

# **CHAPTER 1**

## **OVERVIEW OF RENAL BIOPSY IN MALAYSIA**

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## 1.1 Introduction

- The Malaysian Registry of Renal Biopsy (MRRB) was established in 2005 with the main objective of determining the disease burden attributable to glomerular disease.
- It was initiated with data contributions from Ministry of Health (MOH) hospitals (2005-2007). In 2008, other institutions including Ministry of Education, Ministry of Defence and private hospitals were invited to participate.
- Since its inception in 2005, seven reports have been published.
- In this report, the number of renal biopsies performed was reported every 5 yearly. However, the data for the last 3 years were reported yearly.
- This chapter reports data on native renal biopsy.

## 1.2 Renal biopsy

- There has been an increasing number of participating centres. Nine new centers participated in this report.
- There is a total of 58 centres: 36 Ministry of Health (MOH), 4 Ministry of Education (MOE), 1 Ministry of Defense (MOD) and 17 private hospitals.
- There was a total of 25376 biopsies reported from 2005 till 2022.
- The number of renal biopsies performed had been steadily increasing over the years, ranged 1500-1800 cases yearly from year 2011 onwards.
- However, there was a slight reduction in the total number of biopsies in 2020-2021 likely due to the Covid-19 pandemic (Figure 1.2).

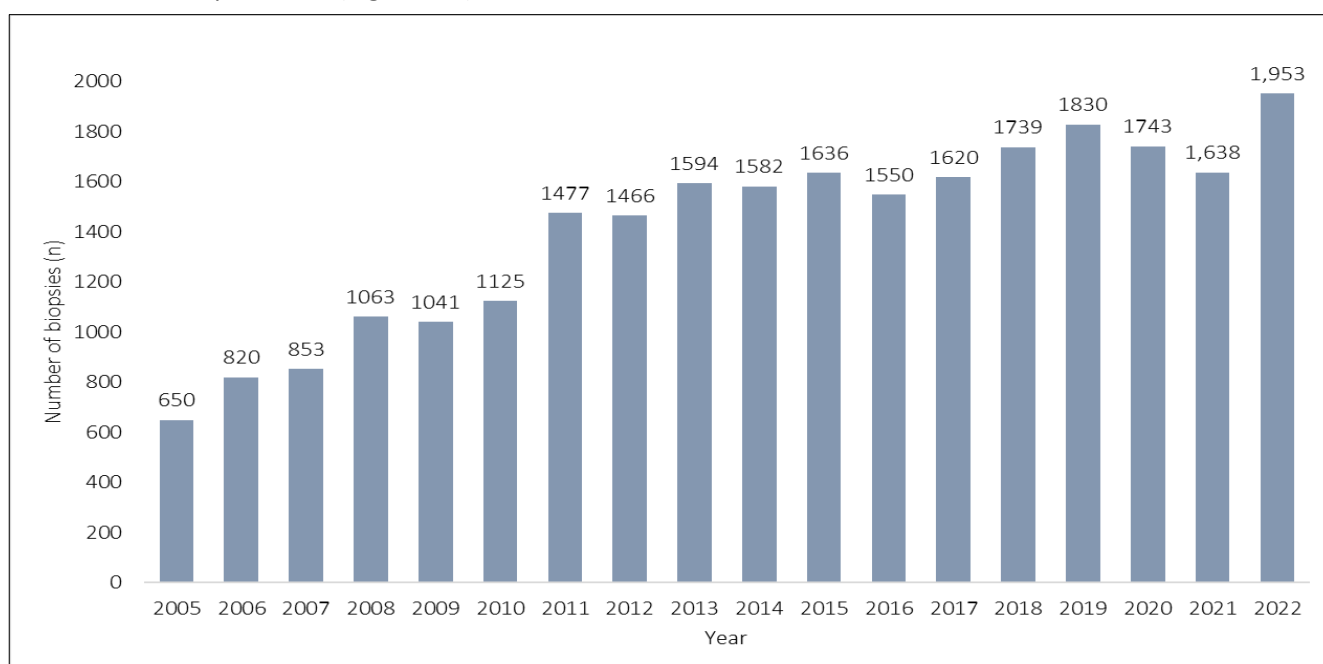


Figure 1.2: Distribution of reported renal biopsies by centre, 2005-2022

### 1.3 Number of episodes of renal biopsy

- Majority (85%) of the renal biopsies performed were first episode (Figure 1.3).
- Repeat biopsies accounted for the remaining 15%, with a 2<sup>nd</sup> biopsy performed in 11.5% of cases, a 3<sup>rd</sup> in 2.7%, and a 4<sup>th</sup> in 0.8%.

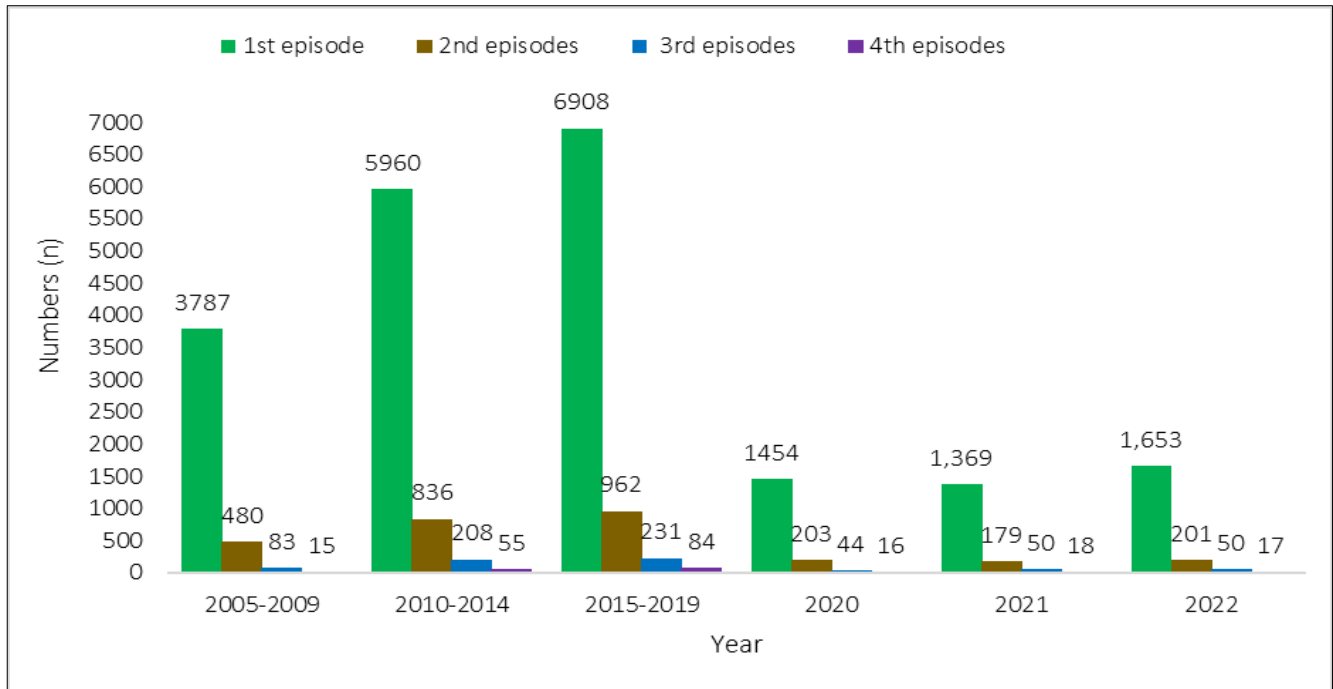


Figure 1.3: Distribution of renal biopsy in patients by number of episodes, 2005-2022

## 1.4 Demographic distribution of renal biopsy

### 1.4.1 Age distribution

- Most of the patients who underwent renal biopsies for the last two decades were adults (age  $\geq 15$  years old).
- The paediatric (age  $<15$  years old) biopsies accounted for about 5-6 % of the total biopsies for 2020 - 2022 (Figure 1.4.1.1).
- The greatest number of the patients who had renal biopsies were reproductive young adults, aged between 15 to 45 years old with the peak age of 25-35 years old with reported data of 457 (26.2%), 399 (24.4%) and 528 (27.0%) cases for 2020, 2021 and 2022 respectively (Figure 1.4.1.2).

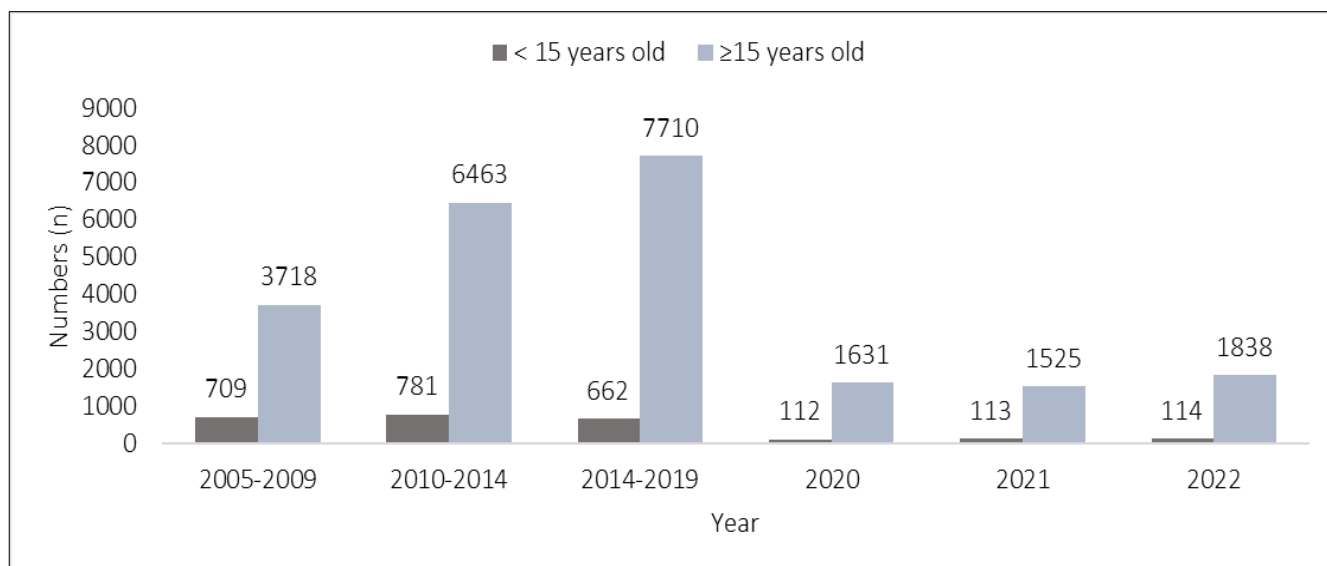


Figure 1.4.1.1: Distribution of renal biopsy in the paediatric and adult age groups, 2005-2022

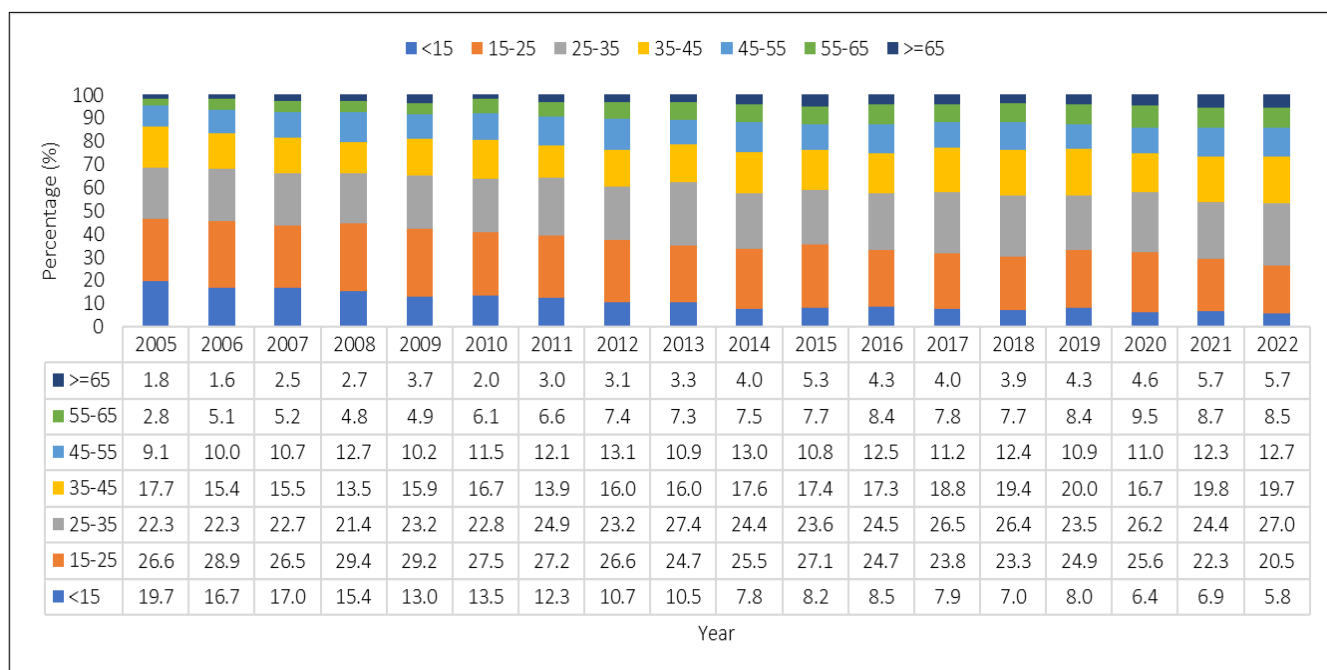


Figure 1.4.1.2: Age distribution of renal biopsy, 2005-2022

### 1.4.2 Age distribution by state

- Johor and Selangor consistently reported the highest number of renal biopsies in the paediatric age group.
- Every year, Johor contributed >20% of the total paediatric biopsies, followed by Selangor which contributed about 12-18% per year.
- In adults, Selangor reported the highest number of renal biopsies 18.9%, 15.6% and 21.5% for 3 consecutive years from 2020 to 2022 respectively (Tables 1.4.2.1 and 1.4.2.2)

Table 1.4.2.1: Renal biopsies by state in patients age < 15, 2005-2022

Year	2005-2009 (n=709)		2010-2014 (n=781)		2015-2019 (n=662)		2020 (n=112)		2021 (n=113)		2022 (n=114)		Total (n=2491)	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Johor	167	23.6	141	18.1	145	21.9	30	26.8	26	23.0	21	18.4	530	21.3
Kedah	49	6.9	79	10.1	47	7.1	10	8.9	8	7.1	9	7.9	202	8.1
Kelantan	19	2.7	41	5.2	12	1.8	3	2.7	0	0	1	0.9	76	3.1
Melaka	16	2.3	16	2.0	11	1.7	2	1.8	3	2.7	10	8.8	58	2.3
Negeri Sembilan	38	5.4	24	3.1	27	4.1	8	7.1	10	8.8	7	6.1	114	4.6
Pahang	29	4.1	14	1.8	21	3.2	6	5.4	4	3.5	5	4.4	79	3.2
Penang	41	5.8	38	4.9	26	3.9	3	2.7	8	7.1	6	5.3	122	4.9
Perak	43	6.1	74	9.5	42	6.3	10	8.9	9	8.0	2	1.8	180	7.2
Perlis	7	1.0	3	0.4	6	0.9	1	0.9	1	0.9	1	0.9	19	0.8
Sabah	51	7.2	50	6.4	61	9.2	4	3.6	7	6.2	13	11.4	186	7.5
Sarawak	64	9.0	60	7.7	53	8.0	7	6.3	5	4.4	3	2.6	192	7.7
Selangor	123	17.3	160	20.5	144	21.8	15	13.4	13	11.5	13	11.4	468	18.8
Terengganu	16	2.3	18	2.3	19	2.9	2	1.8	15	13.3	7	6.1	77	3.1
WP KL	40	5.6	58	7.4	40	6.0	10	8.9	4	3.5	7	6.1	159	6.4
Not available	0	0	0	0	0	0	0	0	0	0	9	7.9	9	0.4
Non-Malaysian	6	0.8	5	0.6	8	1.2	1	0.9	0	0	0	0	20	0.8

Table 1.4.2.2: Renal biopsies by state in patients age > 15, 2005-2022

Year	2005-2009 (n=3718)		2010-2014 (n=6463)		2015-2019 (n=7710)		2020 (n=1631)		2021 (n=1525)		2022 (n=1838)		Total (n=22885)	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Johor	433	11.6	586	9.1	641	8.3	133	8.2	147	9.6	172	9.4	2112	9.2
Kedah	301	8.1	562	8.7	530	6.9	96	5.9	132	8.7	119	6.5	1740	7.6
Kelantan	107	2.9	249	3.9	194	2.5	83	5.1	50	3.3	66	3.6	749	3.3
Melaka	103	2.8	128	2.0	204	2.6	65	4.0	34	2.2	45	2.4	579	2.5
Negeri Sembilan	118	3.2	261	4.0	411	5.3	134	8.2	119	7.8	62	3.4	1105	4.8
Pahang	167	4.5	287	4.4	433	5.6	87	5.3	75	4.9	84	4.6	1133	5.0
Penang	293	7.9	363	5.6	446	5.8	114	7.0	89	5.8	69	3.8	1374	6.0
Perak	191	5.1	550	8.5	605	7.8	158	9.7	150	9.8	163	8.9	1817	7.9
Perlis	25	0.7	28	0.4	45	0.6	6	0.4	2	0.1	5	0.3	111	0.5
Sabah	164	4.4	177	2.7	603	7.8	104	6.4	125	8.2	204	11.1	1377	6.0
Sarawak	388	10.4	545	8.4	701	9.1	112	6.9	100	6.6	166	9.0	2012	8.8
Selangor	889	23.9	1445	22.4	1787	23.2	308	18.9	238	15.6	256	13.9	4923	21.5
Terengganu	64	1.7	146	2.3	200	2.6	42	2.6	30	2.0	34	1.8	516	2.3
WP KL	420	11.3	1015	15.7	847	11.0	184	11.3	83	5.4	72	3.9	2621	11.5
Not available	0	0	1	0	3	0	1	0.1	66	4.3	297	16.2	368	1.6
Non-Malaysian	55	1.5	120	1.9	60	0.8	4	0.2	85	5.6	24	1.3	348	1.5

### 1.4.3 Gender distribution

- There was a consistent ratio trend of female to male patients that underwent renal biopsies of 3:2 for the last 2 decades.
- Female patients made up 61.2% of all renal biopsies in 2022 (Table 1.4.3.1 and Figure 1.4.3.1).
- This is likely due to higher proportion of female patients with lupus nephritis.

Table 1.4.3.1: Gender distribution of renal biopsy, 2005-2022

Gender	2005-2009 (n=4427)		2010-2014 (n=7244)		2015-2019 (n=8372)		2020 (n=1743)		2021 (n=1638)		2022 (n=1952)		Total (n=25376)	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Male	1772	40	2872	39.6	3176	37.9	669	38.4	618	37.7	749	38.4	9856	38.8
Female	2655	60	4372	60.4	5196	62.1	1074	61.6	1020	62.3	1203	61.6	15520	61.2

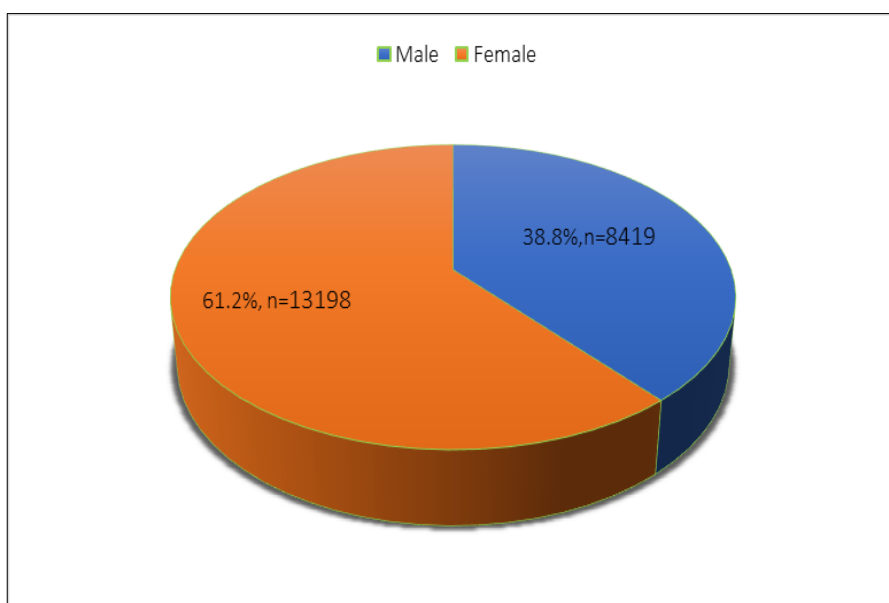


Figure 1.4.3.1: Gender distribution of renal biopsy, 2005-2022

### 1.4.4 Ethnicity distribution

- Malay was the predominant ethnicity among patients who underwent renal biopsies over the last twenty years (60%) followed by Chinese 21.7% (2022) and others 12.8% (2022). Indian ethnicity had the lowest number of reported cases each year (Table 1.4.4.1 and Figure 1.4.4.1).
- This is consistent with the racial distribution in our country.

Table 1.4.4.1: Racial distribution of renal biopsy, 2005-2022

Race	2005-2009 (n=4427)		2010-2014 (n=7244)		2015-2019 (n=8372)		2020 (n=1743)		2021 (n=1638)		2022 (n=1952)		Total (n=25376)	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Malay	2483	56.1	4250	58.7	5008	59.8	1115	64.0	1072	65.4	1173	60.1	15101	59.5
Chinese	1128	25.5	1723	23.8	1734	20.7	297	17.0	244	14.9	370	19.0	5496	21.7
Indian	313	7.1	438	6.0	474	5.7	117	6.7	111	6.8	90	4.6	1543	6.1
Others	503	11.4	833	11.5	1156	13.8	214	12.3	211	12.9	319	16.3	3236	12.8

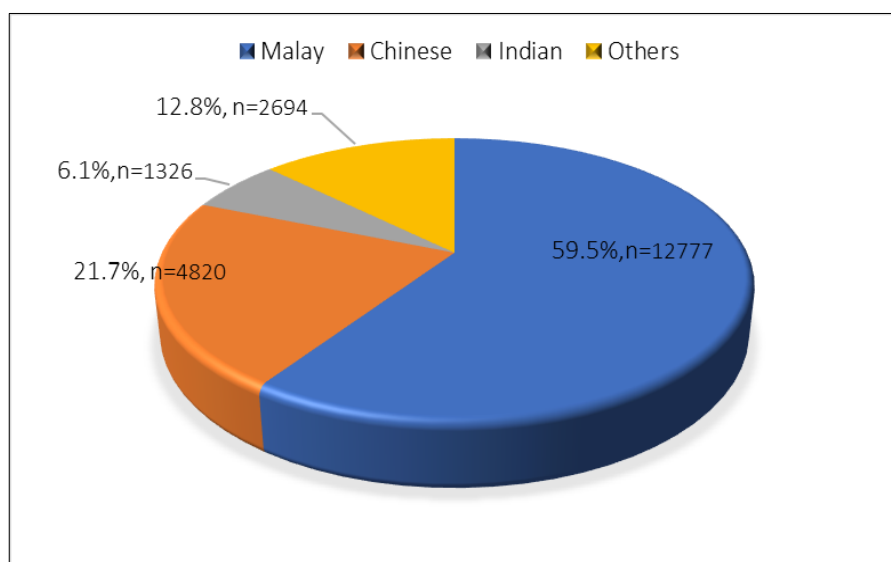


Figure 1.4.4.1 Racial distribution of renal biopsy, 2005-2022

## 1.5 Biopsy characteristics and Complications

### 1.5.1 Number of glomeruli on biopsy

- Majority of renal biopsy sample were considered adequate which is defined as at least 10 glomeruli.
- Inadequate glomeruli in biopsy were reported in less than 20% of the biopsy each year.
- There were increasing number of missing information in the last 3 years being reported (Figure 1.5.1). This reflects the quality of data entered into the registry.

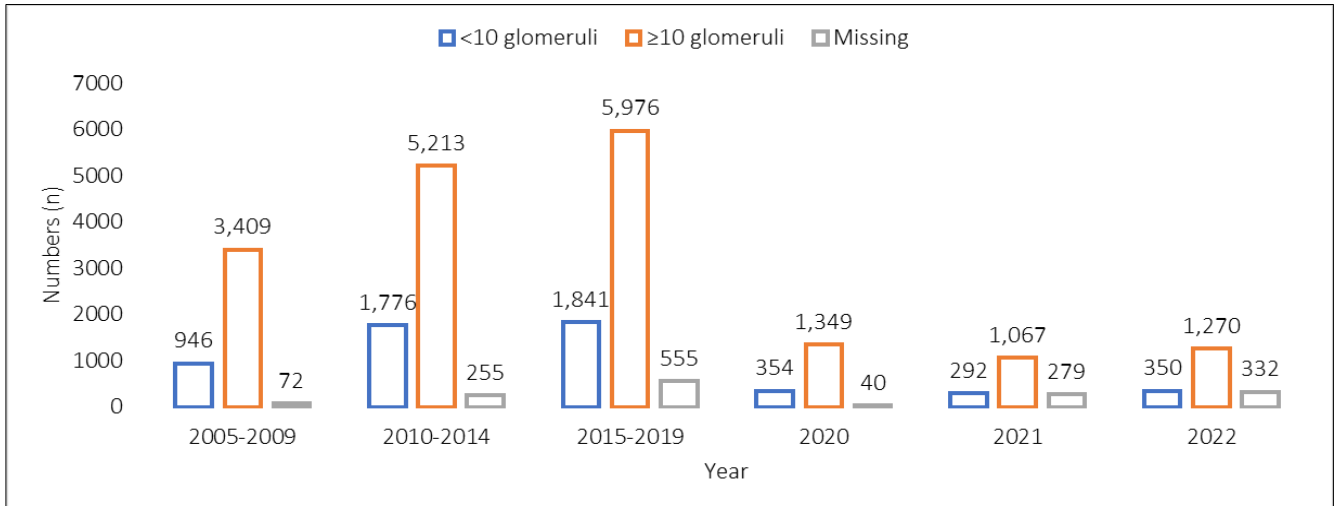


Figure 1.5.1: Number of glomeruli obtained at each renal biopsy by centres, 2005-2022

### 1.5.2 Operator of biopsy

- Over the years, the number of renal biopsies performed by nephrologist had declined with the lowest in 2021 to almost 10%. However, the figure had increased to 25% in 2022.
- The procedures were performed mainly by the trainee nephrologist as part of the training requirement.
- However, there were significant numbers of around 600 cases per year that did not report the operator (Figure 1.5.2).

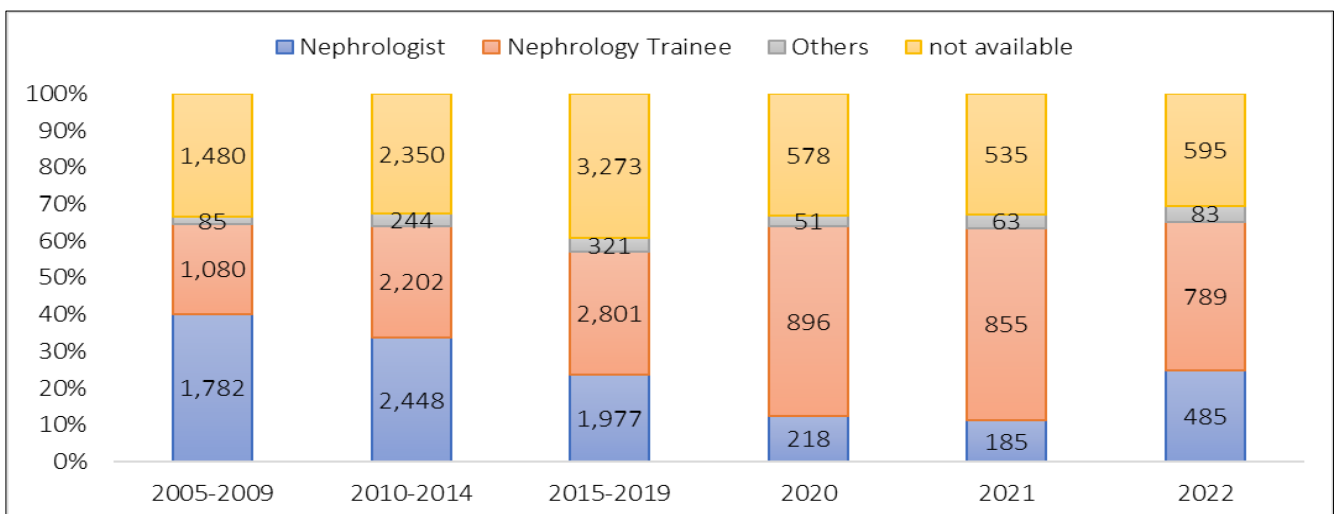


Figure 1.5.2: Operator of biopsy, 2005-2022

### 1.5.3 Complications of biopsy

- The rate of reported biopsy complications ranged from 1.5 to 2% for the last twenty years except in 2021 where the rate was higher at 3.7%.
- However about 36% of the cases did not report biopsy complications (Table 1.5.3 and Figure 1.5.3).

Table 1.5.3: Complications of biopsy, 2005-2022

Complication	2005-2009 (n=4427)		2010-2014 (n=7244)		2015-2019 (n=8372)		2020 (n=1743)		2021 (n=1638)		2022 (n=1952)		Total (n=25376)	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Yes	92	2.1	144	2.0	123	1.5	35	2.0	61	3.7	42	2.2	497	2.0
No	2767	62.5	4655	64.3	4886	58.4	1095	62.8	1016	62.0	1271	65.1	15690	61.8
Not Available	1568	35.4	2445	33.8	3363	40.2	613	35.2	561	34.2	639	32.7	9189	36.2

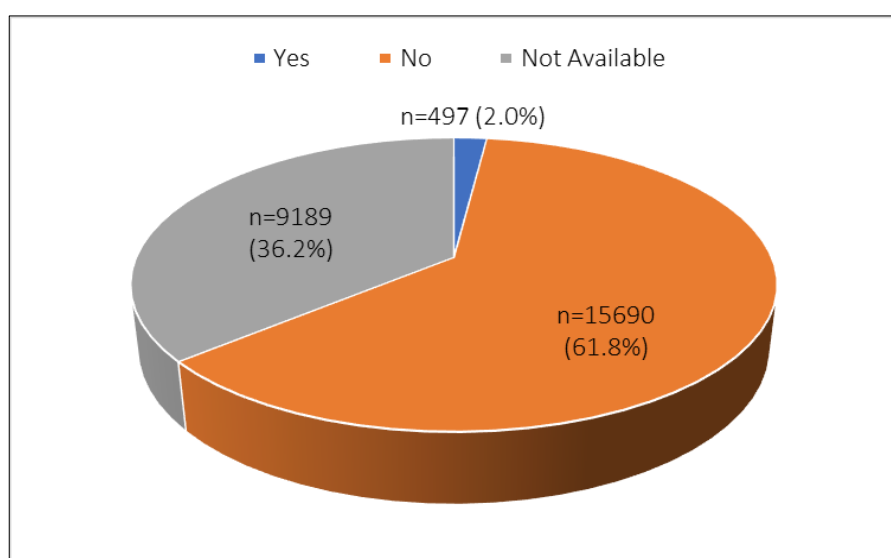


Figure 1.5.3: Complications of biopsy, 2005-2022

### 1.5.4 Types of biopsy complications

- The commonest biopsy complication was bleeding (64.8%), followed by perirenal collection (20.9%) and hypotension (2%) (Table 1.5.4 and Figure 1.5.4).

Table 1.5.4: Types of complications of biopsy, 2005-2022

Complication	2005-2009 (n=91)		2010-2014 (n=162)		2015-2019 (n=111)		2020 (n=30)		2021 (n=54)		2022 (n=44)		Total (n=492 <sup>^</sup> )	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Bleeding	51	56.0	114	70.4	76	68.5	23	76.7	22	40.7	33	75.0	319	64.8
Perirenal collection	33	36.3	35	21.6	35	31.5	6	20	32	59.3	11	25.0	152	30.9
Infection	1	1.1	1	0.6	0	0	0	0	0	0	0	0	2	0.4
AVM	1	1.1	3	1.9	0	0	0	0	0	0	0	0	4	0.8
Hypotension	4	4.4	6	3.7	0	0	0	0	0	0	0	0	10	2.0
Other	1	1.1	3	1.9	0	0	1	3.3	0	0	0	0	5	1.0

<sup>^</sup>Patients may have more than once complications; 36 patients with no complication records

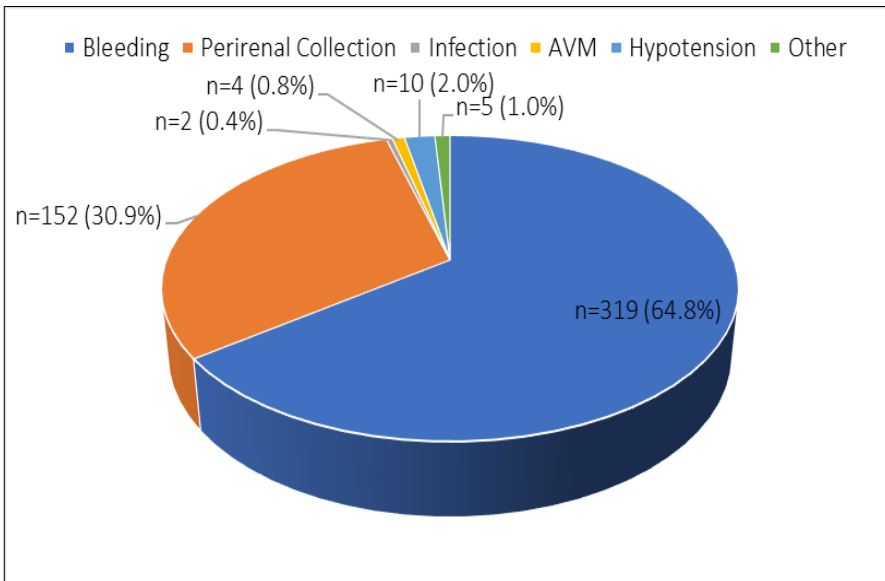


Figure 1.5.4: Types of complications of biopsy, 2005-2022

### 1.5.5 Intervention for biopsy complications

- A total of 118 (23.7%) biopsy procedures required intervention following complications.
- Three-quarters required only blood transfusion while 21.3% needed radiological intervention.
- Only 2.8% patients received surgical intervention to manage the biopsy complication (Figure 1.5.5).

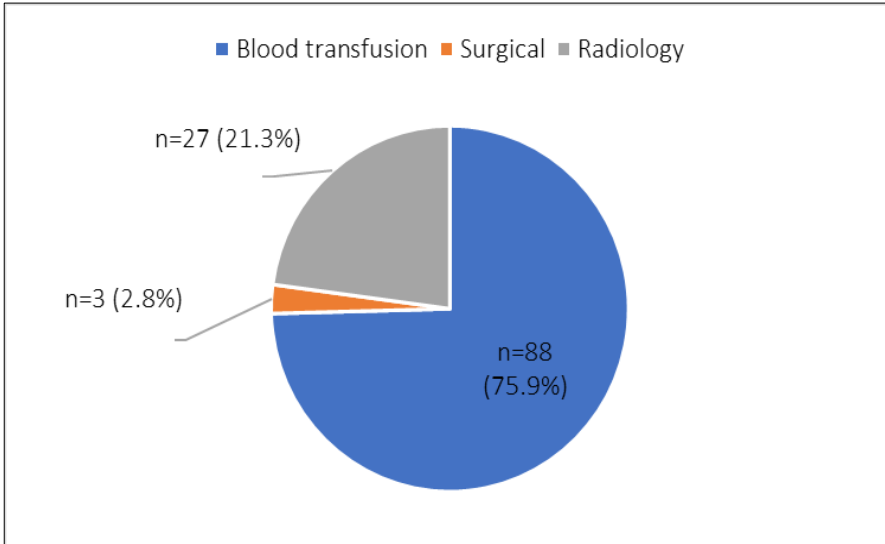


Figure 1.5.5: Intervention for biopsy complications, 2005-2022

## 1.6 Histopathological Lab

- The in-house laboratories provided histopathological services in two third of the biopsy samples while remaining one third were sent to the external laboratories (Table 1.6.3 and Figure 1.6.1).

Table 1.6.3: Summary of biopsies received by in-house and external laboratories, 2005-2022

Summary of biopsies received	2005-2009 (n=4427)		2010-2014 (n=7244)		2015-2019 (n=8372)		2020 (n=1743)		2021 (n=1638)		2022 (n=1952)		Total (n=25376)	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
In house	2100	47.4	4649	64.2	5822	69.5	1261	72.3	1025	62.6	1230	63.0	16087	63.4
External	2291	51.8	2412	33.3	2116	25.3	317	18.2	294	17.9	440	22.5	7870	31.0
Not available	36	0.8	183	2.5	434	5.2	165	9.5	319	19.5	1230	63.0	1419	5.6

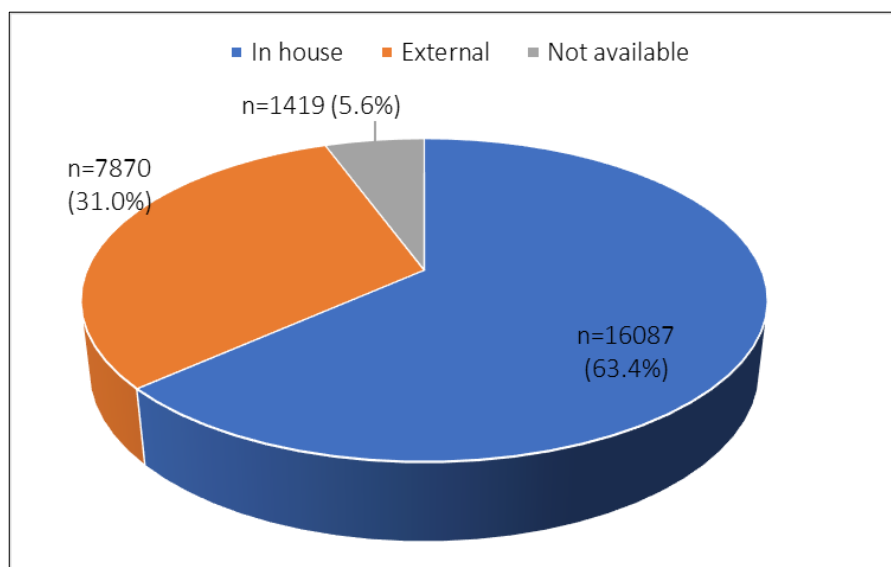


Figure 1.6.1: Summary of biopsies received by in-house and external laboratories, 2005-2022

## 1.7 Clinical Indications of renal biopsy

- Asymptomatic urine abnormalities was the main reason for renal biopsies each year (around 35-38%).
- This was followed by nephrotic syndrome in 30% and nephritic nephrotic in 20% of the cases (Figure 1.7.1).

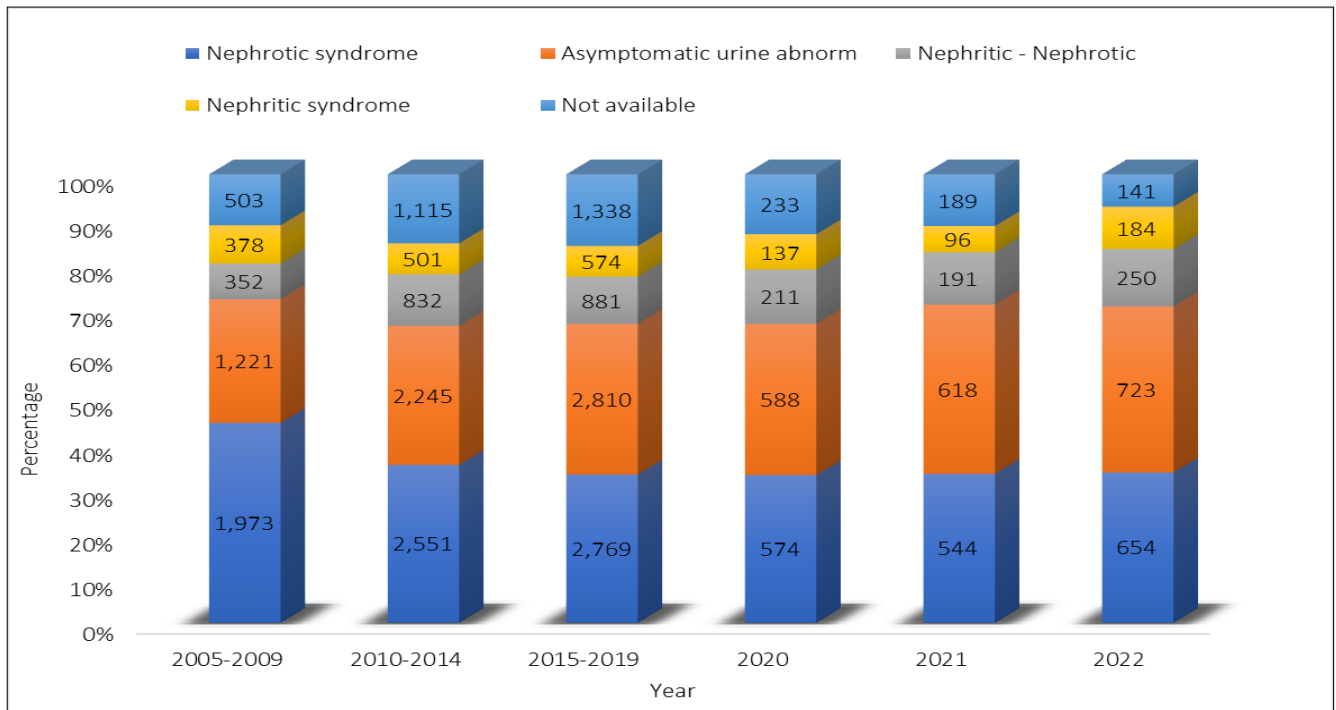


Figure 1.7.1: Indications for native renal biopsies, 2005-2022

## 1.8 Renal function at time of biopsy

- Approximately 31% of patients had normal kidney function with eGFR  $\geq 90$ mls/min/m<sup>2</sup> at the time of renal biopsy.
- About 10% of those with impaired kidney function of eGFR  $< 15$ mls/min/m<sup>2</sup> were biopsied (Table 1.8.1).

Table 1.8.1: Renal function at time of biopsy, 2005-2022

eGFR (mls/min/1.73m <sup>2</sup> )	2005-2009 (n=4457)		2010-2014 (n=7244)		2015-2019 (n=8372)		2020 (n=1743)		2021 (n=1638)		2022 (n=1952)		Total (n=25376)	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
< 15	440	9.9	737	10.2	750	9.0	175	10.0	174	10.6	223	11.4	2499	9.8
15 to < 30	415	9.4	710	9.8	874	10.4	196	11.2	174	10.6	213	10.9	2582	10.2
30 to < 60	831	18.8	1243	17.2	1463	17.5	300	17.2	298	18.2	383	19.6	4518	17.8
60 to < 90	904	20.4	1243	17.2	1389	16.6	280	16.1	253	15.4	331	17.0	4400	17.3
$\geq 90$	1446	32.7	2303	31.8	2598	31.0	530	30.4	464	28.3	568	29.1	7909	31.2
Not available	391	8.8	1008	13.9	1298	15.5	262	15.0	275	16.8	234	12.0	3468	13.7

## 1.9 Histopathological Diagnosis

- Histopathological diagnoses were divided into primary, secondary glomerulonephritis, tubulointerstitial disease, vascular, hereditary kidney disease, advanced GN and others.

### 1.9.1 Histopathological diagnosis overview

- The main primary GN in Malaysia were FSGS (30%) followed by minimal change nephropathy (28.9%) and IgA nephropathy (23.8%).
- However, there was slight change in trend in 2022, with IgA nephropathy becoming the leading cause of primary GN (Table 1.9.1 and Figure 1.9.1).
- Lupus nephritis remained the most common secondary GN, accounting for 70-80% of the cases.

Table 1.9.1: Histopathology of all native renal biopsies, 2005-2022

Type / Histopathological Diagnosis	2005-2009 (n=2017)		2010-2014 (n=3045)		2015-2019 (n=3302)		2020 (n=726)		2021 (n=547)		2022 (n=675)		Total (n=10312)	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
<b>Primary GN</b>														
FSGS	665	33.0	901	29.6	1006	30.5	194	26.7	152	27.8	171	25.3	3089	30
Minimal Change	680	33.7	958	31.5	851	25.8	187	25.8	138	25.2	167	24.7	2981	28.9
IgA nephropathy	355	17.6	695	22.8	839	25.4	198	27.3	158	28.9	212	31.4	2457	23.8
Membrano-proliferative	42	2.1	44	1.4	59	1.8	13	1.8	8	1.5	7	1.0	173	1.7
Membranous nephropathy	165	8.2	257	8.4	342	10.4	87	12.0	63	11.5	74	11.0	988	9.6
Mesangial Prol: non-IgA	67	3.3	101	3.3	77	2.3	25	3.4	10	1.8	14	2.1	294	2.9
Idiopathic Crescentic GN	29	1.4	33	1.1	27	0.8	4	0.6	2	0.4	1	0.1	96	0.9
Crescentic ANCA	9	0.4	21	0.7	24	0.7	11	1.5	9	1.6	17	2.5	91	0.9
Not Available	5	0.2	35	1.1	77	2.3	7	1.0	7	1.3	12	1.8	143	1.4
Type / Histopathological Diagnosis	2005-2009 (n=1912)		2010-2014 (n=3088)		2015-2019 (n=3385)		2020 (n=723)		2021 (n=521)		2022 (n=670)		Total (n=10299)	
Secondary GN	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Lupus Nephritis	1590	83	2413	78	2648	78	516	71	377	72	476	71	8020	78
Diabetic nephropathy	167	8.7	373	12.1	443	13.1	157	21.7	113	21.7	162	24.2	1415	13.7
Post Infectious GN	80	4.2	170	5.5	135	4.0	18	2.5	10	1.9	11	1.6	424	4.1
Amyloidosis	9	0.5	21	0.7	23	0.7	8	1.1	7	1.3	2	0.3	70	0.7
Anti GBM disease	0	0	4	0.1	8	0.2	3	0.4	2	0.4	1	0.1	18	0.2
Henoch-Schonlein Purpura	29	1.5	21	0.7	29	0.9	5	0.7	4	0.8	2	0.3	90	0.9
HUS / TTP	3	0.2	5	0.2	5	0.1	3	0.4	0	0	0	0	16	0.2
Immunotactoid / fibrillary	0	0	1	0	2	0.1	1	0.1	0	0	1	0.1	5	0
Light / Heavy chain deposit disease	2	0.1	2	0.1	6	0.2	1	0.1	0	0	2	0.3	13	0.1
Malignancy	4	0.2	4	0.1	2	0.1	0	0	0	0	0	0	10	0.1
Multiple myeloma	8	0.4	4	0.1	7	0.2	1	0.1	0	0	2	0.3	22	0.2
Other infection	8	0.4	19	0.6	17	0.5	4	0.6	0	0	3	0.4	51	0.5
Systemic vasculitis	8	0.4	15	0.5	12	0.4	0	0	1	0.2	2	0.3	38	0.4
Not Available	4	0.2	36	1.2	48	1.4	6	0.8	7	1.3	6	0.9	107	1.0
Type / Histopathological Diagnosis	2005-2009 (n=322)		2010-2014 (n=468)		2015-2019 (n=509)		2020 (n=110)		2021 (n=125)		2022 (n=121)		Total (n=1655)	
Tubulointerstitial disease	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Acute tubular necrosis	152	47.2	159	34.0	151	29.7	35	31.8	28	22.4	42	34.7	567	34.3
Acute interstitial nephritis	64	19.9	157	33.5	157	30.8	28	25.5	29	23.2	26	21.5	461	27.9
Chronic interstitial nephritis	102	31.7	142	30.3	153	30.1	35	31.8	62	49.6	44	36.4	538	32.5
Missing	4	1.2	10	2.1	48	9.4	12	10.9	6	4.8	9	7.4	89	5.4

Type / Histopathological Diagnosis	2005-2009 (n=63)		2010-2014 (n=157)		2015-2019 (n=228)		2020 (n=76)		2021 (n=90)		2022 (n=80)		Total (n=694)	
<b>Vascular</b>	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Athero-embolic disease	0	0	2	1.3	2	0.9	0	0	1	1.1	0	0	5	0.7
Benign / Malignant Hypertension	58	92.1	130	82.8	193	84.6	75	98.7	84	93.3	77	96.3	617	88.9
Systemic sclerosis	2	3.2	14	8.9	9	3.9	1	1.3	2	2.2	0	0	28	4.0
Not Available	3	4.8	11	7.0	24	10.5	0	0	3	3.3	3	3.8	44	6.3
<b>Type / Histopathological Diagnosis</b>	<b>2005-2009 (n=10)</b>		<b>2010-2014 (n=14)</b>		<b>2015-2019 (n=17)</b>		<b>2020 (n=2)</b>		<b>2021 (n=90)</b>		<b>2022 (n=80)</b>		<b>Total (n=43)</b>	
<b>Hereditary</b>	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Alport's syndrome	3	30	2	14.3	4	23.5	0	0	0	0	0	0	9	19.6
Thin Basement Membrane disease	5	50	3	21.4	3	17.6	0	0	0	0	0	0	11	23.9
Others	2	20	2	14.3	0	0	0	0	0	0	0	0	4	8.7
Not Available	0	0	7	50	10	58.8	2	100	3	100	0	0	22	47.8
<b>Type / Histopathological Diagnosis</b>	<b>2005-2009</b>		<b>2010-2014</b>		<b>2015-2019</b>		<b>2020</b>		<b>2021</b>		<b>2022</b>		<b>Total</b>	
	n		n		n		n		n		n		n	
<b>Advance GN</b>	122		137		108		26		17		17		436	
<b>Type / Histopathological Diagnosis</b>	<b>2005-2009</b>		<b>2010-2014</b>		<b>2015-2019</b>		<b>2020</b>		<b>2021</b>		<b>2022</b>		<b>Total</b>	
	n		n		n		n		n		n		n	
<b>Others</b>	38		199		338		67		55		55		752	

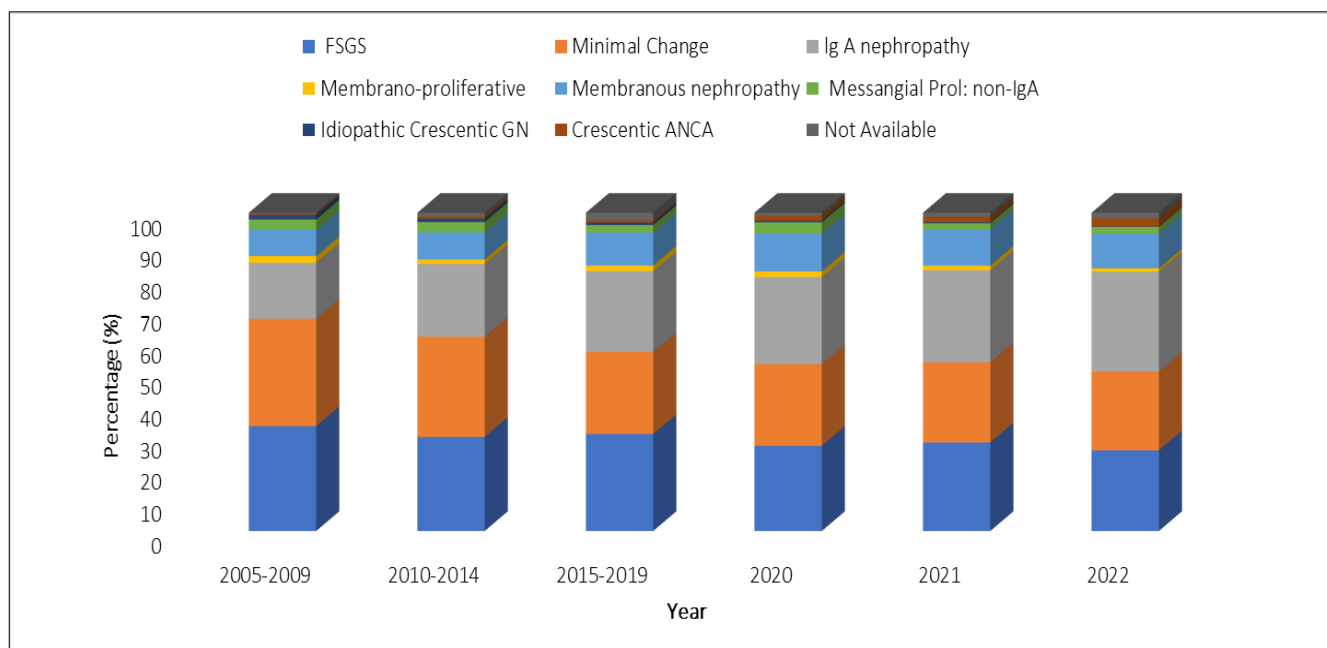


Figure 1.9.1 Histopathology of primary glomerulonephritis on native renal biopsies, 2005-2022

## 1.9.2 Histopathology findings in common clinical presentation

### 1.9.2.1 Nephrotic syndrome

- Minimal change nephropathy (41.8%) and FSGS (33%) were the leading causes of nephrotic syndrome due to primary GN. About 10% of nephrotic syndrome were due to membranous nephropathy.
- Lupus nephritis (73.6%) followed by diabetic nephropathy (19.4%) were the most common causes of secondary GN causing nephrotic syndrome (Table 1.9.2.1).

Table 1.9.2.1: HPE diagnosis in patients presenting with Nephrotic Syndrome, 2005-2022

Type	Histopathological Diagnosis	n	%
Primary GN	FSGS	1703	33.0
	Minimal Change	2158	41.8
	Membranous nephropathy	559	10.8
	IgA nephropathy	518	10
	Idiopathic Crescentic GN	16	0.3
	Membrano-proliferative	67	1.3
	Mesangial Proliferative GN-non-IgA	93	1.8
	Crescentic ANCA	5	0.1
	Not available	46	0.9
	<b>Sub total</b>	<b>5165</b>	<b>59.2</b>
Secondary GN	Lupus Nephritis	1974	73.6
	Diabetic nephropathy	521	19.4
	Post Infectious GN	73	2.7
	Amyloidosis	34	1.3
	Henoch-Schonlein Purpura	8	0.3
	HUS / TTP	2	0.1
	Light / Heavy chain deposit disease	4	0.2
	Malignancy	3	0.1
	Multiple myeloma	2	0.1
	Anti GBM disease	1	0
	Other infection	27	1.0
	Systemic vasculitis	4	0.2
	Immunotactoid / fibrillary GN	1	0
	Not Available	28	1.0
<b>Sub total</b>	<b>2682</b>	<b>30.7</b>	
Others	Others	876	10
<b>Total</b>		<b>8723</b>	<b>100</b>

### 1.9.2.2 Nephritic syndrome

- Secondary GN contributed to more than half of all those who presented with nephritic syndrome.
- Ig A nephropathy is the most common histopathological diagnosis among those who presented with nephritic syndrome (11.4%).
- In the secondary GN group, majority were diagnosed with lupus nephritis, 45.4%. (Table 1.9.2.2)

Table 1.9.2.2: HPE diagnosis in patients presenting with nephritic syndrome, 2005-2022

Type	Histopathological Diagnosis	n	%
Primary GN	FSGS	140	25.2
	Minimal Change	102	18.4
	Membranous nephropathy	39	7.0
	IgA nephropathy	180	32.4
	Idiopathic Crescentic GN	17	3.1
	Membrano-proliferative	17	3.1
	Mesangial Proliferative GN-non-IgA	28	5.0
	Crescentic ANCA	22	4.0
	Not available	11	2.0
	<b>Sub total</b>	<b>556</b>	<b>31.0</b>
Secondary GN	Lupus Nephritis	712	75.7
	Diabetic nephropathy	71	7.6
	Post Infectious GN	112	11.9
	Henoch-Schonlein Purpura	13	1.4
	HUS / TTP	2	0.2
	Amyloidosis	2	0.2
	Anti GBM disease	5	0.5
	Systemic vasculitis	9	1.0
	Malignancy	1	0.1
	Other infection	1	0.1
	Not Available	4	0.4
	<b>Sub total</b>	<b>941</b>	<b>52.5</b>
	Others	Others	295
<b>Total</b>		<b>1568</b>	<b>100</b>

### 1.9.2.3 Asymptomatic Urine Abnormalities

- Among patient who presented with asymptomatic urine abnormalities, lupus nephritis was the main aetiology followed by Ig A nephropathy which accounted for 29.5% and 15.7% respectively (Table 1.9.2.3).

Table 1.9.2.3: HPE diagnosis in patients presenting with asymptomatic urine abnormalities, 2005-2022

Type	Histopathological Diagnosis	n	%
Primary GN	IgA nephropathy	1190	43.5
	FSGS	702	25.7
	Minimal Change	388	14.2
	Membranous nephropathy	227	8.3
	Idiopathic Crescentic GN	25	0.9
	Membrano-proliferative	34	1.2
	Mesangial Proliferative GN-non-IgA	104	3.8
	Crescentic ANCA	26	1.0
	Not Available	41	1.5
	<b>Sub total</b>	<b>2737</b>	<b>36.1</b>
Secondary GN	Lupus Nephritis	2993	80.9
	Diabetic nephropathy	485	13.1
	Post Infectious GN	55	1.5
	Henoch-Schonlein Purpura	46	1.2
	Amyloidosis	20	0.5
	Systemic vasculitis	13	0.4
	Multiple myeloma	10	0.3
	Other infection	10	0.3
	Light / Heavy chain deposit disease	3	0.1
	Anti GBM disease	6	0.2
	HUS / TTP	5	0.1
	Malignancy	1	0
	Immunotactoid / fibrillary GN	1	0
	Not Available	50	1.4
	<b>Sub total</b>	<b>3698</b>	<b>48.8</b>
Others	Others	1148	15.1
<b>Total</b>		<b>7583</b>	<b>100</b>

#### 1.9.2.4 Nephritic-nephrotic syndrome

- Lupus nephritis was the predominant cause of patients presenting with nephritic nephrotic syndrome 43.6%, followed by IgA nephropathy (10%) and FSGS (8.7%) (Table 1.9.2.4).

Table 1.9.2.4: HPE diagnosis in patients presenting with nephritic-nephrotic syndrome, 2005-2022

Type	Histopathological Diagnosis	n	%
Primary GN	FSGS	232	26.9
	IgA nephropathy	266	30.8
	Minimal Change	149	17.3
	Membranous nephropathy	84	9.7
	Mesangial Proliferative GN-non-IgA	39	4.5
	Membrano-proliferative	32	3.7
	Idiopathic Crescentic GN	19	2.2
	Crescentic ANCA	29	3.4
	Not Available	13	1.5
	<b>Sub total</b>	<b>863</b>	<b>32.4</b>
Secondary GN	Lupus Nephritis	1162	79.4
	Post Infectious GN	131	9.0
	Diabetic nephropathy	114	7.8
	Henoch-Schonlein Purpura	17	1.2
	Other infection	8	0.6
	HUS / TTP	2	0.1
	Malignancy	2	0.1
	Immunotactoid / fibrillary GN	1	0.1
	Light / Heavy chain deposit disease	1	0.1
	Multiple myeloma	1	0.1
	Amyloidosis	5	0.3
	Anti GBM disease	4	0.3
	Systemic vasculitis	8	0.6
	Not Available	8	0.6
<b>Sub total</b>	<b>1464</b>	<b>54.9</b>	
<b>Others</b>	<b>Others</b>	<b>338</b>	<b>12.7</b>
<b>Total</b>		<b>2665</b>	<b>100</b>

\* Patients may have either one or more histopathology or not have any histopathology

\*\*Others = Tubular disease + Vascular + Advance GN + Others + Hereditary

### 1.9.3 Primary GN according to age groups

- Minimal change disease (43%) and FSGS (34.9%) were the commonest GN affecting paediatric age group (<15 years old) whereas, membranous nephropathy predominantly affected the elderly (≥55 years old) in 55.5% of the cases.
- On the other hand, IgA nephropathy affected mostly the young adults between 25-45 years old (64.8%) (Table 1.9.3 and Figure 1.9.3).

Table 1.9.3: Primary glomerulonephritis according to the various age group, 2005-2022

Age group	<15 (n=1368)		15-<25 (n=2669)		25-<35 (n=2357)		35-<45 (n=1608)		45-<55 (n=1104)		55-<65 (n=764)		≥65 (n=422)		Total (n=10312)	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
FSGS	477	34.9	742	27.8	711	30.2	499	31.0	312	28.3	203	26.6	145	32.8	3089	30
Minimal Change	589	43.1	1080	40.5	569	24.1	293	18.2	223	20.2	154	20.2	73	16.5	2981	28.9
IgA nephropathy	176	12.9	576	21.6	771	32.7	516	32.1	255	23.1	122	16.0	41	9.3	2457	23.8
Membrano-proliferative	17	1.2	39	1.5	44	1.9	34	2.1	18	1.6	14	1.8	7	1.6	173	1.7
Membranous nephropathy	35	2.6	105	3.9	136	5.8	163	10.1	217	19.7	205	26.8	127	28.7	988	9.6
Mesangial Prol: non-IgA	45	3.3	64	2.4	73	3.1	59	3.7	26	2.4	20	2.6	7	1.6	294	2.9
Idiopathic Crescentic GN	11	0.8	23	0.9	18	0.8	15	0.9	14	1.3	10	1.3	5	1.1	96	0.9
Crescentic ANCA	5	0.4	6	0.2	9	0.4	7	0.4	15	1.4	24	3.1	25	5.7	91	0.9
Not Available	13	1.0	34	1.3	26	1.1	22	1.4	24	2.2	12	1.6	12	2.7	143	1.4

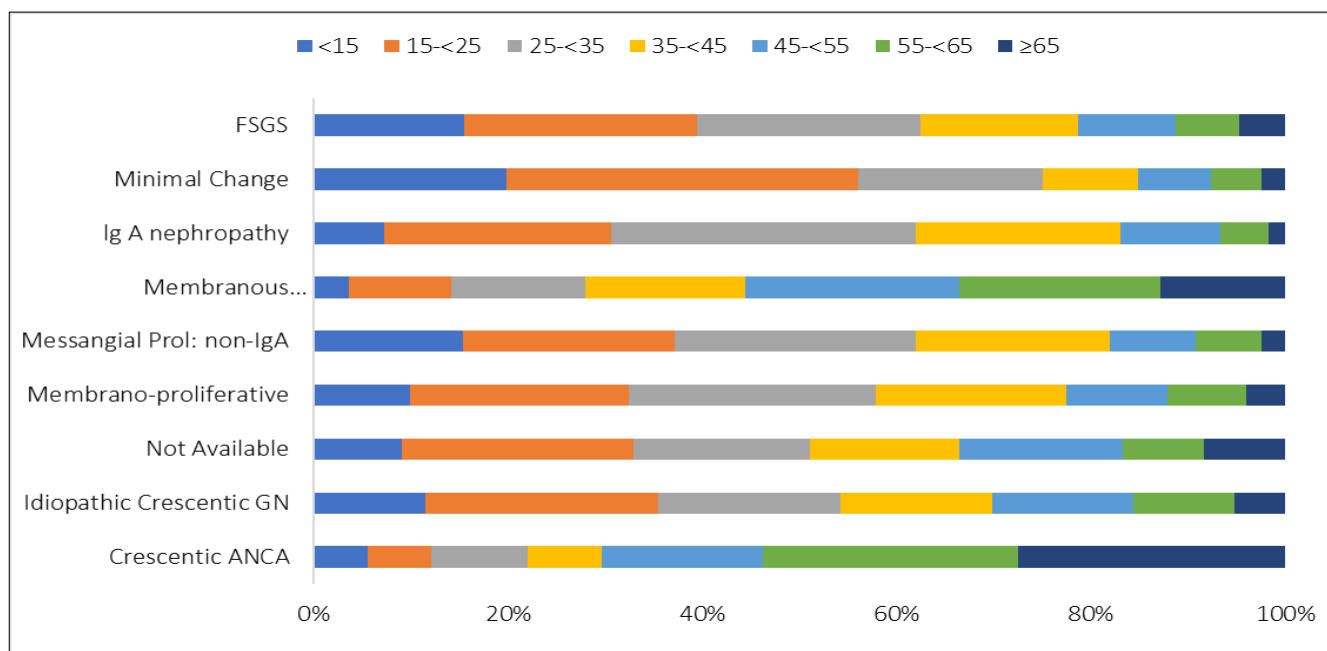


Figure 1.9.3: Primary glomerulonephritis according to the various age group, 2005-2022

#### 1.9.4 Secondary GN according to age groups

- The two most common causes of secondary GN were lupus nephritis and diabetic nephropathy.
- As mentioned in the literature worldwide, lupus nephritis affected predominantly those in their reproductive age group and the incidence started to reduce in patients  $\geq 55$  years old.
- In contrast to diabetic nephropathy the incidence started to increase by the age of 45 years and older (Table 1.9.4).

Table 1.9.4: Secondary glomerulonephritis according to the various age group, 2005-2022

Age group	<15 (n=863)		15-<25 (n=2815)		25-<35 (n=2742)		35-<45 (n=1866)	
	n	%	n	%	n	%	n	%
<b>Histopathological Diagnosis</b>								
Lupus Nephritis	596	69.1	2652	94.2	2431	88.7	1415	75.8
Diabetic nephropathy	0	0	43	1.5	193	7.0	328	17.6
Post Infectious GN	172	19.9	79	2.8	67	2.4	52	2.8
Henoch-Schonlein Purpura	71	8.2	8	0.3	1	0	2	0.1
Amyloidosis	1	0.1	0	0	1	0	8	0.4
Other infection	1	0.1	5	0.2	12	0.4	15	0.8
Systemic vasculitis	8	0.9	3	0.1	7	0.3	4	0.2
Multiple myeloma	0	0	0	0	0	0	3	0.2
HUS / TTP	6	0.7	2	0.1	4	0.1	3	0.2
Light / Heavy chain deposit disease	0	0	1	0	1	0	1	0.1
Anti GBM disease	1	0.1	3	0.1	2	0.1	5	0.3
Malignancy	1	0.1	1	0	0	0	2	0.1
Immunotactoid / fibrillary GN	0	0	1	0	0	0	0	0
Not Available	6	0.7	17	0.6	23	0.8	28	1.5

Age group	45-<55 (n=1190)		55-<65 (n=601)		$\geq 65$ (n=222)		Total (n=10299)	
	n	%	n	%	n	%	n	%
<b>Histopathological Diagnosis</b>								
Lupus Nephritis	688	57.8	196	32.6	42	18.9	8020	77.9
Diabetic nephropathy	413	34.7	316	52.6	122	55.0	1415	13.7
Post Infectious GN	29	2.4	17	2.8	8	3.6	424	4.1
Henoch-Schonlein Purpura	6	0.5	1	0.2	1	0.5	90	0.9
Amyloidosis	18	1.5	27	4.5	15	6.8	70	0.7
Other infection	7	0.6	8	1.3	3	1.4	51	0.5
Systemic vasculitis	6	0.5	6	1.0	4	1.8	38	0.4
Multiple myeloma	5	0.4	8	1.3	6	2.7	22	0.2
HUS / TTP	0	0	1	0.2	0	0	16	0.2
Light / Heavy chain deposit disease	3	0.3	3	0.5	4	1.8	13	0.1
Anti GBM disease	2	0.2	2	0.3	3	1.4	18	0.2
Malignancy	1	0.1	3	0.5	2	0.9	10	0.1
Immunotactoid / fibrillary GN	0	0	2	0.3	2	0.9	5	0
Not Available	12	1.0	11	1.8	10	4.5	107	1.0

### 1.9.5 Histology of repeat biopsies

- The majority of repeat renal biopsies were performed in patients with lupus nephritis; 54.3% required 2 biopsies, 69.3% had 3 biopsies and 72.6% required 4 biopsies.
- The other histology of repeat biopsies included FSGS, Ig A nephropathy, minimal change, chronic interstitial nephritis and Others.
- About 5% of the repeated biopsies revealed a non-conclusive diagnosis (Figure 1.9.5 (a) to (c)).

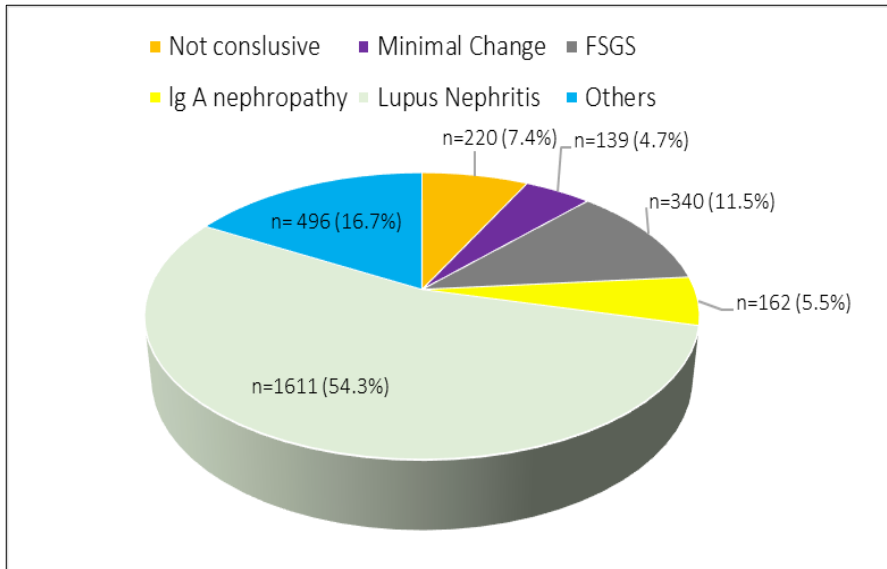


Figure 1.9.5 (a): Histopathological diagnosis of repeat biopsies (2<sup>nd</sup> episode), 2005-2022

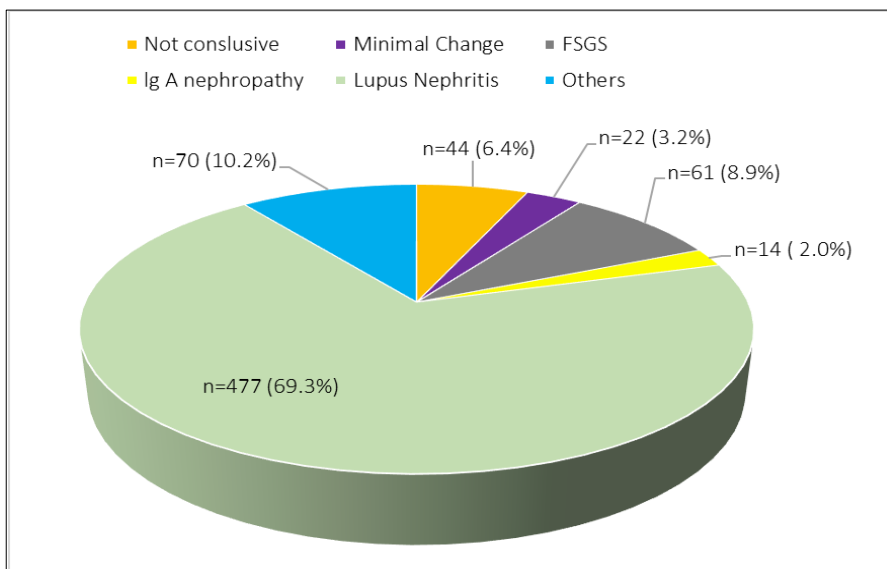


Figure 1.9.5 (b): Histopathological diagnosis of repeat biopsies (3<sup>rd</sup> episode), 2005-2022

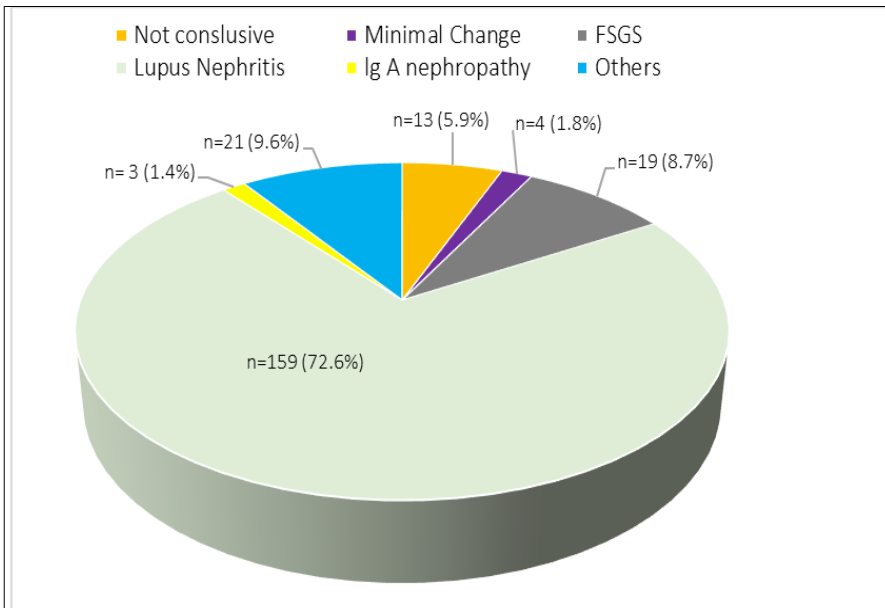


Figure 1.9.5 (c): Histopathological diagnosis of repeat biopsies (4<sup>th</sup> episode and above), 2005-2022