Chronic Kidney Disease in Children

KIDMAC Report
May 2024

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Information about submitting new research proposals via the CKiD Concept Sheet submission process and accessing publicly available CKiD data can be found on the CKiD website's "Investigator Resources":
https://statepi.jhsph.edu/ckid/investigator-resources/

KIDMAC REPORT

May 2024

Note: This report is abbreviated with a selected subset of tables and figures.

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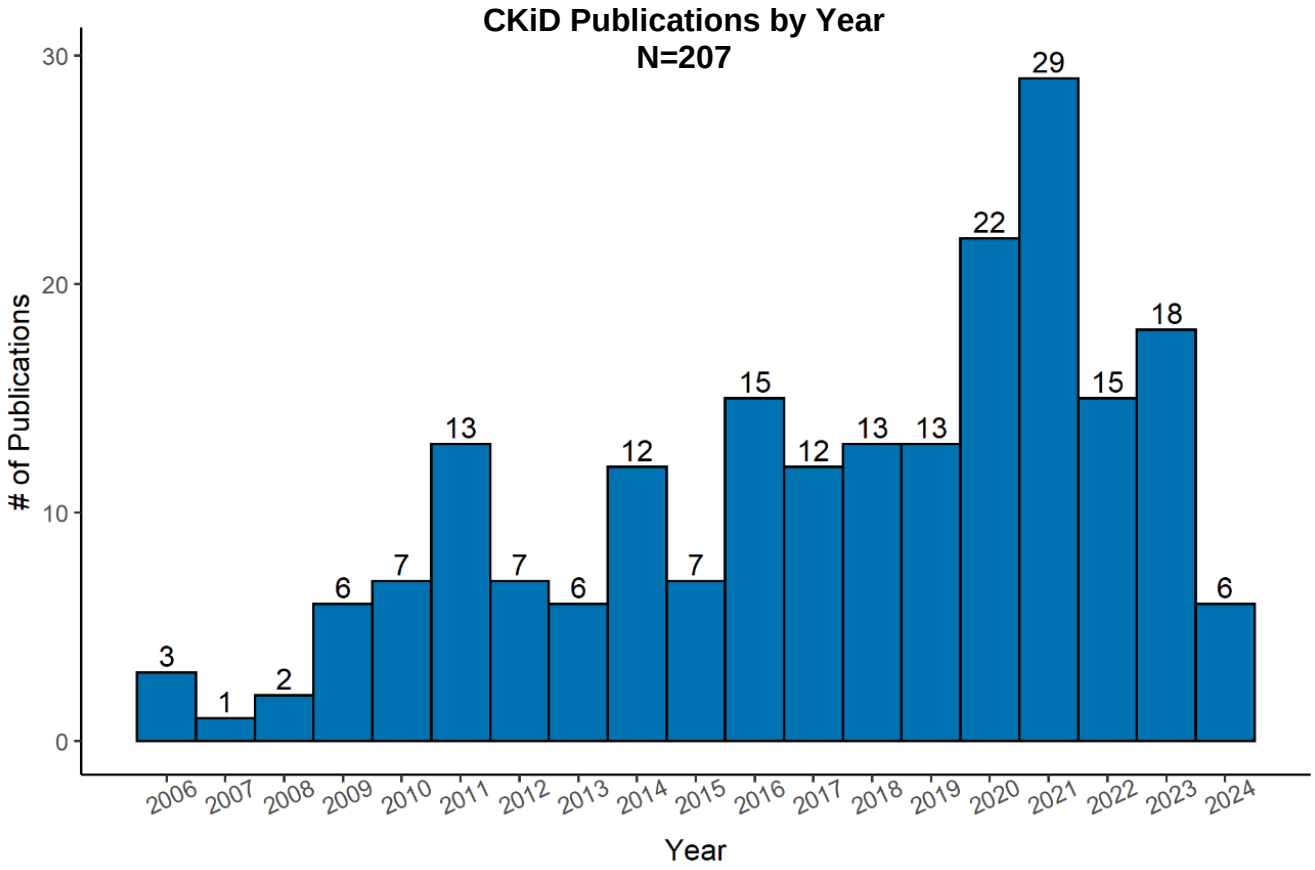
KEY FOR ABBREVIATIONS/TERMS

Event	**- Dialysis, Transplant or Death**
KRT	**- Kidney Replacement Therapy = Dialysis or Transplant**
RFU	**- Regular follow-up study visits**
LTRFU	**- Lost to regular follow-up by withdrawal, UTFU or pregnancy**
PIP	**- Continued follow-up interview/survey completed by phone, in-person or by mail**
ePIP	**- Continued follow-up survey completed electronically**
DSEN	**- Disenrolled**
iGFRc	**- Iohexol-based GFR based upon re-calibration (Schwartz et al.; JALM 2018)**
U25GFR	**- Estimated GFR based on CKiD estimating equations (Pierce et al.; Kidney Int 2021;99:948-956)**
e2012GFR	**- Estimated GFR based on CKiD estimating equation (Schwartz et al.; Kidney Int 2012;82:445-453)**
bedGFR	**- CKiD bedside estimating equation (41.3*Ht[m] / SCr[mg/dl])**
NG	**- Non-glomerular diagnosis**
G	**- Glomerular diagnosis**
IQR	**Interquartile range**
%ile	**Percentile**
HTN	**Hypertension**

Publications by Year and List of Publications



CKiD List of Publications 2023-2024 (as of May 2024)

Below is a list of recent CKiD publications (2023-current) that have resulted from core CKiD data managed by KIDMAC. A full list of CKiD publications is available on the study website.

2024 Publications

Fino NF, Adingwupu OM, Coresh J, Greene T, Haaland B, Shlipak MG, Costa E Silva VT, Kalil R, Mindikoglu AL, Furth SL, Seegmiller JC, Levey AS, Inker LA. Evaluation of novel candidate filtration markers from a global metabolomic discovery for glomerular filtration rate estimation. Kidney Int. 2024 Mar;105(3):582-592. doi: 10.1016/j.kint.2023.11.007. Epub 2023 Nov 23. PMID: 38006943; PMCID: PMC10932836.

Inker LA, Tighiouart H, Adingwupu OM, Ng DK, Estrella MM, Maahs D, Yang W, Froissart M, Mauer M, Kalil R, Torres V, de Borst M, Klintmalm G, Poggio ED, Seegmiller JC, Rossing P, Furth SL, Warady BA, Schwartz GJ, Velez R, Coresh J, Levey A. Performance of GFR Estimating Equations in Young Adults. Am J Kidney Dis. 2024 Feb;83(2):272-276. doi: 10.1053/j.ajkd.2023.06.008. Epub 2023 Sep 17. PMID: 37717845.

Kim HS, Ng DK, Matheson MB, Atkinson MA, Akhtar Y, Warady BA, Furth SL, Ruebner RL. Pubertal luteinizing hormone levels in children with chronic kidney disease and association with change in glomerular filtration rate. Pediatr Nephrol. 2024 May;39(5):1543-1549. doi: 10.1007/s00467-023-06210-7. Epub 2023 Nov 23. PMID: 37996757.

Ng DK, Muñoz A, CKiD Study Investigators. Assessing bias in GFR estimating equations: improper GFR stratification can yield misleading results. Pediatric Nephrol 2024 Feb 24. doi: 10.1007/s00467-024-06318-4. Epub ahead of print. PMID: 38396091.

Ren X, Chen J, Abraham AG, Xu Y, Siewe A, Warady BA, Kimmel PL, Vasan RS, Rhee EP, Furth SL, Coresh J, Denburg M, Rebholz CM; Chronic Kidney Disease Biomarkers Consortium. Plasma Metabolomics of Dietary Intake of Protein-Rich Foods and Kidney Disease Progression in Children. J Ren Nutr. 2024 Mar;34(2):95-104. PMID: 37944769 PMCID: PMC10960708

Sandokji I, Xu Y, Denburg M, Furth S, Abraham A, Greenberg JH. Current and Novel Biomarkers of Progression Risk in Children with Chronic Kidney Disease. Nephron. 2024;148(1):1-10. doi: 10.1159/000530918. Epub 2023 May 15.
PMID: 37232009 PMCID: PMC10840447

2023 Publications

Akchurin O, Molino AR, Schneider MF, Atkinson MA, Warady BA, Furth SL. Longitudinal Relationship Between Anemia and Statural Growth Impairment in Children and Adolescents With Nonglomerular CKD: Findings From the Chronic Kidney Disease in Children (CKiD) Study. Am J Kidney Dis. 2023 Apr;81(4):457-465.e1. doi: 10.1053/j.ajkd.2022.09.019. Epub 2022 Dec 5. PMID: 36481700; PMCID: PMC10038884.

Bae S, Schwartz GJ, Mendley SR, Warady BA, Furth SL, Muñoz A; CKiD Study Investigators. Trajectories of eGFR after kidney transplantation according to trajectories of eGFR prior to kidney replacement therapies in children with chronic kidney disease. Pediatr Nephrol. 2023 Dec;38(12):4157-4164. doi: 10.1007/s00467-023-06056-z. Epub 2023 Jun 23. PMID: 37353626; PMCID: PMC10591981.

Brown DD, Roem J, Ng DK, Coghlan RF, Johnstone B, Horton W, Furth SL, Warady BA, Melamed ML, Dauber A; CKiD Study Investigators. Associations between collagen X biomarker and linear growth velocity in a pediatric chronic kidney disease cohort. Pediatr Nephrol. 2023 Dec;38(12):4145-4156. doi: 10.1007/s00467-023-06047-0. Epub 2023 Jul 19. PMID: 37466864; PMCID: PMC10642619.

Carlson J, Gerson AC, Matheson MB, Manne S, Lande M, Harshman L, Johnson RJ, Shinnar S, Kogon AJ, Warady B, Furth S, Hooper S. Longitudinal changes of health-related quality of life in childhood chronic kidney disease. Pediatr Nephrol. 2023 Dec;38(12):4127-4136. doi: 10.1007/s00467-023-06069-8. Epub 2023 Jul 10. PMID: 37428223; PMCID: PMC10591962.

Douglas CE, Roem J, Flynn JT, Furth SL, Warady BA, Halbach SM; Chronic Kidney Disease in Children study investigators*. Effect of Age on Hypertension Recognition in Children With Chronic Kidney Disease: A Report From the Chronic Kidney Disease in Children Study. Hypertension. 2023 May;80(5):1048-1056. doi: 10.1161/HYPERTENSIONAHA.122.20354. Epub 2023 Mar 2. PMID: 36861464; PMCID: PMC10133176.

Faulkner SC, Matheson MB, Greenberg JH, Garimella PS, Furth SL, Ix JH, Bakhoum CY. Association of clinical characteristics with urine uromodulin in children with chronic kidney disease. Pediatr Nephrol. 2023 Nov;38(11):3859-3862. doi: 10.1007/s00467-023-05947-5. Epub 2023 Mar 29. PMID: 36988691; PMCID: PMC10528151.

Harshman LA, Ward RC, Matheson MB, Dawson A, Kogon AJ, Lande MB, Molitor SJ, Johnson RJ, Wilson C, Warady BA, Furth SL, Hooper SR. The Impact of Pediatric CKD on Educational and Employment Outcomes. Kidney360. 2023 Oct 1;4(10):1389-1396. doi: 10.34067/KID.0000000000000206. Epub 2023 Jul 7. PMID: 37418621; PMCID: PMC10615373.

Jiang K, Greenberg JH, Abraham A, Xu Y, Schelling JR, Feldman HI, Schrauben SJ, Waikar SS, Shlipak MG, Wettersten N, Coca SG, Vasan RS, Gutierrez OM, Ix JH, Warady BA, Kimmel PL, Bonventre JV, Parikh CR, Mitsnefes MM, Denburg MR, Furth S; CKD Biomarkers Consortium. Associations of Biomarkers of Kidney Tubule Health, Injury, and Inflammation with Left Ventricular Hypertrophy in Children with CKD. Kidney360. 2023 Aug 1;4(8):1039-1047. doi: 10.34067/KID.0000000000000183. Epub 2023 Jun 12. PMID: 37303083; PMCID: PMC10476681.

Kogon AJ, Roem J, Schneider MF, Mitsnefes MM, Zemel BS, Warady BA, Furth SL, Rodig NM. Associations of body mass index (BMI) and BMI change with progression of chronic kidney disease in children. Pediatr Nephrol. 2023 Apr;38(4):1257-1266. doi: 10.1007/s00467-022-05655-6. Epub 2022 Aug 26. PMID: 36018433; PMCID: PMC10044533.

Kula AJ, Flynn JT, Prince DK, Furth SL, Warady B, Isakova T, Christenson R, Bansal N. Descriptions and Determinants of N-Terminal Pro-B-Type Natriuretic Peptide in Pediatric CKD: The Chronic Kidney Disease in Children (CKiD) Study. Am J Kidney Dis. 2023 Dec;82(6):776-778. doi: 10.1053/j.ajkd.2023.03.020. Epub 2023 Jun 29. PMID: 37393051 PMCID: PMC10989192

Kurzinski KL, Xu Y, Ng DK, Furth SL, Schwartz GJ, Warady BA; CKiD Study Investigators. Hyperkalemia in pediatric chronic kidney disease. Pediatr Nephrol. 2023 Sep;38(9):3083-3090. doi: 10.1007/s00467-023-05912-2. Epub 2023 Mar 20. PMID: 36939915; PMCID: PMC10550342.

Lee AM, Xu Y, Hooper SR, Abraham AG, Hu J, Xiao R, Matheson MB, Brunson C, Rhee EP, Coresh J, Vasan RS, Schrauben S, Kimmel PL, Warady BA, Furth SL, Hartung EA, Denburg MR; CKD Biomarkers Consortium. Circulating Metabolomic Associations with Neurocognitive Outcomes in Pediatric CKD. Clin J Am Soc Nephrol. 2023 2023 Oct 23;19(1):13-25 PMID: 37871960 PMCID: PMC10843217

Menon G, Pierce CB, Ng DK; CKiD Study Investigators. Revisiting the Application of an Adult Kidney Failure Risk Prediction Equation to Children With CKD. Am J Kidney Dis. 2023 Jun;81(6):734-737. doi: 10.1053/j.ajkd.2022.11.004. Epub 2022 Dec 28. PMID: 36586560; PMCID: PMC10548839.

Ng DK, Carroll MK, Furth SL, Warady BA, Flynn JT; CKiD Study Investigators. Blood Pressure Classification Status in Children With CKD Following Adoption of the 2017 American Academy of Pediatrics Guideline. Am J Kidney Dis. 2023 May;81(5):545-553. doi: 10.1053/j.ajkd.2022.10.009. Epub 2022 Dec 12. PMID: 36521780; PMCID: PMC10122698.

Ng DK, Matheson MB, Schwartz GJ, Wang FM, Mendley SR, Furth SL, Warady BA; CKiD investigators. Development of an adaptive clinical web-based prediction tool for kidney replacement therapy in children with chronic kidney disease. Kidney Int. 2023 Nov;104(5):985-994. doi: 10.1016/j.kint.2023.06.020. Epub 2023 Jun 28. PMID: 37391041; PMCID: PMC10592093.

Ng DK, Patel A, Cox C. Data quality control in longitudinal epidemiologic studies: conditional studentized residuals from linear mixed effects models for outlier detection in the setting of pediatric chronic kidney disease. Ann Epidemiol. 2023 Sep;85:38-44. doi: 10.1016/j.annepidem.2023.07.005. Epub 2023 Jul 16. PMID: 37454831; PMCID: PMC10538390.

Schwartz GJ, Roem JL, Hooper SR, Furth SL, Weaver DJ Jr, Warady BA, Schneider MF. Longitudinal changes in uric acid concentration and their relationship with chronic kidney disease progression in children and adolescents. Pediatr Nephrol. 2023 Feb;38(2):489-497. PMID: 35650320 PMCID: PMC9712592

Singh NS, Johnson RJ, Matheson MB, Carlson J, Hooper SR, Warady BA. A longitudinal analysis of the effect of anemia on executive functions in children with mild to moderate chronic kidney disease. Pediatr Nephrol. 2023 Mar;38(3):829-837. doi: 10.1007/s00467-022-05682-3. Epub 2022 Jul 21. PMID: 35861871; PMCID: PMC10659592.

***Publications that have resulted from CKiD public data stored at the NIDDK Central Repository*:**

1. Thomas E, Klomhaus AM, Laster ML, Furth SL, Warady BA, Salusky IB, Hanudel MR. Associations between anemia and FGF23 in the CKiD study. Pediatr Nephrol. 2024 Mar;39(3):837-847. doi: 10.1007/s00467-023-06160-0. Epub 2023 Sep 26. PMID: 37752381 PMCID: PMC10817837

2. Kusumi K, Raina R, Samuels J, Tibrewal A, Furth S, Mitsnefes M, Devineni S, Warady BA. Evidence of increased vascular stiffness and left ventricular hypertrophy in children with cystic kidney disease. Pediatr Nephrol. 2023 Jul 10. doi: 10.1007/s00467-023-06081-y. Online ahead of print. PMID: 37428222

3. Byfield RL, Xiao R, Shimbo D, Kronish IM, Furth SL, Amaral S, Cohen JB. Antihypertensive medication nonadherence and target organ damage in children with chronic kidney disease. Pediatr Nephrol. 2023 Jul 13. doi: 10.1007/s00467-023-06059-w. Online ahead of print. PMID: 37442816

4. Pagi R, Yadin O, Wesseling-Perry K, Norris K, Laster ML. Racial-ethnic diversity in ambulatory blood pressure monitoring in children with chronic kidney disease. Pediatr Nephrol. 2023 Mar;38(3):819-827. doi: 10.1007/s00467-022-05659-2. Epub 2022 Jul 8. PMID: 35802270

5. Sebastião YV, Cooper JN, Becknell B, Ching CB, McLeod DJ. Prediction of kidney failure in children with chronic kidney disease and obstructive uropathy. Pediatr Nephrol. 2021 Jan;36(1):111-118. doi: 10.1007/s00467-020-04661-w. Epub 2020 Jun 25. PMID: 32583045

6. Black E, Lee J, Flynn JT, McCulloch CE, Samuels JA, Seth D, Warady B, Furth S, Mitsnefes M, Ku E. Discordances between pediatric and adult thresholds in the diagnosis of hypertension in adolescents with CKD. Pediatr Nephrol 2021 Jun 25 [online ahead of print]. PMID: 34170411

7. McLeod DJ, Sebastião YV, Ching CB, Greenberg JH, Furth SL, Becknell B. Longitudinal kidney injury biomarker trajectories in children with obstructive uropathy. Pediatr Nephrol. 2020 Oct;35(10):1907-1914. PMC7502482

8. Chu DI, Abraham AG, Tasian GE, Denburg MR, Ross ME, Zderic SA, Furth SL. Urologic care and progression to end-stage kidney disease: a Chronic Kidney Disease in Children (CKiD) nested case-control study. J Pediatr Urol 2019;15:266.e1-266.e7. PMCID: PMC6588473

9. McLeod DJ, Ching CB, Sebastião YV, Greenberg JH, Furth SL, McHugh KM, Becknell B. Common clinical markers predict end-stage renal disease in children with obstructive uropathy. Pediatr Nephrol 2019;34:443-448. PMCID: PMC65000428

10. Altemose KE, Kumar J, Portale AA, Warady BA, Furth SL, Fadrowski JJ, Atkinson MA. Vitamin D insufficiency, hemoglobin, and anemia in children with chronic kidney disease. Pediatr Nephrol. 2018;22:2131-2136. PMCID: PMC6528819

11. Richardson KL, Weiss NS, Halbach S. Chronic school absenteeism of children with chronic kidney disease. J Pediatr 2018;199:267-271. PMCID: PMC6063782

12. Winnicki E, McCulloch CE, Mitsnefes MM, Furth SL, Warady BA, Ku E. Use of the Kidney Failure Risk Equation to Determine the Risk of Progression to End-stage Renal Disease in Children With Chronic Kidney Disease. JAMA Pediatr 2018:172:174-180. PMCID: PMC5839269

13. Ku E, Kopple JD, McCulloch CE, Warady BA, Furth SL, Mak RH, Grimes BA, Mitsnefes M. Associations between weight loss, kidney function decline, and risk of ESRD in the Chronic Kidney Disease in Children (CKiD) cohort study. Am J Kidney Dis 2018:71:648-656. PMCID: PMC5916028

14. Clark SL, Denburg MR, Furth SL. Physical activity and screen time in adolescents in the chronic kidney disease in children (CKiD) cohort. Pediatr Nephrol 2016;31:801-808. PMCID: PMC4924924

Citations of Selected CKiD Publications (ordered by citations per year*)

First Author	Year	Journal	Title	Times Cited*	Years since publication	Citations per year
Schwartz	2009	JASN	New equations to estimate GFR in children with CKD.	2707	15	180
Pierce	2021	Kidney Int	Age and sex dependent clinical equations to estimate glomerular filtration rates in children and young adults with chronic kidney disease	145	3	48
Schwartz	2009	CJASN	Measurement and estimation of GFR in children and adolescents	718	15	48
Schwartz	2012	Kidney Int	Improved equations estimating GFR in children with chronic kidney disease using an immunonephelometric determination of cystatin C.	380	12	32
Verbitsky	2019	Nat Genet	The copy number variation landscape of congenital anomalies of the kidney and urinary tract.	133	5	27
Warady	2015	AJKD	Predictors of rapid progression of glomerular and nonglomerular kidney disease in children and adolescents: the Chronic Kidney Disease in Children (CKiD) Cohort.	180	9	20
Furth	2006	CJASN	Design and methods of the Chronic Kidney Disease in Children (CKiD) prospective cohort study.	332	18	18
Wong	2012	AJKD	Chronic Kidney Disease in Children (CKiD) prospective cohort study: A review of current findings.	200	12	17
Mitsnefes	2010	JASN	Masked hypertension associates with left ventricular hypertrophy in children with CKD.	231	14	17
Lopez-Rivera	2017	NEJM	Genetic drivers of kidney defects in the DiGeorge Syndrome.	104	7	15
Schwartz	2007	Pediatr Nephrol	Glomerular filtration rate measurement and estimation in chronic kidney disease	216	17	13
Flynn	2008	Hypertension	Blood pressure in children with chronic kidney disease: a report from the Chronic Kidney Disease in Children study.	203	16	13

*Number of citations comes from Web of Science “All Databases” search

Citations of Selected CKiD Publications (ordered by citations per year*)

First Author	Year	Journal	Title	Times Cited	Years since publication	Citations per year
Gerson	2010	Pediatrics	Health-related quality of life of children with mild to moderate chronic kidney disease	165	14	12
Greenberg	2020	JASN	Plasma biomarkers of tubular injury and inflammation are associated with chronic kidney disease progression in children	47	4	12
Mitsnefes	2018	CJASN	FGF23 and left ventricular hypertrophy in children with chronic kidney disease.	68	6	11
Schwartz	2006	Kidney Int	Glomerular filtration rate via plasma iohexol disappearance: pilot study for chronic kidney disease in children	197	18	11
Rodenbach	2015	AJKD	Hyperuricemia and progression of CKD in children: The Chronic Kidney Disease in Children (CKiD) Cohort Study	96	9	11
Denburg	2016	JASN	Fracture Burden and Risk Factors in Childhood CKD: Results from the CKiD Cohort Study	69	7	10
Portale	2014	CJASN	Disordered FGF23 and mineral metabolism in children with CKD	102	10	10
Ng	2018	Kidney Int	Combination of pediatric and adult formulas yield valid glomerular filtration rate estimates in young adults with a history of pediatric chronic kidney disease	60	6	10

*Number of citations comes from Web of Science “All Databases” search

Characteristics (Median or %) of CKiD Cohort

	Baseline			Observed at Age ≥ 16		
	G N=275	Non-G N=824	Overall N=1099	First visit age<16 N=441	First visit age≥16 N=542	Latest visit N=542
Demographics						
Male	53%	67%	64%	61%	60%	60%
African-American	31%	19%	22%	20%	20%	20%
Hispanic Ethnicity	16%	14%	14%	12%	13%	13%
Income ≤ $36K	41%	39%	40%	37%	33%	33%
Maternal Education, years	13	14	14	14	14	14
Age, years	14	8	10	13	16	19
Kidney Progression						
Glomerular diagnosis			25%	30%	34%	34%
Age at CKD onset, years	8.5	0.0	0.0	0.0	0.0	0.0
Years since CKD onset	3.5	7.3	6.0	9.2	16.2	17.7
Age at CKD awareness, years	8.5	<0.1	0.6	2.5	3.5	3.5
SCr (Enzymatic), mg/dL	1.1	1.0	1.0	1.0	1.6	2.0
Cystatin C (IFCC), mg/L	1.4	1.7	1.6	1.6	1.7	1.8
Urine protein:creatinine (uP/C)	0.7	0.3	0.4	0.3	0.4	0.7
iGFRc, ml/min/1.73m^2	59	46	49	50	47	42
U25eGFR, ml/min/1.73m^2	57	47	50	53	47	39
Cardiovascular						
Stage 1 or 2 Hypertension	23%	29%	28%	23%	22%	32%
Self- Reported Hypertension	56%	40%	44%	52%	46%	44%
Left Ventricular Hypertrophy[a]	15%	10%	11%	8%	10%	10%
Neurocognitive						
IQ	96	98	98	99	99	101
Parent Overall QOL	76	79	78	78	79	80
Child Overall QOL	79	77	78	78	83	84
Growth						
Premature (Gestational Age< 36 wks)	9%	14%	13%	11%	10%	10%
Low Birth Weight (< 2500 grams)	15%	20%	19%	18%	17%	17%
Small for Gestational Age	21%	17%	18%	19%	18%	18%
ICU Treatment after Delivery	16%	52%	43%	38%	35%	35%
Height Percentile – 50	-9	-24	-21	-16	-17	-16
Weight Percentile – 50	+23	-11	-2	+6	+9	+6
BMI Percentile – 50	+32	+13	+18	+18	+16	+14

[a] Baseline data collected at Visit 2

Section 1:

RECRUITMENT AND RETENTION

This section provides a description of the total number of children enrolled in the CKiD study, recruitment numbers stratified by cohort and diagnosis, status of visits, visit patterns for baseline (V1) and regular and post kidney replacement therapy follow-up visits, and an analysis of continued follow-up data.

Definitions:
Regular and Irregular Visits are in-person study visits that occur prior to kidney replacement therapy to capture biomarker values. The irregular visit consists of the collection of iohexol GFR (unless data has been obtained in the past 3 months) and the collection of as much of the regular study visit data as possible.

Post kidney replacement therapy (post KRT) visits are in-person study visits that occur after the kidney replacement therapy.

LTRFU are individuals who have transitional forms (documented transition out of in-person visits) because the family has withdrawn from completing study visits, the site is unable to reach the family or the female participant has become pregnant.

Continued follow-up interviews/surveys (PIPs/ePIPs) are administered via phone, in-person interview, mail, or online to participants who have initiated kidney replacement therapy and are unable to complete post KRT visits, are LTRFU, or are unable to complete clinical study visits due to unordinary circumstances (such as suspended clinical research activities). The data collected includes vital and medical status, occurrences of replacement therapy, and key biomarkers in children.

Table 1.1a

Number of Children Enrolled at Midwest Sites, N=604 (55% of 1100)

Midwest Clinical Coordinating Center Principal Investigator: Bradley Warady, MD

Site #	Sites	Principal Investigator	G	NG	Overall
17	University of Manitoba (Children's Hospital Research Institute of Manitoba)	Allison Dart, MD, MSc, FRCPC	23	50	73
9	University of Alabama at Birmingham (Children's Hospital of Alabama)	Sahar Fathallah, MD	17	39	56
5	Cincinnati Children's Hospital and Medical Center	Donna Claes, MD, Mark Mitsnefes, MD	14	37	51
8	British Columbia Children's Hospital	Tom Blydt-Hansen, MD, FRCPC; Janis Dionne, MD, FRCPC	6	40	46
28	Children's Healthcare of Atlanta / Emory University	Larry Greenbaum, MD, PhD	16	26	42
1	Children's Mercy Hospital - Kansas City	Bradley Warady, MD	11	29	40
15	Seattle Children's Hospital	Joseph Flynn, MD; Susan Halbach, MD	6	29	35
3	University of New Mexico Health Sciences Center	Craig Wong, MD, MPH	10	19	29
20	University of California – Los Angeles (UCLA)	Isidro Salusky, MD	7	22	29
4	Oregon Health and Science University	Amira Al-Uzri, MD; Kelsey Richardson, MD	2	22	24
11	Case Western Reserve University/Cleveland Clinic Children's	Katherine Dell, MD	3	20	23
30	Northwest Pediatric Kidney Specialist†	Randall Jenkins, MD	1	17	18
25	University of California – San Francisco (UCSF)	Elaine Ku, MD, MAS	5	13	18
2	Medical College of Wisconsin	Rajasree Sreehdaran, MD	6	11	17
7	Boston Children's Hospital	Nancy Rodig, MD[a]	1	15	16
10	Washington University in St. Louis (St. Louis Children's Hospital)	Vikas Dharnidharka, MD	1	14	15
6	Stanford University Medical Center	Cynthia Wong, MD	5	10	15
27	Phoenix Children's Hospital	Anjali Nayak, MD	2	12	14
12	University of Wisconsin	Sharon Bartosh, MD	1	12	13
18	LeBonheur Children's Medical Center[a]	Colleen Hastings, MD	3	4	7
21	University of California – San Diego (UCSD)	Elizabeth Ingulli, MD; Robert Mak, MD, PhD	1	5	6
13	Oklahoma University Health Sciences Center	Ikuyo Yamaguchi, MD, PhD	1	5	6
22	University of Texas Southwestern Medical Center[a]	Smitha Vidi, MD	2	2	4
16	Cardinal Glennon Hospital (St. Louis University [SLU])[a]	Ellen Wood, MD	0	3	3
31	Children's Kidney Specialists, Idaho[a]	Randall Jenkins, MD	0	3	3
24	Children's Hospital of Los Angeles[a]	Gary Lerner, MD	0	1	1
		Total Number of Children who completed Visit 10s:	144	460	604

[a] No longer participating site that enrolled children in the study

† All participants transferred to Site 4.

Table 1.1b

Number of Children Enrolled at East Coast Sites, N=496 (45% of 1100)

East Coast Clinical Coordinating Center Principal Investigator: Susan Furth, MD, PhD

Site #	Sites	Principal Investigator	G	NG	Overall
83	Children's Hospital of Philadelphia	Susan Furth, MD, PhD	17	27	44
61	University of Texas Health Science Center at Houston	Joshua Samuels, MD	10	29	39
50	Johns Hopkins University (Johns Hopkins Children's Center)	Meredith Atkinson, MD	8	29	37
57	Riley Hospital for Children at Indiana University	Amy Wilson, MD	6	29	35
79	Corewell Health/Spectrum Health Hospitals	Jason Thomas, MD	7	27	34
80	Levine Children's Hospital (Carolinas Medical Center)	Susan Massengill, MD	9	19	28
59	University of Michigan	Zubin Modi, MD	5	23	28
60	University of North Carolina, Chapel Hill[a]	Maria Ferris, MD	6	16	22
54	Nationwide Children's Hospital	Hiren Patel, MD	5	15	20
85	East Carolina University	Liliana Gomez-Mendez, MD	7	11	18
64	Albert Einstein College of Medicine/Montefiore Medical Center	Frederick Kaskel, MD, PhD	7	11	18
72	University of Rochester Medical Center	Rebecca Levy, MD; Marc Lande, MD	2	14	16
73	University of Virginia	Victoria Norwood, MD	3	13	16
68	Icahn School of Medicine at Mount Sinai	Jeffrey Saland, MD	3	11	14
51	Wayne State University (Children's Hospital of Michigan)[a]	Tej Matoo, MD	5	8	13
74	Rutgers - Robert Wood Johnson Medical School	Joann Carlson, MD	2	10	12
70	Baylor College of Medicine (Texas Children's Hospital)	Poyyapakkam Srivaths, MD	4	6	10
52	Ann & Robert H. Lurie Children's Hospital of Chicago	Priya Verghese, MD	2	8	10
82	University of Illinois at Chicago	Sonia Krishnan, MD	3	6	9
58	University of Maryland[a]	Susan Mendley, MD	5	3	8
75	University of Florida[a]	Kiran Upadhyay, MD	2	6	8
55	INOVA Fairfax Hospital for Children	Davoud Mohtat, MD	2	5	7
84	Hospital for Sick Children (Sick Kids)	Rulan Parekh, MD	2	4	6
86	Dartmouth-Hitchcock Medical Center (Children's Hospital at Dartmouth) [a]	Matthew Hand, DO	3	3	6
53	Children's National Medical Center	Asha Moudgil, MD	2	3	5
65	University of Iowa	Lyndsay Harshman, MD	1	4	5
88	University of Kentucky[b]	Stefan Kiessling, MD; Margaret Murphy,PhD; Chihsti Aftab, MD	0	4	4
63	Maria Fareri Children's Hospital at Westchester[a]	Dmitry Samsonov, MD	0	3	3
67	Maimonides Medical Center[a]	Juan Kupferman, MD	3	0	3
89	Loma Linda University[b]	Cheryl Sanchez-Kazi, MD	0	3	3
76	Nemours/Alfred I. duPont Hospital for Children[b]	Sonal Bhatnagar, MD	0	3	3
93	University of Miami[c]	Marissa DeFrietas, MD; Carolyn Abitbol, MD	0	3	3
94	Driscoll Children's Hospital[c]	Amy Becker, MD	0	2	2
90	St. Joseph University Medical Center[ab]	Hanan Tawadrous, MD; Roberto Jodorkovsky, MD	0	2	2
91	Tulane University[b]	Samir El-Dahr, MD	0	2	2
92	University of Louisville (Novak Center for Children's Health)[b]	Siddharth Shah, MD, Janice Sullivan, MD	0	2	2
81	State University of New York, Downstate Medical Center[b]	Anil Mongia, MD	0	1	1
		Total Number of Children who completed Visit V1a:	131	365	496

[a] No longer participating site that enrolled children in the study

[b] New site for Cohort 3 recruitment

Figure 1.2

CKiD Participating Sites

	Midwest	East Coast	Overall
# Participating sites that recruited in Cohort 1	26	22	**48**
# New participating sites that recruited in Cohort 2	0	6	**6**
# New participating sites that recruited in Cohort 3	0	9	**9**
Total # sites to ever recruit in C1, C2 or C3	26	37	**63**
# Sites no longer participating that recruited in CKiD	6	8	**14**
# Active Participating Sites as of 5/2024*	**20**	**29**	**49**

* active sites are in the current CKiD protocol and have enrolled participants in C1, C2 or C3.

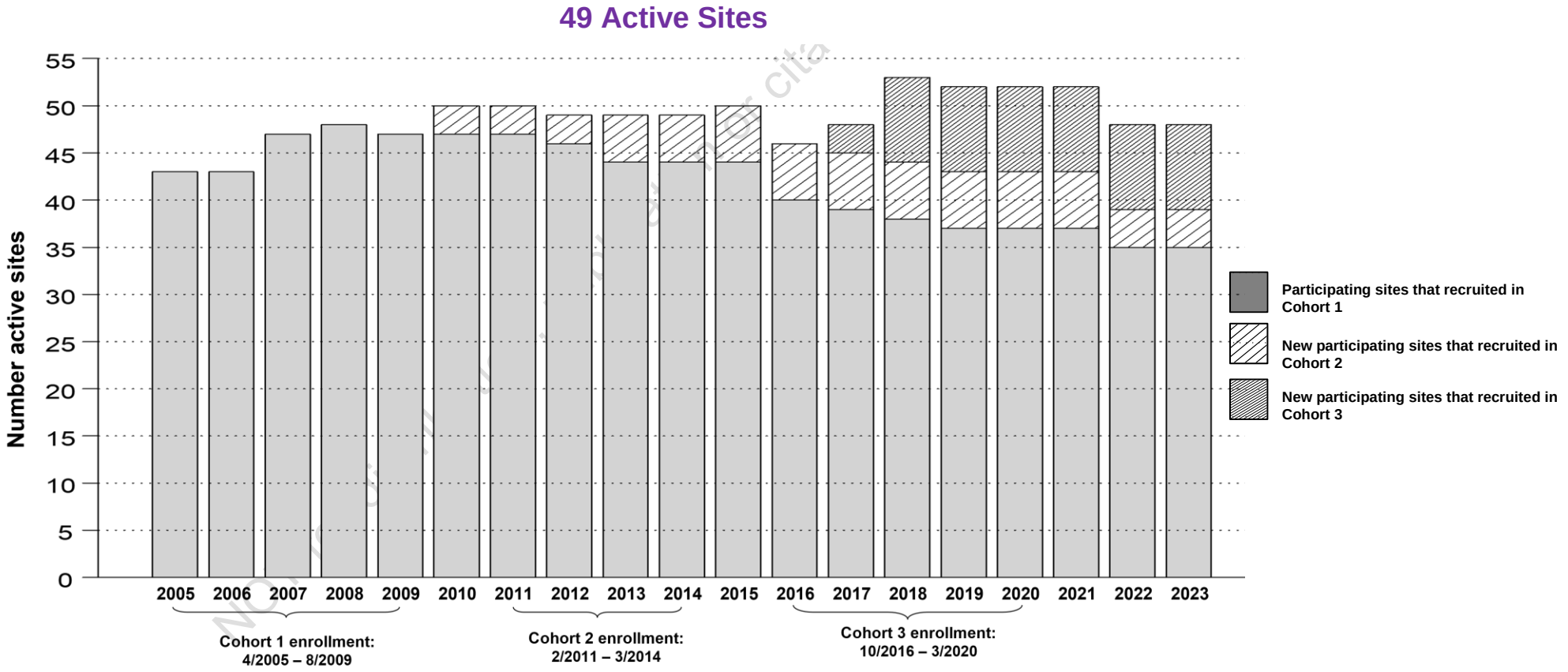
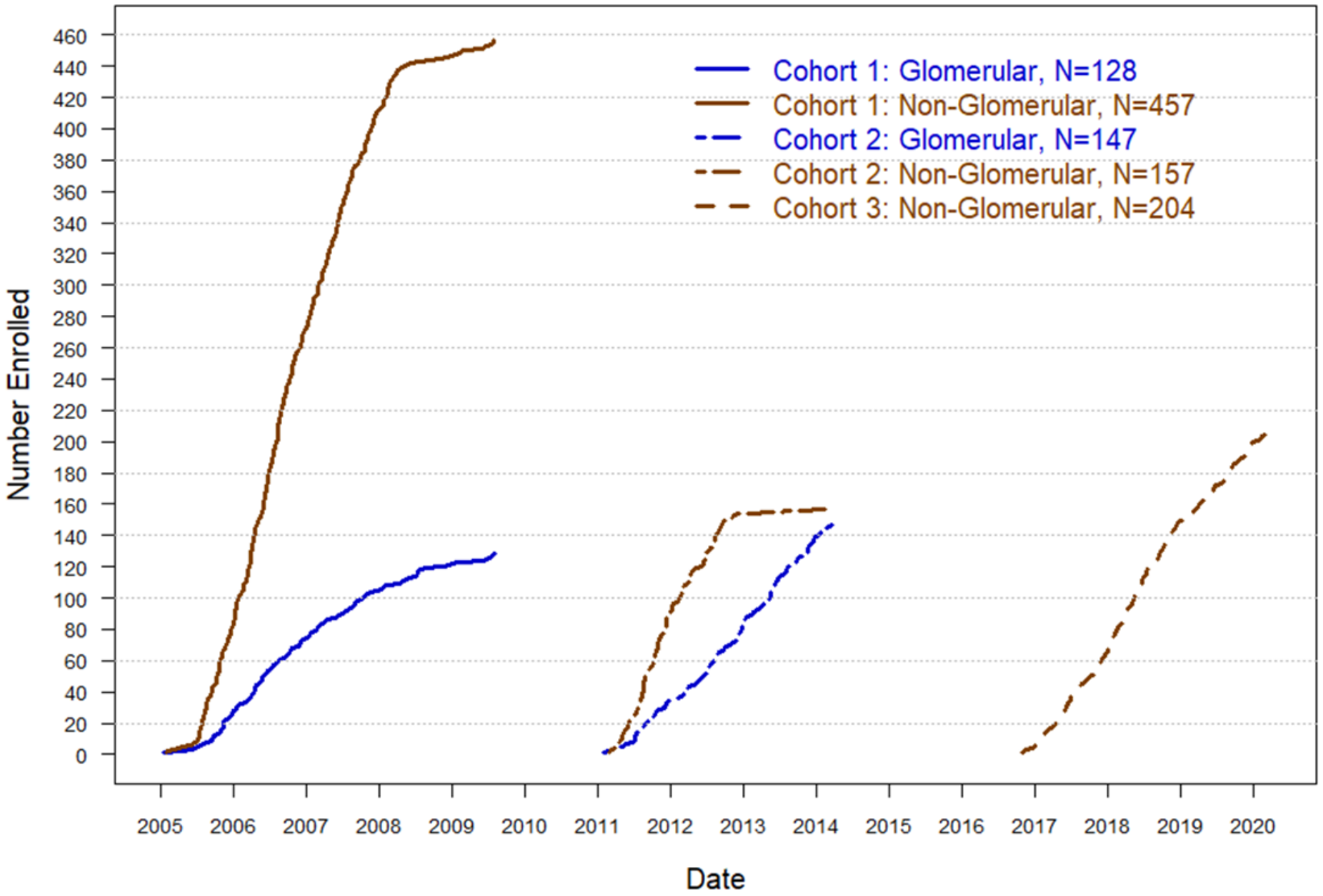


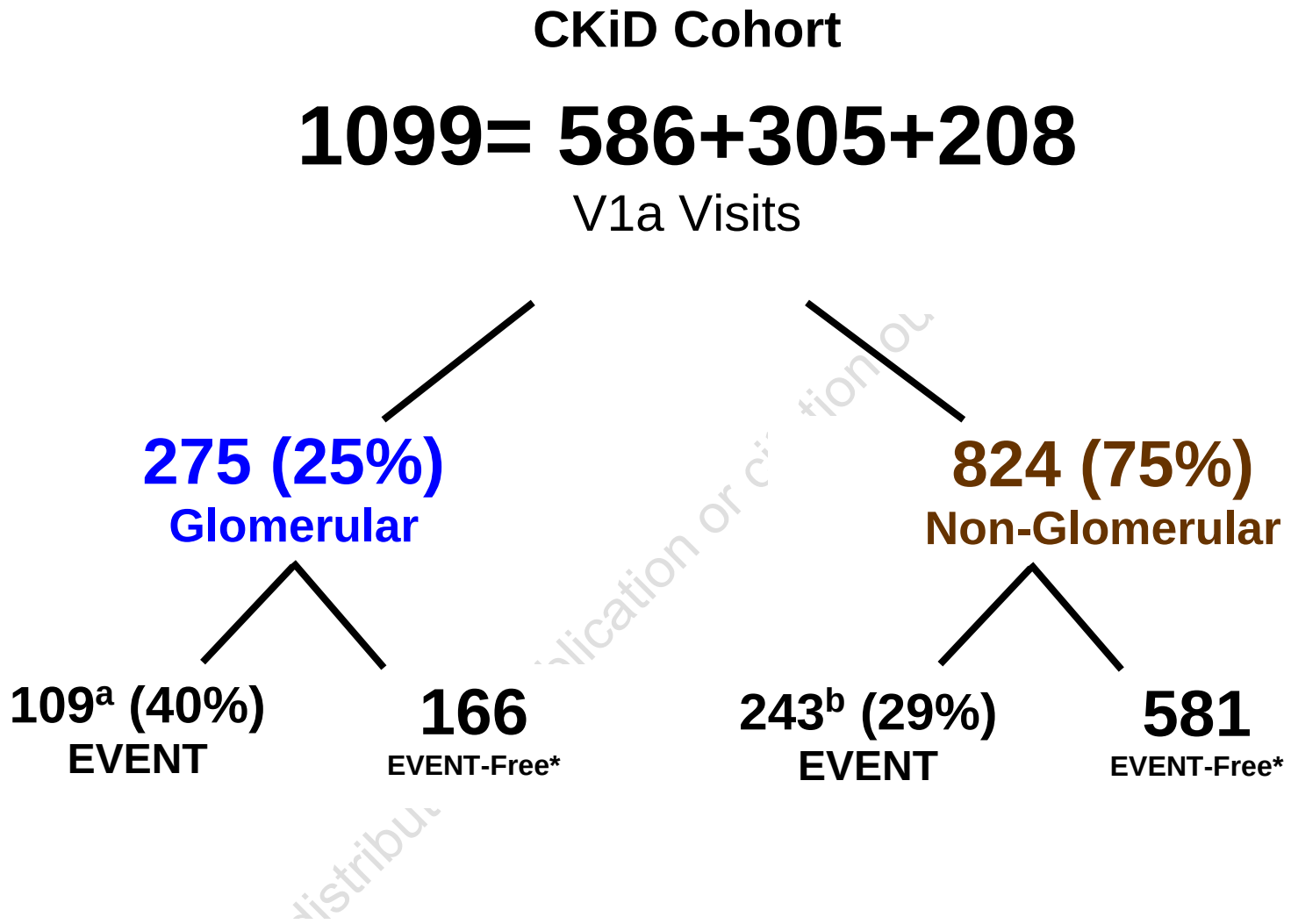
Figure 1.3

Recruitment Based on V1a Visits and at least one GFR, N=1093[a]



[a]Excludes seven (7) KIDs: 6 KIDs with missing U25eGFR; 1 with missing diagnosis and not recorded yet in KIDHIST

Figure 1.4



* Includes participants who had events after transitioning out of regular follow-up study visits for LTRFU reasons.

N=1099 (891 cohort 1 and 2 participants + 208 cohort 3 participants); excludes 1 cohort 3 participant with missing diagnosis

Table 1.3

Distribution of Chronic Kidney Disease Diagnoses, N=1099

Glomerular CKD Diagnosis	%(n) n=275	Non-Glomerular CKD Diagnosis	%(n) n=824
Focal Segmental Glomerulosclerosis	29% (79)	*Aplastic/Hypoplastic/Dysplastic Kidneys*	*25% (203)*
Hemolytic Uremic Syndrome	19% (52)	*Obstructive Uropathy*	*24% (197)*
Systemic Immunological Disease (including SLE)	14% (37)	*Reflux Nephropathy*	*17% (141)*
Chronic Glomerulonephritis	8% (22)	*Other*[a]	6% *(50)*
Familial Nephritis (Alport's)	7% (19)	*Congenital Urologic Disease*	*7% (56)*
IgA Nephropathy (Berger's)	6% (17)	Autosomal Recessive Polycystic Kidney Disease	5% (38)
Membranoproliferative Glomerulonephritis Type I	4% (12)	Renal Infarct	3% (27)
Henoch Schonlein Nephritis	3% (9)	Cystinosis	2% (19)
Other	3% (9)	Pyelonephritis/Interstitial Nephritis	2% (15)
Idiopathic Crescentic Glomerulonephritis	3% (7)	Perinatal Asphyxia	2% (14)
Congenital Nephrotic Syndrome	1% (4)	Medullary Cystic Disease/Juvenile Nephronophthisis	1% (12)
Membranous Nephropathy	1% (4)	*Syndrome of Agenesis of Abdominal Musculature*	*1% (11)*
Membranoproliferative Glomerulonephritis Type II	1% (3)	*Vactrel or Vacter Syndrome*	*1% (10)*
Sickle Cell Nephropathy	<1% (1)	Wilms' Tumor	1% (8)
		Autosomal Dominant Polycystic Kidney Disease	1% (7)
		Branchio-oto-Renal	1% (8)
		Methylmalonic Acidemia[b]	1% (6)
		Oxalosis	<1% (2)

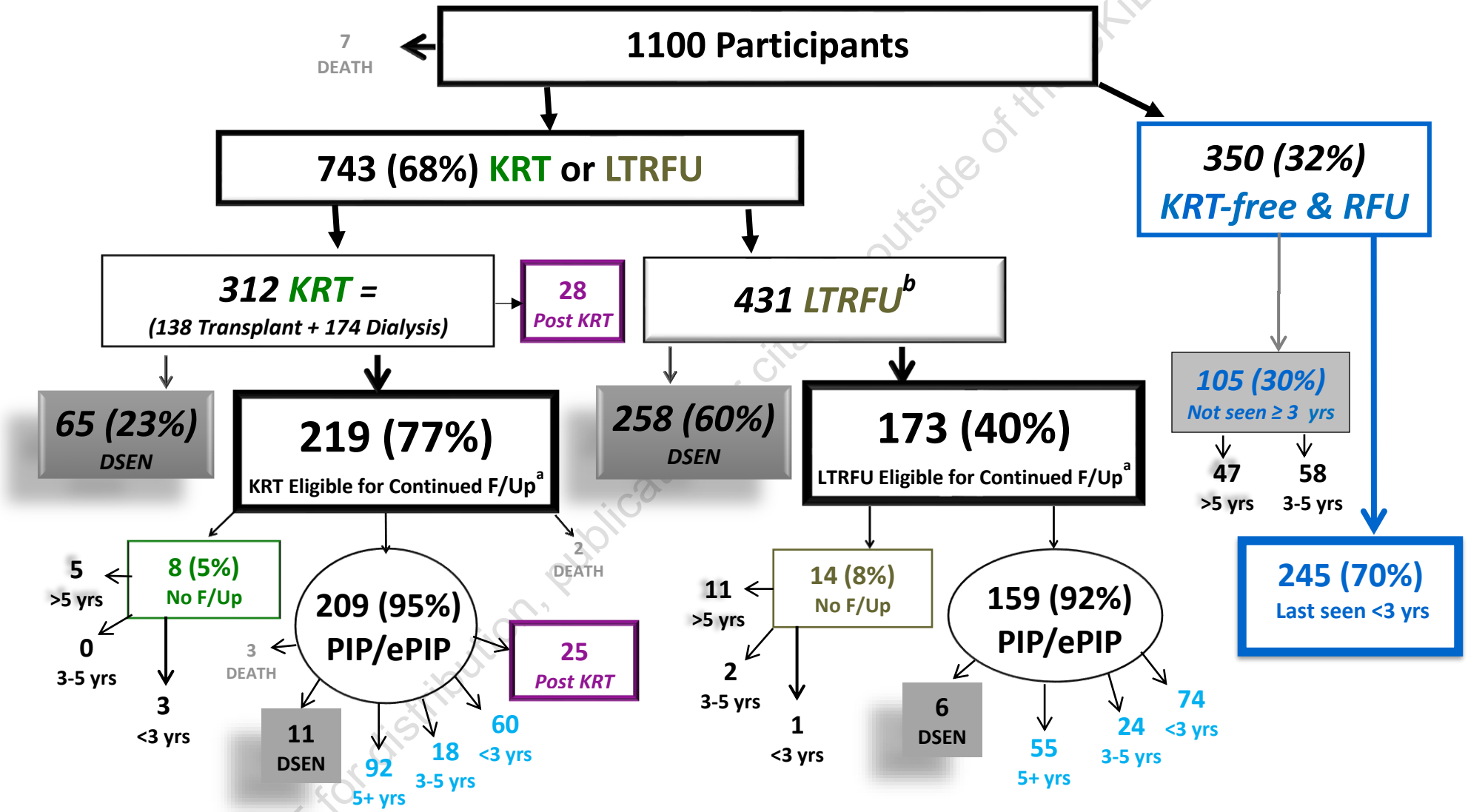
Data Source: January 2024 *Italics indicate urologic diagnosis*

[a] 28 KIDs with non-glomerular "other" primary diagnosis were classified as urologic diagnosis

[b] Methylmalonic Acidemia was added as a primary diagnosis category in May 2013

Figure 1.5

Status of Participants



[a] Eligible for PIP/ePIP excludes: deaths and participants who have declined to consent to the PIP protocol (i.e., disenrolled)
[b] Participant no longer completing regular study/documented TRS form indicating family's decision to stop completing study visits, stie unable to follow-up or pregnancy

DSEN = [65 + 11 + 258 + 6] + [7 + 3 + 2] = [340 + 12] = **352**
deaths

PIP = [60 + 18 + 92] + [97 + 24 + 55] = [170 + 153] = **323**

Post KRT = [28 + 25] = **53**

Table 1.4

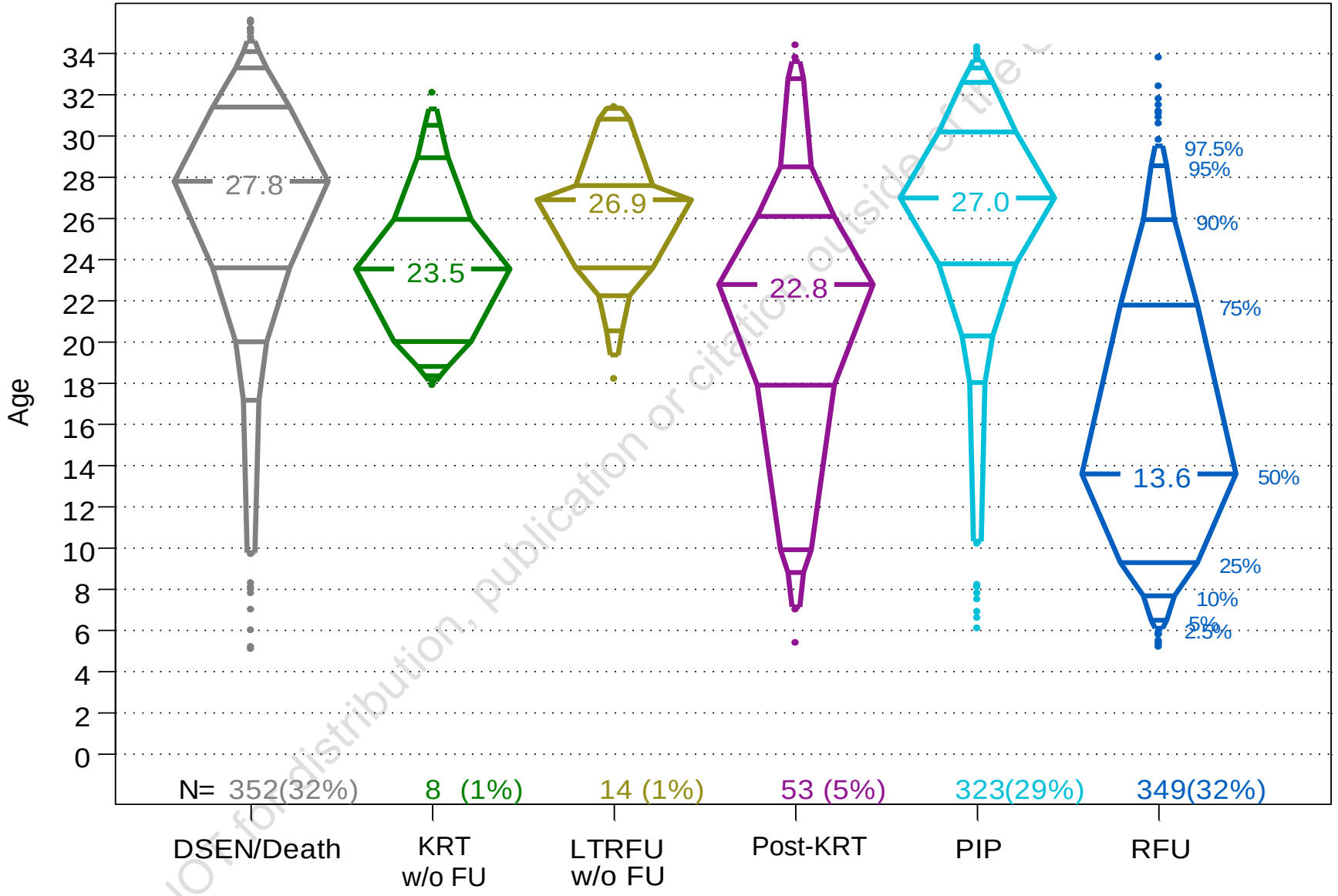
Sociodemographic and Clinical Characteristics by Status of Participants[a]

Characteristic	Median [IQR] or % (n)							
	KRT (n=307)				LTRFU (n=431)			RFU (n=350)
	DSEN (n=76)	No F/Up (n=8)	PIP (n=170)	Post KRT (n=53)	DSEN (n=264)	No F/Up (n=14)	PIP (n=153)	
Male	71% (54)	75% (6)	59% (101)	60% (32)	61% (161)	86% (12)	58% (88)	68% (237)
African American	38% (29)	38% (3)	23% (39)	9% (5)	25% (66)	21% (3)	21% (32)	19% (66)
Income < 36K	45% (33)	75% (6)	49% (81)	33% (17)	39% (100)	15% (2)	36% (54)	37% (122)
Glomerular	36% (27)	50% (4)	31% (53)	25% (13)	25% (66)	29% (4)	32% (49)	16% (55)
Midwest	47% (36)	50% (4)	61% (103)	57% (30)	55% (145)	64% (9)	59% (91)	51% (179)
U25eGFR annualized ratio	0.82 [0.69, 0.89]	0.91 [0.84, 0.95]	0.84 [0.74, 0.91]	0.90* [0.78, 0.94]	0.98 [0.93, 1.01]	0.99 [0.96, 1.00]	0.97 [0.93, 1.00]	0.99 [0.96, 1.01]
Age at baseline, years	12.8 [9.6, 14.7]	10.6 [3.3, 13.3]	10.9 [8.1, 14.0]	7.1 [4.1, 12.2]	11.3 [7.9, 14.9]	15.1 [8.4, 15.5]	13.3 [9.1, 15.7]	4.8 [3.0, 8.6]
Years in CKiD[b]	2.8 [1.1, 4.5]	7.0 [5.7, 9.3]	3.3 [1.3, 6.1]	6.8 [3.4, 11.6]	3.6 [1.3, 6.0]	6.3 [4.9, 10.6]	4.9 [3.0, 7.1]	6.1 [3.8, 10.3]
Age as of 01/01/23, years	29.5 [26.3, 31.9]	23.5 [19.8, 26.5]	26.9 [23.9, 30.0]	22.7 [17.9, 26.1]	26.8 [22.9, 30.6]	26.9 [23.3, 27.6]	27.2 [23.3, 30.4]	13.5 [9.3, 21.8]
Years from last CKiD visit | PIP to 01/01/23	13.6 [8.8, 15.5]	6.3 [1.6, 7.5]	5.4 [1.4, 7.8]	1.0 [0.6, 2.1]	10.3 [7.1, 13.9]	6.7 [5.4, 8.0]	3.0 [0.9, 6.3]	1.4 [0.6, 3.4]
Age at first PIP, years	N/A	N/A	16.8 [15.1, 19.2]	N/A	N/A	N/A	20.0 [16.8, 22.3]	N/A
Years from last CKiD visit to first PIP | first Post RRT	N/A	N/A	1.6 [1.0, 3.2]	1.8 [0.5, 5.0]	N/A	N/A	1.6 [1.1, 2.5]	N/A

[a]Excludes (12) twelve deaths [b] From baseline to last regular/irregular visit *53 KIDs with completed post-KRT visits

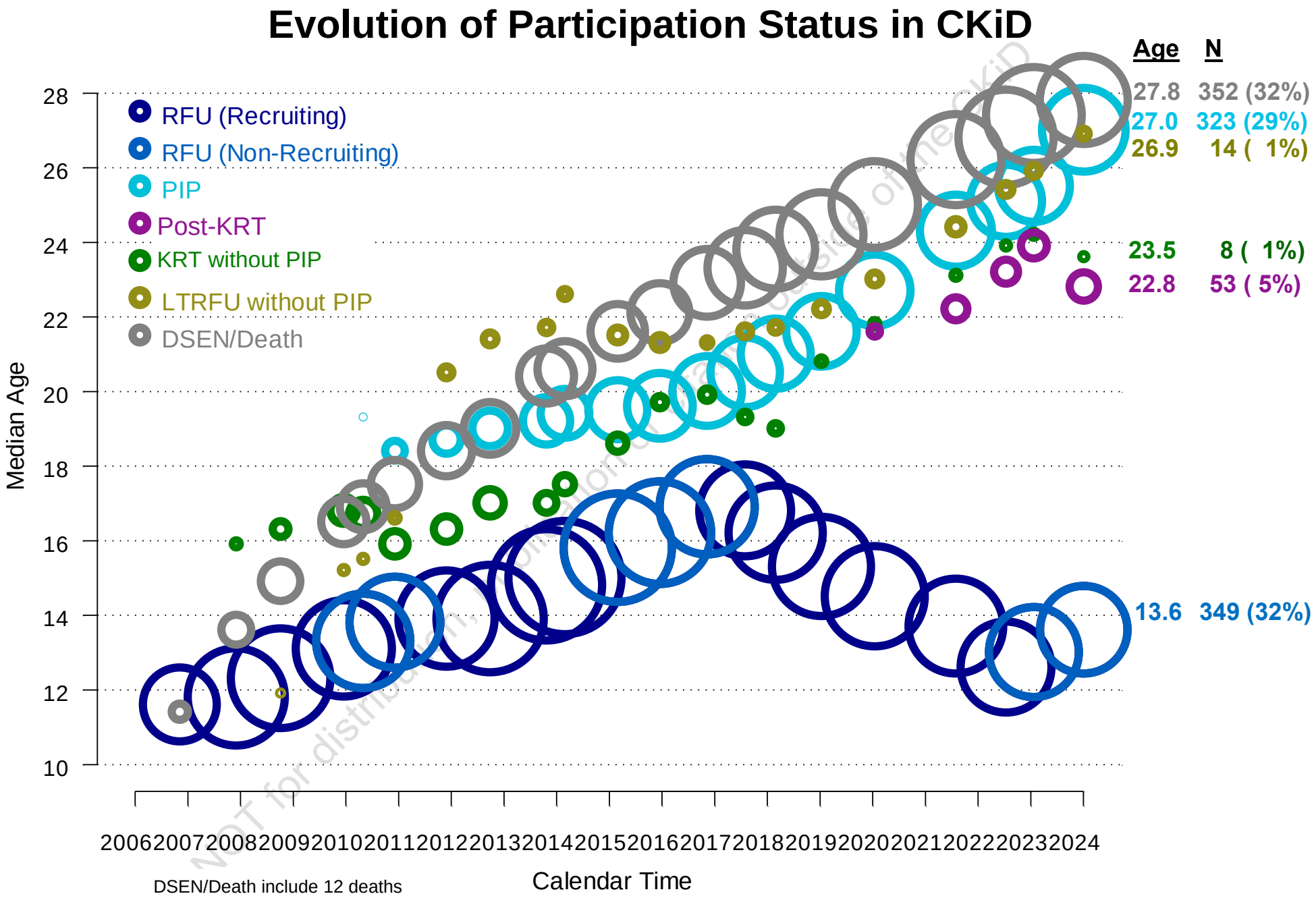
Figure 1.7a

Current Age (as of 01/24) by Participant Study Status, N=1099*



66% are in active follow-up (Post KRT, PIP + RFU); Median=9.45 years of follow-up. DSEN/Death include 12 deaths
*N=1099, excludes 1 cohort 3 participant with missing diagnosis

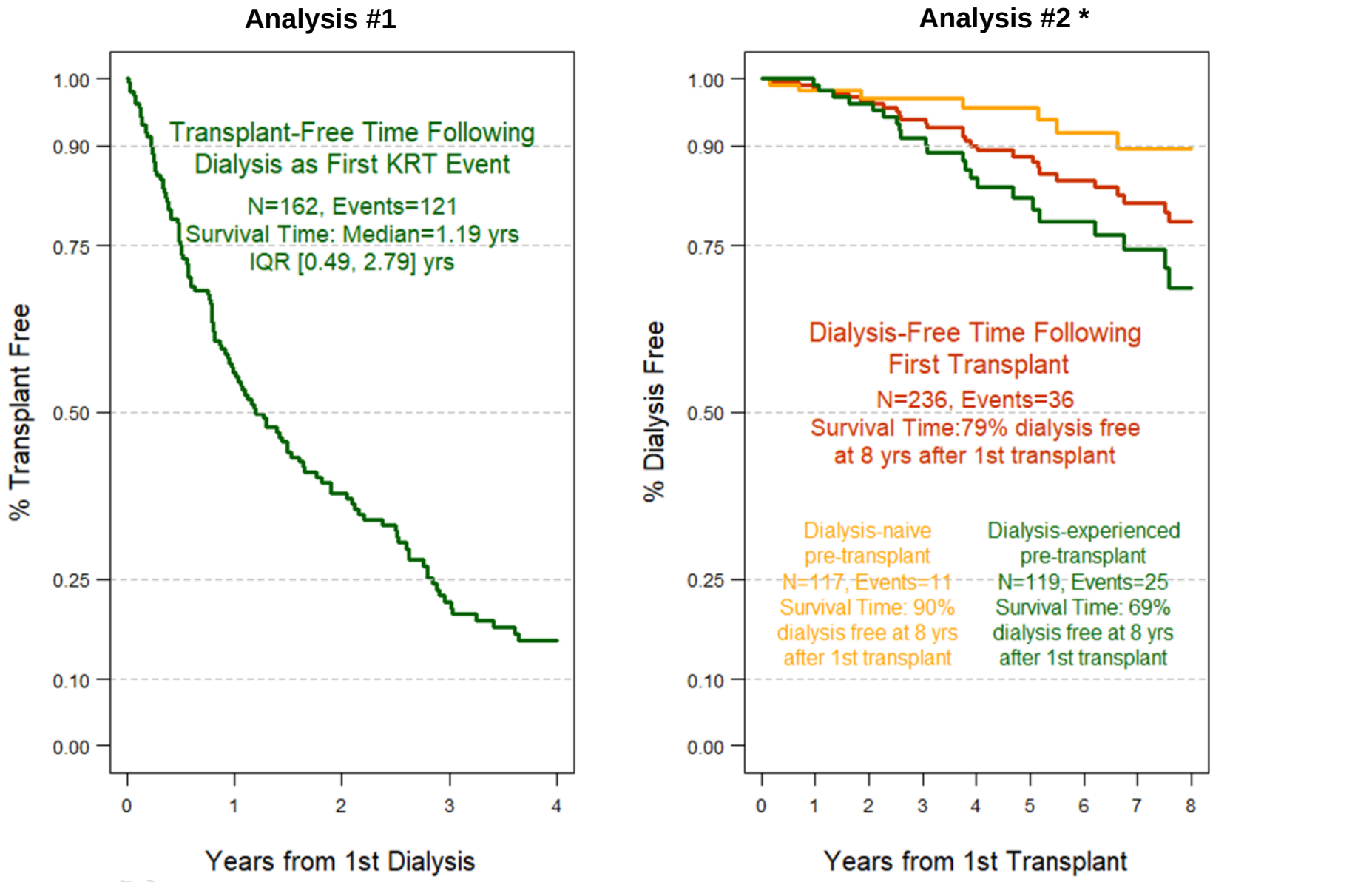
Figure 1.7b



DSEN/Death include 12 deaths

Figure 1.10

Transplant-free time after Dialysis and Dialysis-free time after Transplant



Atkinson MA et al. Mode of initial renal replacement therapy and transplant outcomes in the chronic kidney disease in children (CKiD) study. Pediatr Nephrol 2019

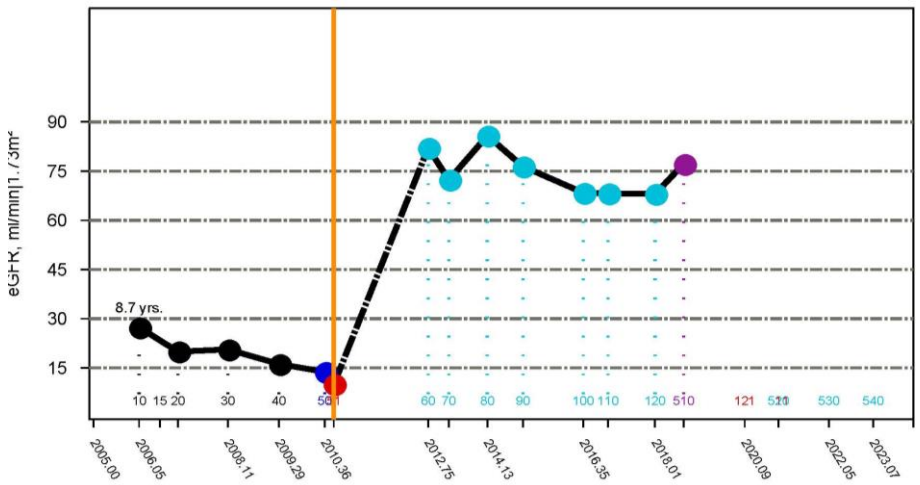
* Dialysis-free time following first transplant is shown overall (red-orange line) and stratified by pre-transplant KRT experience: dialysis-naïve (yellow line) and dialysis-experienced (green line).

Figure 1.12

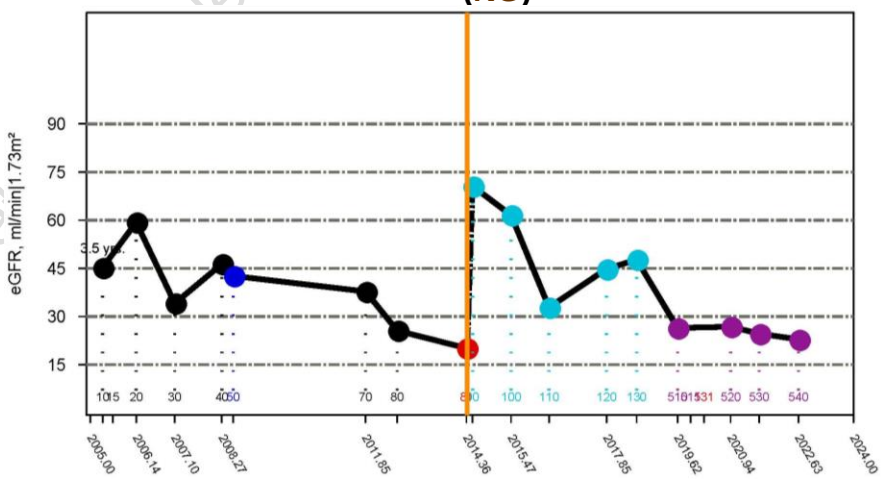
Complementary Data Provided by Continued Follow-up

Examples of Participants with PIP and Post KRT Visits

(G)

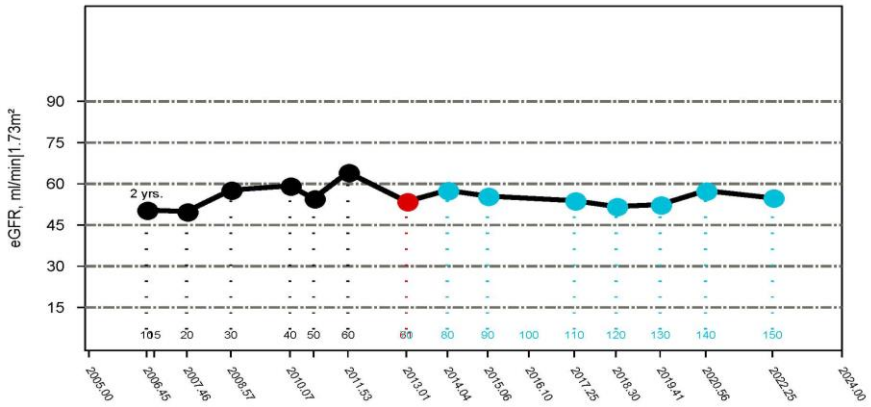


(NG)

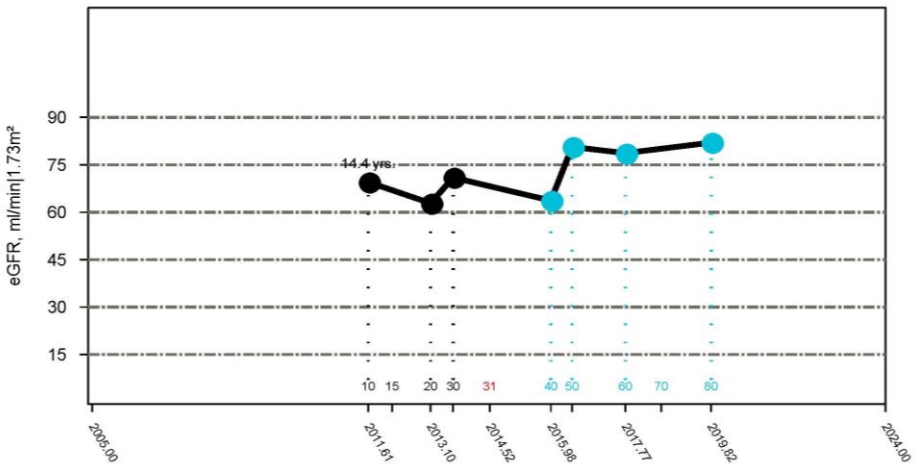


Examples of LTRFU Individuals with Stable GFR

(NG)

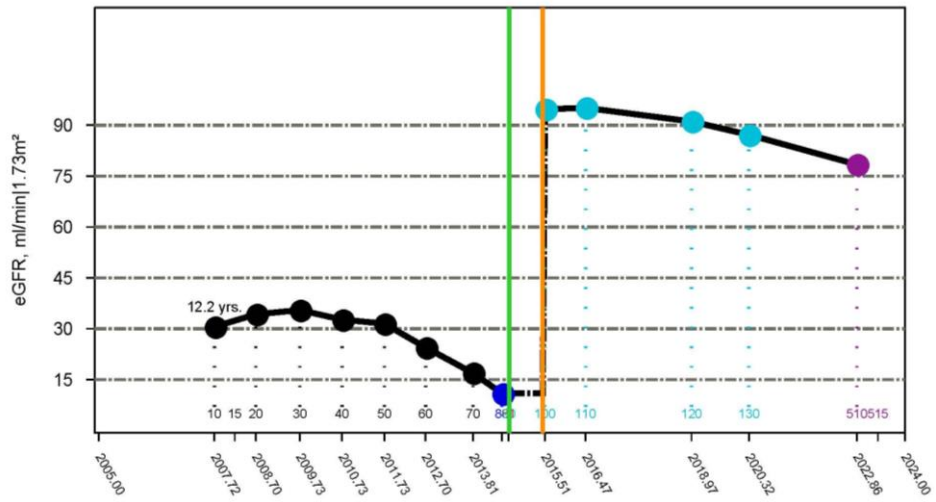


(NG)

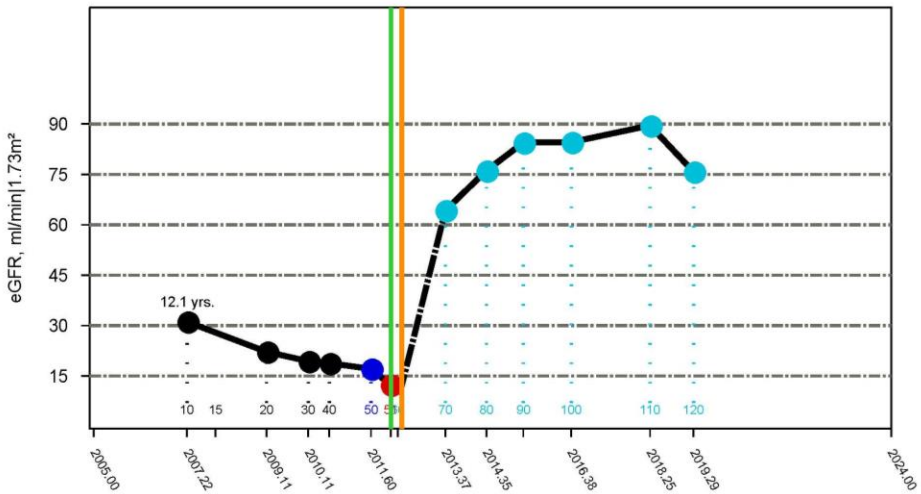


Examples of Participants with Good Response after Transplant

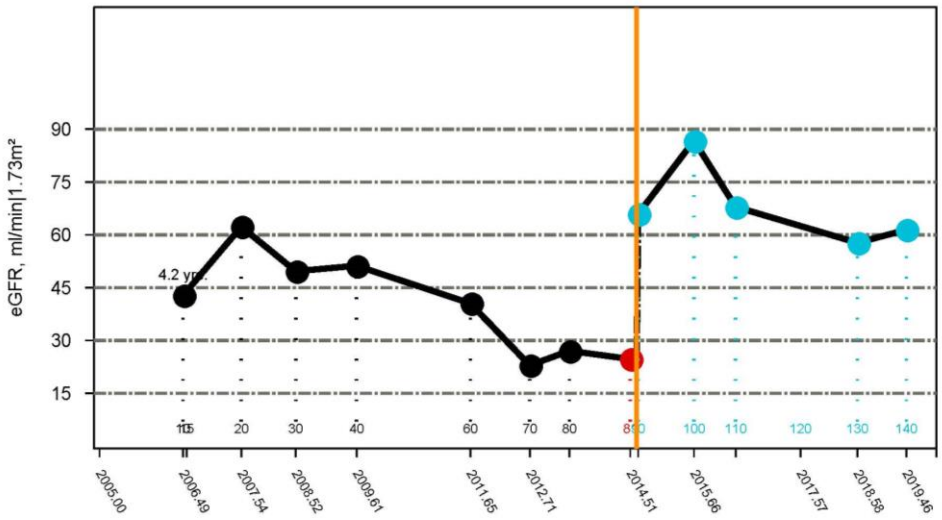
(G)



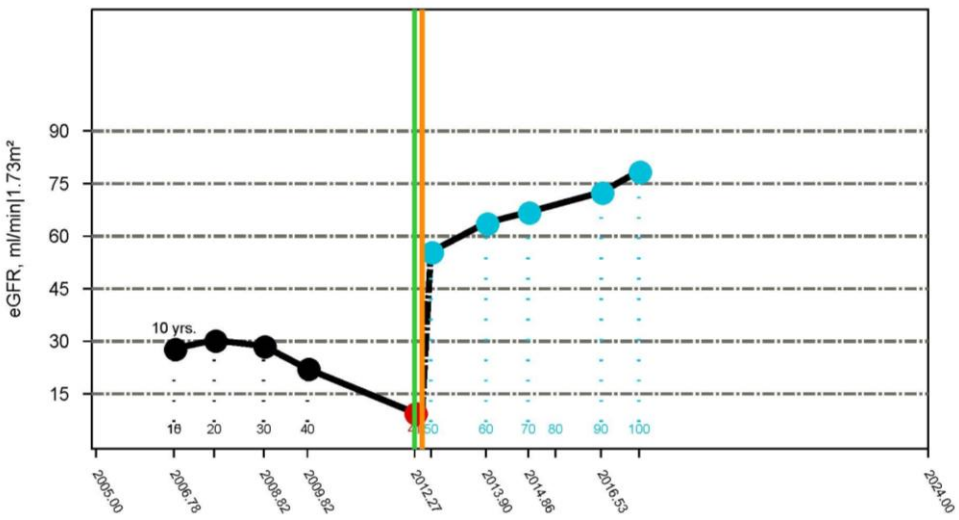
(NG)



(NG)

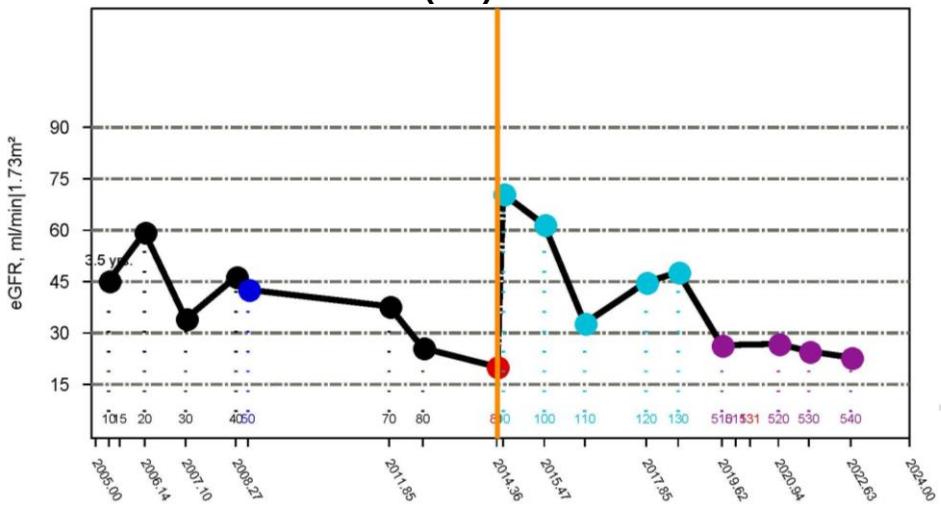


(NG)

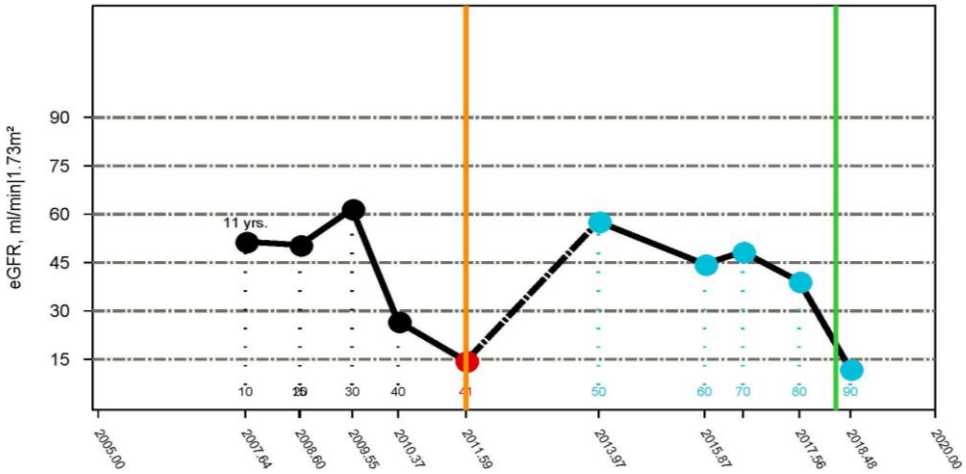


Examples of Participants with Good Response after Transplant, but then subsequent decline

(NG)

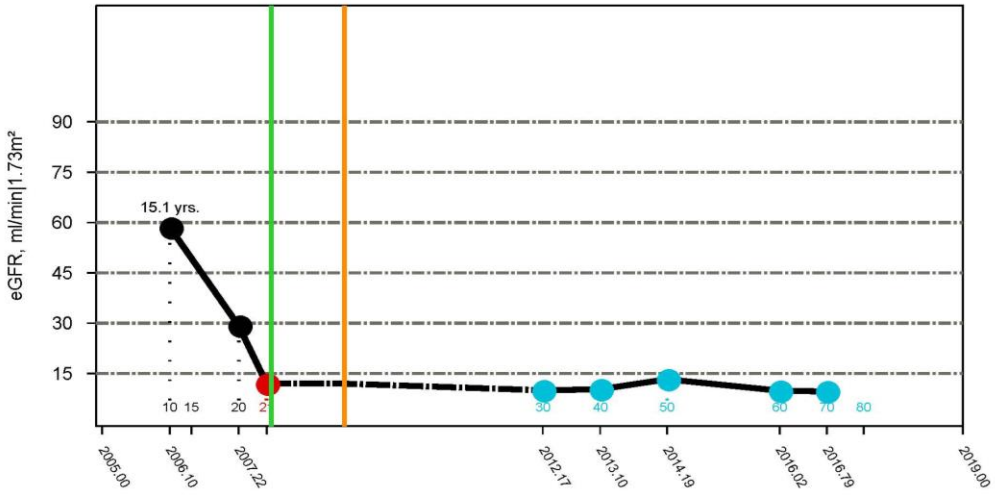


(NG)



Examples of Participants with No Response after Transplant

(NG)



(NG)

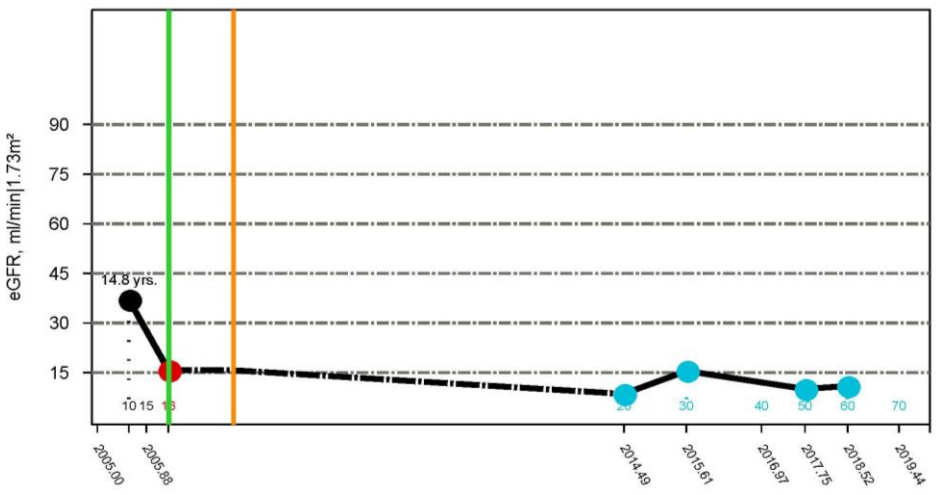
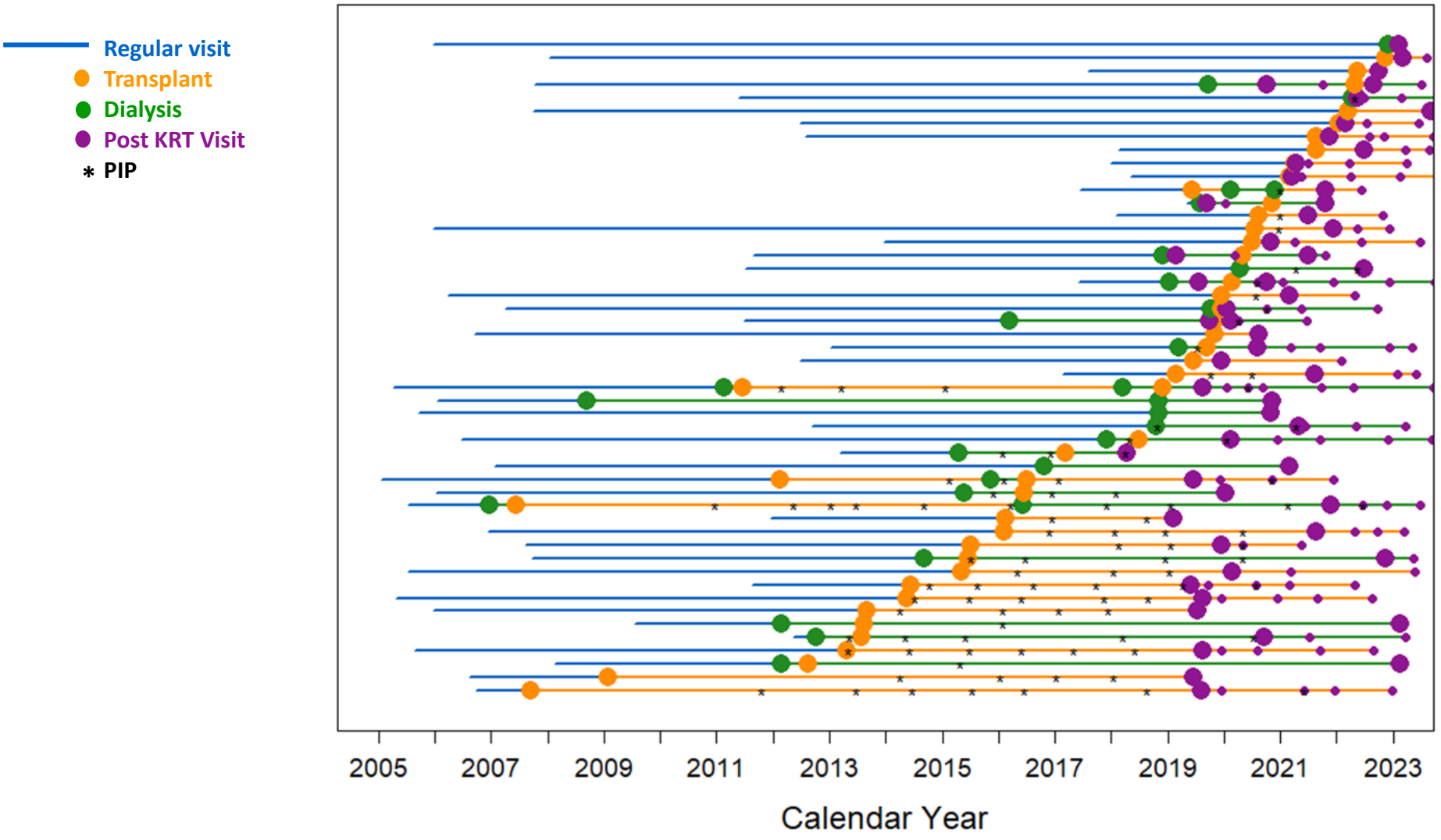


Figure 1.13

Years in CKiD among Participants with Post KRT Study Visits, N=50



Median [IQR] Years from baseline visit to first post-KRT= 12.8 [7.5, 14.4]
Median [IQR] Years from last KRT event to first post KRT visit= 2.3 [0.5, 5.5]

Section 2:

COHORT CHARACTERISTICS

(1099 participants with baseline visits)

(Glomerular: N=275 and Non-Glomerular: N=824)

(Analysis as of January 2024)

This section describes diagnostic characteristics (glomerular vs. non-glomerular), comorbid conditions, biomarker patterns, and medication use in the cohort at baseline and over time.

Analytical notes:

- The Ns represented in the table are composed of individuals for whom data is available at the given visit, regardless of whether the individual completed a past visit.
- Annual % change is calculated by regressing a line through all log-transformed data points across time for each individual. The slope is then exponentiated to obtain the annual % change.
- "Ever Resolved" is calculated based on the number of children who had a condition at baseline, but the condition disappeared at some follow-up visit.
- "Ever Developed" is calculated based on the number of children who did not have a condition at baseline, but the condition appeared at some follow-up visit.
- Both "Ever Resolved" and "Ever Developed" percentages are based only on subjects who have follow-up data available for the given condition.

Table 2.1a

CKiD Baseline Characteristics (Median or %) of CKiD Cohort

	G N=275	Non-G N=824	Overall N=1099
Demographics			
Male	53%	67%	64%
African-American	31%	19%	22%
Hispanic Ethnicity	16%	14%	14%
Income ≤ $36K	41%	39%	40%
Maternal Education, years	13	14	14
Age, years	14	8	10
Kidney Progression			
Age at CKD onset, years	8.5	0.0	0.0
Years since CKD onset	3.5	7.3	6.0
Age at CKD awareness, years	8.5	<0.1	0.6
SCr (Enzymatic), mg/dL	1.1	1.0	1.0
Cystatin C (IFCC), mg/L	1.4	1.7	1.6
Urine protein:creatinine (uP/C)	0.7	0.3	0.4
iGFRc, ml/min/1.73m^2	59	46	49
U25eGFR, ml/min/1.73m^2	57	47	50
Cardiovascular			
Stage 1 or 2 Hypertension	23%	29%	28%
Self- Reported Hypertension	56%	40%	44%
Left Ventricular Hypertrophy[a]	15%	10%	11%
Neurocognitive			
IQ	96	98	98
Parent Overall QOL	76	79	78
Child Overall QOL	79	77	78
Growth			
Premature (Gestational Age< 36 weeks)	9%	14%	13%
Low Birth Weight (< 2500 grams)	15%	20%	19%
Small for Gestational Age	21%	17%	18%
ICU Treatment after Delivery	16%	52%	43%
Height Percentile – 50	-9	-24	-21
Weight Percentile – 50	+23	-11	-2
BMI Percentile – 50	+32	+13	+18

[a] Baseline data collected at Visit 2

Table 2.1b

Characteristics (Median or %) of CKiD Cohort Observed at Age ≥ 16

	First visit age<16 (N=441)	First visit age≥16 (N=542)	Latest visit (N=542)
Demographics			
Male	61%	60%	60%
African-American	20%	20%	20%
Hispanic Ethnicity	12%	13%	13%
Income ≤ $36K	37%	33%	33%
Maternal Education, years	14	14	14
Age, years	13	16	19
Kidney Progression			
Glomerular diagnosis	30%	34%	34%
Age at CKD onset, years	0.0	0.0	0.0
Years since CKD onset	9.2	16.2	17.7
Age at CKD awareness, years	2.5	3.5	3.5
SCr (Enzymatic), mg/dL	1.0	1.6	2.0
Cystatin C (IFCC), mg/L	1.6	1.7	1.8
Urine protein:creatinine (uP/C)	0.3	0.4	0.7
iGFRc, ml/min/1.73m^2	50	47	42
U25eGFR, ml/min/1.73m^2	53	47	39
Cardiovascular			
Stage 1 or 2 Hypertension	23%	22%	32%
Self- Reported Hypertension	52%	46%	44%
Left Ventricular Hypertrophy[a]	8%	10%	10%
Neurocognitive			
IQ	99	99	101
Parent Overall QOL	78	79	80
Child Overall QOL	78	83	84
Growth			
Premature (Gestational Age< 36 weeks)	11%	10%	10%
Low Birth Weight (< 2500 grams)	18%	17%	17%
Small for Gestational Age	19%	18%	18%
ICU Treatment after Delivery	38%	35%	35%
Height Percentile – 50	-16	-17	-16
Weight Percentile – 50	+6	+9	+6
BMI Percentile – 50	+18	+16	+14

[a] Baseline data collected at Visit 2

Table 2.2

Baseline and Annualized Percentage Change in Kidney Function Markers

Variables	Median [IQR]			
	Glomerular		Non-Glomerular	
	Baseline n=275	% Change	Baseline n=824	% Change
iGFRc, ml/min|1.73m^2	59 [40, 80]	-5% [-13%, 1%]	46 [35, 60]	-4% [-9%, 0%]
U25eGFR, ml/min|1.73m^2	57 [41, 74]	-6% [-13%, -1%]	47 [34, 62]	-3% [-8%, 0%]
Ht/SCr (Enzymatic), m/mg/dL	1.5 [1.1, 1.9]	-8% [-18%, -2%]	1.2 [0.9, 1.6]	-5% [-11%, -2%]
SCr (Enzymatic) , mg/dL	1.1 [0.8, 1.5]	10% [4%, 24%]	1.0 [0.7, 1.4]	9% [5%, 16%]
Cystatin C (Siemens Healthcare), mg/L	1.4 [1.1, 2.0]	4% [0%, 12%]	1.7 [1.3, 2.3]	2% [-1%, 7%]
Urine creatinine, mg/dL	74 [50, 108]	1% [-8%, 9%]	37 [24, 57]	5% [0%, 10%]
Urine protein, mg/dL	59 [17, 158]	8% [-8%, 33%]	11 [6, 25]	11% [-2%, 30%]
Urine protein:creatinine (uP/C)	0.7 [0.2, 2.0]	6% [-9%, 33%]	0.3 [0.1, 0.8]	7% [-6%, 23%]

Data Source: 5Jan24 gfrsummary

Table 2.3

Mixed Model-Derived Estimated Percentage Change in GFR across all pre-KRT follow-up (including PIP and ePIP data)

GFR measure	Glomerular			Non-Glomerular		
	N (p-v)	Estimate	95% CI	N (p-v)	Estimate	95% CI
iGFRc	271 (721)	-7.8%	(-9.7, -5.9)	682 (2190)	-4.6%	(-5.2, -4.0)
U25eGFR	275 (1434)	-10.0%	(-11.6, -8.3)	823 (5008)	-4.8%	(-5.3, -4.3)

Table 2.4b

Laboratory Markers, Baseline and Current [09/2022-01/2024]

Variables	% (n) Glomerular Baseline n=275	Glomerular 09/2022-01/2024 n=23	Non-Glomerular Baseline n=824	Non-Glomerular 09/2022-01/2024 n=139
Nephrotic Proteinuria, uP/C>2	24% (66)	4% (1)	8% (66)	2% (3)
Hypoalbuminemia, Serum albumin < 4 g/dL	35% (95)	30% (7)	6% (46)	2% (3)
Anemia				
HGB < 5th %ile[a]	37% (102)	39% (9)	19% (155)	19% (27)
HGB < 5th %ile or current use of ESA	42% (115)	39% (9)	24% (195)	19% (27)
Calcium[b]				
abnormal low	30% (83)	9% (2)	13% (110)	5% (7)
abnormal high	1% (3)	0% (0)	3% (26)	7% (9)
Phosphate[b]				
abnormal low	4% (11)	0% (0)	11% (90)	4% (5)
abnormal high	23% (63)	13% (3)	9% (76)	4% (5)
CaXP > ULN[b]	1% (2)	0% (0)	3% (22)	1% (2)
CRP, >3.0 mg/L[c]	18% (44)	17% (1)	17% (119)	26% (11)
Acidosis, CO_2 < 20 mmol/L	11% (31)	9% (2)	16% (129)	7% (10)

Data Source: January 2024

[a] Based on CDC (2005) age-, sex- and race-specific values.

[b] Based on K/DOQI age-specific lower and upper limits of normal:
Calcium (mg/dL) low if <9.4 (ages 1-12), <8.8 (ages 13+)
Calcium (mg/dL) high if >10.8 (ages 1-5), >10.3 (ages 6-12), >10.2 (ages 13+)
Phosphate (mg/dL) low if <4.5 (ages 1-5), <3.6 (ages 6-12), <2.3 (ages 13+)
Phosphate (mg/dL) high if >6.5 (ages 1-5), >5.8 (ages 6-12), >4.5 (ages 13+)

[c] CRP baseline measurement at V1b. Glomerular, N = 244 (31 missing); Non-Glomerular, N = 696 (128 missing); Follow-up measurements at V3, V7, V9, V11, V13, V15, V17, N = 48 (29 missing data)

Table 2.4c

Laboratory Markers, Baseline and Transitions

Variables	% (n)					
	Glomerular			Non-Glomerular		
	Baseline n=275	Ever Resolved	Ever Developed	Baseline n=824	Ever Resolved	Ever Developed
Nephrotic Proteinuria, uP/C>2	24% (66)	29% (19)	27% (53)	8% (66)	39% (26)	19% (128)
Hypoalbuminemia, Serum albumin < 4 g/dL	35% (95)	40% (38)	35% (62)	6% (46)	70% (32)	18% (134)
Anemia						
HGB < 5th %ile[a]	37% (102)	42% (43)	44% (75)	19% (155)	50% (77)	37% (237)
HGB < 5th %ile or current use of ESA	42% (115)	34% (39)	42% (67)	24% (195)	32% (63)	36% (215)
Calcium[b]						
abnormal low	30% (83)	55% (46)	33% (62)	13% (110)	86% (95)	31% (207)
abnormal high	1% (3)	67% (2)	6% (16)	3% (26)	85% (22)	14% (109)
Phosphate[b]						
abnormal low	4% (11)	100% (11)	4% (10)	11% (90)	88% (79)	11% (77)
abnormal high	23% (63)	57% (36)	37% (77)	9% (76)	68% (52)	40% (282)
CaXP > ULN[b]	1% (2)	100% (2)	10% (26)	3% (22)	86% (19)	11% (85)
CRP, >3.0 mg/L[c]	18% (43)	42% (18)	17% (34)	17% (119)	64% (76)	21% (121)
Acidosis, CO_2 < 20 mmol/L	11% (31)	58% (18)	19% (47)	16% (129)	78% (101)	28% (193)

Data Source: January 2024

[a] Based on CDC (2005) age-, sex- and race-specific values.

[b] Based on K/DOQI age-specific lower and upper limits of normal:
Calcium (mg/dL) low if <9.4 (ages 1-12), <8.8 (ages 13+)
Calcium (mg/dL) high if >10.8 (ages 1-5), >10.3 (ages 6-12), >10.2 (ages 13+)
Phosphate (mg/dL) low if <4.5 (ages 1-5), <3.6 (ages 6-12), <2.3 (ages 13+)
Phosphate (mg/dL) high if >6.5 (ages 1-5), >5.8 (ages 6-12), >4.5 (ages 13+)

[c] CRP baseline measurement at V1b. Glomerular, N = 244 (31 missing); Non-Glomerular, N = 696 (128 missing); Follow-up measurements at V3, V7, V9, V11, V13, V15, V17 N = 48 (29 missing data)

Table 2.7

Self-Reported Healthcare Utilization, Baseline and Current [09/2022-01/2024]

Variables[a]	% (n) Glomerular Baseline n=275	Glomerular 09/2022-01/2024 n=23*	Non-Glomerular Baseline n=824	Non-Glomerular 09/2022-01/2024 n=139*
Dental	76% (206)	73% (11)	71% (580)	85% (105)
Private Doctor's Office	72% (197)	47% (7)	71% (584)	50% (62)
Clinic or Health Care Center	66% (181)	67% (10)	69% (562)	59% (73)
Hospital Outpatient Department	62% (168)	27% (4)	61% (496)	50% (62)
Emergency Room	47% (128)	27% (4)	44% (353)	29% (35)
Hospitalization	37% (101)	7% (1)	27% (219)	9% (11)
Nutritionist	36% (99)	7% (1)	43% (348)	31% (38)
Mental Health Professional	20% (54)	33% (5)	13% (105)	25% (31)
Social Worker / Case manager	18% (50)	13% (2)	19% (154)	16% (20)
Food Assistance	17% (47)	7% (1)	22% (178)	12% (15)
Other	7% (18)	20% (3)	6% (43)	6% (6)
Social Services Housing Assistance	2% (6)	0% (0)	1% (8)	0% (0)

Data Source: January 2024

[a] Defined as ever for V1a and within the last year for follow-up visits

*Data not collected at PIP follow-up visits

Table 2.8a

Self-Reported Medication Use for Management of CKD-Specific Complications, Baseline and Current [09/2022-01/2024]

Variables	% (n)			
	Glomerular		Non-Glomerular	
	Baseline n=275	09/2022-01/2024* n=23	Baseline n=824	09/2022-01/2024* n=176
Antihypertensives	92% (252)	57% (13)	48% (394)	50% (70)
ACE-Inhibitors	73% (200)	39% (9)	33% (275)	30% (42)
ARBs	25% (68)	13% (3)	5% (41)	4% (5)
Calcium Channel Blockers	18% (50)	4% (1)	13% (104)	12% (17)
Diuretics	13% (36)	9% (2)	4% (30)	1% (1)
Iron Supplements	24% (67)	4% (1)	29% (235)	27% (37)
Vitamin and Mineral Supplements	24% (67)	9% (2)	21% (174)	18% (25)
Active Vitamin D	19% (52)	4% (1)	31% (257)	24% (33)
Inactive Vitamin D	23% (64)	35% (8)	13% (103)	24% (33)
Phosphate Binders	17% (46)	0% (0)	14% (117)	6% (9)
ESAs	11% (30)	0% (0)	9% (71)	6% (9)
Alkali Therapy	11% (29)	4% (1)	30% (248)	21% (29)
Lipid Lowering	10% (27)	13% (3)	1% (6)	1% (2)
Growth Hormones	3% (8)	0% (0)	11% (87)	4% (6)
Nutritional Supplements (caloric)	1% (2)	0% (0)	2% (19)	4% (6)
Potassium Binder	<1% (1)	0% (0)	2% (16)	2% (3)

Data Source: January 2024
*Some medication data was collected at PIP follow-up visits.

Table 2.8b

Self-Reported Medication Use for Management of CKD-Specific Complications, Baseline and Transitions

	% (n)					
	Glomerular			Non-Glomerular		
Variables	Baseline n=275	Ever Resolved	Ever Developed	Baseline n=824	Ever Resolved	Ever Developed
Antihypertensives	92% (252)	23% (57)	48% (11)	48% (394)	31% (123)	41% (177)
ACE-inhibitors	73% (200)	39% (78)	27% (20)	33% (275)	52% (143)	31% (171)
ARBs	25% (68)	50% (34)	10% (21)	5% (41)	44% (18)	4% (35)
Calcium Channel Blockers	18% (50)	38% (19)	18% (41)	13% (104)	40% (42)	14% (103)
Diuretics	13% (36)	47% (17)	11% (26)	4% (30)	57% (17)	4% (33)
Iron Supplements	24% (67)	45% (30)	20% (41)	29% (235)	48% (113)	29% (173)
Vitamin and Mineral Supplements	24% (67)	57% (38)	20% (41)	21% (174)	69% (120)	28% (181)
Active Vitamin D	19% (52)	33% (17)	21% (46)	31% (257)	34% (88)	31% (174)
Inactive Vitamin D	23% (64)	41% (26)	30% (64)	13% (103)	53% (55)	31% (220)
Phosphate Binders	17% (46)	37% (17)	16% (37)	14% (117)	41% (48)	19% (132)
ESAs	11% (30)	37% (11)	11% (27)	9% (71)	45% (32)	11% (83)
Alkali Therapy	11% (29)	28% (8)	13% (32)	30% (248)	38% (95)	23% (131)
Lipid Lowering	10% (27)	41% (11)	7% (17)	1% (6)	33% (2)	2% (20)
Growth Hormones	3% (8)	25% (2)	4% (12)	11% (87)	61% (53)	10% (76)
Nutritional Supplements (caloric)	1% (2)	50% (1)	2% (6)	2% (19)	53% (10)	4% (35)
Potassium Binder	<1% (1)	0% (0)	3% (8)	2% (16)	56% (9)	1% (10)

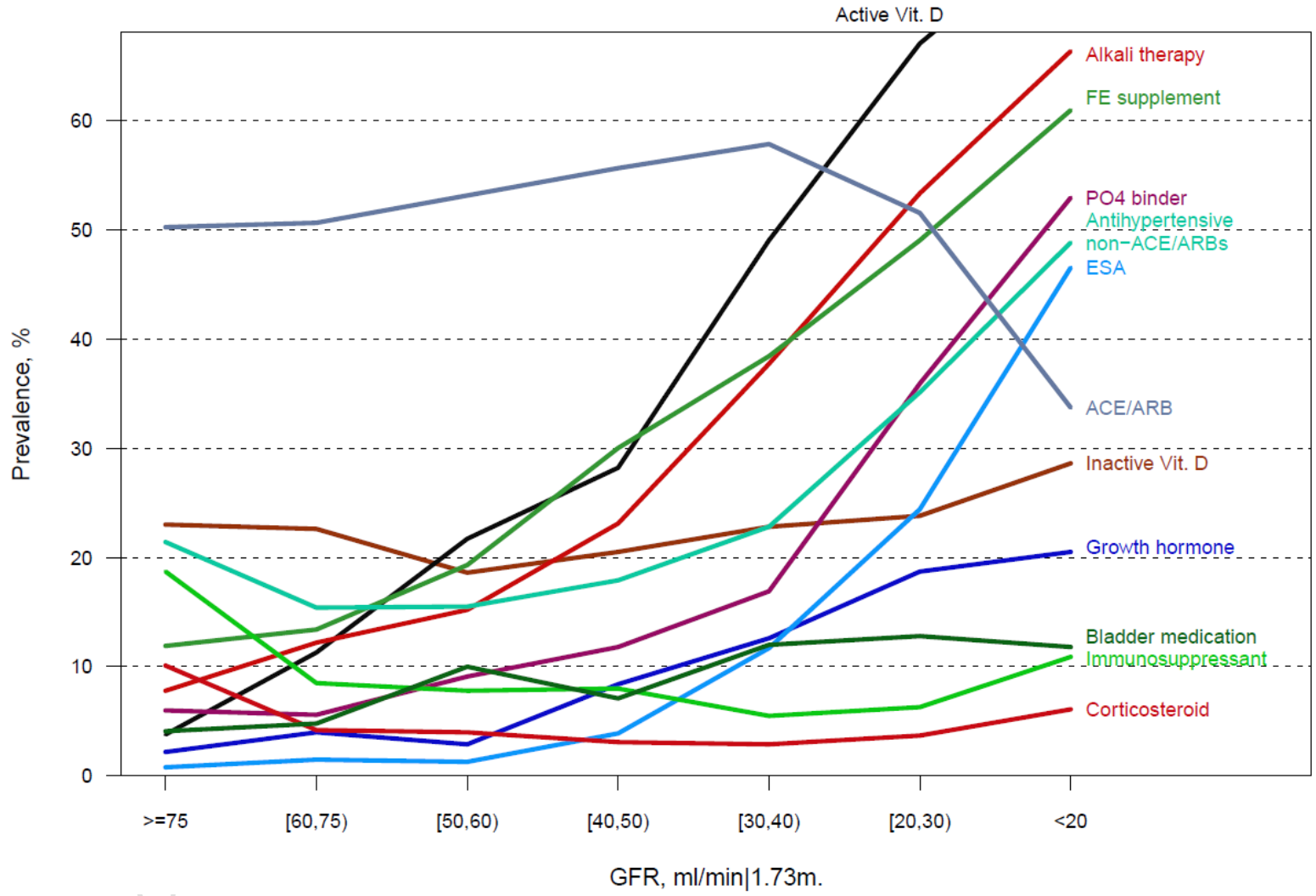
Per analytical notes, “Ever Resolved” is the number of participants who had a condition (i.e., used the medication) at baseline and had follow-up data, but the condition disappeared (i.e., did not use the medication at follow-up). In addition, “Ever Developed” is the number of did not have a condition (i.e., did not use medication) at baseline and had follow-up data, but the condition appeared (i.e., used the medication at follow-up).

Examples

- 252 participants used antihypertensive medication at baseline. Of the 218 participants *(# is not provided in table)* with follow-up data, 57 (23%) stopped using antihypertensive medication at follow-up.
- 23 participants did not use antihypertensive medication at baseline (275 - 252 = 23). Of the 23 participants *(# is not provided in table)* with follow-up data, 11 (48%) started using antihypertensive medication at follow-up.

Figure 2.2a

Prevalence of Medication Use for Management of CKD-specific Complications by GFR, N=6500[a]



[a] Medication data not collected at V1b visit. Analysis restricted to KID-visits with U25eGFR.

Immunosuppressant, n=6244 and Antihypertensive, n=6223 medication data collected at PIP follow-up visit

Table 2.10

Lack of Compliance/Adherence to Medications During the Past 30 and 7 days

Medication	N reported prescriptions[a]	% reporting missed 1+ times in past 30 days	% reporting missed 1+ times in past 7 days	Adherence[b] < 85% (past 30 days)
Phosphate Binders	1021	38% (326/853)	21% (182/879)	17% (141/813)
ACE inhibitors / ARB	3444	36% (1170/3260)	15% (482/3316)	13% (424/3227)
Inactive Vitamin D	1377	35% (415/1194)	19% (222/1187)	15% (179/1177)
Alkali Therapy	1674	33% (515/1569)	15% (249/1615)	12% (191/1541)
Growth Hormone	536	32% (158/493)	14% (71/516)	13% (61/470)
Antihypertensives	5295	32% (1592/5021)	13% (684/5117)	12% (578/4977)
Iron Supplements	1787	29% (477/1626)	14% (233/1650)	11% (177/1611)
Active Vitamin D	2016	29% (546/1879)	13% (259/1933)	12% (219/1826)
Immunosuppressants	840	28% (218/782)	11% (88/802)	12% (90/768)
Bladder Medication	578	27% (148/549)	15% (83/562)	9% (49/540)
Antibiotics	1335	22% (277/1248)	10% (125/1280)	10% (127/1237)
Corticosteroid	294	19% (52/268)	7% (19/276)	8% (22/265)
ESAs	545	12% (60/498)	4% (19/519)	8% (37/484)

[a] Numbers represent the reported prescriptions across all visits
[b] Adherence= (reported number of times taken med in last 30 days / expected number of times to take the med in the past 30 days based on frequency of dosing)*100

Table 2.11a

Missing Data in Regular Visits for Selected Variables in Children with Glomerular Diagnosis

Variable	# of Person-Visits	% (n) % with Missing Data
Intact Parathyroid Hormone (iPTH)[a]	661	6% (41)
Cystatin C IFCC[b]	1283	5% (59)
iGFRc [c]	743	8% (60)
Diastolic Blood Pressure (DBP)	1561	2% (27)
Systolic Blood Pressure (SBP)	1561	2% (25)
Lipids		
Cholesterol, mg/dL	578	2% (24)
Triglyceride, mg/dL	578	1% (8)
High Density Lipoprotein (HDL), mg/dL	578	1% (8)
SCr (Enzymatic), mg/dL	1291	2% (19)
BUN, mg/dL	1291	1% (18)
Height Percentile	1561	2% (24)
Average Height	1561	<1% (4)
Weight Percentile	1561	11% (169)
Average Weight	1561	<1% (4)
CKD Diagnosis	275	0% (0)

Data Source: January 2024

[a] Data for visits that occurred after Nov 2006 (Updated January 2024)

[b] Data for V1a, V2, V3 after June 2008, V4, V5 … (Updated January 2024)

[c] Data Source: 20Dec2023 gfrsummary

Notes: Indented numbers and percentages represent subgroups

# of occurred visits is based on regular visits only (visstatus=0)

1561 = V1a + V1b + V2 + V3 + V4 + V5 + V6 + V7 + V8 + V9 + V10 + V11 + V12 + V13 + V14 + V15 + V16 + V17

1310 = V1a + V2 + V3 + V4 + V5 + V6 + V7 + V8 + V9 + V10 + V11 + V12 + V13 + V14 + V15 + V16 + V17

853 = V1a + V2 + V4 + V6 + V8 + V10 + V12 + V14 + V16

578 = V2 + V4 + V6 + V8 + V10 + V12 + V14 + V16

Table 2.11b

Missing Data in Regular Visits for Selected Variables in Children with Non-Glomerular Diagnosis

Variable	# of Person-Visits	% (n) % with Missing Data
Intact Parathyroid Hormone (iPTH)[a]	2329	9% (213)
Cystatin C IFCC[b]	4570	8% (352)
iGFRc [c]	2138	8% (164)
Diastolic Blood Pressure (DBP)	5432	3% (175)
Systolic Blood Pressure (SBP)	5432	3% (173)
Lipids		
Cholesterol, mg/dL	2114	3% (56)
Triglyceride, mg/dL	2114	3% (56)
High Density Lipoprotein (HDL), mg/dL	2114	3% (56)
SCr (Enzymatic), mg/dL	4561	3% (143)
BUN, mg/dL	4561	3% (139)
Height Percentile	5432	3% (173)
Average Height	5432	1% (45)
Weight Percentile	5432	6% (297)
Average Weight	5432	1% (29)
CKD Diagnosis	824	0% (0)

Data Source: January 2024

[a] Data for visits that occurred after Nov 2006 (Updated January 2024)

[b] Data for V1a, V2, V3 after June 2008, V4, V5 … (Updated January 2024)

[c] Data Source: 20Dec2023 gfrsummary.

Notes: Indented numbers and percentages represent subgroups

# of occurred visits is based on regular visits only (visstatus=0)

5432 = V1a + V1b + V2 + V3 + V4 + V5 + V6 + V7 + V8 + V9 + V10 + V11 + V12 + V13 + V14 + V15 + V16 + V17

4680 = V1a + V2 + V3 + V4 + V5 + V6 + V7 + V8 + V9 + V10 + V11 + V12 + V13 + V14 + V15 + V16 + V17

2938 = V1a + V2 + V4 + V6 + V8 + V10 + V12 + V14 + V16

2114 = V2 + V4 + V6 + V8 + V10 + V12 + V14 + V16

Section 3:

NATURAL HISTORY OF KIDNEY DISEASE

This section describes, by CKD diagnosis, the number and distribution of pre-KRT GFR measurements, descriptive statistics of Cohort, and the annual percentage change in GFR.

Analytical Notes:

- The Ns represented in the table are composed of individuals for whom data is available at the given visit, regardless of whether the individual completed a past visit.
- Annual % change is calculated by regressing a line of each individual's outcome data on time in years from baseline with the outcome being log-transformed. The slope is then exponentiated to obtain the annual % change as 100*(exp(slope) -1).
- The annual % changes in GFR are summarized using box-percentile plots.

Table 3.2a

Baseline Descriptive Statistics by CKD Diagnosis (Glomerular vs Non-Glomerular)

Characteristic	% (n) or Median					
	Glomerular n=275		Non-Glomerular n=824		Overall n=1099	
Sex						
Male	53%	(147)	67%	(544)	64%	(701)
Female	47%	(128)	33%	(269)	37%	(397)
Race						
Caucasian	53%	(146)	70%	(575)	66%	(721)
African-American	31%	(84)	19%	(158)	22%	(242)
Other	15%	(42)	6%	(51)	8%	(93)
Multi-racial[a]	1%	(3)	5%	(38)	4%	(41)
Hispanic Ethnicity	16%	(43)	14%	(116)	14%	(159)
Income ≤ $36K	41%	(109)	39%	(311)	40%	(420)
Maternal Education, years		13.0		14.0		14.0
Age at V1a, years		14.2		8.0		9.8
Age at CKD onset, years		8.5		0.0		0.0
Years since CKD onset		3.5		7.3		6.1
Age at CKD awareness, years		8.5		<0.1		0.6
SCr (Enzymatic), mg/dL		1.1		1.0		1.0
Cystatin C (IFCC), mg/L		1.4		1.7		1.6
Urine protein:creatinine (uP/C)		0.7		0.3		0.4
iGFRc, ml/min/1.73m^2		58.9		46.2		48.9
U25eGFR, ml/min/1.73m^2		57.5		47.3		49.8
bedGFR, ml/min/1.73m^2		60.0		50.8		53.5
BP Hypertension Stages 1 and 2	23%	(63)	29%	(214)	28%	(277)
Self-Reported Hypertension	56%	(151)	40%	(324)	44%	(475)
Left Ventricular Hypertrophy[b]	15%	(31)	10%	(55)	11%	(86)
IQ		96		98		98
Parent Overall Quality Of Life		76		79		78
Child Overall Quality Of Life		79		77		78
Premature (Gestational Age <36 weeks)	9%	(24)	14%	(114)	13%	(138)
Low Birth Weight (<2500 grams)	15%	(39)	19%	(148)	18%	(187)
Small for Gestational Age[c]	21%	(50)	16%	(122)	17%	(172)
ICU Treatment after Delivery	16%	(44)	52%	(415)	43%	(459)
Height Percentile – 50th		-9		-24		-20
Weight Percentile – 50th		+23		-11		-2
BMI Percentile – 50th		+32		+13		+18
Tanner Stage						
I	35%	(92)	72%	(554)	63%	(646)
II	9%	(23)	7%	(54)	8%	(77)
III	11%	(29)	6%	(48)	8%	(77)
IV	25%	(65)	9%	(67)	13%	(132)
V	20%	(54)	5%	(39)	9%	(93)

[a] Excludes African-American race
[b] Baseline data collected at Visit 2
[c] SGA is defined as birth weight < 10th percentile based on US normative data

Table 3.2b

Baseline Descriptive Statistics by CKD Diagnosis (Glomerular vs Non-Glomerular) and Cohort

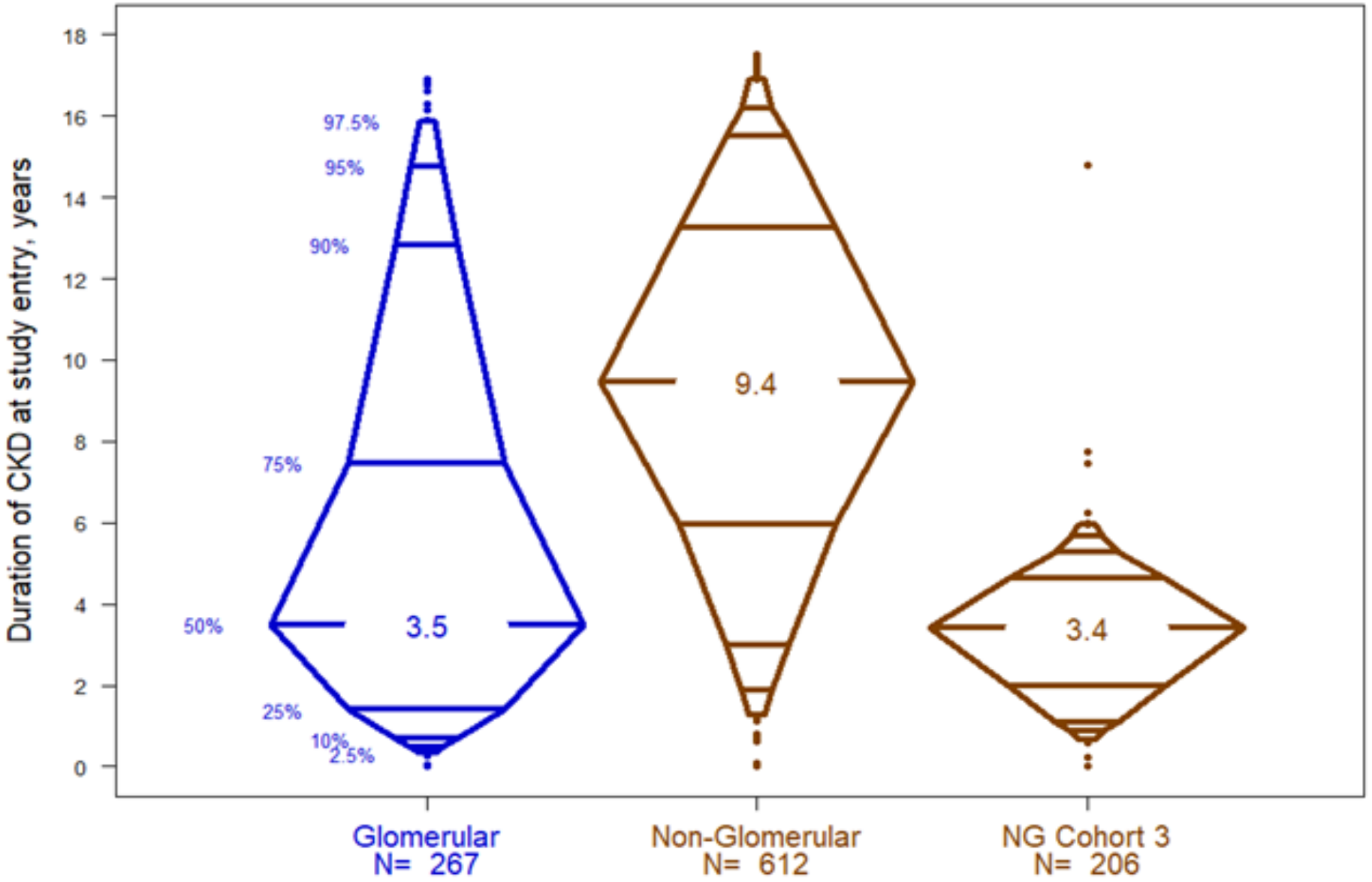
Characteristic	% (n) or Median							
	C1 & C2 Glomerular n=275		C1 & C2 Non-Glomerular n=616		C3 Non-Glomerular n=208		Overall n=1099	
Sex								
Male	53%	(147)	66%	(405)	72%	(149)	64%	(701)
Female	47%	(128)	34%	(211)	28%	(58)	36%	(397)
Race,% (n)								
Caucasian	53%	(146)	71%	(437)	67%	(138)	66%	(721)
African-American	31%	(84)	19%	(115)	21%	(43)	22%	(242)
Other	15%	(42)	5%	(33)	9%	(18)	8%	(93)
Multi-racial[a]	1%	(3)	5%	(31)	3%	(7)	4%	(41)
Hispanic Ethnicity	16%	(43)	14%	(86)	15%	(30)	14%	(159)
Income ≤ $36K	41%	(109)	41%	(245)	35%	(66)	40%	(420)
Maternal Education, years		13.0		14.0		15.5		14.0
Age at V1a, years		14.2		10.1		3.6		9.8
Age at CKD onset, years		8.5		0.0		0.0		0.0
Years since CKD onset		3.5		9.4		3.4		6.1
Age at CKD awareness, years		8.5		<0.1		0.0		0.6
SCr (Enzymatic), mg/dL		1.1		1.1		0.7		1.0
Cystatin C (IFCC), mg/L		1.4		1.7		1.4		1.6
Urine protein:creatinine (uP/C)		0.7		0.3		0.4		0.4
iGFRc, ml/min/1.73m^2		58.9		46.1		50.0*		48.9
U25eGFR, ml/min/1.73m^2		57.5		46.6		52.6		49.8
bedGFR, ml/min/1.73m^2		60.0		49.7		59.9		53.5
BP Hypertension Stages 1 and 2	23%	(63)	27%	(160)	36%	(54)	28%	(277)
Self-Reported Hypertension	56%	(151)	43%	(264)	29%	(60)	44%	(475)
Left Ventricular Hypertrophy[b]	15%	(31)	11%	(52)	4%	(3)	11%	(86)
IQ		96		98		99		98
Parent Overall Quality Of Life		76		78		85		78
Child Overall Quality Of Life		79		77		--		78
Premature (Gestational Age <36 weeks)	9%	(24)	13%	(75)	20%	(39)	13%	(138)
Low Birth Weight (<2500 grams)	15%	(39)	20%	(115)	20%	(33)	18%	(187)
Small for Gestational Age[c]	21%	(50)	18%	(104)	11%	(18)	17%	(172)
ICU Treatment after Delivery	16%	(44)	49%	(294)	59%	(121)	43%	(459)
Height Percentile – 50th		-9		-23		-27		-20
Weight Percentile – 50th		+23		-5		-20		-2
BMI Percentile – 50th		+32		+12		+17		+18
Tanner Stage								
I	35%	(92)	65%	(382)	98%	(172)	63%	(646)
II	9%	(23)	9%	(54)	0%	(0)	8%	(77)
III	11%	(29)	8%	(48)	0%	(0)	8%	(77)
IV	25%	(65)	11%	(65)	1%	(2)	13%	(132)
V	20%	(54)	6%	(37)	1%	(2)	9%	(93)

[a] Excludes African-American race *Data available for 59 of the 208 Cohort 3 participants

[b] Baseline data collected at Visit 2 [c] SGA is defined as birth weight < 10th percentile based on US normative data

Figure 3.1a

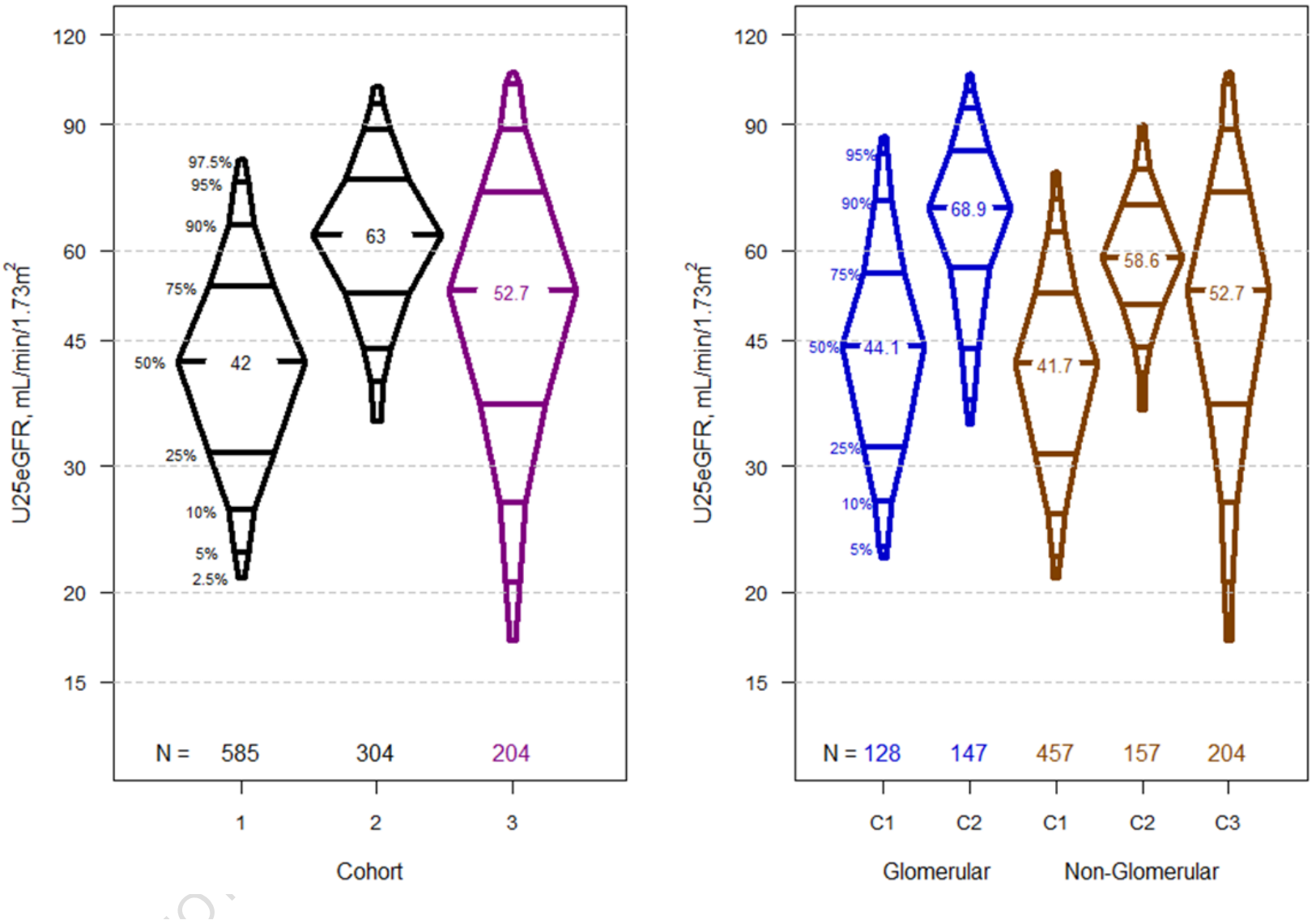
Distribution of CKD Duration at Study Entry by CKD Diagnosis, N=1085[a]



[a]Excludes 14 KIDs with missing CKD onset date

Figure 3.1b

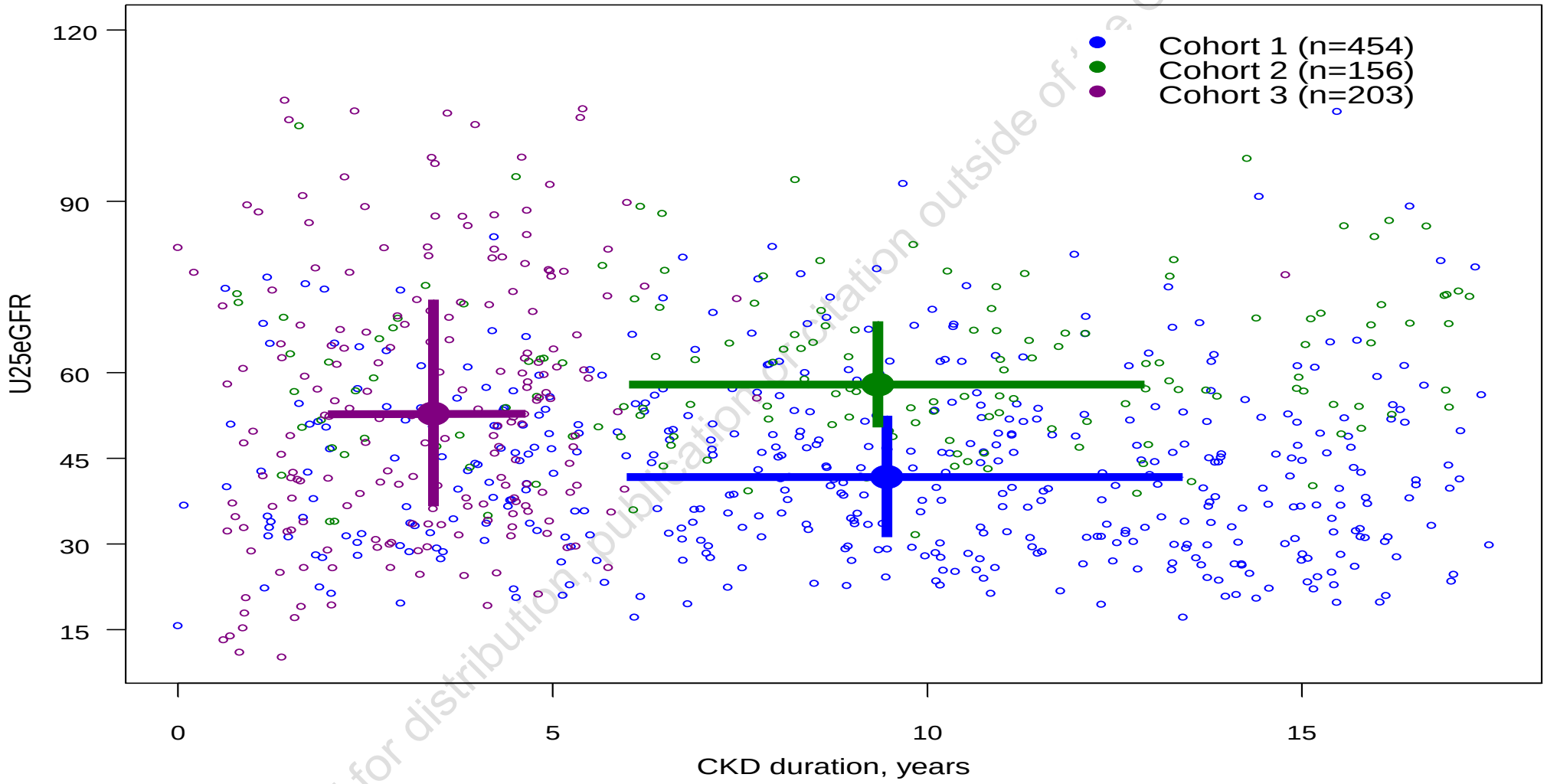
Distribution of Baseline U25eGFR by Cohort and CKD Diagnosis, N=1093[a]



[a]Excludes six (6) KIDs with missing U25eGFR

Figure 3.2

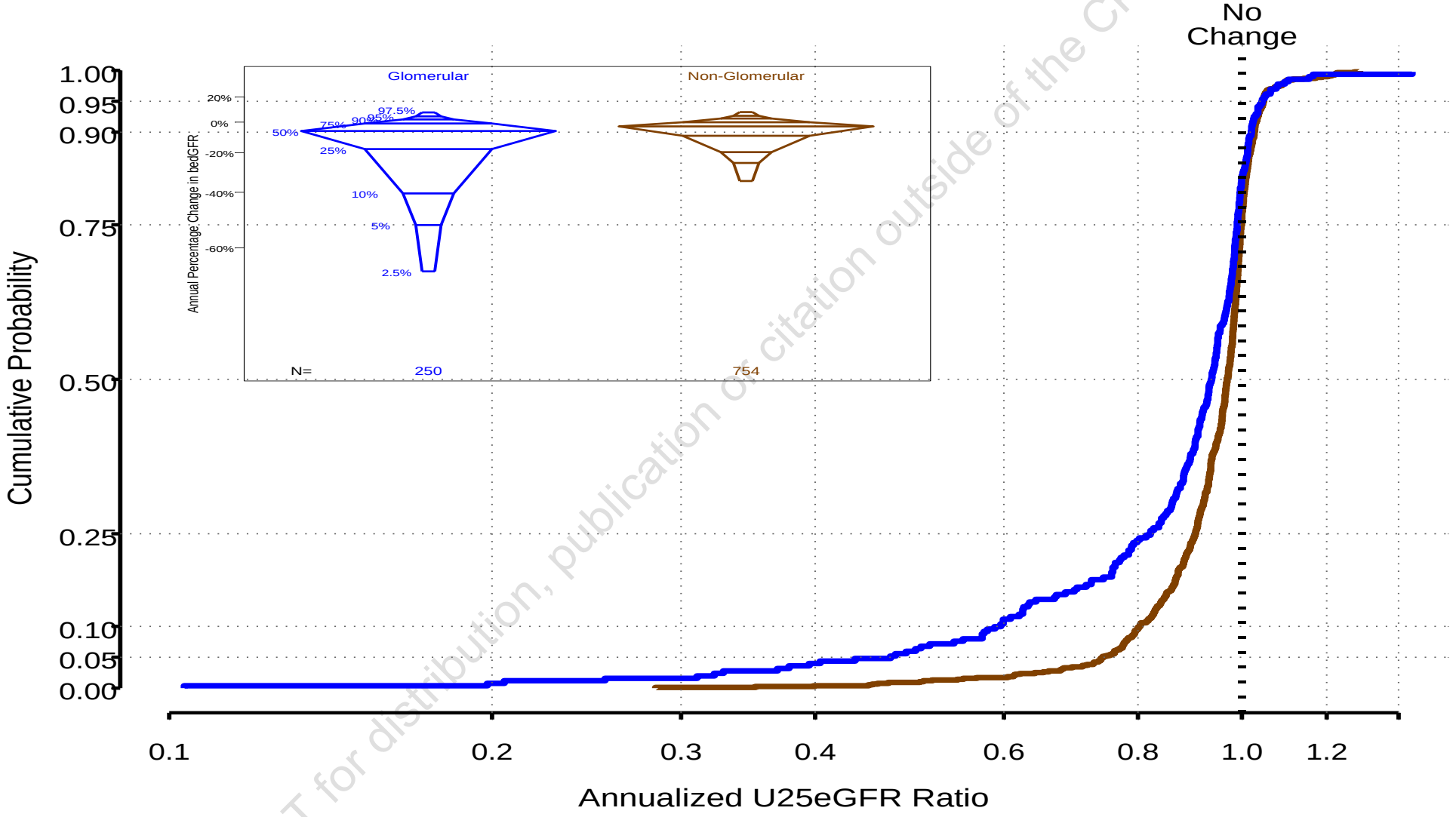
U25eGFR by CKD Duration at Baseline Visit for Children with Non-Glomerular Diagnosis, N= 813[a]



[a]Excludes 11 KIDs with missing U25eGFR and/or CKD duration data

Figure 3.4

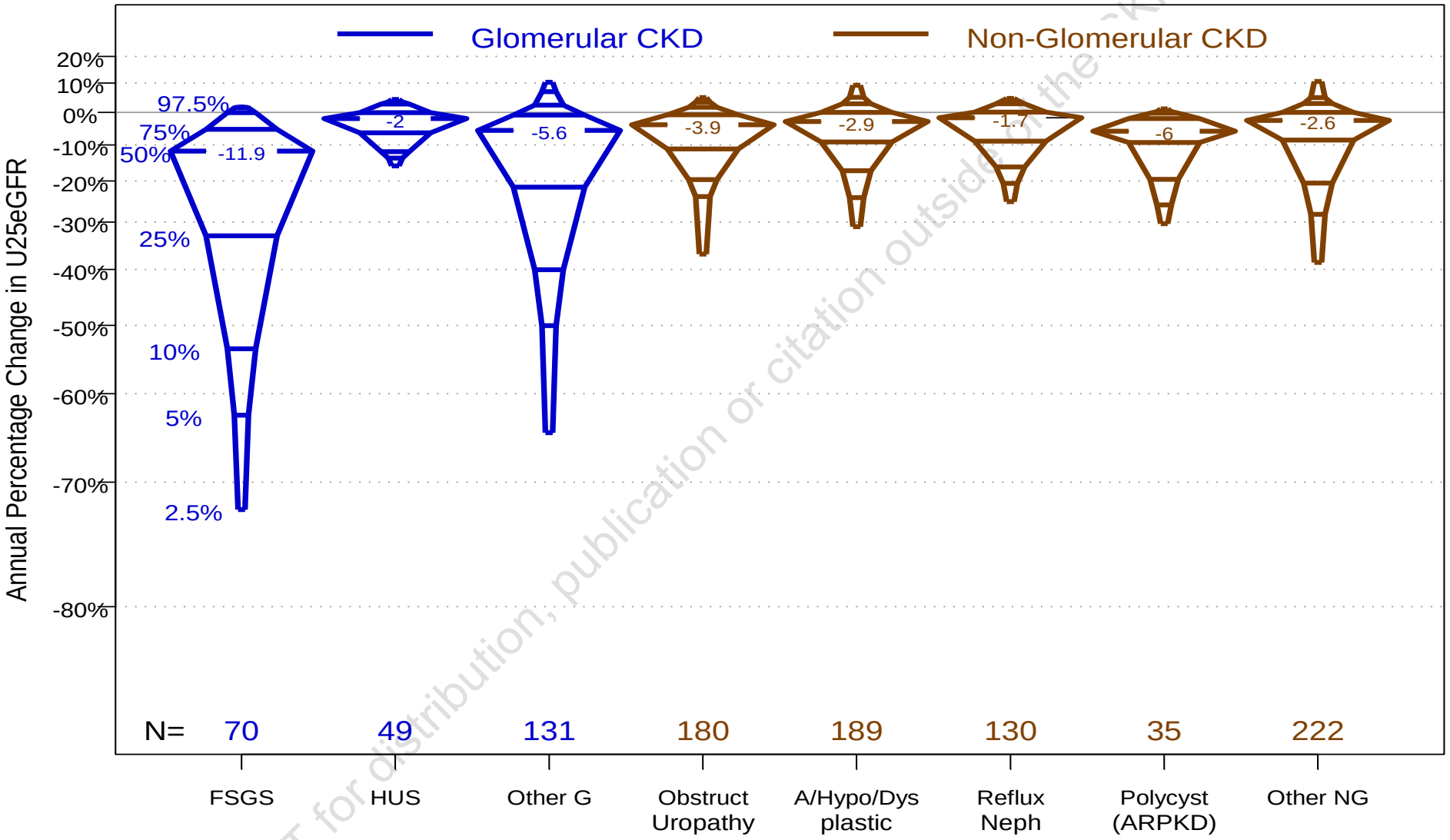
Annualized Percentage Change in U25eGFR by CKD Diagnosis, N=1006



(Update of Pierce, Cox, …, Muñoz; AJE 2011;174:604-12)

Figure 3.5

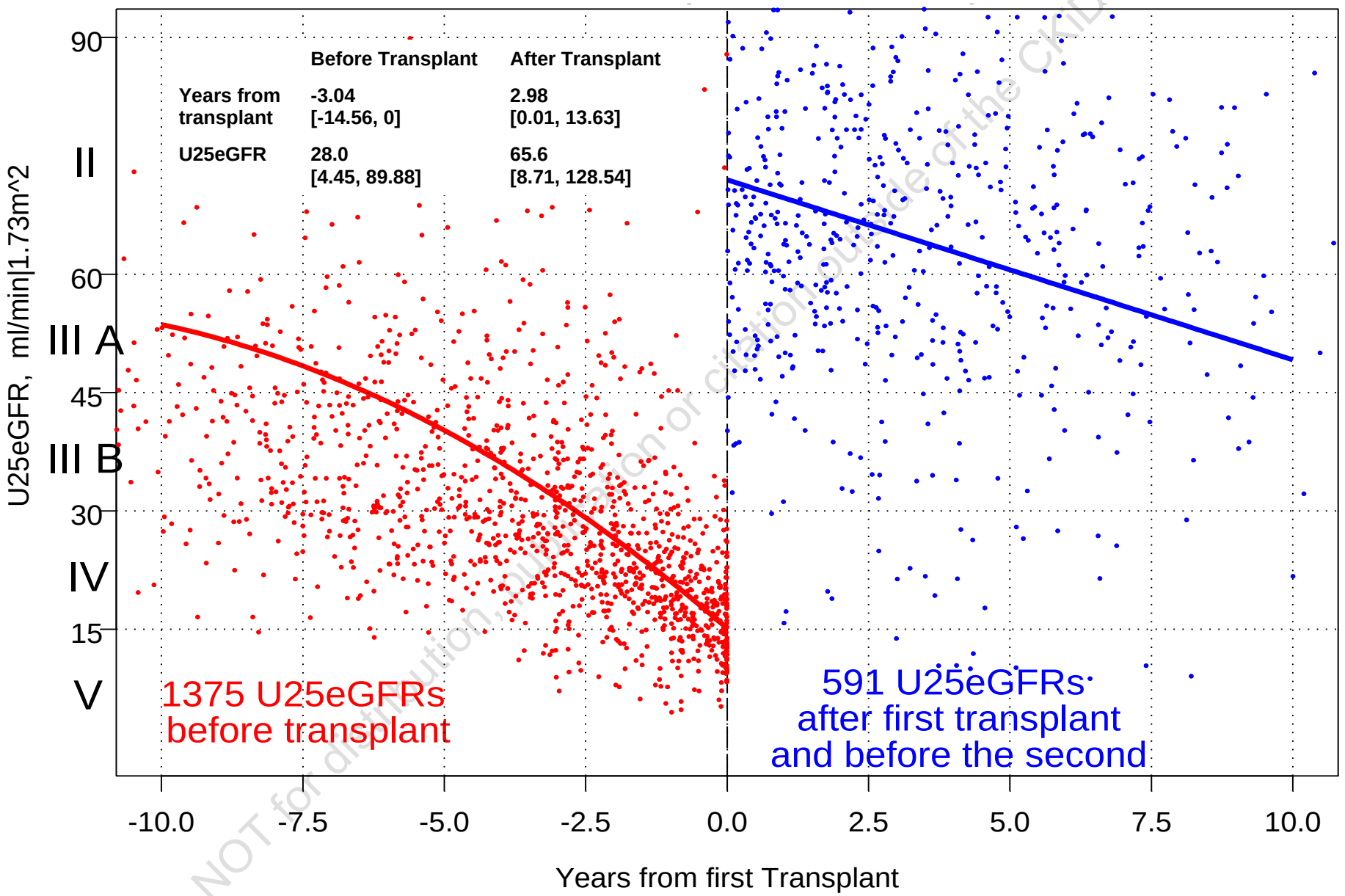
Distribution of Annualized Percentage Change in U25eGFR by CKD Diagnosis Subgroups



(Update of Furth, Abraham, Jerry-Fluker,…, Warady; CJASN 2011;6:2132)

Figure 3.7

U25eGFR in 246 Kidney Transplant Recipients



Section 4:

CARDIOVASCULAR

This section describes, by CKD diagnosis, variables associated with cardiovascular health, specifically, lipids and cholesterol levels, blood pressure (auscultatory and ambulatory), and cardiac structure.

Casual auscultatory blood pressure (also referred to as casual or clinical BP) is measured at each visit while ambulatory 24-hour blood pressure (ABP) is measured at even visits only.

Ambulatory blood pressure monitoring (ABPM) requires participants to wear an ambulatory blood pressure device for 24 hours.

Cardiac structure is measured by echocardiogram at even visits for all CKiD participants. Carotid artery intima-media thickness (cIMT) is measured in only a subset of the cohort from selected sites.

Analytical Notes:

Casual (Clinical) Blood Pressure Measurements

- Casual blood pressure (BP) measurements – systolic and diastolic - are based on published guidelines. Prior to the 2017, NHBPEP 4th Report defined the normal range of BP in the general pediatric population, specific to sex, age and height. In 2017, the American Academy of Pediatrics published updated blood pressure guidelines. The new guidelines consider that overweight and obese children are more likely to have increased blood pressure. Thus, only normal-weight children are included in the updated percentile calculations. In addition, BP stages are determined differently for children < 13 years of age and ≥ 13 years. For children < 13 years old, BP stages are based on raw blood pressure and blood pressure percentiles. Whereas, for children ≥ 13 years, BP stages are based on raw blood pressure values only and align with the 2017 American Heart Association (AHA) and American College of Cardiology (ACC) adult HTN guidelines. The table below reflects the updated definitions of BP categories and stages:

	Children Aged 1 – <13y	Children Aged ≥13
Normal	<90th	<120/<80 mmHg
Elevated BP	90th to <95th or if BP exceeds 120/80 mmHg while BP <95th percentile	120/<80 to 129/80 mmHg
Stage 1 Hypertension	95th to <95th + 12mmHg, or 130/80 to 139/89 mmHg (whichever is lower)	130/80 to 139/89 mmHg
Stage 2 Hypertension	>=95th percentile + 12mmHg, or >= 140/90 mmHg (whichever is lower)	≥140/90 mmHg

- Casual BP Index (systolic or diastolic) is calculated by dividing the measured BP value by the 95th percentile value for a given child's age, sex, and height. BP Index values equal to or greater than 1 indicate BP measurements in the top 5% of expected BP among children of the same sex, age and height in the normal population. Participants ≥18 will not receive a casual BP Index since they do not have a 95th percentile for age, sex and height.

Ambulatory Blood Pressure Measurements

- Categories of hypertensive status link ABPM data with casual auscultatory blood pressure measurements and define normal BP, white coat hypertension, masked hypertension and confirmed hypertension.

Definitions of ABPM Terms and Blood Pressure Status:

- ABPM hypertension – ABP greater than or equal to 95th percentile specific to the ABPM protocol and to age, sex and height, based on Soergel et al. (1997).
- Load - the percent of ABP readings that exceeded the 95th percentile limit for a given individual (Soergel et al., 1997). Loads > 25% indicate an abnormal ABPM.

Table 4.1a

Baseline (Visit 2) and Annualized Percentage Change of Lipid Panel

Variables	Median [IQR]			
	Glomerular		Non-Glomerular	
	Baseline n=238	% Change	Baseline n=695	% Change
Cholesterol, mg/dL	175 [148, 198]	0% [-2%, 3%]	167 [147, 190]	0% [-2%, 3%]
Triglyceride, mg/dL	102 [71, 162]	3% [-4%, 11%]	98 [72, 141]	3% [-3%, 10%]
High Density Lipoprotein, mg/dL	51 [41, 60]	0% [-4%, 4%]	51 [42, 59]	0% [-3%, 4%]
Non-High Density Lipoprotein, mg/dL	120 [97, 150]	0% [-3%, 5%]	117 [94, 137]	0% [-3%, 4%]

Per protocol, lipid panel measured at Visit 2.
Data Source: January 2024

Table 4.1b

Abnormal Lipid Panel Variables, Baseline and Current [09/2022-01/2024]

Variables	% (n)			
	Glomerular		Non-Glomerular	
	Baseline	09/2022-01/2024	Baseline	09/2022-01/2024
High Cholesterol[a,c]	27% (37)	*0% (0)*	23% (116)	24% (7)
High Triglycerides[b,c]	36% (29)	*0% (0)*	43% (62)	0% (0)
Low HDL[a,c]	9% (13)	*0% (0)*	8% (39)	0% (0)
High Non-HDL[a,c]	21% (29)	*0% (0)*	10% (48)	10% (3)

Data Source: January 2024. *Italics* indicate small sample size.
[a]Age ≥ 4 to <16;
Glomerular, Baseline: n=138; Non-Glomerular, Baseline: n=497;
Glomerular, 09/2022-01/2024: n=2; Non-Glomerular, 09/2022-01/2024: n=29
[b]Age ≥12 to <16;
Glomerular, Baseline: n=80; Non-Glomerular, Baseline: n=145;
Glomerular, 09/2022-01/2024: n=1; Non-Glomerular, 09/2022-01/2024: n=2

[c]Based on the Lipid Screening and Cardiovascular Health in Children Clinical Report, *Pediatrics* 122: 198-208, 2008

Table 4.3a

Blood Pressure Stage*, Baseline and Current

Variables	Median [IQR]			
	Glomerular		Non-Glomerular	
	Baseline n=271	09/2022-01/2024 n=20	Baseline n=729	09/2022-01/2024 n=133
Normotensive	60% (163)	*60% (12)*	58% (426)	60% (80)
Elevated BP	17% (45)	*15% (3)*	12% (89)	13% (17)
Stage 1 Hypertension	19% (51)	*20% (4)*	24% (176)	25% (33)
Stage 2 Hypertension	4% (12)	*5% (1)*	5% (38)	2% (3)

*BP stage is not estimated for participants with height z-score < -3.09 or > 3.09

Italics indicate small sample size.

Table 4.3b

Baseline and Annualized Percentage Change of Casual Blood Pressures

Variables	Median [IQR]			
	Glomerular		Non-Glomerular	
	Baseline n=275	% Change	Baseline n=824	% Change
Systolic				
Blood Pressure	109 [99, 120]	1% [-1%, 3%]	103 [95, 113]	1% [0%, 3%]
BP Percentile[a]	65 [31, 90]	-3% [-23%, 12%]	72 [46, 90]	-3% [-16%, 5%]
BP Index[a,b]	0.89 [0.82, 0.97]	-1% [-4%, 3%]	0.90 [0.85, 0.97]	-1% [-2%, 1%]
Diastolic				
Blood Pressure	66 [59, 73]	1% [-1%, 4%]	63 [58, 71]	1% [-1%, 3%]
BP Percentile[a]	63 [36, 86]	0% [-16%, 13%]	78 [53, 93]	-2% [-11%, 4%]
BP Index[a,b]	0.84 [0.75, 0.94]	0% [-4%, 5%]	0.88 [0.79, 0.98]	-1% [-3%, 2%]

Data Source: January 2024

[a] Based on 2017 American Academy of Pediatrics Hypertension Guidelines; based on age, sex, and height for those age < 18.

[b] BP Index: Blood Pressure/95th %ile (age, sex and height-specific for those age < 18)

Table 4.3c shows the distribution of blood pressure stage for 528 participants across three time points: the first visit in which the participant was less than 16 years old (if applicable), the first visit in which the participant was at least 16 years old, and the last visit in which blood pressure was measured. Within each group, the table provides the percentage of participants with normotensive, elevated BP, and stage 1 and stage 2 hypertension. The data specifically shows a decrease in the percentage of participants with normotensive BP, while the percentage of participants classified as having stage 2 hypertension increases.

Table 4.3c

Blood Pressure Stage*, by Age Status

	% (n) or Median		
	First visit age < 16 (n=428)	**First visit age ≥ 16 (n=528)**	**Latest visit (n=528)**
Age, years	12.9	16.5	19.2
Blood Pressure Stage			
Normotensive	65% (280)	66% (348)	56% (295)
Elevated BP	11% (49)	13% (66)	12% (64)
Stage 1 Hypertension	20% (85)	16% (87)	23% (121)
Stage 2 Hypertension	3% (14)	5% (27)	9% (48)

*BP stage is not estimated for participants with height z-score < -3.09 or > 3.09

Table 4.4 shows the excess or deficit of expected blood pressure percentiles in the CKiD cohort relative to the normal population. Normal population BP percentile estimates are from the 2017 American Academy of Pediatrics guidelines. Percentiles (adjusted for age, sex, and height) are based on the normal-weight pediatric (age 1 - 18) population. BP z-scores are not estimated for those with height z-score < -3.09 or > 3.09. If the CKiD cohort were representative of the normal population (i.e., the null hypothesis), we would expect 50% of the subjects to be less than the 50th percentile and about 40% of the cohort to be between the 50th and 90th percentile, etc. Thus, to provide an indication of how the CKiD cohort compares to the normal population, we subtracted the % expected in a normal population for a given interval of BP percentiles from the % observed within this interval in the CKiD population. For example, under the null hypothesis for any given visit it is expected that 5% of the CKiD cohort would be at or above the 95th percentile and the Glomerular baseline data shows that there is 11% more than the expected 5% above the 95th percentile for Systolic BP.

Table 4.4

Excess or Deficit of BP %ile Categories based on Expectation of Normal Population, Baseline and Current [09/2022-01/2024]

	% (n)			
	Glomerular		Non-Glomerular	
Variables	Baseline n=275*	09/2022-01/2024 n=5*	Baseline n=823*	09/2022-01/2024 n=99*
Systolic BP[a]				
% < 50th %ile – 50%	-14% (95)	*+30% (4)*	-22% (204)	-22% (28)
% ≥ 50 to < 90th %ile – 40%	-2% (101)	*-20% (1)*	+6% (336)	+6% (46)
% ≥ 90th to < 95th %ile – 5%	+5% (28)	*-5% (0)*	+4% (67)	+6% (11)
% ≥ 95th %ile – 5%	+11% (43)	*-5% (0)*	+12% (124)	+9% (14)
Diastolic BP[a]				
% < 50th %ile – 50%	-10% (106)	*-10% (3)*	-28% (164)	-29% (21)
% ≥ 50 to < 90th %ile – 40%	-2% (102)	*0% (2)*	+6% (333)	+6% (45)
% ≥ 90th to < 95th %ile – 5%	+3% (21)	*-5% (0)*	+7% (85)	+5% (10)
% ≥ 95th %ile – 5%	+9% (38)	*-5% (0)*	+15% (149)	+18% (23)

Data Source: January 2024. *Italics* indicate small sample size.

*BP z-scores/BP percentiles are not estimated for participants with height z-score < -3.09 or > 3.09 nor for participants ≥18 years old.

[a] Based on 2017 American Academy of Pediatrics Hypertension Guidelines; based on age, sex, and height for those age < 18.

Table 4.5

Cardiac Structure and Function Markers, Baseline and Current [09/2022-01/2024*]

Variables	% (n) Glomerular Baseline[a]	Glomerular 09/2022-01/2024[b]	Non-Glomerular Baseline[c]	Non-Glomerular 09/2022-01/2024[d]
Left Ventricular Structure				
Left Ventricular Hypertrophy	15% (31)	*0% (0)*	10% (56)	*0% (0)*
Increased Relative Wall Thickness (≥ 0.4)	12% (25)	*0% (0)*	13% (75)	*0% (0)*
Left Ventricular Geometry				
Normal Geometry	78% (158)	*100% (1)*	81% (462)	*83% (5)*
Eccentric LVH	10% (21)	*0% (0)*	6% (35)	*0% (0)*
Concentric Remodeling	7% (15)	*0% (0)*	9% (54)	*17% (1)*
Concentric LVH	5% (10)	*0% (0)*	4% (21)	*0% (0)*
Systolic Function				
Abnormally Low Shortening Fraction[e]	5% (10)	*0% (0)*	5% (27)	*17% (1)*
Abnormally High Shortening Fraction[f]	3% (7)	*0% (0)*	6% (34)	*0% (0)*
Abnormal Mid-Wall SF[g]	9% (18)	*0% (0)*	8% (45)	*17% (1)*
Diastolic Function				
Abnormal E/A Ratio (Mitral Valve Inflow)[h]	<1% (1)	*0% (0)*	<1% (2)	*17% (1)*
Abnormal Em/Am Ratio (Tissue Doppler)[i]	2% (5)	*0% (0)*	1% (4)	*0% (0)*

Data Source: January 2024. *Italics* indicate small sample size.

*As of the June 2014 Protocol Amendment, echocardiogram is performed at Visit 2 and then every four (4) years thereafter. Previously the measure was performed every two (2) years. Changing the visit pattern in which cardiac structure and function markers are collected, resulted in a reduction in the number of visits that occurred during the time period 09/2021-12/2022.

[a] Baseline Glomerular, n=204:
Of the G with first follow-up/baseline visits (n=238), 34 records were missing data.

[b] Current Glomerular, n=1:
Of the G with studies from 09/2022-01/2024 (n=23), 22 records were not scheduled for data collection due to protocol change or had missing data.

[c] Baseline Non-glomerular, n=572:
Of the NG with first follow-up/baseline (n=696), 124 records were missing data.

[d] Current Non-glomerular, n=6:
Of the NG studies from 09/2022-01/2024 (n=139), 133 records were not scheduled for data collection due to protocol change or had missing data.

[e] Abnormally Low Shortening Fraction (≤ 25%)

[f] Abnormally High Shortening Fraction (≥ 47%)

[g] Abnormal Mid-Wall SF (<16%)

[h] Abnormal E/A Ratio < 1.0

[i] Abnormal Em/Am Ratio <1.0

Table 4.6

Descriptive Statistics of ABPM based Hypertensive Indicators, Baseline and Current [09/2022-01/2024]

	% (n)			
	Glomerular		Non-Glomerular	
Variables	**Baseline**	**09/2022-01/2024**	**Baseline**	**09/2022-01/2024**
Successful ABPM[a]	61% (145)	*20% (2*)*	57% (394)	*13% (9*)*
Dipping[b] < 10%				
Systolic	39% (57)	*100% (2)*	37% (145)	*22% (2)*
Diastolic	18% (26)	*0% (0)*	15% (59)	*0% (0)*
Hypertension (HTN)[c]				
Wake Systolic	14% (20)	*0% (0)*	16% (62)	*11% (1)*
Sleep Systolic	19% (27)	*50% (1)*	19% (75)	*11% (1)*
Wake Diastolic	11% (16)	*0% (0)*	11% (42)	*22% (2)*
Sleep Diastolic	24% (35)	*0% (0)*	21% (83)	*33% (3)*
Load[d] > 25%				
Wake Systolic	28% (41)	*0% (0)*	33% (129)	*33% (3)*
Sleep Systolic	32% (47)	*50% (1)*	36% (141)	*22% (2)*
Wake Diastolic	28% (41)	*50% (1)*	31% (123)	*56% (5)*
Sleep Diastolic	44% (64)	*50% (1)*	43% (169)	*56% (6)*
Systolic ABPM HTN[e]	41% (59)	*50% (1)*	45% (176)	*44% (4)*
Diastolic ABPM HTN[f]	48% (70)	*50% (1)*	49% (192)	*56% (5)*
ABPM HTN[g]	52% (76)	*50% (1)*	58% (229)	*67% (6)*

Data Source: January 2024. *Italics* indicate small sample size.

This table includes all ABPM studies, regardless of height.

[a] Successful ABPM refers to at least 75% successful wake readings and 75% successful sleep readings and at least 21 hours of readings in a 24 hour period and not more than three (3) hours missed. This is the denominator for following rows within each column.

[b] Dipping (% Dip): (Mean Wake BP – Mean Sleep BP)/Mean Wake BP

[c] HTN: value >=95th percentile for mean 24 hour, wake and sleep BP (Soergel Limits)

[d] Load: % BP readings over 95th percentile

[e] Systolic ABPM HTN: Wake or Sleep Mean SBP ≥ 95th percentile or Wake or Sleep SBP load >25%

[f] Diastolic ABPM HTN: Wake or Sleep Mean DBP ≥ 95th percentile or Wake or Sleep DBP load >25%

[g] ABPM HTN: Systolic ABPM HTN or Diastolic ABPM HTN

*Of the 80 attempted ABPMs, 12 (15%) were successful. Of the remaining 68 that were unsuccessful, 44 (65%) were cohort 3. Of which 6 (14%) were < 110 cm tall

Section 5:
NEUROPSYCHOLOGY

This section describes the results of the quality of life, cognitive/developmental, and behavioral assessments which were administered to participants and parents at baseline and at follow-up visits.

Analytical Notes

- The Ns represented in the tables are composed of individuals for whom data is available at the given visit, regardless of whether the individual completed a past visit.
- Change is calculated by regressing a line through all data points for each individual. Quality of life (QOL) scores are not annualized (i.e., all data points are assumed to be equally spaced in time); this is termed "Visit-to-Visit Change."
- % missing is calculated based on total number of visits with expected tests based on test-specific criteria (age, visit number, dates of use). For example, BASC-PRS scores are expected for any KID with a visit 1b, 3, 5, etc. occurring when the KID was between the ages of 2 and 21 throughout the study; WIAT-II-A scores are expected for any KID with a visit 1b, 3, 5, etc. occurring both when the KID was at least 6 years of age and prior to May 2008 when the instrument was removed from the protocol.

The following tests were administered:

The Core Tests for Quality of Life Assessment:

- Pediatric Quality of Life (PedsQL)-Parent Form
  - 2 to 18 years
- Pediatric Quality of Life (PedsQL)-Self-Report Form
  - 8 to 18 years
- Pediatric Quality of Life (PedsQL)-Young Adults Form
  - 18 years and older

The Core Tests for Cognitive and Developmental Assessment:

- Mullen Scales of Early Learning (Mullen Scales)
  - 12 to 29 months
- Wechsler Preschool and Primary Scale of Intelligence Third Edition (WPPSI-III)
  - 30 months through 5 years
- Wechsler Abbreviated Scales of Intelligence (WASI)
  - 6 years and older
- Wechsler Individual Achievement Test-II-Abbreviated (WIAT-II-A)
  - 6 years and older
  - Test was not performed in *Cohorts 2 or 3* (discontinued in 2008 protocol)
- Wechsler Intelligence Scale for Children Fourth Edition (WISC-IV) Digit Span Subtest
  - 6 to 16 years
- Wechsler Adult Intelligence Scale Fourth Edition (WAIS-IV) Digit Span Subtest
  - 17 years and older
- Conner's Kiddie Continuous Performance Test (K-CPT)
  - 4 to 5 years
- Conner's' Continuous Performance Test II (CPT-II)
  - 6 years and older
- Delis-Kaplan Executive Function System (D-KEFS) Tower Subtest
  - 6 years and older

The Core Tests for Behavioral Assessment:

- Adaptive Behavior Assessment System – 2nd Edition (ABAS-II) Parent Form
  - 12 months and older
  - Test was not performed in *Cohorts 2 or 3* (discontinued in 2008 protocol)
- Behavior Assessment System for Children – 2nd Edition (BASC-2) Parent Form
  - 2 to 21 years
- Behavior Assessment System for Children – 2nd Edition (BASC-2) Self-Report Form
  - 8 to 18 years
  - Test was not performed in *Cohorts 2 or 3* (discontinued in 2008 protocol)
- Behavior Rating Inventory of Executive Function-Preschool Version–Parent Form (BRIEF-P)
  - 2 to 5 years
- Behavior Rating Inventory of Executive Function-Parent Form (BRIEF)
  - 6 to 18 years
- Behavior Rating Inventory of Executive Function-Adult Version (BRIEF-A)
  - 18 years and older
- Child Depression Inventory (CDI) – Self-Report Form
  - 7 to 17 years
  - Test was not performed in *Cohorts 2 or 3* (discontinued in 2008 protocol)

Table 5.1

Baseline (Visit 1b) and Visit-to-Visit Change for Quality of Life

QOL Variables	Norm	Median [IQR]			
		Glomerular		Non-Glomerular	
		Baseline n=252	Change	Baseline n=706	Change
Parent Physical	83	81 [63, 94]	0.1 [-3.2, 5.0]	84 [66, 97]	0.0 [-3.0, 2.3]
Parent Emotional	80	80 [60, 90]	0.8 [-2.5, 5.0]	75 [60, 90]	0.0 [-2.5, 3.0]
Parent Social	82	85 [65, 100]	0.0 [-2.6, 5.0]	85 [65, 100]	0.0 [-2.1, 2.9]
Parent School	77	70 [50, 85]	0.0 [-4.0, 4.0]	65 [50, 85]	-0.5 [-4.0, 2.5]
Parent Overall QOL[a]	81	76 [63, 88]	0.3 [-2.9, 3.8]	79 [64, 89]	0.0 [-2.0, 2.4]
Child Physical	87	83 [72, 94]	0.3 [-1.7, 3.0]	84 [72, 94]	0.3 [-2.1, 3.0]
Child Emotional	78	80 [60, 90]	0.7 [-1.5, 5.0]	75 [60, 85]	1.4 [-1.6, 5.0]
Child Social	84	90 [75, 100]	0.0 [-0.5, 5.0]	85 [70, 95]	1.0 [-1.0, 4.5]
Child School	80	65 [50, 80]	1.6 [-1.9, 6.0]	65 [50, 80]	0.5 [-2.5, 3.6]
Child Overall QOL[b]	83	79 [67, 88]	1.3 [-1.4, 4.0]	77 [66, 86]	0.8 [-1.3, 3.2]

Data Source: January 2024

[a] Parent QOL Glomerular n=247 (5 missing data), Non-Glomerular n=623 (83 missing data)

[b] Child QOL (administered to participants 8 years old and older):
Glomerular n=220 (9 missing data), Non-Glomerular n=378 (29 missing data)

Table 5.2a

Baseline (Visit 1b) and Annual Change for Cognitive Variables

Cognitive Variables	Median [IQR]			
	Glomerular		Non-Glomerular	
	Baseline n=252	% Change	Baseline n=743	% Change
WPPSI-III or WASI[a]				
Verbal IQ	98 [87, 108]	0.4 [-1.8, 2.2]	98 [87, 109]	-0.3 [-2.3, 1.9]
Performance IQ	98 [84, 106]	1.0 [-1.0, 3.3]	96 [87, 107]	0.9 [-1.4, 2.8]
Mullen, WPPSI-III or WASI[a]				
Full Scale IQ	96 [86, 107]	0.8 [-0.6, 2.1]	98 [85, 108]	0.6 [-1.5, 2.2]
WIAT-II-A[a]				
Word Reading	96 [81, 108]	0.3 [-5.0, 2.6]	99 [86, 108]	0.0 [-3.0, 3.3]
Numerical Operations	89 [77, 104]	-0.6 [-5.8, 3.9]	96 [82, 108]	-1.2 [-6.0, 3.4]
Spelling	98 [84, 108]	1.9 [-1.1, 4.3]	96 [85, 108]	0.0 [-2.6, 3.1]
Total Achievement	92 [79, 104]	0.0 [-2.1, 2.9]	94 [83, 108]	-0.6 [-2.6, 1.8]
D-KEFS[b]				
Total Achievement	10 [8, 11]	0.5 [-0.4, 1.1]	10 [8, 11]	0.4 [-0.3, 1.0]
WISC-IV or WAIS-IV[b]				
Digit Span Forward	8 [6, 10]	0.0 [-0.6, 0.6]	8 [7, 10]	0.0 [-0.5, 0.5]
Digit Span Backward	10 [7, 11]	0.1 [-0.5, 0.9]	10 [8, 11]	0.0 [-0.5, 0.7]
Digit Span Total	9 [6, 10]	-0.1 [-0.9, 0.5]	8 [7, 10]	0.0 [-0.6, 0.5]
CPT-II[c]				
Variability	48 [40, 58]	0.0 [-2.3, 3.2]	51 [43, 60]	-0.2 [-2.3, 1.8]
Errors of Omission	47 [44, 56]	0.2 [-1.1, 2.8]	48 [45, 56]	0.0 [-1.9, 1.4]
Errors of Commission	50 [41, 57]	0.6 [-1.5, 3.3]	53 [47, 60]	0.0 [-2.2, 1.8]
Hit Reaction Time	49 [42, 57]	0.0 [-2.3, 2.4]	48 [40, 56]	-0.3 [-2.3, 1.8]
Detectability	52 [45, 58]	0.5 [-1.9, 2.8]	54 [48, 59]	-0.1 [-2.2, 1.8]
BRIEF[c]				
Behavioral Regulation Index	50 [44, 59]	-0.7 [-2.9, 1.0]	51 [44, 60]	-0.2 [-1.8, 1.1]
Metacognition Index	53 [45, 62]	-0.4 [-2.8, 1.8]	55 [47, 63]	0.0 [-1.8, 1.4]
Global Executive Composite	52 [45, 61]	-0.7 [-2.5, 1.1]	53 [45, 62]	0.0 [-2.1, 1.3]

Data Source: January 2024

[a] Norms = 100 (sd 15); n/a: Test was not performed after *Cohort 1*

[b] Norms = 10 (sd 3); Glomerular n=138, Non-Glomerular n=148

[c] Norms = 50 (sd 10)

Table 5.2b

Most Recent Data for Expanded Cognitive Battery

Cognitive Variables	Median [IQR] Glomerular		Non-Glomerular	
WISC-IV or WMS-III	n=	40	n=	63
Spatial Span Forward	9	[7, 12]	10	[7, 12]
Spatial Span Backward	10	[8, 12]	9	[8, 12]
D-KEFS Tower	n=	142	n=	256
Mean First-Move Time Ratio	12	[10, 13]	11	[10, 13]
Time-Per-Move Time Ratio	11	[9, 11]	11	[9, 11]
Move Accuracy Ratio	10	[8, 11]	10	[8, 11]
Rule-Violation-Per-Item Ratio	10	[10, 10]	10	[10, 10]
D-KEFS Verbal	n=	88	n=	107
Letter Fluency	10	[7, 12]	9	[7, 11]
Category Fluency	10	[8, 13]	10	[8, 13]
Category Switching	9	[6, 11]	9	[7, 12]
Total Category Switching	10	[8, 12]	10	[8, 11]
D-KEFS Design	n=	87	n=	105
Filled Dots	9	[7, 11]	9	[7, 10]
Empty Dots	9	[8, 11]	9	[7, 11]
Design Switching	10	[8, 12]	10	[8, 12]
Design Fluency	10	[8, 11]	9	[7, 12]
D-KEFS Color-Word	n=	88	n=	104
Color Naming	10	[7, 11]	9	[7, 11]
Word Reading	10	[8, 12]	10	[8, 12]
Inhibition	9	[7, 11]	10	[8, 12]
Inhibition/Switching	10	[7, 12]	9	[7, 11]

Data Source: January 2024

All norms = 10 (sd 3)

Table 5.3

Baseline (Visit 1b) and Annualized Change for Behavioral Variables

Behavioral Variables	Median [IQR]			
	Glomerular		Non-Glomerular	
	Baseline n=252	% Change	Baseline n=743	% Change
ABAS-II[a]				
Conceptual Composite Score	94 [84, 111]	-0.8 [-3.4, 1.9]	94 [84, 105]	0.0 [-4.6, 4.9]
Social Composite Score	96 [81, 105]	0.3 [-7.2, 7.0]	95 [83, 106]	0.0 [-4.8, 7.3]
Practical Composite Score	93 [81, 103]	0.0 [-4.1, 7.0]	90 [78, 100]	0.0 [-5.9, 4.5]
General Adaptive Composite	92 [79, 109]	-1.9 [-4.9, 5.1]	91 [77, 103]	0.0 [-5.3, 5.9]
BASC 2-PRS[b]	n= 246		n= 616	
Externalizing Problems	48 [43, 54]	-0.6 [-1.9, 0.7]	49 [43, 56]	-0.4 [-1.5, 0.7]
Internalizing Problems	50 [45, 59]	-0.2 [-2.3, 1.3]	51 [45, 59]	-0.5 [-2.0, 0.8]
Behavioral Symptoms	50 [44, 56]	-0.8 [-2.5, 0.6]	50 [44, 57]	-0.4 [-1.8, 0.8]
Adaptive Skills	47 [41, 56]	1.2 [-0.7, 3.5]	47 [40, 54]	0.3 [-1.0, 1.9]
BASC 2-SRP[b]	n= 88		n= 244	
School Problems	48 [41, 56]	-0.6 [-2.8, 3.5]	48 [42, 55]	0.3 [-4.7, 3.5]
Internalizing Problems	47 [42, 51]	-0.2 [-1.5, 2.0]	46 [42, 52]	-0.4 [-2.8, 1.4]
Inattention/Hyperactivity	47 [41, 55]	-0.9 [-2.2, 2.0]	51 [44, 58]	-0.6 [-2.4, 2.3]
Emotional Symptoms	47 [42, 52]	-0.2 [-2.8, 1.3]	47 [42, 52]	-0.3 [-1.9, 0.8]
Personal Adjustment	52 [45, 59]	-0.3 [-1.7, 3.1]	51 [44, 57]	0.3 [-1.1, 3.3]
CDI[b]				
CDI Overall Score	42 [39, 49]	0.0 [-2.8, 1.2]	44 [39, 49]	-1.2 [-3.2, 2.1]

Data Source: January 2024

ABAS-II, BASC2-SRP & CDI were discontinued after *Cohort 1*.

[a] Norm = 100 (sd 15)

[b] Norm = 50 (sd 10)

Table 5.6

Currently Collected NIH Toolbox Cognitive and Emotional Data

	Median [IQR]	
	Glomerular	Non-Glomerular
Cognitive Variables[a]	n= 71	n= 335
Dimensional Change Card Sort	98 [82, 115]	97 [87, 107]
Flanker Inhibitory Control and Attention	87 [74, 97]	91 [83, 101]
Oral Reading Recognition	101 [91, 113]	96 [86, 112]
Pattern Comparison Processing Speed	100 [81, 115]	92 [73, 107]
Picture Sequence Memory	100 [88, 113]	99 [88, 114]
Picture Vocabulary	102 [90, 113]	98 [87, 109]
List Sorting Working Memory	97 [86, 110]	97 [89, 107]
Fluid Composite	95 [79, 112]	91 [79, 105]
Crystallized Composite	101 [91, 114]	99 [89, 110]
Total Composite	102 [88, 112]	94 [81, 108]
Early Childhood Composite	97 [82, 109]	95 [84, 109]
Emotional Variables[b,c]	n= 64	n= 183
Emotional Support	48 [42, 56]	48 [43, 57]
Friendship	50 [41, 55]	49 [41, 55]
Self-Efficacy	52 [45, 60]	53 [47, 62]
General Life Satisfaction	55 [50, 61]	52 [45, 59]
Loneliness	52 [44, 56]	51 [45, 56]
Perceived Hostility	48 [41, 55]	49 [42, 55]
Perceived Rejection	53 [46, 62]	51 [44, 57]
Perceived Stress	50 [42, 60]	46 [40, 55]
Sadness	47 [39, 53]	48 [42, 54]

Data Source: January 2024

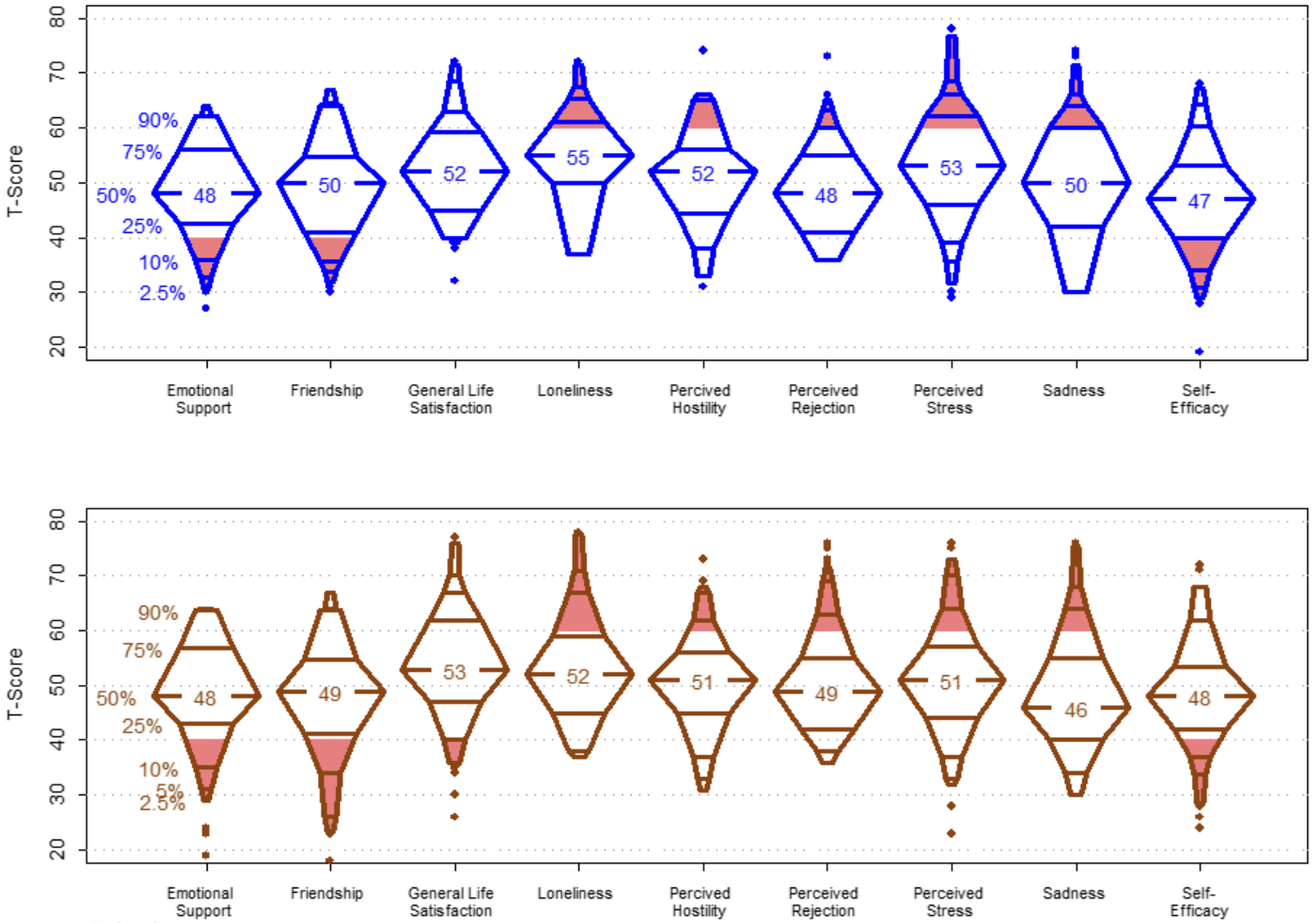
[a]Age-corrected Standard Scores used

[b]Uncorrected T-Scores used

[c] Norm = 50 (sd 10)
Higher scores are indicative of more emotional support, friendship, general life satisfaction and self-efficacy.
Lower scores are indicative of less loneliness, perceived hostility, perceived rejection, perceived stress and sadness.

Figure 5.6b

Distribution of NIH Toolbox Emotional Summary Scores by CKD Diagnosis



All norms = 50 (sd 10)
Higher scores are indicative of more emotional support, friendship, general life satisfaction and self-efficacy.
Lower scores are indicative of less loneliness, perceived hostility, perceived rejection, perceived stress and sadness.
Red shaded sections indicate “at-risk” scores.

Section 6:

GROWTH

This section describes, by CKD diagnosis, the height, height velocity, growth velocity, weight, body mass index, and body surface area of the CKiD participants at baseline and over time. This section also provides information on nutrients intake and hand grip.

Analytical Notes:

- Annual % change is calculated by regressing a line of each individual's outcome data on time in years from baseline with the outcome being log-transformed. The slope is then exponentiated to obtain the annual % change as 100*(exp(slope) -1).

- Height velocity is calculated as the difference in heights divided by the difference in age across two consecutive visits (restricted to 9 months up to 2 years between visits), for a given individual. Age and sex specific z-scores for height velocity were calculated using the LMS (skewness, median, variability) method. Least Mean Squares (LMS) values were only available for age midpoints between 5.5 and 18.5 for males, and 5.5 and 17.5 for females. Height velocity at the first follow-up visit was measured between the first two CKiD visits. Height velocity for current visit was measured between the two most recent CKiD visits.

Table 6.1a

Baseline and Annualized Percentage Change of Growth Markers

Variables	Median [IQR]			
	Glomerular		Non-Glomerular	
	Baseline n=275	% Change	Baseline n=824	% Change
Height, cm	156 [138, 168]	1% [0%, 3%]	123 [100, 147]	4% [2%, 5%]
Weight, kg	54 [37, 70]	3% [0%, 8%]	25 [16, 45]	11% [6%, 14%]
Height Percentile[a]	41 [15, 73]	-2% [-11%, 2%]	26 [8, 56]	1% [-8%, 14%]
Weight Percentile[a]	73 [38, 95]	-2% [-12%, 1%]	39 [15, 74]	0% [-7%, 12%]
Body Mass Index, kg/m^2	22 [18, 26]	1% [-1%, 4%]	17 [16, 20]	2% [0%, 4%]
BMI Percentile[a]	82 [54, 95]	-2% [-12%, 1%]	63 [35, 88]	0% [-8%, 5%]
Body Surface Area, m^2	1.5 [1.2, 1.8]	2% [0%, 6%]	0.9 [0.7, 1.4]	7% [4%, 9%]

Data Source: January 2024
[a] Percentiles based on CDC growth charts for those < 18.5 years old

Table 6.1b

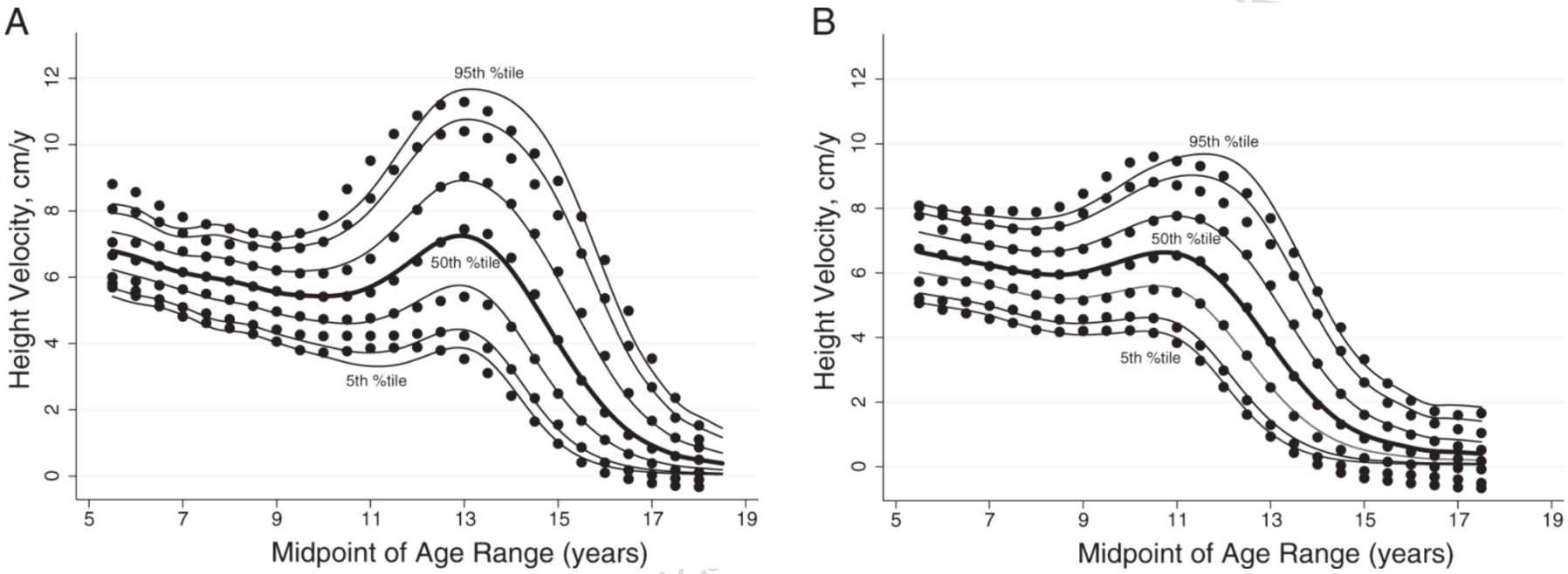
Height Velocity Percentile

Variables	Median [IQR]			
	Glomerular		Non-Glomerular	
	First Follow-up Visit n=204	09/2021-12/2022 n=2	First Follow-up Visit n=479	09/2022-1/2024 n=72
Height velocity percentile*	39.2 [14.2, 72.7]	*N/A [93.3, 99.8]*	50.0 [19.2, 81.6]	57.7 [26.5, 86.1]

Data Source: January 2024 *Italics* indicate small sample size.
*Height velocity calculated for participants ages 5 to < 18.5 years old.

Figure 6.1

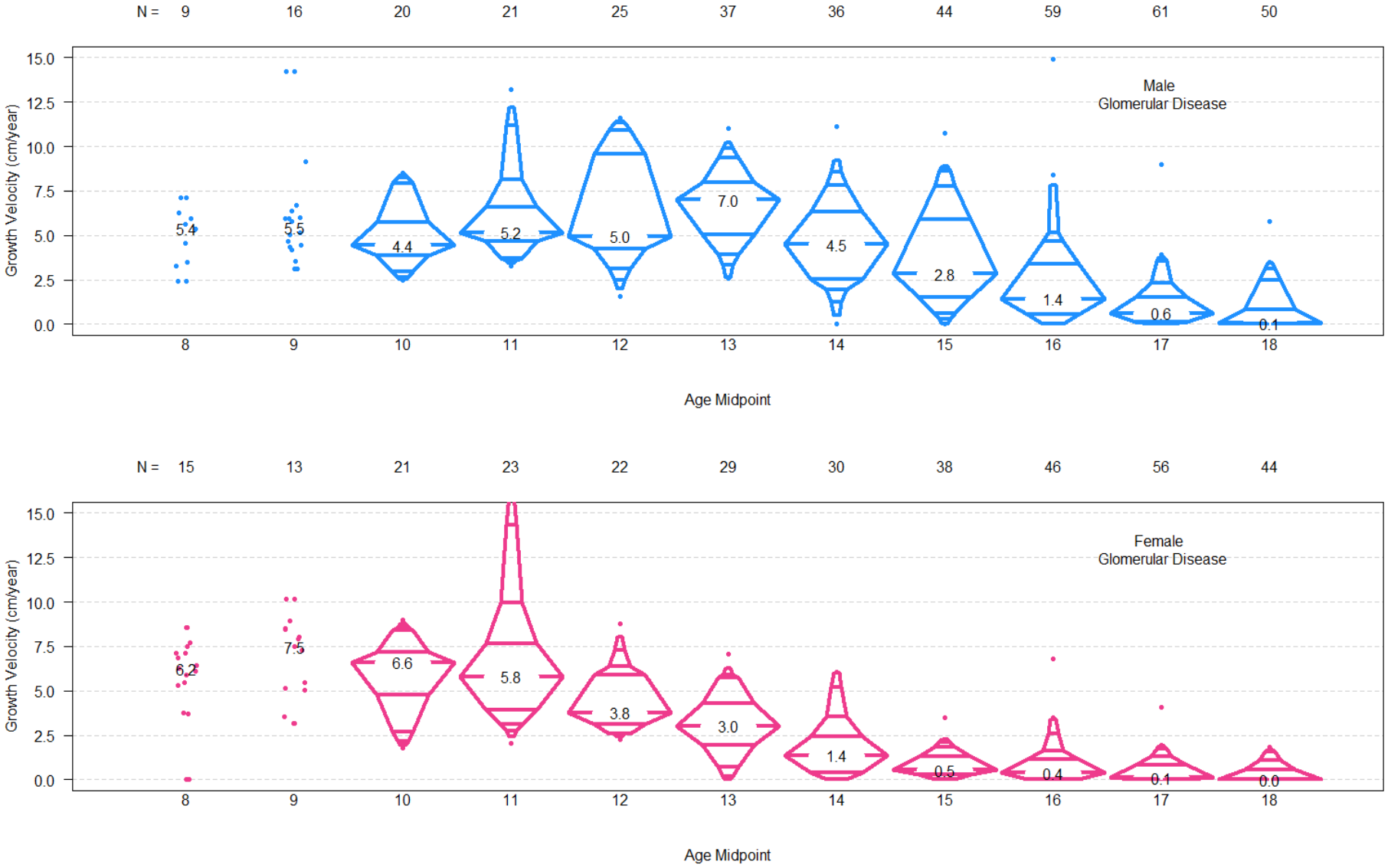
Height Velocity in the Normal Population for Males (A) and Females (B) by Age



Reference curves for HV for males aged 5 to 18.5 years (A) and females aged 5 to 17.5 years (B). Shown are curves for the fifth, 10th, 25th, 50th, 75th, 90th, and 95th percentiles. The dots are the corresponding empirical percentiles smoothed with the Lowess method. Source: Kelly A, Winer KK, Kalkwarf H, et al. Age-Based Reference Ranges for Annual Height Velocity in US Children. The Journal of Clinical Endocrinology and Metabolism. 2014;99(6):2104-2112. doi:10.1210/jc.2013-4455.

Figure 6.2a

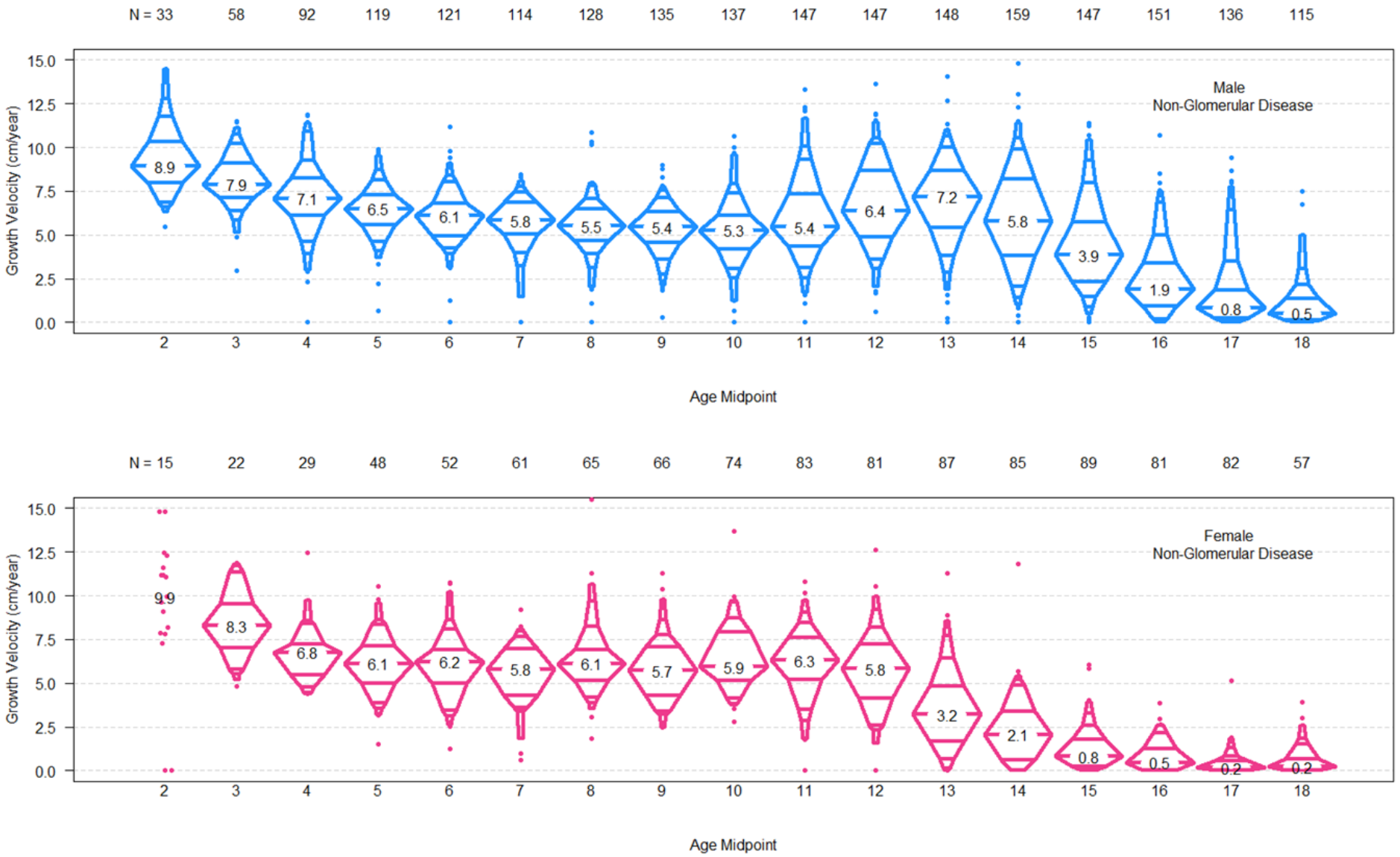
Growth Velocity by Age and Sex in Children with Glomerular Diagnosis



Growth velocity was calculated as the height difference between two visits divided by the time between visits (cm/year). Individual data points were plotted when n < 20 per group. Insufficient data for age < 8 years among children with glomerular diagnosis (n= 21 person-visits < 8 years for males; n= 25 person-visits < 8 years for females).

Figure 6.2b

Growth Velocity by Age and Sex in Children with Non-Glomerular Diagnosis



Growth velocity was calculated as the height difference between two visits divided by the time between the two visits (cm/year); age midpoint was based on these two visits. Individual data points were plotted when n < 20 per group.

Table 6.2

Categorical Growth Variables, Baseline and Current [09/2022-01/2024]

Variables	% (n) Glomerular Baseline n=275	Glomerular 09/2022-01/2024 n=23	Non-Glomerular Baseline n=824	Non-Glomerular 09/2022-01/2024 n=138
Tanner Stage I	35% (92)	*0% (0)*	73% (555)	66% (57)
Height				
% > 50th %ile – 50%	-7% (116)	*+6% (10)*	-20% (239)	-7% (57)
% > 10th to ≤ 50th %ile – 40%	-1% (107)	*-12% (5)*	-1% (309)	-2% (51)
% > 5th to ≤ 10th %ile – 5%	+1% (17)	*+6% (2)*	+5% (81)	+4% (12)
% ≤ 5th %ile – 5%	+7% (32)	*+1% (1)*	+15% (156)	+5% (13)
BMI				
% < 15th %ile[a] – 15%	-7% (22)	*-5% (1)*	-4% (82)	-5% (12)
% ≥ 90th %ile[a] – 10%	+30% (124)	*+5% (2)*	+14% (213)	+12% (31)
% > 85th %ile[a] – 15%	+27% (100)	*+10% (2)*	+12% (165)	+14% (28)

Data Source: January 2024 *Italics* indicate small sample.

[a] Percentiles based on CDC growth charts for participants < 18.5 years old.

Table 6.3 and Table 6.4: At baseline, 732 questionnaires with less than 25% missing items were considered for nutrients intake estimation. Nutrients intake per day were estimated for 710 KIDs aged 2-22y. The daily requirement of energy or Estimated Energy Requirement (EER) was calculated for each KID, from a set of equations that account for age, sex, weight, height, and physical activity level (PAL). 658 KIDs with energy intake in the range 500 - 5000 kcal and between the 2.5th and the 97.5th percentile of %EER were included in the final sample. %EER is simply the ratio of daily energy intake to daily EER.

Table 6.3

Descriptive Statistics of Nutrients Intake per Day

	Median [IQR]		
	Overall n=658	**Glomerular n=203**	**Non-Glomerular n=455**
Energy, kcal	1968 [1523, 2574]	2123 [1508, 2748]	1908 [1523, 2489]
Fat, g	74 [55, 103]	75 [52, 103]	72 [56, 102]
Carbohydrates, g	261 [195, 345]	274 [197, 365]	253 [194, 335]
Proteins, g	69 [50, 91]	77 [50, 98]	66 [50, 89]
Animal, g	45 [32, 63]	49 [31, 66]	44 [32, 62]
Vegetable (g)	22 [16, 30]	23 [16, 33]	21 [15, 29]
Sodium, mg	3089 [2294, 4243]	3375 [2326, 4585]	3029 [2273, 4064]
Potassium, mg	2384 [1804, 3076]	2579 [1832, 3548]	2468 [1855, 3232]
Phosphorus, mg	1206 [894, 1612]	1243 [858, 1696]	1195 [914, 1554]

Nutrient Intake per day = ∑ (Frequency x Amount of nutrient x Serving)

Table 6.4

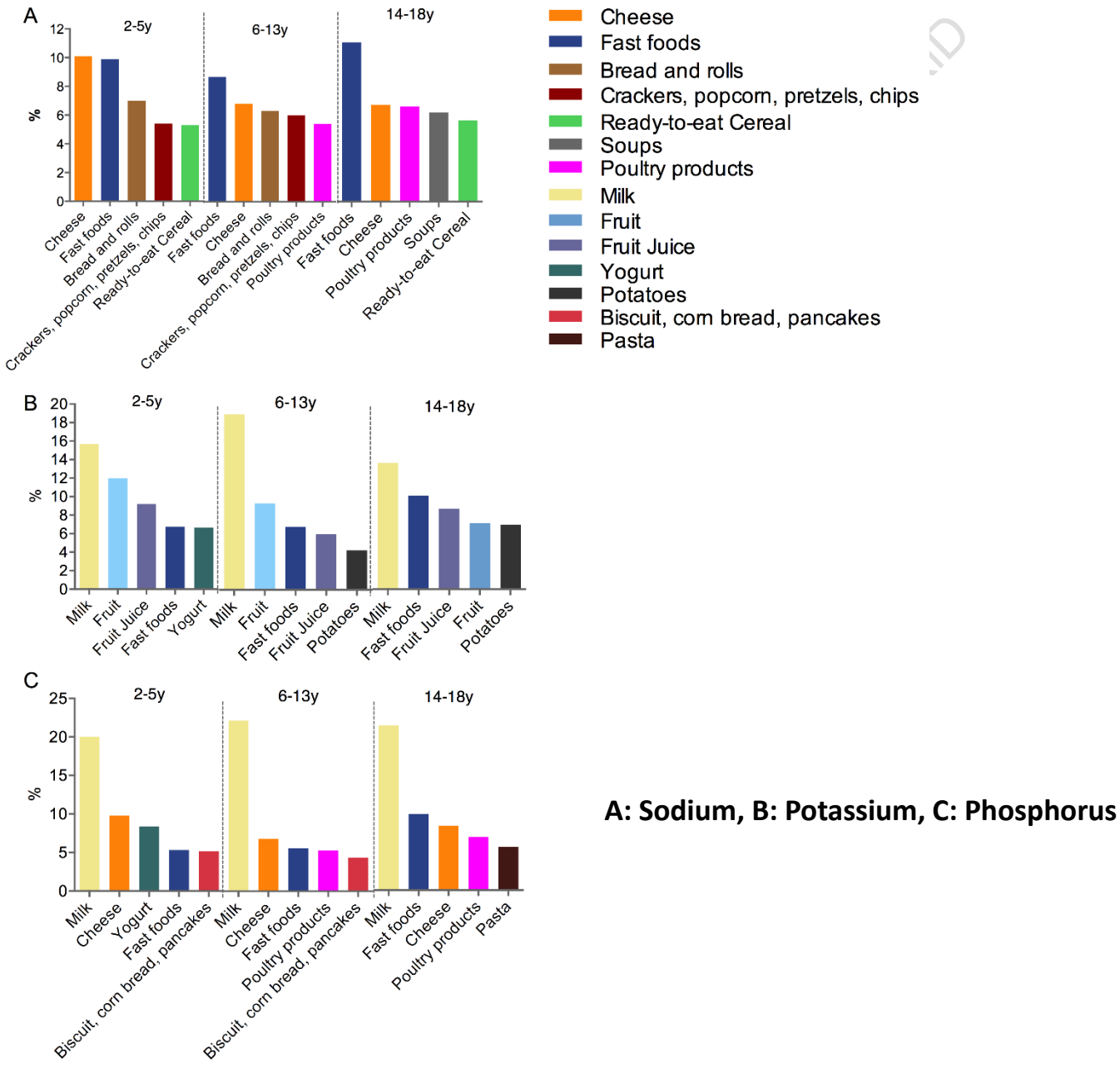
Dietary Sources of Energy among Participants 2 to 18 years old

Ranking	Food groups/items[a]	Mean (%)	Cumulative (%)
1	Milk	7.7	7.7
2	Fast foods	6.8	14.5
3	Bread and rolls	6.6	21.1
4	Fruit	6.1	27.2
5	Crackers, popcorn, pretzels, chips	5.6	32.8
6	Poultry products	5.3	38.1
7	Pasta	5.1	43.2
8	Beverages	4.5	47.7
9	Ready-to-eat cereals	4.2	51.9
10	Candy, chocolate and sugary foods	4.2	56.1
11	Fruit juice	3.4	59.5
12	Pork products	3.2	62.7
13	Milk products	3.1	65.8
14	Cake, cookies and pie	3.0	68.8
15	Biscuit, corn bread, pancakes	2.8	71.6
16	Cheese	2.6	74.2
17	Nuts and seeds	2.6	76.8
18	Yogurt	2.4	79.2
19	Pizza	2.3	81.5
20	Mayonnaise and salad dressing	2.2	83.7

[a] Food groups (n = 11) contributing at least 1% to total energy intake in descending order: eggs, potatoes, beef, rice, other vegetables, coffee and tea, butter and margarine, vegetable soup and other soup, fish and fish products, sausage and luncheon meats, and legumes.

Figure 6.5

Top Five Food Sources for Sodium, Potassium and Phosphate by Age



A: Sodium, B: Potassium, C: Phosphorus

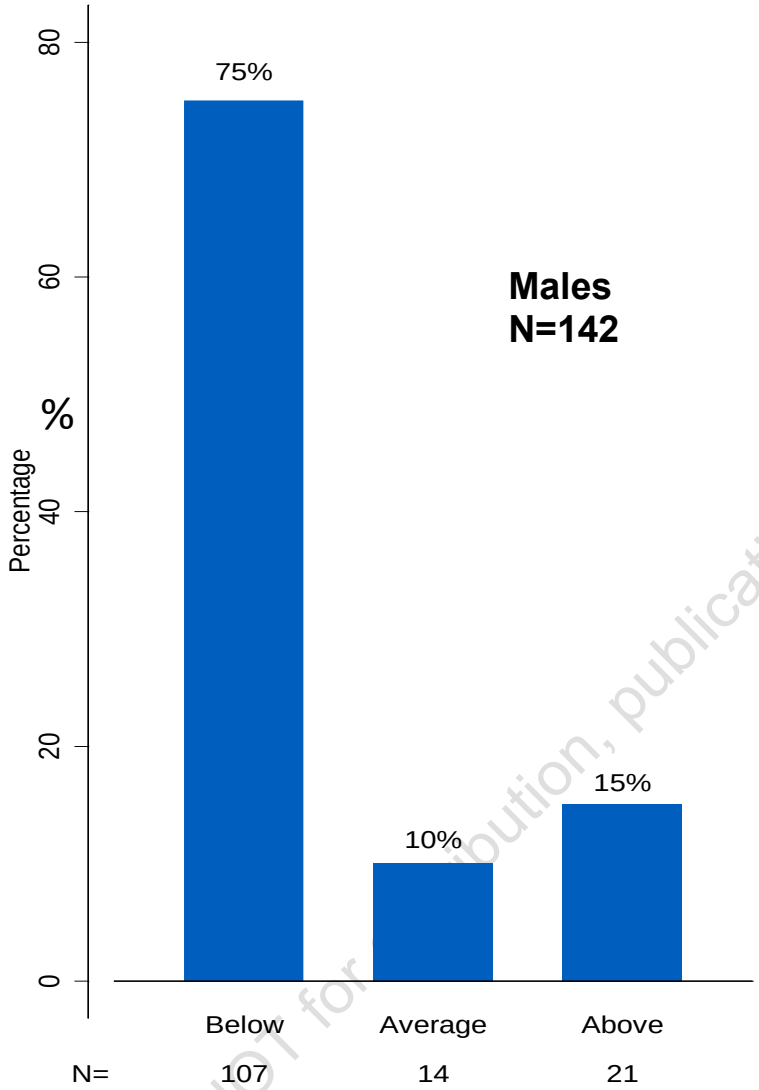
Table 6.5

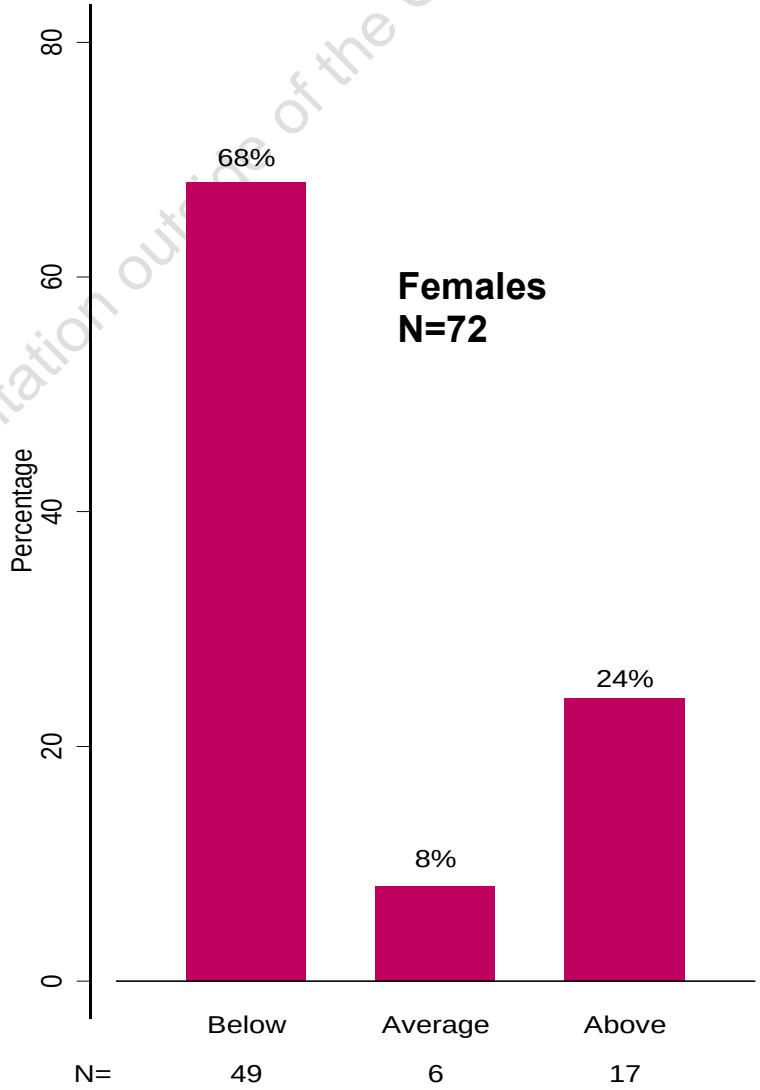
Descriptive Statistics for Participants with Hand Grip Data, N=429

	% (n) or Median [IQR]	
	Glomerular n=126	**Non-Glomerular n=303**
Male	54% (68)	66% (200)
Age, yrs	17 [13, 19]	13 [10, 17]
African-American	24% (30)	17% (52)
U25eGFR, ml/min|1.73m^2	68 [49, 85]	51 [36, 64]
Weight, kg	61 [48, 84]	50 [32, 65]
Height, cm	164 [153, 171]	153 [135, 166]
Combined Grip Strength, lbs	111 [87, 149]	91 [58, 139]

Figure 6.7a

Combined Grip Strength among Participants 7 to <15 years old, N=214

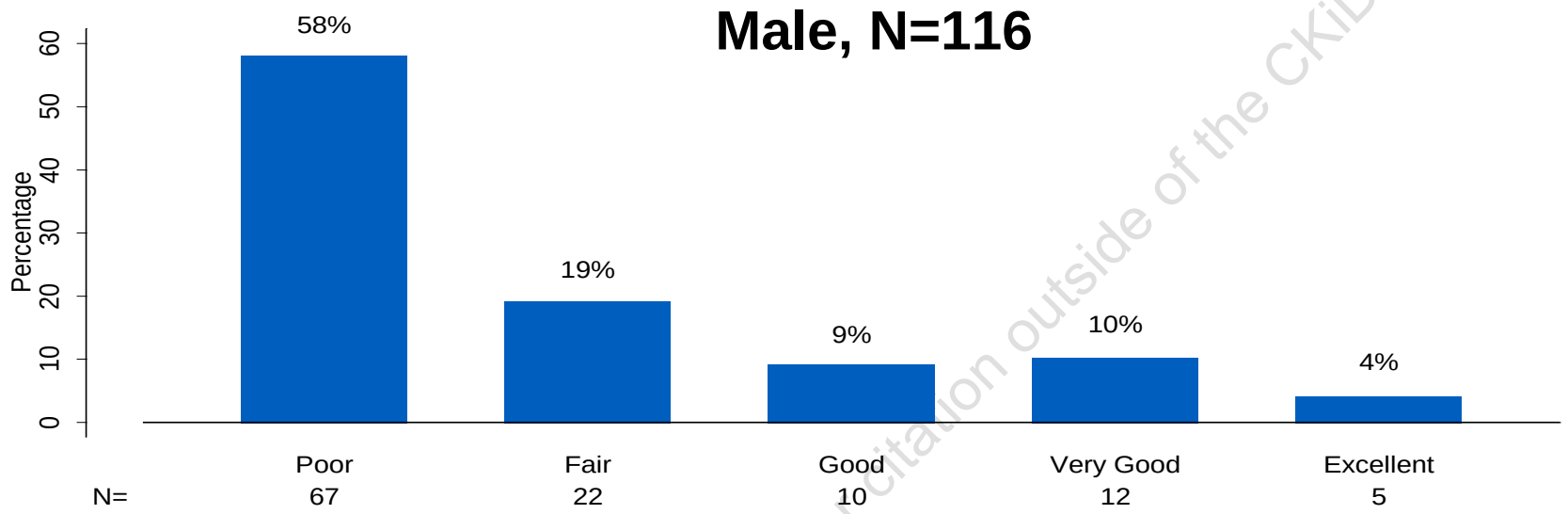


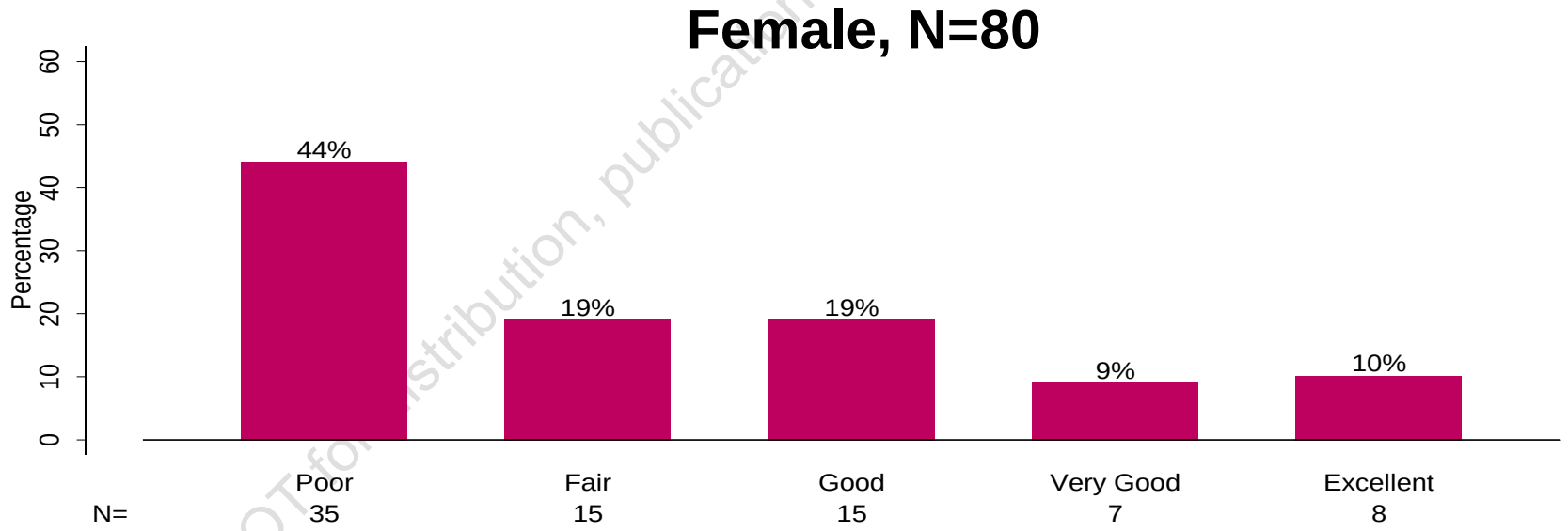


Reference: Canadian Fitness and Lifestyle institute (1988)
Canada Fitness Survey Longitudinal

Figure 6.7b

Combined Grip Strength among Participants ≥ 15 years old, N=196





Reference: Canadian Society for Exercise Physiology (2004)
The Canadian Physical Activity and Lifestyle Approach 3rd Edition

Section 7:

SOCIOECONOMIC STATUS, HEALTHCARE UTILIZATION, CENSUS, HEALTH LITERACY, AND RISK BEHAVIORS

This section provides univariate statistics and describes the bivariate relationships between various indicators of SES and outcomes from other sections of the report. This section also provides statistics on census data, and risk behaviors.

Risk behaviors described in this section include use of alcohol, marijuana, tobacco and vapor products. The questions were adapted from the Youth Risk Behavior Survey (YRBS) and completed by participants who were 12 years of age or older.

<u>SES indicators include:</u>

Income – categorized as ≤$36 000, $36 000 to $75 000, and > $75 000

Insurance status – categorized as private, public and uninsured

Maternal education – categorized as less than high school, some college and college graduate

<u>Outcomes include:</u>

Neuropsychology

Quality of Life – PedsQL parent and self-report form
Full Scale IQ – Wechsler Intelligence Scale

Table 7.1

Income, Insurance Status and Maternal Education

Variables	% (n) Glomerular Baseline n=275	Glomerular 09/2022-01/2024 n=15	Non-Glomerular Baseline n=824	Non-Glomerular 09/2022-01/2024 n=122
Income				
≤ $36 000	41% (109)	*15% (2)*	39% (311)	17% (18)
> $36 000 to 75 000	29% (76)	*31% (4)*	28% (225)	25% (26)
> $75 000	30% (80)	*54% (7)*	32% (257)	58% (61)
Insurance Status [a]				
Private	66% (174)	*80% (12)*	66% (528)	71% (82)
Any Public	46% (123)	*47% (7)*	49% (387)	43% (50)
Uninsured	2% (6)	*0% (0)*	2% (17)	3% (4)
Maternal Education				
High School or Less	45% (119)	*20% (1)*	36% (288)	27% (15)
Some College	22% (59)	*20% (1)*	28% (227)	20% (11)
College Grad	33% (88)	*60% (3)*	36% (296)	54% (30)

Data Source: January 2024. *Italics* indicate small sample size.

[a] Sum of percentages may exceed 100% since private and public insurance are non-exclusive categories.

Table 7.2a

Baseline Socioeconomic Status variables by Race in Children with Glomerular Diagnosis, N=275

	% (n)		
	African American n= 84	Non-African American n= 191	Difference between AA and non-AA
Hispanic ethnicity	5% (4)	21% (39)	-16%
Abnormal birth history	45% (32)	22% (39)	+23%
Household structure			
Birth parents, not married, not living together	61% (46)	10% (19)	+51%
Birth parents, married, living together	25% (19)	63% (118)	-38%
Other living arrangements	14% (11)	26% (49)	-12%
3 people or less in household	47% (39)	36% (67)	+11%
Income			
≤ $36K	58% (47)	34% (62)	+24%
> $36-75K	28% (23)	29% (53)	-1%
> $75K	14% (11)	38% (69)	-24%
Insurance [a]			
Any health insurance	96% (81)	97% (185)	-1%
Any public insurance	60% (49)	40% (74)	+20%
Any private insurance	57% (46)	69% (128)	-12%
Social services [a]			
Food assistance in past year	29% (24)	12% (23)	+17%
Social worker visit in past year	21% (18)	17% (32)	+4%
Healthcare utilization [a]			
ER visit in past year	51% (43)	45% (85)	+6%
Private MD visit in past year	71% (59)	73% (137)	-2%
Clinic center visit in past year	61% (51)	68% (129)	-7%
Hospitalized in past year	35% (29)	38% (72)	-3%
Psychologist visit in past year	22% (18)	19% (36)	+3%
Dental center visit in past year	77% (64)	75% (142)	+2%

[a] Sum of percentages may exceed 100% since categories are non-exclusive.

Table 7.2b

Baseline Socioeconomic Status variables by Race in Children with Non-Glomerular Diagnosis, N=824

	% (n)		
	African American n= 158	Non-African American n= 664*	Difference between AA and non-AA
Hispanic ethnicity	8% (12)	16% (104)	-8%
Abnormal birth history	40% (63)	28% (183)	+12%
Household structure			
Birth parents, not married, not living together	49% (76)	12% (78)	+37%
Birth parents, married, living together	30% (46)	66% (424)	-36%
Other living arrangements	22% (34)	22% (141)	-0%
3 people or less in household	46% (73)	39% (258)	+7%
Income			
≤ $36K	68% (100)	33% (211)	+35%
> $36-75K	22% (33)	30% (192)	-8%
> $75K	10% (15)	37% (241)	-27%
Insurance [a]			
Any health insurance	99% (158)	98% (644)	+2%
Any public insurance	71% (112)	43% (275)	+28%
Any private insurance	42% (65)	73% (463)	-31%
Social services [a]			
Food assistance in past year	44% (70)	16% (108)	+28%
Social worker visit in past year	25% (40)	17% (114)	+8%
Healthcare utilization [a]			
ER visit in past year	52% (82)	41% (271)	+11%
Private MD visit in past year	59% (94)	74% (491)	-15%
Clinic center visit in past year	81% (128)	66% (433)	+15%
Hospitalized in past year	25% (39)	27% (180)	-3%
Psychologist visit in past year	13% (20)	13% (85)	-0%
Dental center visit in past year	66% (105)	72% (474)	-5%

[a] Sum of percentages may exceed 100% since categories are non-exclusive.
* Excludes two (2) KIDs with missing race

Table 7.3

Income and Insurance Status by Baseline Self-Reported Maternal Education, US sites only, N=936[a]

	% [b] (n)					
	High School or Less n=327		Some college n=253		College grad n=356	
Income	**Private insurance**	**Any public insurance**	**Private insurance**	**Any public insurance**	**Private insurance**	**Any public insurance**
≤ $36,000 (n= 362)	11% (35)	55% (180)	9% (24)	31% (78)	2% (7)	11% (38)
> $36,000 to 75,000 (n= 264)	12% (40)	9% (30)	22% (56)	15% (38)	18% (64)	10% (36)
> $75,000 (n= 310)	10% (33)	3% (9)	17% (42)	6% (15)	50% (178)	9% (33)
Total	33% (108/327)	67% (219/327)	48% (122/253)	52% (131/253)	70% (249/356)	30% (107/356)

Data Source: January 2024

[a] Excludes 57 children from Canadian sites, 16 children without insurance from US sites and 90 missing data.

[b] Percentages are calculated using respective maternal education category as the denominator.

Figure 7.1

Change in Health Insurance Status over Time, Stratified by Age

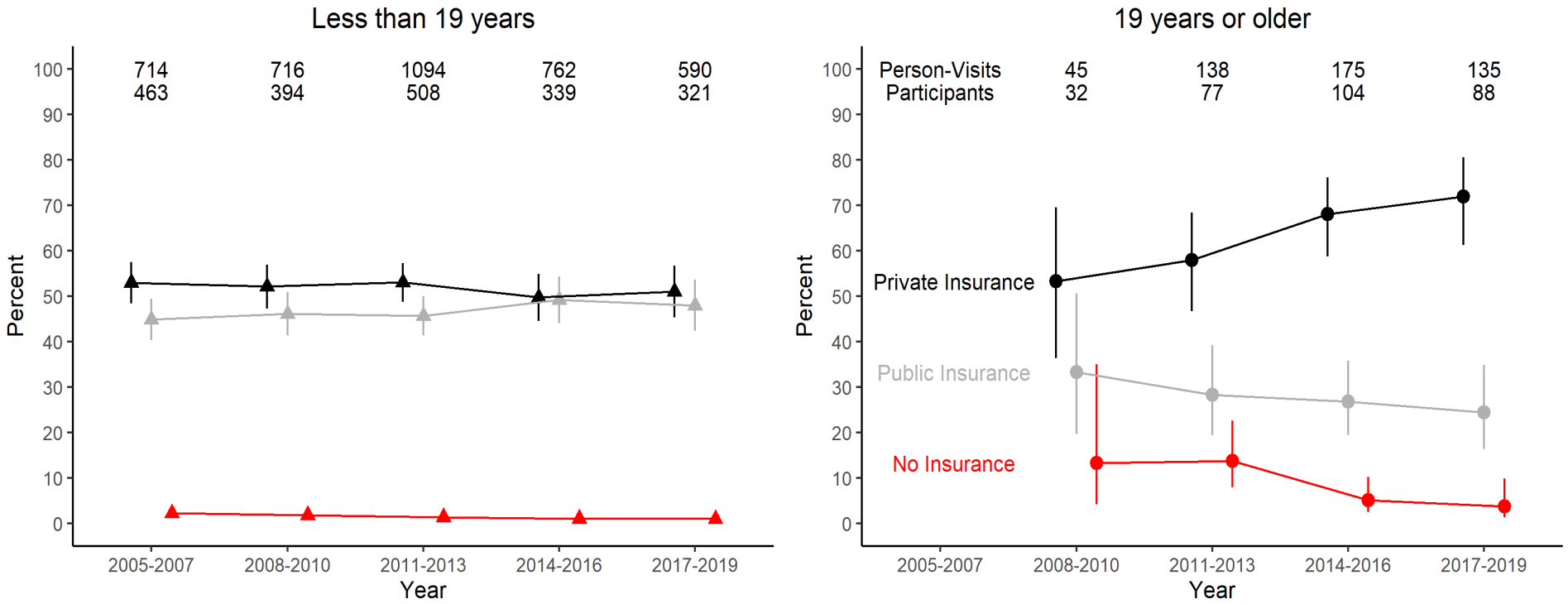


Figure 7.1. Change in health insurance status over time in the CKiD cohort, stratified by under 19 years vs. 19 years of age or older assessed separately at each person-visit. The percentage, and associated 95% CI, reporting each health insurance type (private, public, or none) is on the y-axis, and the time in three-year bins is presented on the x-axis. Person-visits contributed by those under the age of 19 years are represented by triangles (▲), and by circles (●) for those 19 years of age or older. Black markers represent private insurance, gray represents public insurance, and red represents no health insurance coverage (i.e., uninsured). The number of person-visits and individual participants contributing to each time period and age group are listed across the top of each plot. No data is shown for those 19 years of age or older in the 2005-2007 time period as fewer than 20 person-visits were present.

Figure 7.4a

CKiD Participant Household Income vs. Neighborhood Median Household Income, N=493

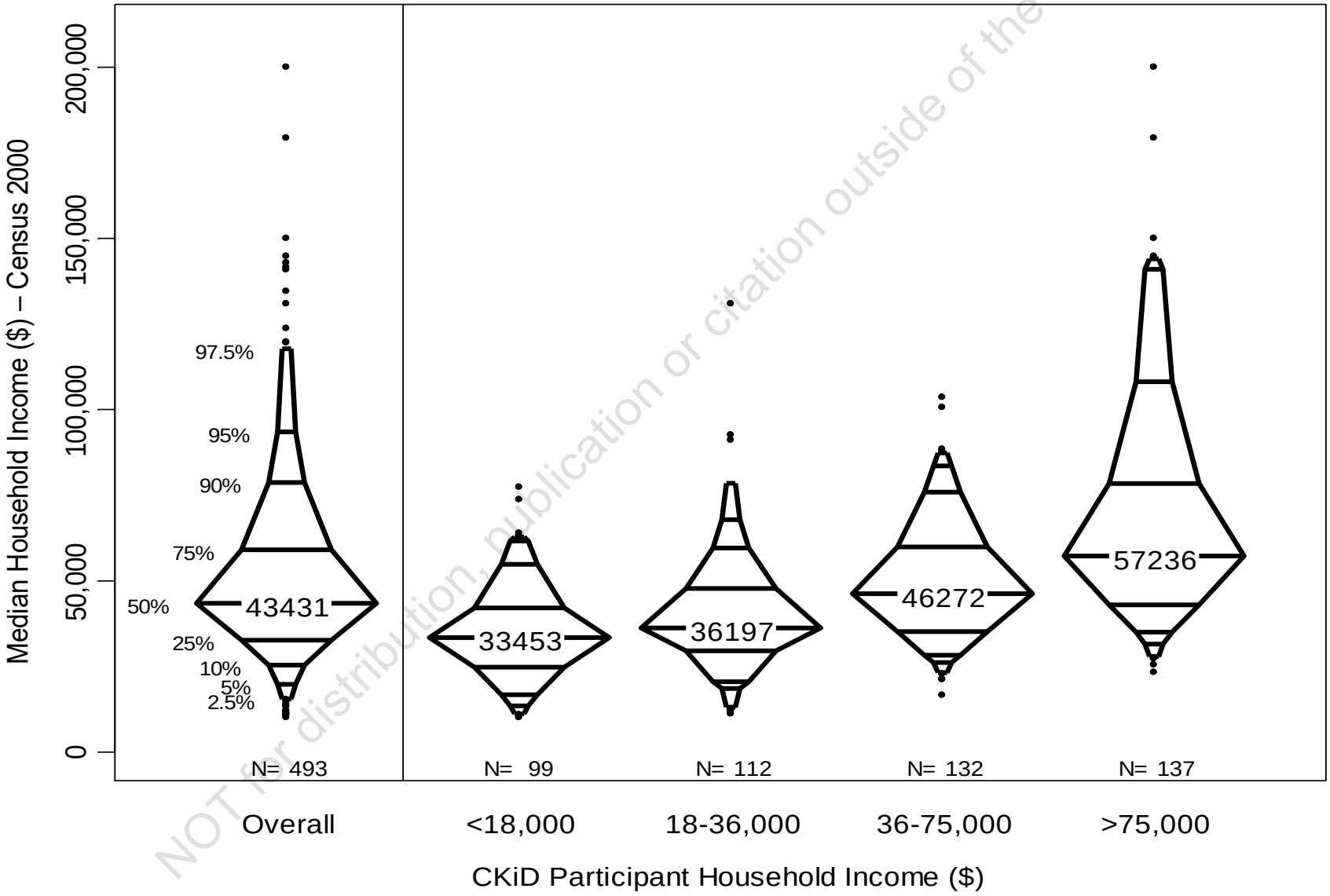
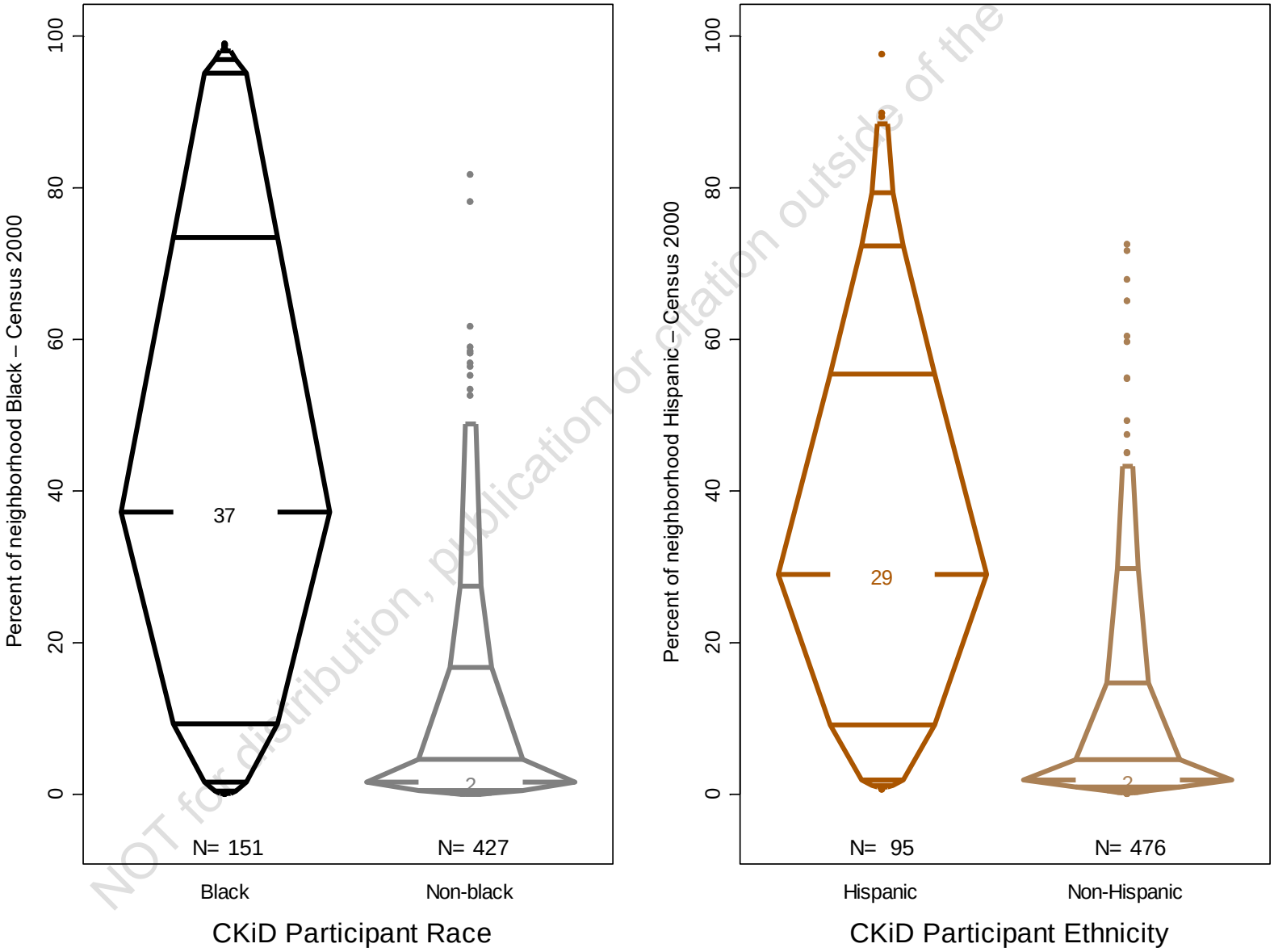


Figure 7.5a

Racial Ethnicity of Neighborhoods by Race and Ethnicity of CKiD Population



Section 8:

ENDPOINTS

This section describes the progression to study endpoints and characterizes the follow-up time, risk factors and baseline exposures of those that have experienced dialysis or transplant. The additional events and follow-up time resulting from PIP/ePIP interviews are included in all analyses presented in this section.

Analytical Notes:

- The cumulative percentage of individuals experiencing an endpoint (dialysis, transplant or loss to regular follow-up) takes into account the shorter follow-up time of some participants and non-parametrically (i.e., a la Kaplan-Meier) projects their likely event status by a given time, *t*, after baseline. Thus, estimated percentages are higher than actually observed at *t* due to the incomplete follow-up.

- Incidence curves are presented for various comorbidities among those with no history of the comorbidity at baseline and at least two iGFR measurements. Curves were created by regressing log(iGFR) on time to determine each individual GFR trajectory and then accumulating events and person time across GFR categories over time (number of events and person-time contributing to each category are enumerated above the curves).

Table 8.1a

Characteristics of Participants with Glomerular Diagnosis by Endpoint (Dialysis, Transplant, or Non-Event), N=275

Characteristics	% (n) or Median [IQR] Non-Events* (n=168)	Transplant (n=26)	Dialysis (n=81)
Age at last Visit (years)	19.1 [16.9, 21.7]	16.5 [13.5, 18.8]	16.1 [14.2, 17.7]
Race			
Caucasian	55% (92)	85% (22)	40% (32)
African American	29% (48)	12% (3)	41% (33)
Other	16% (27)	4% (1)	17% (14)
Multiracial	1% (1)	0% (0)	2% (2)
Female	45% (76)	62% (16)	44% (36)
Age at CKD onset	8.5 [3.5, 12.5]	4.5 [2.5, 9.5]	8.5 [2.5, 12.5]
Years since CKD onset	10.9 [7.5, 15.5]	11.0 [7.1, 16.3]	8.9 [5.2, 13.3]
Urine Protein:Creatinine at V1	0.4 [0.1, 0.9]	2.0 [1.1, 4.9]	1.9 [0.7, 5.5]
U25eGFR at V1	68 [52, 82]	38 [31, 60]	42 [31, 56]
Last study visit U25eGFR	60 [42, 77]	18 [15, 23]	23 [15, 33]
% change U25eGFR/year*	-2% [-7%, +0%]	-21% [-29%, -12%]	-32% [-47%, -13%]

*Restricted to those with a calculated % change in U25eGFR/year.

Missing Data:

Dialysis: age at CKD dx, n=3; length of CKD, n=3; uP/C, n=2; last U25eGFR, n=11; % change U25eGFR/year, n=17
Transplant: age at CKD dx, n=1; length of CKD, n=1; uP/C, n=2; % change U25eGFR/year, n=2
Non-Events: age at CKD dx, n=4; length of CKD, n=4; uP/C, n=5; last U25eGFR, n=2; % change U25eGFR/year, n=6

Table 8.1b

Characteristics of Participants with Non-Glomerular Diagnosis by Endpoint (Dialysis, Transplant, or Non-Event), N=824

Characteristics	% (n) or Median [IQR] Non-Events* (n=584)	Transplant (n=121)	Dialysis (n=118)
Age at last Visit (years)	14.6 [8.1, 19.2]	14.8 [11.2, 16.8]	15.5 [12.6, 18.2]
Race			
Caucasian	70% (409)	77% (93)	62% (73)
African American	19% (112)	12% (14)	28% (33)
Other	7% (38)	4% (5)	7% (8)
Multiracial	4% (25)	7% (9)	3% (4)
Female	33% (192)	29% (35)	36% (42)
CKD onset at birth	90% (521)	92% (110)	92% (108)
Years since CKD onset	14.3 [8.1, 19.3]	15.4 [11.4, 17.5]	16.5 [13.3, 18.9]
Urine Protein:Creatinine at V1	0.2 [0.1, 0.6]	0.5 [0.2, 1.6]	0.7 [0.3, 1.4]
U25eGFR at V1	54 [42, 67]	33 [27, 43]	36 [29, 46]
Last study visit U25eGFR	49 [35, 65]	21 [17, 24]	18 [15, 23]
% change U25eGFR/year*	-1% [-4%, +1%]	-11% [-20%, -7%]	-15% [-22%, -9%]

*Restricted to those with a calculated % change in U25eGFR/year

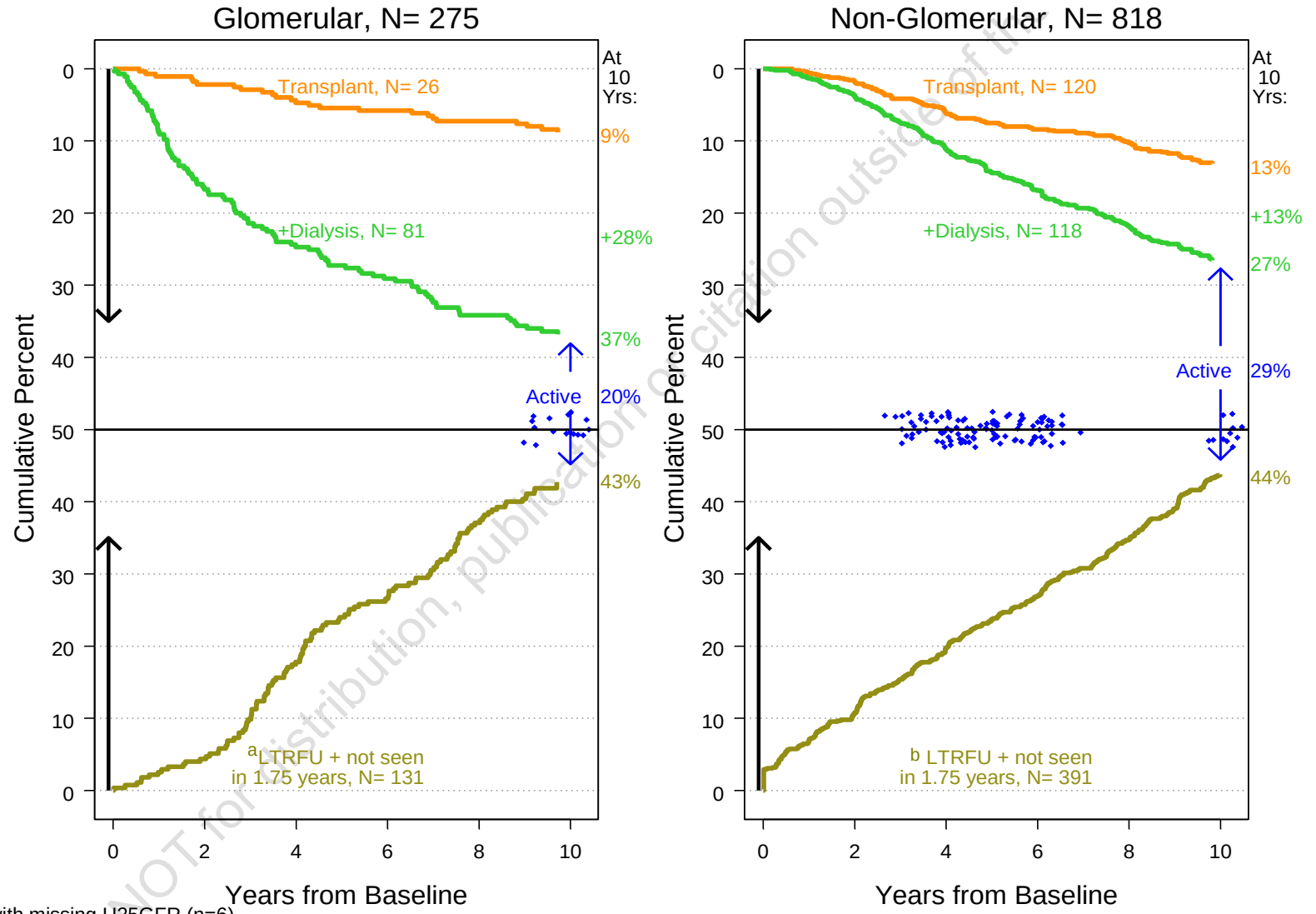
Missing Data:

Dialysis: CKD onset at birth, n=1; length of CKD, n=1; uP/C, n=5; last U25eGFR, n=5; % change U25eGFR/year, n=7
Transplant: CKD onset at birth, n=1; length of CKD, n=1; uP/C, n=11; last U25eGFR, n=1; % change U25eGFR/year, n=4
Non-Events: race, n=1; CKD onset at birth, n=3; length of CKD, n=3; uP/C, n=62; U25eGFR at v1a, n=7; last U25eGFR, n=34; % change U25eGFR/year, n=57

Figure 8.2b

Transplant, Dialysis, and Lost to Follow-Up as Competing Events by CKD Diagnosis with age as time scale, N=1093*

(Date of Analysis: January 2024)



* KIDs with missing U25GFR (n=6)

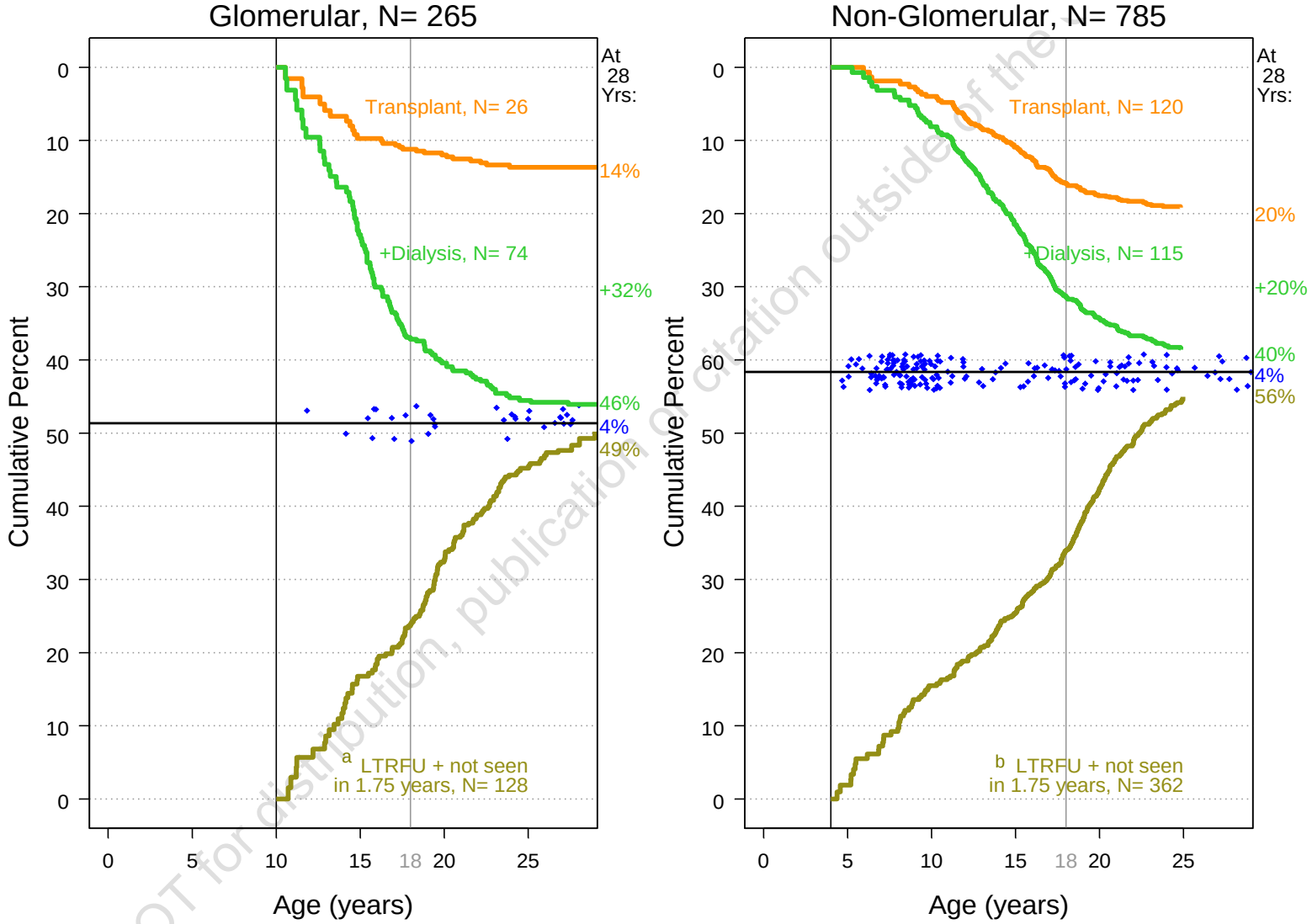
[a] # of KIDs documented LTRFU (n=81) or > 1.75 years from last visit to 01/24 (n=50) after including the additional follow-up provided by phone/in-person interviews

[b] # of KIDs documented LTRFU (n=225) or > 1.75 years from last visit to 01/24 (n=166) after including the additional follow-up provided by phone/in-person interviews

Figure 8.3b

Transplant, Dialysis, and Lost to Follow-Up as Competing Events with time on study as time scale, N=1050 (265 + 785)

(Date of Analysis: January 2024)



[a] # of KIDs LTRFU (n=79) or > 1.75 years from last visit to 1/24 (n=49) after including the additional follow-up provided by phone/in-person interviews

[b] # of KIDs LTRFU (n=215) or > 1.75 years from last visit to 1/24 (n=147) after including the additional follow-up provided by phone/in-person interviews

These figures are conditional on being observed beyond age 10 for children w/ glomerular diagnosis and age 4 for children w/ non-glomerular diagnosis

Figures 8.4b-e summarize time from the onset of kidney disease to kidney replacement therapy (KRT; transplant or dialysis) by risk factors of interest. With the exception of the first figure (glomerular vs. non-glomerular CKD diagnosis), all analyses are stratified by CKD diagnosis. Figures show non-parametric Kaplan-Meier survival curves with years from disease onset on the x-axis. **Due to the fact that few events occur within 2 years of disease onset, the analyses are presented conditioned on surviving 2 years event-free.** Time differences (in years) at each quartile are presented. For example, in figure 8.4b, the time difference at the median (dMedian) is -7.5, indicating that the time at which 50% of children with glomerular disease reach KRT is 7.5 years earlier in the course of disease than the time at which 50% of children with non-glomerular disease reach KRT. Time differences and 95% confidence intervals are computed parametrically using Weibull regression (smooth functions).

Figure 8.4b

Progression to Kidney Replacement Therapy from 2 Years Post-CKD Onset

(Date of Analysis: January 2024)

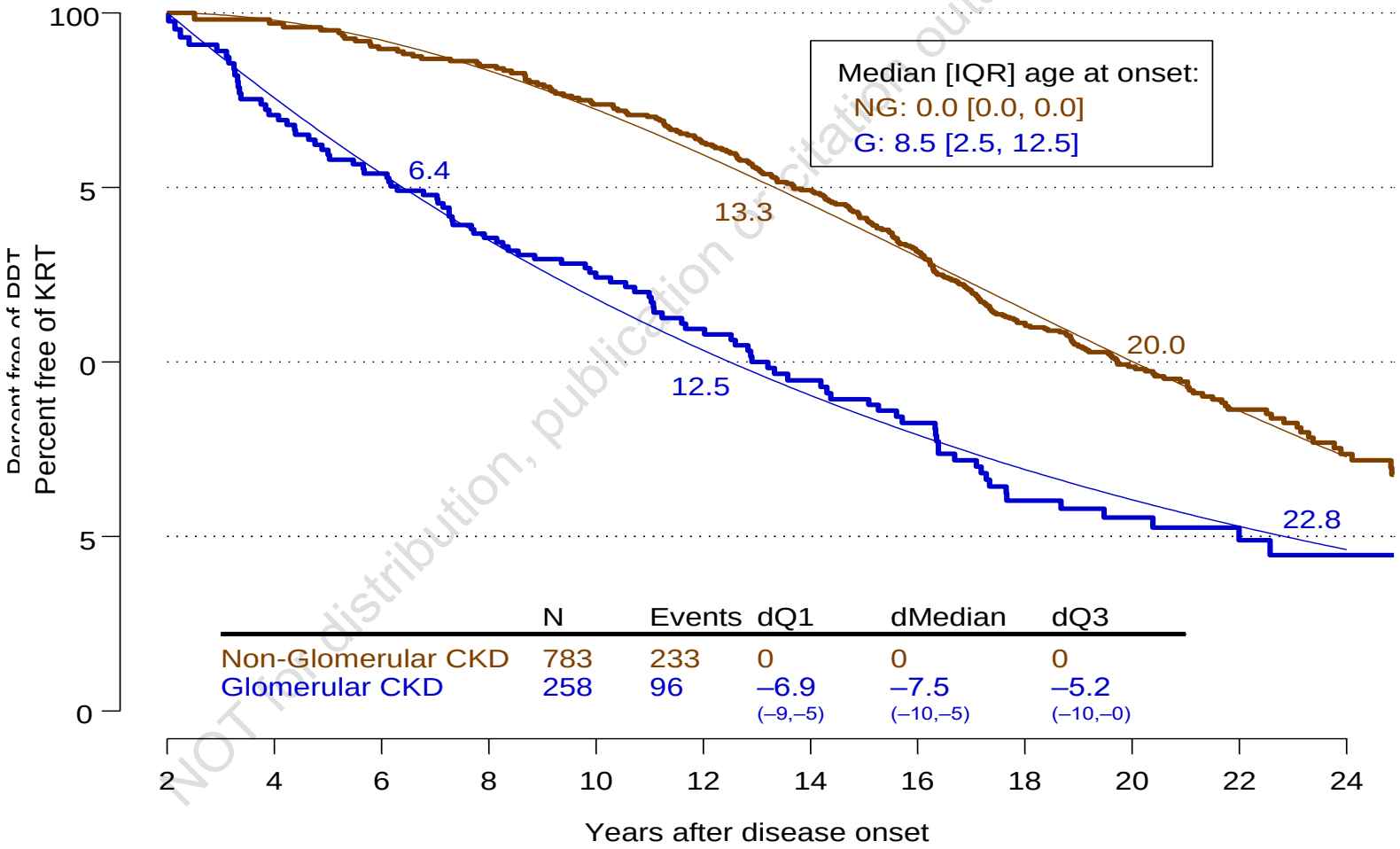


Figure 8.4c

Progression to KRT from 2 Years Post-CKD Onset, Stratified by CKD Diagnosis and Sex

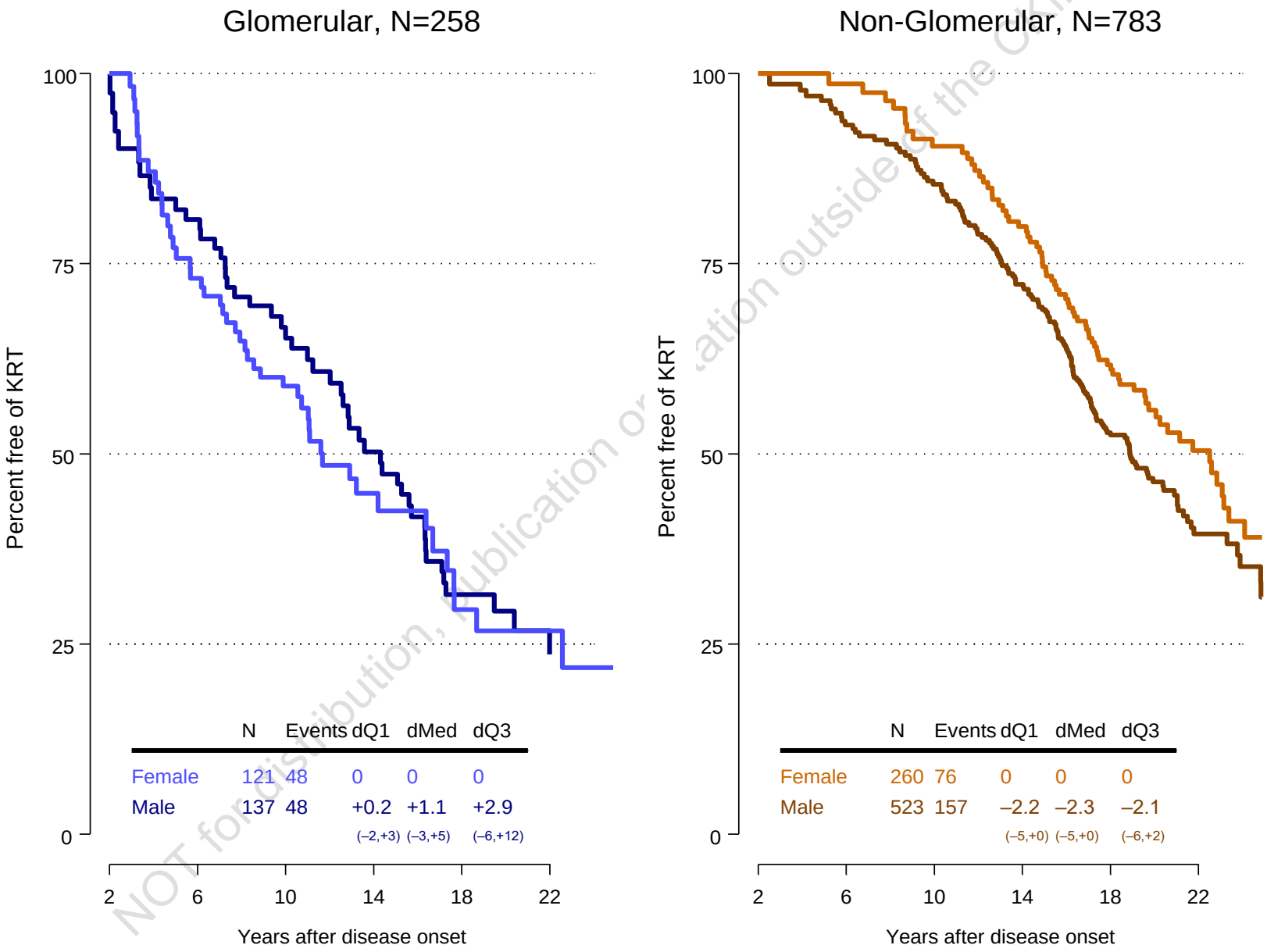


Figure 8.4d

Progression to KRT from 2 Years Post-CKD Onset, Stratified by CKD Diagnosis and Race

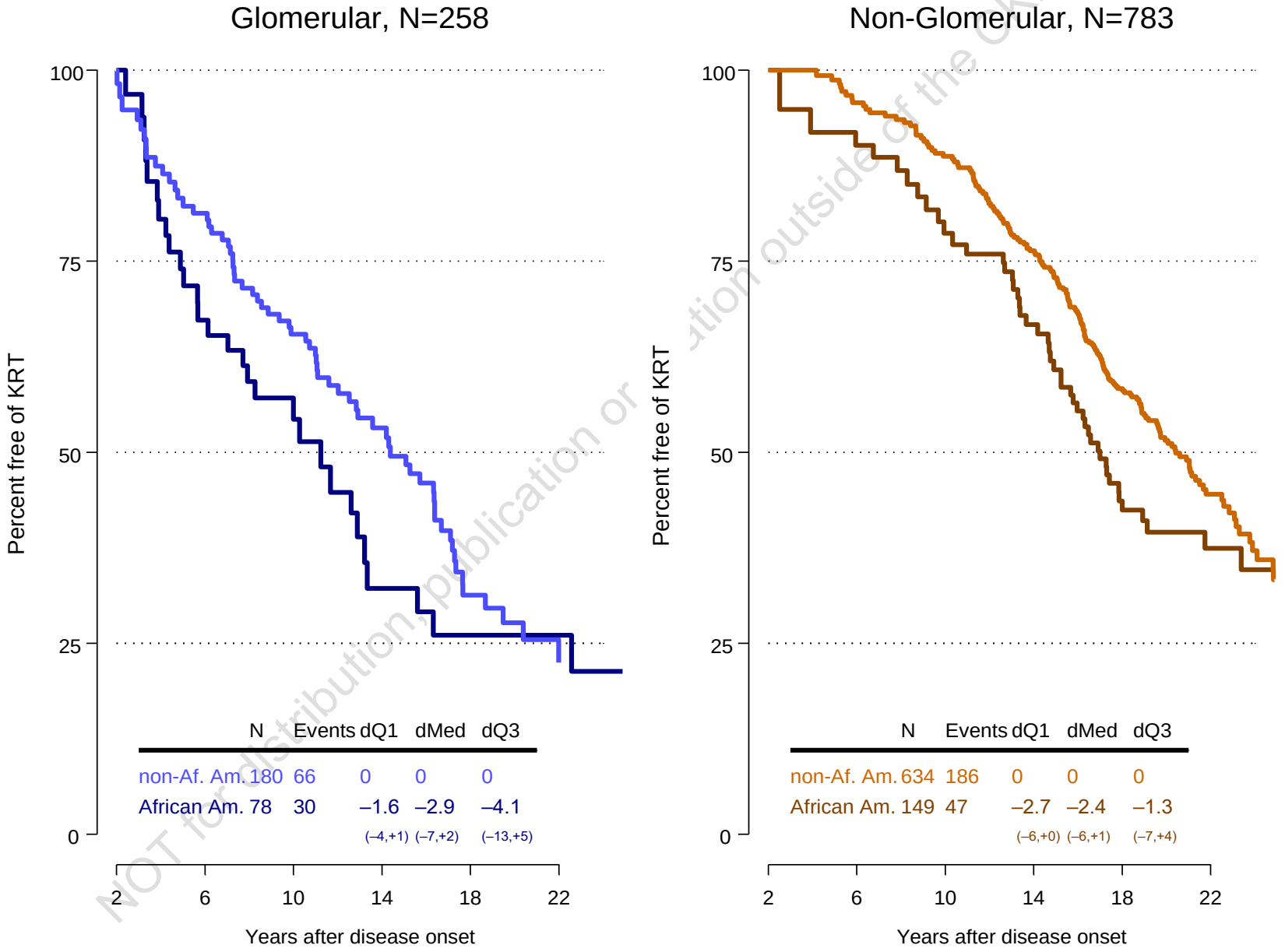


Figure 8.4e

Progression to KRT from 2 Years Post-CKD Onset, Stratified by CKD Diagnosis and Birth History

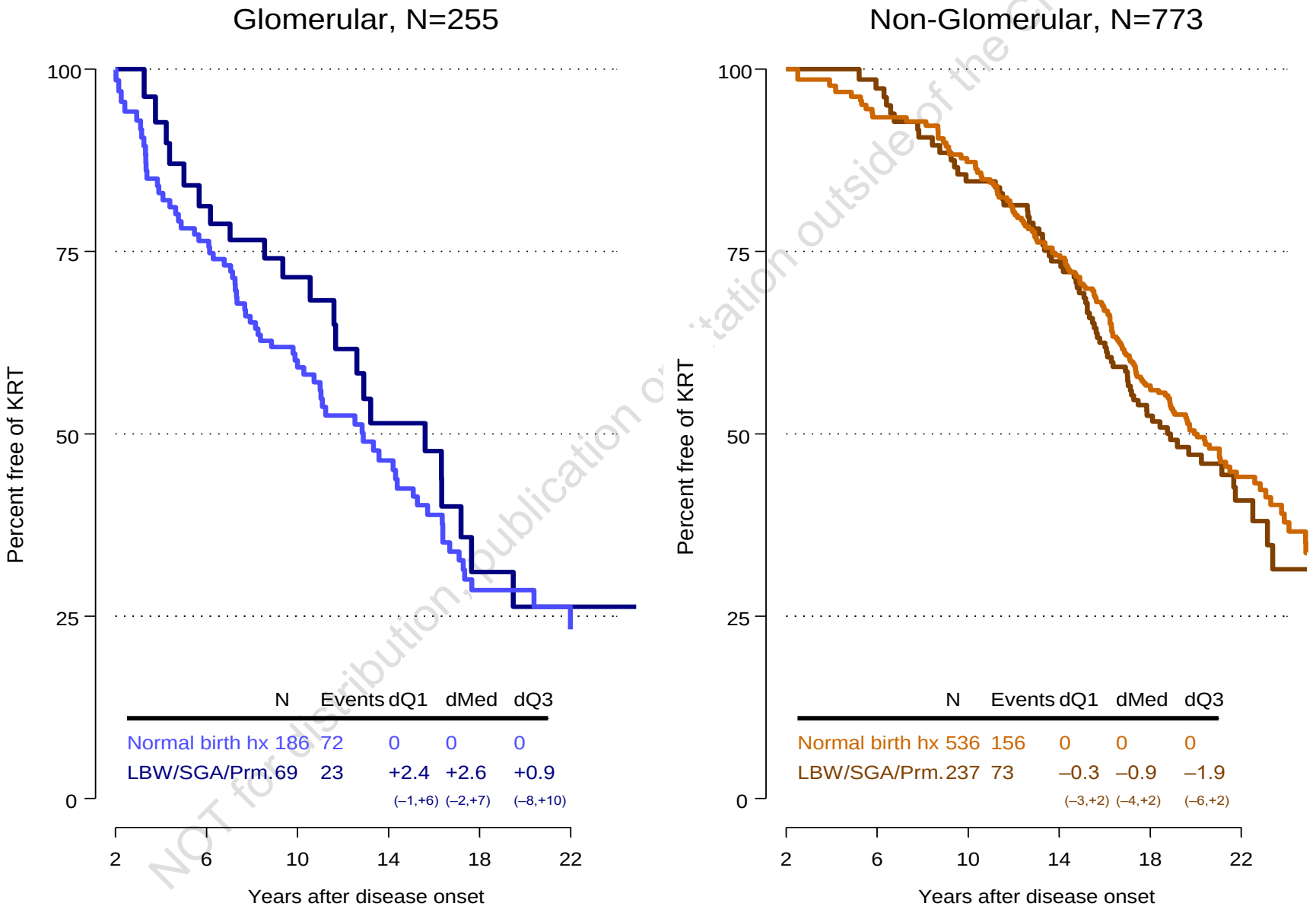


Table 8.3a

Descriptive Statistics by Years from CKD Onset for Children with Glomerular Disease

	Years from onset of Glomerular CKD						
	<2	2-4	4-7	7-10	10-13	>13	Overall
Person-Visits (PIP)[a]	130 (0)	205 (2)	332 (13)	265 (23)	189 (25)	283 (34)	1404 (97)
% of P-V contributed by children with							
FSGS	18%	24%	29%	33%	30%	19%	26%
HUS	11%	14%	18%	29%	35%	45%	27%
Systemic Immunological Disease	28%	23%	14%	9%	5%	2%	12%
Other	42%	40%	39%	29%	30%	34%	35%
% with U25eGFR < 45[b] ml/min|1.73m^2	28%	28%	26%	35%	40%	40%	33%
% with UPCR > 2.0[b]	17%	14%	20%	19%	19%	22%	19%

[a] Includes clinical, PIP, and ePIP pre-KRT visits. Number of PIP/ePIP visits shown in parentheses.
[b] Missing data: eGFR, n=9; UPCR, n=177.

Table 8.3b

Descriptive Statistics by Years from CKD Onset for Children with Non-Glomerular Disease

	Years from onset of Non-Glomerular CKD							
	<4	4-7	7-10	10-13	13-16	16-19	≥19	Overall
Person-Visits (PIP)[a]	381 (13)	751 (43)	836 (19)	895 (30)	943 (30)	756 (41)	474 (103)	5036 (279)
% of P-V contributed by children with								
Obstructive Uropathy	22%	25%	24%	25%	26%	23%	17%	24%
Aplastic/Hypoplastic/Dysplastic Kidney	30%	27%	28%	24%	23%	24%	30%	26%
Reflux Nephropathy	7%	11%	14%	17%	20%	25%	27%	17%
Other	42%	38%	35%	34%	31%	28%	27%	33%
% with U25eGFR < 45[b] ml/min|1.73m^2	42%	40%	41%	50%	55%	55%	54%	49%
% with UPCR > 2.0[b]	21%	14%	14%	20%	26%	28%	32%	22%

[a] Includes clinical, PIP, and ePIP pre-KRT visits. Number of PIP/ePIP visits shown in parentheses.
[b] Missing data: eGFR, n=48; UPCR, n=721.

Figure 8.8a

Incidence of kidney replacement therapy (KRT) after kidney disease onset among participants with non-glomerular (blue; n= 650), hemolytic uremic syndrome (HUS; green; n= 49), glomerular non-HUS (red; n= 216) diagnoses

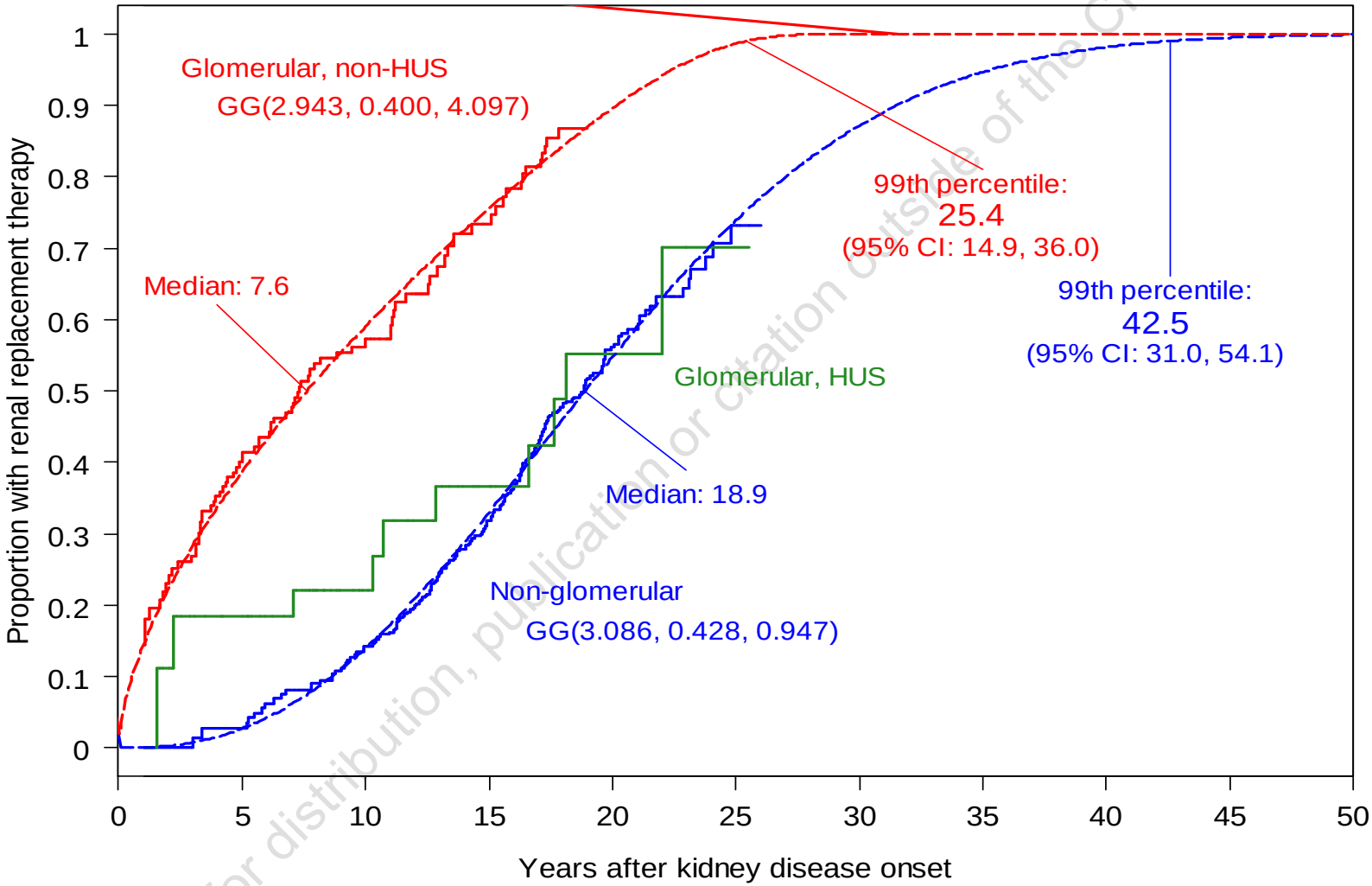


Figure 8.8a. Incidence of renal replacement therapy (RRT) after kidney disease onset among participants with non-glomerular (blue; n= 650), hemolytic uremic syndrome (HUS; green; n= 49), glomerular non-HUS (red; n= 216) diagnoses. Continuous step functions represent non-parametric estimates of the cumulative incidence of RRT. Dashed lines represent group-specific parametric survival models based on the generalized gamma (GG) family with parameters listed as GG(β, σ, κ). Median and 99th percentile times to RRT in years after kidney disease onset are presented with 95% confidence intervals for the 99th percentile.

Ng DK, Matheson M, …, Muñoz A. Am J Epidemiol 2019:188;2156-2164

Figure 8.8c

Incidence of First Transplant or Dialysis as Competing Events Among Non-glomerular and Glomerular Non-hemolytic Uremic Syndrome diagnoses

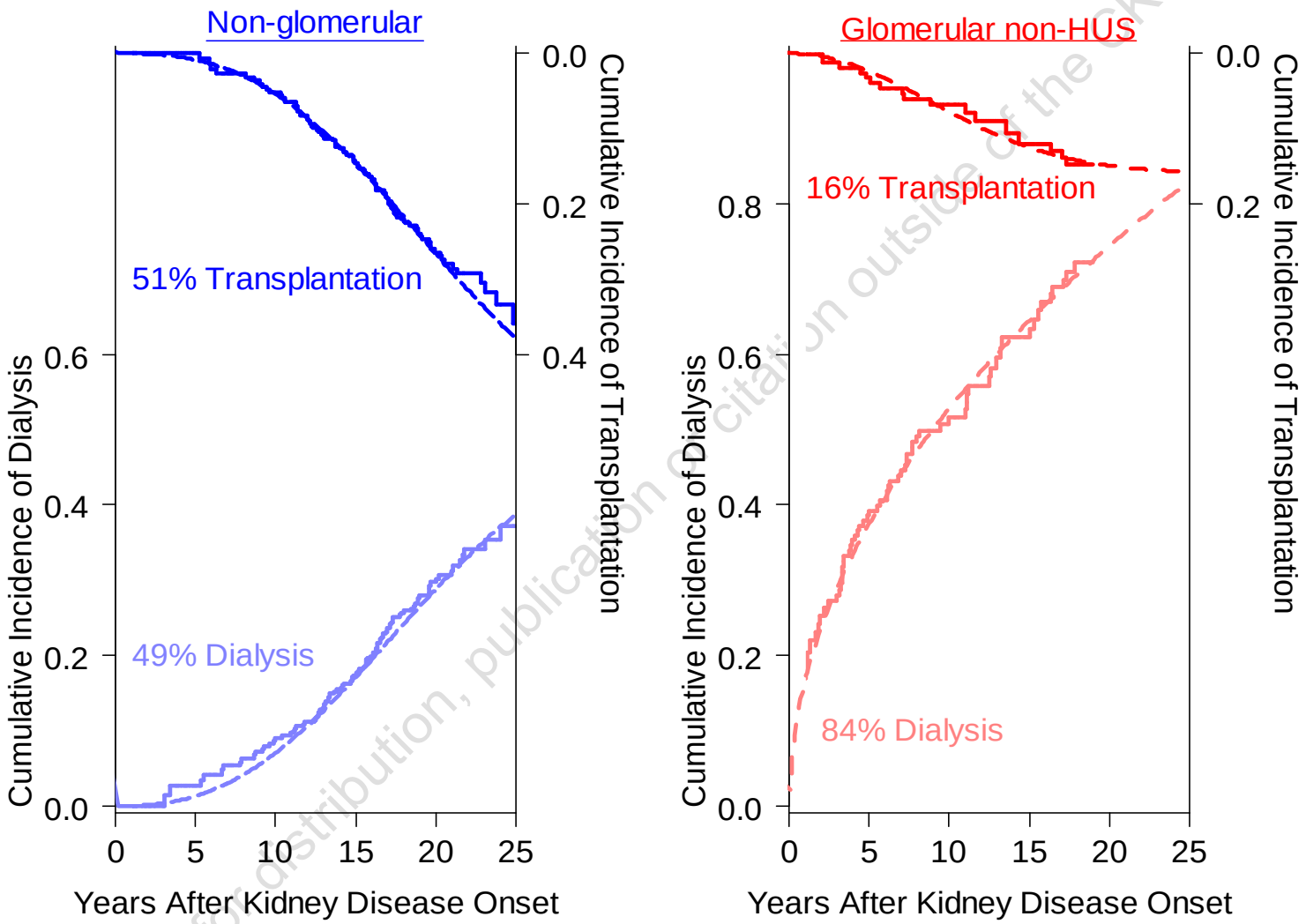


Figure 8.8c. Incidence of first transplant or dialysis as competing events among non-glomerular (NG; n= 650; blue) and glomerular non-hemolytic uremic syndrome (G; n= 216; red) diagnoses. Continuous step functions represent non-parametric competing risk estimates of the cumulative incidence of first dialysis (bottom) or first transplant (top). Dashed lines represent group-specific parametric mixture models with parameters listed as the mixture parameter (%) and Generalized Gamma (GG(β, σ, κ)) or Weibull distributions (WE(β, σ)).

Section 9:

REPOSITORY SAMPLES

This section provides a description of samples stored at the NIDDK Biological Repository and Rutgers Genetic Repository. Samples are collected at different study visits. Therefore, the number and average volume of samples collected at each visit are provided. Specifically, hair samples and whole blood for DNA samples are collected at V1b. However, nail clippings are collected at V1b and V4 whereas serum, plasma and urine are collected at V1b and each annual follow-up visit.

Analytical note:

- The amount of serum and plasma varies depending on the weight of the child; therefore, the data are presented for children < 30kg (kilograms) and ≥ 30 kg.
    - 5^{th} %ile – the volume of sample that follows below the 5^{th} percentile.
    - 95^{th} %ile – the volume of sample about the 95^{th} percentile.

Figure 9.1

Status of Repository Samples collected at V1b

(Date of Analysis: January 2024)

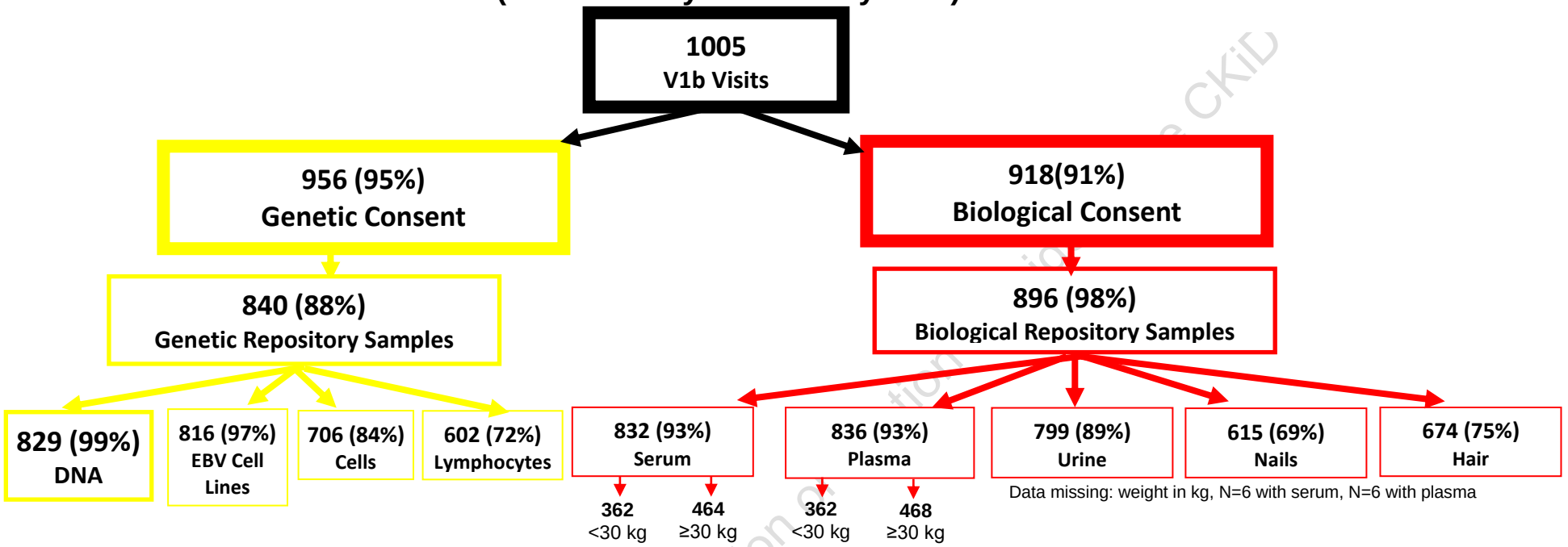


Table 9.1a

Description of DNA Samples at Repository at V1b

Variables	Visit 1b n=829 DNA Samples % or Median [5th %ile, 95th %ile]	
Genotyped	98% (815)	
DNA Yield	1,686.6	[14.34, 2414.59]

Table 9.1b

Description of Biological Samples at Repository at V1b

	Visit 1b n=896 Biological Samples N	Median	[5th %ile, 95th %ile]
Serum, mL			
<30 kg	362	1.6	[0.5, 3.2]
≥30 kg	464	2.0	[0.6, 3.5]
Plasma, mL			
<30 kg	362	1.1	[0.4, 3.0]
≥30 kg	468	2.1	[0.7, 3.3]
Urine, mL	799	40.0	[11.5, 56.0]

Figure 9.2
Status of Biorepository Samples collected at V2

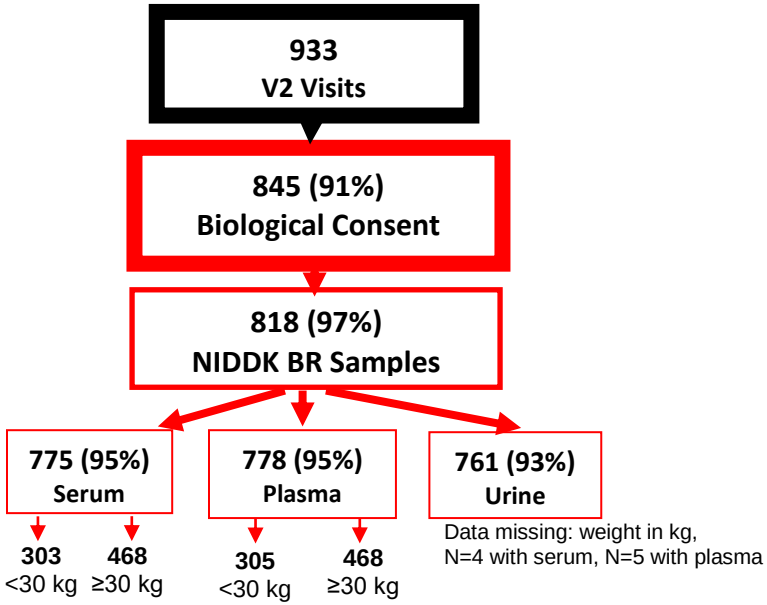


Figure 9.3
Status of Biorepository Samples collected at V3

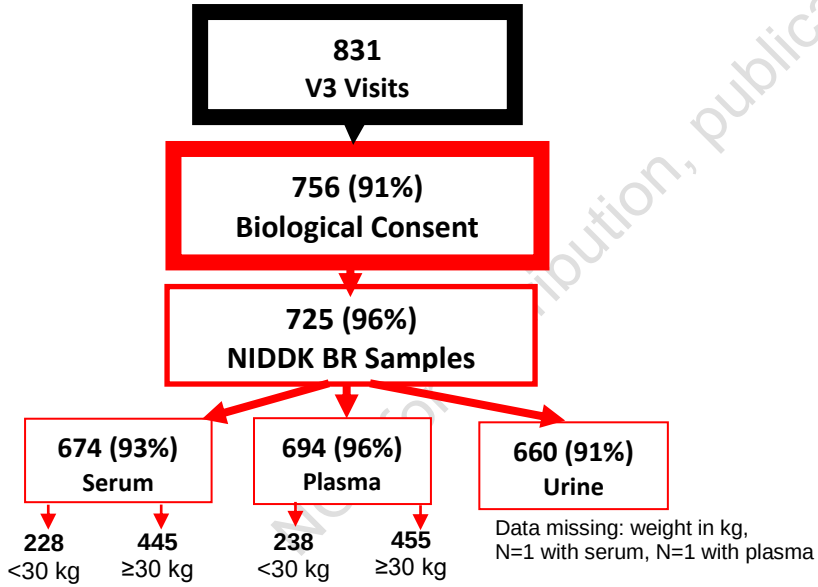


Table 9.2
Description of Biorepository Samples at V2

	Visit 2 n=818		
	Biological Samples		
	N	Median	[5th %ile, 95th %ile]
Serum, mL			
<30 kg	303	1.9	[0.5, 5.8]
≥30 kg	468	2.5	[0.7, 5.6]
Plasma, mL			
<30 kg	305	1.7	[0.8, 3.8]
≥30 kg	468	2.8	[1.3, 4.3]
Urine, mL	761	42.0	[14.4, 60.0]

Table 9.3
Description of Biorepository Samples at V3

	Visit 3 n=725		
	Biological Samples		
	N	Median	[5th %ile, 95th %ile]
Serum, mL			
<30 kg	228	2.5	[0.5, 5.5]
≥30 kg	445	2.9	[0.8, 6.1]
Plasma, mL			
<30 kg	238	1.4	[0.5, 3.5]
≥30 kg	455	2.4	[1.0, 4.0]
Urine, mL	660	50.9	[17.9, 60.5]

Figure 9.4
Status of Biorepository Samples collected at V4

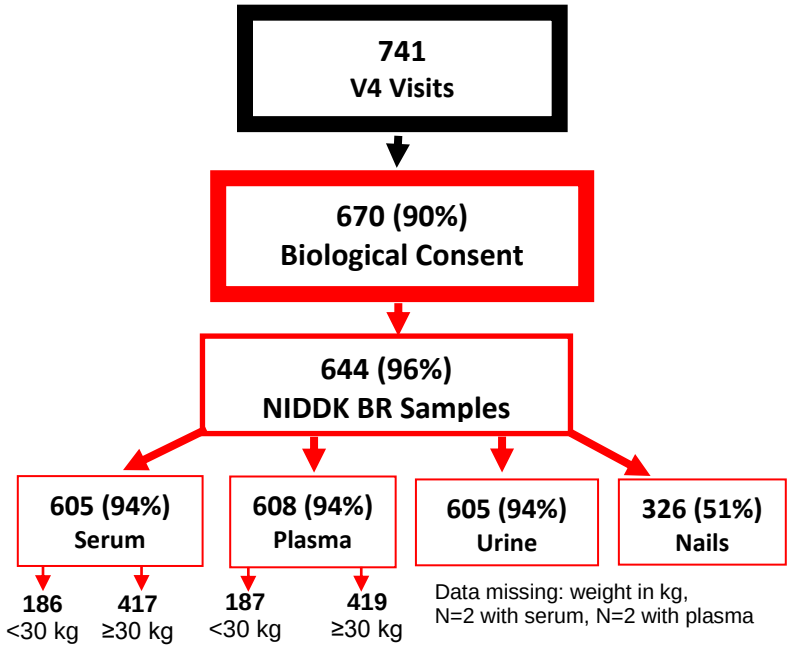


Table 9.4
Description of Biorepository Samples at V4

	Visit 4 N=644 Biological Samples		
	N	**Median**	**[5th %ile, 95th %ile]**
Serum, mL			
<30 kg	186	2.3	[0.5, 6.0]
≥30 kg	417	3.0	[0.8, 6.3]
Plasma, mL			
<30 kg	187	1.9	[1.0, 3.7]
≥30 kg	419	3.0	[1.3, 4.9]
Urine, mL	605	50.0	[18.7, 61.4]

Section 10:

SUMMARYFILES

SUMMARYFILES

ID-Based File

KIDHIST: A horizontally structured data file with one record for each participant. The file contains key clinical and date variables describing each participant's kidney disease history. Clinical variables include primary CKD diagnosis, current CKD status (no history of KRT, on dialysis, transplant recipient, and in rare cases, death), study status at last visit, and parametric estimates of each participant's baseline GFR and percentage change in GFR over follow-up. Date variables document the following occurrences: birth, study baseline, last date KRT free, first transplant, first dialysis, last active study date (i.e., last date at which scientific data was collected), and in rare cases, date of death.

OUTCOMES: The OUTCOMES file captures the transitions between modalities of KRT obtained by the continued follow up (non-clinical visit) protocol. The file provides a record for each participant-event (transplant, dialysis, or death) that has occurred along with event date and type. In addition, for a dialysis event it specifies the type as either peritoneal or hemodialysis while for a transplant event it records the donor type (living related, living unrelated, or deceased).

ID-VISIT Based File

DATEBASE: An ID-visit file, which provides visit numbers, corresponding study dates and status of visit. The status of each visit (file record) is defined as one of the following: regular (occurring per clinical study protocol), irregular (occurring on an accelerated schedule due to an anticipated transition to kidney replacement therapy), transitional (out of regular clinical study visits), phone-follow-up or in-person interview (non-clinical visit), online survey (non-clinical visit), or disenrollment due to participant withdrawal, initiation of KRT, or death (documented via the disenrollment form. This file is used to calculate the number of visits, which is reported during Steering Committee conference calls and meetings.

GFRSUMMARY: An ID-visit file which provides a complete description of all variables related to both the measurement and estimation of each participant's glomerular filtration rates (GFR). This includes all variables related to the iohexol-infusion protocol (iGFR) as well as the biomarkers (serum creatinine, BUN and Cystatin C) that are used to estimate GFR (eGFR).

LABMARKERS: An ID-visit file containing variables for laboratory markers. The file includes basic metabolic panel, complete blood count, urine analysis, intact parathyroid, c-reactive protein, lipid panel and iron results as well as calculated proteinuria, acidosis, hypoalbuminemia, abnormal calcium and phosphate (based on KDOQI thresholds), calcium-phosphate product, elevated CRP, anemia and hemoglobin z-scores and percentiles based on age, sex and race per CDC guidelines.

CARDIO: An ID-visit file containing variables summarizing blood pressure variables from the clinic and ambulatory blood pressure monitoring protocol. Annual clinic BP measurements and biennial ABPM measurements are included. Working Group Clinic BP limits and Soergel ABPM limits according to age, sex and height are reported. Summary clinic BP measurements include SBP and DBP index (i.e. SBP/Limit based on age, sex and height), and z-scores and percentiles adjusted to age, sex and height. Summary ABPM variables include mean systolic and diastolic BP over 24 hour monitoring, load (i.e. % of readings that are over the 95% Soergel limit), dipping status and success rates.

ECHO: An ID-visit dataset of summarized echocardiogram scans collected at biennial visits and sent from the CKiD ECHO lab (Cardiovascular Imaging Core Research Laboratory (CIRCL), Cincinnati, OH) to KIDMAC. Variables quantify the following clinical characteristics: left ventricular mass (LVM, including LVM index), left ventricular geometry, left ventricular hypertrophy, ascending aortic distensibility, ascending aortic stiffness, and shortening fraction abnormalities.

CIMT: An ID-visit file containing variables of measurement of the carotid artery, assessed using ultrasound, including carotid Intimal Media Thickness (cIMT) and incremental elastic modulus or carotid artery pressure (EINC). By protocol, subjects have a cIMT ultrasound at every other visit beginning at visit 2. This ultrasound is conducted on a subset of the CKiD population (n= 139 at visit 2).

NEURO: An ID-visit file containing key variables from the Neurocognitive battery, the Behavioral battery as well as the quality of life measurements. Key variables include: 1) Verbal IQ, Performance IQ and Full Scale IQ as measured by the Mullen, WPPSI-III or WASI; 2) scaled overall achievement score as measured by the WIAT-II-A; 3) scaled attention scores as measured by the K-CPT or CPT-II; 4) scaled executive functioning summary scores as measured by the BRIEF-P or BRIEF and 5) parent and child quality of life sub-scale and overall scores as measured by the PedsQL inventory. This is a vertical file with each record corresponding to one person-visit. Additional variables will be added as the need arises.

GROWTH: An ID-visit file, which contains key variables describing the growth markers (i.e., height, weight, tanner staging). Age and sex adjusted percentiles and z-scores are calculated based on CDC growth charts with normative data. Quantitative data on the participant's birth weight and gestational age, along with qualitative indicator variables for low birth weight (<2500 grams), premature birth (gestational age <36 weeks), small for gestational age (birth weight <10th percentile for gestational age), and intensive care unit immediately after delivery are also included.

GRIPSTRENGTH: An ID-visit file summarizing variables from the grip strength assessment.

NUTRIENTS: An ID-visit file containing variables from food frequency questionnaires to assess food intake. Individual level data is summarized into single variables. Total energy and nutrients intake for each participants were computed as the sum over all food items. Individual food items were aggregated into mutually exclusive food groups based on the USDA Dietary Sources of Nutrients database, NHANES classifications and clinical dietitians' input. Food groups and nutrients data have been assembled into a summary file available to all investigators.

CENSUS: An ID-visit file containing variables from census block groups and tracts to summarize area-level socioeconomic data.

ID-VISIT Medication Files

MEDSUM_SHORT: The MEDSUM_SHORT file is structured as one record per participant-visit and summarizes whether or not the study participant has been prescribed during the past 30 days any medication that falls into one of several major medication classes including antihypertensives, ESAs, growth hormones, immunosuppressives, anticholinergics, and antidepressants.

MEDSUM_FULL: The MEDSUM_FULL file contains one record per medication per participant-visit and provides more detailed information for the medication including dosing amounts and schedules as well as a set of variables that describe the participant's adherence to the medication.