

The CERTAIN Registry

Registry for Paediatric Kidney Transplantation

Britta Höcker, Alexander Fichtner, Antonia H. Bouts, Kai Krupka, Lars Pape, Jan U. Becker and Burkhard Tönshoff

on behalf of the CERTAIN Research Team,
the German Society of Paediatric Nephrology (GPN),
the European Society for Paediatric Nephrology (ESPN) ,
and Eurotransplant, Leiden, The Netherlands



Overview

- 1. The CERTAIN Registry**
- 2. Ongoing projects**
- 3. Outlook: nephropathology module**

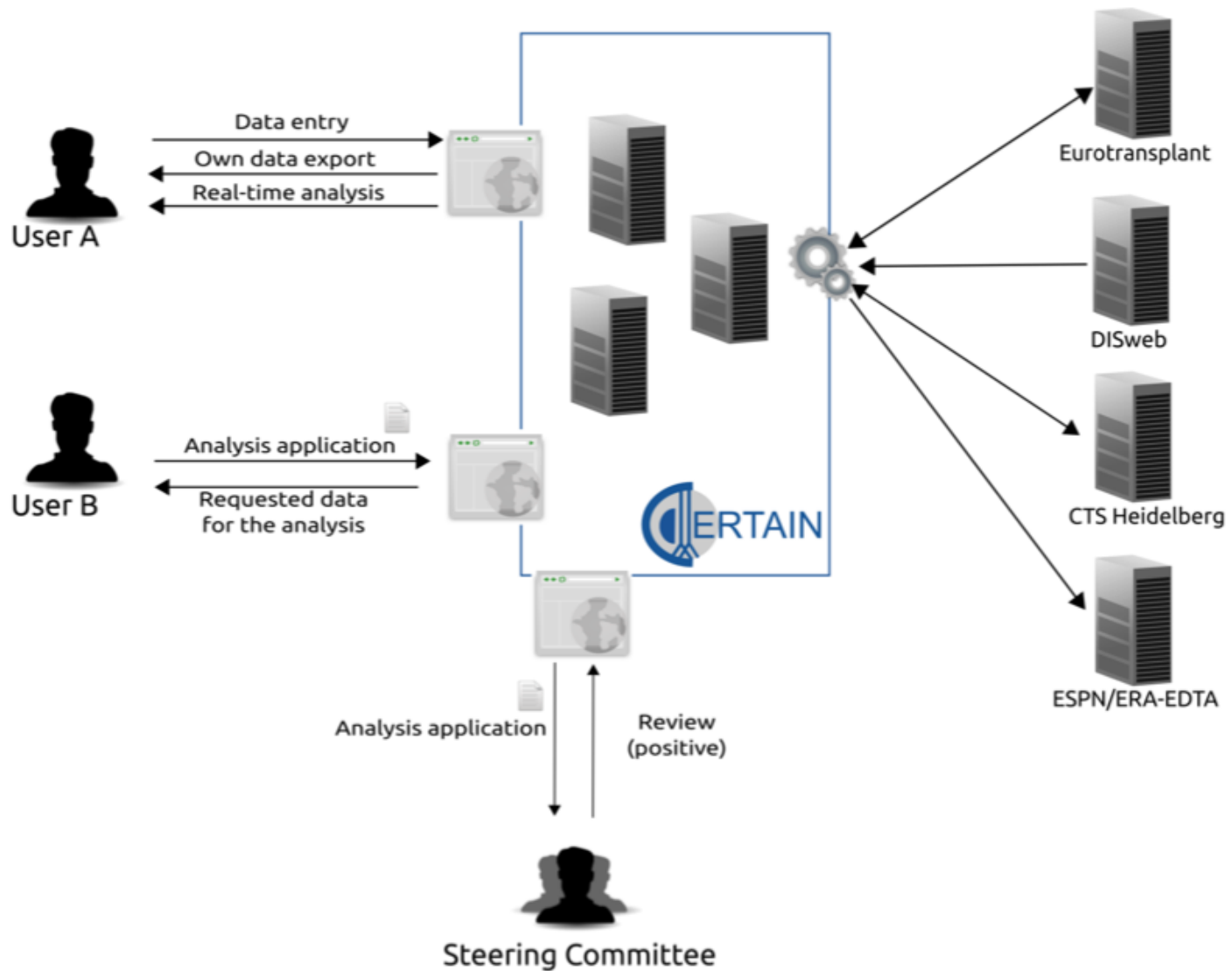
Overview

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2. Ongoing projects
3. Outlook: nephropathology module

Background

- The results of paediatric kidney transplantation have improved markedly in the last decade.
- However, a number of relevant clinical problems remain. These unmet clinical needs require intense collaborative and interdisciplinary clinical research.
- In 2010, we thus founded the **C**ooperative **E**uropean Paediatric **R**enal **T**ranspl**A**nt **I**Nitiative (CERTAIN; www.certain-registry.eu) as a European research network built on a novel, web-based registry.

Data flow



Activities linking with other registries



Since 2012 IT interface between
CERTAIN and ESPN/ERA-EDTA Registry:
Tool for ESPN Working Group “Renal
Transplantation”

www.espn.org

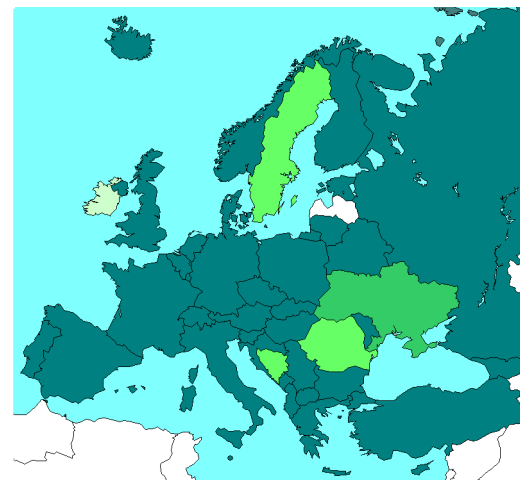


ERKNet
The European Rare Kidney Disease Reference Network

Link to CERTAIN Research Network envisaged

www.erknet.org

National registries that contributed data as of November 2016



Provided extended data to
the ESPN/ERA-EDTA Registry

Provided limited data to
the ESPN/ERA-EDTA Registry

Provided data via
the ERA-EDTA Registry

Intend to contribute data
in the near future



CERTAIN workshops and newsletter



Cooperative
European Paediatric
Renal Transplant
Initiative



Newsletter 2 / 2018

Dear colleagues,

this newsletter will update you on the recent publications from the CERTAIN Registry and on-going projects (see our website www.certain-registry.eu). Since many of the CERTAIN colleagues are also members of the ESPN working group "Transplantation" and/or of the ERKNet working group "Renal Transplantation", we decided to issue one newsletter for all three initiatives to bundle the forces. Many thanks to all of you for your contribution to previous and ongoing projects!

Yours, Burkhard Tönshoff and Lars Pape
Burkhard.Tonshoff@med.uni-heidelberg.de; Pape.Lars@mh-hannover.de

Documentation and centres

More than 2150 patients from 60 centres in 17 countries are currently enrolled into the CERTAIN Registry. We are very grateful to all of you who contributed to this great success. Since the last newsletter one new centre joined the CERTAIN family: Lyon (France). For German centres in conjunction with the curatorship for home dialysis and transplantation (KFH), data entry will soon be facilitated by an interface between DISweb and CERTAIN.

Save the date

The next meeting of our combined working groups will take place during the upcoming *ESPN congress in Antalya, Turkey* on Thursday, October 4, from 14:30 to 15:30 in Hall 2. The agenda:

14:30 - 14:45 Urinary proteomics to diagnose chronic antibody-mediated rejection in pediatric kidney transplantation – an analysis of the IM-MRES-CERTAIN trial *Lars Pape, Hannover*

14:45 - 15:00 Incidence, treatment and outcome of recurrent focal-segmental glomerulosclerosis after paediatric kidney transplantation in Europe *Antonia Bouts, Amsterdam*

15:00 - 15:15 Long-term outcome after pediatric combined liver and kidney transplantation: A CERTAIN Registry analysis *Florian Brinkert, Hamburg*

15:15 - 15:30 Antibody-mediated Rejection in European Paediatric Renal Transplant Recipients: Incidence, Risk Factors and Outcome *Alexander Fichtner and Burkhard Tönshoff, Heidelberg*

The 40th Symposium of the CERTAIN Study Group will take place in *Heidelberg, December 7 - 8, 2018*. Online-registration will be available in September 2018.

Manuscripts recently published or submitted

1. Höcker B, Schneble L, Murer L, Carraro A, Pape L, Kranz B, Oh J, Zirnigbl M, Dello Strologo L, Büscher A, Weber LT, Awan A, Pohl M, Bald M, Printza N, Rusai K, Peruzzi L, Topaloglu R, Fichtner A, Krupka K, Köster L, Bruckner T, Schnitzler P, Hirsch H, Tönshoff B. *Epidemiology of and Risk Factors for BK Polyomavirus Replication and Nephropathy in Pediatric Renal Transplant Recipients: An International CERTAIN Registry Study*. Transplantation 2018, in press

2. Höcker B, Schneble L, Murer L, Carraro A, Pape L, Kranz B, Oh J, Zirnigbl M, Dello Strologo L, Büscher A, Weber LT, Awan A, Pohl M, Bald M, Printza N, Rusai K, Peruzzi L, Topaloglu R, Fichtner A, Krupka K, Köster L, Bruckner T, Schnitzler P, Hirsch HH, Tönshoff B. *JC polyomavirus replication and associated disease in pediatric renal transplantation: An international CERTAIN Registry study*. *Pediatr Nephrol* 2018 <https://doi.org/10.1007/s00467-018-4029-9>.

3. Kreuzer M, Prüfe J, Tönshoff B, Pape L. *Survey on Management of Transition and Transfer From*

CERTAIN workshop

1. German Society of Paediatric Nephrology (GPN) congress
2. European Society for Paediatric Nephrology (ESPN) congress
3. Symposium of the "Interdisciplinary Study Group Renal Transplantation in Paediatrics"

CERTAIN newsletter

Data set

Minimal data set		Extended data set	
General data	Medication	Vaccination	Study
History	Drug monitoring	24 hr blood pressure	
Donor	Laboratory	Psychosocial data	
Surgery	Immunology		
Anthropometry	Infectiology		
Graft function	Rejection		
	Biopsy		
	Complication		
	Hospitalisation		

Participating centres

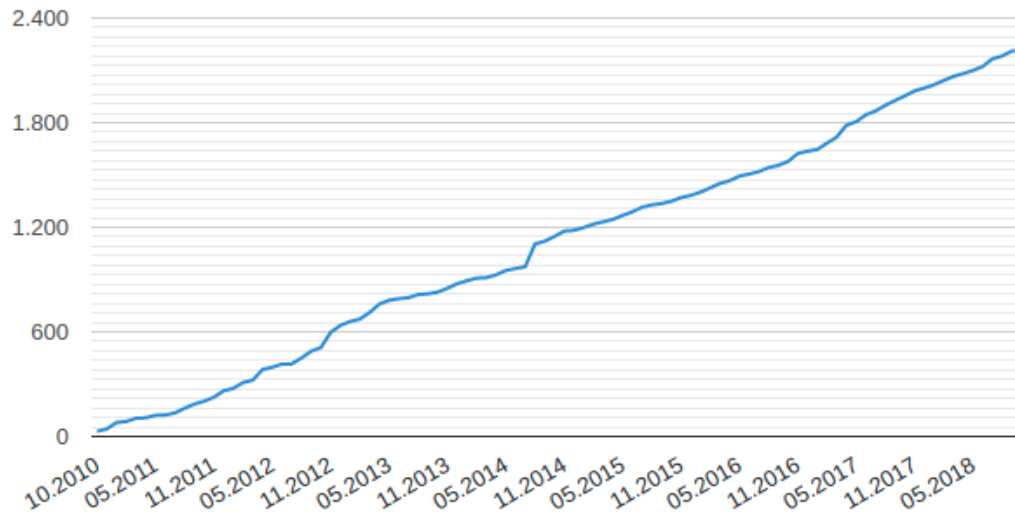
■ 62 participating centres in 18 countries

- Austria (2)
- Belarus (1)
- Belgium (1)
- Czech Republic (1)
- France (2)
- Germany (22)
- Greece (1)
- Hungary (1)
- Ireland (1)
- Italy (5)
- Poland (1)
- Russia (1)
- Slovenia (1)
- Spain (1)
- Switzerland (2)
- The Netherlands (1)
- Turkey (14)
- United Kingdom (4)



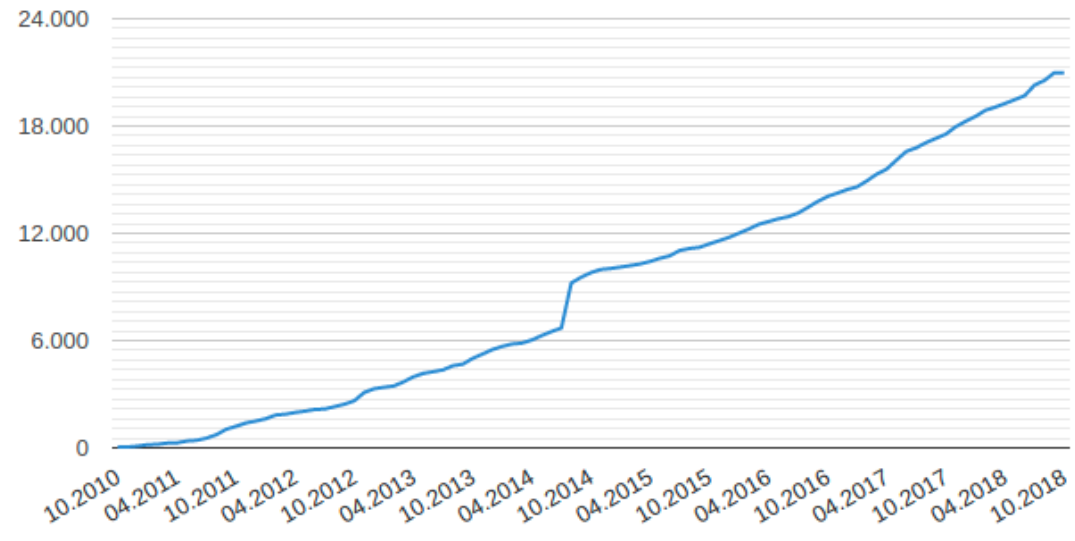
■ 194 registered users

Enrolled patients and documented visits



Enrolled patients 2,212

Documented visits 20,987



Finalised scientific projects

Title	Author	Journal
1. Epidemiology of and risk factors for BK polyomavirus replication and nephropathy in pediatric renal transplant recipients: an international CERTAIN Registry study	Höcker B et al.	Transplantation 2018
2. JC polyomavirus replication and associated disease in pediatric renal transplantation: an international CERTAIN Registry study	Höcker B et al.	Pediatr Nephrol 2018
3. Survey on management of transition and transfer from pediatric- to adult-based care in pediatric kidney transplant recipients in Europe	Kreutzer M et al.	Transplant Direct 2018
4. Outcome of renal transplantation in small infants: a match-controlled analysis.	Weitz M et al.	Pediatr Nephrol 2018
5. Vaccination titres pre- and post-transplant in paediatric renal transplant recipients and the impact of immunosuppressive therapy	Höcker B et al.	Pediatr Nephrol 2018
6. Incomplete vaccination coverage in European children with end-stage kidney disease prior to renal transplantation	Höcker B et al.	Pediatr Nephrol 2018
7. Dyslipidemia after pediatric renal transplantation - the impact of immunosuppressive regimens	Habbig S et al.	Pediatr Transplant 2017
8. Cytomegalovirus infection in pediatric renal transplantation and the impact of chemoprophylaxis with (val-) ganciclovir	Höcker B et al.	Transplantation 2016
9. Impact of everolimus and low-dose cyclosporin on cytomegalovirus replication and disease in pediatric renal transplantation	Höcker B et al.	Am J Transplant 2016
10. Efficacy and safety of an everolimus- vs. a mycophenolate mofetil-based regimen in pediatric renal transplant recipients	Brunkhorst LC et al.	PLoS One 2015
11. Longitudinal growth on an everolimus- versus an MMF-based steroid-free immunosuppressive regimen in paediatric renal transplant recipients	Billing H et al.	Transpl Int 2013
12. Urinary proteomics to diagnose chronic antibody-mediated rejection in pediatric kidney transplantation	Kanzelmeyer NK et al.	<i>Submitted</i>
13. Arterial hypertension and the use of antihypertensive medication in pediatric renal transplant patients: an analysis of the CERTAIN Registry	Melk A et al.	<i>In preparation</i>

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2. JC polyomavirus replication and associated nephropathy in pediatric renal transplant recipients: an international CERTAIN Registry study	Höcker B et al.	Pediatr Nephrol 2018
3. Survey on management of transplant rejection in pediatric kidney transplant recipients: results from the European Paediatric Transplant Cohort Study	Kreutzer M et al.	Transplant Direct 2018
4. Outcome of renal transplant recipients with primary immunodeficiency: a retrospective analysis	Wang Y et al.	Pediatr Nephrol 2018
5. Vaccination coverage in pediatric renal transplant recipients and the impact on transplant outcomes	Höcker B et al.	Pediatr Nephrol 2018
6. Incomplete vaccination coverage in pediatric renal transplant recipients and the impact on transplant outcomes	Höcker B et al.	Pediatr Nephrol 2018
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9. Impact of everolimus on cytomegalovirus replication and disease in pediatric renal transplant recipients	Höcker B et al.	Am J Transplant 2016
10. Efficacy and safety of an everolimus-based immunosuppressive regimen in pediatric renal transplant recipients	Linkhorst LC et al.	PLoS One 2015
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Ongoing prospective studies

Title	PI
IMMRES Study Immune response of paediatric renal transplant recipients challenged by sensitization, vaccination or non-adherence: cross-sectional and prospective analyses of the international CERTAIN Registry cohort	Pape L
HPVaxResponse Study Prevention of human papillomavirus (HPV) infection in paediatric kidney and liver transplant recipients and in paediatric patients with advanced chronic kidney disease: a prospective, observational multi-centre vaccine surveillance study clinicaltrials.gov NCT03100682	Höcker B

Ongoing registry analyses

Title	PL
1. Antibody-mediated rejection in European Paediatric Renal Transplant Recipients: Incidence, Risk Factors and Outcome	Fichtner A Heidelberg
2. Proteinuria as a non-invasive marker for renal allograft histology and graft failure in paediatric renal transplant recipients	Büscher A Essen
3. Operative reconstruction of the lower urinary tract: an analysis of pre- vs. post-transplant intervention	Nyarangi-Dix J Heidelberg
4. Transplantation in methylmalonic academia: An European survey	Dello Strologo L Rome
5. Long-term outcome after pediatric combined liver and kidney transplantation: a CERTAIN Registry analysis	Brinkert F Hamburg
6. Incidence, treatment and outcome of recurrent focal-segmental glomerulosclerosis after paediatric kidney transplantation in Europe	Bouts A Amsterdam
7. Transplantation of small kidneys	Schild R Hamburg
8. Risk of <i>de novo</i> DSA development in paediatric renal transplant recipients with BK polyomavirus (BKPyV) viremia and associated nephropathy (BKPyVAN)	Höcker B Heidelberg

Overview

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3. Outlook: nephropathology module

Antibody-mediated Rejection in European Paediatric Renal Transplant Recipients: Prevalence, Risk factors and Outcome

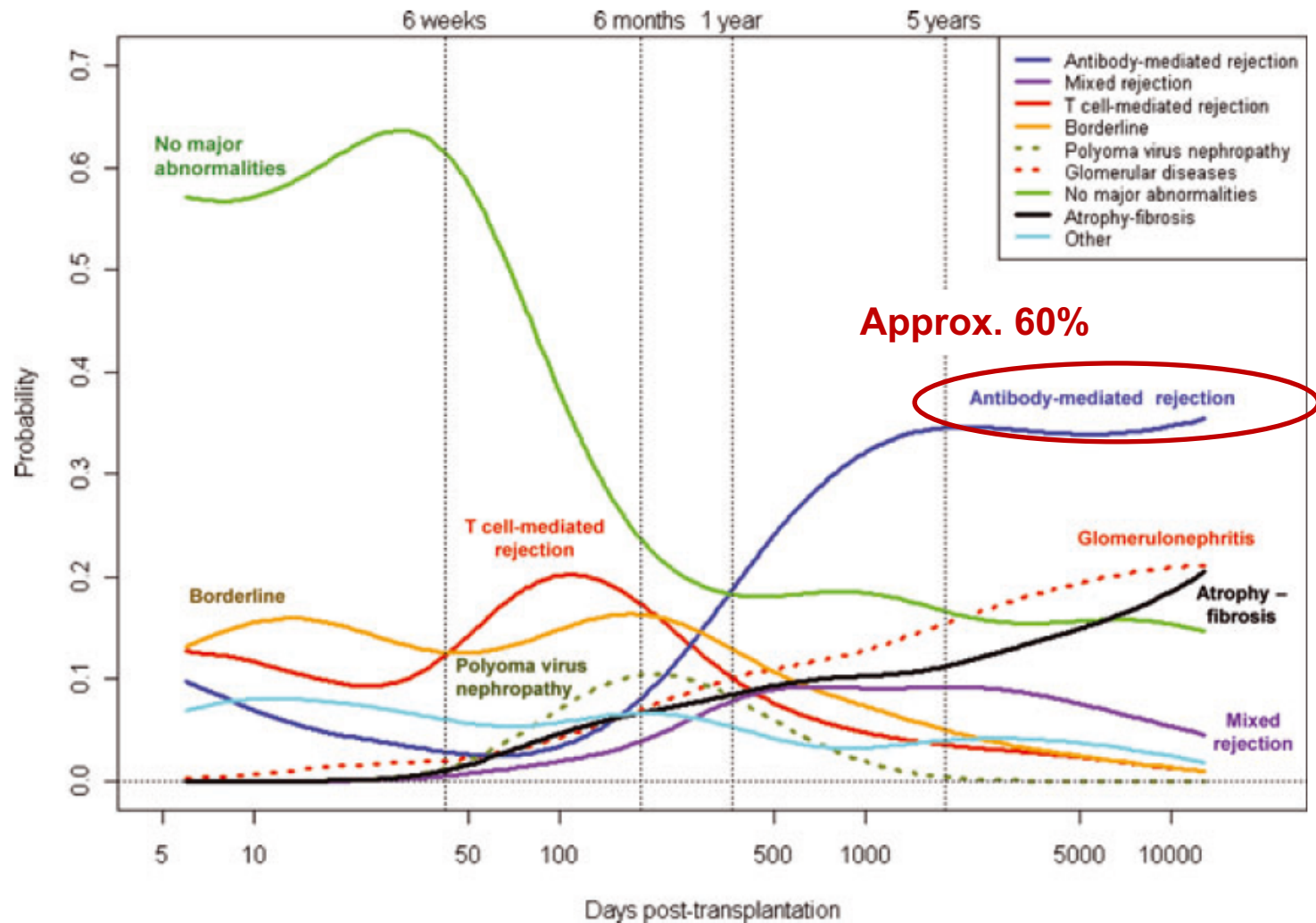
A CERTAIN interim analysis

Alexander Fichtner, Caner Süsal, Britta Höcker, Jan Becker, Lars Pape, Stephen Marks, Luca dello Strologo, Kai Krupka, Lennart Köster, Members of the CERTAIN Research Network, Burkhard Tönshoff

For the CERTAIN Research Community and Interdisciplinary Study Group "Renal Transplantation in Paediatrics"



Biopsy-proven causes of graft loss in adults



Rationale

- Representative data on prevalence and outcome of ABMR in paediatric renal transplant recipients are limited
- Results from adult studies cannot necessarily be extrapolated to the paediatric population because of
 - Different immune biology
 - Different underlying diseases
 - Different risk profiles
 - Immunisation events: infections, vaccinations
 - Necessity of re-transplantation due to higher life expectancy
 - Efficacy and safety of treatment may not be directly translated from adults to children

Study Aims

- To describe the **prevalence** of different ABMR subtypes in European paediatric renal transplant recipients
- To analyze **risk factors** associated with the development of ABMR
- To describe different **treatment strategies** of ABMR
- To determine the **outcome** of ABMR

Study design

CERTAIN minimal data set

Prevalence of
documented
ABMR

Risk factors
for the
development
of ABMR

- Re-transplantation
- HLA mismatches
- Infections
- Vaccinations
- Type of immuno-suppressive regimen

ABMR
treatment strategies

- PE / IA
- IVIG
- Rituximab
- *Steroid pulse*
- Eculizumab
- Bortezomib
- Increase of maintenance immunosuppression

Outcome

Graft loss

eGFR < 50% of
baseline values

Biopsy specificities

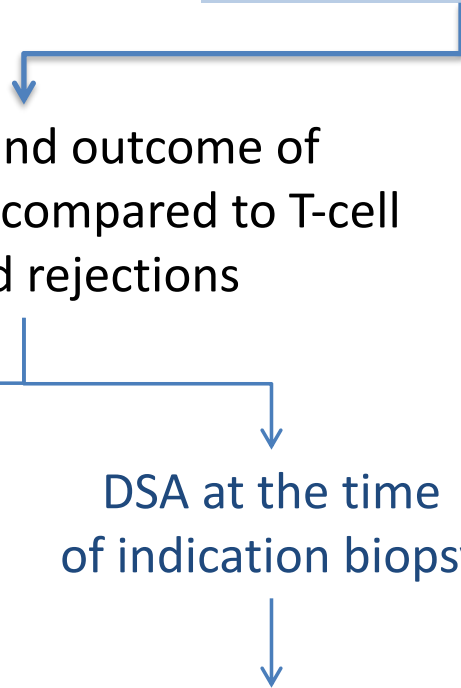
ABMR data set

Prevalence and outcome of
ABMR subtypes compared to T-cell
mediated rejections

Biopsies
Single lesions
according to
BANFF

DSA at the time
of indication biopsy

DSA pre-transplant



Donor-specific HLA antibodies (DSA)



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Renal
Transpl-
Ant
Initiative

2018.09 (25. Sep. 2018)

Current visit

Patient: [redacted] Scheduled on: 15.01.2018
Visit type: 3.0 years visit Timescope: 15.10.2017 - 15.04.2018
Visit status: Accepted Previous comments: [i](#)

Current user 14:59

Username: britta.hoecker
Centre: DE_Heidelberg



Log out

[Follow up] [Continuous entries] ABMR BKV/JCV Prote...

Measurement results Biopsy results Therapy

Please use this field to document the patient's donor specific antibody measurement results. Be aware: Entries in the initial visit may be 12 months before transplantation. In all other visits, the visit time scopes have to take into account.

M Has any DSA measurement been performed since the last visit
(Please document all available measurements, even if negative)?

Yes

Pre-treatment

Unknown

Pre-screening

No

Donor specific antibodies (HLA class I)

No

Donor specific antibodies (HLA class II)

Yes

Uploading a Luminex sheet without documenting an entry is sufficient. However, if you want to document measurement results as entries it has to be documented on the right side via "+" symbol.

Centre-specific cut-off values for C1q or DSA positivity has to be documented once via the menu "Centre" -> "Centre settings".

Upload Luminex sheets ?

DSA measurement

Date:

11.04.2018

Result:

Positive

HLA Type:

DQA

Antigen:

DQA1*03:02

Bead-antigen density
corrected MFI values:

12534

Isotype:

IgG

Specify IgG isotype subclass:

Unknown

De novo donor specific
antibodies:

No

C1q measurement:

Unknown

Cancel

Edit

Histopathological results



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2018.09 (25. Sep. 2018)

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Log out

> [Follow up] [Continuous entries] ABMR BKV/JCV Prote...

Measurement results Biopsy results Therapy

If a renal biopsy was performed, please fill out the BIOPSY PAGE. In case of a pathological result, you will be automatically asked which kind of pathology was found. Currently, the system operates on the actual Banff 2009 classification. You may give additional results under the category Other findings.

M Has any graft biopsy been performed since the last visit?

N No

Uploading a pathology report without documenting the results in the entry is sufficient, but please document the bold printed fields for each pathology report. However, if you want to document (further) biopsy results within the entries it has to be documented on the right side via the "+" symbol.

Upload pathology report document ⓘ

No.	Date	Result
1	12.06.2015	Pathological

Renal biopsy

Date of biopsy (dd.mm.yyyy):

23.01.2015

Reason:

Clinically indicated (decline of graf

Ultrasound:

Serum creatinine

4.19

mg/dl

Result of biopsy:

Pathological

Antibody-mediated changes:

None

Borderline changes:

Yes

T-cell-mediated rejection:

None

Interstitial fibrosis and tubular atrophy: ct - tubular atrophy

1

Other findings:

Other

acute tubular necrosis,
nephrocalcinosis

g - glomerulitis

0

t - tubulitis

1

i - interstitial inflammation

2

v - intimal arteritis

0

ci - interstitial fibrosis

1

1

cg - allograft glomerulopathy

0

mm - mesangial matrix increase

Unknown

cv - vascular fibrous intimal thickening

1

ah - arteriolar hyaline thickening

2

ptc - peritubular capillaritis

0

C4d technique

Immunohistology (Paraffin)

C4d positivity

No

Cancel

< >

Edit

Biopsy specificities

ABMR data set

Prevalence and outcome of
ABMR subtypes compared to T-cell
mediated rejections

Biopsies
Single
to
NFF

Upload tool

DSA at the time
of indication biopsy

DSA pre-transplant

Treatment



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Renal
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2018.09 (25. Sep. 2018)

Current visit

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Log out

[Follow up] [Continuous entries] **ABMR BKV/JCV Prote...**

Measurement results Biopsy results **Therapy**

Please use this field to document the patient's ABMR therapy. Be aware: Entries in the initial visit may be 12 months before transplantation. In all other visits, the visit time scopes have to take into account.

M Has any treatment of DSA been performed since the last visit?

I Immunosuppressive medication

M Dose increase of maintenance immunosuppression **No**

L Change of maintenance immunosuppression **No**

Steroid boli **No**

Specific therapy

Plasmapheresis **No**

Immunoadsorbition **No**

ATG **No**

Rituximab **No**

Bortezumib **No**

Eculizumab **No**

Intravenous immunoglobulin **No**

Other therapy **No**

Any additional treatment has to be documented on the right side via the "+" symbol.

No.	Substance	Entry type	Date	Dose
1	Immunoadsorbition	Stop	23.09.2015	--
2	Bortezumib	Single dose	20.08.2015	75[mg]
3	Bortezumib	Single dose	17.08.2015	75[mg]
4	Bortezumib	Single dose	13.08.2015	75[mg]
5	Bortezumib	Single dose	10.08.2015	75[mg]
6	Bortezumib	Single dose	02.05.2015	1.3[mg/m²/d]
7	Bortezumib	Single dose	28.04.2015	1.3[mg/m²/d]
8	Immunoadsorbition	New	30.03.2015	--
9	Immunoadsorbition	Single dose	28.03.2015	--
10	Immunoadsorbition	Single dose	27.03.2015	--
11	Immunoadsorbition	Single dose	26.03.2015	--
12	Plasmapheresis	Single dose	25.03.2015	--
13	Plasmapheresis	Single dose	24.03.2015	--
14	Methylprednisolone	Stop	28.02.2015	100[mg/m²/d]
15	Methylprednisolone	Change	27.02.2015	100[mg/m²/d]
16	Methylprednisolone	Change	25.02.2015	200[mg/m²/d]
17	Methylprednisolone	New	24.02.2015	400[mg/m²/d]
18	Immunoadsorbition	Single dose	13.02.2015	--
19	Immunoadsorbition	Single dose	11.02.2015	--
20	Plasmapheresis	Single dose	09.02.2015	--

Edit

Interim data report

Patient characteristics		n = 290
Age, years (mean \pm SD)		10.7 \pm 5.51
Gender (female)		114 (39.3%)
HLA-Mismatches (mean \pm SD)		
A		0.87 \pm 0.67
B		1.13 \pm 0.65
DR		0.93 \pm 0.67
Re-transplant, n (%)		39 (13.4%)
Living donation, n (%)		88 (30.3%)
Pre-emptive donation, n (%)		75 (25.9%)
Donor age, years (mean \pm SD)		30.2 \pm 16.9
Delayed graft function, n (%)		14 (4.8%)
Cold ischemia time, h (median, IQR)		10.1 (3.0 – 15.0)

Interim data report

DSA (based on “accepted visits”)	2016	2018
Documented HLA-DSA measurements	566	1469
HLA-DSA negative		986 (67.1%)
DSA HLA-Class I positive (only)		36 (2.5%)
DSA HLA-Class II positive (only)		199 (13.5%)
DSA HLA-Class I & II positive		243 (16.3%)
Measurements per patient, median (IQR)	5 (3 to 7)	5 (2 to 8)

Interim data report: biopsies

Biopsy results	n=147 2016	n=469 2018
Protocol biopsies		192
Indication biopsies		277
Borderline		128 (27.3%)
BANFF IA to III	12%	55 (11.7%)
Acute ABMR	3,4%	36 (7.7%)
Chronic ABMR	5.4%	22 (4.7%)
IFTA I	27%	128 (27.3%)
IFTA II	10%	41 (8.7%)
C4d Positivity	14%	46 (9.8%)

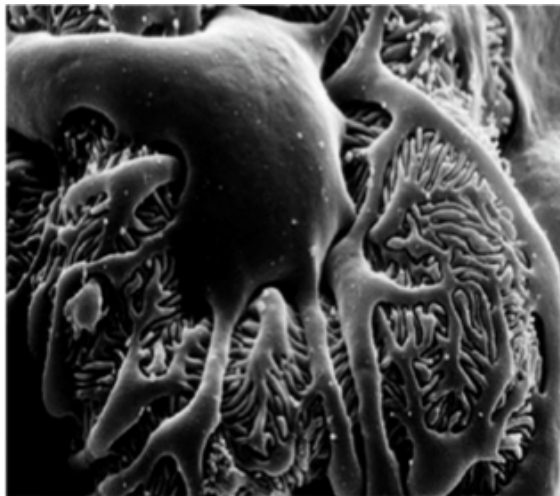
Ongoing registry analyses

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Incidence, treatment and outcome of recurrent steroid resistant nephrotic syndrome after pediatric kidney transplantation in Europe.

CERTAIN Research Project

Antonia Bouts, Floor Veltkamp, Marina Vivarelli, Burkhard Tönshoff



BACKGROUND

Responses of ESPN Survey on FSGS recurrence performed with working group “Transplantation” and “INS”. (20 Questions)

- Total 807 children with focal segmental glomerulosclerosis
- 59 respondents
- 31 countries
- Frequency 0.12-3.82 / year
- 240 (30%) recurrence post-tx



Global insight into the variation of current practice of the treatment of FSGS and its recurrence after transplantation.

Certain research project: objectives

- To analyze the recurrence rate of nephrotic syndrome after kidney transplantation in children with steroid resistant nephrotic syndrome (SRNS).
- To analyze factors that predispose to post-transplantation recurrence of nephrotic syndrome.
- To investigate the relationship of biopsy results in the native kidneys of children with SRNS with outcome after kidney transplantation.
- To investigate the genetic mutation analysis and outcome of SRNS and recurrence after transplantation.
- To analyze differences in treatment policies of SRNS recurrence and outcome.
- To develop a European guideline for treatment of SRNS recurrence.

Methods

- Retrospective analysis in Certain registry of all transplanted children with steroid resistant nephrotic syndrome.
- Using a minimal and study-specific data set in CERTAIN.
- Collecting and (re)appraisal of renal biopsy results of native kidney.
- Collecting genetic mutation analysis.
- (Future planning: Biobanking, mutation analysis of all patients, renal biopsy digital slides)



Overview

1. The CERTAIN Registry
2. Ongoing projects
- 3. Outlook: nephropathology module**

What do we have so far?

- The CERTAIN Registry fills a gap in Europe for collaborative research and quality assurance in the field of paediatric renal transplantation.
- It is a comprehensive and flexible registry which serves to investigate cutting-edge research topics and allows an in-depth characterisation of specific patient cohorts.
- Data of more than 2,000 well-characterized patients with almost 21,000 study visits and more than 2,000 renal transplant biopsies have been already included.
- The mandatory minimal data set contains a data sheet on histopathological results.
- An extended pathology data set has been already implemented and is currently used for the ABMR study.
- An upload tool for pathology reports has been implemented in the registry.
- Technical prerequisites exist for an extended nephropathology tool.

The Banff 2017 Kidney Meeting Report: Revised diagnostic criteria for chronic active T cell-mediated rejection, antibody-mediated rejection, and prospects for integrative endpoints for next-generation clinical trials

M. Haas¹ | A. Loupy² | C. Lefaucheur³ | C. Roufosse⁴ | D. Glotz³ | D. Seron⁵ |
 B. J. Nankivell⁶ | P. F. Halloran⁷  | R. B. Colvin⁸ | Enver Akalin⁹ | N. Alachkar¹⁰ |
 S. Bagnasco¹¹ | Y. Bouatou^{2,12}  | J. U. Becker¹³ | L. D. Cornell¹⁴ | J. P. Duong van
 Huyen² | I. W. Gibson¹⁵ | Edward S. Kraus¹⁶ | R. B. Mannon¹⁷ | M. Naesens¹⁸ |
 V. Nickleit¹⁹ | P. Nickerson²⁰ | D. L. Segev²¹ | H. K. Singh¹⁹ | M. Stegall²² |
 P. Randhawa²³ | L. Racusen¹¹ | K. Solez²⁴ | M. Mengel²⁴

“...To this end, the Banff group formed a new working group on surrogate endpoints aimed at fostering collaboration with other professional societies and regulatory agencies on the common goal to develop a path forward to successful next generation multicenter trials and approval of novel drugs in solid organ transplantation...”

Banff rules
and
dissimi-
nation
(new
working
group)

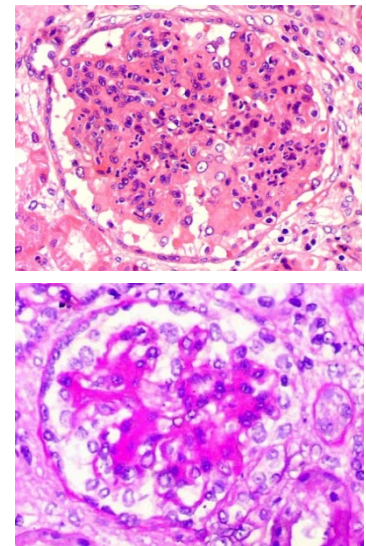
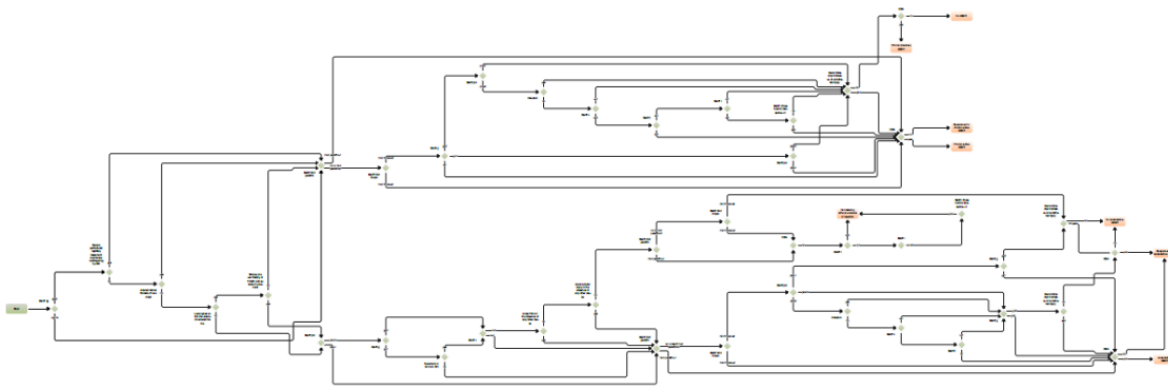
J. U. Becker,
C. Roufosse

Collation of contents of previous Banff reports in a central web-based, updatable repository including diagnostic parameters, definitions and rules.
Elaboration of a minimum dataset and algorithms for application of Banff classification.

Finalisation of the collation of current content during a meeting in London, UK in September 2017.
Preparation of a review manuscript with contents of previous Banff reports up to 2015.
Incorporation of possible changes in Banff 2017 report to content for the web-based repository in 2018.

Next steps: nephropathology module

1. Implementation of nephropathology module in CERTAIN Registry
2. Upload of slide scans (digital pathology)
3. Computerised image pathology (machine learning)



Thank you for your attention!



The screenshot shows the CERTAIN Registry homepage. At the top, there is a navigation bar with links: Sign in, Register, Support, and Conference. Below this is a header with the CERTAIN logo and the text 'Cooperative European Paediatric Renal Transplant Initiative'. The main content area features a map of Europe with a red dot indicating the registry's location. Text on the page states: 'Registry realized as a modern web application', 'Provides instant access to own data and real time data analysis', and 'Ensures data privacy and security'. A sidebar on the right contains links: About, Research topics, Participating centres, Team & Contact, Resources, Links, and Sponsors. At the bottom, there is a section titled 'DEVELOPMENT OF THE CERTAIN REGISTRY' and a '50th Anniversary' logo.

Registry realized as a modern web application

Provides instant access to own data and real time data analysis

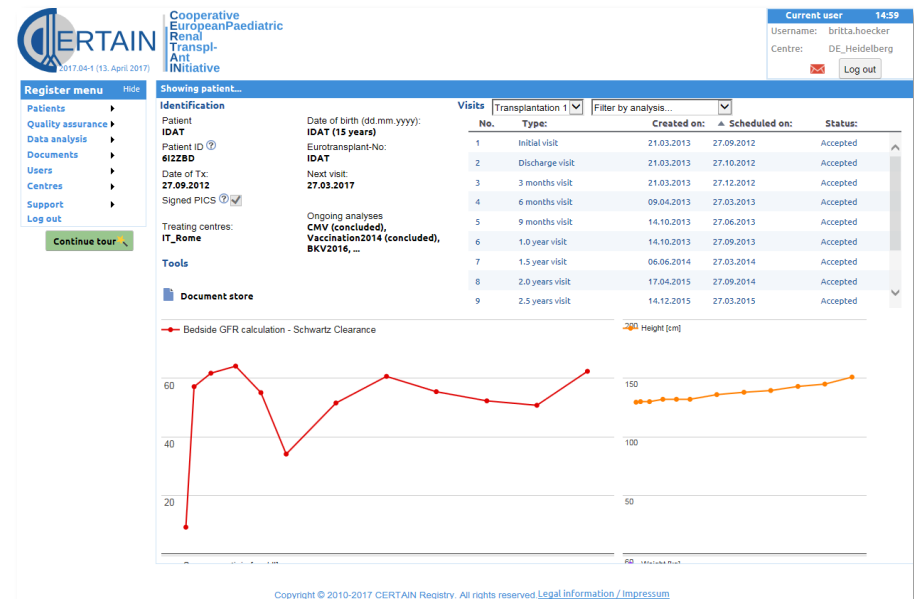
Ensures data privacy and security

DEVELOPMENT OF THE CERTAIN REGISTRY, the Cooperative European Paediatric Renal Transplant Initiative registry founded by the **Society for Paediatric Nephrology in Austria, Germany & Switzerland (CPN)**, aims to provide pertinent information on the short- and long-term outcome of paediatric renal allograft recipients for clinical research, quality assurance and improved patient care purposes. It co-operates with institutions such as **Eurotransplant**, **CTS Heidelberg**, **European Society for Paediatric Nephrology (ESPN)**, **Curatorship for Dialysis and Kidney Transplantation KfH** (Kuratorium für Dialyse und Nierentransplantation e.V.) and the **German Organ Transplantation Foundation DSO** (Deutsche Stiftung Organtransplantation), thus facilitating comprehensive data collection and reducing manual data input efforts of the participating clinicians. Thanks to the large number of paediatric nephrology and transplantation centres involved, the registry will allow speedy collection of high-quality data needed for reliable scientific analysis.

The CERTAIN REGISTRY is realised as a state-of-the-art web application supporting not only the data entry and quality assurance process but also providing a 24/7 access to the saved data and real-time data analysis for the participating centres.

FOR DETAILED INFORMATION about the registry, please look at the resources section or contact the registry headquarters via e-mail.

www.certain-registry.eu



The screenshot shows the CERTAIN Registry user interface. At the top, there is a navigation bar with links: Sign in, Register, Support, and Conference. Below this is a header with the CERTAIN logo and the text 'Cooperative European Paediatric Renal Transplant Initiative'. The main content area displays a patient's data, including identification, visits, and a graph showing 'Bedside GFR calculation - Schwartz Clearance' and 'Height [cm]'. A sidebar on the left contains links: Patients, Quality assurance, Data analysis, Documents, Users, Centres, Support, and Log out. At the bottom, there is a section titled 'DEVELOPMENT OF THE CERTAIN REGISTRY'.

Showing patient...

Identification

Patient ID: 612ZBD

Date of birth (dd.mm.yyyy): 27.09.2012

Next visit: 27.03.2017

Signed PICS: [X]

Treating centres: IT_Rome

Ongoing analyses: CMV (concluded), Vaccination2014 (concluded), BKV2016, ...

Visits

No.	Type	Created on	Scheduled on	Status
1	Initial visit	21.03.2013	27.09.2012	Accepted
2	Discharge visit	21.03.2013	27.10.2012	Accepted
3	3 months visit	21.03.2013	27.12.2012	Accepted
4	6 months visit	09.04.2013	27.03.2013	Accepted
5	9 months visit	14.10.2013	27.06.2013	Accepted
6	1.0 year visit	14.10.2013	27.09.2013	Accepted
7	1.5 year visit	06.06.2014	27.03.2014	Accepted
8	2.0 years visit	17.04.2015	27.09.2014	Accepted
9	2.5 years visit	14.12.2015	27.03.2015	Accepted

Tools

Document store

Bedside GFR calculation - Schwartz Clearance

Height [cm]

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40th Symposium

Interdisciplinary Study Group „Renal Transplantation in Paediatrics“



Online registration:
www.certain-registry.eu

December 7 - 8, 2018

Crowne Plaza Hotel, Heidelberg, Germany



CERTAIN analysis protocol Template

CERTAIN analysis protocol	
Study Title:	The title of the protocol should include study design, indication and, where applicable, dosage, dosage form, and comparative agent(s).
Institution Name	
Investigator Contact Information: - Full address - Phone No. - Fax No. - e-mail address	

CERTAIN analysis protocol

- Objectives/hypotheses
- Background/rationale
- Study design
- Study flowchart
- Study procedures
- Study duration

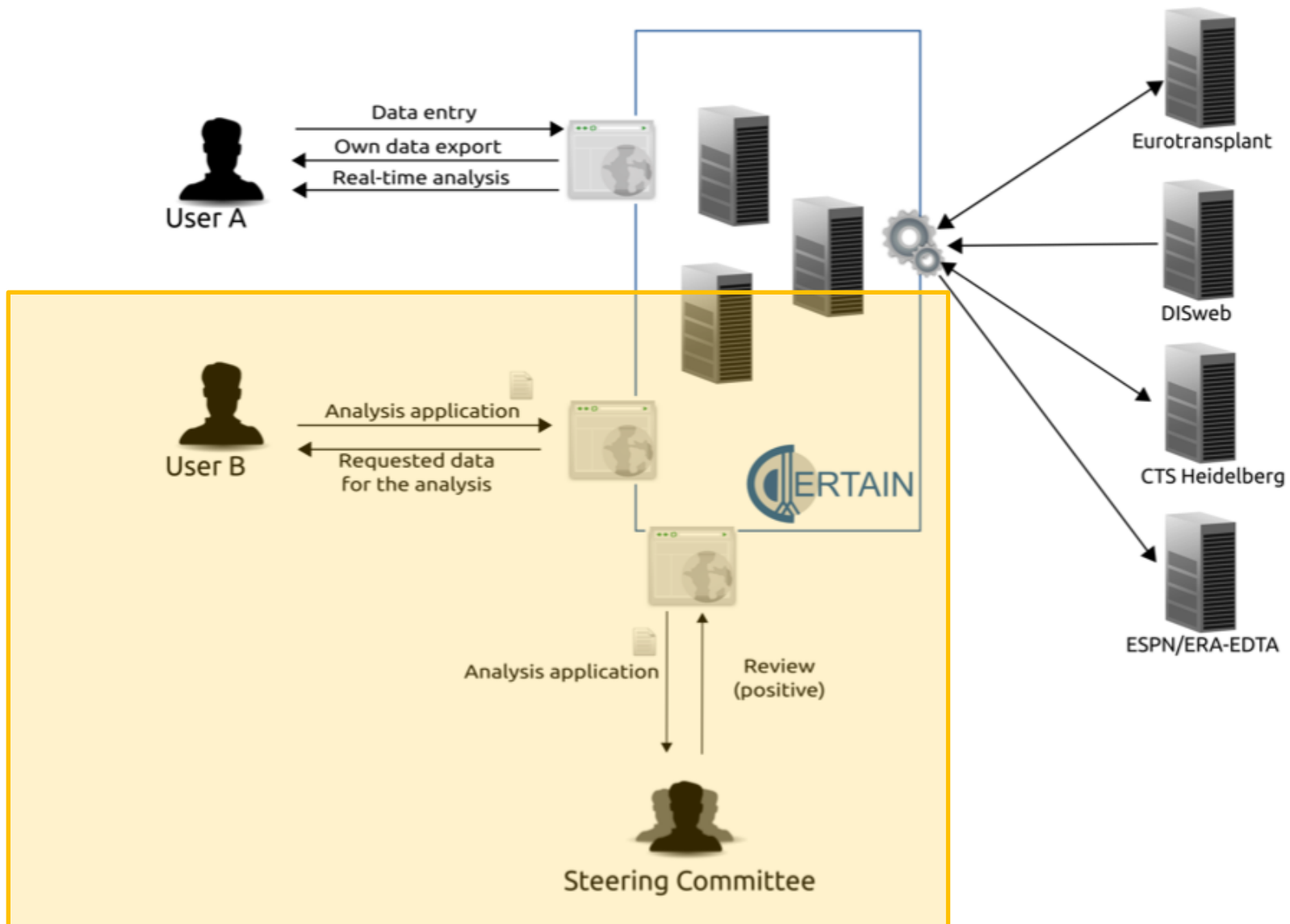
1. Objectives & Hypotheses	<p>1.1 List the objectives.</p> <p>The objectives must clearly define and specifically state what the study is intended to accomplish, for example one primary efficacy objective.</p> <p>One to two secondary objectives may be stated. They should be in the order of priority. The higher priority secondary objectives should have corresponding secondary hypotheses associated with them. Not all secondary objectives need to have a corresponding secondary hypothesis.</p> <p>1.1.1 List the clinical hypotheses.</p> <p>The primary efficacy and safety hypotheses should correspond directly with the primary objectives of the study. All hypotheses should be in the order of priority. If the study is estimation study, no hypotheses is needed.</p>
2. Background & Rationale, Significance of Selected Topic & Preliminary Data	<p>A brief presentation should be made of the reasons for conducting the clinical study based on current knowledge of the product and/or disease states so that the study is presented in the proper perspective. Include the rationale for conducting the study and selecting the dose(s). Selected literature references critical to the study design, dosage selection, or rationale for the study should be cited, as appropriate.</p>
3. Study Design	<p>This section is a concise overview of the study design stating the type of experimental design (observational or interventional; randomized block, crossover, etc.); whether the study is controlled (treatments other than the test product and/or placebo); whether the study is open or blinded/masked (single blind or double blind); the number of study centers (single or multicenter). The total number of patients included in the study and how they will be assigned to treatment groups must be indicated. When appropriate, state if the patients will be stratified. The procedures must be clear and concise. A description of the specific patient population to be studied should be stated. Both inclusion and exclusion criteria should be listed and should be consistent with the current product label.</p> <p>If the study is intended to be observational then the protocol needs to state this and the expectations are different since most observational studies are database studies, retrospective, aggregate studies as opposed to open label studies for efficacy and safety.</p>
4. Study Flowchart	<p>A study flow chart is highly recommended. It should display all clinical and laboratory measurements and the time periods (e.g., hours, days, weeks) at which data are to be collected.</p>
5. Study Procedures	<p>This section is a detailed explanation of the experimental design. The use of subheadings, lists, tables, or outlines are recommended. Describe the initial screening period(s), baseline period(s), treatments to be compared, study configuration (parallel, crossover, etc.), duration of the treatment period(s), control group(s), follow-up procedures, and length of time specified for washout intervals and safety follow-up. In protocols that specify a screening or washout period, indicate that once a patient signs a consent form, a unique number (screening or baseline number) should be assigned for identification purposes. It should be noted that that under no circumstances should a patient be assigned more than one allocation number.</p>
6. Study Duration	<p>Estimate the length of time (e.g., number of days, weeks, months) required to recruit patients and complete the study.</p>

7. Statistical Analysis and Sample Size Justification	<p>State who will be responsible for analyzing the study data (Investigator, contract CRO, etc.). When appropriate state how the blind will be maintained during the study, as appropriate, and when the data will be unblinded. For the purpose of the final analysis, the official clinical database will not be unblinded until medical/scientific review has been completed, protocol violators have been identified (if appropriate), and data has been declared complete.</p> <p><u>Variables/Time Points of Interest</u></p> <p>All variables (primary and secondary) that are listed in the study hypotheses, and the time points at which they will be analyzed, need to be described in detail.</p> <p>Efficacy variables discussed in this section should have been included as part of an objective or hypothesis section. These variables and the time points at which they are to be analyzed should be consistent with the primary and secondary hypotheses, i.e., primary variables and time points should relate to the primary hypotheses.</p> <p><u>Statistical Methods</u></p> <p>All planned primary analyses and key secondary analyses should be discussed in this section. If other secondary and tertiary analyses are planned, then a statement should be included in this section as to what these analyses are.</p> <p>Describe in detail the statistical methods that will be used for the primary hypotheses or estimation. State the statistical tests which will be used (e.g., ANOVA, Kaplan-Meier) along with other important considerations (e.g., factors in ANOVA, pre-specification of covariates, strata for Mantel-Haenszel, use of historical controls).</p> <p><u>Multiplicity</u></p> <p>If appropriate, describe the multiplicity approach to support the statistical conclusions of the trial.</p> <p><u>Power/Sample Size:</u></p> <p>In studies with hypotheses, minimally, for the primary endpoint of the study, a power statement needs to be included to show the detectable difference relative to the primary hypothesis. For example, the following level of detail is expected:</p> <p>Based upon a sample size of n=40 patients per group, this study has 80% power to detect a 5.4 mmHg difference between groups in systolic blood pressure; this calculation is based on a between subject standard deviation of change of 9 mmHg for systolic BP (reference for where this variability statement originated).</p> <p>In estimation studies, the precision of the primary/secondary estimations needs to be given with the sample size of the trial.</p>
8. References	All literature references cited in the protocol should be listed accordingly in the reference section.

CERTAIN analysis protocol

- Variables/time points
- Statistical methods
- Sample size
- References

Steering committee



Analyses



2018.09 (25. Sep. 2018)

Cooperative
European Paediatric
Renal
Transplant
Ant
Initiative

Current user 14:59

Username: britta.hoecker

Centre: DE_Heidelberg



Log out

Register menu Hide

- Patients
- Quality assurance
- Data analysis
- Documents
- Users
- Centres
- Support
- Log out

Documents overview

Categories



- Abstracts
- Analyses**
- Bylaws
- Clinical guidelines of the "Arbeitskreis paediatrische Nierentransplantation"
- HPVaxResponse
- Instructions
- MINI-START
- Newsletter
- Original articles
- Patient information and consent forms (de)
- Patient information and consent forms (en)
- Presentations CERTAIN
- Presentations Heidelberg 2017
- Presentations Hinterzarten 2011
- Presentations Hinterzarten 2012
- Presentations Hinterzarten 2013
- Presentations Hinterzarten 2014
- Presentations Hinterzarten 2015
- Presentations Hinterzarten 2016
- Review articles

Analyses

Documents below are exclusively for **personal** and **scientific** use!

"Antibody-mediated Rejection in European Paediatric Renal Transplant Recipients: Incidence, Risk Factors and Outcome"

Size: 371.7 kB

Last change: 12.09.2016

"Arterial hypertension after renal transplantation – triggers, treatment and sequelae"

Size: 28.1 kB

Last change: 16.08.2016

"BK-Polyomavirus (BKPyV) Infection and Nephropathy (BKPyVAN) in European Paediatric Renal Transplant Recipients"

Size: 780.7 kB

Last change: 26.07.2016

"Clinical outcomes of MMA patients undergoing renal, liver or simultaneous transplantation: a descriptive study"

Size: 408.6 kB

Last change: 22.11.2017

"Epidemiology and morbidity of CMV infection in paediatric renal transplant recipients and the impact of antiviral prophylaxis"

Size: 126.0 kB

Last change: 16.08.2016

"Kidney transplantation in small infants: A match-controlled risk-assessment"

Size: 147.0 kB

Last change: 21.02.2017

"Long-term outcome after pediatric combined liver and kidney transplantation: A CERTAIN Registry analysis"

Size: 202.0 kB


Last change: 24.07.2018

"Operative reconstruction of the lower urinary tract: an

Documents



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Current user		14:59
Username:	britta.hoecker	
Centre:	DE_Heidelberg	
		Log out










Register menu Hide

- Patients ▶
- Quality assurance ▶
- Data analysis ▶
- Documents ▶
- Users ▶
- Centres ▶
- Support ▶
- Log out

Documents overview

Categories



-  Abstracts
-  Analyses
-  Bylaws
-  Clinical guidelines of the "Arbeitskreis paediatrische Nierentransplantation"
-  HPVaxResponse
-  Instructions
-  MINI-START
-  Newsletter
-  Original articles
-  Patient information and consent forms (de)
-  Patient information and consent forms (en)
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-  Presentations Hinterzarten 2011
-  Presentations Hinterzarten 2012
-  Presentations Hinterzarten 2013
-  Presentations Hinterzarten 2014
-  Presentations Hinterzarten 2015
-  Presentations Hinterzarten 2016
-  Review articles

Graft rejection



Cooperative
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Renal
Transpl-
Ant
INitiative

2018.09 (25. Sep. 2018)

Current visit

Patient: [redacted] Scheduled on: 20.03.2015
Visit type: 5.0 years visit Timescope: 20.12.2014 - 20.06.2015
Visit status: Accepted Previous comments: [i](#)

Current user 14:59

Username: britta.hoecker
Centre: DE_Heidelberg
[Log out](#)

[Follow up] Anthr... Rejec... Biopsies Infec... Nonin... Hospi... Labor... Medic... Drug ... Non-d... Cardi... Immun... Studies [Analyses]

On the REJECTION SITE you document any suspected or biopsy-proven and/or treated rejections. If a biopsy was done, please do also complete the BIOPSY PAGE. It likewise needs to be indicated whether the patient received anti-rejection therapy (steroid boli, anti-lymphocyte antibodies), change of maintenance immunosuppression or intermittent dialysis. Please document drug or dosage changes on the MEDICATION SITE. State the outcome of rejection and at least one serum creatinine value both before and after the rejection episode in the LABORATORY SECTION.

M	Has any rejection episode been observed since the last visit?	No.	
I	No	1	15.
N		2	21.
I			
M	Please document any rejection since last visit		
A			
L			

Rejection episode entry

Signs and symptoms

Date first suspected (dd.mm.yyyy):

21.10.2013

Diagnosed by:

Graft dysfunction

Diagnostics

Biopsy:

Yes

Please document this biopsy in the corresponding section.

Second biopsy due to insufficient response to therapy:

Yes, due to slow or no reaction to

Outcome

General outcome:

Rejection completely resolved

Anti-rejection therapy

Blood purification:

None

Antilymphocyte antibodies:

None

Steroid boli:

Yes

Please document this as medication in the corresponding section.

Change of maintenance immunosuppression:

No

Dose increase of maintenance immunosuppression:

No

Intravenous immunoglobulin G:

Low-dose (less than 1 g per kg b.w.)

Anti-rejection therapy triggered by the 2nd biopsy

Blood purification:

None

Antilymphocyte antibodies:

ATG

Steroid boli:

No

Change of maintenance immunosuppression:

No

Dose increase of maintenance immunosuppression:

No

Intravenous immunoglobulin G:

None

Cancel

Report Edit

Biopsy



Cooperative
European Paediatric
Renal
Transpl-
Ant
Initiative

2018.09 (25. Sep. 2018)

Current visit

Patient: [redacted] Scheduled on: 20.03.2015
Visit type: 5.0 years visit Timescope: 20.12.2014 - 20.06.2015
Visit status: Accepted Previous comments: ⓘ

Current user 14:59

Username: britta.hoecker
Centre: DE_Heidelberg



Log out

[Follow up] Anthr... Rejec... **Biopsies** Infec... Nonin... Hospi... Labor... Medic... Drug ... Non-d... Cardi... Immun... Studies [Analyses]

If a renal biopsy was performed, please fill out the BIOPSY PAGE. In case of a pathological result, you will be automatically asked which kind of pathology was found. Currently, the system operates on the actual Banff 2009 classification. You may give additional results under the category Other findings.

M Has any graft biopsy been performed
I since the last visit?

No

M Please document all biopsies since last
A visit.

L

No.	Date	Result
1	16.01.2014	Pathological
2	29.11.2013	
3	21.10.2013	
4	20.03.2010	

Renal biopsy

Date of biopsy (dd.mm.yyyy):

16.01.2014

Reason:

Clinically indicated (decline of graf

Ultrasound:

Normal

Result of biopsy:

Pathological

Antibody-mediated changes:

None

Borderline changes:

No

T-cell-mediated rejection:

Chronic active T-cell mediated rejectio

Interstitial fibrosis and tubular
atrophy:

II

Other findings:

Viral infection; Other

BKV nephropathy grade A

Cancel

Report

Edit

Immunosuppression



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2018.09 (25. Sep. 2018)

Current visit

Patient [REDACTED] Scheduled on: 20.03.2015
Visit type: 5.0 years visit Timescope: 20.12.2014 - 20.06.2015
Visit status: Accepted Previous comments: [i](#)

Current user

14:59

Username: britta.hoecker
Centre: DE_Heidelberg



Log out

[Follow up] Anthr... Rejec... Biopsies Infec... Nonin... Hospi... Labor... Medic... Drug ... Non-d... Cardi... Immun... Studies [Analyses]

This page is to be used for documentation of immunosuppressive, anti-infectious drugs, agents to ameliorate complications (...)

Immunosuppressants Anti-infectious agents Antihypertensive agents Hormones Other medication

M Has any of the listed immunosuppressants been prescribed since the last visit or are still active? If so, please provide the trade names and representative doses.

N Has any antilymphocyte antibody been administered?

I No

A Has any calcineurin inhibitor been administered?

L Yes

Cyclosporine microemulsion

☒ No

per m² BSA

Cyclosporine

☒ No

per m² BSA

Tacrolimus

Prograf 2.5 mg ☐ No

3.25 mg per m² BSA

Rejection prophylaxis

Tacrolimus delayed release

☒ No

per m² BSA

No.	Substance	Tradename	Entry type	Date	Dose
1	Tacrolimus	Prograf	Change	13.06.2014	4.5[mg]
2	Tacrolimus	Prograf	Change	10.06.2014	5[mg]
3	Tacrolimus	Prograf	Change	06.06.2014	3[mg]
4	Tacrolimus	Prograf	Change	30.05.2014	2[mg]
5	Tacrolimus	Prograf	Change	26.03.2014	3.5[mg]
6	Tacrolimus	Prograf	Change	13.03.2014	3[mg]
7	Tacrolimus	Prograf	Change	07.02.2014	3.5[mg]
8	Tacrolimus	Prograf	Change	06.01.2014	3.75[mg]
9	Methylprednisolone	Urbason	Change	11.12.2013	2[mg]
10	Tacrolimus	Prograf	Change	07.12.2013	3.5[mg]
11	ATG	Thymoglobulin	Single dose	06.12.2013	36[mg]
12	ATG	Thymoglobulin	Single dose	04.12.2013	45[mg]
13	Tacrolimus	Prograf	Change	04.12.2013	3[mg]
14	ATG	Thymoglobulin	Single dose	02.12.2013	35[mg]
15	ATG	Thymoglobulin	Single dose	30.11.2013	25[mg]
16	Methylprednisolone	Urbason	Change	23.11.2013	5[mg]
17	Other#IgG	Kiovig	Single dose	19.11.2013	20[g]
18	Methylprednisolone	Urbason	Change	16.11.2013	8[mg]

Report

Edit

Non-infectious complications



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2018.09 (25. Sep. 2018)

Current visit		Current user	14:59
Patient	[REDACTED]	Username:	britta.hoecker
Visit type:	5.0 years visit	Centre:	DE_Heidelberg
Visit status	Accepted	Log out	
Previous comments:			

[Follow up] Anthr... Rejec... Biopsies Infec... Nonin... Hospi... Labor... Medic... Drug ... Non-d... Cardi... Immun... Studies [Analyses]

Please indicate all relevant transplant-related complications that patients suffered, except infections. The latter are to be documented (...)"

M Has any of the listed complications been observed since
I the last visit?

N Arterial hypertension

I Left ventricular hypertrophy

A Diabetes mellitus

L Anorexia

Cushingoid habitus

Growth impairment

Tumour

Fracture

Upper gastrointestinal compl.

Lower gastrointestinal compl.

Glaucoma

Cataract

Papilloedema

Fundus hypertonicus

Gingival hyperplasia

Hypertrichosis

Striae

Skin warts

Acne

Yes
No
No
No
No
No
No
No
No
No
No
No
No
No
No
No
No
No
No
No

No.	▼ Date	Type	Immunosuppression changed	End date
1	30.09.2013	Upper gastrointestinal	Yes	14.10.2013
2	01.02.2013	Upper gastrointestinal	No	03.02.2013
3	09.11.2012	Leukocytopaenia	Yes	15.11.2012
4	18.07.2011	Lower gastrointestinal	No	14.08.2011
5	23.05.2011	Lower gastrointestinal	Yes	16.06.2011
6	28.09.2010	Secondary hyperparathyroidism	No	--
7	20.09.2010	Anaemia	No	24.02.2011
8	09.09.2010	Leukocytopaenia	Yes	12.12.2010
9	04.04.2010	Lower gastrointestinal	Yes	07.04.2010
10	20.03.2010	Arterial hypertension	No	--

Report Edit

Initial recipient data



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Renal Transpl-
Ant Initiative

2018.09 (25. Sep. 2018)

Current visit

Patient [REDACTED]
Visit type: Initial visit
Visit status: Accepted
Scheduled on: 20.03.2010
Timescope: 05.03.2010 - 04.04.2010
Previous comments: [i](#)

Current user

14:59

Username: britta.hoecker
Centre: DE_Heidelberg
[Log out](#)

General History Donor Recip... Vacci... Vacci... Vacci... Patie... Psych... [Continuous entries] [Analyses]

Here the requisite recipient- and surgery-related data should be entered. Again, some items may already have been documented by ET. If the patient participates in a prospective study, please fill in the page STUDIES under CONTINUOUS ENTRIES.

M Type of transplantation:

I Right donor kidney
Cold ischaemia time
(hours/minutes):

24 0

Warm ischaemia time
(hours/minutes):

8 0 ☐ Unknown

Biopsy before/during
transplantation:

Yes

Biopsy result:

mm0, g0, ci1, ct1, cv0, partly
necrosis of tubular epithelia

Nephrectomy of native
kidneys?

No

Explantation of previous
kidney grafts?

No

Blood group:

A

ABO group incompatible
transplantation:

No

CMV-IgG:

Negative

EBV-IgG:

Negative

HLA-A ?

Broad Split Allele

1 A1
2 blank

HLA-B ?

Broad Split Allele

1 B8
2 B17 B57 B*57:XX

HLA-DR ?

Broad Split Allele

1 DR3
2 DR7

Current PRA (in %):

0

Highest PRA (in %):

☒ Unknown

Desensitisation procedure:

No

Edit

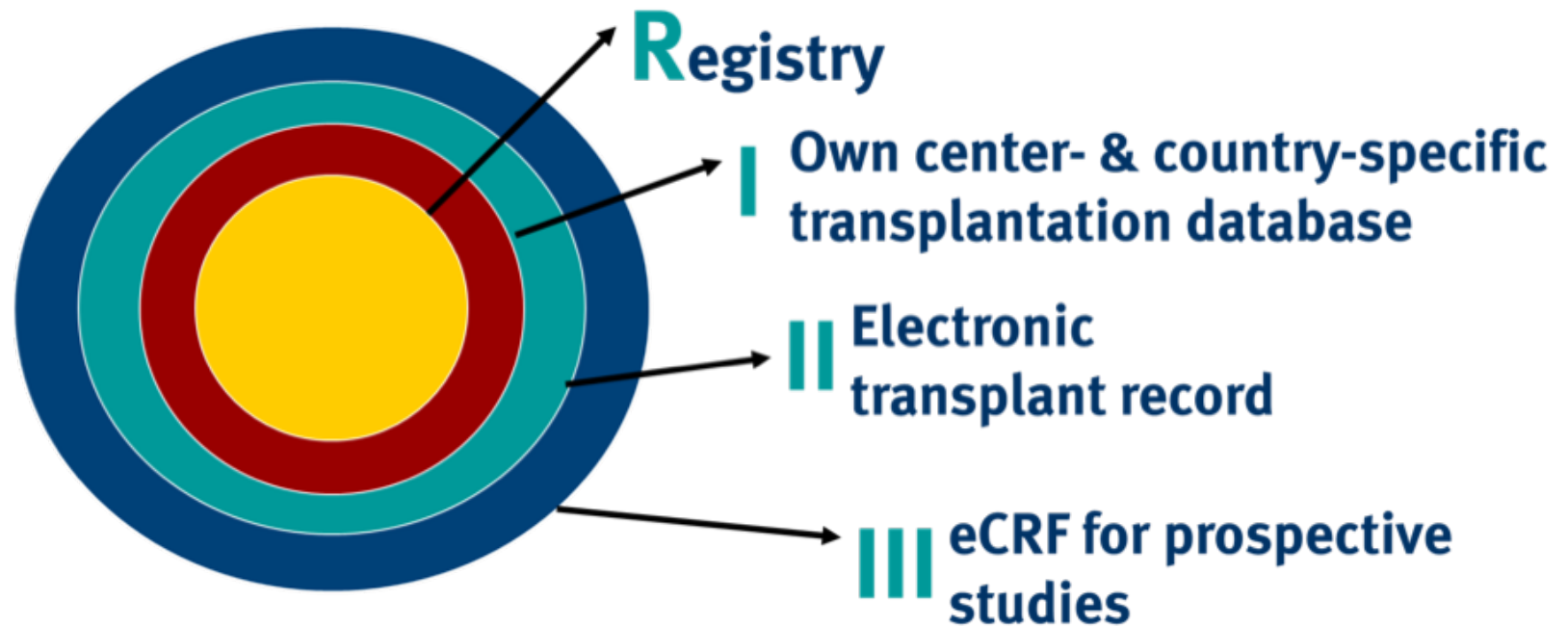


The CERTAIN Registry: A Novel, Web-Based Registry and Research Platform for Pediatric Renal Transplantation in Europe

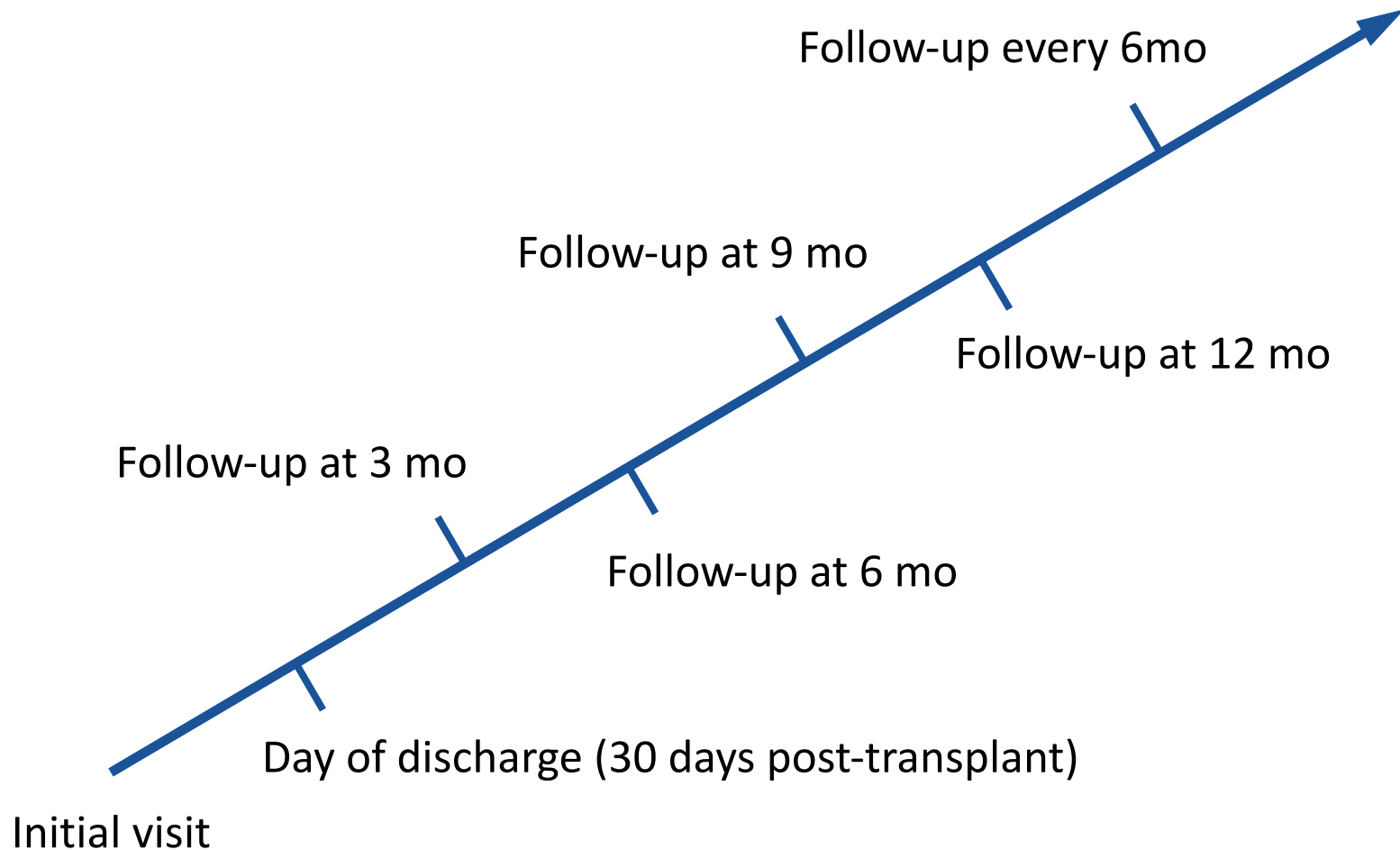
L. Plotnicki, C.D. Kohl, B. Höcker, K. Krupka, A. Rahmel, L. Pape, P. Hoyer, S.D. Marks, N.J.A. Webb, O. Söylemezoglu, R. Topaloglu, A.J. Szabo, T. Seeman, E.A. Marlies Cornelissen, N. Knops, R. Grenda, and B. Tönshoff

Transplantation Proceedings, 45, 1414–1417 (2013)

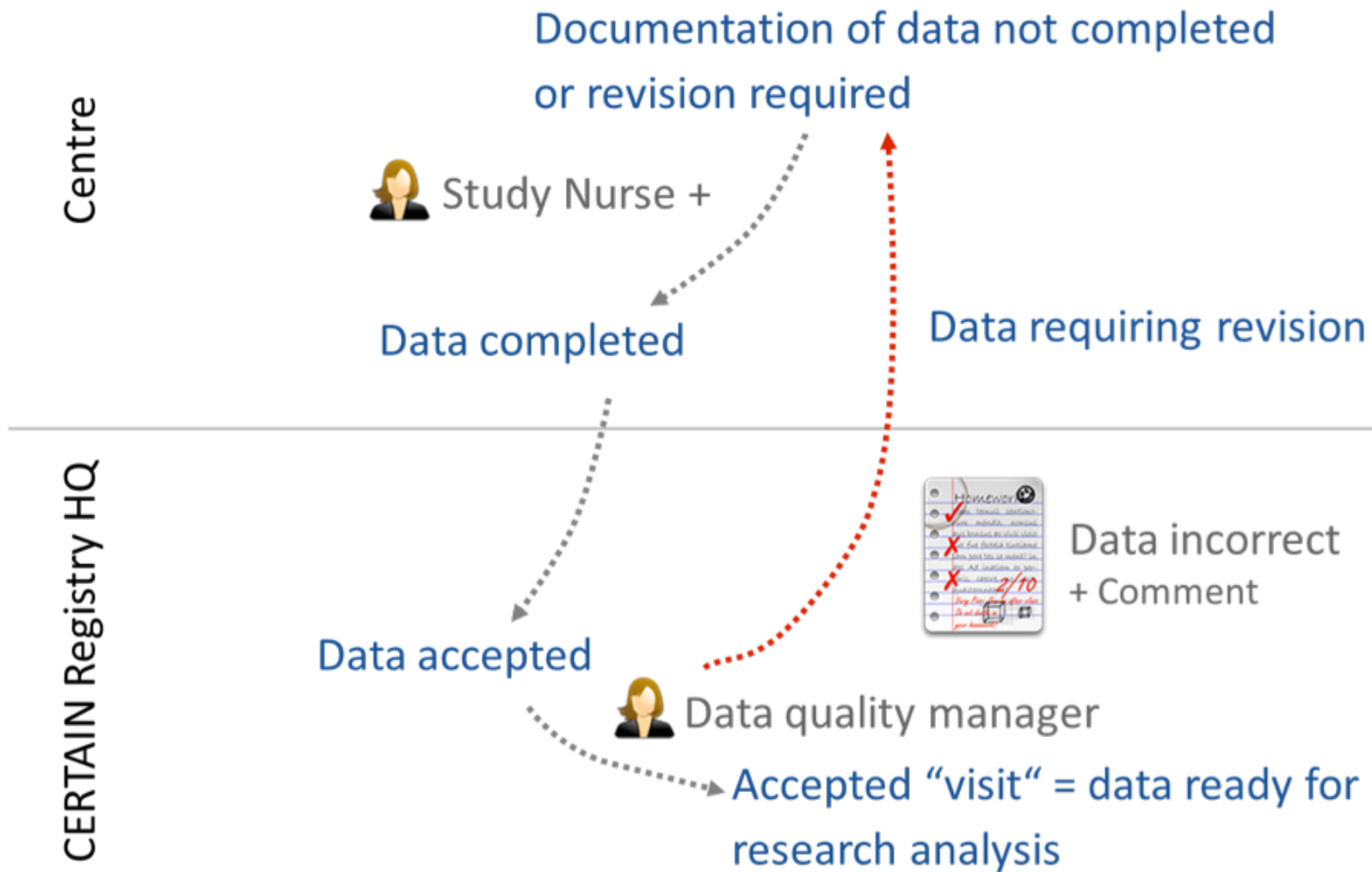
Data volume & usage



Data entry schedule

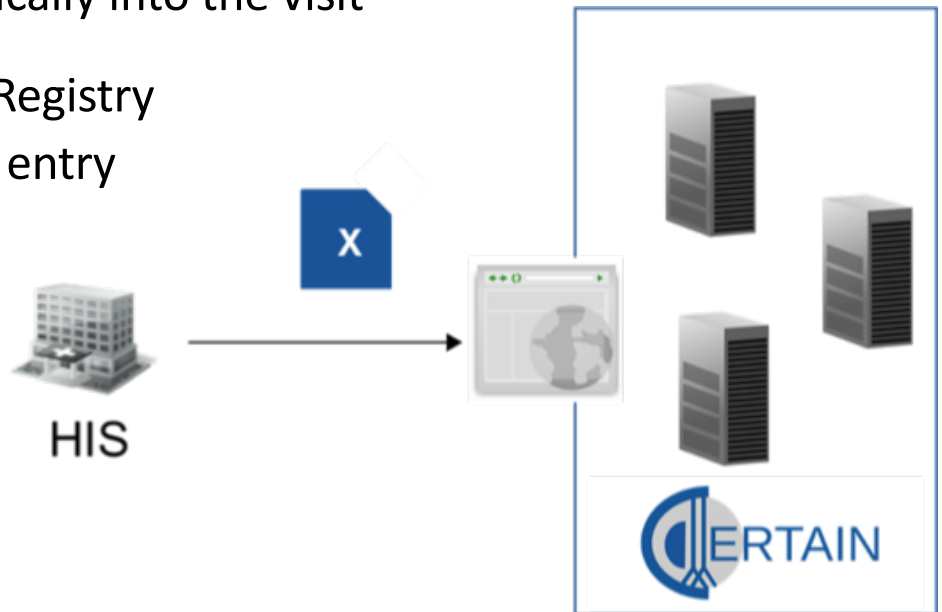


Data quality assurance process



Automatic data entry: import of laboratory values

- Activated for the centers in Germany (Essen, Heidelberg, Leipzig, Stuttgart), Hungary (Budapest), Italy (Rome), UK (Manchester) and Switzerland (Zürich)
- Steps for importing data
 - Export laboratory values as a standardized Excel file from the hospital information system (HIS)
 - Upload file to the CERTAIN Registry for a specific visit
 - Values get integrated automatically into the visit
- Benefits for both users and CERTAIN Registry
 - Reduced time for manual data entry
 - Improved data quality



Centre report

Report 10/2018

All Centres



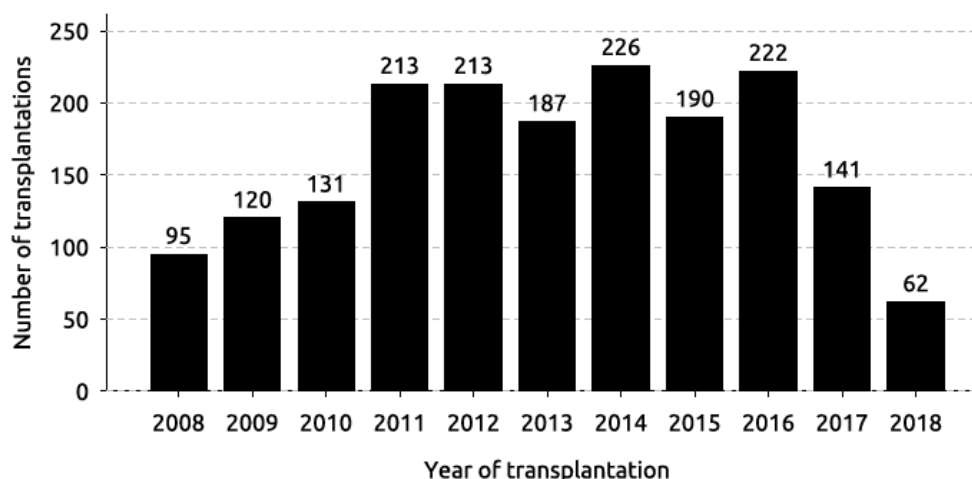
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Renal
Transplant
Ant
Initiative

Registry

Total number of patients: 2212
Total number of transplants: 2265
Total number of visits: 20987

Cohort

Total number of patients: 2212
Total number of transplants: 2265
Total number of visits: 20987
Timeliness of follow-up: 35.3%



Number of kidney transplantations (incl. living-related Tx)

Year	No. of Tx reported by ET*	No. of Tx for which D/R data were requested from ET	No. of recipients in adult care
2018	100	17 (17.0%)	0
2017	138	53 (38.4%)	2
2016	133	70 (52.6%)	2

* up to recipient age of 21 years

Centre report

Centre Report 10/2018

DE_Heidelberg



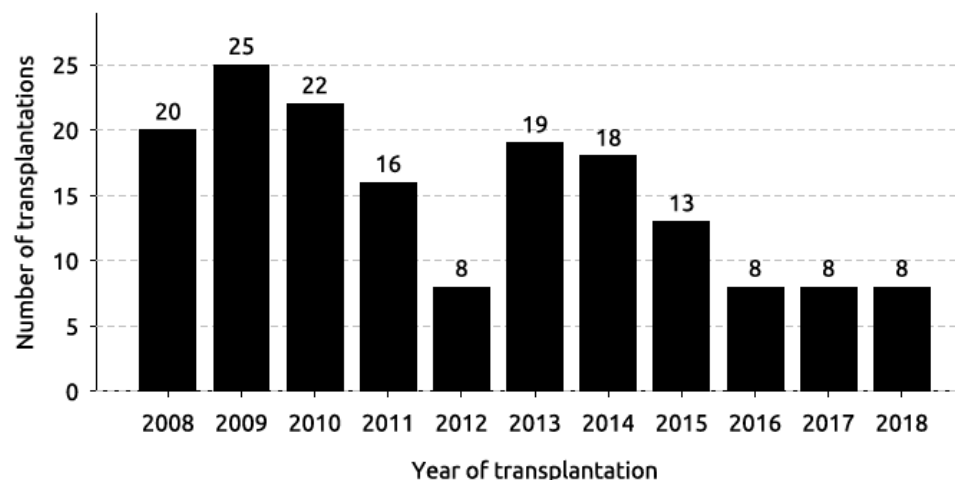
Cooperative
European Paediatric
Renal
Transplant
Ant
Initiative

Registry

Total number of patients: 2212
Total number of transplants: 2265
Total number of visits: 20987

Centre

Total number of patients: 349
Total number of transplants: 382
Total number of visits: 5669
Timeliness of follow-up: 50.0%



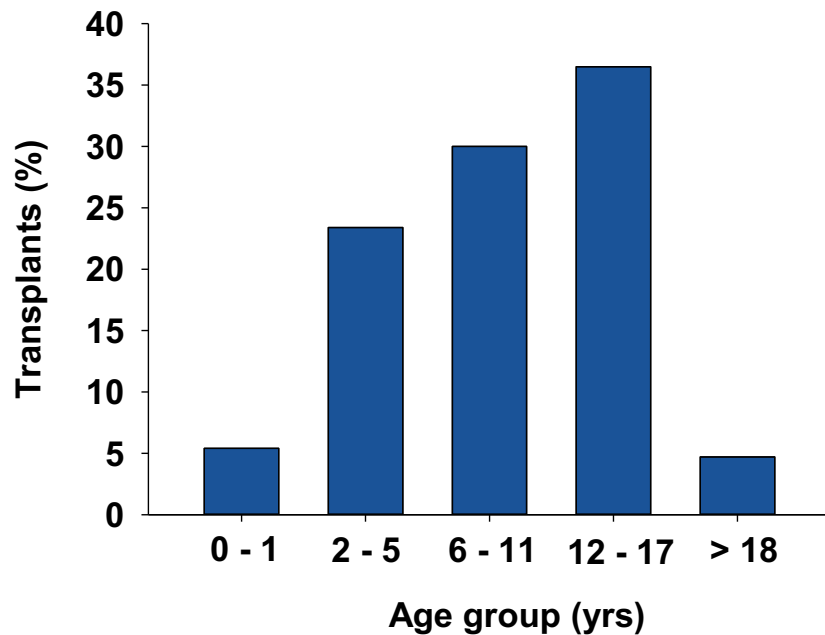
Number of kidney transplantations (incl. living-related Tx)

Year	No. of Tx reported by ET*	No. of Tx for which D/R data were requested from ET	No. of recipients in adult care
2018	12	8 (66.7%)	0
2017	12	8 (66.7%)	1
2016	8	8 (100.0%)	0

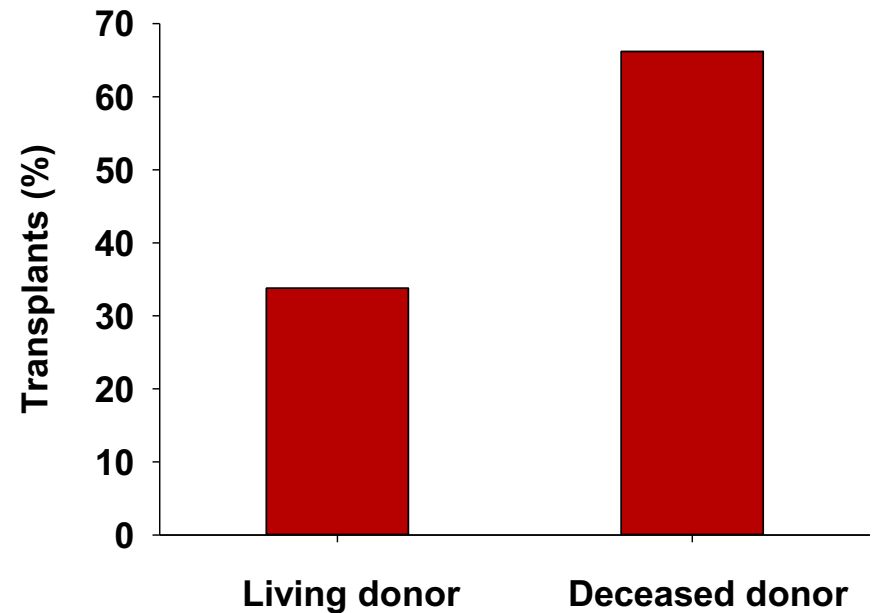
* up to recipient age of 21 years

Recipient age and donor type

Recipient age at RTx



Donor type

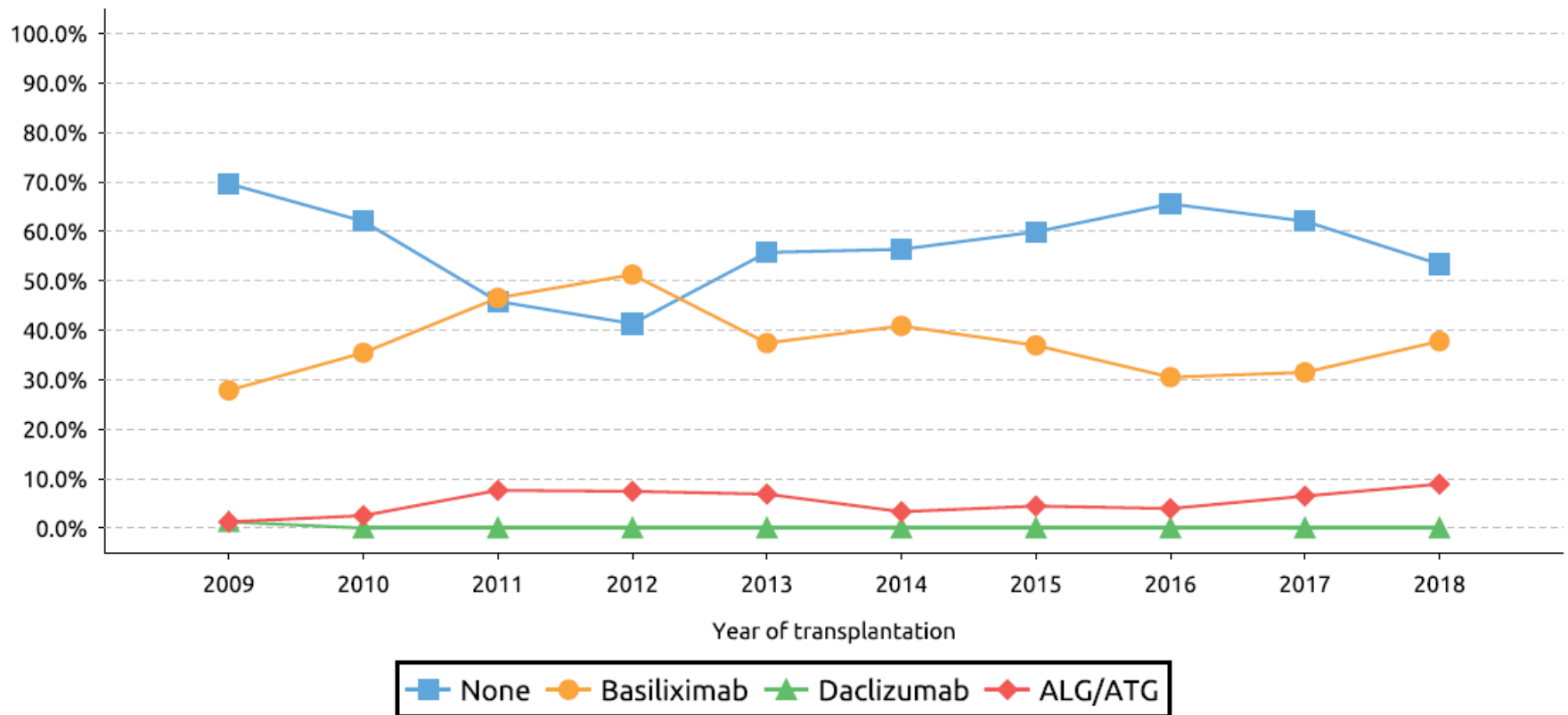


n = 2265 transplants

Induction therapy

Immunosuppressive regimen within the last 10 years (N=1222)

Induction therapy stratified by substance



Maintenance immunosuppressive treatment

Immunosuppressive therapy at 30 days post-transplant stratified by substance

