



2018 Annual Report of Organ Transplantation in Thailand

- Heart and Lung Transplantation
- Kidney Transplantation
- Kidney Transplantation for recipients younger than 18 years old
- Liver Transplantation for adults and children in 2016-2018

Thai Transplantation Society

Message from President of Thai Transplantation Society

The information was collected as a report and its purpose to develop organ transplantation in Thailand. As we are aware that organ transplantation is important in medical profession advancement which helps improving their lives from the chronic disease such as chronic kidney disease, cirrhosis, and last stage of heart failure to perform their activities like normal once again. Nowadays, the transplant knowledge has fast evolution in both width and depth related to basic transplant Immunology and new immunosuppressive medication for organ transplant recipients. It is very necessary that physicians who work in this field should follow up with the recent knowledge.

Even though, there are a lot of advantages in organ transplantation but the main problem is the shortage of organ donors when compare to recipients (There are 6,401 of total recipients - 6,082 of kidney recipients, 20 of heart recipients, 23 of heart-lung recipients, 1 of lung recipient, 257 of liver recipients, 4 of liver-lung recipients, 13 of pancreas-kidney recipients and 1 of pancreas recipient as of 31 December 2018) and the large difference amount of waiting list each year.

The shortage of kidney and other organs donation are a major problem in transplantation. The last stage renal disease is important to the public health's problem as the patients have higher risk to death and waste of medical expenses. However, the treatment which is suitable for the long-term quality of the patient life is kidney transplantation. To honor the Celebrations on the Auspicious Occasion of Her Royal Highness Princess Maha Chakri Sirindhorn's 60th Birthday Anniversary in 2017, Kidney Foundation of Thailand, Thai Transplantation Society, cooperated parties and harvesting team organizing "the kidney transplant give a royal charity 60 years, Her Royal Highness Princess Maha Chakri Sirindhorn" during 2 April 2015 – 1 April 2016 which covered the cost of special medication for kidney transplant patients to support and helped increasing in donors and caring for patients in 2017 compare to the previous year.

On behalf of President and committee of Thai Transplantation Society, would like to thank you, the registration subcommittee for report of organ transplantation in 2018 and hope this will be useful for physicians, nurses and medical staffs for future references.

Surazee Prommool M.D.

Preface

The Thai Transplantation Society has collecting the transplant information since 2002 and has presenting in annual meeting since 2004 which informed the membership, doctors and nurses to aware of situation in transplantation each year. In 2012, the registration subcommittee first published annual report and present the society website in both Thai and English to make it convenient for information searching and references, as well as make it useful for planning, strategic planning and research.

This Annual Report of Transplantation in 2018 was continuing part from last year report of heart and lung transplantation, kidney transplantation including recipients younger than 18 years old and information for liver transplantation in adults and children. All the information has been supported by transplant coordinator nurses, surgeons, nephrologists, pediatric nephrologists, hepatologists and pediatric hepatologists from organ transplantation centers in order to analyze and aware of transplant situation in Thailand.

The patients of heart- lung transplant information received surgery in 2018 was collected by Dr. Pat Ongcharit and his colleagues, kidney transplantation information was collected by Assistant Professor Dr. Kajornsak Noppakun and his colleagues, they also brought out the various information to analyze in several dimensions continuously from previous year, the information of kidney recipients younger than 18 year old was collected by Associate Professor Dr. Pornpimol Rianthavorn, liver transplantation was collected and analyzed by Professor Dr. Suporn Treepongkaruna, Dr. Chutwichai Tovikkai, Dr. Goragoch Gesprasert and their colleagues.

The registration subcommittee would like to thank Thai Transplantation Society's organizing committee for supporting and establishing annual report of organ transplantation, transplant coordinator nurses for sending patients' information from each institution, Dr. Pat Ongcharit, Professor Dr. Kajornsak Noppakun, Associate Professor Dr. Pornpimol Rianthavorn, Professor Dr. Suporn Treepongkaruna, Dr. Chutwichai Tovikkai, Dr. Goragoch Gesprasert and their colleagues for gathering and analyzing information, Ms. Nongnuch Kuttiya and Ms. Pharita Keelee for general coordination, including staffs, doctors and nurses from every kidney institutions which make this report completely successful. With expectation that 2018 annual report will be useful for surgeons, nurses, staffs and whose interest for their

reference in other fields such as academic, public health economic including strategic planning in future organ transplantation.

The registration subcommittee of organ transplantation

Thai Transplantation Society

Year 2019-2021

Executive Committee, Thai Transplantation Society

Year 2019-2021

Name	Surname	Position
Dr. Surazee	Prommool	President
Prof. Dr. Yingyos	Avihingsanon	Vice-President
Asst.Prof.Dr. Somchai	Limsrichamrern	Vice-President and Liver and Pancreas Standard and Supportive
Assoc.Prof.Dr. Attapong	Vongwiwatana	Secretary General
Assoc.Prof.LTG.Dr. Praej	Ruangkanchanasetr	Treasurer
Prof.Dr. Adis	Tasanarong	Foreign Relations
LTG.Dr. Adisorn	Lumpaopong	Registration and Information
Assoc.Prof.Dr. Atiporn	Ingsathit	Research Chairman
Asst.Prof.Dr. Kajohnsak	Noppakun	Public Relations
Asst.Prof.Dr. Natavudh	Townamchai	Kidney Transplantation Clinical Practice Guideline Development
Assoc.Prof. Cholatip	Pongskul	Scientific Chairman
Dr. Pat	Ongcharit	Cardiothoracic Organ Transplantation Standard of Practice Development
Assoc.Prof.Dr. Supanit	Nivatvongs	Thai Red Cross Organ Donation Centre Coordination
Prof.Dr. Suporn	Treepongkaruna	Pediatric and Adult Hepatology Coordination
Dr. Siros	Jitpraphai	Pediatric and Adult Gastroenterology Coordinator
Dr. Goragoch	Gesprasert	Committee for Promoting Organ donation

Organ Transplant Registration Subcommittee

Year 2019 – 2021

Name	Surname	Position
LTG.Dr. Adisorn	Lumpaopong	President
LTG.Dr. Thanom	Supaporn	Advisory
Prof.Dr. Kriengsak	Vareesangthip	Advisory
Assoc.Dr. Supanit	Nivatvongs	Subcommittee
Dr. Pat	Ongcharit	Subcommittee
Assoc.Prof.Dr.Pornpimol	Rianthavorn	Subcommittee
Asst.Prof.Dr. Nutavudh	Townamchai	Subcommittee
Assoc.Prof.Dr. Atiporn	Ingsathit	Subcommittee
Asst.Prof.Dr. Sathit	Kurathong	Subcommittee
Assoc.Prof.Dr. Cholatip	Pongskul	Subcommittee
Ms. Pawinee	Kupatawintu	Subcommittee
Ms. Aroonee	Juengsa-ngasom	Subcommittee
Dr. Sirin	Jiwakanon	Subcommittee
Dr. Thitiya	Puavilai	Subcommittee
Prof.Dr. Suporn	Treepongkaruna	Subcommittee
Assoc.Prof.Dr.		
Abhasnee	Sobhonslidsuk	Subcommittee
Dr. Goragoch	Gesprasert	Subcommittee
Dr. Tanun	Ngamvichukorn	Subcommittee
Asst.Prof.Dr. Somchai	Limsrichamren	Subcommittee
Asst.Prof.Dr. Kajohnsak	Noppakun	Subcommittee
Dr. Pichaya	Tantiyavarong	Subcommittee
Dr. Nuttasith	Larpparisuth	Subcommittee and secretary

Liver Transplant Registration Subcommittee

Year 2018-2021

Name	Surname	Position
LTG.Dr. Thanom	Supaporn	Subcommittee Advisory
LTG.Dr. Adisorn	Lumpaopong	Subcommittee Advisory
Assoc.Prof.Dr. Surasak	Leelaudomlip	Subcommittee Advisory
Assoc.Prof.Dr. Yongyut	Srivatanauksorn	Subcommittee Advisory
Prof.Dr. Suporn	Treepongkaruna	Subcommittee President
Dr. Goragoch	Gesprasert	Subcommittee
Assoc.Prof.Dr. Voranush	Chongsrisawat	Subcommittee
Assoc.Prof.Dr. Bunthoon	Nonthasoot	Subcommittee
Dr. Chalermrat	Bunchorntavakul	Subcommittee
Dr. Ake	Pugkhem	Subcommittee
Asst.Prof.Dr. Sunhawit	Junrungsee	Subcommittee
Asst.Prof.Dr. Somchai	Limsrichamrern	Subcommittee and Secretary
Dr. Chutwichai	Tovikkai	Subcommittee and Assistant Secretary

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Organ Transplant Coordinator Nurses

Name	Surname	Hospital
Thararat	Phudpart	Bangkok
Napaporn	Boonnaj	Chulalongkorn
Salin	Wattanatorn	Chulalongkorn
Wongkhae	Kanthawong	Chulalongkorn
Piyaporn	Wanawongsawad	Chulalongkorn
Watcharee	Ratanawong	Chonburi
Supan	Chunhanant	Police General
Sasipim	Pairojkittrakul	Thammasat
Benjaporn	Taenawakul	Thammasat
Ornkamon	Pengkul	Bumrungrad
Panarat	Nopacoon	Bumrundrad
Suwapee	Chantornjetsada	Phyathai 1
Benjawan	Sookruan	Phyathai 1
Kanokporn	Ratanatrisri	Buddhachinaraj
Sunisa	Pikhulkhao	Phramongkutklao
Kaenchai	Pipatpanawong	Praram 9
Panatchana	Aroonrojsiri	Bhumibol Adulyadej
Anchalee	Saikam	Maharajnakornchiangmai
Kanya	Udomsin	Maharajnakornchiangmai
Jugkree	Korsakul	Maharajnakhonratchasima
Panida	Opakawinkul	Rajavithi
Mallika	Sitthisarn	Rajavithi
Ladda	Wudhinitikornkij	Rajavithi
Chutima	Charoentanakit	Ranathibodi
Piyaphorn	Thakoorabutr	Ranathibodi

Napapat	Butsriphum	Ranathibodi
Wararat	Wongwean	Vajira
Jongruk	Pongskul	Srinagarind
Tassanee	Phimsawat	Srinagarind
Nartsiri	Ratchawang	Siriraj
Punika	Pongpisit	Siriraj
Pera	Panprom	Siriraj
Nutjanat	Rintawut	Khonkaen
Monrutai	Thammaroekrit	Songklanagarind
Wanida	Ratanasuwan	Samitvej Srinakarin
Pisinee	Namprom	Samitivej Sukhumvit
Athitaya	Lekpratum	Samitivej Sukhumvit
Phataraporn	Jit-im	Sappasitthiprasong
Tasana	Nilapat	Surat Thani
Jamaree	Pondee	Surat Thani
Kingkarn	Sirikarin	Hatyai
Sasipin	Monkolchai	Udonthani
Amnuayporn	Nammun	Udonthani
Nichakorn	Pasook	Bumirajanagarindra Kidney Institute
Sirilak	Leawseng	Bumirajanagarindra Kidney Institute
Paphanida	Borsuwan	Vejthani
Nitikan	Jaiklom	Chiang Rai Prachanukroh
Wantana	Sempoon	Vichaiyuth
Apaporn	Kaenchan	Vichaiyuth

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Information of Heart and Lung Transplantation

Information of Heart and Lung Transplantation

Intrathoracic organ transplantation

From 2008-2018, 133 patients received heart transplantation from 6 hospitals i.e. Chulalongkorn, Siriraj, Rajavidhi, Ramathibodi, Central Chest Institute of Thailand and Bumrungrad.

	Year										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Chulalongkorn	3	5	3	7	8	6	14	12	10	9	14
Siriraj	-	1	2	1	4	4	4	7	4	7	8
Ramathibodi	-	-	-	-	-	-	-	-	-	1	4
Rajvidhi	1	-	-	-	-	2	5	5	2	3	
Central of Chest Institute of Thailand	-	2	-	-	-	-	-	-	-	-	
Bumrungrad	1	-	-	-	-		-	-	-	-	
Total	5	8	5	8	12	12	23	24	16	20	26

Table 1.1 Number of heart transplant recipients, separated by year and hospital.

In 2018, 26 patients received heart transplantation which increased from 2017 by 6 patients as shown in table 1.1.

In 2018, there was no heart-lung and single lung transplantation, 21 and 23 patients waiting to receive heart and heart-lung transplantation respectively.

Information of Kidney Transplantation

Information of Kidney Transplantation

Number of Kidney Transplant Recipients in 2018

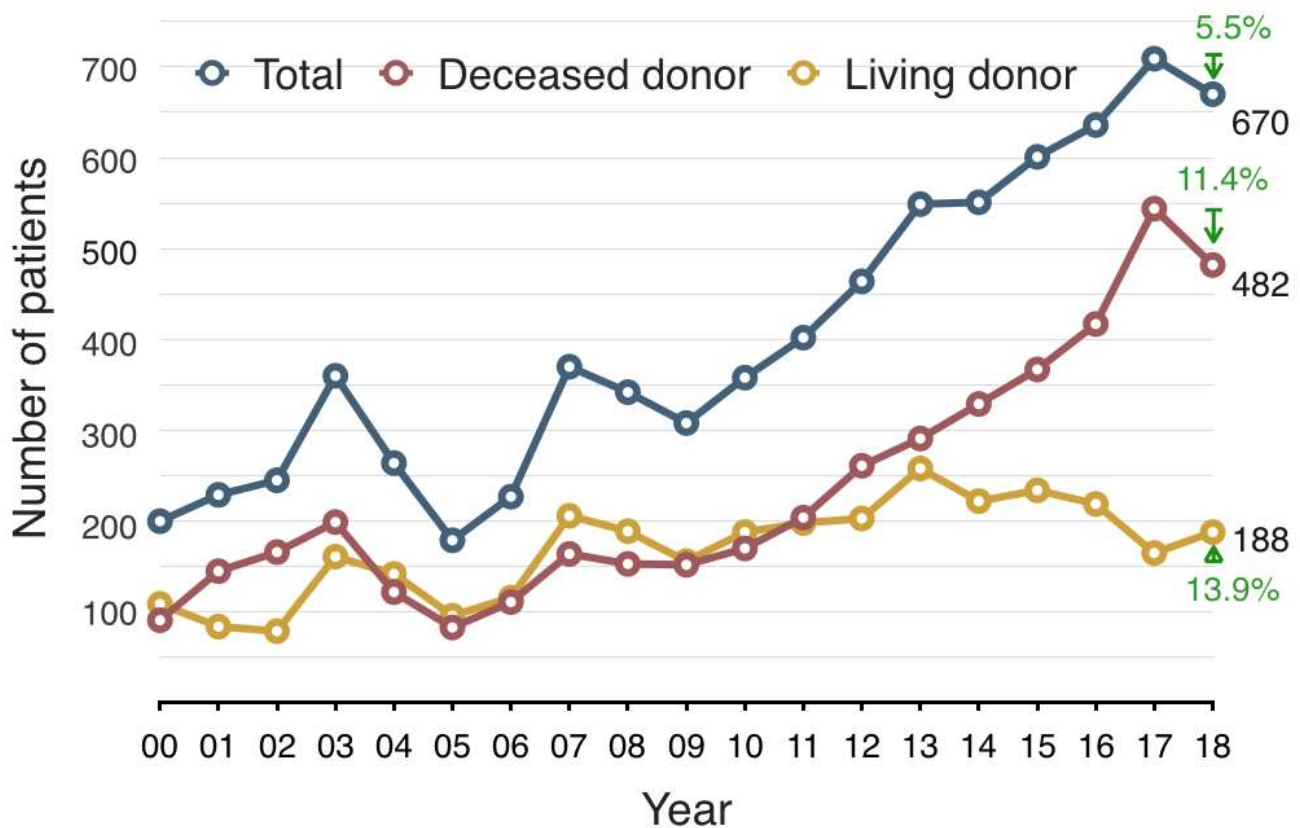
In 2018 (1 January 2018 – 31 December 2018), 670 patients received kidney transplantation from 28 hospitals, by 188 of living donors and 482 of deceased donors, separated by hospitals as shown in table 2.1.

Table 2.1 Number of Recipients in 2018, separated by hospitals.

	Kidney Transplant Recipients from Deceased donors	Kidney Transplant Recipients from Living donors	Total
Ramathibodi	119	59	178
Praram 9	73	9	82
Siriraj	53	24	77
Maharaj Nakorn Chiangmai	41	28	69
Srinagarind	49	2	51
Chulalongkorn	31	10	41
Phramongkutklao	16	4	20
Bumrungrad	15	5	20
Rajavidhi	14	2	16
Police General	13	0	13
Vachira	5	8	13
Thammasat	7	5	12
Bhumibol Adulyadej	8	2	10
Khonkaen	8	1	9
Smithivej Srinakarin	6	1	7
Songklanakarin	4	3	7
Srinakarinwirot Ongkharak	0	7	7
Supphasitprsong	4	2	6

Maharaj Nakornrachasima	0	6	6
Smithivej Sukhumvit	4	1	5
Phayathai 1	4	1	5
Bhumirajanagarindra	0	5	5
Hat Yai	3	0	3
Udonthani	3	0	3
Bangkok	2	0	2
Buddhachinaraj	0	1	1
Vejthani	0	1	1
Chiangrai Prachanukroh	0	1	1
Total	482	188	670

Compare to 2017, found that previous kidney transplant decreased by 5.5% (from 709 to 670), recipients from living donors increased by 13.9% (from 165 to 188) and from deceased donors decreased by 11.4% (from 544 to 482).



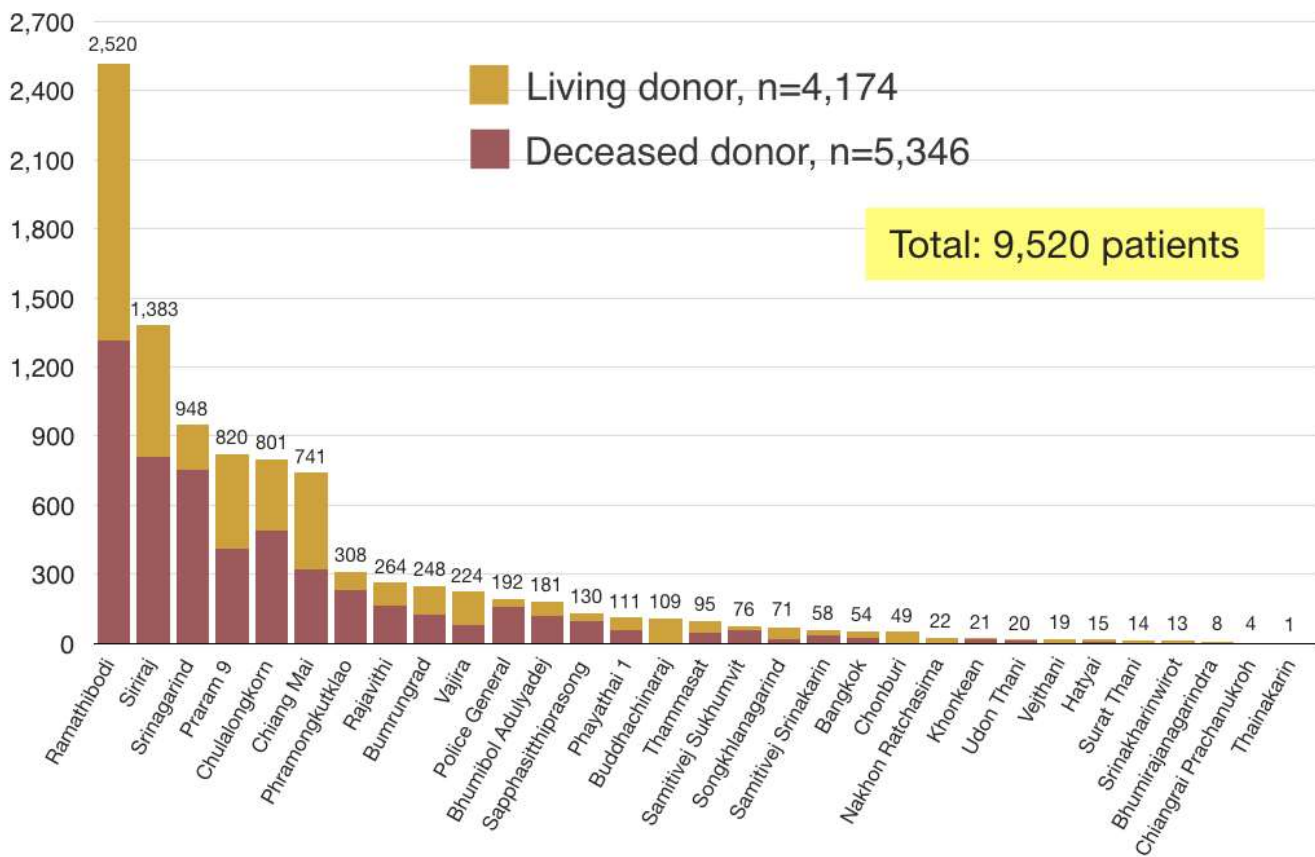
Picture 2.1 Number of kidney transplant each year since 2000, separated by kidney transplant categories.

From picture 2.1 showed patients information of kidney transplantation since 2000, who officially registered for kidney transplantation in Thailand. There were a lot of kidney transplant recipients who received kidney transplantation in 2003 and 2007. In 2003, The Kidney Foundation of Thailand established the occasion to give a royal charity dedicated to HRH Princess Galyani Vadhana Kromma Luang Naradhiwas Rajanagarindra for her 80th Birthday and in 2007, then established "The kidney is the charity dedicated 80/ 84 years "to give a royal charity dedicated on the occasion of 80th Birthday Anniversary for His Majesty King Bhumibol Adulyadej The Great and HRH Princess Galyani Vadhana Kromma Luang Naradhiwas Rajanagarindra on the occasion of 84th Birthday Anniversary which caused the increasing of kidney transplant recipients.

In 2015, in honor of the Celebrations on the Auspicious Occasion of Her Royal Highness Princess Maha Chakri Sirindhorn's 60th Birthday Anniversary, Kidney Foundation of Thailand and cooperated parties organizing "the kidney transplant give a royal charity 60 years, Her Royal Highness Princess Maha Chakri Sirindhorn " during 2 April 2015 – 1 April 2016 which encouraged kidney donation campaign, gave additional support to hospital, staffs, harvesting and retrieval team, altogether with covering the cost of special medication for kidney transplant patients by providing medical expenses from original affiliation such as Comptroller General's Department, Social Security Office and National Health Security Office which were cooperated parties of campaign.

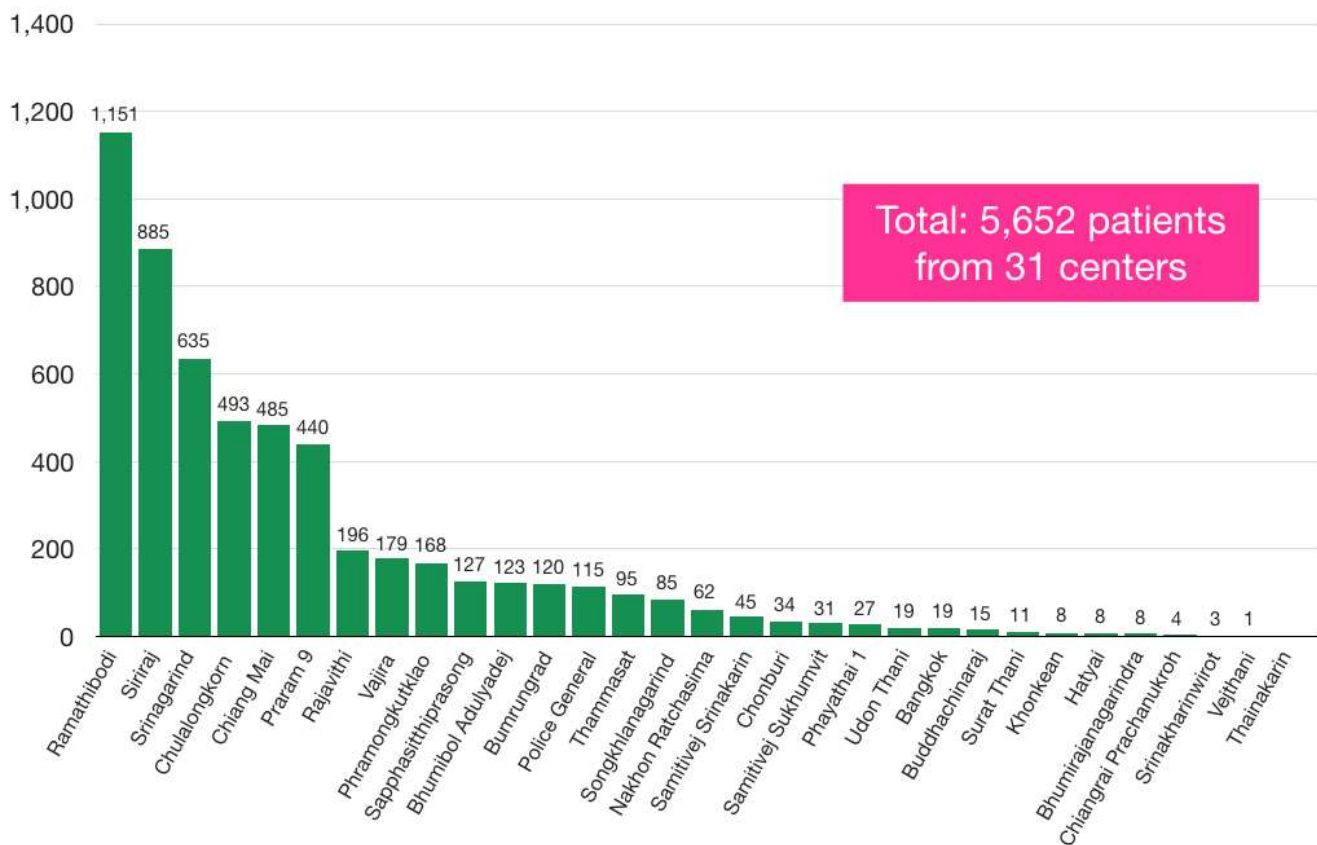
In 2004, the Social Security Office implemented kidney transplant coverage for employees and in 2008, National Health Security Office approved to add the kidney transplant in the universal health care coverage. In addition, the Ministry of Public Health implemented the deceased donor campaign and establishes the donor Hospital which showed that there were more deceased donors than living donors since 2011.

There were 9,520 kidney transplant recipients in Thailand, 4,174 of living donors and 5,346 of deceased donors as shown in picture 2.2.



Picture 2.2 Number of all kidney transplant recipients in Thailand, separated by hospitals.

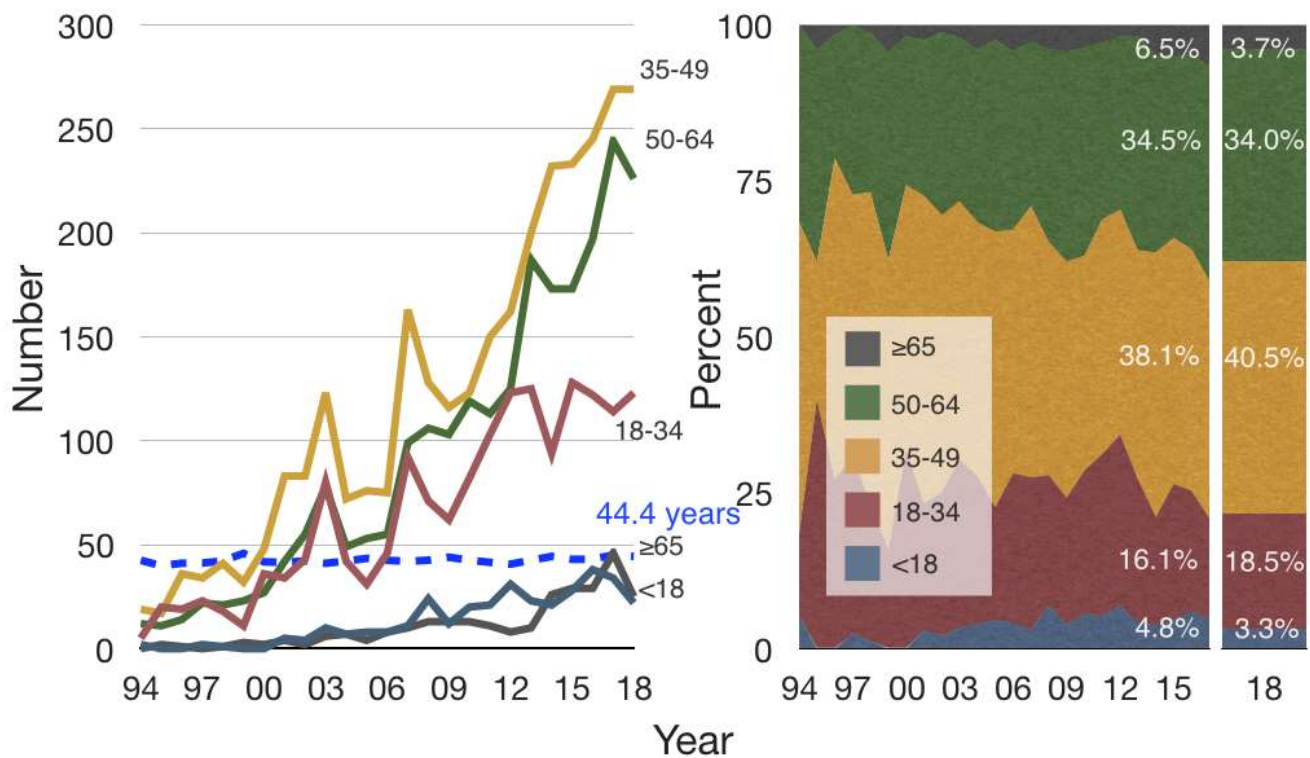
The prevalence of kidney transplant as of 31 December 2018 from 31 institutions were 5,652 as shown in picture 2.3.



Picture 2.3 The prevalence showed kidney transplant recipients as of 31 December 2018.

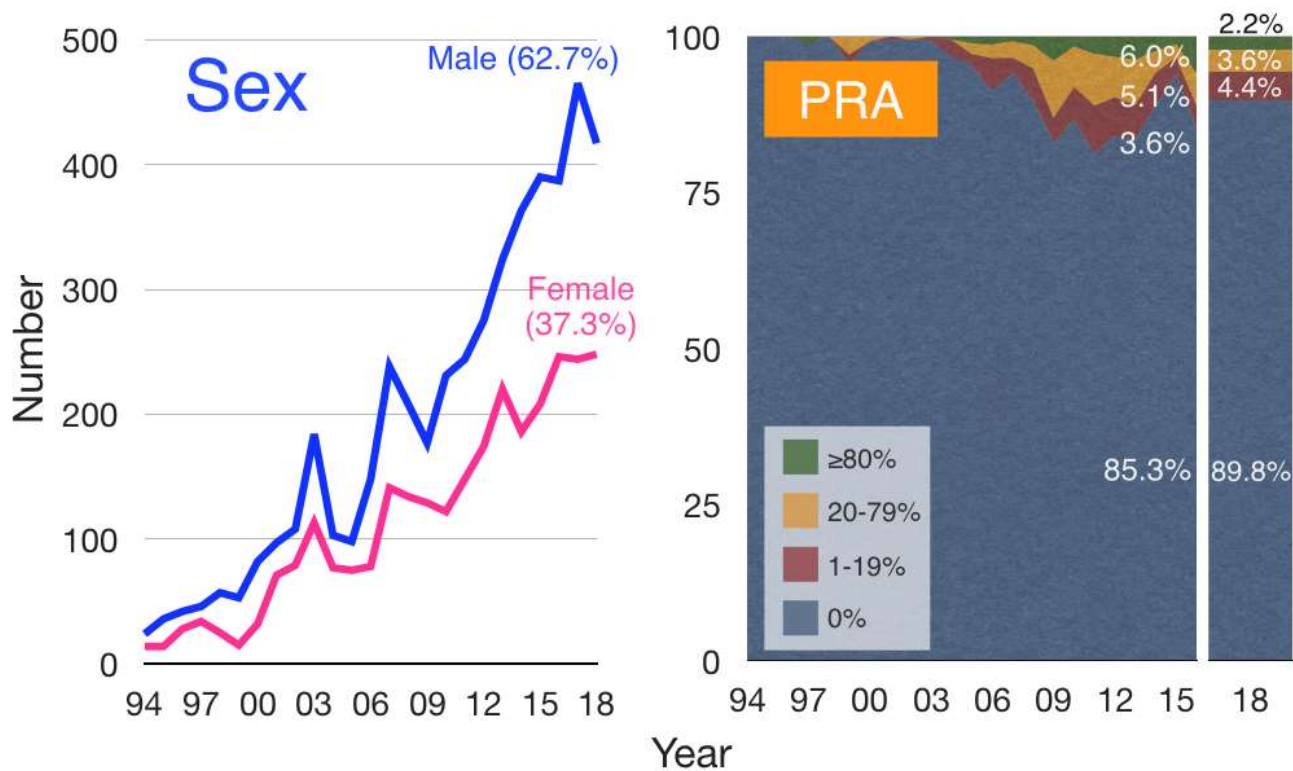
Information of kidney transplantation in 2018

The average age of kidney transplant in 2018 was equal to 44.4 years old, which decreased from 2017 equal to 45.0 years old and the maximum age who received the kidney transplant was during 35-49 years old. The proportion of kidney transplant in 2018 by span of age, found that 3.3% of recipients younger than 18 years old, 18.5% of recipients aged 18-34 years old and 40.5% of recipients aged 35-49 years old, 34.0% of recipients aged 50-65 years old and 3.7% of recipients aged more than 65 years old as shown in picture 2.4. When compare to 2017, found that the age of 18-34 was the most increasing in proportion of 2.4% and the age of 35-49 was secondary increased proportion of 1.4% while the age less than 18 and aged 65 decreased.



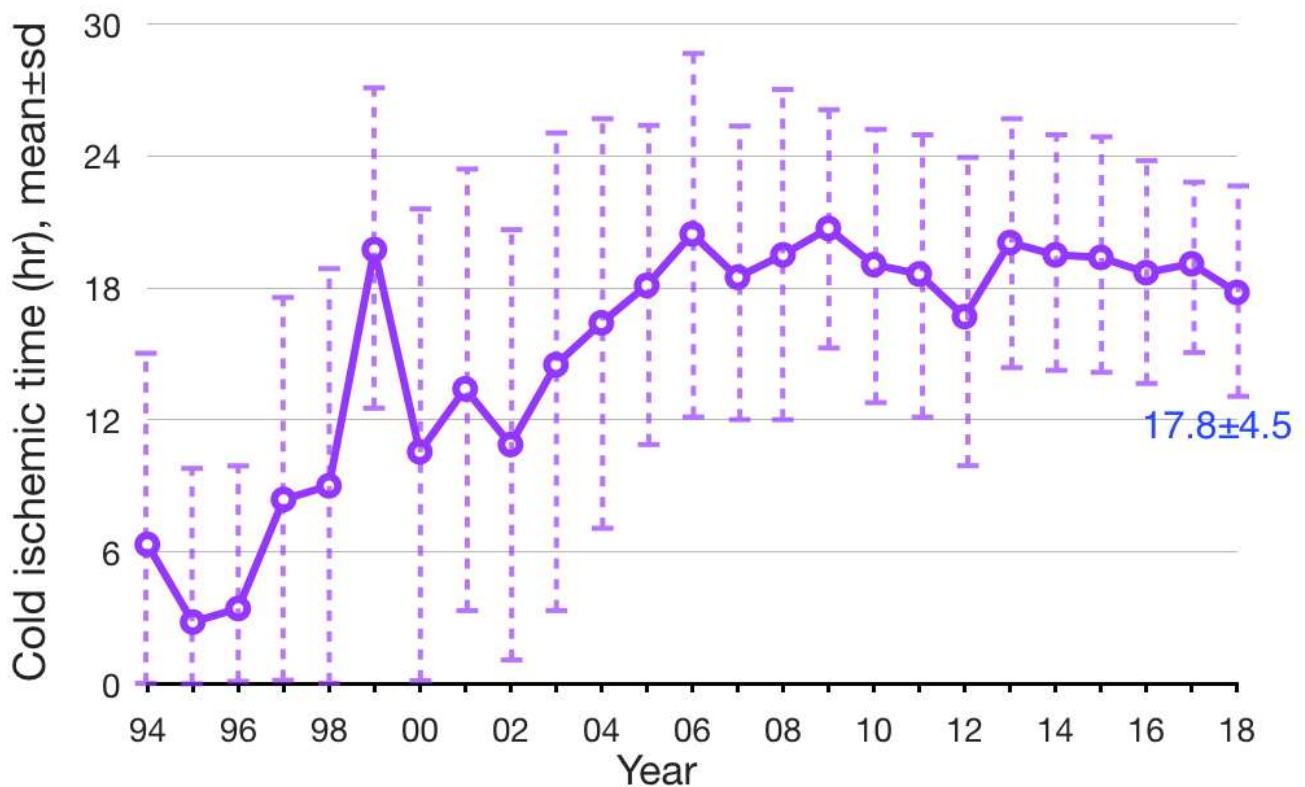
Picture 2.4 The proportion of kidney transplant recipients, separated by ages.

When separated by sex, found that there were more male than female kidney transplant recipients by the proportion of 62.7% which increased from 2017. The kidney transplant recipients of 89.8% had PRA equal to 0, 4.4% had PRA between 1-19, 3.6% had PRA between 20-79 and 2.2% had PRA more than 80 as shown in picture 2.5 which recipients who had PRA equal to 0 decreased when compare to 2017.



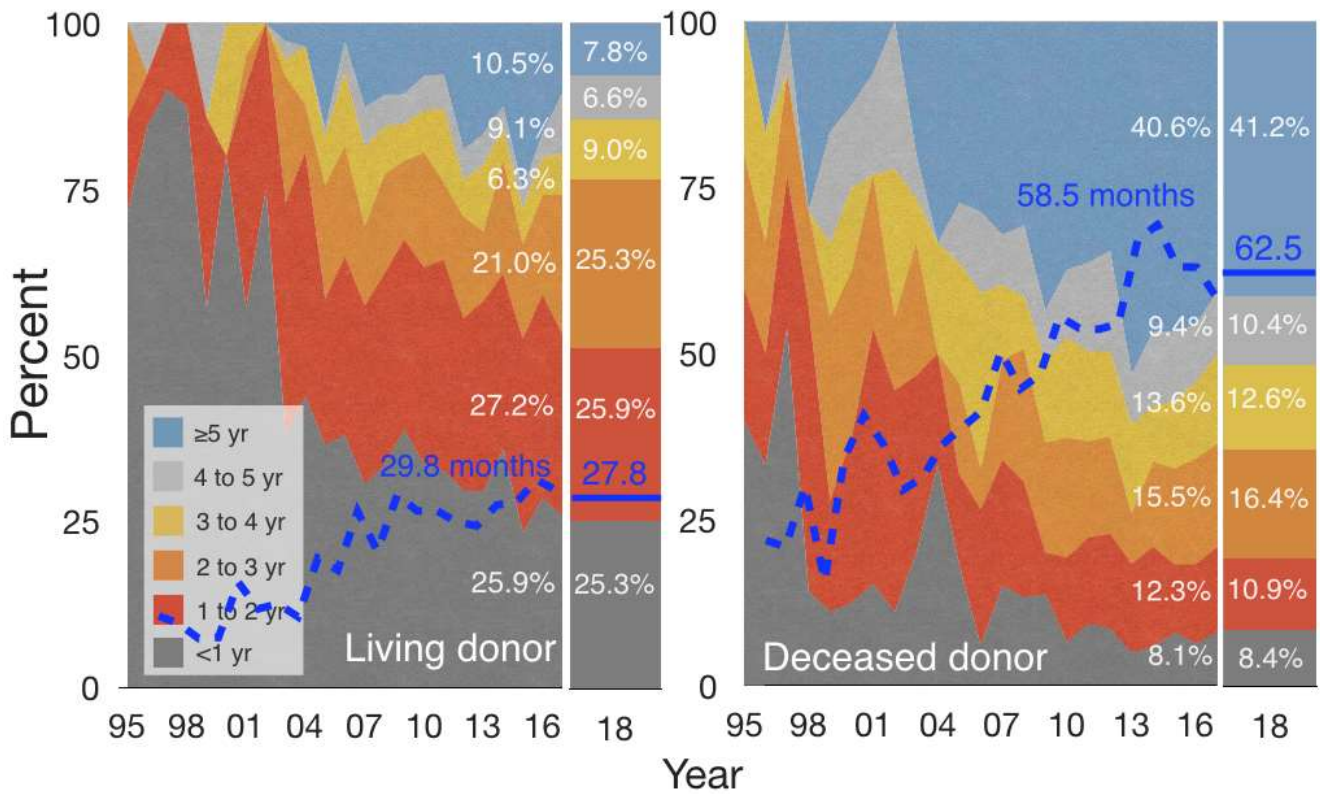
Picture 2.5 Sex and Panel Reactive Antibody (PRA) of kidney transplant recipients.

For deceased donor group, found that the period of cold ischemic time in 2018 was equal to 17.8 ± 4.5 hours as shown in picture 2.6.



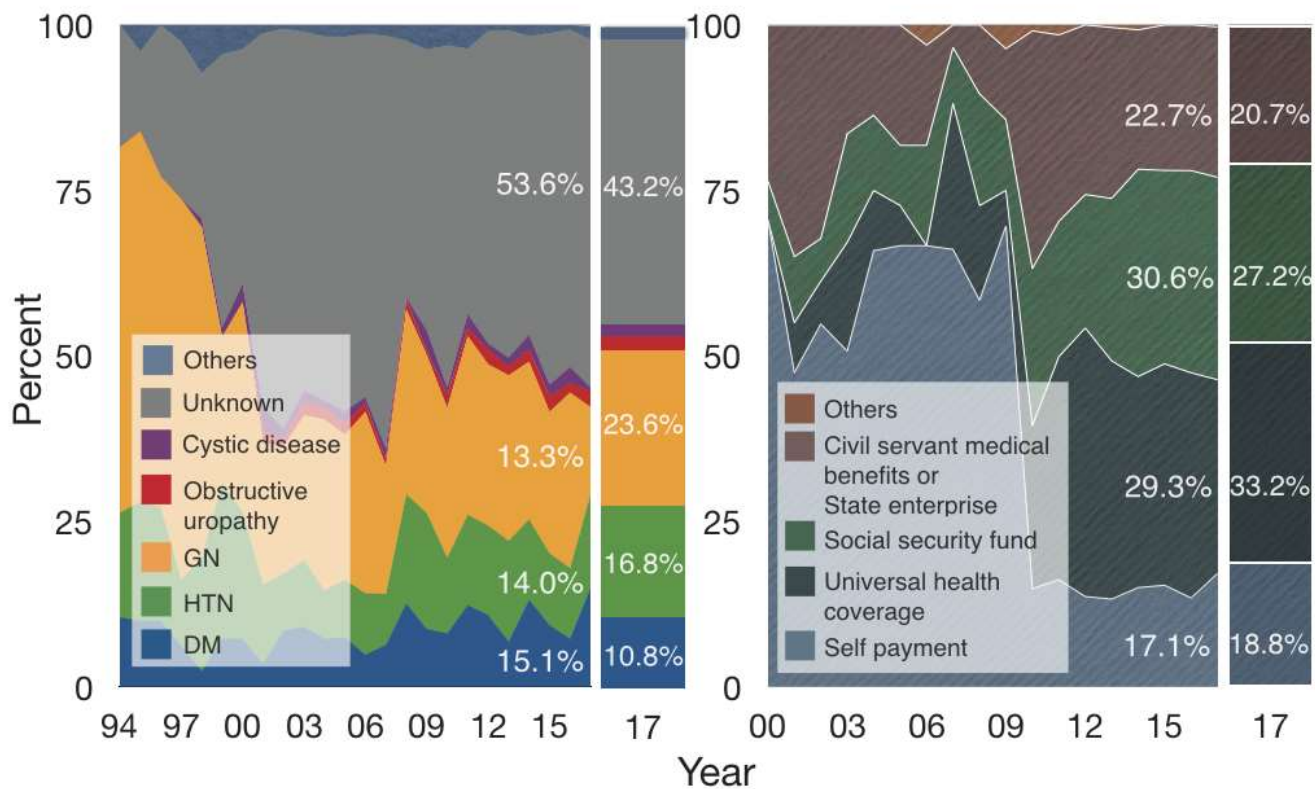
Picture 2.6 Period of Cold Ischemic Time of kidney transplant of deceased donors.

The waiting time for kidney transplant in 2018 of living donors were equal to 27.8 months and deceased donors were equal to 62.5 months which decreased when compare to 2017 as shown in picture 2.7.



Picture 2.7 The waiting time of kidney transplant recipients of living donors and deceased donors.

The main cause of end-stage renal disease by kidney transplant categories, as shown in picture 2.8 were diabetes, hypertension and chronic glomerulonephritis. When compare to 2017, the proportion of chronic glomerulonephritis increased while diabetes decreased and considered from healthcare schemes, found that 33.2% used universal coverage scheme, 27.2% used social security scheme and 20.7% used government and state enterprise healthcare coverage as shown in picture 2.8.



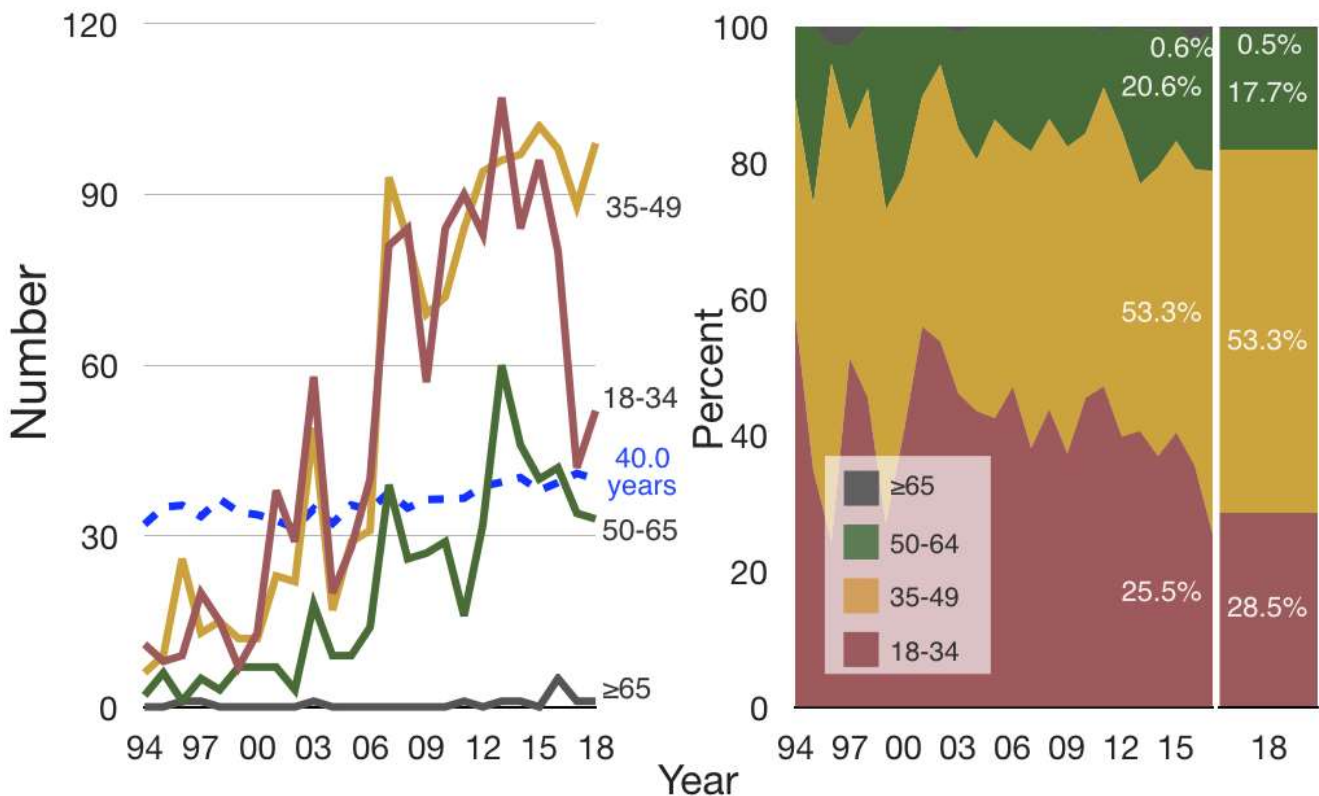
Picture 2.8 The causes of end-stage renal disease and healthcare scheme.

In Summary of year 2018

- The number of kidney transplantation in 2018 decreased from 709 to 670 as the proportion of living donors increased by 13.9% and deceased donors decreased by 11.4% when compare to 2017.
- The main age of kidney transplant recipients were between 35-49 and 50-64 years old respectively.
- The waiting time for kidney transplant of living donors were equal to 27.8 months and deceased donors were equal to 62.5 months
- The period of cold ischemic time was equal to 17.8 ± 4.5 hours.
- The major causes of end-stage renal disease were chronic glomerulonephritis, hypertension and diabetes respectively.
- The major healthcare coverage schemes in kidney transplant recipients were universal coverage scheme, social security scheme and government/ state enterprise healthcare coverage respectively.

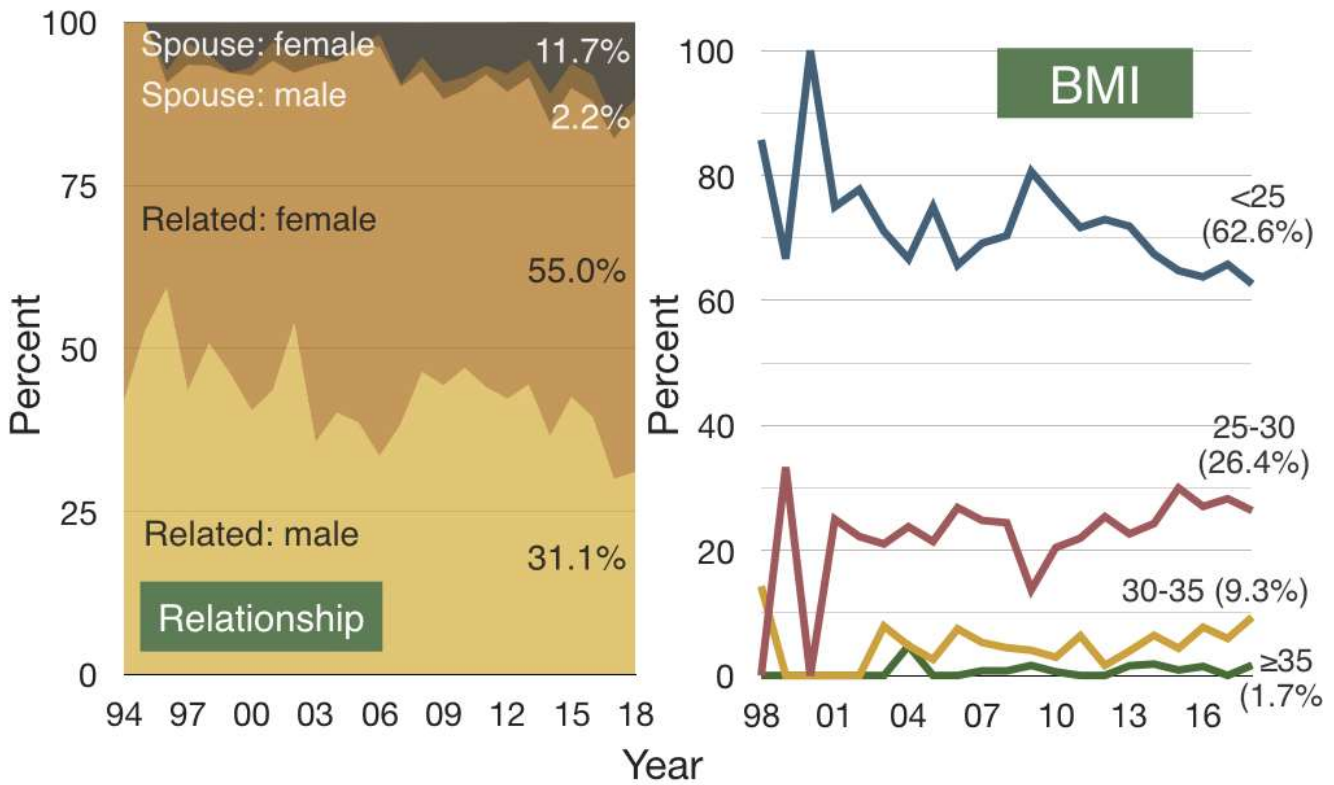
Information of kidney transplant donors

In 2018, the average age of living donors were equal to 40.0 years old which decreased from 2017 by 41.0 years old, mostly between 35-49 years old of age by 53.3% which was the most increasing age proportion as shown in table 2.9. While kidney transplant donors aged 50-65 years old had the most decreasing age proportion when compare to 2017.



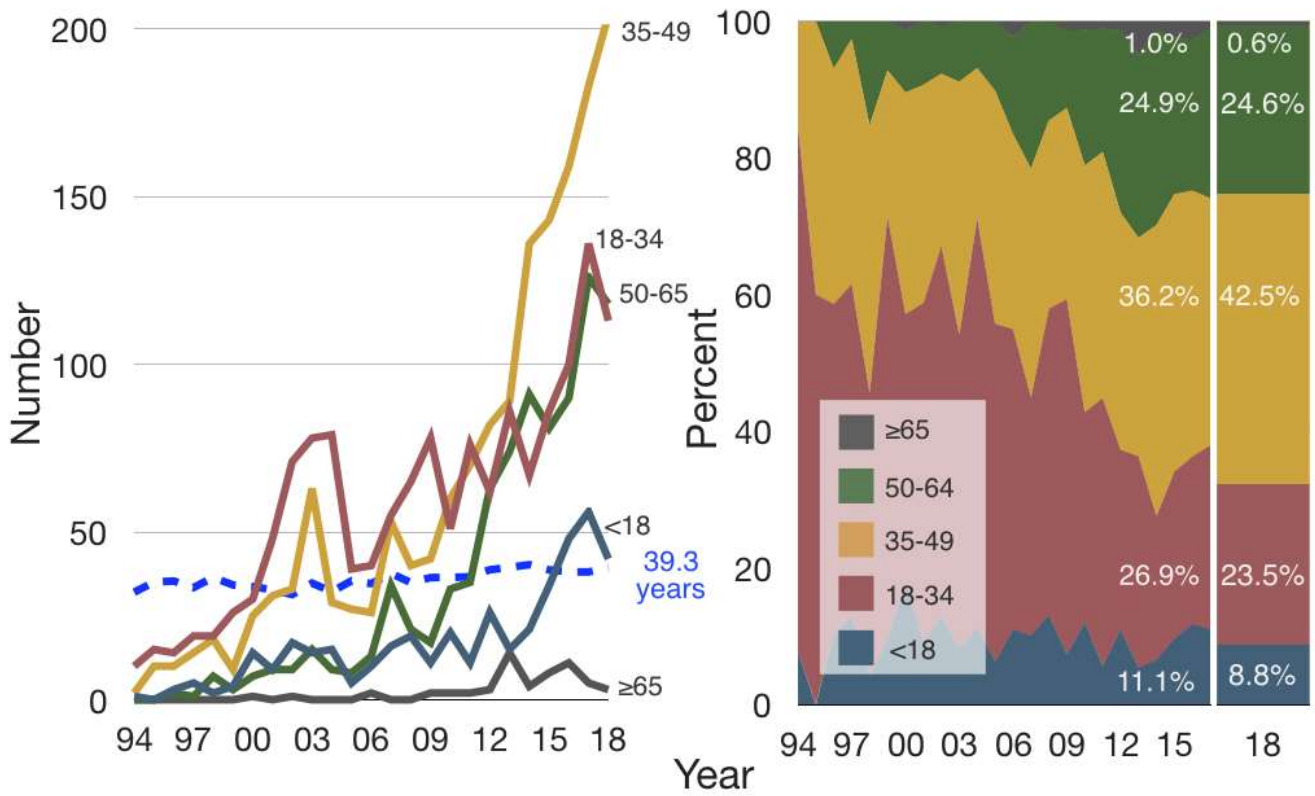
Picture 2.9 Age of living donors.

The main donors were 55.0% from female blood relation and 31.1% from male blood relation which were 11.7% wife donated to husband and 2.2% husband donated to wife as shown in picture 2.10. Moreover, 62.6%, 26.4% and 11.0 were living donors which body mass index (BMI) less than 25, between 25-30 and more than 30 kilograms per square meter respectively.



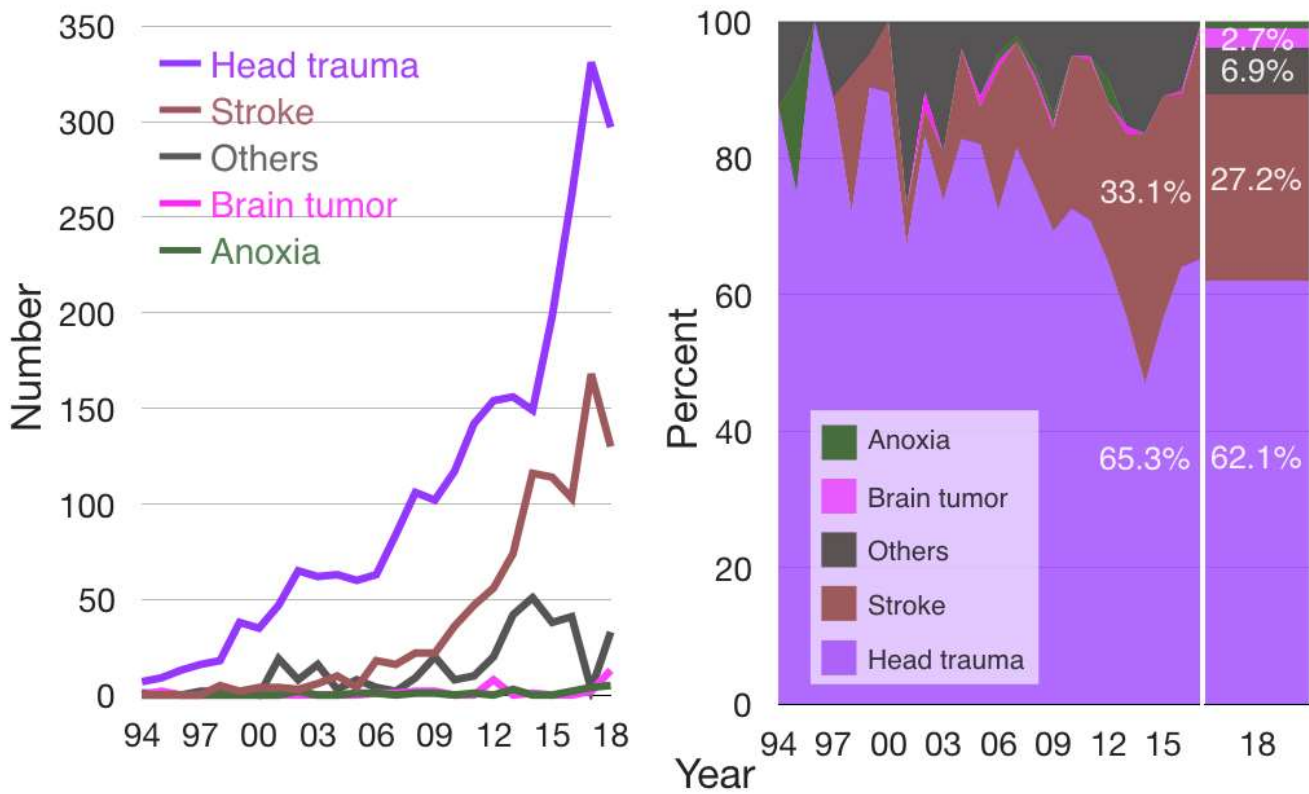
Picture 2.10 The relationship between donors and recipients of living donors.

In deceased donor group found the average age was equal to 39.3 years old which adjacent to year 2017 as the age group of 35-49 years old was the most increasing proportion of age span from 2017 as shown in picture 2.11.



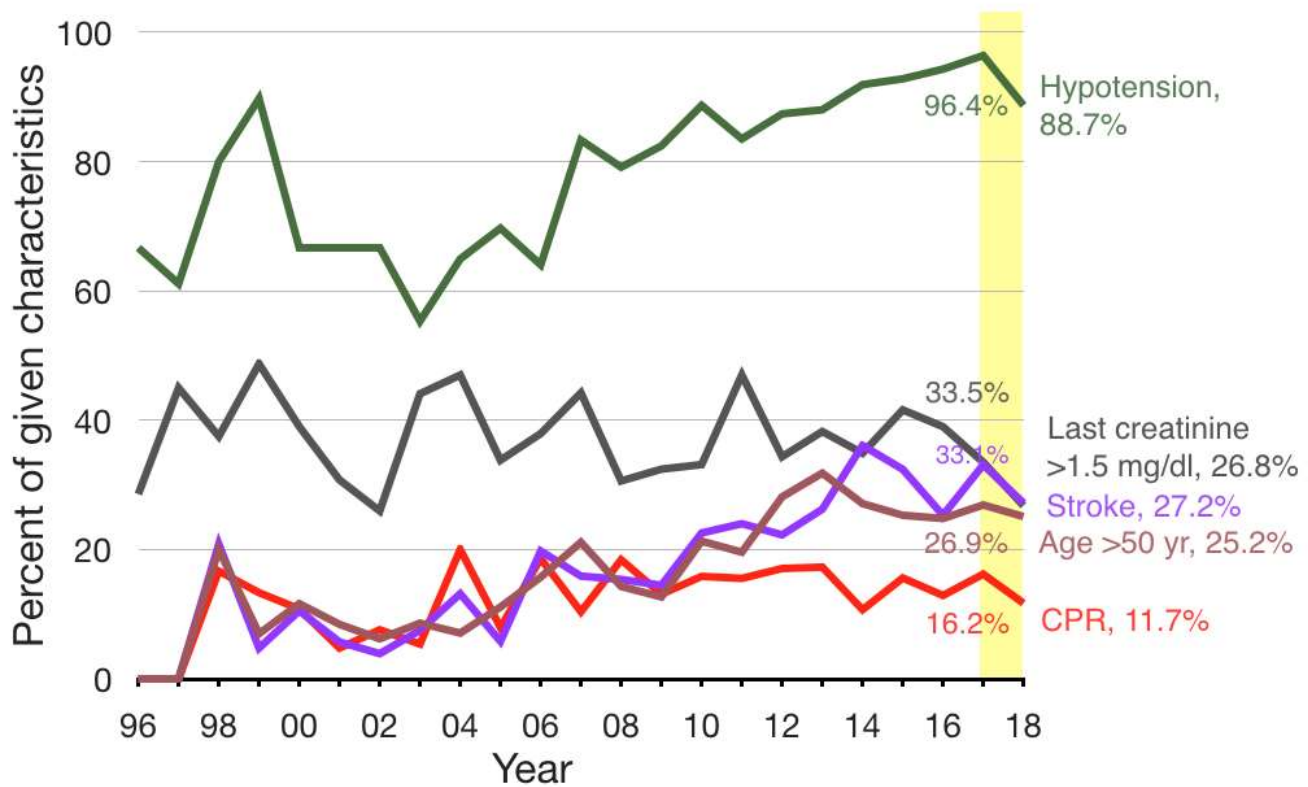
Picture 2.11 Age span of deceased donors.

The main causes of brain death were head trauma and stroke respectively as shown in Picture 2.12 when compare to 2017. The proportion of deceased donors caused by head injury were stable while deceased donors caused by stroke were decreased from 33.1% to 27.2%.



Picture 2.12 The causes of brain death in deceased donors.

There were 88.7% of deceased donors had hypotension, 11.7% had been performed the cardiopulmonary resuscitation (CPR). 26.8% had the serum creatinine more than 1.5 mg/dl, 25.2% were age older than 50 years old and 27.2% were caused by stroke as shown in Picture 2.13 when compare to 2017. The proportion of deceased donor qualification stated above all decreased.



Picture 2.13 The characteristics of deceased donors.

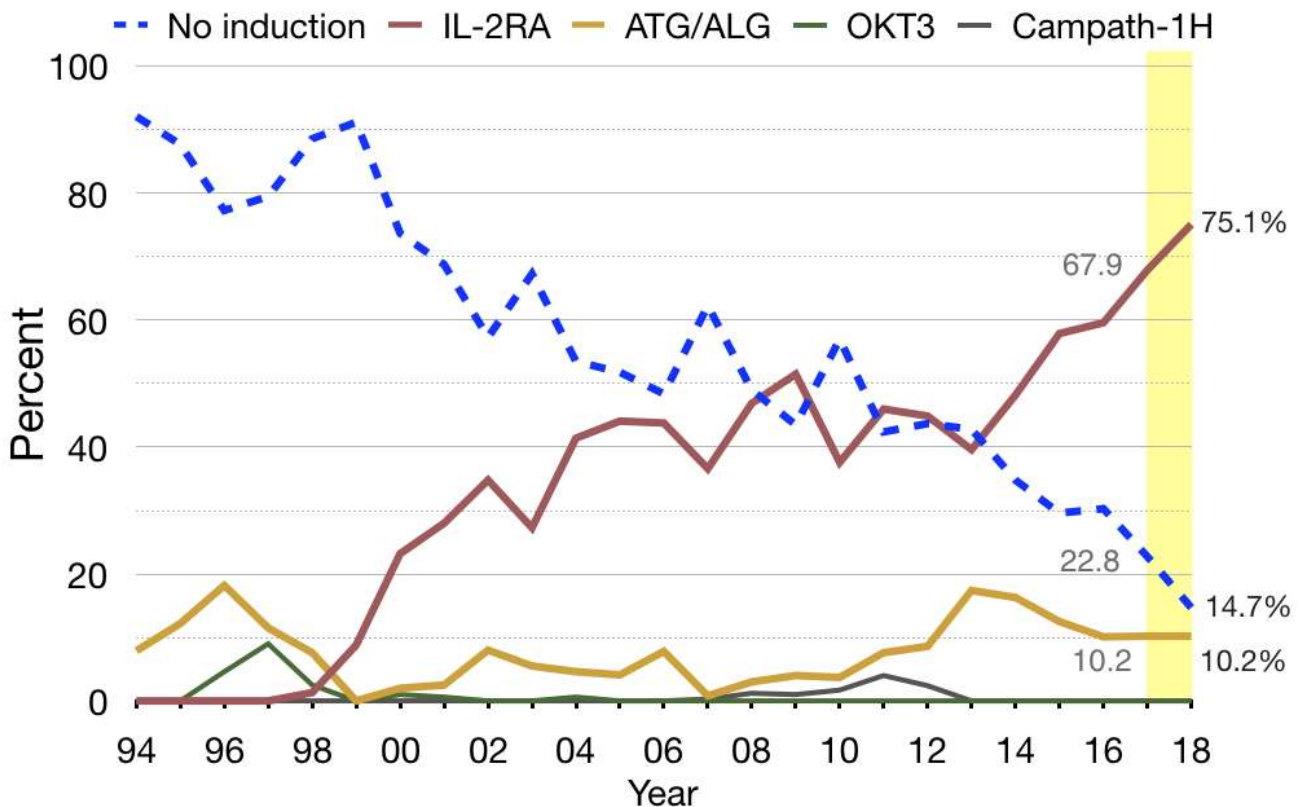
In Summary of kidney transplant in year 2018

- The kidney living donors and deceased donors had average age between 40.0 and 39.3 years old respectively.
- The main kidney recipients had blood relation in living donors and spouse related donors which female is the major living donors.
- In deceased donors, found that
 - The major causes of brain death were head trauma and stroke respectively.
 - When compare to 2017, the deceased donors who had hypotension need to perform the cardiopulmonary resuscitation (CPR).The deceased donors from stoke who were more than 50 years old and who had serum creatinine were more than 1.5 mg/dl decreased.

Information of Immunosuppressive medication

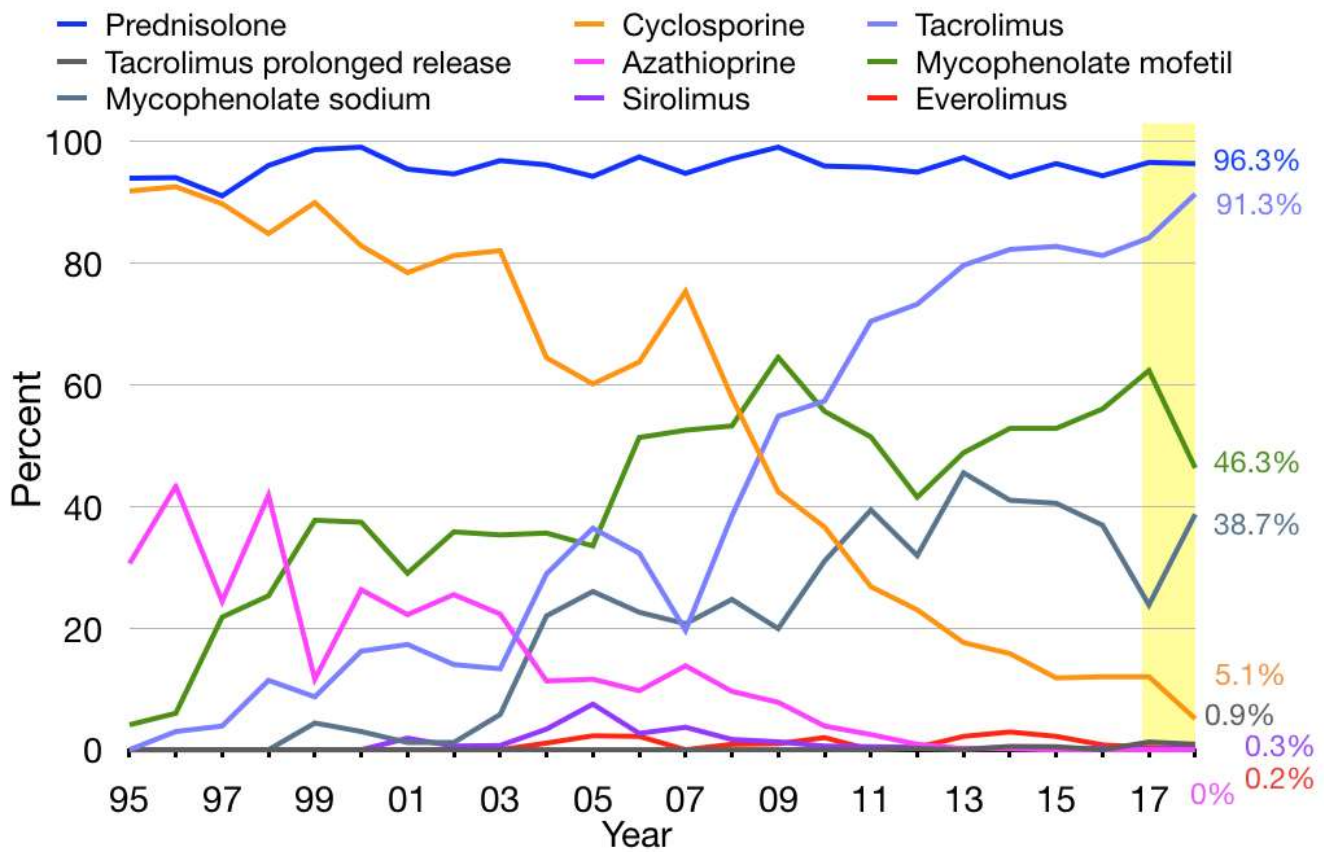
Immunosuppressive medication

In 2018, 85.3% of antibody induction therapy was used and was increased from 2017 that equal to 77.2%; 75.1% interleukin-2 receptor antagonist (IL-2 RA) was increased from 2017 which equal to 67.9%, 10.2% of anti-thymocytoglobulin (ATG)/anti-lymphocyte globulin (ALG) was used which equal to 2017 as shown in Picture 2.14.



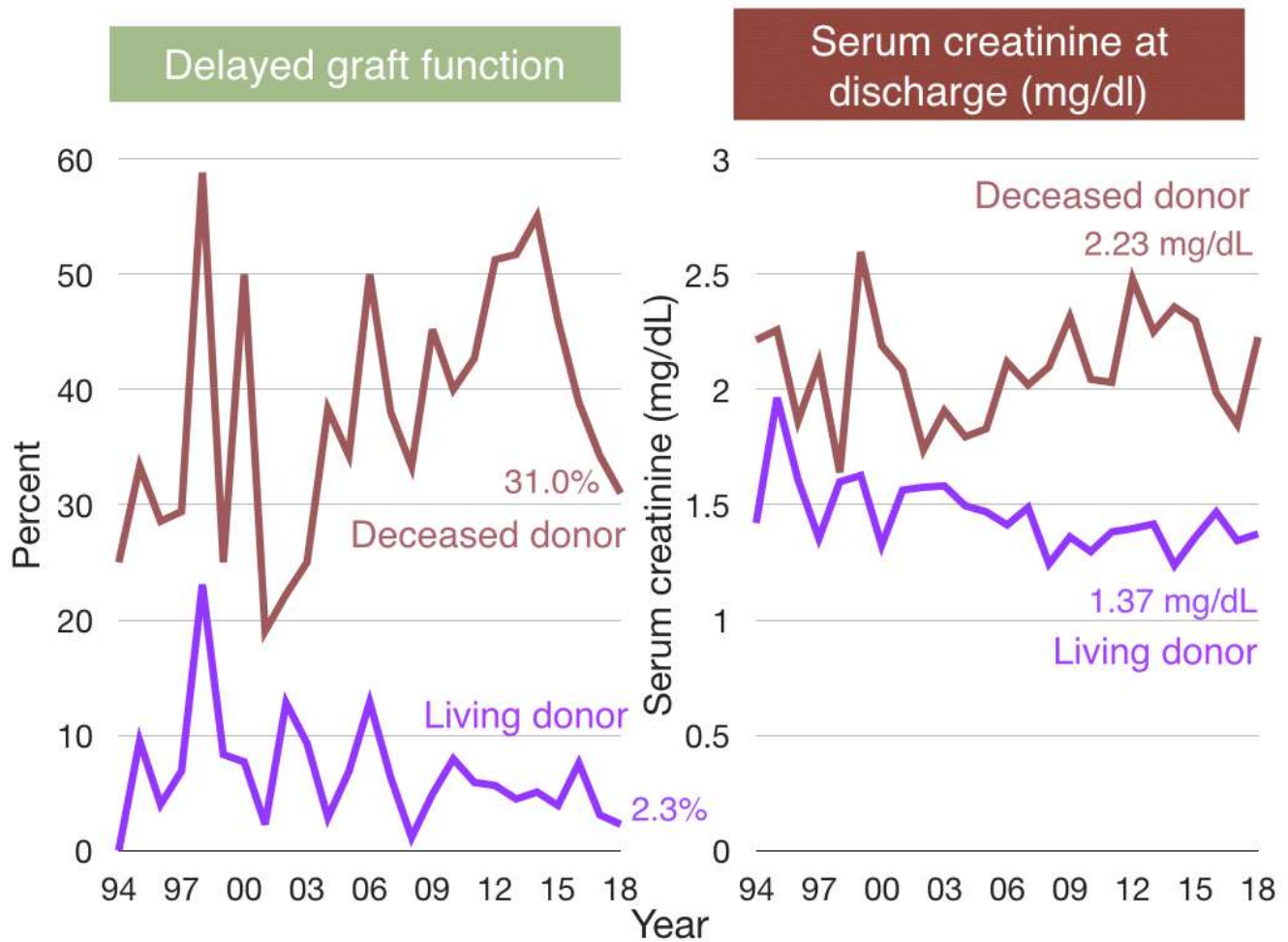
Picture 2.14 The proportion of recipients who received antibody induction therapy, separated by year of transplantation.

The proportion and tendency of immunosuppressive medication used on discharge date as shown in picture 2.15. In 2018, patients received prednisolone, tacrolimus, tacrolimus prolonged release, cyclosporine, mycophenolate mofetil and mycophenolate sodium at 96.3%, 91.3%, 0.9%, 5.1%, 46.3% and 38.7% respectively. Less than 0.5% of the patients received sirolimus or everolimus and no patients received azathioprine on discharge date.



Picture 2.15 The proportion of immunosuppressive treatment on discharge date, separated by year of kidney transplantation.

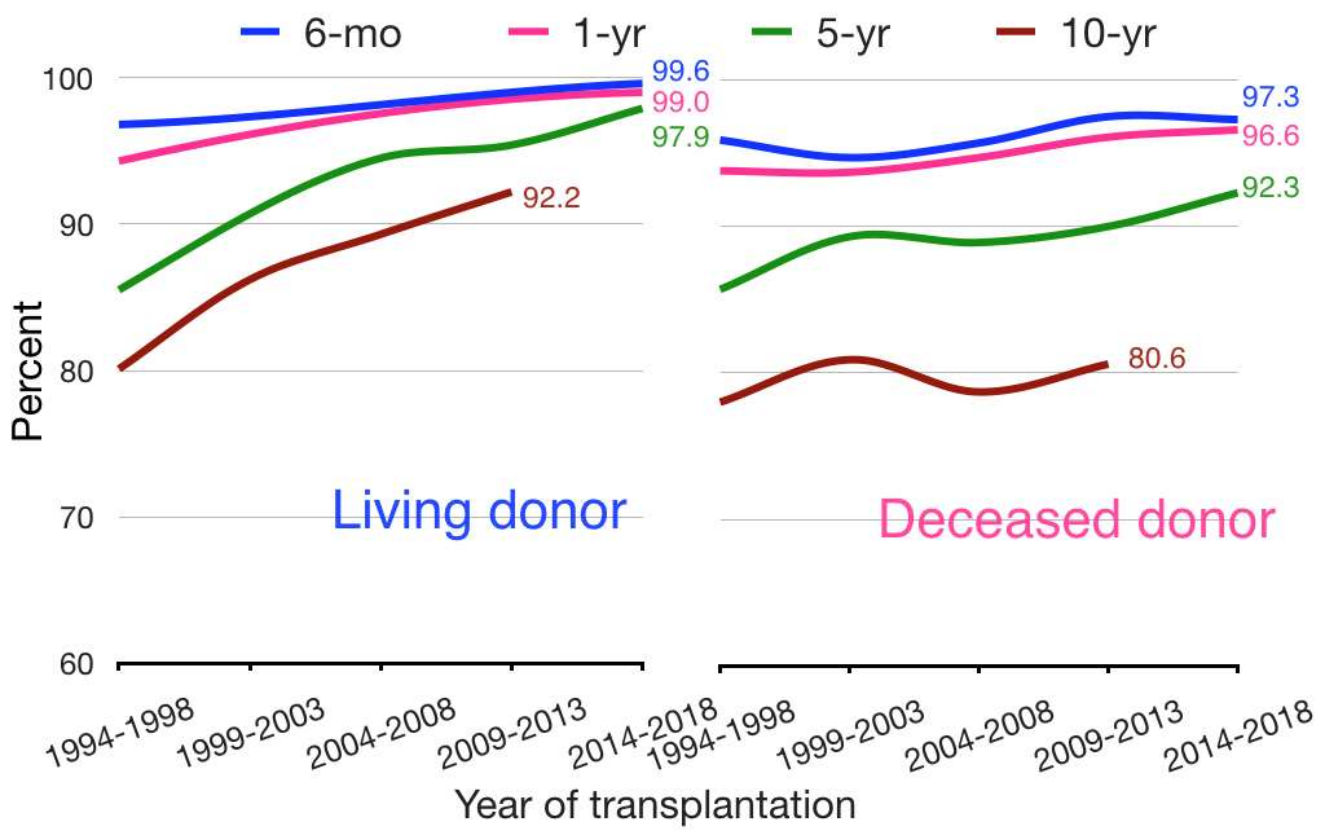
The comparison between proportion of delayed graft function (DGF) after kidney transplantation and serum creatinine level on discharge date of the recipients from the living donors and deceased donors as shown in Picture 2.16, found that delayed graft function and serum creatinine level of living and deceased donors on discharge date decreased when compare to 2017.



Picture 2.16 Delayed graft function and serum creatinine on discharge date, separated by transplant types.

Patient survival rate

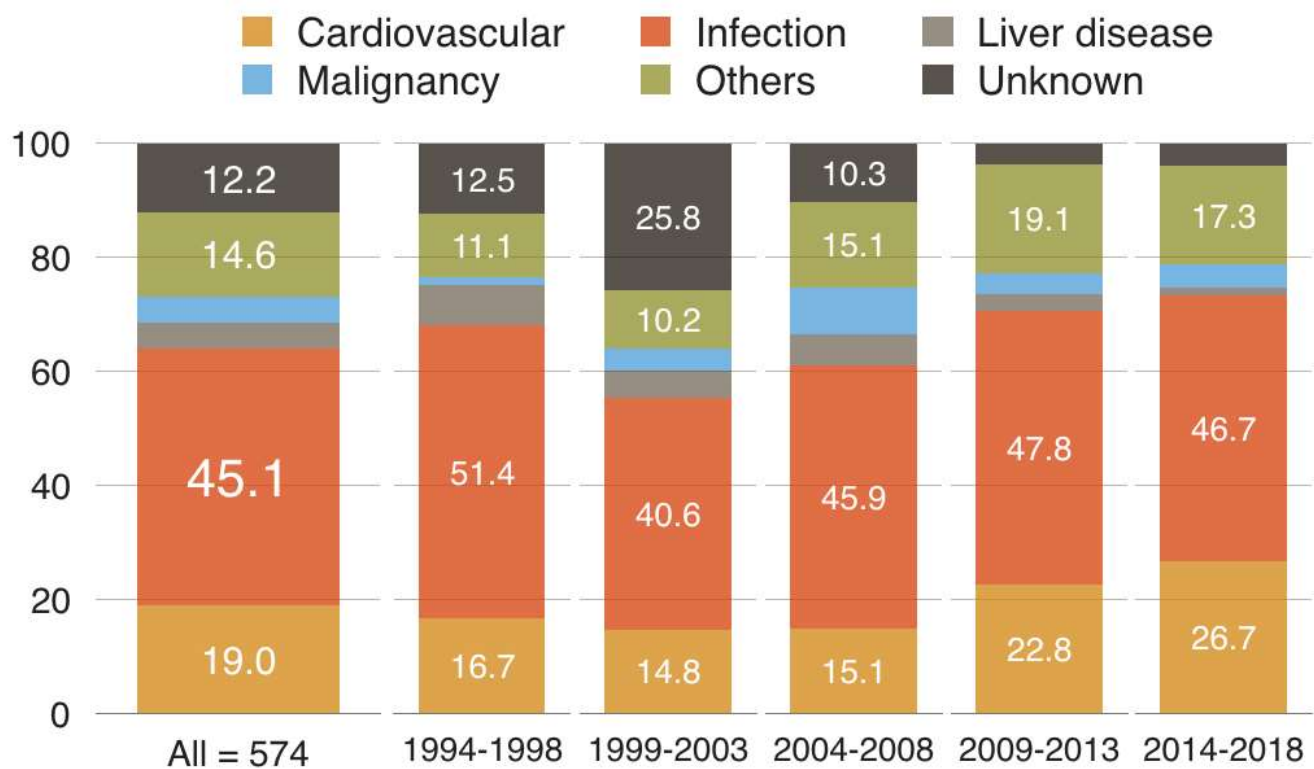
The patient survival rate after kidney transplantation significantly increased from previous period which the recipients of the living donors and deceased donors had death rate in various period of time as shown in picture 2.17.



Picture 2.17 Patient survival rate, separated by types of kidney transplantation.

Causes of death

The causes of death in every age after kidney transplantation within the first year were infection, heart diseases and vascular diseases and as shown in picture 2.18.



Picture 2.18 The causes of patient death in various period of time.

Graft survival rate

The graft survival rate increased from the past for both living donors and deceased donors. The graft survival rate in different time was decreased by period of time as shown in picture 2.19. However, the graft survival of kidney transplant from deceased donors at 10 years had decreased between 2009-2013 when compare to the previous year.

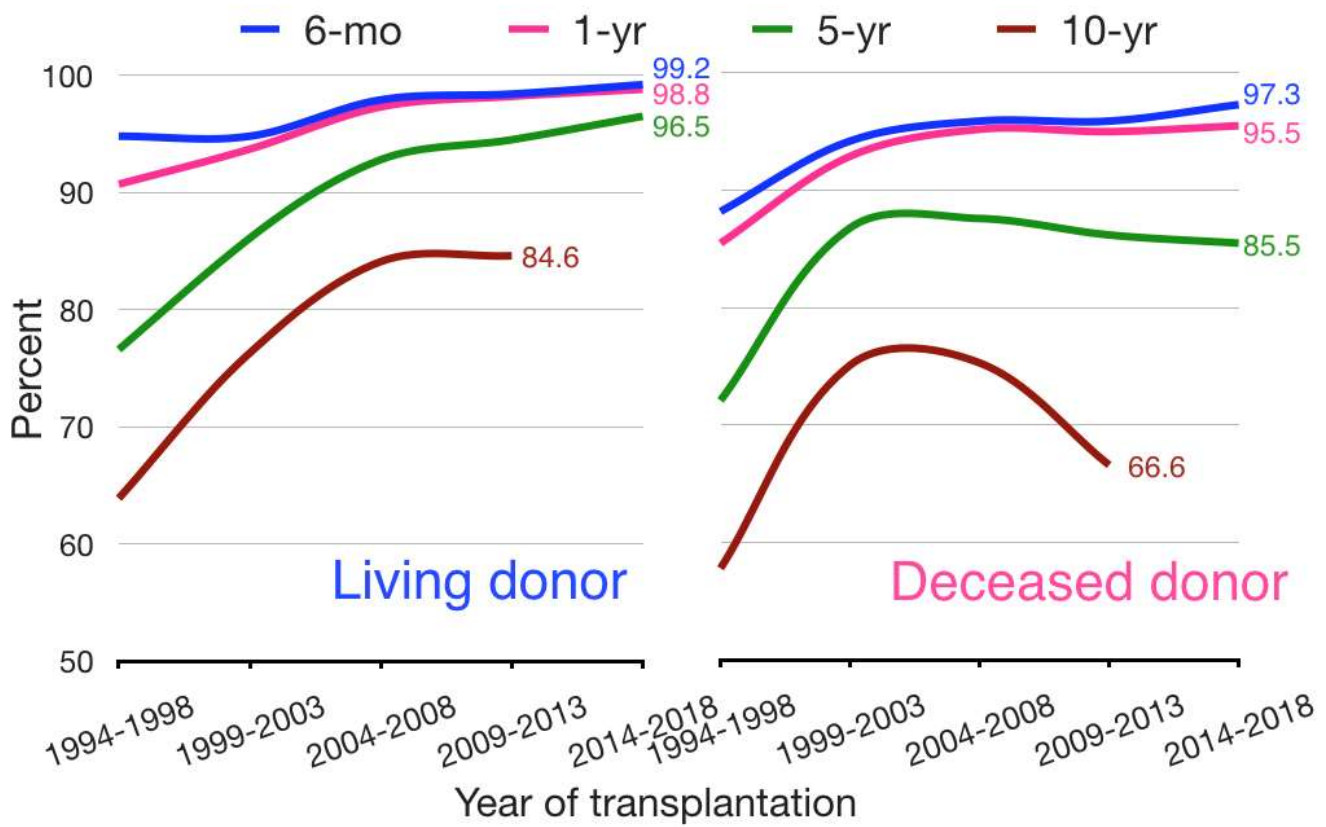
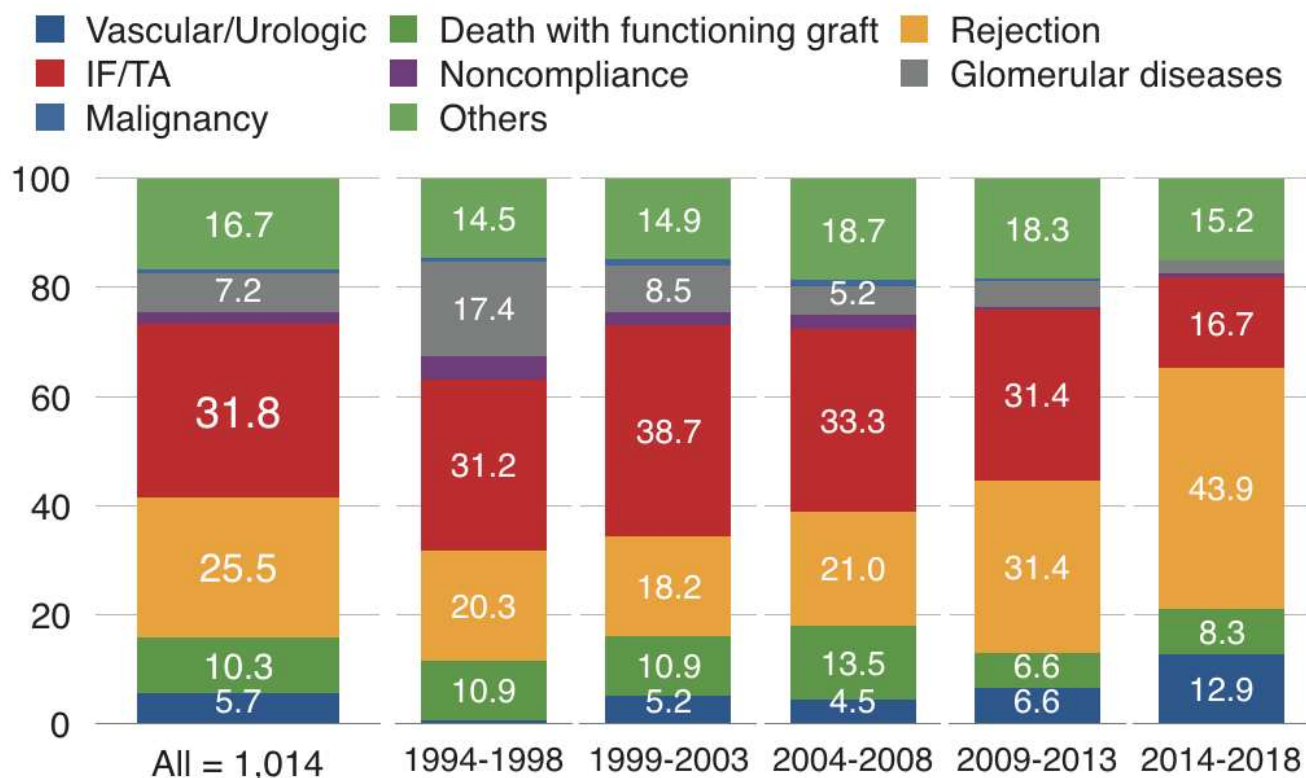


Table 2.19 The graft survival rate, separated by types of kidney transplantation.

Graft loss in different period of time after kidney transplantation as shown in picture 2.20, found that the patients had received kidney transplant more than 10 years (between 1994 to 2008) and less than 10 years (between 2009 to 2018), the main reason of graft loss were interstitial fibrosis/tubular atrophy (IF/TA) and rejection respectively.



Picture 2.20 Graft loss of kidney transplant recipients in different year period.

Kidney transplant 2018 Summary

- Comparing to the past, 85.3% antibody induction therapy had significantly increased.
- Immunosuppressive medication used on discharge date, 91.3% of tacrolimus was used by calcineurin inhibitor group. 46.3% of mycophenolatemofetil was used by antiproliferative and 38.7% of mycophenolate sodium
- There are 31.0% and 2.3% of delayed graft function in recipients who received kidney transplant from deceased donors and living donor respectively.
- Infection was the major cause of death.
- The major cause of graft loss was IF/TA and rejection.
- The tendency of patient survival rate and graft survival rate were increased compare to the past, especially from living donors.

Information of Kidney Transplantation in patients younger than 18 years old

Number of kidney transplant recipients younger than 18 years old in 2018

From 1 January to 31 December 2018, there were 29 patients of kidney transplant recipients younger than 18 years old, 9 recipients from living donors and 20 recipients from deceased donors, separated by hospital as shown in table 3.1.

Table 3.1 Number of kidney transplant recipients younger than 18 years old in 2018, separated by hospital.

Hospital	Kidney transplant recipients of Living donor	Kidney transplant recipients of Deceased donors	Total
Ramathibodhi	4	7	11
Siriraj	1	4	5
Chiang Mai	1	2	3
Phramongkutkloa	0	3	3
Srinagarind	0	3	3
Chulalongkorn	1	0	1
Vajira	1	0	1
Maharat Nakhon Ratchasima	1	0	1
Bumrungrad	0	1	1
Total	9	20	29

The comparison between 2017 and 2018, the kidney transplantation for child patients decreased by 23.5%. (picture 3.1).

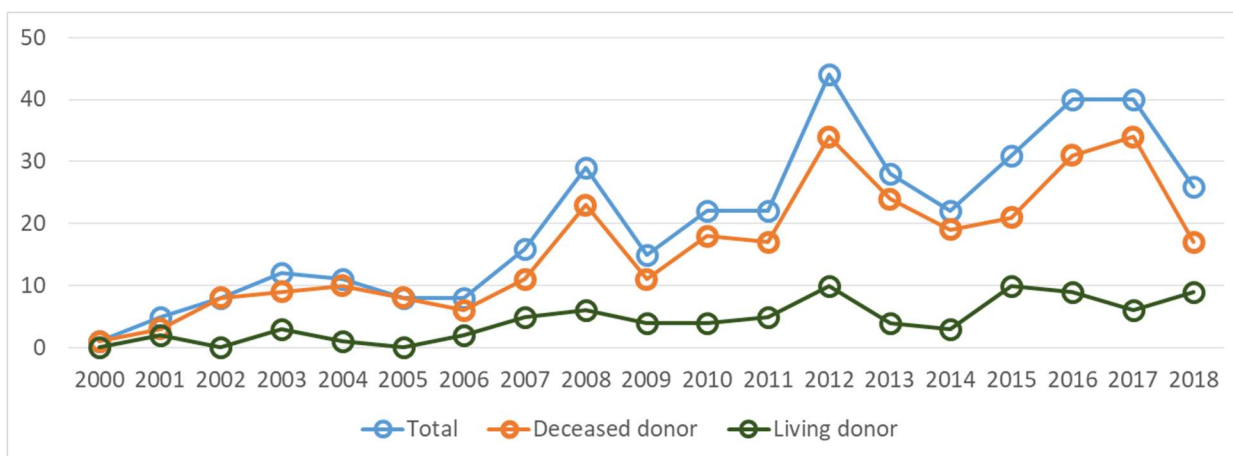


Table 3.1 Number of the kidney transplantation for child patients each year since 2000, separated by transplant types.

Information of kidney transplant recipients and donors younger than 18 years old in 2018

There were 26 from 29 kidney transplant recipients who were younger than 18 years old in 2018 which were 16 male (73%)

There were 9 kidney recipients from living donors which were 3 male (33%), the average age was equal to 12.8 ± 5.7 years old. The total of first time kidney transplant for young patients; 4 recipients received hemodialysis, 3 recipients received peritoneal dialysis and 2 recipients received preemptive transplantation.

From the donors information found that 67% were female, the average age as equal to 41.8 ± 9.7 years old (Table 3.2)

Table 3.2 Information of kidney transplant recipients younger than 18 years old from living donors.

	Recipient	Donor
Male gender, %	33	67
Age (mean \pm SD), years	12.8 ± 5.7	41.8 ± 9.7
(range)	(1–18)	(25–54)
Number of transplant, %		

1	100	
Mode of renal replacement therapy, %		
Preemptive	22	
Hemodialysis	44	
Peritoneal dialysis	33	
Serum creatinine at discharge (mg/dL)		
	0.88 ± 0.44	

SD, standard deviation

There were 17 kidney transplant from deceased donors which were 12 male (63%), the average age was equal to 13.47 ± 2.96 years old. All first time patients of kidney transplant were 82% who received peritoneal dialysis before transplantation.

The deceased donors were 76% of male, the average age was equal to 32.24 ± 10.99 years old. The cold ischemic time period in 2018 was equal to 15.6 ± 4.4 hours as shown in table 3.3.

Table 3.3 Information of kidney transplant recipients younger than 18 years old received from deceased donors.

	Recipient	Donor
Male gender, %	63	76
Age (mean ± SD), years (range)	13.47 ± 2.96 (8–18)	32.24 ± 10.99 (13–44)
Number of transplant, % 1	100	
Mode of renal replacement therapy, %		
Hemodialysis	18	
Peritoneal dialysis	82	
Serum creatinine at discharge (mg/dL)		
	0.99 ± 0.62	
Cold ischemic time (hour)		
	15.6 ± 4.4	

SD, standard deviation

The kidney recipients from living and deceased donors in 2018 increased in kidney replacement therapy before transplantation when compare to 2017 which equal to 11.9 and 21.7 months respectively.

Immunosuppressive medication usage and result of kidney transplant recipients younger than 18 years old in 2018

In 2018, 26 kidney transplant recipients had informed of induction therapy and immunosuppressive medication on discharge date, as shown in Table 3.4 and 3.5 respectively and indicated that 76.9% received basiliximab induction therapy, the rest of recipients did not received the therapy. The most formula of 42.3% used on discharge date were tacrolimus, mycophenolate mofetil and prednisolone.

Table 3.4 Kidney transplant recipients younger than 18, separated by induction therapy.

Induction therapy	N (%)
No induction	6 (23.1)
Basiliximab	20 (76.9)
Total	26 (100)

Table 3.5 Information of Immunosuppressive regimen on discharge date.

Immunosuppressive regimen	N (%)
Prednisolone + tacrolimus + mycophenolate mofetil	11 (42.3)
Prednisolone + tacrolimus + mycophenolate sodium	7 (26.9)
Prednisolone + tacrolimus	5 (19.2)
Prednisolone + cyclosporine A + mycophenolate mofetil	2 (7.7)
Tacrolimus	1 (3.8)

Total	26 (100)
-------	----------

In 2018, the kidney transplant recipients of deceased donors had delayed graft function and 4 patients had received peritoneal dialysis after transplantation, but the recipients of living donors did not have delayed graft function.

In 2018, the patient survival and graft survival of kidney transplant recipients were 100.0% and 100.0% respectively at one year respectively.

Information of kidney transplant recipients younger than 18 years old during 1994-2018

Number of kidney transplant recipient younger than 18 years old by year of transplantation

From kidney transplant database by Thai Transplantation Society between 1994-2018, there were 396 recipients younger than 18 years old, which divided into 85 recipients from living donors and 311 recipients from deceased donors. The average age was equal to 13.78 ± 3.87 years old, 58.6% were male as shown in table 3.6.

Table 3.6 The information of kidney transplant recipients of living donors and deceased donors.

	Kidney Transplant Recipient of Living donor	Kidney Transplant Recipient of Deceased donor
Number	85	311
Male gender, %	57.6	58.8
Recipient age, years (mean \pm SD, range)	14.09 ± 3.79 (1–18)	13.70 ± 3.89 (1–18)
Number of transplant, %	97.7	98.4
1		
Peak PRA (% , range)	0 (0–33)	0 (0–89)

Last PRA	0 (0–27)	0 (0–55)
Mode of renal replacement therapy, %		
Preemptive transplant	16.5	1.0
Hemodialysis	36.5	33.1
Peritoneal dialysis	41.2	61.4
Missing	5.8	4.5
Waiting time, months (Interquartile range)	17.9 (7.5–26.2)	19.7 (11.0–30.7)
Payment type, %		
Government Healthcare	12.9	8.7
Social Security Office	1.2	0.3
National Health Security Office	52.9	67.2
State Enterprise Healthcare	1.2	2.3
Self-Support	5.9	2.9
Others	25.9	18.6

SD, standard deviation

The number of kidney transplant recipients younger than 18 years old, separated by renal replacement therapy before transplantation as shown in picture 3.2. The 57% of most child patients received peritoneal dialysis.

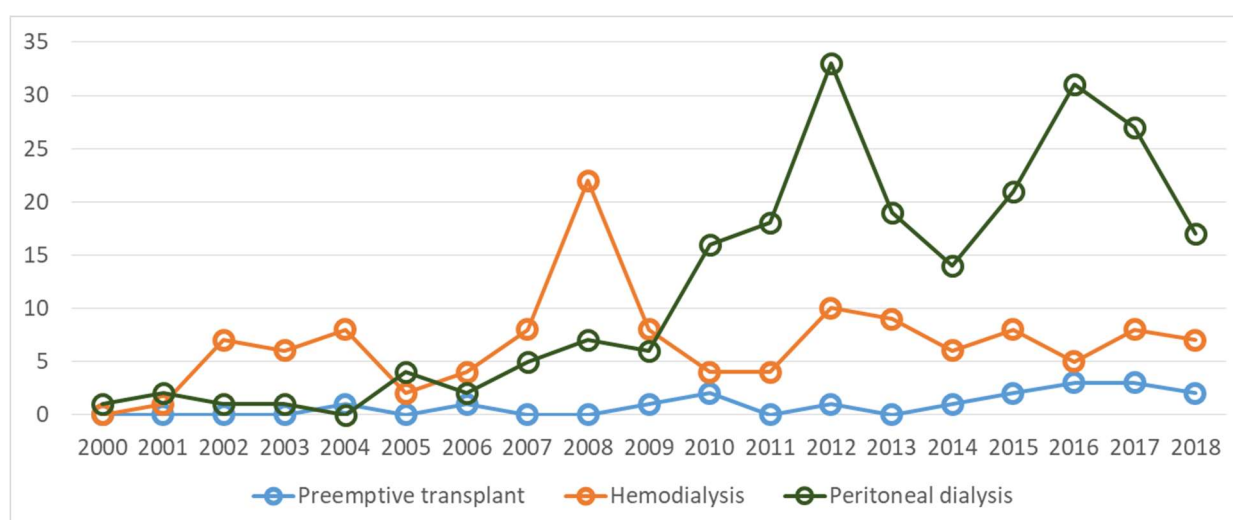
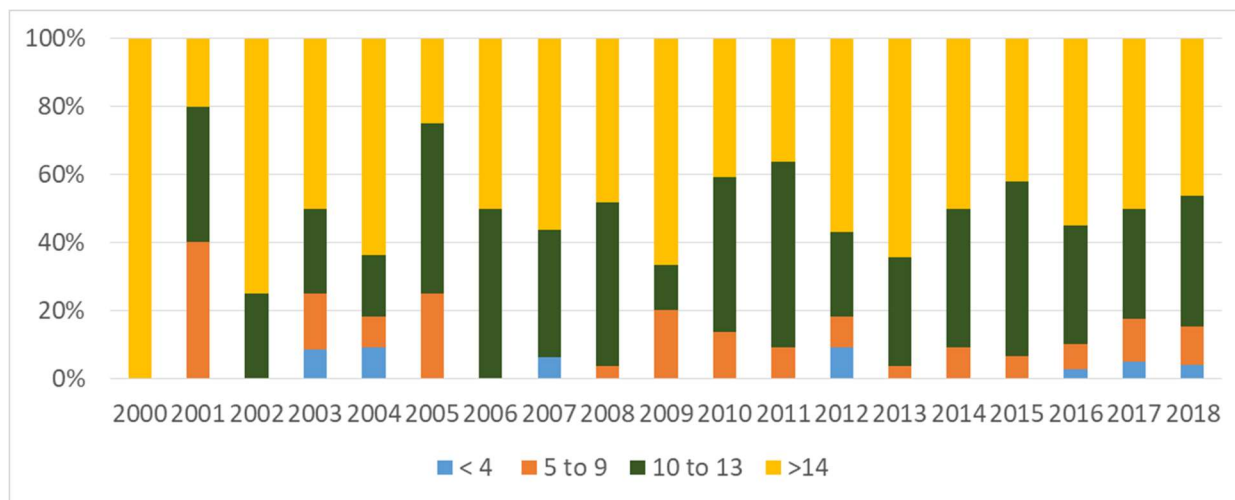


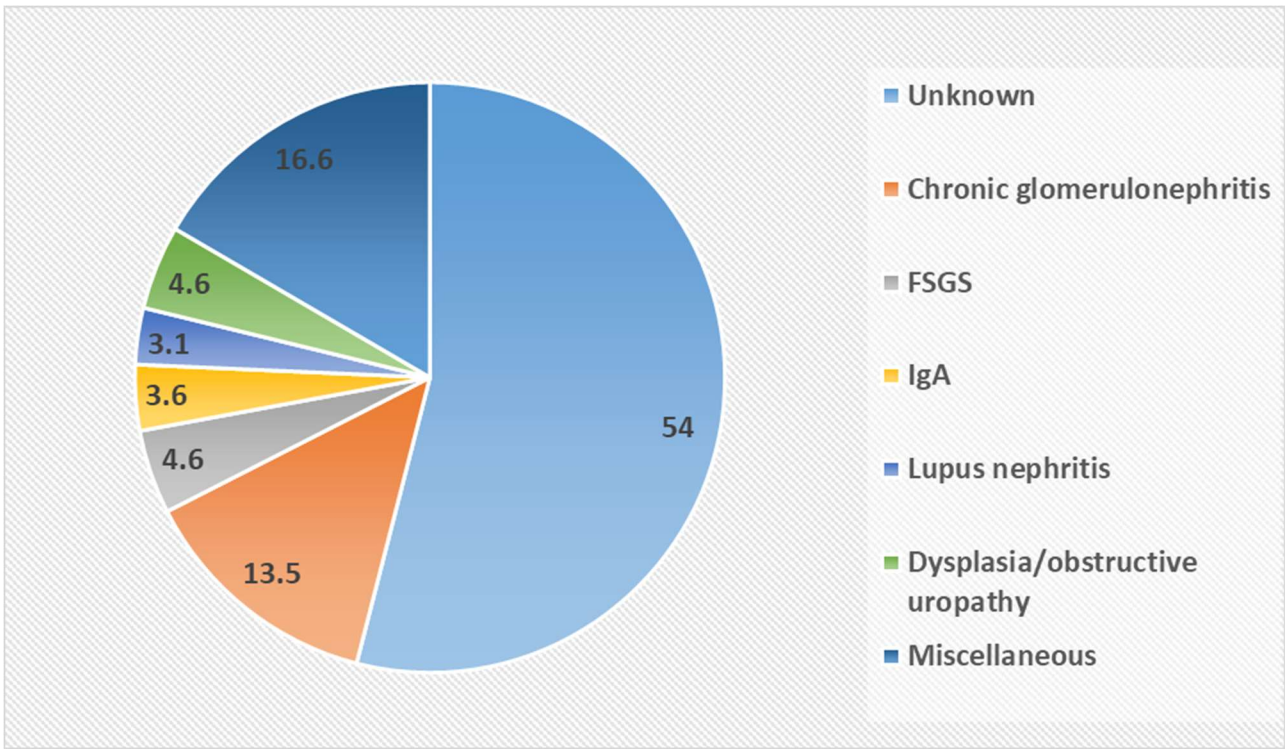
Table 3.2 The number of child recipients since 2000, separated by renal replacement therapy.

The number and proportion of kidney transplant patients younger than 18 years old by age as shown in picture 3.3 found that there were increasing in children kidney transplantation.



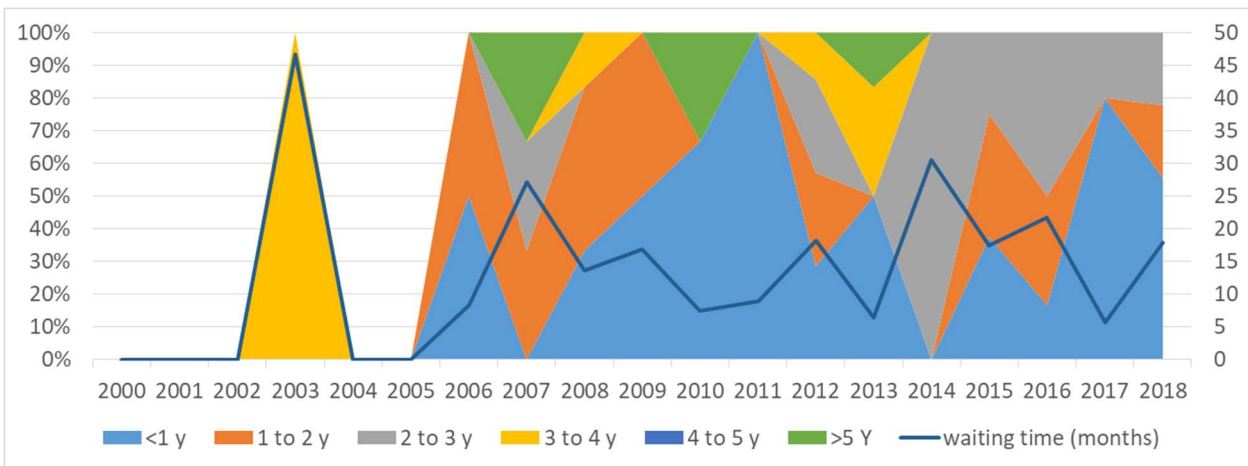
Picture 3.3 The proportion of kidney transplant patients younger than 18 years old, separated by ages.

The major causes of chronic kidney disease were 13.5% of chronic glomerulonephritis, 4.6% of focal segmental glomerulosclerosis (FSGS) and uropathy, 3.6% of igA nephropathy and 3.1% of lupus nephritis and 54% of unidentified causes (Picture 3.4).

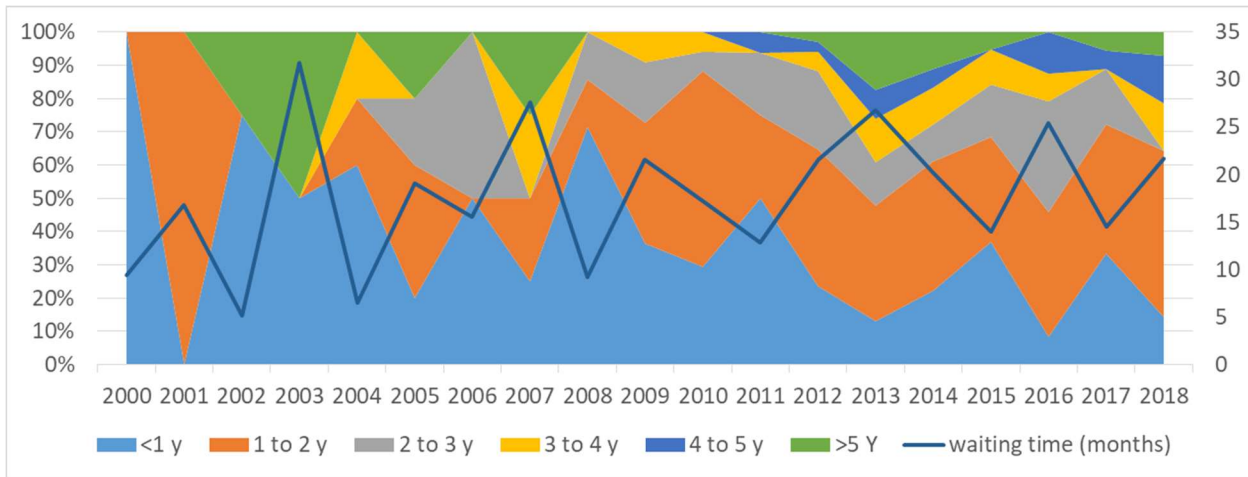


Picture 3.4 Causes of chronic kidney disease in child recipients.

The kidney recipients from deceased donors had longer period of renal replacement therapy before transplantation than living donors (Table 3.6). The period of renal replacement therapy before transplantation of child kidney recipients from living donors and deceased donors were separated by year as shown in picture 3.5 and 3.6 respectively.



Picture 3.5 The period of renal replacement therapy before kidney transplantation from living donors.



Picture 3.6 The period of renal replacement therapy before kidney transplantation from deceased donors.

Information of Donors

The information of kidney transplantation separated by transplant types of 85 of living donors, 27% were male. The relationship between donors and recipients as shown in table 3.8.

Table 3.7 The information of living donors and deceased donors.

	Living donor	Deceased donor
Number	85	311
Male gender, %	27.1	77.2
Donor age, years (mean \pm SD, range)	39.71 \pm 8.34 (20–54)	32.05 \pm 12.60 (3–64)
Donor best serum creatinine, mg/dL	0.56 \pm 0.42	0.83 \pm 1.08
Donor last serum creatinine, mg/dL	0.84 \pm 0.30	1.22 \pm 0.68
Donor hypotension, %	1.2	11.6
Donor CPR, %	0	9.3

Table 3.8 The relationship between living donors and recipients.

Relationship between recipient	Number of donor (%)		
	Male	Female	Total
Parents	15 (65.2)	53 (85.5)	68 (80.0)
Siblings	4 (17.4)	2 (3.2)	6 (7.1)
Others e.g. twin, cousin	4 (17.4)	7 (11.3)	11 (12.9)
Total	23	62	85

From 311 deceased donors, 77.2% were male and 11.6% had hypotension before amputation, 9.3 had cardiopulmonary resuscitation (Table 3.7), The main cause of brain death was car accident as shown in table 3.9.

Table 3.9 The causes of brain death.

Cause	%
Traffic related accidents	63.3
CVA	17.36
Gunshot	2.89
Fall	2.57
Primary brain tumor	0.96
Asphyxia	0.32
Others	5.14
Unidentified	7.40

Immunosuppressive medication used and kidney transplant result.

The patients younger than 18 years old received induction therapy and its significantly increased every year but decreased in non-induction therapy. The kidney transplant recipients were 44.7% of living donors and 35.4% of deceased donors (Table 3.10).

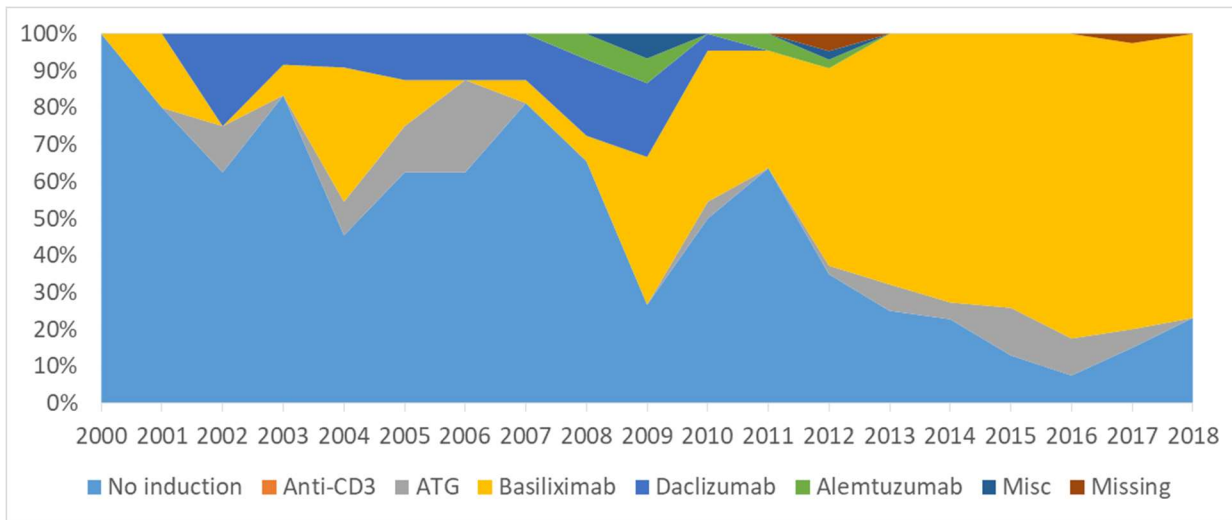
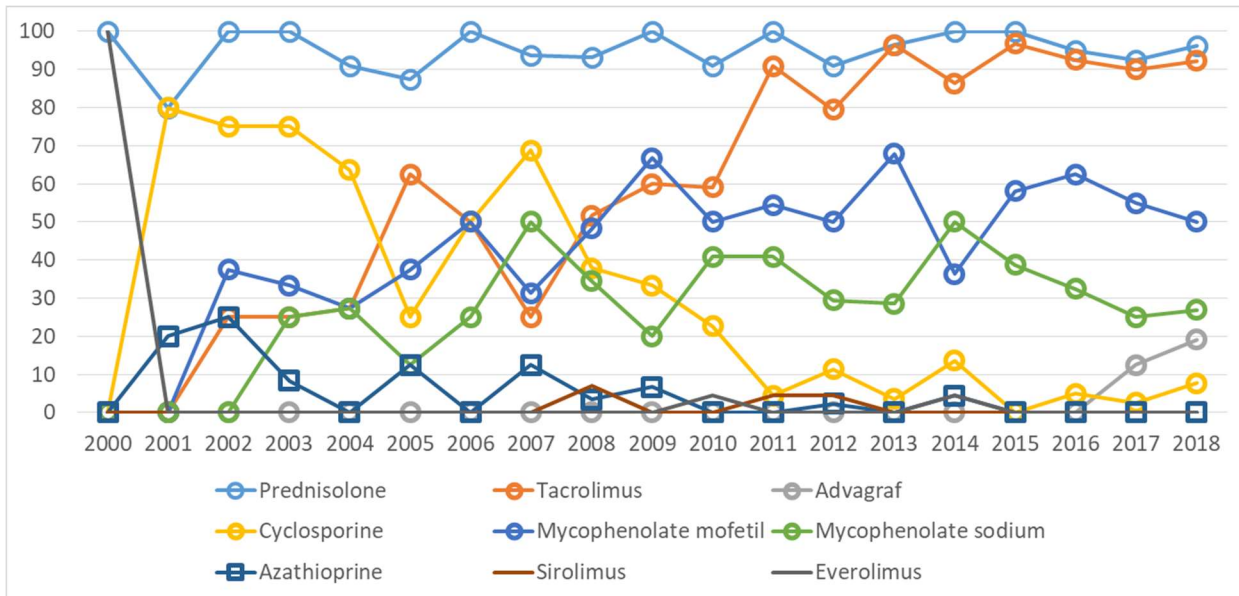


Table 3.7 The proportion of patients received induction therapy, separated by year of transplantation.

Table 3.10 The proportion of antibody induction therapy, separated by transplant types.

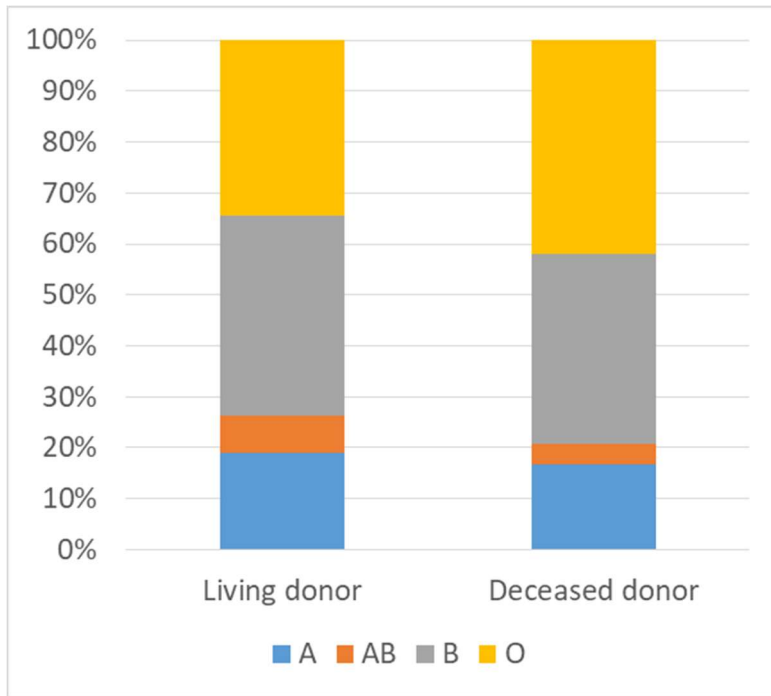
	Number of kidney transplant recipient (%)	
	Living donor (N=85)	Deceased donor (N=311)
No induction	38 (44.7)	110 (35.4)
Basiliximab	33 (38.8)	164 (52.7)
Daclizumab	4 (4.7)	14 (4.8)
ATG	5 (5.9)	15 (4.8)
OKT3	0 (0.0)	2 (0.6)
Alemtuzumab	3 (3.5)	2 (0.6)
Others	1 (1.2)	1 (0.3)
Missing	1 (1.2)	3 (1.0)

The proportion and tendency of immunosuppressive medication used on discharge date was shown in picture 3.8. The patients younger than 18 years old received prednisolone, tacrolimus, mycophenolate mofetil or mycophenolate sodium were significantly increased.



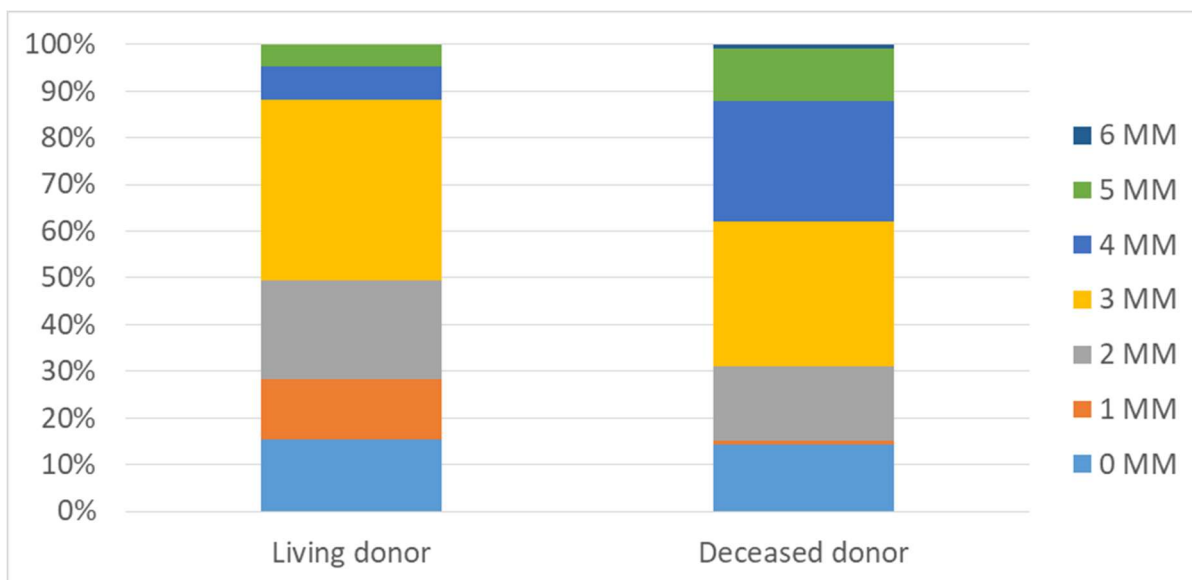
Picture 3.7 The proportion of immunosuppressive treatment on discharge date, separated by year of transplantation.

For blood types of recipients from living donors, type O, B, A and AB which represented 34.5%, 39.3%, 19.1% and 7.1% respectively. On the other hand, blood types of recipients from deceased donors, the percentage were 41.9%, 37.4%, 16.8% and 3.9% respectively (Picture 3.9).



Picture 3.8 The proportion of kidney transplant recipients, separated by blood types.

There were tissue matching of 3 HLA mismatch (32.66%) in most child patients which the proportion was separated by transplantation types as shown in picture 3.10.



Picture 3.10 The tissue matching of child patients, separated by transplant types.

The kidney recipients from deceased donors had both high delayed graft function and serum creatinine level at discharge date than from living donors. The number of recipients from deceased donors had longer stay in hospital than from living donors. (Table 3.11)

Table 3.11 The delayed graft function and serum creatinine on discharge date and the number of patients admission, separated by transplant types.

	kidney transplant from living donor	kidney transplant from deceased donor
Delayed graft function, %	4.3	21.7
Serum creatinine at discharge, mg/dL	1.06 ± 1.13	1.40 ± 1.27
Admission days after transplantation, days (Interquartile range)	15 (11–21)	22 (16–33)

Cytomegalovirus Infection in child patients of kidney transplantation

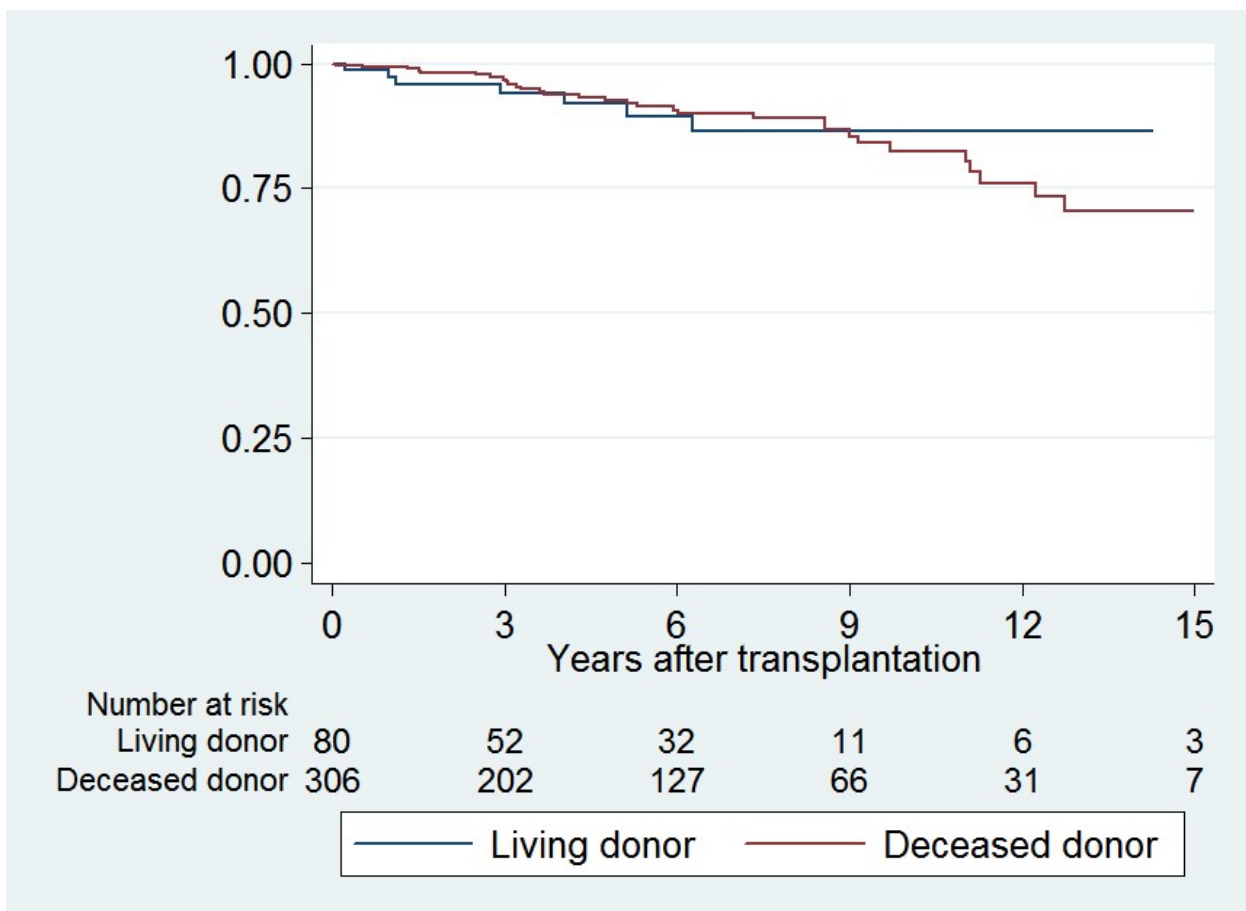
The child patients tended to have Cytomegalovirus (CMV) infection; 287 patients (72.7%) had Anti-CMV IgG positive and 12 patients (3.0%) had Anti-CMV IgM positive; 6 patients had Anti-CMV IgM positive had Anti-CMV IgG negative. The relationship between recipients and donors were separated by CMV infection as shown in table 3.12.

Table 3.12 The relationship between recipients and donors, separated by Cytomegalovirus (CMV) infection.

Recipient	Donor		
	Anti-CMV IgG positive	Anti-CMV IgG negative	Unknown
Anti-CMV IgG positive	240	14	33
Anti-CMV IgG negative	29	17	3
Unknown	10	2	48

Patient survival rate

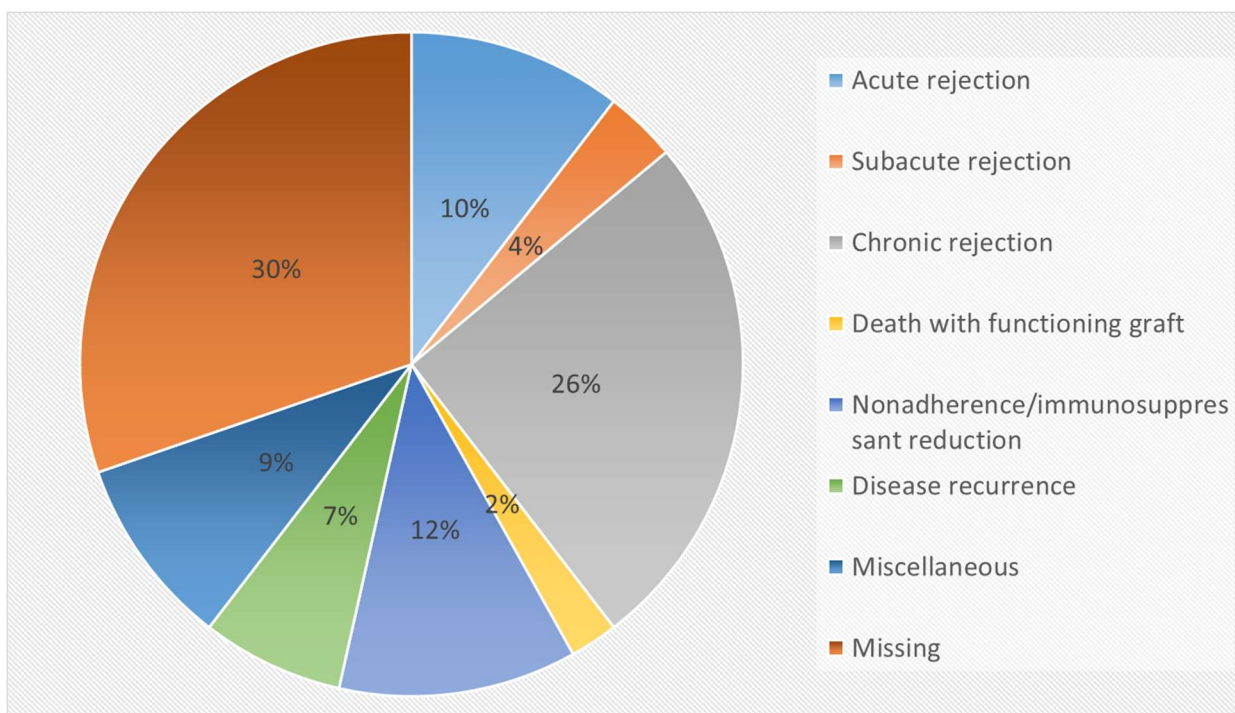
The survival rate after kidney transplant had significantly increased. During 1996 – 2018, 38 patients died after kidney transplantation which was 9.6%. The causes of death were 9 cases of infection, 2 cases of heart failure, 1 case of stroke, 2 cases of kidney failure, 3 cases of others and 21 cases of unknown causes. The patient survival rate of children age at 1,5 and 10 years old were 98.9%, 92.8% and 84.3% respectively. There were no difference between kidney transplant from living and deceased donors in statistic. (Picture 3.11)



Picture 3.11 The patient survival rate of kidney transplant in children from living donors and deceased donors.

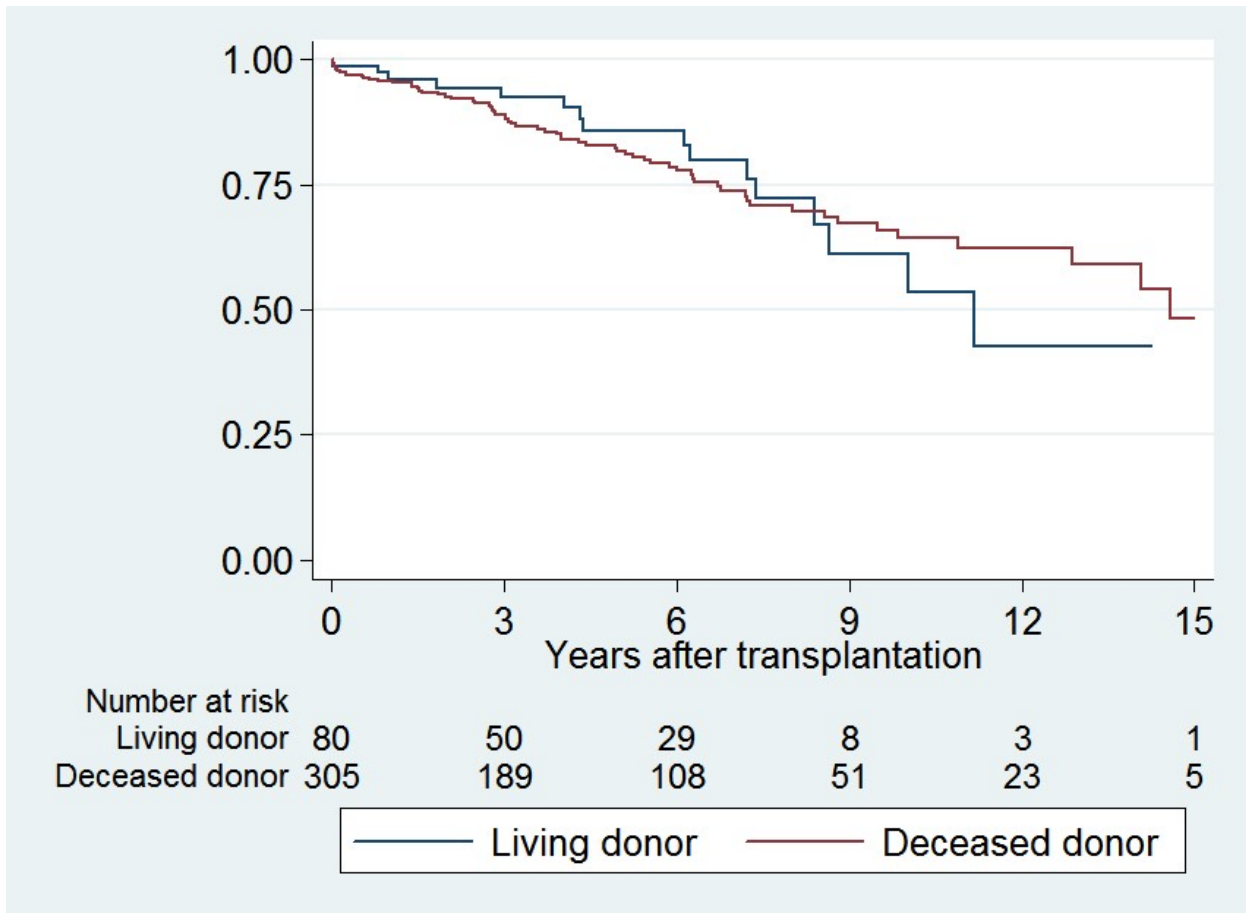
Graft survival rate

During 1996 – 2018, there were 84 cases lost their kidneys, the causes were chronic renal allograft nephropathy, acute rejection, subacute rejection, withdrawal immunosuppression/ nonadherence, recurrence of primary disease, death with functioning graft, renal artery stenosis, renal vein thrombosis and other causes which represented 22, 9, 3, 10, 6, 2, 1, 1, 6 cases respectively and 24 unidentified caused cases (Picture 3.12).



Picture 3.12 Causes of child kidney transplant recipients who lost their kidneys.

The graft survival rate at the 1,5 and 10 years were 95.6% ,83.2% and 66.4% respectively when compare in statistic, there were no difference between living donors and deceased donors (Picture 3.11).



Picture 3.11 The graft survival rate of child kidney transplant recipients from living donors and deceased donors.

Information of Liver transplantation

Information of Liver transplantation

Annual Report of Liver Transplantation 2018

By Registration of Liver Transplant subcommittee, Thai Transplantation Society

The first liver transplant registration from appointed committee held the meeting in March 2018 to organize the registration and collect the information of recipients, donors, results and

immunosuppressive medication used in past three year (2016-2018). The report divided into liver transplant in adults and in children (age less than 18 years old).

Liver Transplant in adults

There were 215 patients of liver transplantation between 2016-2018 at 77 ,96 and 79 respectively. The most patients had liver transplant in 2017 which was consistent to donors to The Thai Red Cross.

Liver transplantation was separated by hospitals: Siriraj, Chulalongkorn, Srinagarind, Maharaj Nakorn Chiangmai, Ramathibodi, Vichaiyuth, Rajavidhi, Bumrungrad and Smithivej Sukhumvit at 73, 62, 55, 21, 18, 13, 8, 1 and 1 respectively as shown in table 1.

Hospital	2016	2017	2018	Total
Siriraj	26	28	19	73
Chulalongkorn	23	21	18	62
Srinagarind	8	23	24	55
Maharaj Nakorn Chiangmai	7	8	6	21
Ramathibodi	6	8	4	18
Vichaiyuth	5	4	4	13
Rajavidhi	2	3	3	8
Bumrungrad	0	0	1	1
Smithivej Sukhumvit	0	1	0	1
Total	77	95	79	252

Table 1 Number of Liver transplantation in adults between 2016-2018, separated by hospitals.

The type of liver transplant classified to 238 (94.4%) of first transplant and 14 (5.6%) of repeated transplant (second transplant) and classified to type of donors; 242 (96.4%) from donors after brain death and 9 (3.6%) from living donors.

Type of Liver Donors

The average age of donor was 55.3 years old, the standard deviation, SD was equal 12 years old, the median was equal to 58 years old, the youngest age was 19 years old and the oldest age was 78 years old. There were more male donors than female donors; 177 (70.5%) in male and 74 (29.5%) in female. The most donor had O blood type at 97 (38.7%), secondary had B blood type at 81 (32.3%), A blood type at 50 (19.9%), AB blood type at 23 (9.2%). The body mass index (BMI) was equal to 26.9 kg/m²; 18 (7.2%) had BMI between 30-35 kg/m² (obesity) and 9 (3.6%) had BMI more than 35 kg/m² (morbid obesity), median was equal to 24.2 kg/m²; the minimum median was equal to 14.9 kg/m² and the maximum median was 38.5 kg/m² as shown in table 2.

	Category	Average, Number	SD (range), %
Age	Year	55.2	12 (19-78)
Sex	Male	177	70.5
	Female	74	29.5
Blood Type	A	50	19.9
	B	81	32.3
	O	97	38.7
	AB	23	9.2
BMI	kg/m ²	24.7	4.4 (14.9-38.5)

Table 2 Types of Liver transplant in adult recipients between 2016-2018

The main cause of liver transplant were 126 (50.2%) of Hepatocellular carcinoma, secondary was 77 (30.7%) of acute hepatitis B infection/chronic hepatitis B cirrhosis, 72 (28.7%) of hepatitis C cirrhosis, 39 (15.5%) of alcoholic cirrhosis, 21(8.4%) of non-alcoholic steatohepatitis cirrhosis and other causes respectively as shown in table 3. The cause individually had more than one indicator such as hepatocellular carcinoma together with acute hepatitis B infection.

Cause	Number	%
Hepatocellular carcinoma	126	50.2
Hepatitis B infection/cirrhosis	77	30.7
Hepatitis C cirrhosis	72	28.7
Alcoholic cirrhosis	39	15.5
Non-alcoholic steatohepatitis cirrhosis	21	15.5
Biliary atresia	10	4.0
Cryptogenic cirrhosis	7	2.8
Autoimmune hepatitis	5	2.0
Acute fulminant hepatic failure	5	2.0
Primary biliary cirrhosis	4	1.6
Hepatic artery thrombosis	4	1.6
Calori's disease	3	1.2
Primary sclerosing cholangitis	2	0.8
Budd-Chiari syndrome	2	0.8
Cholangiocarcinoma	2	0.8
Familial amyloidosis polyneuropathy	2	0.8
Wilson disease	2	0.8
Primary graft non-function	1	0.4

Table 3 The causes of liver transplant in adults between 2016-2018.

The common symptoms and complications from liver transplant were 57 (22.7%) of variceal bleeding, 50 (19.9%) of refractory ascites, 32 (12.8%) of recurrent spontaneous bacterial peritonitis and others as shown in table 4.

Symptom and Complication	Number	%
Variceal bleeding	57	22.7
Refractory ascites	50	19.9
Recurrent spontaneous bacterial peritonitis	32	12.8
Recurrent hepatic encephalopathy	23	9.2
Recurrent cholangitis	13	5.2
Hepatorenal syndrome	11	4.4
Hepatopulmonary syndrome	3	1.2
Hepatic hydrothorax	3	1.2
Polyneuropathy	2	0.8

Table 4 Symptoms and Complications of liver transplantation in adults between 2016-2018.

The common comorbidities found in liver transplantation were 72 (28.%) of diabetes, 16 (6.4%) of dyslipidemia, 14 (7.6%) of chronic kidney disease, moreover 2 (0.8%) of previous cancer other than liver cancer i.e. 1 of breast cancer and 1 of ovarian cancer as shown in table 5.

Comorbidity	Number	%
Diabetes mellitus	72	28.7
Dyslipidemia	16	6.4
Chronic kidney disease	14	7.6
Heart disease (CAD, heart block)	8	3.2
Hematologic disease (thalassemia, ITP)	4	1.6
Previous cancer (CA breast, CA ovary)	2	0.8

Pulmonary disease (asthma, old TB)	2	0.8
Hyperthyroid	2	0.8
Gout	1	0.4
Old cerebrovascular accident	1	0.4
Myasthenia gravis	1	0.4

Table 5 The common comorbidities found in liver transplantation in adults between 2016-2018 (CAD: coronary artery disease, ITP: idiopathic thrombocytopenic purpura, CA: carcinoma, TB: tuberculosis)

The information of liver transplantation had 2.5 mg/dL of total bilirubin median, 3 g/dL of albumin, 0.95 mg/dL of creatinine, 136 mmol/L of serum sodium, 1.4 of INR and 20.2 of model of end-stage liver disease -sodium (MELD-Na) score average, 8.2 of standard deviation (SD), 20 of MELD-Na score median, the lowest equal to 6 and the highest equal to 47. The median of waiting period from the first date of registration to transplant date was 103 days or 3.4 months as the shortest waiting time was 1 day and the longest was 4,010 days or 11 years. The median of ischemic time counted from donor clamp time to reperfusion time was 6 hours 2 minutes. The median of length of hospital stayed after liver transplant counted from date of transplant until discharged date was 17 days, the shortest was equal to 8 days and the longest was equal to 380 days. The information did not include the patients who dies during transplantation or hospital stayed as shown in table 6.

	Unit	Median	Average (SD)	Range
Laboratory Test before liver transplantation				
Total bilirubin	mg/dL	2.5		0.4 – 44
Albumin	g/dL	3		1.6 – 4.8
Creatinine	mg/dL	0.95		0.3 – 8.2
Serum sodium	mmol/L	136		114 – 153
INR		1.4		0.9 – 11.6

AFP	ng/mL	3.8		0.7 – 60,500
MELD-Na score		20	20.2 (8.2)	6 – 47
Waiting time	day	103		1 – 4,010
Ischemic time	hour	6:02		1:25 – 16:39
Length of hospital stay*	day	17		8 – 380

Table 6 Liver transplantation database between 2016-2018 showed non-normal distribution that median represent “hospital stayed from transplant date until discharged date”, this was not included patients who died during transplant or hospital stayed (SD: standard deviation, INR: international normalized ratio of prothrombin time, MELD-Na: Model of end-stage liver disease-sodium score)

To consider payment method, 46% used direct governmental plan, 28% used self-support and 10% used social security plan, moreover, withdrew from other funds such as fund from hospital foundation as shown in table 7.

Payment Method	Number	%
Government Healthcare	115	45.8
Self-support	70	27.9
Social Security Office	25	10.0
State Enterprise Healthcare	7	2.8
Others	34	13.5

Table 7 Payment method for liver transplant in adults between 2016-2018

Type of Donors

The average age of donors were 33.8 years old, SD equal to 14.1 years old, the youngest was 7 years old and oldest was 61 years old, there were male more than female; 209 (83.3%) of male and 41 16.3%) of female. From total donors, 109 (43.4%) from O blood type which were the most donors, 83

(33.1%) from B, 46 (18.3%) from A and 13 (5.2%) from AB respectively which were consistent to donors. The average BMI was equal to 23.0 kg/m²; the lowest was equal to 15.6 kg/m² and the highest was equal to 35.2 kg/m². The donors of 196 (78.1%) had systolic blood pressure less than 80 mmHg, longer than 60 minutes and 23 (9.2%) had cardiopulmonary resuscitation, CPR. The median of alanine aminotransferase (ALT) at highest was equal to 38 IU/L, ranged between 8-615 IU/L and at last ALT before transplantation was equal to 31 IU/L, ranged between 7-630 IU/L. The main causes of death (except living donors) were brain injury (71%), Stroke (19%) and asphyxiation (2%) as shown in table 8.

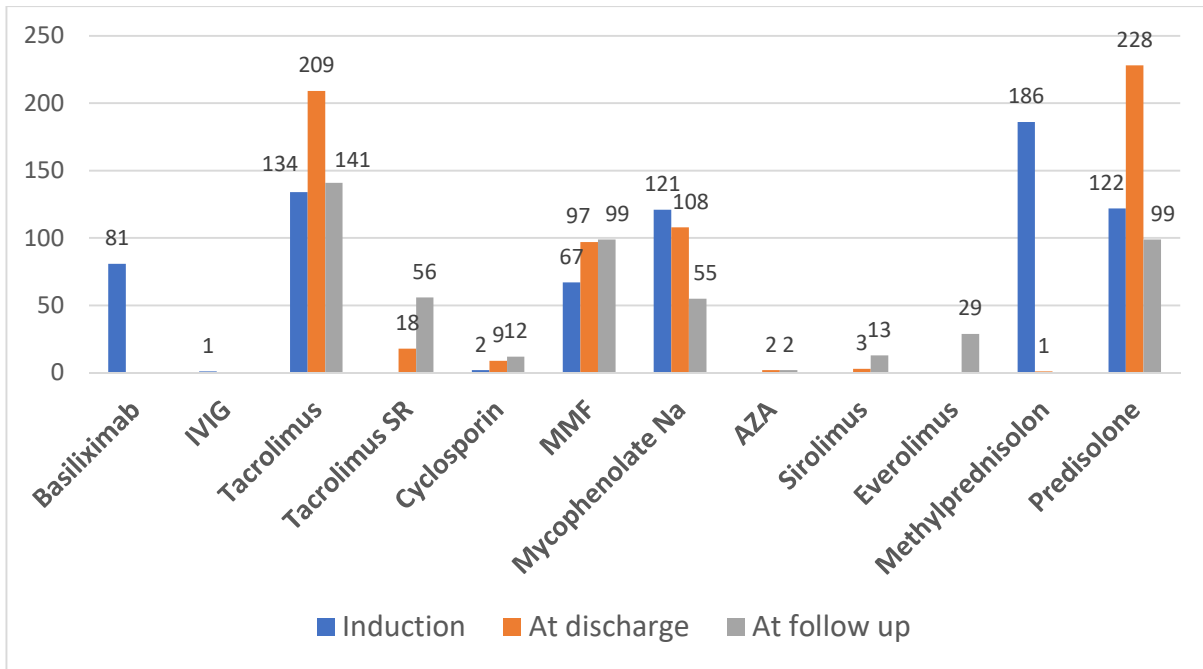
	Unit	Median	Average(SD)	Range
Age	Year	35	33.8 (14.1)	7 – 61
BMI	kg/m ²	22.85	23.0 (3.2)	15.6 – 35.2
Highest ALT	IU/L	38		8 – 615
Last ALT	IU/L	31		7 – 630
			Number	%
Sex	Male		209	83.3
	Female		41	18.3
Blood Type	A		46	18.3
	B		83	33.1
	O		109	43.3
	AB		13	5.2
Hypotension			196	78.1
CPR			23	9.2
Cause of Death	Brian Injury		172	71.1
	Stroke		46	19.0

	Asphyxiation		4	1.6
	Others		4	1.6

Table 8 Donor type of liver transplantation in adults between 2016-2018.

Immunosuppressive medication

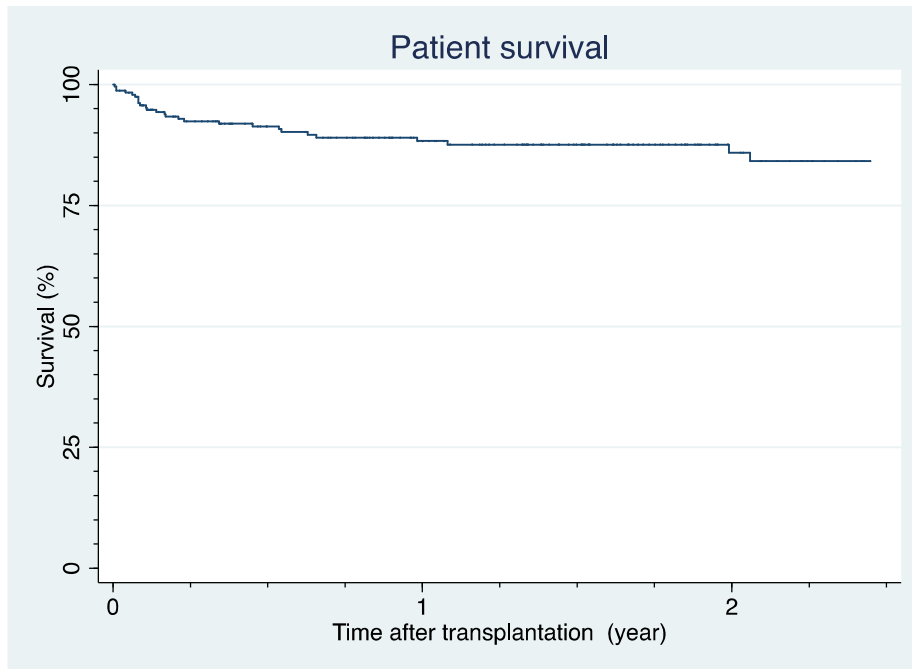
The liver recipients received immunosuppressive during first 24 hours of induction, 74% received most of methylprednisolone, 53% of tacrolimus, 32%of basilximab on discharge date, 91% of prednisolone, 83% of tacrolimus, 43% of mycophenolate sodium during the latest following up, 56% of tacrolimus, 39% of prednisolone and mycophenolate mofetil, 22% of sustained released tacrolimus and mycophenolate sodium, The immunosuppressive medication used in least recipients; 12% of evelorimus, 5% of sirolomus and cyclosporin and 1% of azathioprine as shown in picture 1.



Picture 1 The liver recipients who received immunosuppressive on discharged date at first 24 hours induction and latest follow up for liver transplant between 2016-2018.

Patients survival rate and graft survival rate

The patient death rate after transplantation between 2016-2018 within 30 days was equal to 3.9% (95% confidence interval, CI: 2.0 – 7.3) and within 90 days was equal to 7.6% (95% CI: 4.8 – 11.9). The survival rate at 1 year was equal to 88.3% (95% CI: 83.0 – 92.1) and patient survival rate at 2 years was equal to 85.9% (95% CI: 79.2 – 90.6). The Kaplan-Meier's survival rate as shown in picture 2 which calculated from the first time and repeated transplantation.



Picture 2 Patients survival rate between 2016-2018, calculated by Kaplan-Meier

Patients death rate within 90 days after transplantation were separated by year: 7.3% (95% CI: 3.1 – 16.7) in 2016, 4.5% (95% CI: 1.7 – 11.6) in 2017 and 11.3% (95% CI: 5.7 – 21.4) in 2018. The first year survival rate as follow: 89.5% (95% CI: 79.3 – 94.9) in 2016, 90.9% (95% CI: 82.6 – 95.4) in 2017 and the liver transplantation in year 2018 could not calculate yet due to lack of time following up.

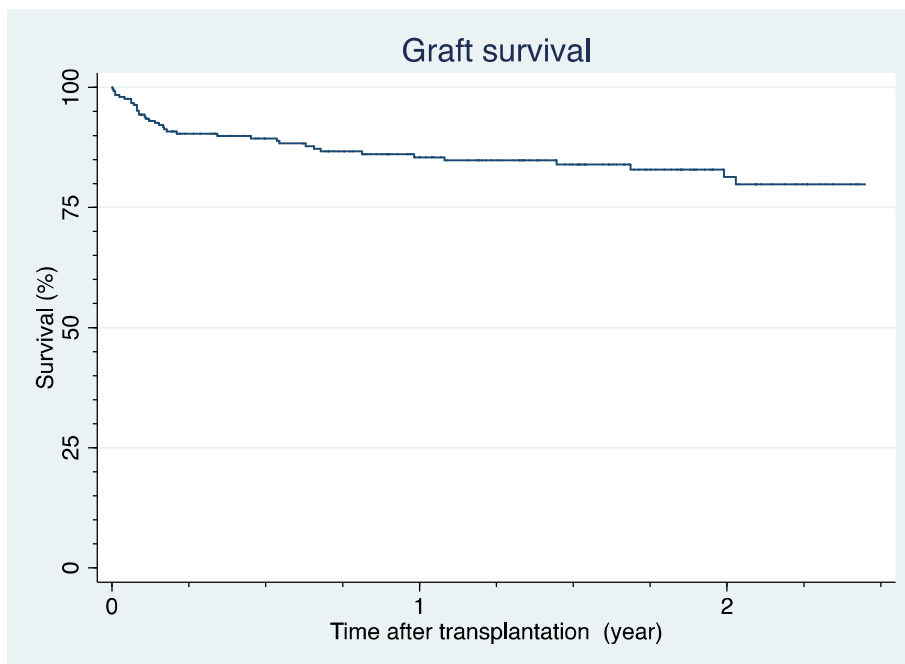
During follow up period between 2016-2018, 29 died from 62% of infection and 10% of liver failure as shown in table 9.

Cause of death	Number	%
Infection	18	62.1
Liver failure	3	10.2
Cardiovascular	1	3.4
Blood vessel	1	3.4
Recurrent cancer	1	3.4

Severe bleeding	1	3.4
Several organs failure	1	3.4
Unidentified causes	3	10.2

Table 9 Causes of death in most adults liver transplant between 2016-2018.

The graft survival of liver transplantation between 2016-2018 at 30 days was equal to 95.1% (95% CI: 91.6- 97.2), at 90 days was equal to 90.4% (95% CI: 85.9 – 93.5), at 1 year was equal to 85.5% (95% CI: 80.0 – 89.6) and at 2 years was equal to 81.3% (95% CI: 74.3 – 89.6). The Kaplan-Meier transplantation was shown in picture 3.



Picture 3 Graft survival of liver transplantation between 2016-2018 by Kaplan-Meier process.

Graft survival at 90 days was separated by year: 88.0% (95% CI: 78.2 – 93.6) in 2016, 93.6% (95% CI: 86.2 – 97.1) in 2017 and 89.2% (95% CI: 79.5 – 94.5) in 2018. The first year transplantation in 2016 was equal to 85.2% (95% CI: 74.9 – 91.5) and 2017 was 87.1% (95% CI: 78.3 – 92.4). The liver transplantation in year 2018 could not calculate yet due to lack of time following up.

During follow up period between 2016-2018, the causes of graft failure were 6 of vascular complications, 2 of primary graft non-function, 1 of biliary complications and 10 of unidentified causes as shown in table 10.

Cause of graft failure	Number	%
Vascular Complications	6	31.6
Primary graft non-function	2	10.5
Biliary complications	1	5.3
Unidentified causes	10	51.6

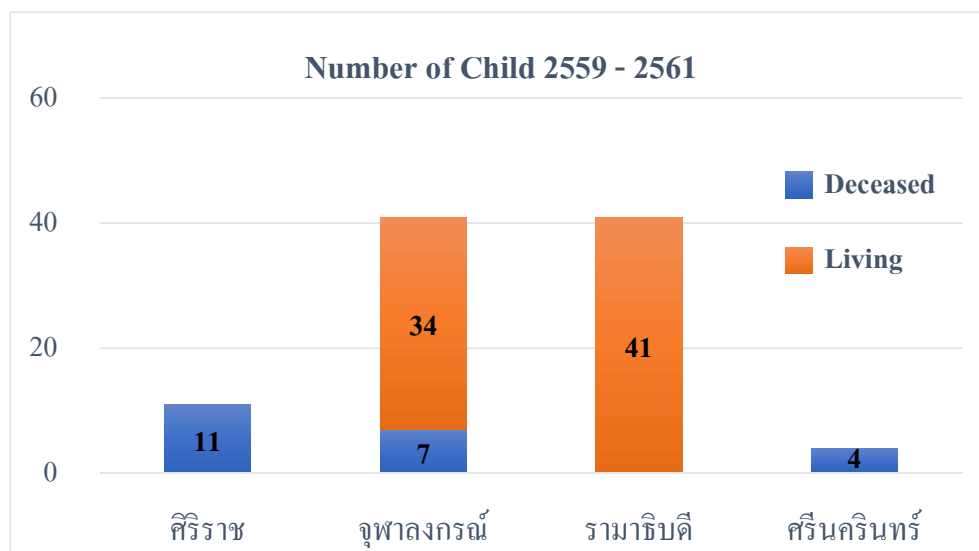
Table 10 The graft failure in adult liver transplantation between 2016-2018.

Information of Liver transplantation in children

The information of liver transplantation in children between 2016-2018 found that 97 patients (table 10) counted from the date of transplant were received transplant with 4 hospitals i.e. Siriraj, Chulalongkorn, Ramathibodi and Srinagarind: 75 recipients from living donors which were 77.32% (picture 4 and table 2)

Year	Hospital				Total
	Siriraj	Chulalongkorn	Ramathibodi	Srinagarind	
2559	4	11	14	0	29
2560	4	15	10	2	31
2561	3	15	17	2	37
Total	11	41	41	4	97

Table 10 Number of liver transplantation in children between 2016-2018.

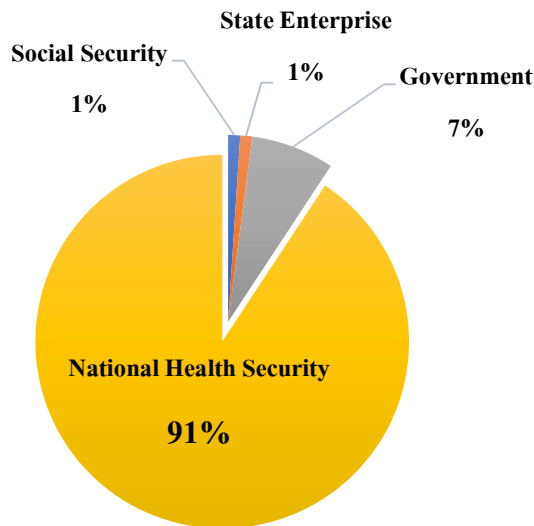


Picture 4 Number of liver transplantation in children, separated by hospitals and type of donors.

Type of Donor	Number				Transplant waiting time (Day)		
	2016	2017	2018	Total	Minimum	Maximum	Median
Deceased	5	10	7	22	0	3,189	147.5
Living	24	21	30	75	0	1,436	154

Table 11 Number of liver transplantation in children, separated by type of donors between 2016-2018 and the transplant waiting time from each type.

The waiting time for liver transplantation in children from registration date at 0 day to 3,189 days (8 years 8 months 26 days). The median for waiting time of recipients of deceased donors were 147.5 days. The waiting time of recipients of living donors from 0 days to 1,436 days (1 year 11 months 7 days), the median was close to waiting time for deceased donors which were 154 days (Table 11).



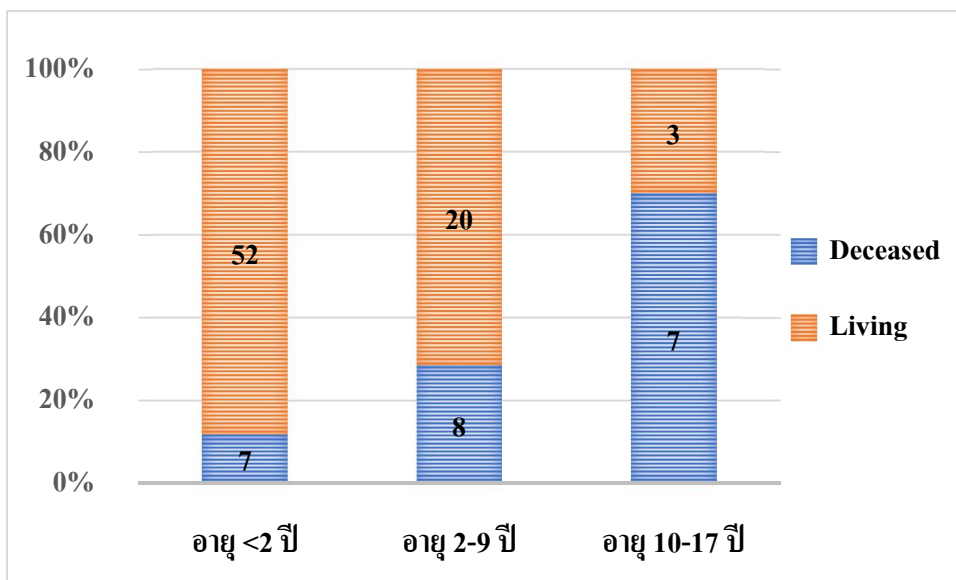
Picture 5 Health care coverage for liver transplantation in children between 2016-2018.

Most of young patients used National Health Security which were 91% as the recipients younger than 18 years had liver failure were approved by National Health Security since 2012. The patients who

registered before aged of 18 and did not received any transplantation until aged over 18 years old would not get any health care coverage recently. The patients who were over 18 years old will be able to used government/state enterprise scheme and social security only.

The information of liver transplantation in children between 2016-2018

The most youngest child who received liver transplant aged less than 2 years old which was 60.8%, aged 2-9 years old were 10,3% and 10-17 years old were 10.3%. The age median when received transplant was 567.5 days (1 year 6 months 19.5 days). There were less male than female at 43%:57% (Table 12). When compare with the growth, more than half of young patients who received from living donors were growing slow than normal (< -2.0 SD) while almost half who received from deceased donors were growing normally (Table 13) which could explain that all young patients who had mild acute liver failure could grow normally.



Picture 6 The liver transplantation in children, separated by ages.

		Deceased donor (n=22)	Living donor (n=75)	Total (n=97)
Sex	Male	10 (45.5%)	32 (42.7%)	42 (43.3)
	Female	12 (54.5%)	43 (57.3%)	55 (56.7)
Age	Median (Day)	1378	490	567.5
	Range	(257 - 6325)	(112 - 5123)	(112 - 6325)
BMI	Mean (kg/m ²)	17.56	16	16.35
	Range	(13.1 - 28.0)	(10.4 - 25.1)	(10.4 - 28.0)
Waiting time	Median (Day)	147.5	154	154
	Range	(0 - 3189)	(0 - 1436)	(0 - 3189)
PELD/MELD	Mean	23.4	20.4	21.0
	Range	(13 - 43)	(10 - 47)	(0 - 47)
Graft Type	Partial	12 (54.5%)	75 (100%)	87 (89.7%)
	Whole	10 (45.5%)		10 (10.3%)
Cold Ischemic Time	Mean (Minute)	452.3	105.3	183.7
	Range	(309 - 770)	(18 - 370)	(18 - 770)

Table 12 The basic data of liver transplantation in children between 2016-2018.

	Height		Weight	
	DBD	Living	DBD	Living
Median	10 (50.0%)	17 (23.0%)	9 (45.0%)	18 (24.3%)
-1.5 S.D. ถึง -2.0 S.D.	1 (5.0%)	11 (14.9%)	3 (15.0%)	14 (18.9%)
< -2.0 S.D.	9 (45.0%)	46 (62.1%)	8 (40.0%)	42 (56.8%)

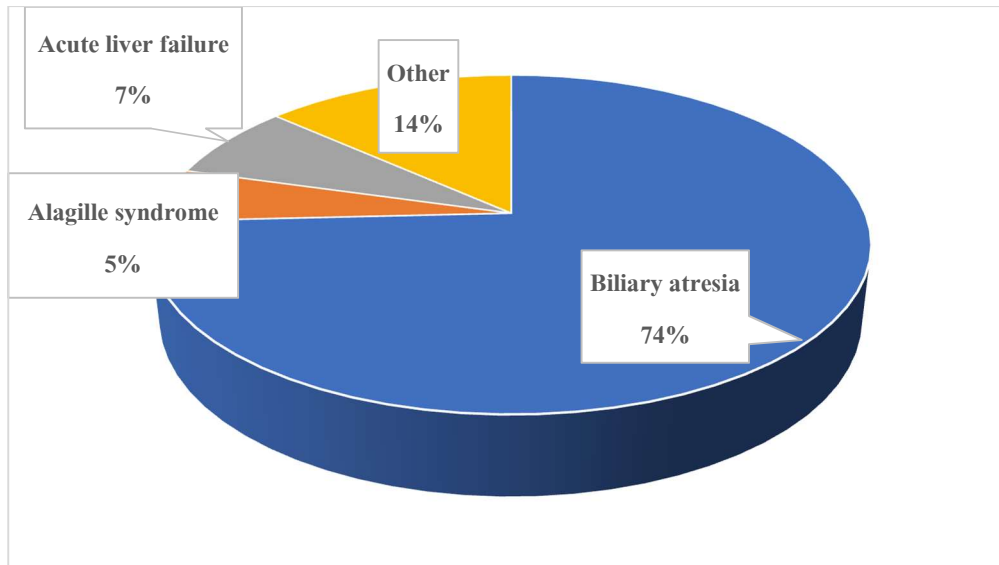
Table 13 The height and weight of patients based on age standard.

The major blood type group was 38.1% of O, secondary was 24.7% of B, the total of 97 patients were Rh +, 5 (5.2%) of ABO incompatibility transplant type, 1 patient was died with unidentified causes but no other patients had problem after transplantation.

		Recipient blood group				Total
		A	AB	B	O	
Donor blood group	A	9 (9.3%)	3 (3.1%)	1 (1.0%)	2 (2.1%)	15 (15.5%)
	AB	-	1 (1%)	1 (1.0%)	-	2 (2.1%)
	B	-	3 (3.1%)	24 (24.7%)	1 (1.0%)	28 (28.9%)
	O	5 (5.2%)	-	10 (10.3%)	37 (38.1%)	52 (53.6%)
Total		14 (14.4%)	7 (7.2%)	36 (37.1)	40 (41.2%)	97 (100%)

Table 14 The blood type comparison between recipients and donors of liver transplantation in children between 2016-2018 (ABO incompatibility represent in **bold number**)

The most causes of liver failure in children were 74% of biliary atresia (72 patients), 7% of acute renal failure (7 patients) and 5% of Alagille syndrome (5 patients) respectively.(Picture 7) The other causes were 4 patients of cirrhosis unknown cause, 2 patients of choledochal cyst, 1 patient of hepatocellular carcinoma, 1 patient of autoimmune hepatitis, 1 patient of progressive familial intrahepatic cholestasis (PFIC), 1 patient of Wilson’s disease and 1 patient of Budd–Chiari syndrome.

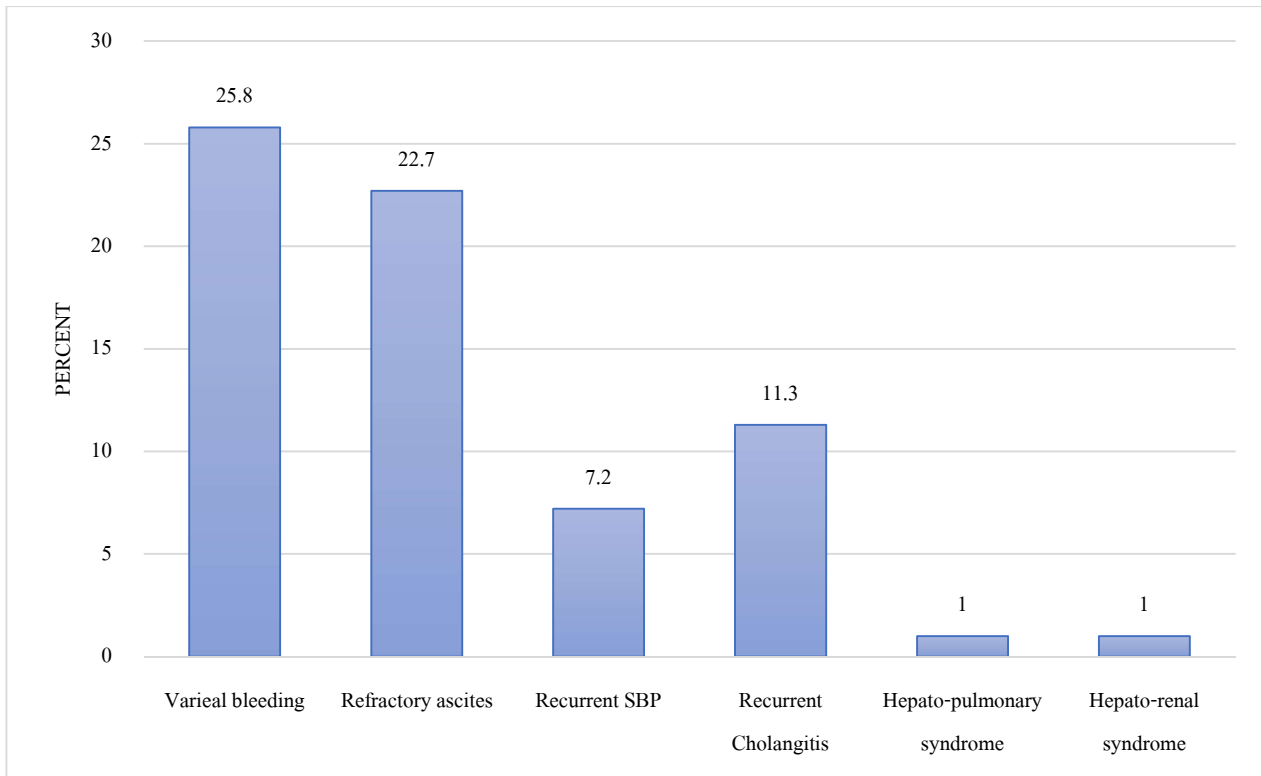


Picture 7 The causes of liver failure in child liver transplantation between 2016-2018.

The MELD/PELD score used to consider for severity of disease level before transplantation found that there were no different between living donors and deceased donors which had MELD/PELD score average at 20.36 and 23.36 respectively. The most liver complications was variceal bleeding (25.8%) and refractory ascites (22.7%) respectively, (Picture 8).

The cold ischemic time average between deceased donors and living donors were 7.54 +/- 1.68 hours and 1.75 +/- 0.83 hours respectively.

The result of serology of patient found that most recipients had 89.4% of cytomegalovirus (CMV) IgG positive when compare to donors who had 9.6% of D+/R- and 88.3% of D+/R+ (Table 15).



Picture 8 The liver complications before liver transplantation in children between 2016-2018.

		Deceased donor (n=22)	Living donor (n=75)	Total (n=97)
Recipient serology (positive)				
	HBsAg	0% (0/20)	0% (0/73)	0% (0/97)
	Anti-HBs	61.9% (13/21)	85.9% (61/71)	80.4% (74/92)
	Anti-HCV	0% (0/21)	0% (0/69)	0% (0/90)
	Anti-CMV IgG	85.7% (18/21)	90.4% (66/73)	89.4% (84/94)
	Anti-HIV	0% (0/20)	0% (0/73)	0% (0/93)
CMV status (Donor/Recipient)				
	D- / R-	4.8% (1/21)	0%	1.1% (1/94)
	D- / R+	0%	0%	0%
	D+ / R-	9.5% (2/21)	9.6% (7/73)	9.6% (7/94)
	D+ / R+	85.7% (18/21)	89.0% (65/73)	88.3% (83/94)

Pre-transplant chemistry, Mean (range)				
	Total bilirubin (mg/dL)	20.5	18.5	18.9
		(1.5 - 38.6)	(0.7 - 42.3)	(0.7 - 42.3)
	Albumin (g/L)	2.8	2.67	4.1
		(1.7 - 3.8)	(1.4 - 4.5)	(1.4 - 4.5)
	Creatinine (mg/dL)	0.3	0.2	0.2
		(0.1 - 0.7)	(0.1 - 0.4)	(0.1 - 0.7)
	Sodium (mmol/L)	136.2	135.4	135.6
		(126 - 146)	(127 - 158)	(126 - 158)
	INR	2.04	1.46	1.59
		(1.2 - 6.1)	(0.9 - 6.2)	(0.9 - 6.2)
	AFP (ng/mL), [Median]	3.0	35.0	24.8
		(0.7 - 61.5)	(1.3 - 5474.2)	(0.7 - 5474.2)

Table 15 Blood result before liver transplantation in children between 2016-2018.

Information of Donors

The most of donor was 77.3% of living donors which found that there were male deceased donors than female which were 81.8% and 18.2% respectively but there were female living donors than male which were 63.3% and 34.7% respectively. The average age was 30.7 years old, 29.4% of deceased donors had hypotension and one of them need CPR which ALT median of deceased donors were clearly higher than living donors. The main organ preservation solution used were 63.5% of University of Wisconsin (UW) solution and 36.5% of Custodiol which there were no different in liver function between them after liver transplantation. (Table 16)

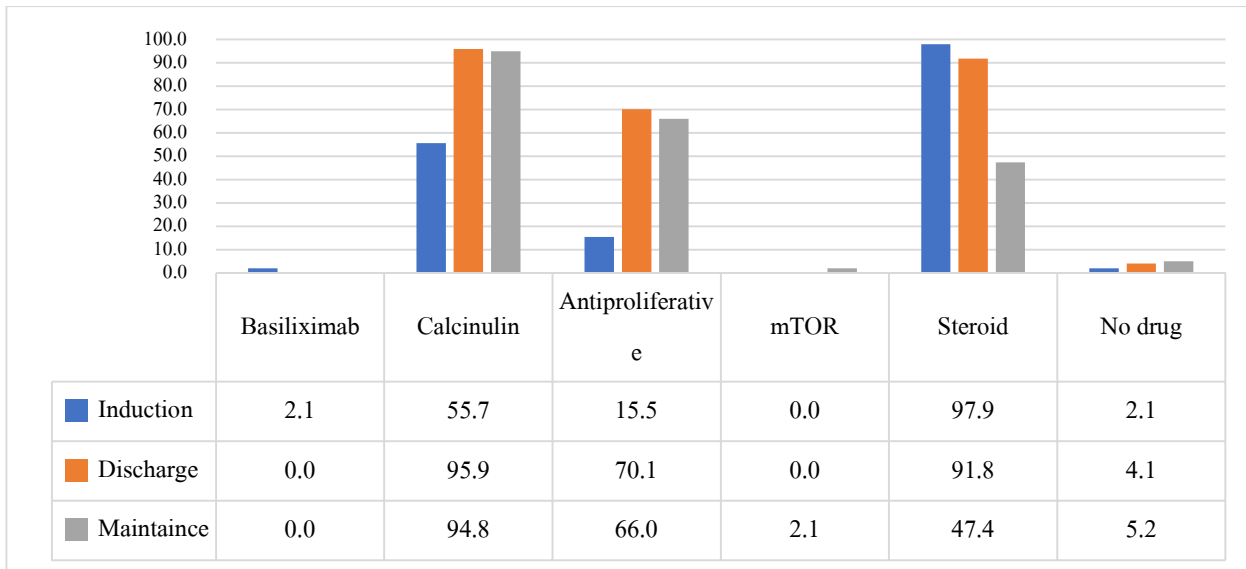
		Deceased donor (n=22)	Living donor (n=75)	Total (n=97)
Sex	Male(%)	18 (81.8)	26 (34.7)	44 (45.4)

	Female(%)	4 (18.2)	49 (65.3)	53 (54.6)
Age	Mean (วัน)	26	32.12	30.74
	Range	(13 - 54)	(11 - 56)	(11 - 56)
BMI	Mean (kg/m ²)	21.57	22.01	21.91
	Range	(16.6 - 26.6)	(14.79 - 29.53)	(14.79 - 29.53)
Hypotension		5/17 (29.4)	-	-
CPR		1 (4.6)	-	-
Peak ALT	Median (IU/L)	40	20	22
	Range	(11 - 944)	(9 - 120)	(9-944)
Last ALT	Median (IU/L)	33.5	18	20
	Range	(11 - 466)	(7 - 120)	(7 - 466)
Perfusate	UW solution	19 (90.5)	42 (56)	62 (63.5)
	Custodiol	2 (9.5)	33 (44)	35 (36.5)

Table 16 The information of donors of liver transplantation in children between 2016-2018.

Immunosuppressive Medication

The major immunosuppressive medication used before induction was tacrolimus and methylprednisolone, secondary was used only methylprednisolone. (Table 17, 18) which calcineurin inhibitor and steroid were used in most treatment period (Picture 9). On maintenance period found that calcinurin inhibitor + antiproliferative + steroid were most used but reduced less than half in steroid.



Picture 9 The percentage of immunosuppressive medication before induction, on discharged date and maintenance period of liver transplantation in children between 2016-2018.

	Tacrolimus	Cyclosporin	Mycophenolate mofetil	Mycophenolate sodium	Azathioprine	Sirolimus	Methylprednisolone	Prednisolone
Induction	54.6	1	9.3	6.2	0	0	84.5	15.5
Discharge	88.6	7.2	56.7	6.2	7.2	0	0	91.8
Maintenance	87.6	7.2	59.8	3.1	3.1	2.1	0	47.4

Table 17 The percentage of immunosuppressive medication used during treatment period.

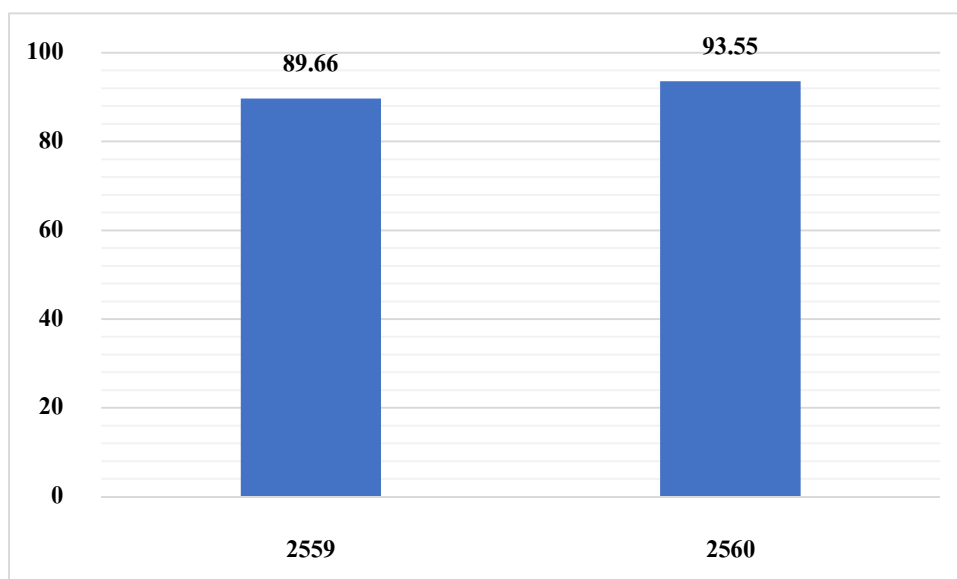
Drug regimen	Percent
Induction	
Methylprednisolone	40.2
Tacrolimus + Methylprednisolone	42.3
Tacrolimus + Mycophenolate + Prednisolone	12.3
Discharge	
Tacrolimus + Mycophenolate + Prednisolone	58.8

Tacrolimus + Prednisolone	22.7
Tacrolimus + Azathioprine + Prednisolone	5.2
Maintenance	
Tacrolimus + Mycophenolate + Prednisolone	34.1
Tacrolimus + Mycophenolate	24.7
Tacrolimus	16.5

Table 18 The most used immunosuppressive medication on each treatment period.

Graft survival rate and patient survival rate

From liver transplantation in children database of 2016-2018, there were no graft loss found after transplant or need to register again for transplant waiting list but there were 9 patients (9.3%) who died in first year and no patients died after 1 year. Some of patients who died from unidentified causes could not calculate accurate graft survival as 89.7% (3/29) were patients who had graft survival at 1 year and 93.6% (2/31) in 2016 and 2017 respectively (picture 7). The average of graft survival was 91.7% from 4 patients who died at the first year caused from 1 of hepatic artery thrombosis, 1 of portal vein thrombosis, and 2 of unidentified causes. The causes of 5 patients who died at the first year were 1 of infection, 1 of post-transplant lymphoproliferative disorder (PTLD) and 3 of unidentified causes (Picture 10).



Picture 10 The patient survival in children after liver transplantation at 1 year (1-year patient survival) between 2016 and 2017.

Index

	Page
A ABO incompatibility Acute rejection Age (mean \pm SD), Antibody induction /Antibody induction therapy Anti-lymphocyte globulin (ALG) Anti-proliferative Anti-thymocyte globulin (ATG) ATG/ALG Azathioprine	
B Basiliximab	
C Calcineurin inhibitor Cardiopulmonary resuscitation Cerebrovascular accident Chronic renal allograft nephropathy Chronic glomerulonephritis Comorbidity Cold ischemic time Cyclosporine	
D Deceased donor Delayed graft function (DGF)	

<p>Death with functioning graft</p> <p>Dilated cardiomyopathy</p> <p>Diabetic nephropathy</p> <p>Donor</p> <p>Donor age</p> <p>Donor Hospital</p> <p>Dysplasia/obstructive uropathy</p>	
<p>E</p> <p>Everolimus</p>	
<p>F</p> <p>Focal segmental glomerulosclerosis (FSGS)</p>	
<p>G</p> <p>Graft failure</p> <p>Graft loss</p> <p>Graft survival</p>	
<p>H</p> <p>Harvesting Team</p> <p>Head injury</p> <p>Head trauma</p> <p>Heart transplantation</p> <p>Heart-Lung transplantation</p> <p>Hemodialysis</p> <p>Hypertensive nephropathy</p> <p>Hypotension</p>	
<p>I</p> <p>IgA nephropathy</p> <p>IL-2R antagonist</p> <p>Indication for transplantation</p> <p>Induction immunosuppression</p> <p>Intrathoracic organ transplantation</p> <p>Interleukin-2 receptor antagonist (IL-2RA)</p> <p>Interstitial fibrosis/tubular atrophy (IF/TA)</p>	

Ischemic nephropathy	
L Length of stay Liver transplantation Living donor Lung transplantation Lupus nephritis	
M Male gender Miscellaneous Mode of renal replacement therapy Month (IQR) Mycophenolic acid Mycophenolate mofetil Mycophenolate sodium	
N No induction Number Number of transplant	
O OKT3 Others	
P Panel reactive antibody (PRA) Parents Patient mortality Patient survival Payment type Pediatric liver transplantation Perfusate Peritoneal dialysis PRA	

Prednisolone Preemptive	
R Rapidly progressive glomerulonephritis Recipient Recipient age Recurrent of primary disease Rejection Renal artery stenosis	
S Serum creatinine Serum creatinine at discharge, mg/dl Siblings Single Lung transplantation Sirolimus Stroke	
T Tacrolimus Tacrolimus prolonged release	
W Waiting time, month (IQR) Withdrawal immunosuppression/nonadherence	

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