# 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 contributed by Ministry of Health (MOH) hospitals (2005-2007).
- In 2008, other centres i.e. Ministry of Education, Ministry of Defence and private hospitals were invited to participate.
- Since its establishment in 2005, there have been five published reports.
- In this report, the data is displayed 5 yearly to demonstrate the trend of glomerular diseases in Malaysia. The data from the first 5 years 2005-2009 will be combined followed by 2010-2014 and data of 2015-2017 is displayed independently.
- There has been an increasing number of participating centres. Hence, the data reported is hopefully comprehensive.
- This chapter reports data on native kidney biopsy.

### 1.2 Renal biopsy

- Four new centres participated in this report.
- There is a total of 49 centres: 30 Ministry of Health (MOH), 3 Ministry of Education (MOE), 1 Ministry of Defence (MOD) and 15 private hospitals.
- There is a total of 16,453 biopsies reported in this 13-year period (2005-2017).
- There has been a marked increment from 4,429 biopsies in the first 5 years (2005-2009) to 7,245 in the 2010-2014 reported to the MRRB. This could be partially explained by the addition of more SDP since 2008.
- An average of 1500-1700 renal biopsies was reported annually since 2015. *(Figure 1.2)*

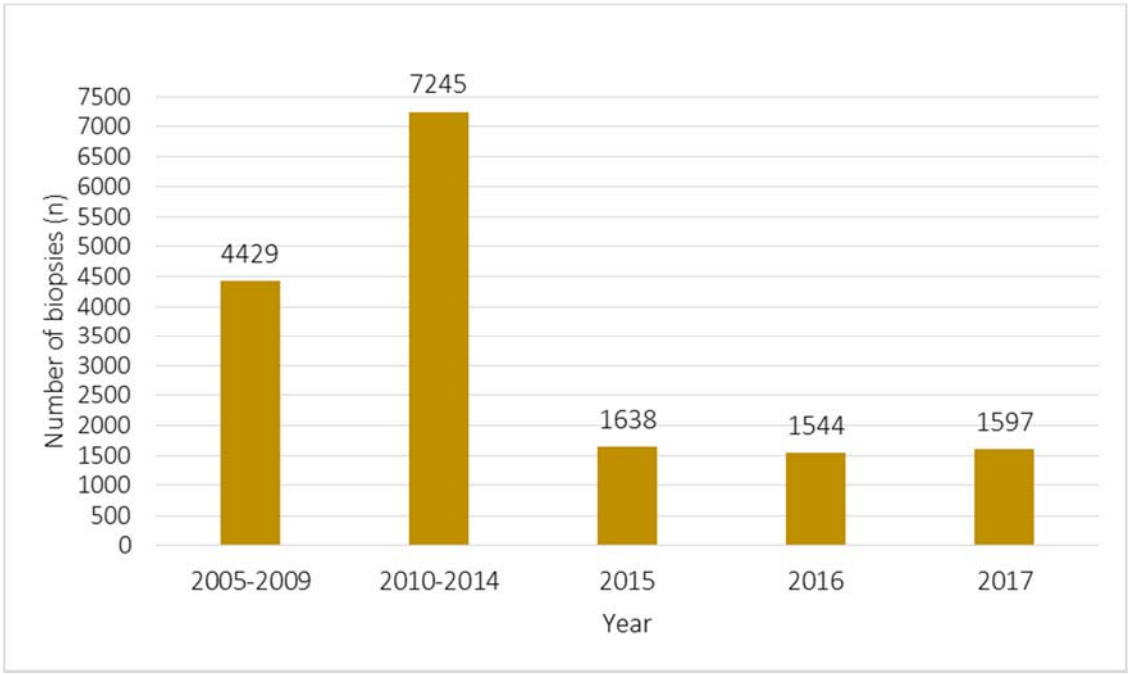


Figure 1.2: Distribution of reported renal biopsies, 2005-2017

### 1.3 Number of episodes of renal biopsy

- Eighty-five percent of renal biopsies were first episode biopsy.
- Repeat biopsies contributed to the remaining 15% in which second episode biopsy was performed in 11-13% of the cases followed by third episode of biopsy in 2-3%. *(Figure 1.3)*

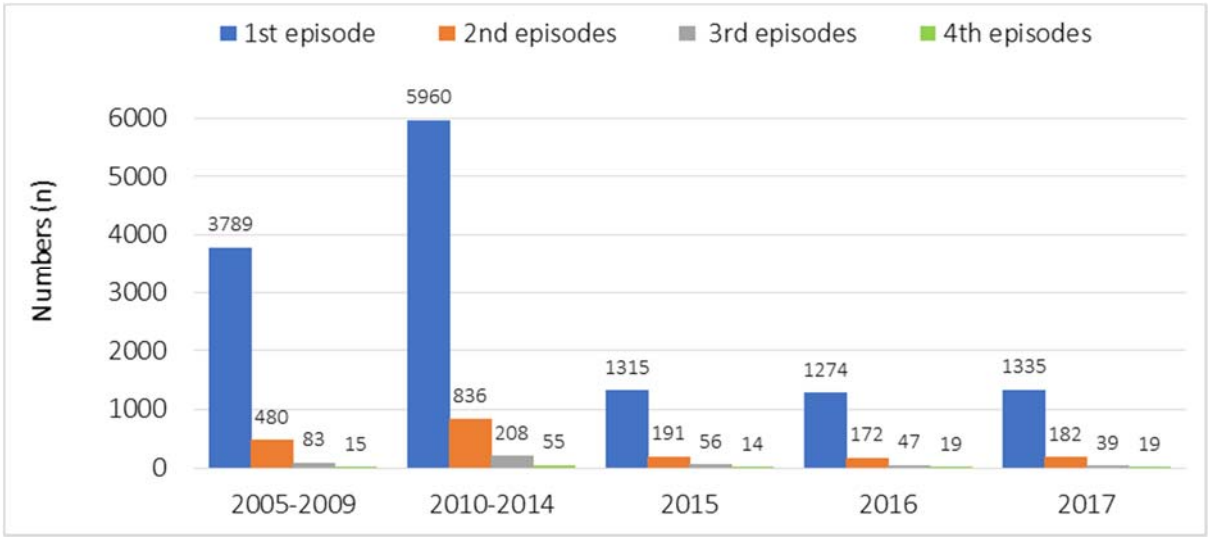


Figure 1.3: Distribution of renal biopsy in patients by number of episodes, 2005-2017

## 1.4 Demographic distribution of renal biopsy

### 1.4.1 Age distribution

- 85-90% of the biopsies performed were in adult patients (≥15 years old) and the paediatric cases contributed to the remaining 10-15%. *(Figure 1.4.1(a))*
- In adult, 2/3 of the biopsies involved patients in the 15 - 45 years old age group. Only 10% of the biopsies were performed in the patients >55 years and older. *(Figure 1.4.1(b))*

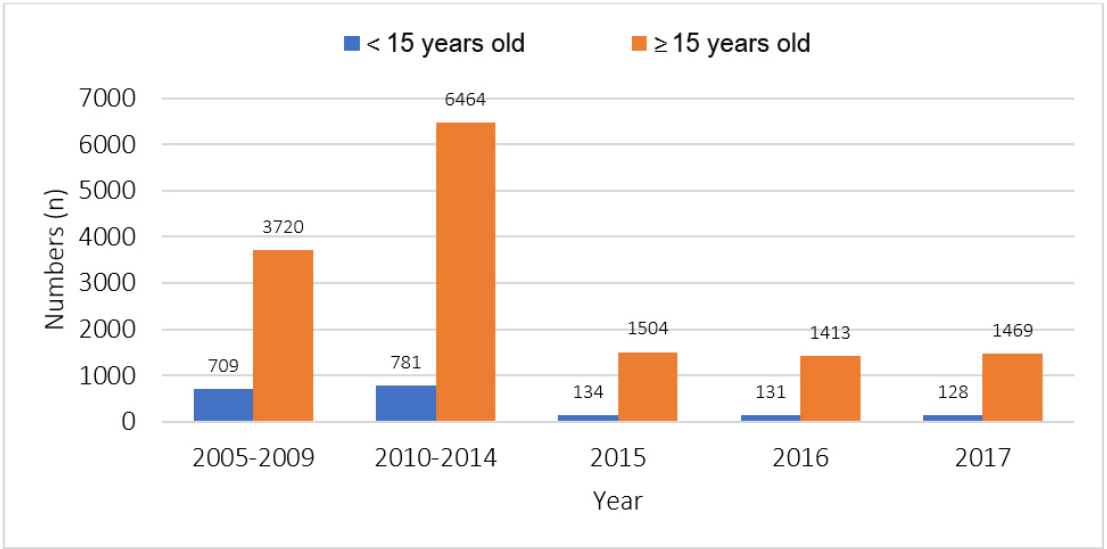


Figure 1.4.1(a) Distribution of renal biopsy in the paediatric and adult age groups, 2005-2017

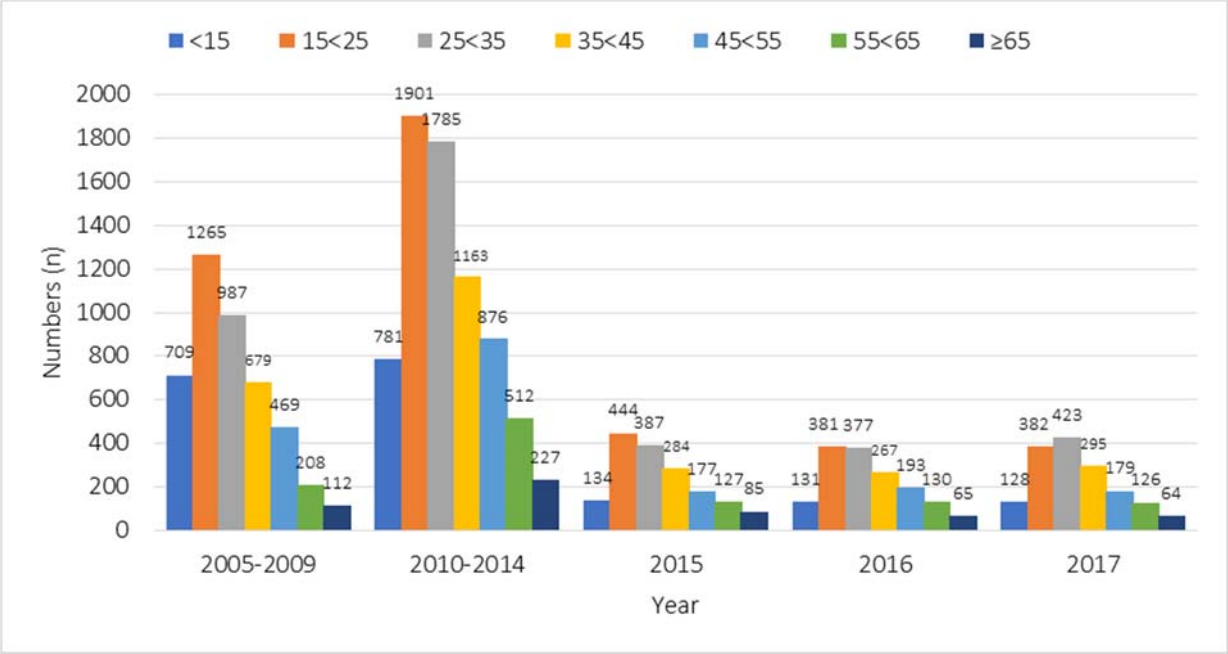


Figure 1.4.1 (b): Age distribution of renal biopsy patients, 2005-2017

### 1.4.2 Age distribution by state

- Johor and Selangor constantly reported the highest number of renal biopsies in the paediatric age group (age <15), with each state contributing to 20% of the overall biopsies. (*Table 1.4.2 (a)*)
- Selangor and WP Kuala Lumpur were the top two states performing kidney biopsies in adult population contributing to 23.6% and 13.3% respectively. *(Table 1.4.2 (b))*

Table 1.4.2(a): Renal biopsies by state in patients age < 15 years, 2005-2017

| Year | 2005-2009 (n=709) | | 2010-2014 (n=781) | | 2015 (n=134) | | 2016 (n=131) | | 2017 (n=128) | | Total (n=1883) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % | n | % |
| **Johor** | **167** | **23.6** | **141** | **18.1** | **24** | **17.9** | **27** | **20.6** | **26** | **20.3** | **385** | **20.4** |
| Kedah | 49 | 6.9 | 79 | 10.1 | 10 | 7.5 | 12 | 9.2 | 7 | 5.5 | 157 | 8.3 |
| Kelantan | 19 | 2.7 | 41 | 5.2 | 1 | 0.7 | 0 | 0.0 | 1 | 0.8 | 62 | 3.3 |
| Melaka | 16 | 2.3 | 16 | 2.0 | 2 | 1.5 | 1 | 0.8 | 0 | 0.0 | 35 | 1.9 |
| N Sembilan | 38 | 5.4 | 24 | 3.1 | 3 | 2.2 | 4 | 3.1 | 8 | 6.3 | 77 | 4.1 |
| Pahang | 29 | 4.1 | 14 | 1.8 | 3 | 2.2 | 3 | 2.3 | 1 | 0.8 | 50 | 2.7 |
| Penang | 41 | 5.8 | 38 | 4.9 | 6 | 4.5 | 9 | 6.9 | 4 | 3.1 | 98 | 5.2 |
| Perak | 43 | 6.1 | 74 | 9.5 | 7 | 5.2 | 10 | 7.6 | 12 | 9.4 | 146 | 7.8 |
| Perlis | 7 | 1.0 | 3 | 0.4 | 0 | 0.0 | 2 | 1.5 | 0 | 0.0 | 12 | 0.6 |
| Sabah | 51 | 7.2 | 50 | 6.4 | 11 | 8.2 | 15 | 11.5 | 17 | 13.3 | 144 | 7.6 |
| Sarawak | 64 | 9.0 | 60 | 7.7 | 13 | 9.7 | 7 | 5.3 | 10 | 7.8 | 154 | 8.2 |
| **Selangor** | **123** | **17.3** | **160** | **20.5** | **38** | **28.4** | **27** | **20.6** | **31** | **24.2** | **379** | **20.1** |
| Terengganu | 16 | 2.3 | 18 | 2.3 | 3 | 2.2 | 1 | 0.8 | 4 | 3.1 | 42 | 2.2 |
| WP KL | 40 | 5.6 | 58 | 7.4 | 11 | 8.2 | 10 | 7.6 | 7 | 5.5 | 126 | 6.7 |
| Non M'sian | 6 | 0.8 | 5 | 0.6 | 2 | 1.5 | 3 | 2.3 | 0 | 0 | 16 | 0.8 |

Table 1.4.2(b): Renal biopsies by state in patients age > 15 years, 2005-2017

| Year | 2005-2009 (n=3720) | | 2010-2014 (n=6464) | | 2015 ((n=1504) | | 2016 (n=1413) | | 2017 (n=1469) | | Total (n=14570 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % | n | % |
| Johor | 433 | 11.6 | 586 | 9.1 | 81 | 5.4 | 117 | 8.3 | 145 | 9.9 | 1362 | 9.3 |
| Kedah | 301 | 8.1 | 562 | 8.7 | 109 | 7.2 | 114 | 8.1 | 118 | 8.0 | 1204 | 8.3 |
| Kelantan | 107 | 2.9 | 249 | 3.9 | 29 | 1.9 | 23 | 1.6 | 35 | 2.4 | 443 | 3.0 |
| Melaka | 103 | 2.8 | 128 | 2.0 | 44 | 2.9 | 29 | 2.1 | 23 | 1.6 | 327 | 2.2 |
| N Sembilan | 118 | 3.2 | 261 | 4.0 | 87 | 5.8 | 77 | 5.4 | 54 | 3.7 | 597 | 4.1 |
| Pahang | 167 | 4.5 | 288 | 4.5 | 91 | 6.1 | 76 | 5.4 | 89 | 6.1 | 711 | 4.9 |
| Penang | 293 | 7.9 | 363 | 5.6 | 90 | 6.0 | 88 | 6.2 | 75 | 5.1 | 909 | 6.2 |
| Perak | 191 | 5.1 | 550 | 8.5 | 109 | 7.2 | 84 | 5.9 | 89 | 6.1 | 1023 | 7.0 |
| Perlis | 25 | 0.7 | 28 | 0.4 | 9 | 0.6 | 10 | 0.7 | 8 | 0.5 | 80 | 0.5 |
| Sabah | 166 | 4.5 | 178 | 2.8 | 121 | 8.0 | 128 | 9.1 | 121 | 8.2 | 714 | 4.9 |
| Sarawak | 388 | 10.4 | 544 | 8.4 | 108 | 7.2 | 122 | 8.6 | 147 | 10.0 | 1309 | 9.0 |
| **Selangor** | **889** | **23.9** | **1445** | **22.4** | **401** | **26.7** | **368** | **26.0** | **342** | **23.3** | **3445** | **23.6** |
| Terengganu | 64 | 1.7 | 146 | 2.3 | 26 | 1.7 | 33 | 2.3 | 28 | 1.9 | 297 | 2.0 |
| **WP KL** | **420** | **11.3** | **1015** | **15.7** | **184** | **12.2** | **135** | **9.6** | **182** | **12.4** | **1936** | **13.3** |
| Not available | 0 | 0 | 1 | 0 | 1 | 0.1 | 0 | 0 | 0 | 0 | 2 | 0 |
| Non-M'sian | 55 | 1.5 | 120 | 1.9 | 14 | 0.9 | 9 | 0.6 | 13 | 0.9 | 211 | 1.4 |

### 1.4.3 Gender Distribution

- A similar trend of female predominance and a female to male ratio of 3:2 has been recognised since 2005. *(Table 1.4.3)*

Table 1.4.3: Gender distribution of renal biopsy, 2005-2017

| Gender | 2005-2009 (n=4429) | | 2010-2014 (n=7245) | | 2015 (n=1638) | | 2016 (n=1544) | | 2017 (n=1597) | | Total (n=16453) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % | n | % |
| Male | 1774 | 40.1 | 2871 | 39.6 | 647 | 39.5 | 611 | 39.6 | 607 | 38.0 | 6510 | 39.6 |
| Female | 2655 | 59.9 | 4374 | 60.4 | 991 | 60.5 | 933 | 60.4 | 990 | 62.0 | 9943 | 60.4 |

### 1.4.4 Ethnicity distribution

- Fifty-eight (58%) percent of patients biopsied were of Malay ethnicity and this trend was persistent throughout different time periods. *(Table 1.4.4).*
- There were no notable racial preponderance in glomerular disease in Malaysia.

Table 1.4.4: Racial distribution of renal biopsy, patients, 2005-2017

| Race | 2005-2009 (n=4429) | | 2010-2014 (n=7245) | | 2015 (n=1638) | | 2016 (n=1544) | | 2017 (n=1597) | | Total (n=16453) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % | n | % |
| Malay | 2484 | 56.1 | 4251 | 58.7 | 944 | 57.6 | 851 | 55.1 | 975 | 61.1 | 9505 | 57.8 |
| Chinese | 1128 | 25.5 | 1722 | 23.8 | 365 | 22.3 | 382 | 24.7 | 308 | 19.3 | 3905 | 23.7 |
| Indian | 313 | 7.1 | 438 | 6.0 | 104 | 6.3 | 88 | 5.7 | 81 | 5.1 | 1024 | 6.2 |
| Others | 504 | 11.4 | 834 | 11.5 | 225 | 13.7 | 223 | 14.4 | 233 | 14.6 | 2019 | 12.3 |

## 1.5 Biopsy characteristics and complications

### 1.5.1 Number of glomeruli on biopsy

- Most (80%) of the biopsies performed were considered adequate with more than 10 glomeruli obtained.
- In 15% of the cases, the number of glomeruli obtained were considered inadequate (< 10 glomeruli), whereas 5-10% of the biopsies did not report the number of glomeruli obtained. *( Figure 1.5.1)*
- Obtaining an adequate biopsy sample which includes a good biopsy technique is mandatory to facilitate an accurate histopathological diagnosis.

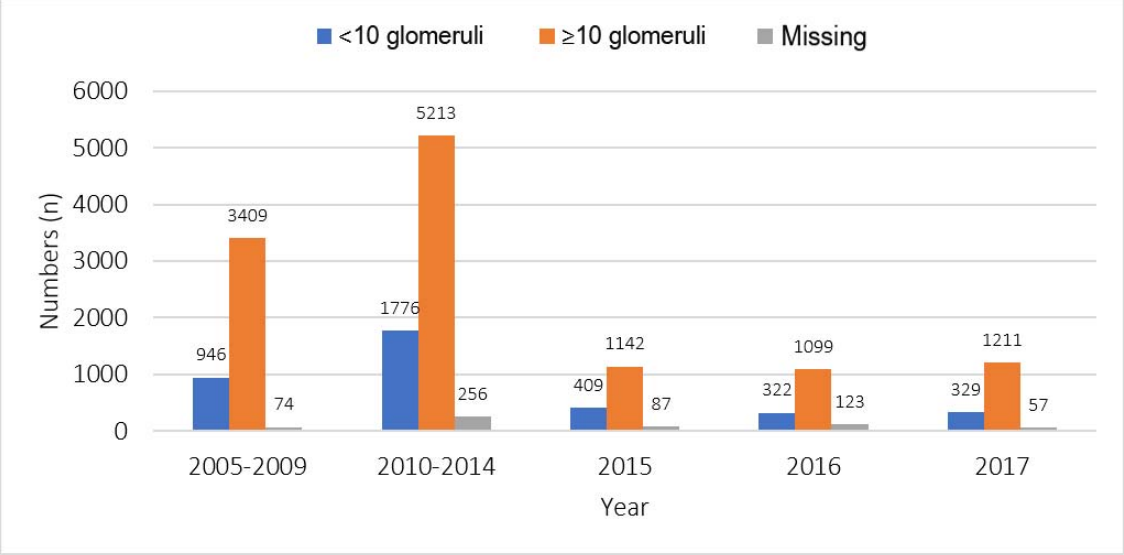


Figure 1.5.1: Number of glomeruli obtained at each renal biopsy, 2005-2017

### 1.5.2 Operator of biopsy

- A large proportion of biopsies were performed by either nephrologist or nephrology trainee, 33.6% and 28.2% respectively.
- However, data were not available in 36.3% of all biopsies performed. *(Figure 1.5.2)*

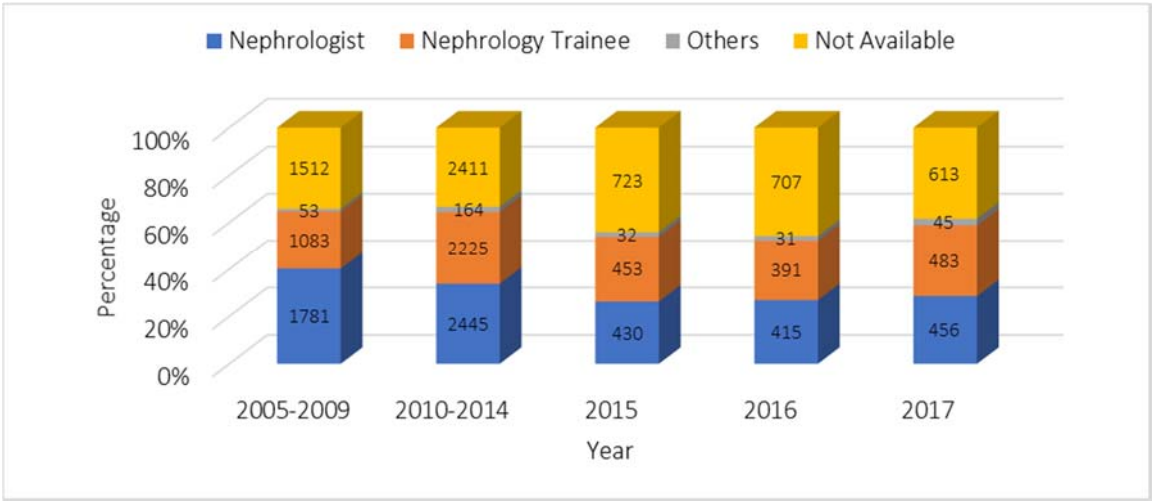


Figure 1.5.2: Operator of biopsy, 2005-2017

### 1.5.3 Complications of biopsy

- Almost 2/3 of cases documented no complications and less than 2% had complications post procedure. *(Table 1.5.3)*
- However, data was not available in 37.2% of the biopsies.

Table 1.5.3: Complications of renal biopsy, 2005-2017

| Complication | 2005-2009 (n=4429) | | 2010-2014 (n=7245) | | 2015 (n=1638) | | 2016 (n=1544) | | 2017 (n=1597) | | Total (n=16453) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % | n | % |
| Yes | 92 | 2.1 | 143 | 2.0 | 21 | 1.3 | 22 | 1.4 | 25 | 1.6 | 303 | 1.8 |
| No | 2766 | 62.5 | 4653 | 64.2 | 882 | 53.8 | 770 | 49.9 | 957 | 59.9 | 10028 | 60.9 |
| Not Available | 1571 | 35.5 | 2449 | 33.8 | 735 | 44.9 | 752 | 48.7 | 615 | 38.5 | 6122 | 37.2 |

### 1.5.4 Types of biopsy complications

- Of 303 biopsy complications, two-thirds of the cases were bleeding and 28% developed perinephric collection.
- The number of other complications are relatively rare; 1.3% arteriovenous malformation (1.3%) and infection (0.6%) . *(Figure 1.5.4)*

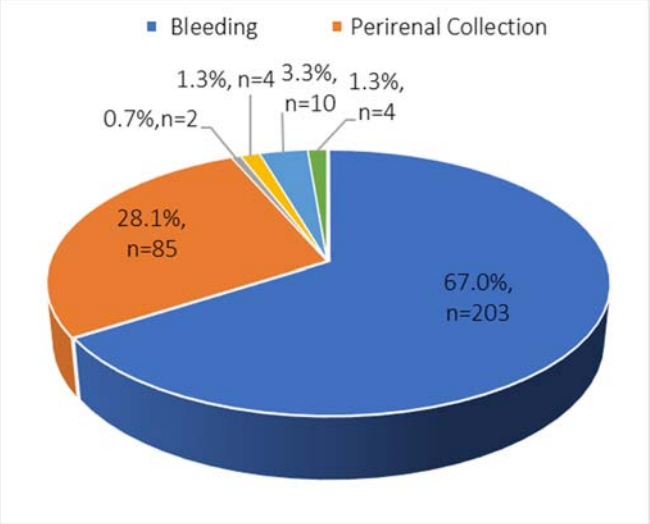


Figure 1.5.4: Types of complications of renal biopsy, 2005-2017

### 1.5.5 Intervention for biopsy complications

- A Ninety cases of biopsy complications required interventions.
- Majority of cases required blood transfusion (76. %), 20% had radiological intervention and 3.3% needed surgical intervention. *(Figure 1.5.5)*

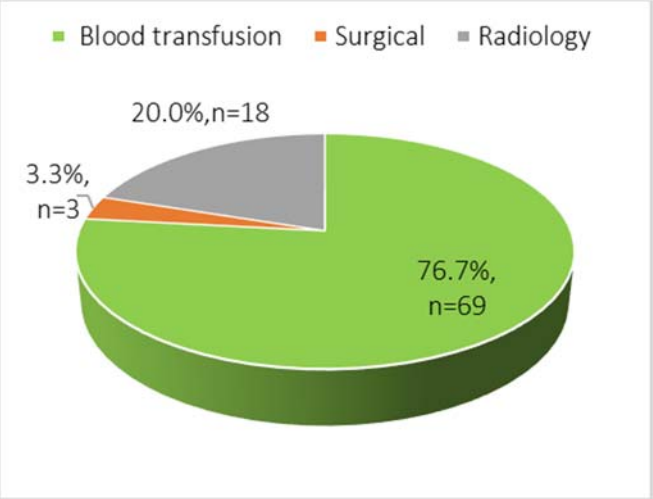


Figure 1.5.5: Intervention for renal biopsy complications, 2005-2017

## 1.6 Histopathological Laboratory Services

- Sixty-one (61%) percent of the biopsies were reported by an in-house histopathologist.
- Twenty-six (26%) were sent to external laboratories.
- Before 2009, less than half of the hospitals were supported by their own renal pathologist.
- However, after 2010, there has been an improvement with 68.4% of the hospitals having their own in-house pathologist. *(Table 1.6)*

Table 1.6: Summary of renal biopsies received by in-house and external laboratories, 2005-2017

| Summary of biopsies received | 2005-2009 (n=4429) | | 2010-2014 (n=7245) | | 2015 (n=1638) | | 2016 (n=1544) | | 2017 (n=1597) | | Total (n=16453) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % | n | % |
| In house | 2100 | 47.4 | 4648 | 64.2 | 1188 | 72.5 | 992 | 64.2 | 1092 | 68.4 | 10020 | 60.9 |
| External | 2287 | 51.6 | 2409 | 33.3 | 380 | 23.2 | 451 | 29.2 | 461 | 28.9 | 5988 | 36.4 |
| Not available | 42 | 0.9 | 188 | 2.6 | 70 | 4.3 | 101 | 6.5 | 44 | 2.8 | 445 | 2.7 |

## 1.7 Clinical Indications of renal biopsy

- This section indicates the clinical indications of renal biopsy in all age groups.
- The clinical indications for a renal biopsy were categorised into four; nephrotic syndrome, nephritic syndrome, combined nephrotic & nephritic and asymptomatic urinary abnormalities.
- The most common clinic indications for a renal biopsy is nephrotic syndrome at 37% and this is followed by asymptomatic urine abnormalities (31%)
- Information on clinical indication was unavailable in 15% of the biopsies. *(Figure 1.7)*

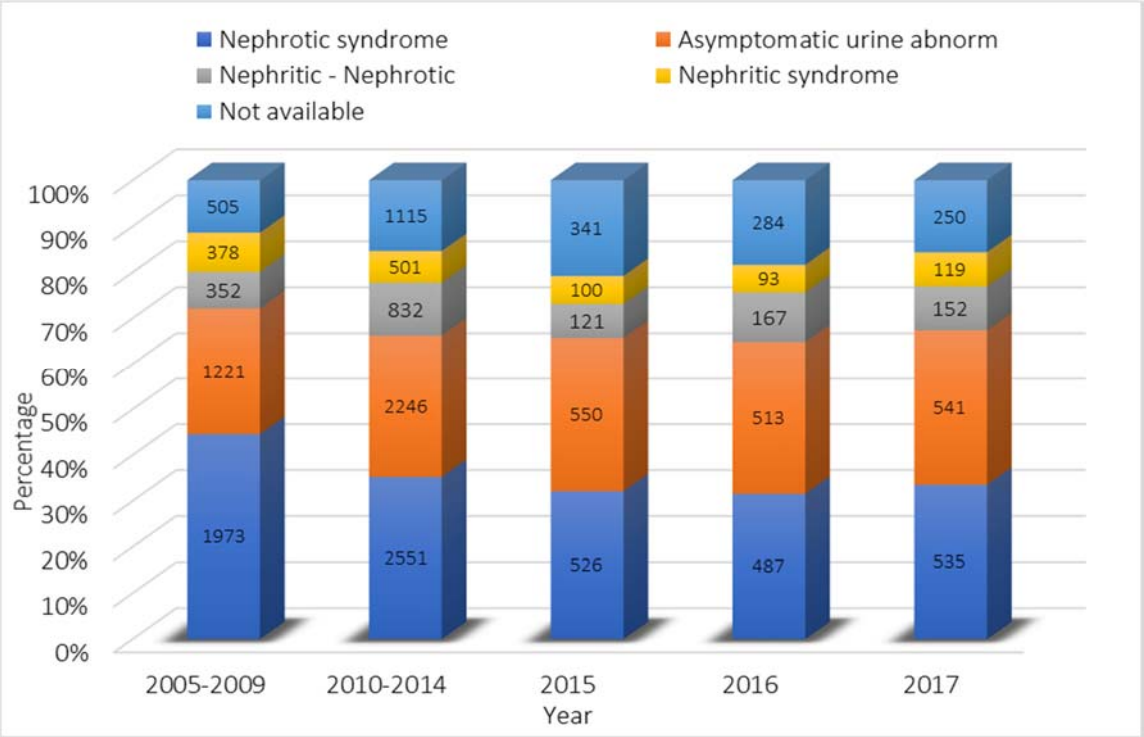


Figure 1.7: Indications for native renal biopsies, 2005-2017

## 1.8 Renal function at time of biopsy

- Renal function was estimated by Modification of Diet in Renal Disease (MDRD)-4 variables equation. (Appendix IV)
- At the time of biopsy, 48.6% of the patients had normal renal function at the time of biopsy.
- However, 37.5% had impaired renal function. *(Table & Figure 1.8)*
- Approximately half (49.2%) of the patients had chronic kidney disease (CKD) stage 1 and 2 while 17.5% had CKD stage 3.
- Those who were categorised as CKD stage 4 and 5 made up 9.9% each.
- Notably, 13.3% did not have sufficient information to calculate the estimated glomerular filtration rate (eGFR). *(Figure 1.8)*

Table 1.8: Renal function at time of renal biopsy, 2005-2017

| Renal function | 2005-2009 (n=4429) | | 2010-2014 (n=7245) | | 2015 (n=1638) | | 2016 (n=1544) | | 2017 (n=1597) | | Total (n=16453) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % | n | % |
| Normal | 2333 | 52.7 | 3496 | 48.3 | 720 | 44.0 | 663 | 42.9 | 781 | 48.9 | 7993 | 48.6 |
| Impaired | 1514 | 34.2 | 2753 | 38.0 | 633 | 38.6 | 612 | 39.6 | 650 | 40.7 | 6162 | 37.5 |
| Not available | 582 | 13.1 | 996 | 13.7 | 285 | 17.4 | 269 | 17.4 | 166 | 10.4 | 2298 | 14.0 |

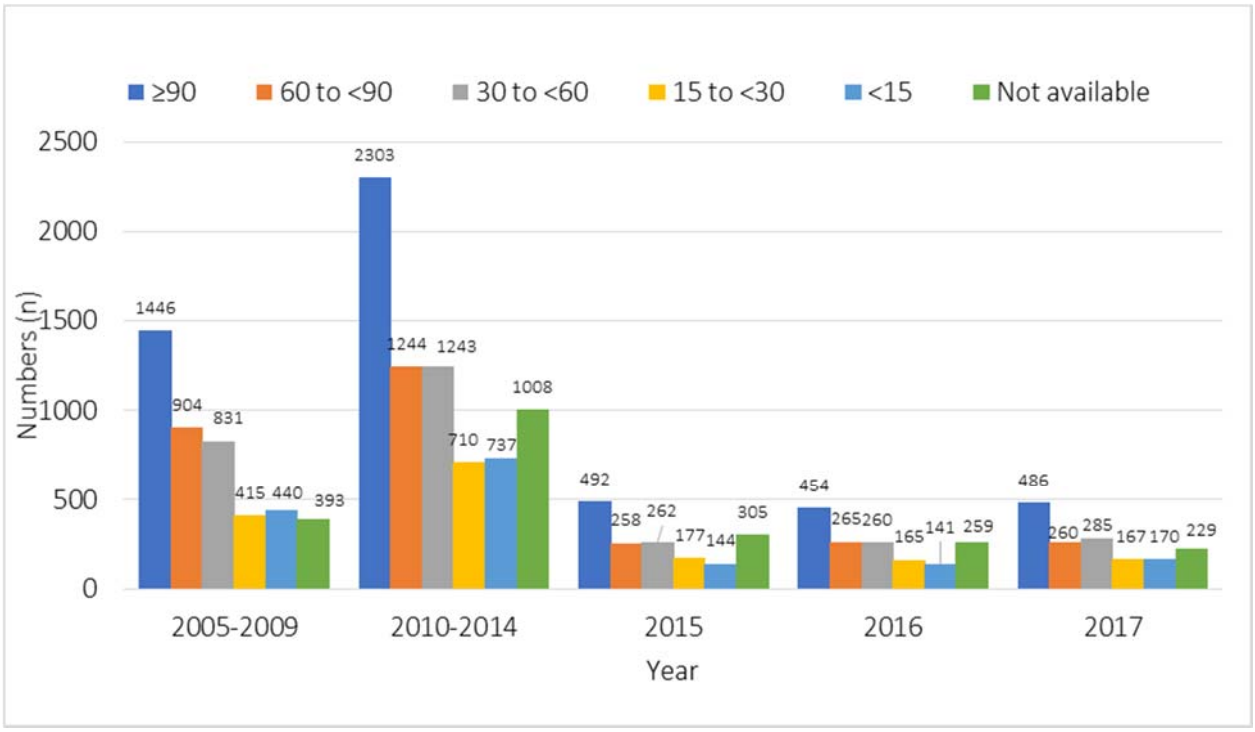


Figure 1.8: Estimated glomerular filtration rate (eGFR),ml/min/1.73m$^2$ at time of renal biopsy, 2005-2017

## 1.9 Histopathological Diagnosis

### 1.9.1 Histopathological diagnosis overview

- Lupus nephritis is the most common GN seen in Malaysia with about 500 biopsies per year.
- The commonest histopathological diagnosis of primary glomerulonephritis (GN) were minimal change disease (30.9%) and FSGS (30.9%).
- Ig A nephropathy has been increasingly diagnosed over the years from 17.6% in 2005-2009 to 27.1% in 2017. This may partly be due to a change in biopsy practices.
- Membranous nephropathy remained constant at 8% to 10%. *(Figure 1.9)*
- Secondary GN were mainly attributed to lupus nephritis (79.6%) followed by diabetic nephropathy (11.6%).
- In the tubulo-interstitial disease category, there is a shift in the histopathology pattern. Acute tubular necrosis (47.2%) which was the most common pattern in 2005-2009 has been replaced by acute interstitial nephritis (36.1%) in 2017. *(Table 1.9.1)*
- Hypertensive nephrosclerosis is the most common vascular renal disease seen.
- Hereditary renal disease (Thin Basement Membrane Disease and Alport Syndrome) is uncommon.

Table 1.9.1: Histopathology of all native renal biopsies, 2005-2017

| | Histopathological Diagnosis | 2005-2009 (n=2017) | | 2010-2014 (n=3044) | | 2015 (n=629) | | 2016 (n=590) | | 2017 (n=658) | | Total (n=6938) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % | n | % | n | % | n | % |
| **Primary GN** | FSGS | 665 | 33.0 | 901 | 29.6 | 195 | 31.0 | 170 | 28.8 | 205 | 31.2 | 2136 | 30.8 |
| | Minimal Change | 680 | 33.7 | 958 | 31.5 | 181 | 28.8 | 172 | 29.2 | 152 | 23.1 | 2143 | 30.9 |
| | Ig A nephropathy | 355 | 17.6 | 694 | 22.8 | 142 | 22.6 | 138 | 23.4 | 178 | 27.1 | 1507 | 21.7 |
| | Membrano-proliferative | 42 | 2.1 | 44 | 1.4 | 15 | 2.4 | 8 | 1.4 | 14 | 2.1 | 123 | 1.8 |
| | Membranous nephropathy | 165 | 8.2 | 257 | 8.4 | 53 | 8.4 | 61 | 10.3 | 68 | 10.3 | 604 | 8.7 |
| | Mesangial Prol: non-IgA | 67 | 3.3 | 101 | 3.3 | 21 | 3.3 | 17 | 2.9 | 13 | 2.0 | 219 | 3.2 |
| | Idiopathic Crescentic GN | 29 | 1.4 | 33 | 1.1 | 3 | 0.5 | 7 | 1.2 | 5 | 0.8 | 77 | 1.1 |
| | Crescentic ANCA | 9 | 0.4 | 21 | 0.7 | 2 | 0.3 | 2 | 0.3 | 6 | 0.9 | 40 | 0.6 |
| | Not Available | 5 | 0.2 | 35 | 1.1 | 17 | 2.7 | 15 | 2.5 | 17 | 2.6 | 89 | 1.3 |
| | **Histopathological Diagnosis** | **2005-2009 (n=1912)** | | **2010-2014 (n=3087)** | | **2015 (n=661)** | | **2016 (n=644)** | | **2017 (n=626)** | | **Total (n=6930)** | |
| | | n | % | n | % | n | % | n | % | n | % | n | % |
| **Secondary GN** | Lupus Nephritis | 1590 | 83.2 | 2413 | 78.2 | 530 | 80.2 | 484 | 75.2 | 498 | 79.6 | 5515 | 79.6 |
| | Diabetic Nephropathy | 167 | 8.7 | 372 | 12.1 | 83 | 12.6 | 97 | 15.1 | 84 | 13.4 | 803 | 11.6 |
| | Post Infectious GN | 80 | 4.2 | 170 | 5.5 | 19 | 2.9 | 23 | 3.6 | 27 | 4.3 | 319 | 4.6 |
| | Amyloidosis | 9 | 0.5 | 21 | 0.7 | 5 | 0.8 | 9 | 1.4 | 2 | 0.3 | 46 | 0.7 |
| | Anti GBM disease | 0 | 0.0 | 4 | 0.1 | 2 | 0.3 | 0 | 0.0 | 2 | 0.3 | 8 | 0.1 |
| | Henoch Schonlein Purpura | 29 | 1.5 | 21 | 0.7 | 7 | 1.1 | 8 | 1.2 | 1 | 0.2 | 66 | 1.0 |
| | HUS / TTP | 3 | 0.2 | 5 | 0.2 | 0 | 0.0 | 0 | 0.0 | 4 | 0.6 | 12 | 0.2 |
| | Immunotactoid / fibrillary | 0 | 0.0 | 1 | 0.0 | 0 | 0.0 | 2 | 0.3 | 0 | 0.0 | 3 | 0.0 |
| | Light / Heavy chain deposit disease | 2 | 0.1 | 2 | 0.1 | 3 | 0.5 | 2 | 0.3 | 0 | 0.0 | 9 | 0.1 |
| | Malignancy | 4 | 0.2 | 4 | 0.1 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 8 | 0.1 |
| | Multiple myeloma | 8 | 0.4 | 4 | 0.1 | 3 | 0.5 | 0 | 0.0 | 0 | 0.0 | 15 | 0.2 |
| | Other infection | 8 | 0.4 | 19 | 0.6 | 2 | 0.3 | 2 | 0.3 | 1 | 0.2 | 32 | 0.5 |
| | Systemic vasculitis | 8 | 0.4 | 15 | 0.5 | 1 | 0.2 | 1 | 0.2 | 2 | 0.3 | 27 | 0.4 |
| | Not Available | 4 | 0.2 | 36 | 1.2 | 6 | 0.9 | 16 | 2.5 | 5 | 0.8 | 67 | 1.0 |

Table 1.9.1: Histopathology of all native renal biopsies, 2005-2017 (*'cont.*)

| | **Histopathological Diagnosis** | **2005-2009 (n=322)** | | 2010-2014 **(n=468)** | | **2015 (n=127)** | | **2016 (n=94)** | | **2017 (n=97)** | | **Total (n=1108)** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** |
| **Tubulointerstitial disease** | Acute tubular necrosis | 152 | 47.2 | 159 | 34.0 | 38 | 29.9 | 26 | 27.7 | 21 | 21.6 | 396 | 35.7 |
| | Acute interstitial nephritis | 64 | 19.9 | 157 | 33.5 | 39 | 30.7 | 29 | 30.9 | 35 | 36.1 | 324 | 29.2 |
| | Chronic interstitial nephritis | 102 | 31.7 | 142 | 30.3 | 35 | 27.6 | 31 | 33.0 | 24 | 24.7 | 334 | 30.1 |
| | Missing | 4 | 1.2 | 10 | 2.1 | 15 | 11.8 | 8 | 8.5 | 17 | 17.5 | 54 | 4.9 |
| | **Histopathological Diagnosis** | **2005-2009 (n=62)** | | **2010-2014 (n=157)** | | **2015 (n=45)** | | **2016 (n=30)** | | **2017 (n=40)** | | **Total (n=335)** | |
| | | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** |
| **Vascular** | Athero-embolic disease | 0 | 0.0 | 2 | 1.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 0.6 |
| | Benign / Malignant Hypertension | 58 | 93.5 | 130 | 82.8 | 39 | 86.7 | 22 | 73.3 | 29 | 72.5 | 278 | 83.0 |
| | Systemic sclerosis | 1 | 1.6 | 14 | 8.9 | 1 | 2.2 | 3 | 10.0 | 5 | 12.5 | 25 | 7.5 |
| | Not Available | 3 | 4.8 | 11 | 7.0 | 5 | 11.1 | 5 | 16.7 | 6 | 15.0 | 30 | 9.0 |
| | **Histopathological Diagnosis** | **2005-2009 (n=10)** | | **2010-2014 (n=14)** | | **2015 (n=4)** | | **2016 (n=6)** | | **2017 (n=3)** | | **Total (n=37)** | |
| | | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** |
| **Hereditary** | Alport's sYndrome | 5 | 50.0 | 3 | 21.4 | 2 | 50.0 | 0 | 0.0 | 0 | 0.0 | 10 | 27.0 |
| | Thin Basement Membrane | 3 | 30.0 | 2 | 14.3 | 0 | 0.0 | 2 | 33.3 | 2 | 66.7 | 9 | 24.3 |
| | Others | 2 | 20.0 | 2 | 14.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 4 | 10.8 |
| | Not Available | 0 | 0.0 | 7 | 50.0 | 2 | 50.0 | 4 | 66.7 | 1 | 33.3 | 14 | 37.8 |
| **Advance GN** | **Histopathological Diagnosis** | **2005-2009** | | **2010-2014** | | **2015** | | **2016** | | **2017** | | **Total** | |
| | **Total** | **122** | | **137** | | **24** | | **10** | | **24** | | **317** | |
| **Others** | **Histopathological Diagnosis** | **2005-2009** | | **2010-2014** | | **2015** | | **2016** | | **2017** | | **Total** | |
| | **Total** | **38** | | **199** | | **80** | | **73** | | **65** | | **455** | |

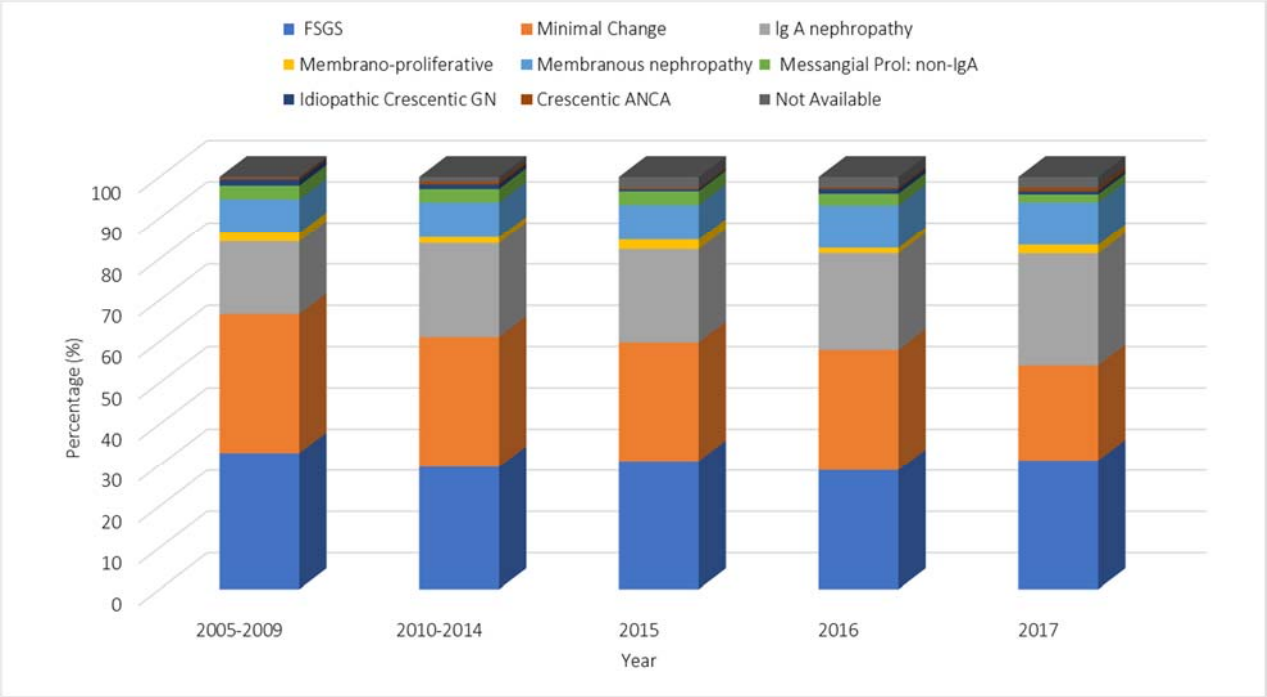


Figure 1.9.1: Histopathology of primary glomerulonephritis on native renal biopsies, 2005-2017

## 1.9.2 Histopathology findings in common clinical presentation

### 1.9.2.1 Nephrotic syndrome

- Sixty percent (60%) of patients who presented with nephrotic syndrome were diagnosed with primary GN and 30% had secondary GN.
- The most common histopathological findings in those presenting with nephrotic syndrome were minimal change disease (26%) followed by lupus nephritis (23%) and FSGS (20%). *(Table 1.9.2.1)*
- Other primary glomerular diseases presenting with nephrotic syndrome are IgA nephropathy and membranous nephropathy contributing to 6% and 5%, respectively.
- Diabetic nephropathy contributed to 5% of all cases presenting with nephrotic syndrome.

Table 1.9.2.1: HPE diagnosis in patients presenting with Nephrotic Syndrome, 2005-2017

| Type | Histopathological Diagnosis | n | % |
|---|---|---|---|
| **Primary GN** | FSGS | 1222 | 20 |
| | Minimal Change | 1557 | 26 |
| | Membranous nephropathy | 358 | 6 |
| | lg A nephropathy | 310 | 5 |
| | Idiopathic Crescentic GN | 15 | 0 |
| | Membrano-proliferative | 51 | 1 |
| | Mesangial Proliferative GN-non-IgA | 78 | 1 |
| | Crescentic ANCA | 1 | 0 |
| | Not available | 34 | 1 |
| | **Sub total** | **3626** | **60** |
| **Secondary GN** | Lupus Nephritis | 1393 | 23 |
| | Diabetic nephropathy | 322 | 5 |
| | Post Infectious GN | 49 | 1 |
| | Amyloidosis | 25 | 0 |
| | Henoch Schonlein Purpura | 7 | 0 |
| | HUS / TTP | 2 | 0 |
| | Light / Heavy chain deposit disease | 3 | 0 |
| | Malignancy | 2 | 0 |
| | Multiple myeloma | 1 | 0 |
| | Other infection | 16 | 0 |
| | Systemic vasculitis | 2 | 0 |
| | Not Available | 18 | 0 |
| | **Sub total** | **1840** | **30** |
| **Others** | | 625 | 10 |
| **Total** | | **6091** | **100** |

### 1.9.2.2 Nephritic syndrome

- The majority of patients who presented with nephritic syndrome were diagnosed with secondary GN (53%) and 31% were primary GN.
- The common histopathological findings in those presenting with nephritic syndrome were Lupus nephritis (40%), idiopathic crescentic GN (10%), FSGS (8%) and post infectious GN (7%). *(Table 1.9.2.2)*

Table 1.9.2.2: HPE diagnosis in patients presenting with nephritic syndrome, 2005-2017

| Type | Histopathological Diagnosis | n | % |
|---|---|---|---|
| **Primary GN** | FSGS | 98 | 8 |
| | Minimal Change | 74 | 6 |
| | Membranous nephropathy | 13 | 1 |
| | lg A nephropathy | 15 | 1 |
| | Idiopathic Crescentic GN | 113 | 10 |
| | Membrano-proliferative | 16 | 1 |
| | Mesangial Proliferative GN-non-IgA | 21 | 2 |
| | Crescentic ANCA | 11 | 1 |
| | Not available | 10 | 1 |
| | **Sub total** | **371** | **31** |
| **Secondary GN** | Lupus Nephritis | 473 | 40 |
| | Diabetic nephropathy | 37 | 3 |
| | Post Infectious GN | 86 | 7 |
| | Henoch Schonlein Purpura | 9 | 1 |
| | HUS / TTP | 2 | 0 |
| | Amyloidosis | 2 | 0 |
| | Anti GBM disease | 3 | 0 |
| | Systemic vasculitis | 7 | 1 |
| | Not Available | 6 | 1 |
| | **Sub total** | **625** | **53** |
| **Others** | | 190 | 16 |
| **Total** | | **1186** | **100** |

### 1.9.2.3 Nephritic-nephrotic syndrome

- About half (49%) of the patients who presented with nephritic-nephrotic syndrome had secondary GN, mostly associated with lupus nephritis (41%).
- Only 36% of patients with this similar presentation had primary GN. *(Table 1.9.2.3)*

Table 1.9.2.3: HPE diagnosis in patients presenting with nephritic-nephrotic syndrome, 2005-2017

| Type | Histopathological Diagnosis | n | % |
|---|---|---|---|
| **Primary GN** | lg A nephropathy | 724 | 15 |
| | FSGS | 448 | 9 |
| | Minimal Change | 281 | 6 |
| | Membranous nephropathy | 144 | 3 |
| | Idiopathic Crescentic GN | 18 | 0 |
| | Membrano-proliferative | 18 | 0 |
| | Mesangial Proliferative GN-non-IgA | 71 | 2 |
| | Crescentic ANCA | 10 | 0 |
| | Not Available | 22 | 1 |
| | **Sub total** | **1736** | **36** |
| **Secondary GN** | Lupus Nephritis | 1983 | 41 |
| | Diabetic nephropathy | 245 | 5.1 |
| | Post Infectious GN | 44 | 1 |
| | Henoch Schonlein Purpura | 30 | 1 |
| | Amyloidosis | 13 | 0 |
| | Systemic vasculitis | 10 | 0 |
| | Multiple myeloma | 8 | 0 |
| | Other infection | 7 | 0 |
| | Light / Heavy chain deposit disease | 3 | 0 |
| | Anti GBM disease | 2 | 0 |
| | HUS / TTP | 1 | 0 |
| | Malignancy | 1 | 0 |
| | Not Available | 30 | 1 |
| | **Sub total** | **2377** | **49** |
| **Others** | | 735 | 15 |
| **Total** | | **4848** | **100** |

### 1.9.2.4 Asymptomatic Urine Abnormalities

- Forty-six percent (46%) of patients who were biopsied for asymptomatic urine abnormalities were patients with lupus nephritis. These patients have symptoms and signs of extra-renal lupus but did not manifest overt renal involvement. *(Table 1.9.2.4)*
- The most common histopathological findings in those biopsied for asymptomatic proteinuria with or without proteinuria were IgA nephropathy and FSGS.

Table 1.9.2.4: HPE diagnosis in patients presenting with Asymptomatic Urine Abnormalities, 2005-2017

| Type | Histopathological Diagnosis | n | % |
|---|---|---|---|
| **Primary GN** | FSGS | 138 | 8 |
| | lg A nephropathy | 157 | 9 |
| | Minimal Change | 92 | 6 |
| | Membranous nephropathy | 41 | 3 |
| | Mesangial Proliferative GN-non-IgA | 28 | 2 |
| | Membrano-proliferative | 21 | 1 |
| | Idiopathic Crescentic GN | 12 | 1 |
| | Crescentic ANCA | 12 | 1 |
| | Not Available | 7 | 0 |
| | **Sub total** | **508** | **31** |
| **Secondary GN** | Lupus Nephritis | 767 | 46 |
| | Post Infectious GN | 95 | 6 |
| | Diabetic nephropathy | 41 | 3 |
| | Henoch Schonlein Purpura | 16 | 1 |
| | Other infection | 7 | 0 |
| | HUS / TTP | 2 | 0 |
| | Malignancy | 2 | 0 |
| | Immunotactoid / fibrillary GN | 1 | 0 |
| | Light / Heavy chain deposit disease | 1 | 0 |
| | Multiple myeloma | 1 | 0 |
| | Amyloidosis | 1 | 0 |
| | Anti GBM disease | 1 | 0 |
| | Systemic vasculitis | 4 | 0 |
| | Not Available | 5 | 0 |
| | **Sub total** | **944** | **57** |
| **Others** | | 211 | 13 |
| **Total** | | **1663** | **100** |

** Patients may have either one or more histopathology or not have any histopathology*
***Others = Tubulo. Disease + Vascular + Advance GN + Others + Hereditary*

### 1.9.3 Primary GN according to age groups

- In the paediatric group ( defined as less than 15 years of age), Minimal change disease was the most common primary GN with 40.5% diagnosed with this condition. This was followed by FSGS contributing 36.3% of cases and IgA nephropathy (12.7%).
- In age group of 15 to less than 25 years old, minimal change was the commonest GN contributing 41.6% of cases. Similar to the paediatric age group, FSGS is the second most common GN but the percentage is lesser at 28.2%, and IgA nephropathy as the third most common GN with a higher percentage at 19.5%.
- The proportion of patients with minimal change disease decreased with age.
- The incidence of membranous nephropathy increased with age and peaks at approximately 25% in patients who were 55 years and older. *(Table 1.9.3)*

Table 1.9.3: Primary glomerulonephritis according to the various age group, 2005-2017

| **Year** | **<15 (n=1020)** | | **15-<25 (n=1871)** | | **25-<35 (n=1563)** | | **35-<45 (n=1032)** | |
|---|---|---|---|---|---|---|---|---|
| **Histopathological Diagnosis** | n | % | n | % | n | % | n | % |
| FSGS | 370 | 36.3 | 528 | 28.2 | 492 | 31.5 | 315 | 30.5 |
| Minimal Change | 413 | 40.5 | 779 | 41.6 | 416 | 26.6 | 210 | 20.3 |
| lg A nephropathy | 130 | 12.7 | 365 | 19.5 | 456 | 29.2 | 306 | 29.7 |
| Membrano-proliferative | 15 | 1.5 | 25 | 1.3 | 35 | 2.2 | 21 | 2.0 |
| Membranous nephropathy | 30 | 2.9 | 63 | 3.4 | 87 | 5.6 | 113 | 10.9 |
| Mesangial Prol: non-IgA | 40 | 3.9 | 58 | 3.1 | 46 | 2.9 | 43 | 4.2 |
| Idiopathic Crescentic GN | 9 | 0.9 | 20 | 1.1 | 11 | 0.7 | 12 | 1.2 |
| Crescentic ANCA | 3 | 0.3 | 3 | 0.2 | 5 | 0.3 | 3 | 0.3 |
| Not Available | 10 | 1.0 | 30 | 1.6 | 15 | 1.0 | 9 | 0.9 |

| **Year** | **45-<55 (n=730)** | | **55-<65 (n=464)** | | **≥65 (n=258)** | | **Total (n=6938)** | |
|---|---|---|---|---|---|---|---|---|
| **Histopathological Diagnosis** | n | % | n | % | n | % | n | % |
| FSGS | 209 | 28.6 | 131 | 28.2 | 91 | 35.3 | 2136 | 30.8 |
| Minimal Change | 173 | 23.7 | 101 | 21.8 | 51 | 19.8 | 2143 | 30.9 |
| lg A nephropathy | 156 | 21.4 | 70 | 15.1 | 24 | 9.3 | 1507 | 21.7 |
| Membrano-proliferative | 16 | 2.2 | 7 | 1.5 | 4 | 1.6 | 123 | 1.8 |
| Membranous nephropathy | 128 | 17.5 | 117 | 25.2 | 66 | 25.6 | 604 | 8.7 |
| Mesangial Prol: non-IgA | 16 | 2.2 | 14 | 3.0 | 2 | 0.8 | 219 | 3.2 |
| Idiopathic Crescentic GN | 13 | 1.8 | 9 | 1.9 | 3 | 1.2 | 77 | 1.1 |
| Crescentic ANCA | 5 | 0.7 | 9 | 1.9 | 12 | 4.7 | 40 | 0.6 |
| Not Available | 14 | 1.9 | 6 | 1.3 | 5 | 1.9 | 89 | 1.3 |

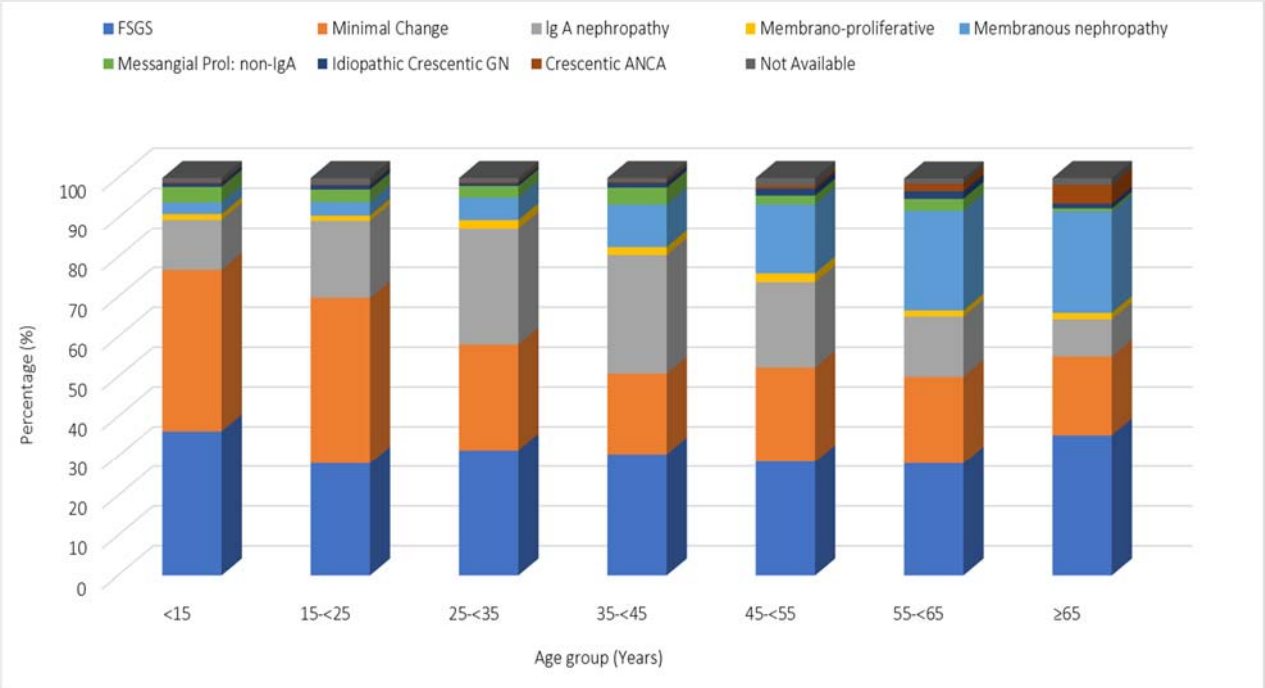


Figure 1.9.3: Primary glomerulonephritis according to the various age group, 2005-2017

### 1.9.4 Secondary GN according to age groups

- In the paediatric age group (age <15 years), lupus nephritis (69%) was the commonest finding on histopathology followed by post-infectious disease (21.2%).
- Similarly, lupus nephritis was also the most frequent diagnosis in patients between age 25 and 65. *(Table 1.9.4)*
- Diabetic nephropathy accounted for half of the cases of secondary GN in patients more than 65 years.

Table 1.9.4: Secondary glomerulonephritis according to the various age group, 2005-2017

| Year | <15 (n-=681) | | 15-<25 (n=120) ) | | 25-<35 (n=1976) | | 35-<45 (n=1819) | |
|---|---|---|---|---|---|---|---|---|
| **Histopathological Diagnosis** | n | % | n | % | n | % | n | % |
| Lupus Nephritis | 466 | 69.0 | 23 | 19.4 | 1857 | 93.52 | 1632 | 88.4 |
| Diabetic nephropathy | 0 | 0 | 59 | 49.5 | 28 | 1.37 | 110 | 7.1 |
| Post Infectious GN | 146 | 21.2 | 7 | 6.0 | 60 | 3.14 | 43 | 2.6 |
| Henoch Schonlein Purpura | 50 | 7.4 | 1 | 0.4 | 6 | 0.36 | 1 | 0 |
| Amyloidosis | 1 | 0.2 | 11 | 9.0 | 0 | 0 | 1 | 0 |
| Other infection | 1 | 0.3 | 1 | 0.8 | 3 | 0.16 | 7 | 0.3 |
| Systemic vasculitis | 6 | 0.6 | 2 | 1.7 | 3 | 0.18 | 5 | 0.3 |
| Multiple myeloma | 0 | 0 | 5 | 3.6 | 0 | 0 | 0 | 0.0 |
| HUS / TTP | 5 | 0.5 | 0 | 0 | 1 | 0.04 | 2 | 0.1 |
| Light / Heavy chain deposit disease | 0 | 0 | 1 | 1.0 | 1 | 0.08 | 1 | 0 |
| Anti GBM disease | 1 | 0.1 | 2 | 2.4 | 1 | 0.07 | 2 | 0.1 |
| Malignancy | 1 | 0.0 | 1 | 0.8 | 1 | 0.04 | 0 | 0 |
| Immunotactoid / fibrillary GN | 0 | 0 | 1 | 0.6 | 1 | 0.08 | 0 | 0 |
| Not Available | 4 | 0.6 | 6 | 4.9 | 14 | 0.95 | 15 | 1.0 |

| Year | 45-<55 (n=1210) | | 55-<65 (n=773) | | ≥65 (n=351) | | Total (n=6930) | |
|---|---|---|---|---|---|---|---|---|
| **Histopathological Diagnosis** | n | % | n | % | n | % | n | % |
| Lupus Nephritis | 959 | 78.0 | 462 | 58.7 | 116 | 34.9 | 5515 | 78.6 |
| Diabetic nephropathy | 173 | 15.2 | 251 | 33.9 | 182 | 50.2 | 803 | 12.6 |
| Post Infectious GN | 33 | 2.7 | 21 | 2.8 | 9 | 2.8 | 319 | 4.4 |
| Henoch Schonlein Purpura | 2 | 0.1 | 5 | 0.5 | 1 | 0.1 | 66 | 0.8 |
| Amyloidosis | 4 | 0.3 | 10 | 1.3 | 19 | 5.1 | 46 | 0.7 |
| Other infection | 11 | 0.9 | 5 | 0.4 | 4 | 0.8 | 32 | 0.4 |
| Systemic vasculitis | 3 | 0.2 | 5 | 0.6 | 3 | 0.8 | 27 | 0.3 |
| Multiple myeloma | 1 | 0.1 | 3 | 0.2 | 6 | 1.5 | 15 | 0.2 |
| HUS / TTP | 3 | 0.5 | 0 | 0.0 | 1 | 0.4 | 12 | 0.2 |
| Light / Heavy chain deposit disease | 1 | 0 | 3 | 0.5 | 2 | 0.5 | 9 | 0.1 |
| Anti GBM disease | 1 | 0.1 | 0 | 0 | 1 | 0.4 | 8 | 0.2 |
| Malignancy | 2 | 0.1 | 1 | 0.1 | 2 | 0.7 | 8 | 0.1 |
| Immunotactoid / fibrillary GN | 0 | 0 | 0 | 0 | 1 | 0.4 | 3 | 0.1 |
| Not Available | 17 | 1.8 | 7 | 1.0 | 4 | 1.4 | 67 | 1.2 |

### 1.9.5 Histology of repeat biopsies

- Fifteen percent (15%) of the biopsies performed were repeat biopsies.
- Most of the cases who underwent repeat biopsies are lupus nephritis and FSGS. *(Figures 1.9.5(a-c))*

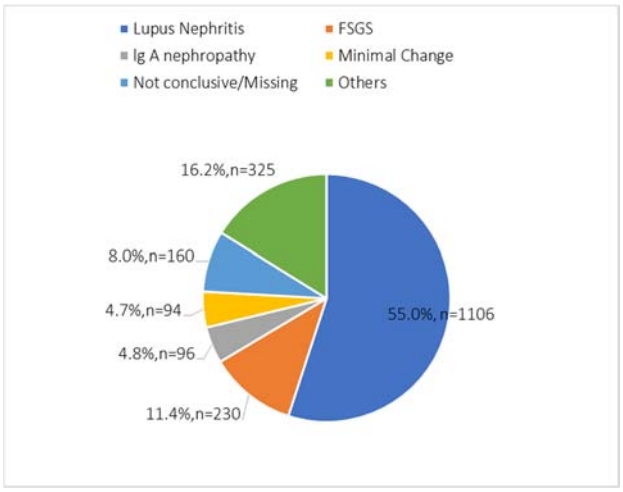


Figure 1.9.5 (a): Histopathological diagnosis of repeat renal biopsies (2nd episode), 2005-2017

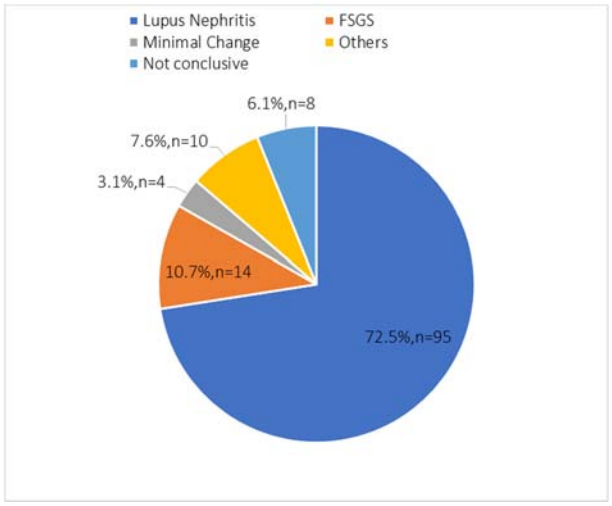


Figure 1.9.5 (b): Histopathological diagnosis of repeat renal biopsies (3rd episode), 2005-2017

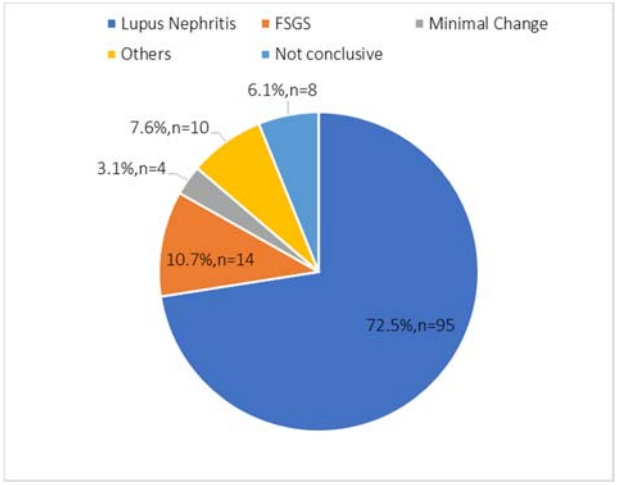


Figure 1.9.5 (c): Histopathological diagnosis of repeat renal biopsies (4th episode and above), 2005-2017