplantation, the survival following retransplantation is markedly better in the recent time-periods

compared to the start of the program. In an intention-to-treat analysis analysing survival from listing for transplantation, the survival is lower but encompasses all events following listing and gives an indication of the performance of the program (Figure 17)

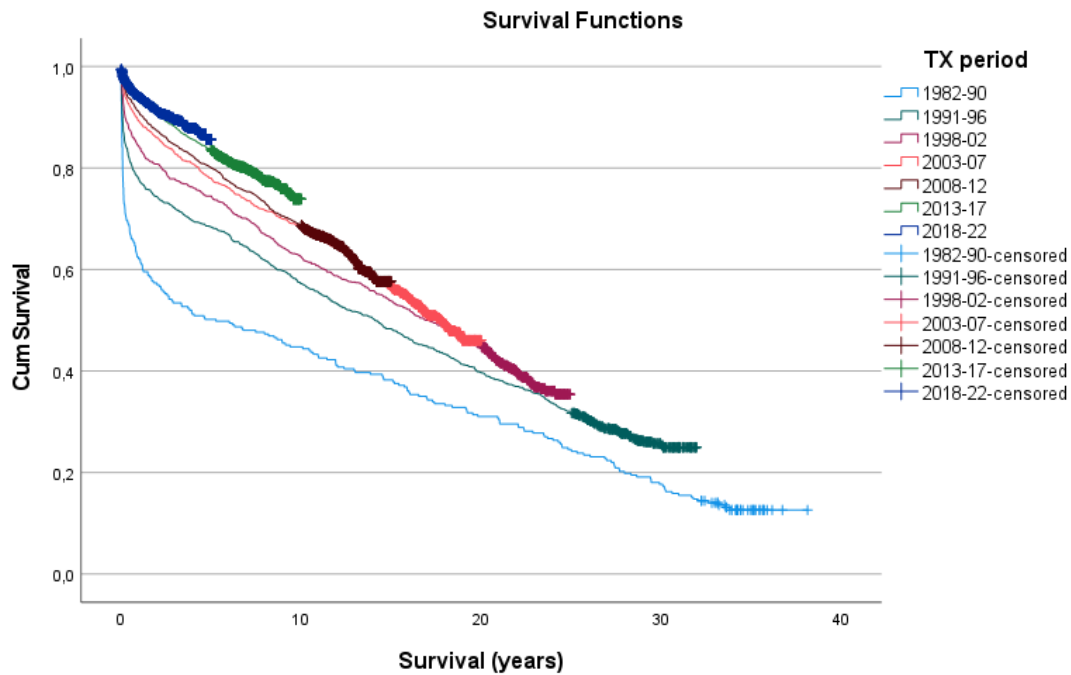


Figure 12. Kaplan-Meier patient survival curve for patients receiving a first liver allograft in the indicated time periods.

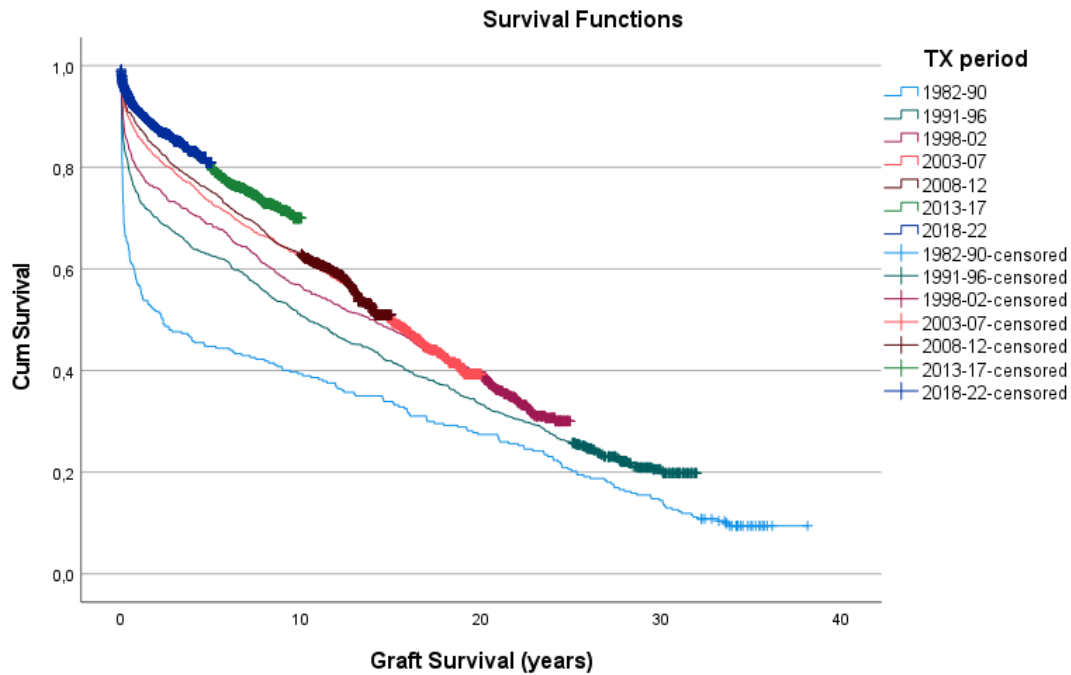


Figure 13. Kaplan-Meier graft survival curve for patients receiving a first liver allograft in the indicated time periods.

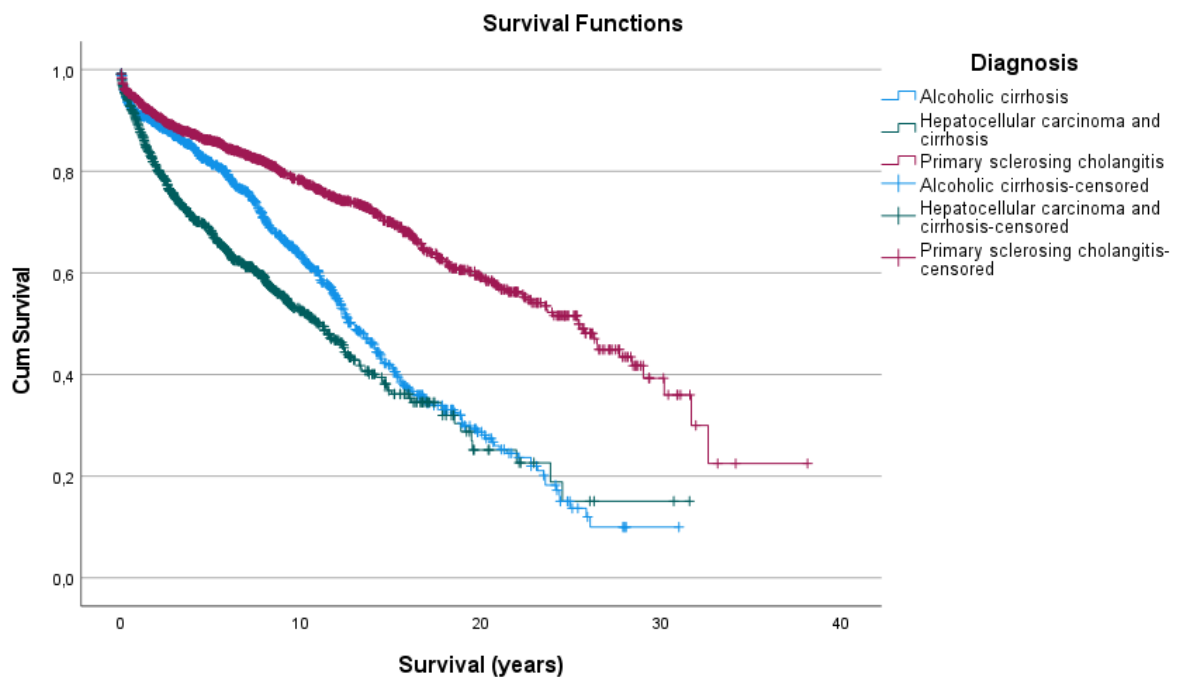


Figure 14. Kaplan-Meier patient survival curve for patients receiving a first liver allograft stratified for the three most common primary diagnoses.

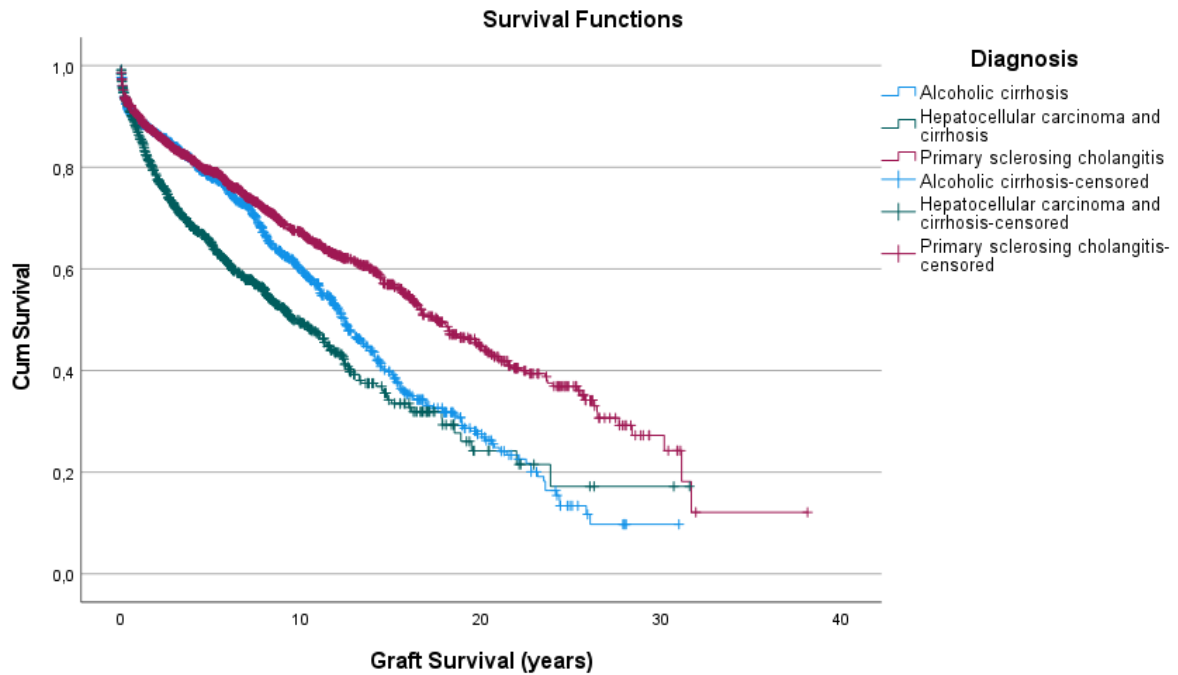


Figure 15. Kaplan-Meier graft survival curve for patients receiving a first liver allograft stratified for the three most common primary diagnoses.

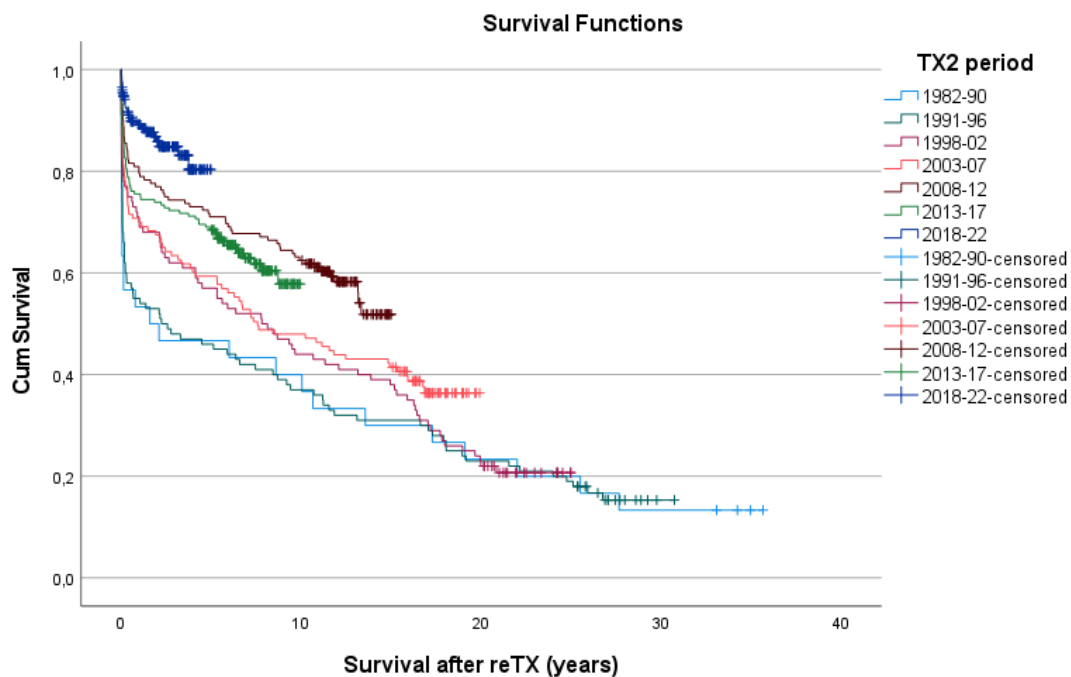


Figure 16. Kaplan-Meier patient survival curve for patients following retransplantation in the indicated time periods.

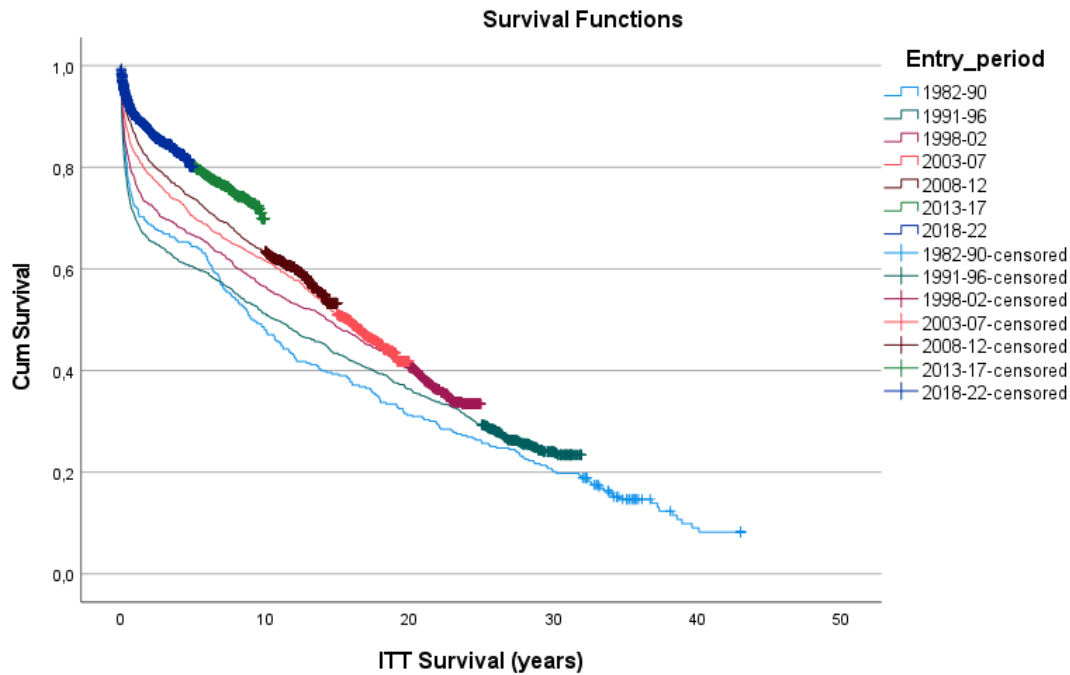


Figure 17. Kaplan-Meier patient intention-to-treat survival curve following listing for transplantation.

	Median age	1-year survival (%)	5-year survival (%)
Primary sclerosing cholangitis	45.2	98 %	90 %
Hepatocellular carcinoma and cirrhosis	61.9	94 %	78 %
Alcoholic cirrhosis	58.2	96 %	85 %
Metabolic disease	52.3	95 %	89 %
Cirrhosis - unknown	57.4	93 %	87 %
Autoimmune cirrhosis	51.6	95 %	85 %
Primary biliary cholangitis	56.4	93 %	89 %
Extrahepatic biliary atresia	1.2	93 %	93 %
Polycystic disease	55.1	97 %	97 %
Post hepatitis C cirrhosis	55.0	87 %	75 %
Listed as highly urgent	40.4	84 %	80 %

Table 7. Age at transplant and survival for the patients listed 2013-2022 for ten selected diagnoses and those listed as highly urgent

8. Maintenance of the registry

There are differences between each center in terms of how extensively data are entered into the NLTR. Diagnosis information, waiting list/transplantation status and survival data for all patients are now complete for 2022. I am extremely grateful for dedicated follow-up provided by the transplant coordinators upon my requests during quality control. In Oslo, I particularly want to thank Monika Olofsson and Martine Andresen, in Gothenburg Ulla Nyström, in Stockholm Malin Aram and Marie Tranäng, in Copenhagen Mette Gottlieb, in Helsinki Leena Toivonen and in Tartu Virge Pall takes care of the registry. Quality control of the content of NLTR is a continuous priority, and a particular emphasis is put into ensuring integrity of the survival data, including cause of death. The remainder of the registry must be maintained at a level set at the discretion of each individual center and contact person.

9. Acknowledgements - financial support

The NLTR received no financial support in 2022. The maintenance of the database system has been performed by Scandiatransplant. We are extremely grateful for the help and support from Ilse Duus Weinreich and the rest of the Scandiatransplant team in Aarhus. Without their assistance, it would very simply not have been possible to maintain the registry and I sincerely hope their efforts are recognized by the NLTG and Scandiatransplant.

10. Organization and data ownership

The registry (software) is the property of Scandiatransplant. The data in the registry are the property of the hospitals represented in the Nordic Liver Transplantation Group. Utilization of data in research projects should be censored by the latter and need to comply with national guidelines for research ethics and data handling. Co-

authorships for publications from research projects should be allocated according to the Vancouver guidelines, this includes presentations of data at conferences. The quality statistics of the transplantation activity presented in this report must not be used in other contexts without permission from the Nordic Liver Transplantation Group.

11. Publications based on the NLTR

Full length articles 1990-2022:

1. Keiding S, Ericzon BG, Eriksson S, Flatmark A, Hockerstedt K, Isoniemi H, Karlberg I, Keiding N, Olsson R, Samela K, Schrumpf E. Survival after liver transplantation of patients with primary biliary cirrhosis in the Nordic countries. Comparison with expected survival in another series of transplantations and in an international trial of medical treatment. *Scand J Gastroenterol* 1990; 25:11-8
2. Hockerstedt K, Ericzon BG, Eriksson LS, Flatmark A, Isoniemi H, Karlberg I, Keiding N, Keiding S, Olsson R, Samela K. Survival after liver transplantation for primary biliary cirrhosis: use of prognostic indices for comparison with medical treatment. *Transpl Proc* 1990; 22:1499-500
3. Hockerstedt K, Isoniemi H, Ericzon BG, Broome U, Friman S, Persson H, Bergan A, Schrumpf E, Kirkegaard P, Hjortrup A. Is a 3-day waiting list appropriate for patients with acute liver failure? *Transpl Proc* 1994;26:1786-7
4. Bjøro K, Friman S, Höckerstedt K, Kirkegaard P, Keiding S, Schrumpf E, Olausson M, Oksanen A, Isoniemi H, Hjortrup A, Bergan A, Ericzon BG. Liver transplantation in the Nordic countries, 1982-1998: Changes of indications and improving results. *Scand J Gastroenterol* 1999;34:714-722

5. Bjøro K, Höckerstedt K, Ericzon BG, Friman S, Hjortrup A, Keiding S, Schrumpf E, Duraj F, Olausson M, Mäkisalo H, Bergan A, Kirkegaard P. Liver transplantation in patients over 60 years of age. *Transpl Int* 2000; 13, 165-170
6. Bjøro K, Kirkegaard P, Ericzon BG, Friman S, Schrumpf E, Isoniemi H, Herlenius G, Olausson M, Rasmussen A, Foss A, Höckerstedt K. Is a 3-day limit for highly urgent liver transplantation for fulminant hepatic failure appropriate – or is the diagnosis in some cases incorrect? *Transpl Proceed* 2001;33:2511-3
7. Ericzon BG, Bjøro K, Höckerstedt K, Hansen B, Olausson M, Isoniemi H, Kirkegaard P, Broome U, Foss A, Friman S. Time to request ABO-identity when transplanting for fulminant hepatic failure? *Transpl Proc* 2001;33:3466-7
8. Leidenius M, Broome U, Ericzon B-E, Friman S, Olausson M, Schrumpf E, Höckerstedt K. Hepatobiliary carcinoma in primary sclerosing cholangitis: a case control study. *J Hepatol* 2001;34:792-8.
9. Olausson M, Mjornstedt L, Backman L, Lindner P, Olsson R, Krantz M, Karlsen KL, Stenqvist O, Henriksson BA, Friman S. Liver transplantation--from experiment to routine care. Experiences from the first 500 liver transplantations in Gothenburg. *Lakartidningen* 2001;98:4556-62
10. Brandsæter B, Höckerstedt K, Ericzon BG, Friman S, Kirkegaard P, Isoniemi H, Foss A, Olausson M, Hansen B, Bjøro K: Outcome following listing for liver transplantation due to fulminant hepatic failure in the Nordic countries. *Liver Transplantation* 2002;8:1055-62
11. Bjøro K, Ericzon BG, Kirkegaard P, Höckerstedt K, Söderdahl G, Olausson M, Foss A, Schmidt LE, Brandsæter B, Friman S. Liver transplantation for fulminant hepatic failure: impact of donor-recipient ABO-matching on the outcome. *Transplantation* 2003; 75:347-53

12. Brandsæter Bjørn, Broomé Ulrika, Isoniemi Helena, Friman Styrbjörn, Hansen Bent, Schrumpf Erik, Oksanen Antti, Ericzon Bo-Göran, Höckerstedt Krister, Mäkisalo Heikki, Olsson Rolf, Olausson Michael, Kirkegaard Preben, Bjøro Kristian. Liver transplantation for primary sclerosing cholangitis in the Nordic countries: outcome after acceptance to the waiting list. *Liver Transpl.* 2003;9:961-9.

13. Brandsaeter B, Friman S, Broome U, Isoniemi H, Olausson M, Backman L, Hansen B, Schrumpf E, Oksanen A, Ericzon BG, Hockerstedt K, Makisalo H, Kirkegaard P, Bjoro K. Outcome following liver transplantation for primary sclerosing cholangitis in the Nordic countries. *Scand J Gastroenterol.* 2003;38:1176-83.

14. Brandsaeter B, Isoniemi H, Broome U, Olausson M, Backman L, Hansen B, Schrumpf E, Oksanen A, Ericzon BG, Hockerstedt K, Makisalo H, Kirkegaard P, Friman S, Bjoro K. Liver transplantation for primary sclerosing cholangitis; predictors and consequences of hepatobiliary malignancy. *J Hepatol.* 2004;40:815-822.

15. Bjøro K, Schrumpf E. Liver transplantation for primary sclerosing cholangitis. *J Hepatol.* 2004;40:570-7.

16. Brandsaeter B, Isoniemi H, Broomé U, Olausson M, Bäckmann L, Hansen B, Oksanen A, Ericzon BG, Höckerstedt K, Mäkisalo H, Kirkegaard P, Friman S, Bjøro K, Schrumpf E (Nordic Liver Transplantation Group). Chemopreventive effect of ursodeoxycholic acid in primary sclerosing cholangitis? Falk Symposium 141. Bile Acid Biology and its Therapeutic Implications. XVIII International Bile Acid Meeting 2005;242-249.

17. Melum E, Schrumpf E, Bjøro K. Liver TX for hepatitis C cirrhosis in a low prevalence population: risk factors and status at evaluation. *Scand J Gastroenterol.* 2006;41:592-6.

18. Bjøro K, Brandsaeter B, Foss A, Schrumpf E. Liver transplantation in primary sclerosing cholangitis. *Semin Liver Dis.* 2006;26:69-79.

19. Melum E, Friman S, Bjøro K, Rasmussen A, Isoniemi H, Gjertsen H, Bäckman L, Oksanen A, Olausson M, Duraj FF, Ericzon BG. Hepatitis C impairs survival following liver transplantation irrespective of concomitant hepatocellular carcinoma. *J Hepatol.* 2007;47:777-83.

20. Friman S, Foss A, Isoniemi H, Olausson M, Höckerstedt K, Yamamoto S, Karlsen TH, Rizell M, Ericzon BG. Liver transplantation for cholangiocarcinoma: selection is essential for acceptable results. *Scand J Gastroenterol.* 2011;46:370-5.

21. Jørgensen KK, Lindström L, Cvancarova M, Castedal M, Friman S, Schrumpf E, Foss A, Isoniemi H, Nordin A, Holte K, Rasmussen A, Bergquist A, Vatn MH, Boberg KM. Colorectal neoplasia in patients with primary sclerosing cholangitis undergoing liver transplantation: a Nordic multicenter study. *Scand J Gastroenterol.* 2012;47:1021-9.

22. Jørgensen KK, Lindström L, Cvancarova M, Karlsen TH, Castedal M, Friman S, Schrumpf E, Foss A, Isoniemi H, Nordin A, Holte K, Rasmussen A, Bergquist A, Vatn MH, Boberg KM. Immunosuppression after liver transplantation for primary sclerosing cholangitis influences activity of inflammatory bowel disease. *Clin Gastroenterol Hepatol.* 2013;11:517-23

23. Fosby B, Melum E, Bjøro K, Bennet W, Rasmussen A, Andersen IM, Castedal M, Olausson M, Wibeck C, Gotlieb M, Gjertsen H, Toivonen L, Foss S, Makisalo H, Nordin A, Sanengen T, Bergquist A, Larsson ME, Soderdahl G, Nowak G, Boberg KM, Isoniemi H, Keiding S, Foss A, Line PD, Friman S, Schrumpf E, Ericzon BG, Höckerstedt K, Karlsen TH. Liver transplantation in the Nordic countries - An intention to treat and post-transplant analysis from The Nordic Liver Transplant Registry 1982-2013. *Scand J Gastroenterol.* 2015;50:797-808.

24. Thorsen T, Aandahl EM, Bennet W, Olausson M, Ericzon BG,

Nowak G, Duraj F, Isoniemi H, Rasmussen A, Karlsen TH, Foss A. Transplantation With Livers From Deceased Donors Older Than 75 Years. *Transplantation*. 2015;99:2534-42

25. Åberg F, Gissler M, Karlsen TH, Ericzon BG, Foss A, Rasmussen A, Bennet W, Olausson M, Line PD, Nordin A, Bergquist A, Boberg KM, Castedal M, Pedersen CR, Isoniemi H. *Hepatology*. 2015;61:668-77

26. Malenicka S, Ericzon BG, Jørgensen MH, Isoniemi H, Karlsen TH, Krantz M, Naeser V, Olausson M, Rasmussen A, Rönholm K, Sanengen T, Scholz T, Fischler B, Nemeth A. Impaired intention-to-treat survival after listing for liver transplantation in children with biliary atresia compared to other chronic liver diseases: 20 years' experience from the Nordic countries. *Pediatr Transplant*. 2017 Mar;21(2). doi: 10.1111/ptr.12851

27. Åberg F, Isoniemi H, Pukkala E, Jalanko H, Rasmussen A, Storm HH, Schultz N, Bennet W, Ekvall N, Ericzon BG, Malenicka S, Tretli S, Line PD, Boberg KM, Østensen A, Karlsen TH, Nordin A. Cancer After Liver Transplantation in Children and Young Adults: A Population-Based Study From 4 Nordic Countries. *Liver Transpl*. 2018 Sep;24(9):1252-1259. doi: 10.1002/lt.25305.

28. Holmer M, Melum E, Isoniemi H, Ericzon BG, Castedal M, Nordin A, Aagaard Schultz N, Rasmussen A, Line PD, Stål P, Bennet W, Hagström H. Nonalcoholic fatty liver disease is an increasing indication for liver transplantation in the Nordic countries. *Liver Int*. 2018 Nov;38(11):2082-2090. doi: 10.1111/liv.13751. Epub 2018 May 2.

29. Nordin A, Åberg F, Pukkala E, Pedersen CR, Storm HH, Rasmussen A, Bennet W, Olausson M, Wilczek H, Ericzon BG, Tretli S, Line PD, Karlsen TH, Boberg KM, Isoniemi H.

Decreasing incidence of cancer after liver transplantation-A Nordic population-based study over 3 decades.
Am J Transplant. 2018 Apr;18(4):952-963. doi: 10.1111/ajt.14507.
Epub 2017 Oct 17.

30. Lindström L, Jørgensen KK, Boberg KM, Castedal M, Rasmussen A, Rostved AA, Isoniemi H, Bottai M, Bergquist A.
Risk factors and prognosis for recurrent primary sclerosing cholangitis after liver transplantation: a Nordic Multicentre Study.
Scand J Gastroenterol. 2018 Mar;53(3):297-304. doi: 10.1080/00365521.2017.1421705. Epub 2018 Jan 4.

31. Tschuor C, Ferrarese A, Kuemmerli C, Dutkowski P, Burra P, Clavien PA; Liver Allocation Study Group.
Allocation of liver grafts worldwide - Is there a best system?
J Hepatol. 2019 Oct;71(4):707-718. doi: 10.1016/j.jhep.2019.05.025.

32. Schult A, Stokkeland K, Ericzon BG, Hulcrantz R, Franck J, Stål P, Castedal M.
Alcohol and drug use prior to liver transplantation: more common than expected in patients with non-alcoholic liver disease.
Scand J Gastroenterol. 2019 Sep;54(9):1146-1154. doi: 10.1080/00365521.2019.1656772.