The Nordic Liver Transplant Registry (NLTR)

Annual report 2019

Report prepared by Espen Melum July 2020

Responsible contact persons:

Scandiatransplant Denmark - Århus; Ilse Duus Weinreich

Denmark - Copenhagen; Allan Rasmussen

Sweden - Gothenburg; William Bennet

Sweden - Stockholm; Bo-Göran Ericzon

Finland - Helsinki; Arno Nordin

Norway - Oslo; Morten Hagness

Estonia - Tartu; Virge Pall

NLTR; Espen Melum espen.melum@medisin.uio.no

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 May 2020. 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. Due to the global COVID-19 pandemic the data presented here was not discussed internally with the Nordic Liver Transplant Group (NLTG) in March 2020 as planned. Instead a formal discussion will take place during the autumn meeting.

2. Data content NLTR 2019

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 2019, data from a total of 8475 patients had been entered into NLTR. Of these, 7430 patients had received a first liver graft, 752 (10.1%) had been transplanted more than once, and 111 (1.4%) had been transplanted more than twice. Of the 752 patients receiving a second liver graft, 7 had received their first graft outside of the Scandiatransplant area. A total of 179 living donor transplantations had been performed. Children below 18 years constituted 805 (10.8%) of the transplanted patients in the registry.

3. Transplantation activity 2019

The total number of patients who received a first liver graft in 2019 was 360 (Figure 1). Of these, 12 were combined liver-kidney transplantations. Of the first liver transplantations performed in 2019 3 were living donor transplantations while no domino transplantations were performed in 2019. The three living donor transplantations were performed in Stockholm (n=1) and Gothenburg (n=2). In addition, 55 re-transplantations were performed (Table 2). The total number of liver transplantations was 415, this is a considerable increase from the 377 transplants performed in 2018 and close to the record year of 2016 when 419 transplants were performed. The most striking increase in 2019 is the number of retransplants that is more than doubled compared with 2018 and back at the activity level we saw in 2016 (Figure 1). Whether this is due to an increased demand for retransplantation or just fluctuations are not clear.

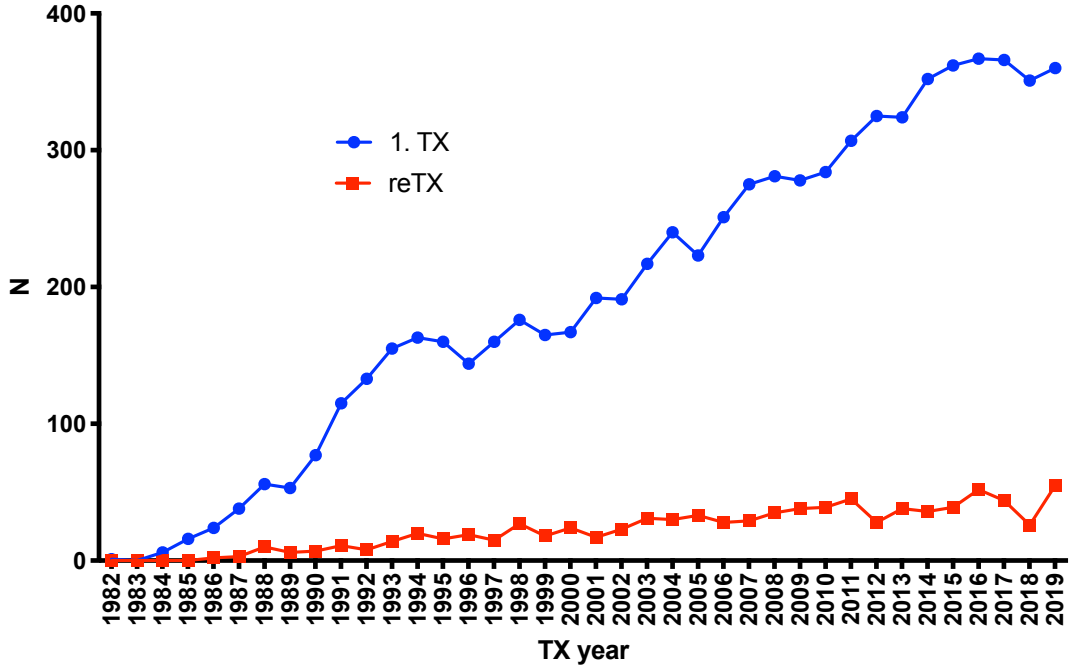

Figure 1. Number of patients receiving a liver allograft 1982-2019. The blue line represents the number of patients receiving a first liver graft while the red line represents the total number of re-transplantations.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Copenhagen	43	43	43	39	41	55	51	52	39	61
Gothenburg	61	66	76	72	89	86	88	84	83	80
Helsinki	47	52	48	44	56	70	54	57	60	56
Oslo	77	81	89	96	89	72	88	85	87	75
Stockholm	53	65	68	73	77	79	86	82	73	78
Uppsala	9	3	0	0	0	0				
Tartu*								6	9	10

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 Estonia joined Scandiatransplant

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Copenhagen	4	9	4	3	6	3	9*	5	4	3
Gothenburg	19	16	4	9	8	8	17	10	3	15
Helsinki	3	4	4	5	3	7	7	6	6	9
Oslo	12	8	11	14	11	14	12	17	8	19
Stockholm	1	8	5	7	8	8*	7	5	4	9
Uppsala	0	0	0	0	0	0	0	0	0	0
Tartu**								0	1	0

Table 2. Total number of re-transplantations performed at the individual centers during the last 10 years. * = 1 pts in 2015 and one in 2016 received their first graft outside SCTP **Data from Tartu are only included from the time Estonia joined Scandiatransplant

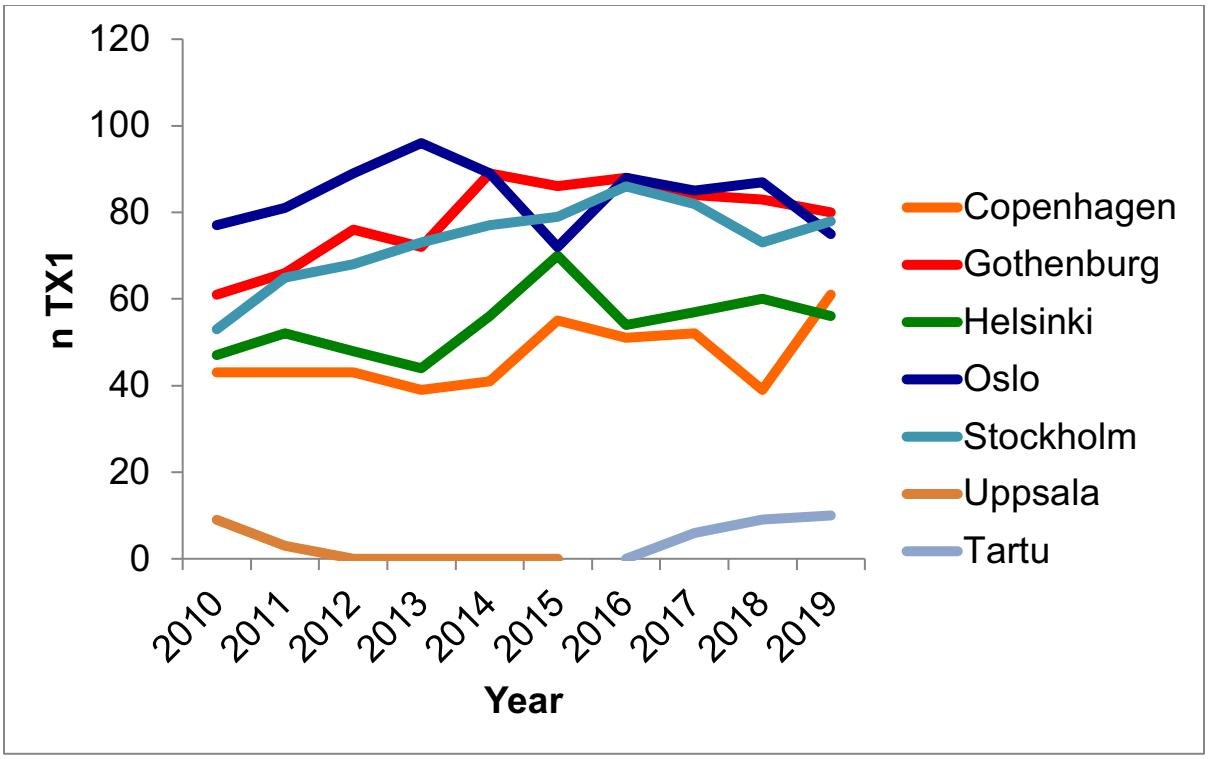

Figure 2. Number of first liver transplantations performed at the Nordic and Estonian centers that are currently performing liver transplantations.

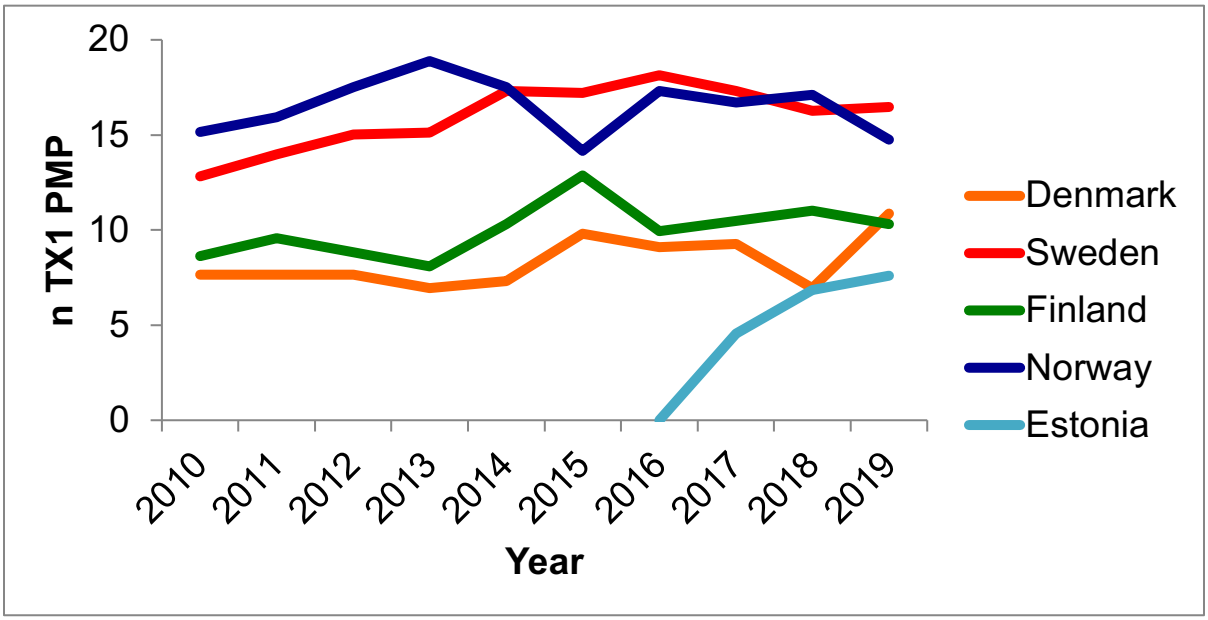

Figure 3. Number of first liver transplantations performed in the Scandiatransplant countries according to the country's population. PMP, per million population.

4. The waiting list 2019

In 2019, a total of 404 patients were entered on the waiting list for a first liver transplant (Table 3), this is an increase from the 380 entered in 2018 (Figure 4). Twenty-seven of the patients entered in 2019 were listed as highly urgent.

Active on waiting list	Deceased donor	Living donor	Dead	Permanent withdrawal
95	279	3	11	16

Table 3. *Patients entering the waiting list in 2019 classified by outcome as of December 31st 2019.*

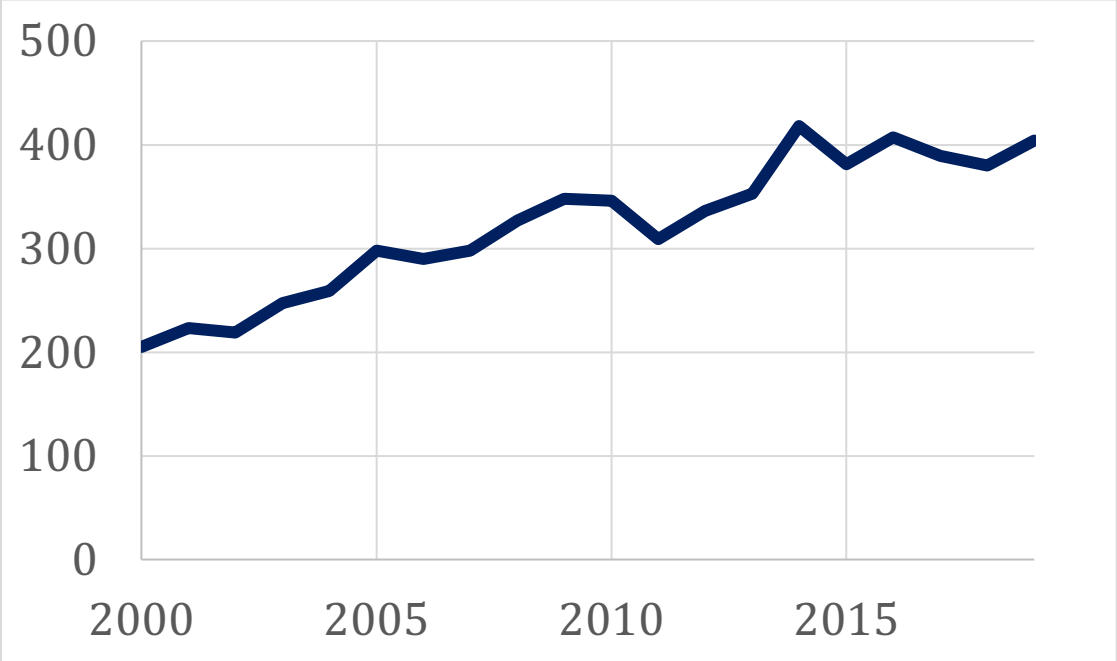

Figure 4. Number of patients entering the waiting list from 2000-2019.

The number of deaths among patients listed in 2019 for a first liver transplant was 11 (Denmark 0, Sweden 5, Finland 1, Norway 5 and Estonia 0). The absolute number of deaths registered on the waiting list has remained stable since 1990 (Figure 5). When the deaths on the

waiting list are evaluated in relation to the total liver transplantation activity in 2019 the relative number of deaths on the waiting list remains low as it has also been since 2011 (Figure 6).

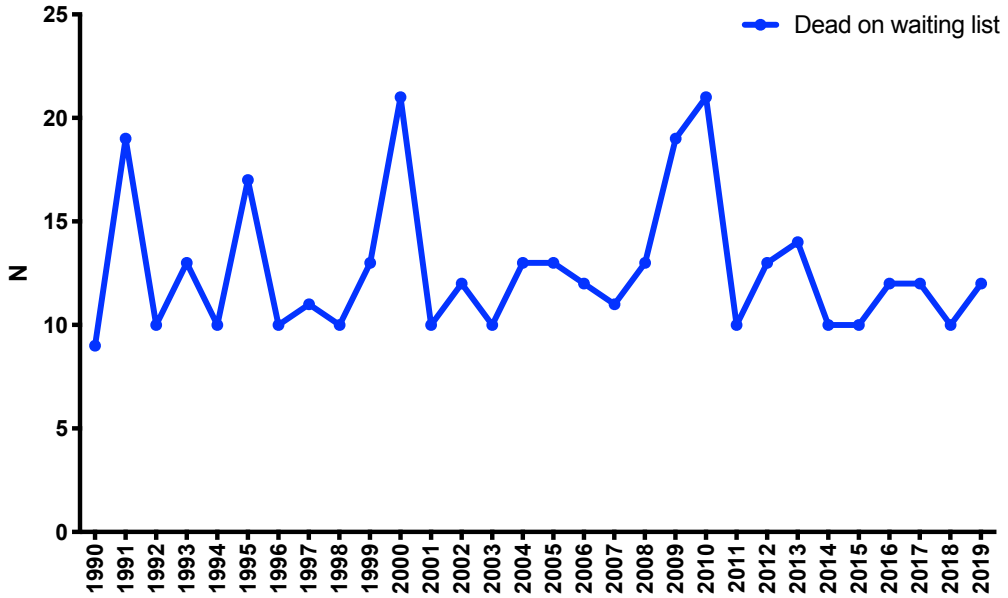

Figure 5. Number of patients registered as dead on the waiting list in the period 1990-2019.

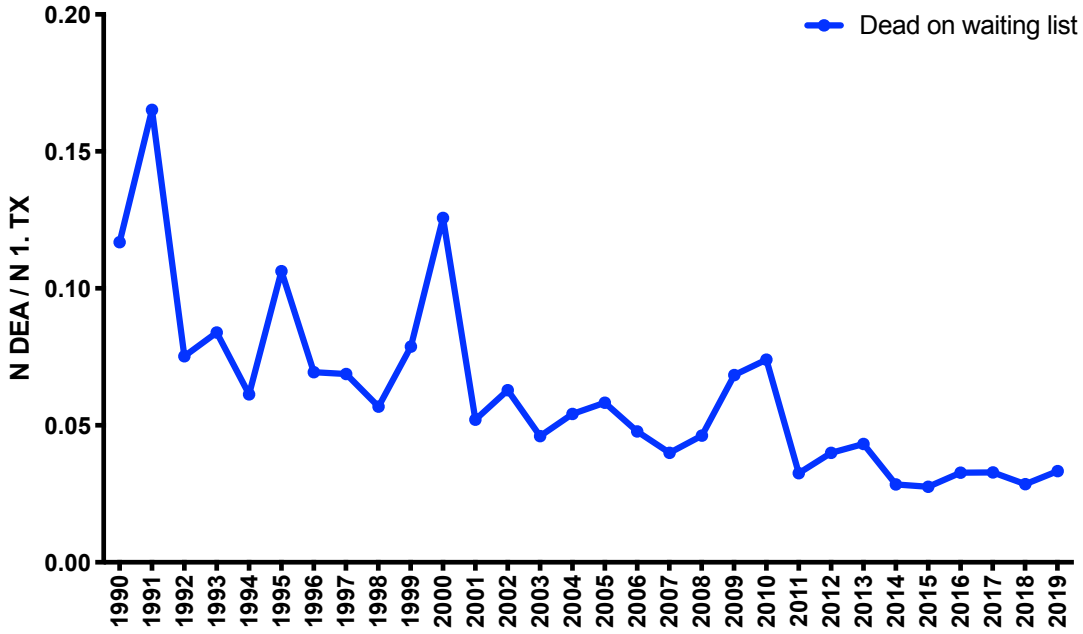

Figure 6. Number of patients registered as dead on the waiting list relative to the total transplantation activity in the period 1990-2019.

The median waiting time in 2019 was 40 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).

0	A	AB	B
92 (1375)	28.5 (516)	13.5 (184)	40.5 (470)

Table 4. Median time on waiting list (days) for patients receiving a first liver allograft in 2019 according to ABO blood type. The number in parenthesis represents the maximum waiting time for the indicated blood type in 2019. (Patients listed as highly urgent are excluded from the calculations.)

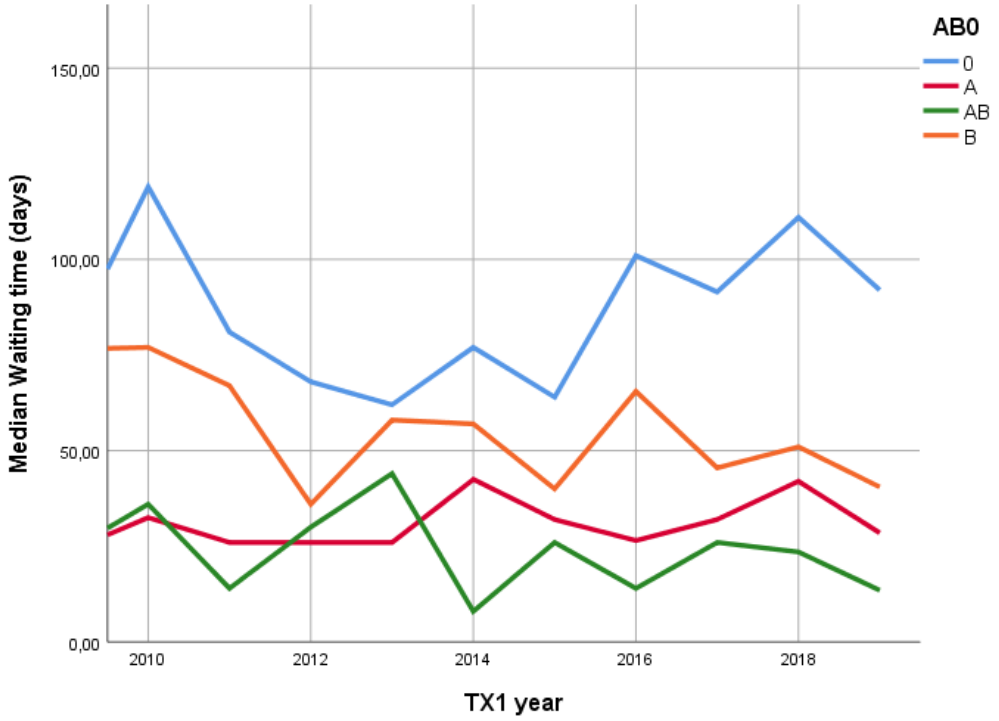

Figure 7. Median waiting time for first liver transplantation according to ABO blood type for 2010-2019. (Patients listed as highly urgent are excluded from the calculations.)

Finland had the lowest and Denmark the longest waiting time in 2019 (Table 5). After slightly increased waiting times in the two recent years, the waiting times have decreased at all centers in 2019 (Figure 8). The waiting times remain remarkably low compared to other programs.

Copenhagen	Gothenburg	Helsinki	Oslo	Stockholm	Tartu
68 (1375)	29 (616)	16 (138)	35 (712)	58.5 (514)	41 (305)

Table 5. Median time on waiting list (days) for patients receiving a first liver allograft in 2019 according to transplantation center. The number in parenthesis represents the maximum waiting time for the indicated center in 2019. (Patients listed as highly urgent are excluded from the calculations.)

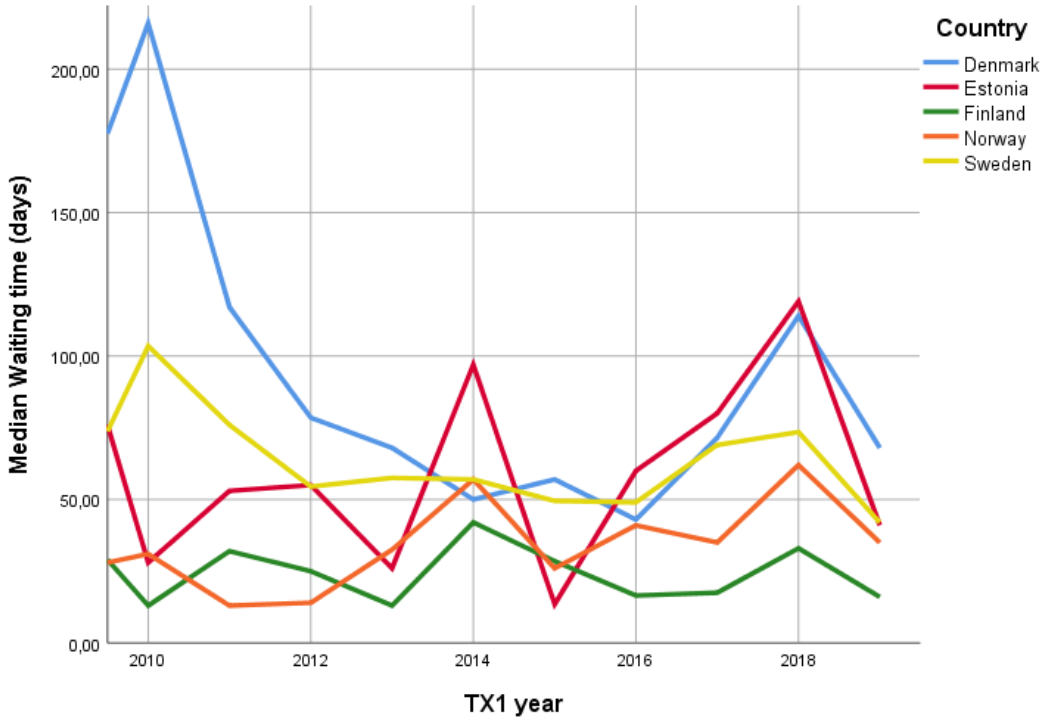

Figure 8. Median waiting time for first liver transplantation according to country for 2010-2019. (Patients listed as highly urgent are excluded from the calculations.)

5. Age of recipients and donors

The mean age of adult liver recipients (>18 years, first liver transplantation) in 2019 was 52.8 years. Mean age of children (<18 years, first liver transplantation) in 2019 was 6.1 years. Since 1990 the proportion of recipients >60 years of age at the first transplantation has gradually increased and seems to have plateaued with 33.1% of the patients in 2019 above 60 years of age (Figure 9). The mean age of the donors has remained stable since 2010 with a median age of 56.0 years in 2019 (Figure 10).

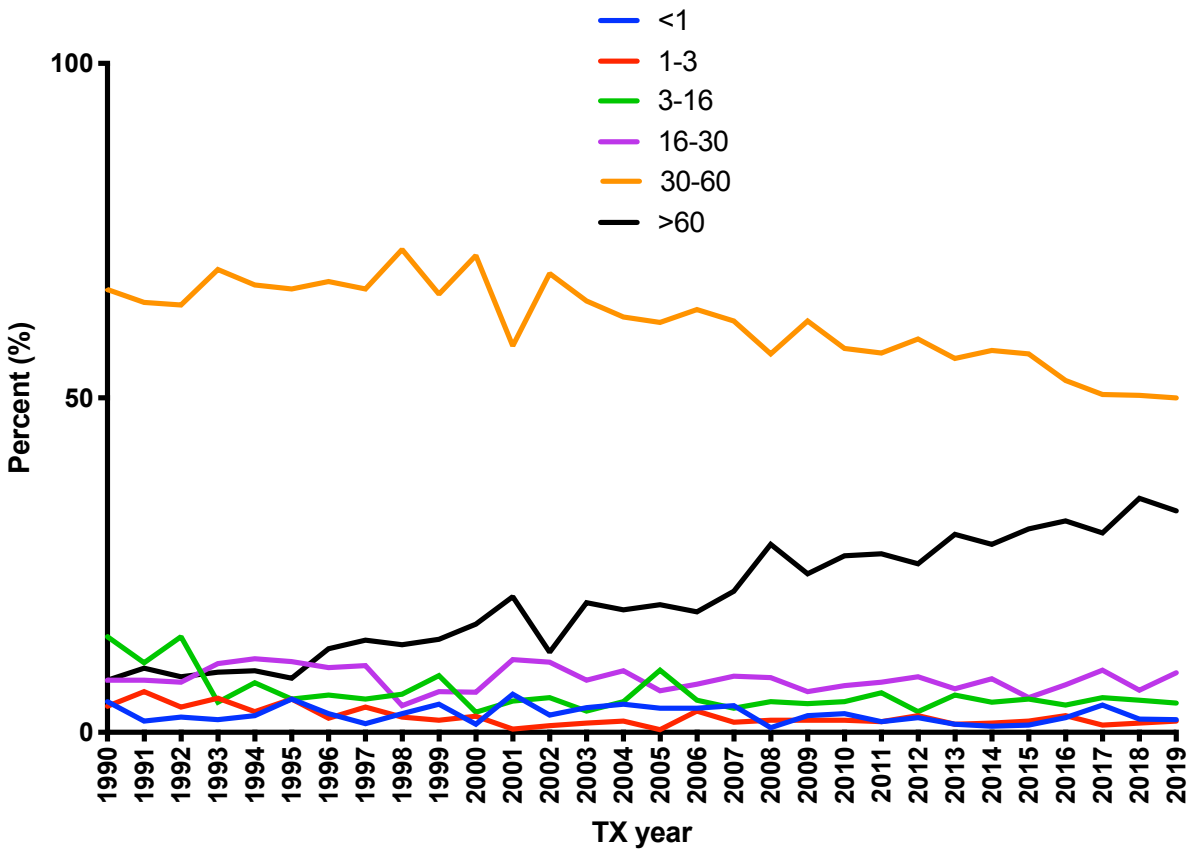

Figure 9. Proportion of liver transplants in the indicated age groups.

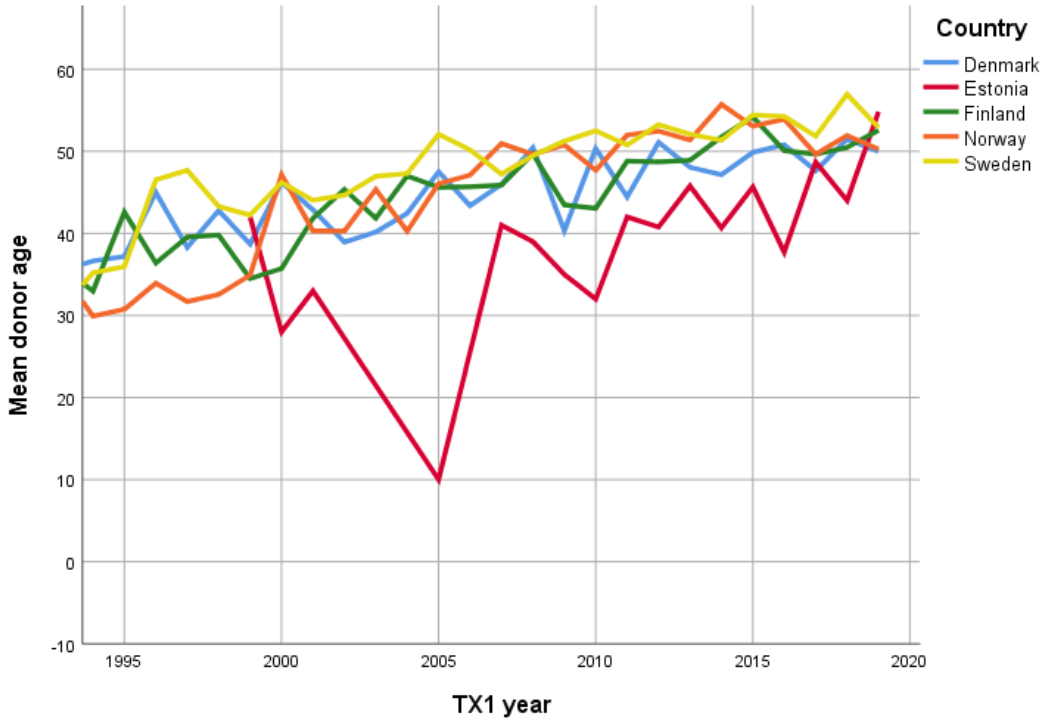

Figure 10. Mean age of donors utilized in the indicated years stratified for the different Nordic countries.

6. Diagnoses

In 2019, alcoholic cirrhosis was for the first time the leading indication for liver transplantation in the Nordic countries closely followed by primary sclerosing cholangitis and hepatocellular carcinoma (Table 6). Of the patients listed for transplantation with a primary diagnosis of hepatocellular carcinoma in 2019 27% were also anti-HCV positive. During the last 5 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.

	1982-89	1990-94	1995-99	2000-04	2005-09	2010-14	2015-19	2019
Alcoholic cirrhosis	0.5 %	6.6 %	11.8 %	12.6 %	11.5 %	11.4 %	13.7 %	16.6 %
Primary sclerosing cholangitis	11.5 %	11.5 %	14.5 %	15.9 %	15.4 %	15.8 %	17.5 %	15.8 %
Hepatocellular carcinoma and cirrhosis	10.6 %	5.5 %	5.6 %	5.9 %	8.9 %	16.6 %	16.1 %	14.9 %
Metabolic disease	9.2 %	9.3 %	5.9 %	5.0 %	6.6 %	6.9 %	9.2 %	9.7 %
Acute liver failure - other	8.3 %	10.9 %	7.7 %	7.0 %	5.6 %	5.0 %	6.5 %	7.7 %
Cirrhosis - unknown	0.5 %	2.0 %	4.0 %	2.4 %	4.4 %	6.1 %	5.6 %	6.9 %
Autoimmune cirrhosis	2.3 %	3.5 %	3.8 %	4.1 %	4.4 %	4.4 %	4.6 %	5.2 %
Primary biliary cirrhosis	26.3 %	14.9 %	10.0 %	6.8 %	7.2 %	5.3 %	4.5 %	4.2 %
Extrahepatic biliary atresia	6.5 %	4.8 %	5.4 %	4.7 %	3.2 %	2.3 %	2.5 %	3.0 %
Acute liver failure - toxic	0.9 %	2.4 %	3.7 %	4.2 %	4.0 %	3.0 %	2.5 %	2.7 %
Post hepatitis C cirrhosis	0.0 %	2.6 %	7.2 %	9.6 %	11.0 %	9.0 %	3.2 %	2.0 %
Polycystic disease	0.0 %	0.8 %	1.5 %	1.4 %	1.5 %	1.5 %	2.6 %	1.7 %
Other liver malignancies	1.4 %	2.8 %	2.2 %	1.8 %	0.7 %	1.6 %	0.8 %	1.2 %
Post hepatitis B cirrhosis	0.5 %	2.8 %	2.8 %	3.5 %	1.7 %	1.3 %	1.0 %	1.0 %
Secondary liver tumors	0.9 %	0.6 %	0.4 %	0.7 %	2.1 %	2.0 %	1.6 %	1.0 %
Acute liver failure - viral	0.0 %	2.6 %	2.0 %	1.3 %	1.5 %	1.3 %	0.8 %	0.7 %
Other	20.7 %	16.3 %	11.8 %	13.0 %	10.4 %	6.4 %	7.2 %	5.7 %

Table 6. *Diagnoses of patients listed for a first liver transplantation in 2019 compared with previous years. In 2019 27% of HCC patients listed for a first liver transplantation were anti-HCV positive.*

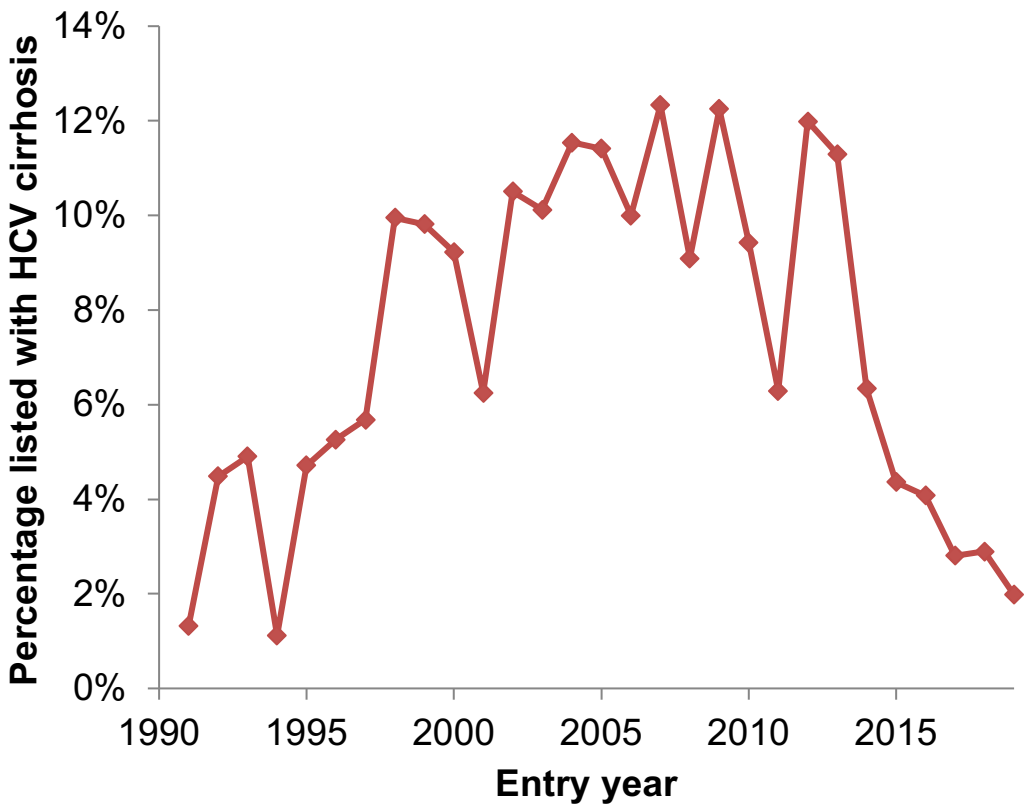

Figure 11. Percentage of patients listed with HCV cirrhosis from 1990-2019.

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). It is now evident that there is a further increase in the observed survival also in the most recent 5-year period. 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 in 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. However, a further improvement in the most recent period is not seen. In an intention-to-treat analysis analysing survival from the 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).

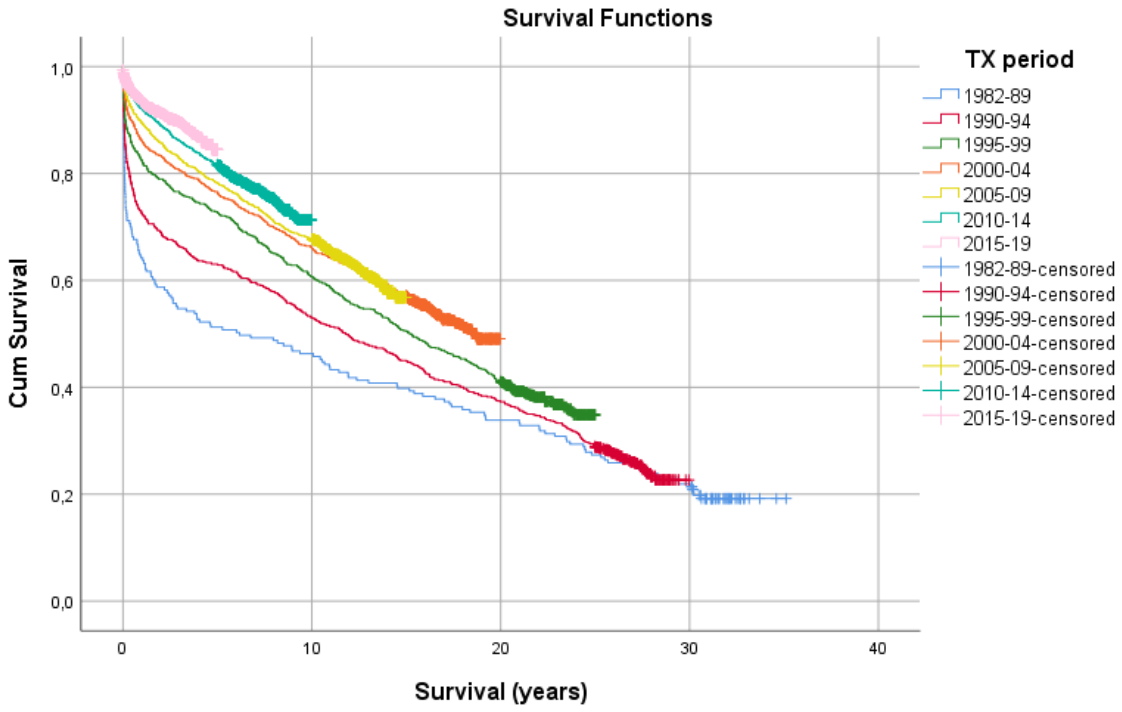

Figure 12. Kaplan-Meier patient survival curve for patients receiving a first liver allograft in the indicated time periods.

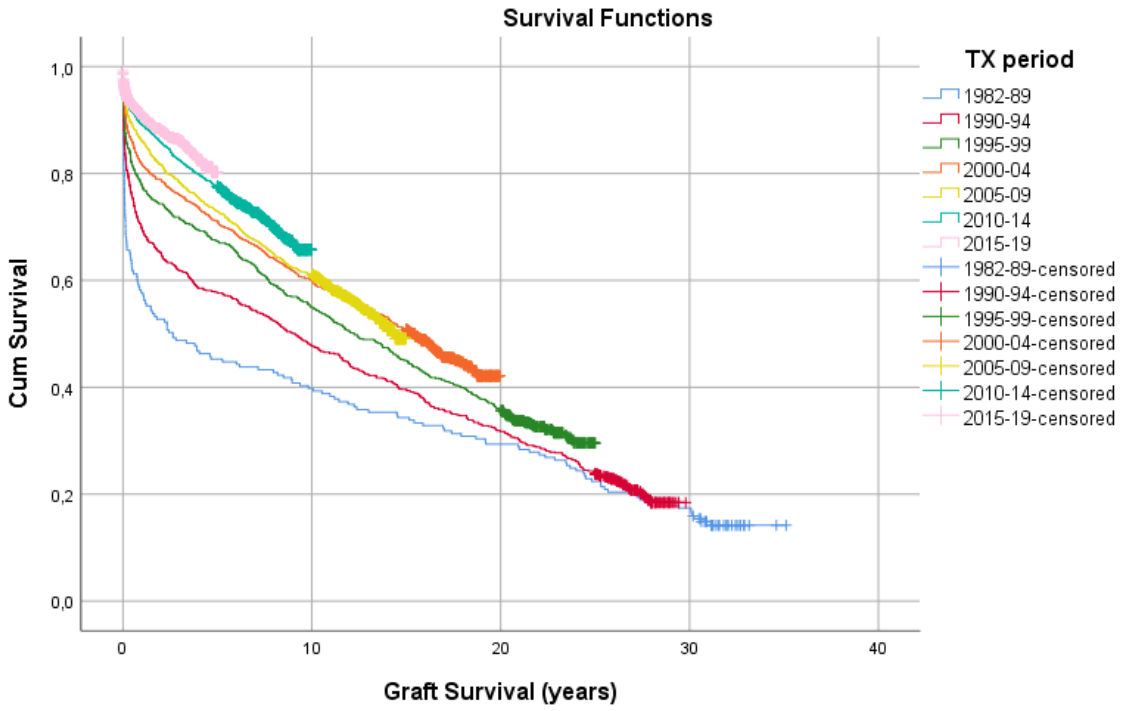

Figure 13. Kaplan-Meier graft survival curve for patients receiving a first liver allograft in the indicated time periods.

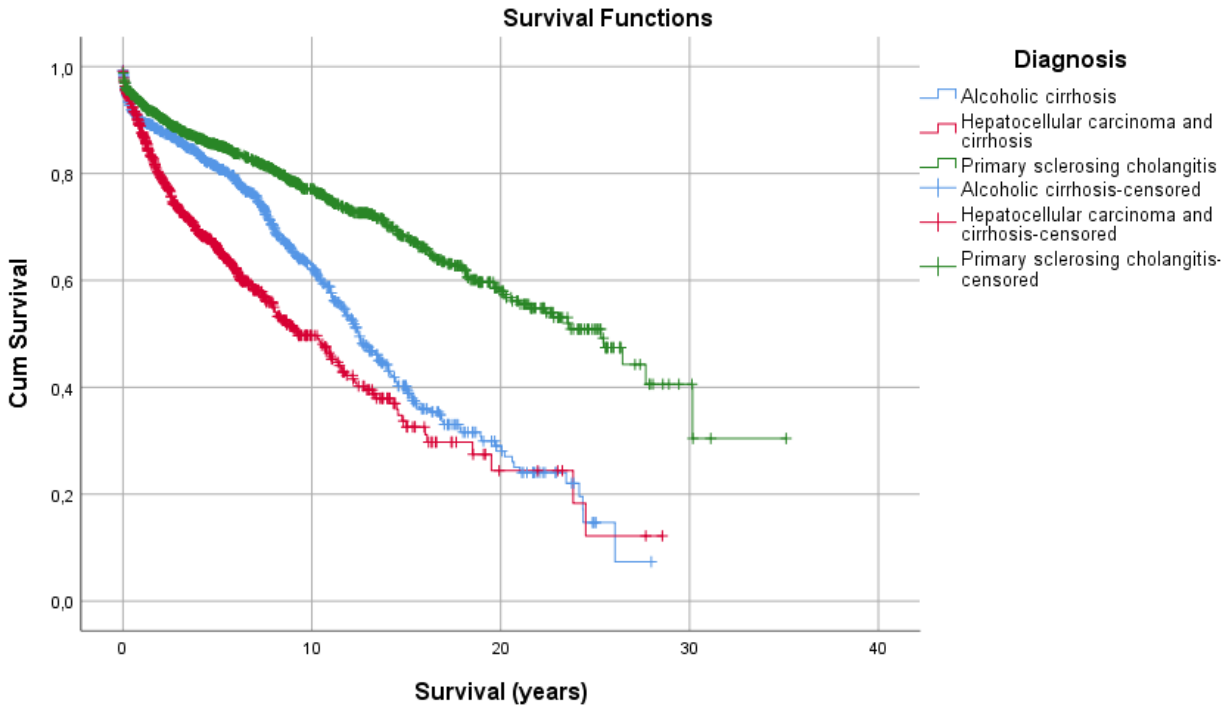

Figure 14. Kaplan-Meier patient survival curve for patients receiving a first liver allograft stratified for the three most common primary diagnoses.

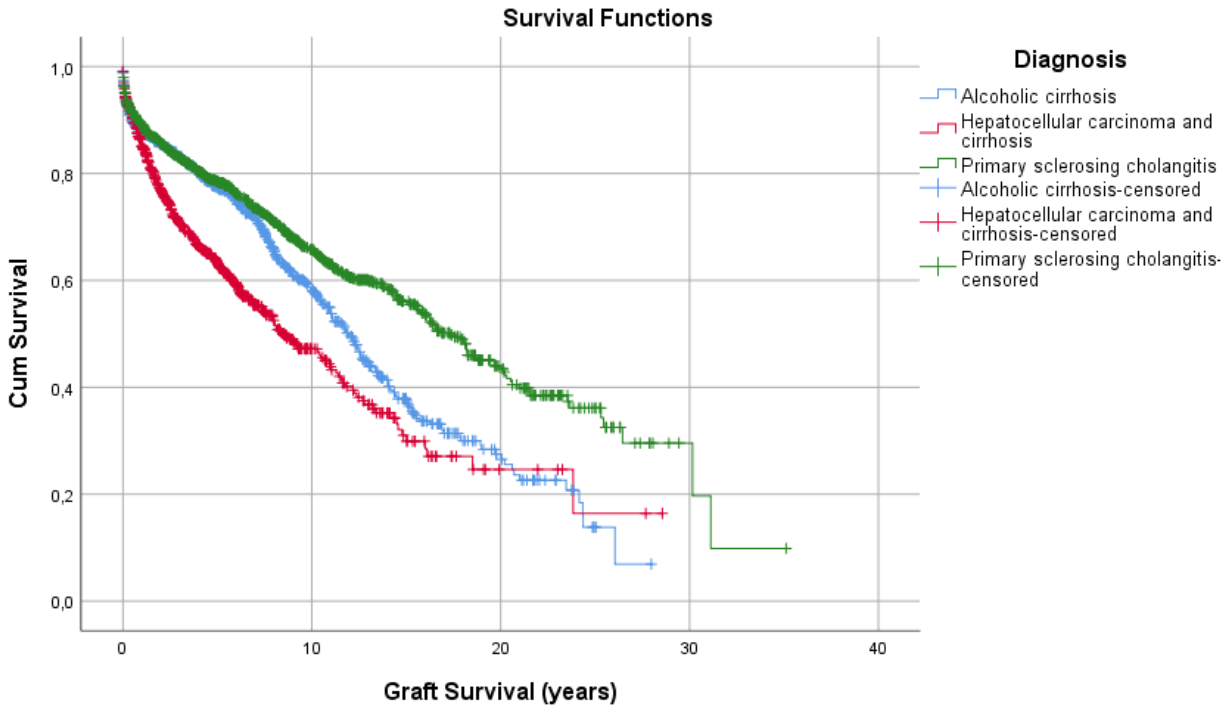

Figure 15. Kaplan-Meier graft survival curve for patients receiving a first liver allograft stratified for the three most common primary diagnoses.

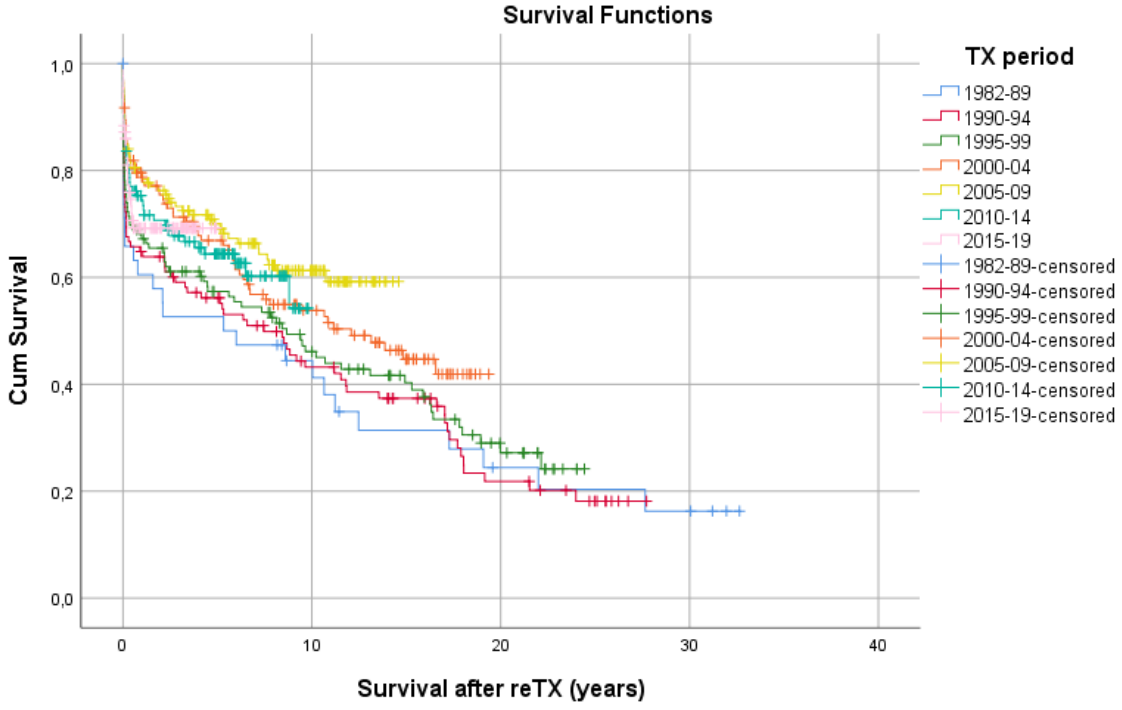

Figure 16. Kaplan-Meier patient survival curve for patients following retransplantation in the indicated time periods.

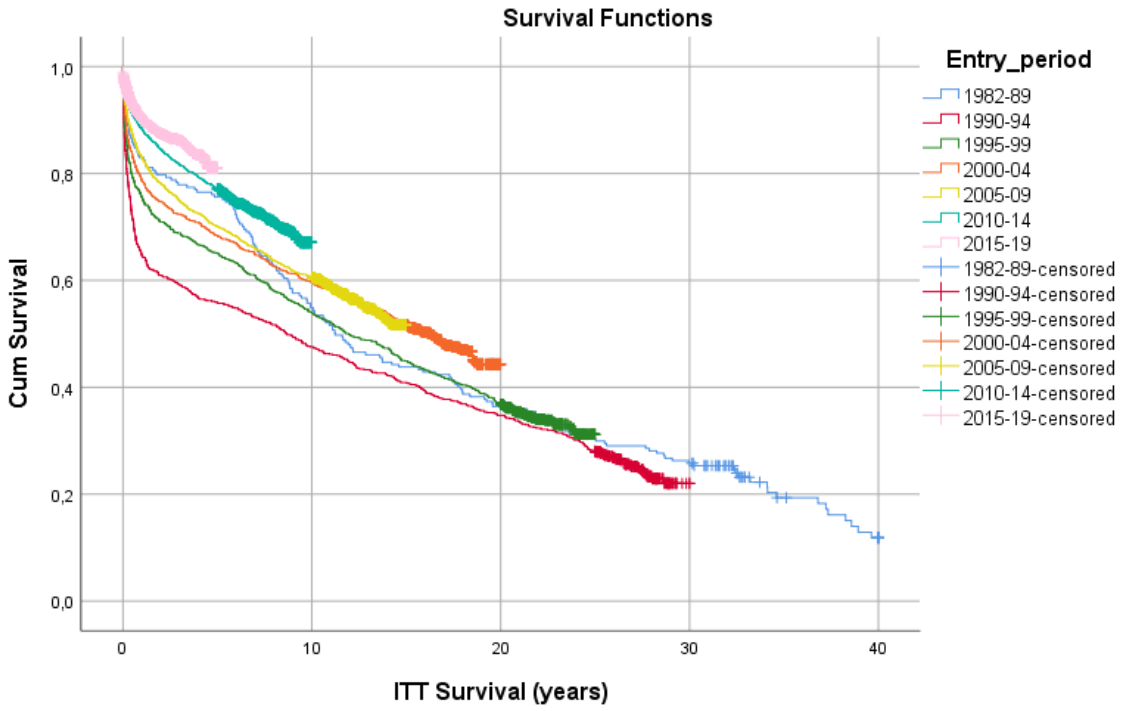

Figure 17. Kaplan-Meier patient intention-to-treat survival curve following listing for transplantation.

	Median age	1-year survival (%)	5-year survival (%)
Alcoholic cirrhosis	57.4	94 %	86 %
Primary sclerosing cholangitis	44.6	98 %	91 %
Hepatocellular carcinoma and cirrhosis	61.1	94 %	75 %
Metabolic disease	49.7	94 %	91 %
Cirrhosis - unknown	56.0	92 %	84 %
Autoimmune cirrhosis	48.6	93 %	88 %
Primary biliary cirrhosis	56.4	93 %	84 %
Extrahepatic biliary atresia	1.3	90 %	85 %
Post hepatitis C cirrhosis	54.2	89 %	74 %
Polycystic disease	54.1	97 %	95 %
Listed as highly urgent	42.3	83 %	80 %

Table 7. *Age at transplant and survival for the patients listed 2010-2019 for the ten most common 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 2019. 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 Stein Foss and Monika Olofsson, in Gothenburg Ulla Nyström, in Stockholm 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. The export of data from NLTR to ELTR is now functional and has reduced the burden with dual data collection at all the centers. In 2019 two scientific papers were published based on data in the registry and several promising projects are ongoing.

9. Acknowledgements - financial support

The NLTR received no financial support in 2019. The maintenance of the Oracle 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 1990-2019:

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, Kirkegard 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 AB0-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 , K Höckerstedt, BG Ericzon, S Friman, P Kirkegaard, H Isoniemi, 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, Olauson 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 ursodeoxycholicacid 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, Rönnholm 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/petr.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. Epub 2019 Jun 12.

32. Schult A, Stokkeland K, Ericzon BG, Hultcrantz 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. Epub 2019 Aug 27.