

CHAPTER 1

Overview of Renal Biopsy in Malaysia

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1.1 Introduction

1.2 Renal biopsy

The number of renal biopsies performed had steadily increased over the years; 4427, 7244 and 8262 for the years 2005-2009, 2010-2014 and 2015-2019 respectively. 1684 renal biopsies were reported in 2020. (Figure 1.2)

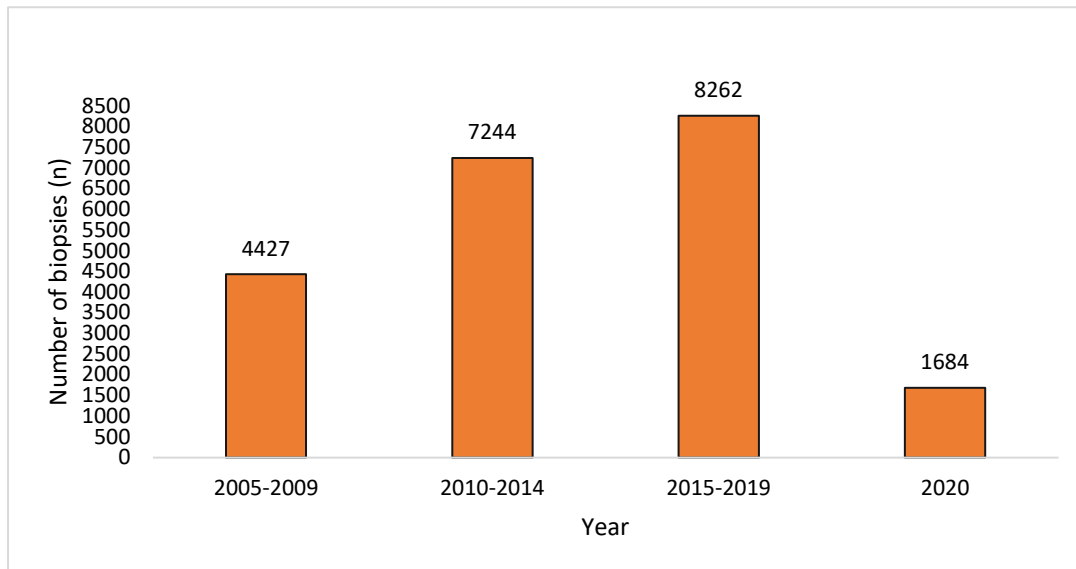


Figure 1.2: Distribution of reported renal biopsies by centre, 2005-2020

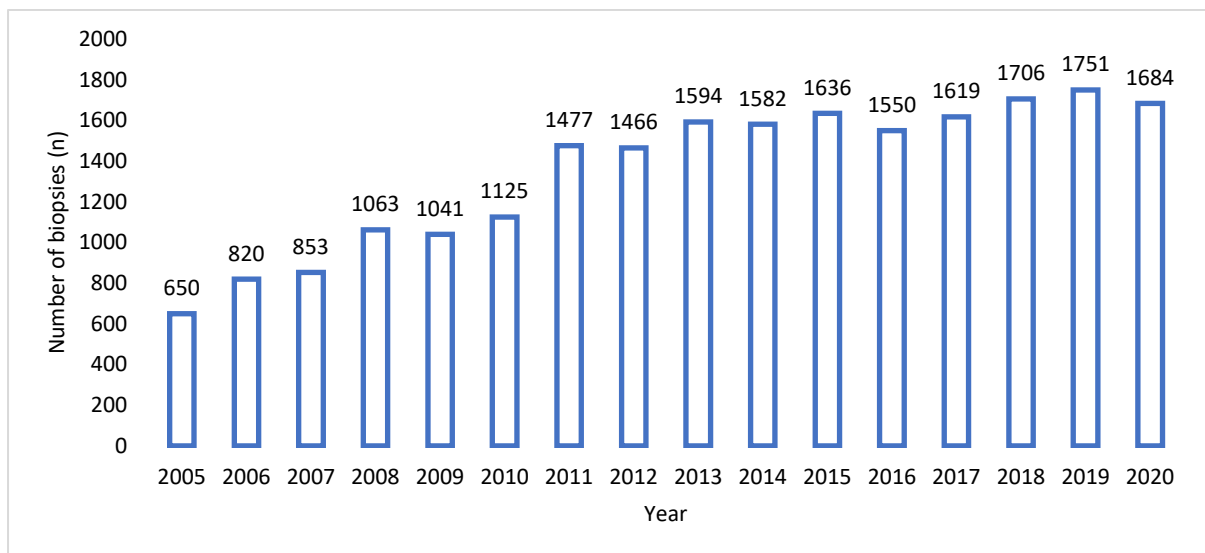


Figure 1.2: Distribution of reported renal biopsies, 2005-2020

1.3 Number of episodes of renal biopsy

The majority of the renal biopsies performed were first episodes. In year 2020, 1405 renal biopsies were first episodes, followed by 202 second episodes. 44 renal biopsies were 3rd episodes and 16 were 4th episodes. (Figure 1.3.1)

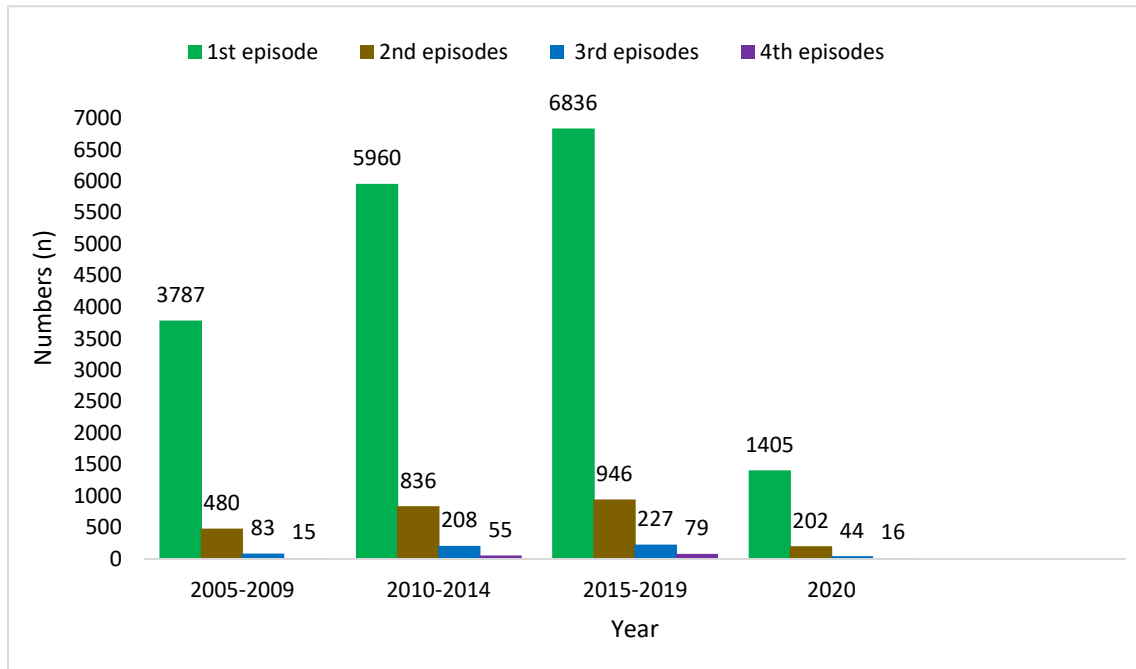


Fig 1.3.1: Distribution of renal biopsy in patients by number of episodes, 2005-2020

1.4 Demographic distribution of renal biopsy

1.4.1 Age distribution

Most of the patients who underwent renal biopsies were adults (age at least 15) from 2005 to 2020. The year 2020 saw 1575 renal biopsies in adults, and the remaining 109 were paediatric patients (age below 15). (Figure 1.4.1.1)

The majority of the patients who had renal biopsies were young adults, between age 15 to 35. The trend was similar in 2020, 441 patients were age 25 to 35, followed by 435 in the age group 15 to 25. Just over a hundred children (age<15) and 73 elderly people (age >65) were biopsied in the recent year. (Figure 1.4.1.2)

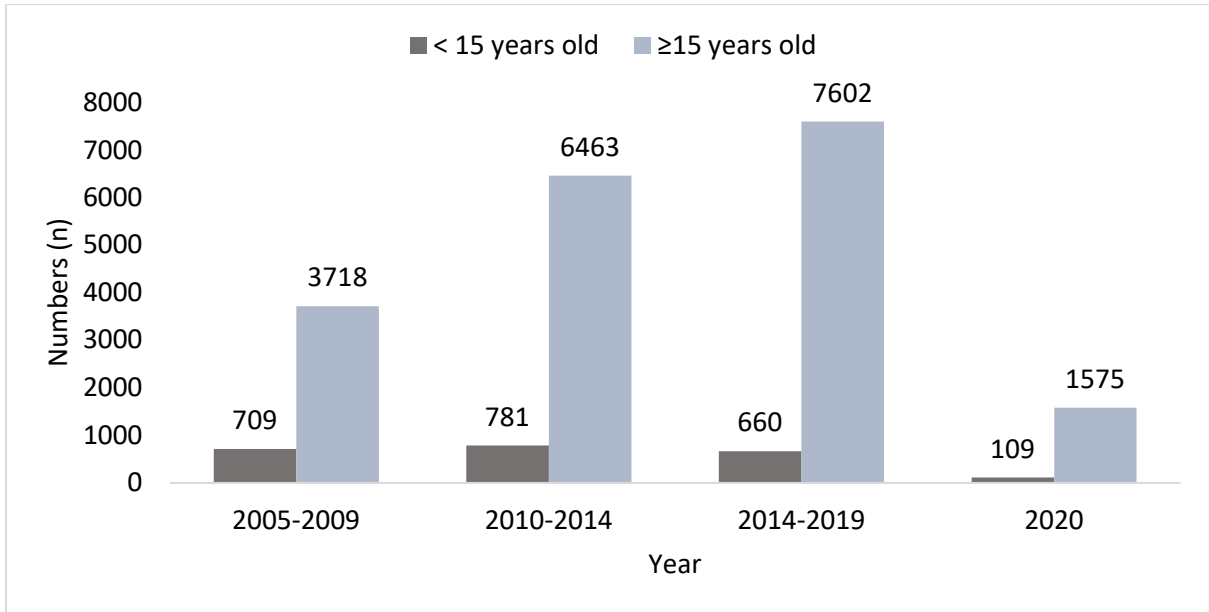


Figure 1.4.1.1: Distribution of renal biopsy in the paediatric and adult age groups

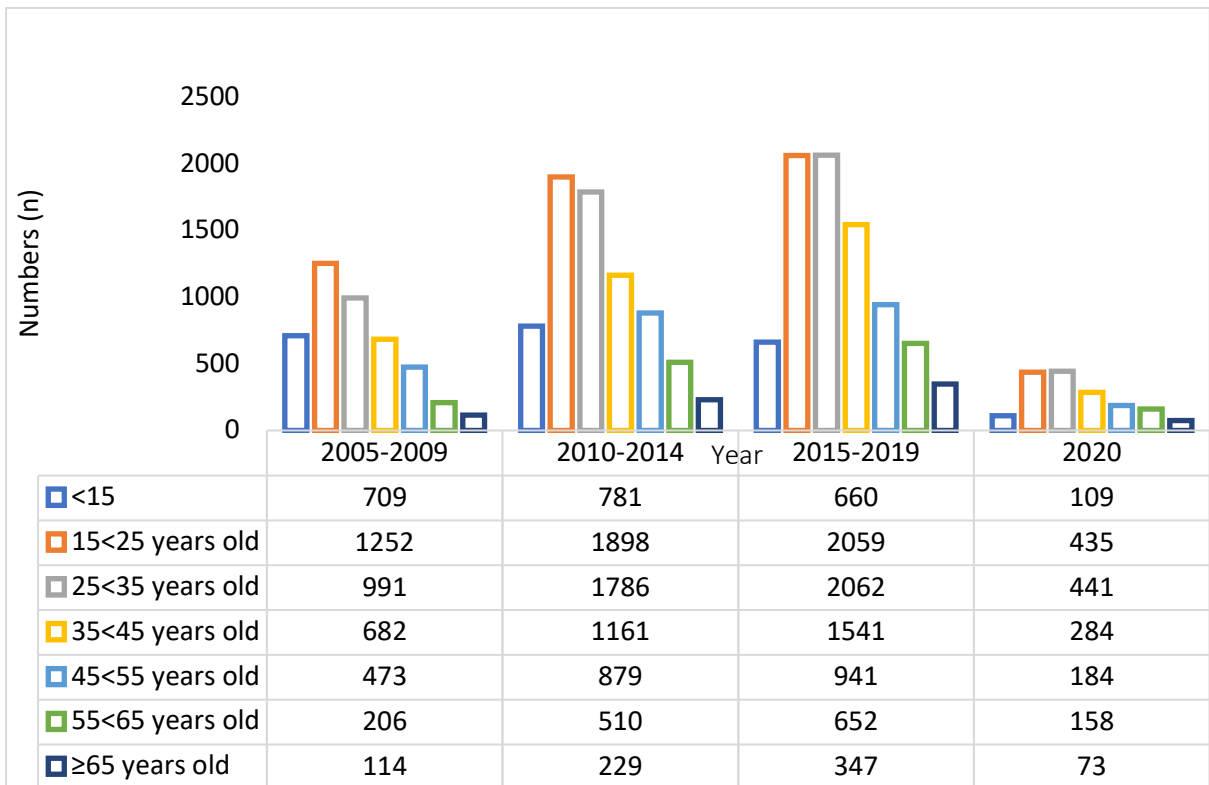


Figure 1.4.1.2: Age distribution of renal biopsy, 2005-2020

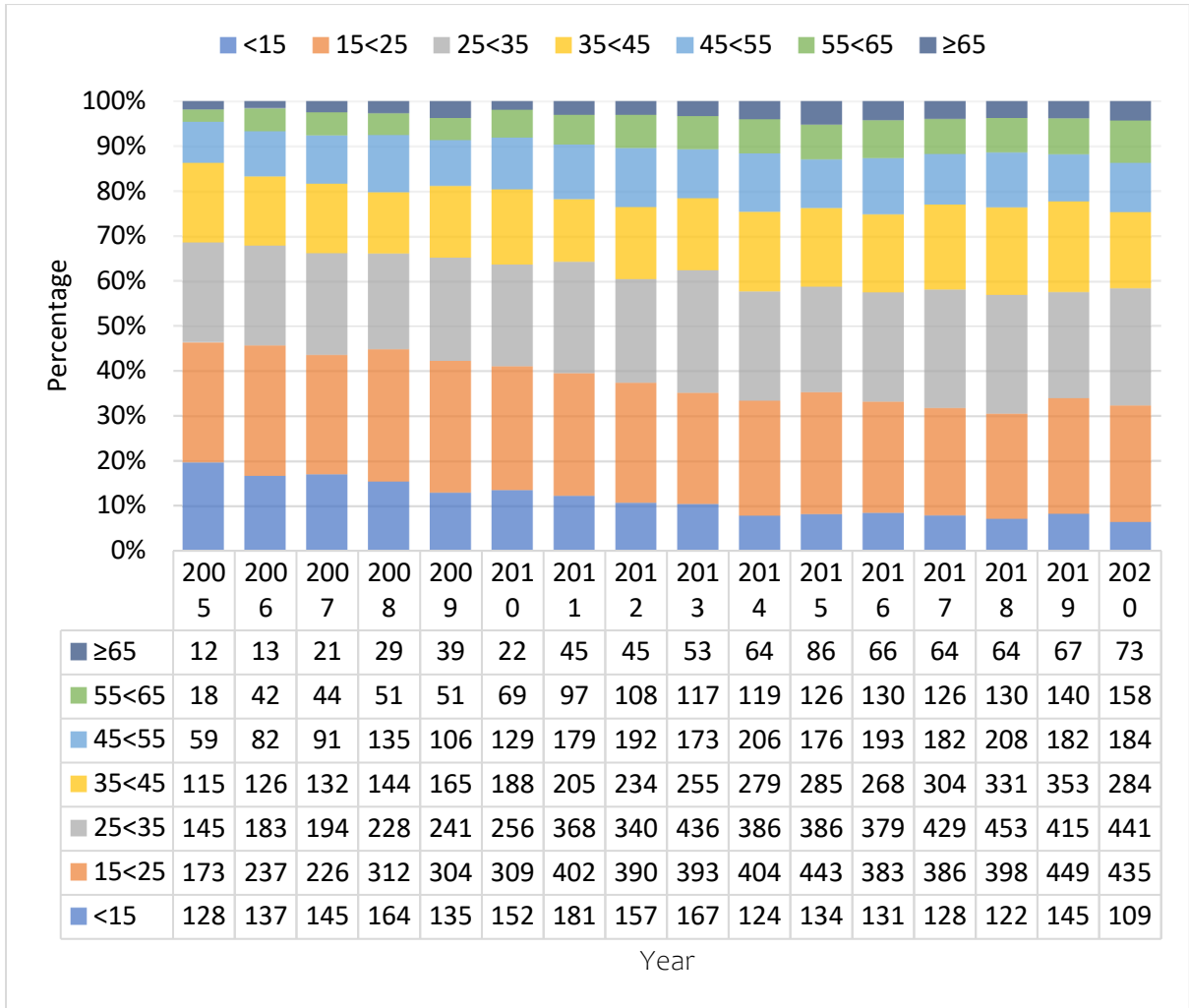


Figure 1.4.1.2: Age distribution of renal biopsy, 2005-2020

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). Johor contributed 27.5% and Selangor contributed 13.8% of all renal biopsies in year 2020. However, in the adult population, Selangor and WP Kuala Lumpur were the top, with 22.1% and 12.1% respectively. (Tables 1.4.2.1 and 1.4.2.2)

Table 1.4.2.1: Renal biopsies by state in patients age < 15, 2005-2020

| Year | 2005-2009 (n=709) | | 2010-2014 (n=781) | | 2015-2019 (n=660) | | 2020 (n=109) | | Total (n=2259) | |
|---------------|----------------------|------|----------------------|------|----------------------|------|-----------------|------|-------------------|------|
| | n | % | n | % | n | % | n | % | n | % |
| Johor | 167 | 23.6 | 141 | 18.1 | 145 | 22.0 | 30 | 27.5 | 483 | 21.4 |
| Kedah | 49 | 6.9 | 79 | 10.1 | 47 | 7.1 | 9 | 8.3 | 184 | 8.1 |
| Kelantan | 19 | 2.7 | 41 | 5.2 | 12 | 1.8 | 3 | 2.8 | 75 | 3.3 |
| Melaka | 16 | 2.3 | 16 | 2.0 | 11 | 1.7 | 2 | 1.8 | 45 | 2.0 |
| N Sembilan | 38 | 5.4 | 24 | 3.1 | 27 | 4.1 | 8 | 7.3 | 97 | 4.3 |
| Pahang | 29 | 4.1 | 14 | 1.8 | 21 | 3.2 | 6 | 5.5 | 70 | 3.1 |
| Penang | 41 | 5.8 | 38 | 4.9 | 26 | 3.9 | 3 | 2.8 | 108 | 4.8 |
| Perak | 43 | 6.1 | 74 | 9.5 | 42 | 6.4 | 10 | 9.2 | 169 | 7.5 |
| Perlis | 7 | 1.0 | 3 | 0.4 | 6 | 0.9 | | 0.0 | 16 | 0.7 |
| Sabah | 51 | 7.2 | 50 | 6.4 | 61 | 9.2 | 3 | 2.8 | 165 | 7.3 |
| Sarawak | 64 | 9.0 | 60 | 7.7 | 53 | 8.0 | 7 | 6.4 | 184 | 8.1 |
| Selangor | 123 | 17.3 | 160 | 20.5 | 143 | 21.7 | 15 | 13.8 | 441 | 19.5 |
| Terengganu | 16 | 2.3 | 18 | 2.3 | 19 | 2.9 | 2 | 1.8 | 55 | 2.4 |
| WP KL | 40 | 5.6 | 58 | 7.4 | 39 | 5.9 | 10 | 9.2 | 147 | 6.5 |
| Non-Malaysian | 6 | 0.8 | 5 | 0.6 | 8 | 1.2 | 1 | 0.9 | 20 | 0.9 |

Table 1.4.2.2: Renal biopsies by state in patients age ≥ 15, 2005-2020

| Year | 2005-2009 (n=3718) | | 2010-2014 (n=6463) | | 2015-2019 (n=7602) | | 2020 (n=1575) | | Total (n=19358) | |
|---------------|-----------------------|------|-----------------------|------|-----------------------|------|------------------|------|--------------------|------|
| | n | % | n | % | n | % | n | % | n | % |
| Johor | 433 | 10.6 | 586 | 9.0 | 638 | 8.7 | 133 | 8.5 | 1790 | 8.9 |
| Kedah | 301 | 8.4 | 562 | 8.3 | 530 | 6.5 | 93 | 5.6 | 1486 | 7.0 |
| Kelantan | 107 | 2.6 | 249 | 3.8 | 193 | 2.6 | 83 | 5.1 | 632 | 3.3 |
| Melaka | 103 | 2.6 | 128 | 1.9 | 203 | 2.7 | 65 | 4.2 | 499 | 2.7 |
| N Sembilan | 118 | 2.5 | 261 | 3.8 | 411 | 5.4 | 133 | 8.4 | 923 | 5.2 |
| Pahang | 167 | 4.3 | 287 | 4.5 | 431 | 5.6 | 87 | 5.5 | 972 | 5.2 |
| Penang | 293 | 7.3 | 363 | 5.6 | 445 | 5.8 | 88 | 5.5 | 1189 | 5.8 |
| Perak | 191 | 4.5 | 550 | 8.1 | 602 | 8.3 | 158 | 10.1 | 1501 | 8.2 |
| Perlis | 25 | 0.7 | 28 | 0.4 | 45 | 0.5 | 6 | 0.4 | 104 | 0.5 |
| Sabah | 164 | 6.6 | 177 | 3.4 | 603 | 7.8 | 102 | 6.3 | 1046 | 6.3 |
| Sarawak | 388 | 9.2 | 545 | 8.2 | 700 | 9.5 | 112 | 7.4 | 1745 | 8.8 |
| Selangor | 889 | 25.3 | 1445 | 22.2 | 1749 | 22.5 | 294 | 18.7 | 4377 | 22.1 |
| Terengganu | 64 | 1.9 | 146 | 2.5 | 199 | 3.0 | 42 | 2.7 | 451 | 2.7 |
| WP KL | 420 | 11.4 | 1015 | 16.4 | 788 | 10.1 | 176 | 11.4 | 2399 | 12.1 |
| Not available | 0 | 0 | 1 | 0.0 | 5 | 0.1 | 2 | 0.1 | 8 | 0.1 |
| Non-Malaysian | 55 | 2.1 | 120 | 1.9 | 60 | 0.8 | 1 | 0.1 | 236 | 1.1 |

1.4.3 Gender distribution

The ratio of female to male patients was 3:2 and this trend was consistent across all era. Female patients made up 60.9% of all renal biopsies in 2020. (Table 1.4.2.1 and Figure 1.4.3.1)

Table 1.4.3.1: Gender distribution of renal biopsy, 2005-2020

| Gender | 2005-2009 (n=4427) | | 2010-2014 (n=7244) | | 2015=2019 (n=8262) | | 2020 (n=1684) | | Total (n=21617) | |
|--------|-----------------------|------|-----------------------|------|-----------------------|------|------------------|------|--------------------|------|
| | n | % | n | % | n | % | n | % | n | % |
| Male | 1772 | 40.1 | 2871 | 40.2 | 3136 | 38.5 | 640 | 39.1 | 8419 | 39.2 |
| Female | 2655 | 59.9 | 4373 | 59.8 | 5126 | 61.5 | 1044 | 60.9 | 13198 | 60.8 |

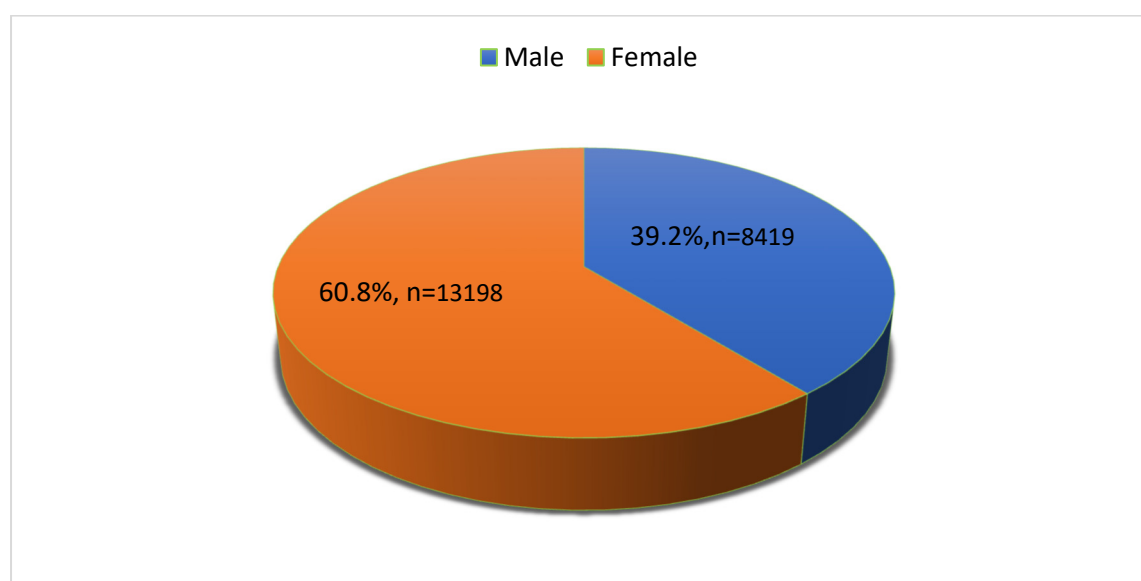


Figure 1.4.3.1: Gender distribution of renal biopsy, 2005-2020

1.4.4 Ethnicity distribution

There was a gradual rise in the proportion of Malay patients from 2005 to 2019 and close to a third (64.3%) of all patients were Malay in 2020. (Table 1.4.4.1 and Figure 1.4.4.1)

Table 1.4.4.1: Racial distribution of renal biopsy, 2005-2020

| Race | 2005-2009 (n=4427) | | 2010-2014 (n=7244) | | 2015=2019 (n=8262) | | 2020 (n=1684) | | Total (n=21617) | |
|---------|-----------------------|------|-----------------------|------|-----------------------|------|------------------|------|--------------------|------|
| | n | % | n | % | n | % | n | % | n | % |
| Malay | 2483 | 54.9 | 4250 | 58.2 | 4959 | 60.3 | 1085 | 64.3 | 12777 | 59.8 |
| Chinese | 1128 | 25.2 | 1723 | 23.5 | 1689 | 20.0 | 280 | 16.4 | 4820 | 20.9 |
| Indian | 313 | 6.8 | 438 | 6.1 | 460 | 5.6 | 115 | 7.0 | 1326 | 6.0 |
| Others | 503 | 13.1 | 833 | 12.2 | 1154 | 14.2 | 204 | 12.3 | 2694 | 13.3 |

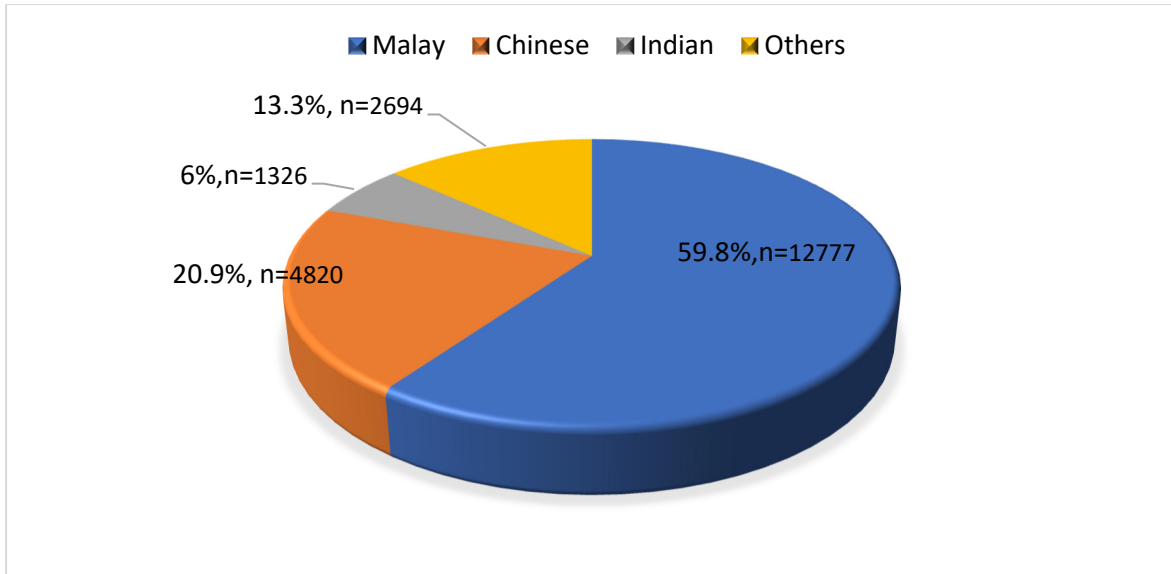


Figure 1.4.4.1: Racial distribution of renal biopsy, 2005-2020

1.5 Biopsy characteristics and Complications

1.5.1 Number of glomeruli on biopsy

The majority of renal biopsy sample was adequate (At least 10 glomeruli). However, roughly one in five was inadequate in 2020 and the number with missing data was only 41 (2.4%). (Figure 1.5.1)

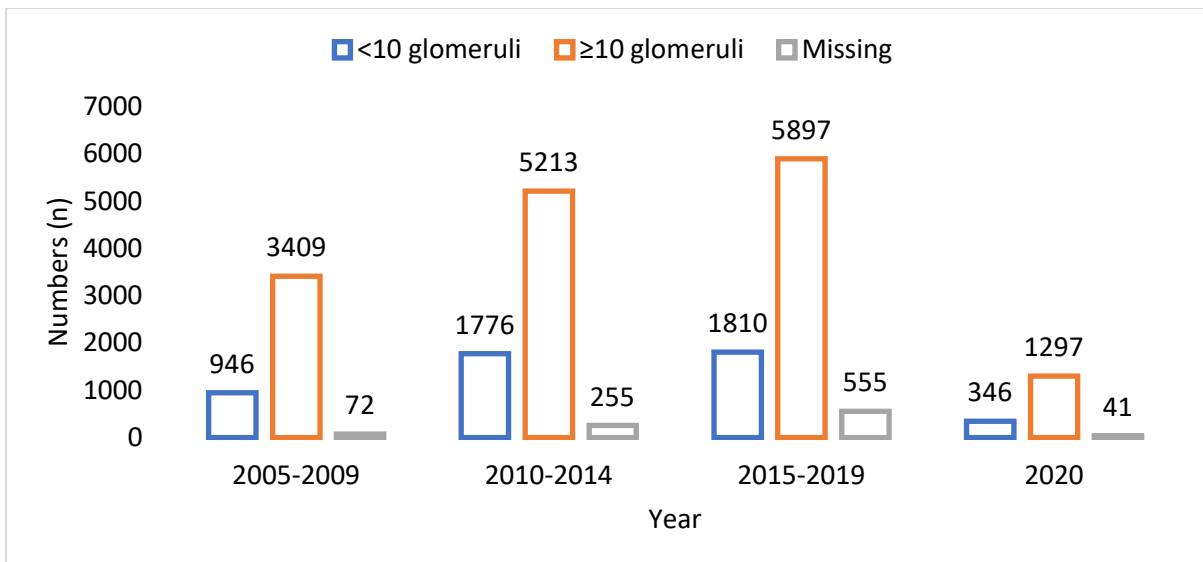


Figure 1.5.1: Number of glomeruli obtained at each renal biopsy by centres, 2005-2020

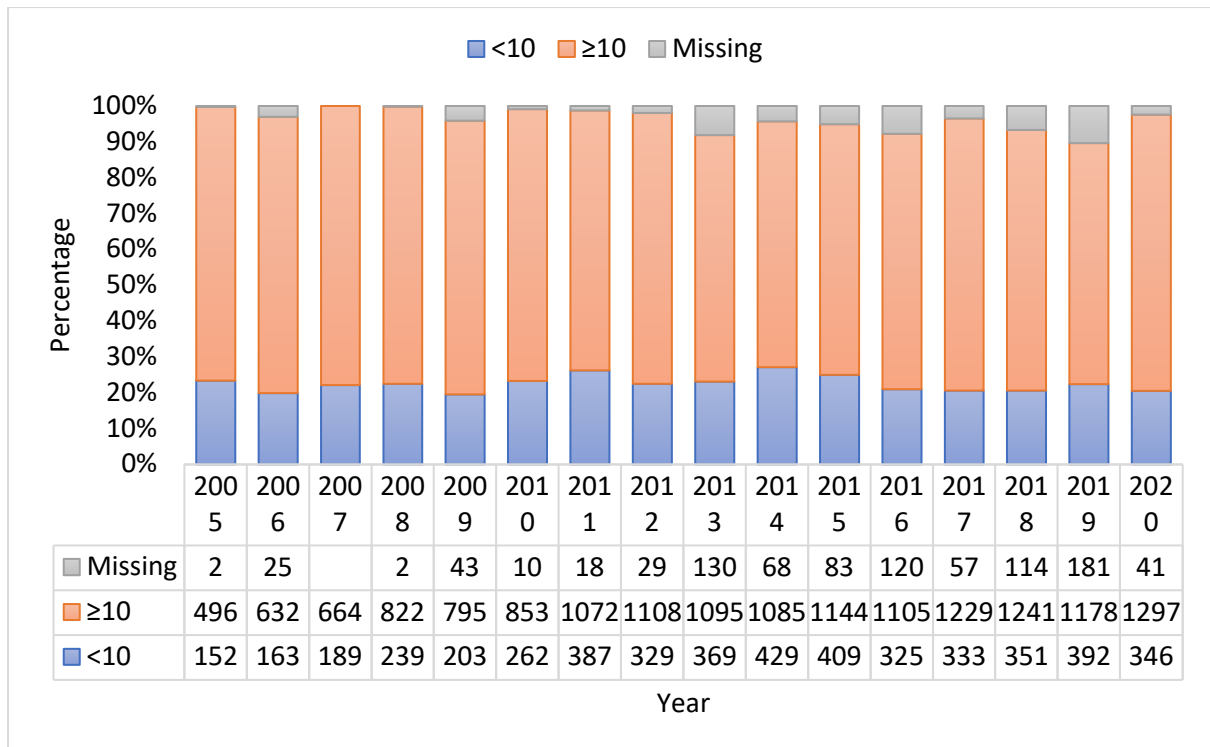


Figure 1.5.1: Number of glomeruli obtained at each renal biopsy by centres, 2005-2020

1.5.2 Operator of biopsy

Over the years, the number of renal biopsies performed by nephrologist had declined to 10% in 2020 while a rise in the proportion contributed by nephrology trainees was seen. Approximately a third consistently did not report the operator of the procedure. (Figure 1.5.2)

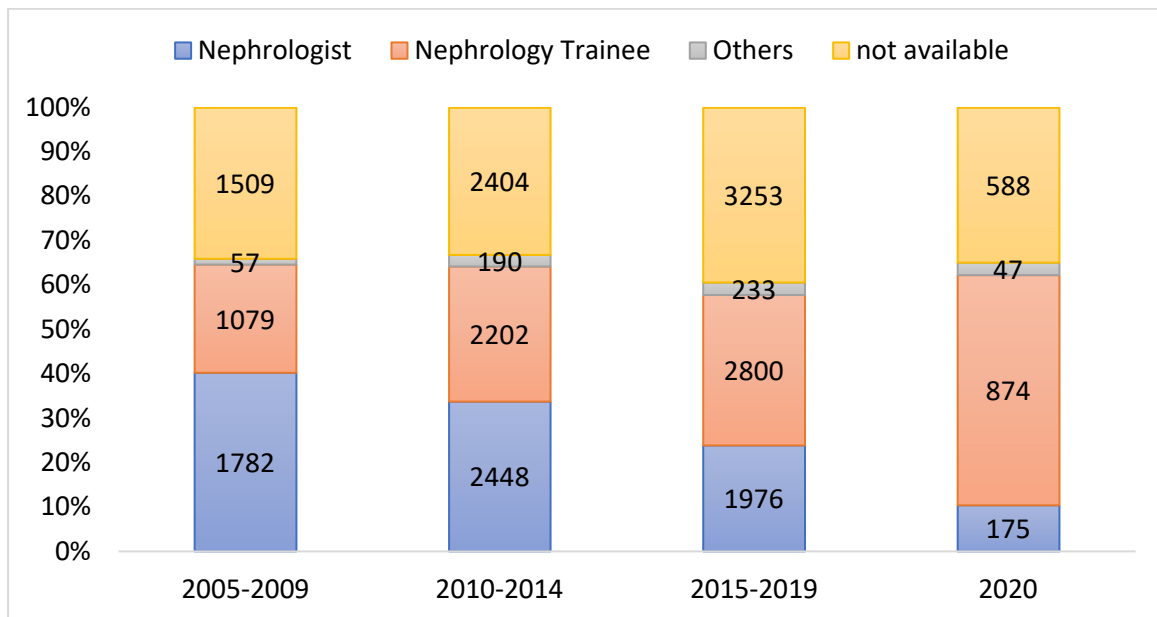


Figure 1.5.2: Operator of biopsy, 2005-2020

1.5.3 Complications of biopsy

Rate of biopsy complications ranged from 1.5 to 2%. However, 35.4 to 40.3% did not report if there was any complications. (Table 1.5.3 and Figure 1.5.3)

Table 1.5.3: Complications of biopsy, 2005-2020

| Complication | 2005-2009 (n=4427) | | 2010-2014 (n=7244) | | 2015=2019 (n=8262) | | 2020 (n=1684) | | Total (n=21617) | |
|---------------|-----------------------|------|-----------------------|------|-----------------------|------|------------------|------|--------------------|------|
| | n | % | n | % | n | % | n | % | n | % |
| Yes | 92 | 1.8 | 144 | 1.9 | 123 | 1.5 | 33 | 2.0 | 392 | 1.7 |
| No | 2767 | 60.0 | 4655 | 62.7 | 4796 | 58.2 | 1042 | 61.7 | 13260 | 60.0 |
| Not Available | 1568 | 38.2 | 2445 | 35.4 | 3343 | 40.3 | 609 | 36.4 | 7965 | 38.3 |

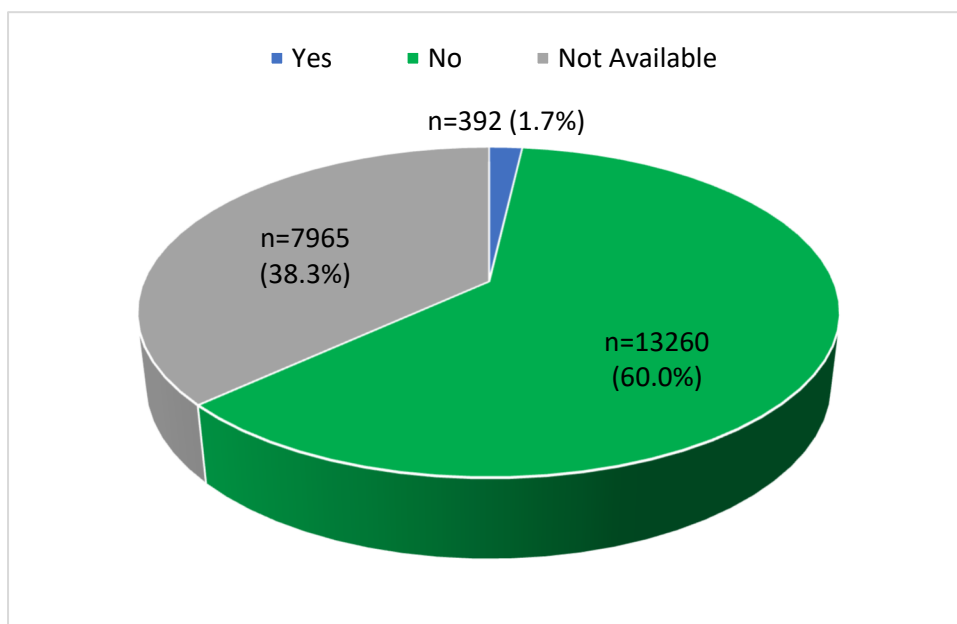


Figure 1.5.3: Complications of biopsy, 2005-2020

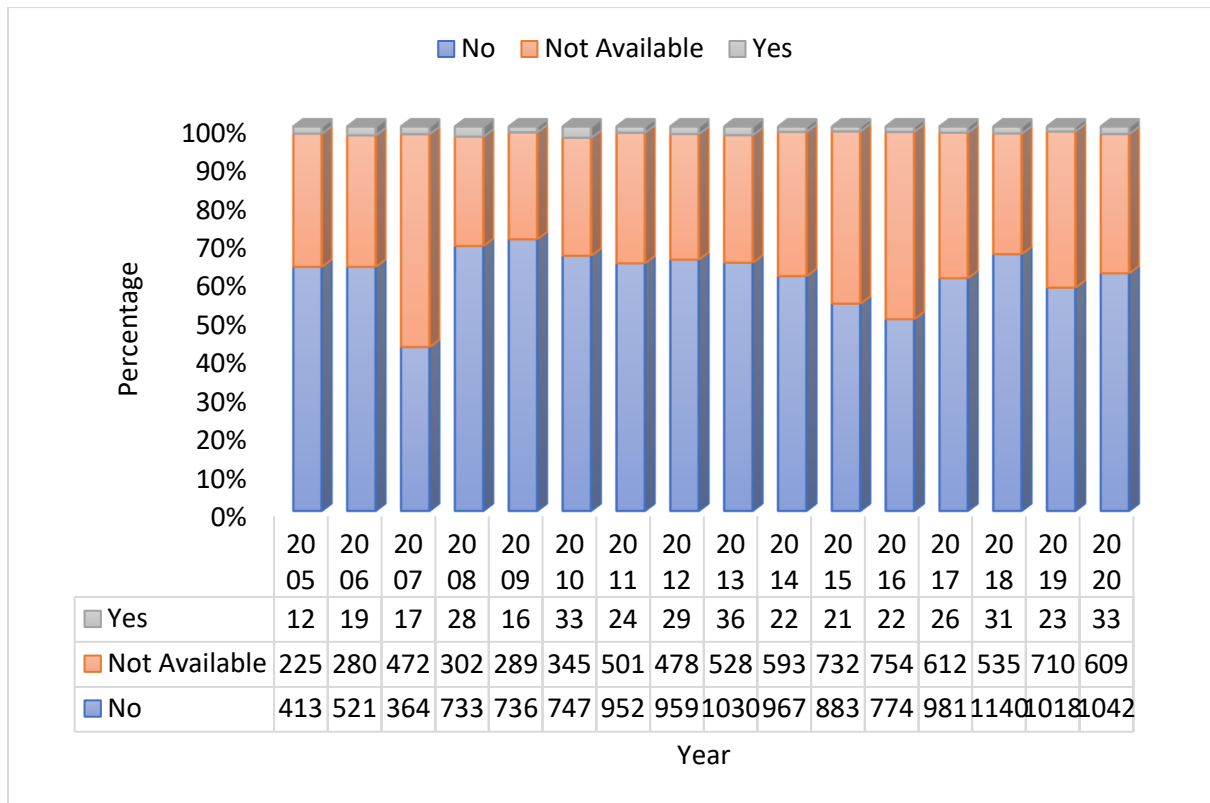


Figure 1.5.3: Complications of biopsy, 2005-2020

1.5.4 Types of biopsy complications

A total of 392 biopsy complications occurred between 2005 to 2020, 66.8% was bleeding and 27.8% had peri-renal collection. A very small proportion had infection, hypotension, arteriovenous malformation and others. (Figure 1.5.4)

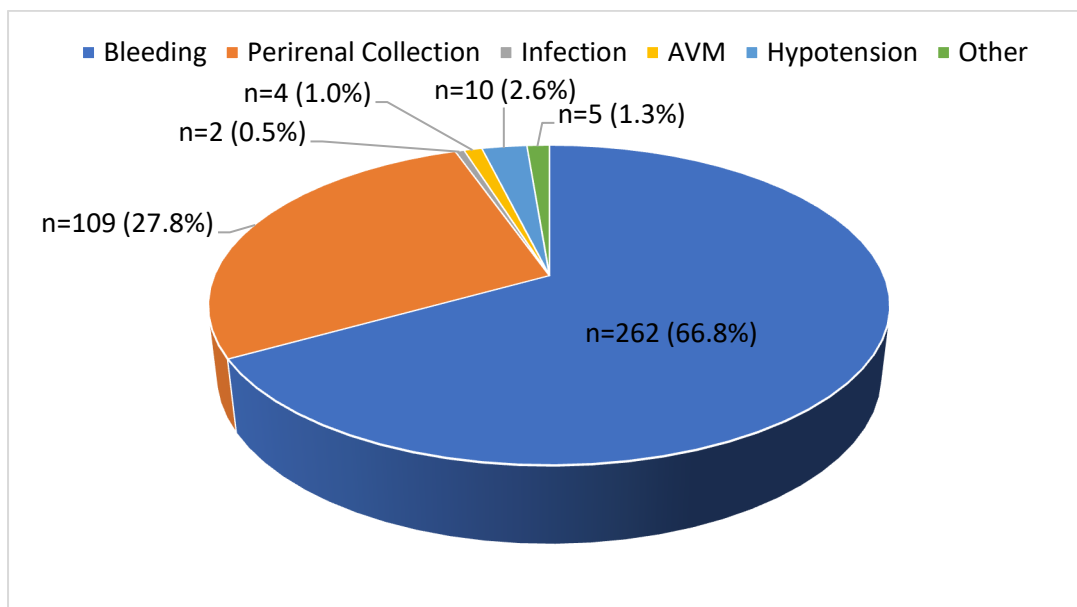


Figure 1.5.4: Types of complications of biopsy, 2005-2020

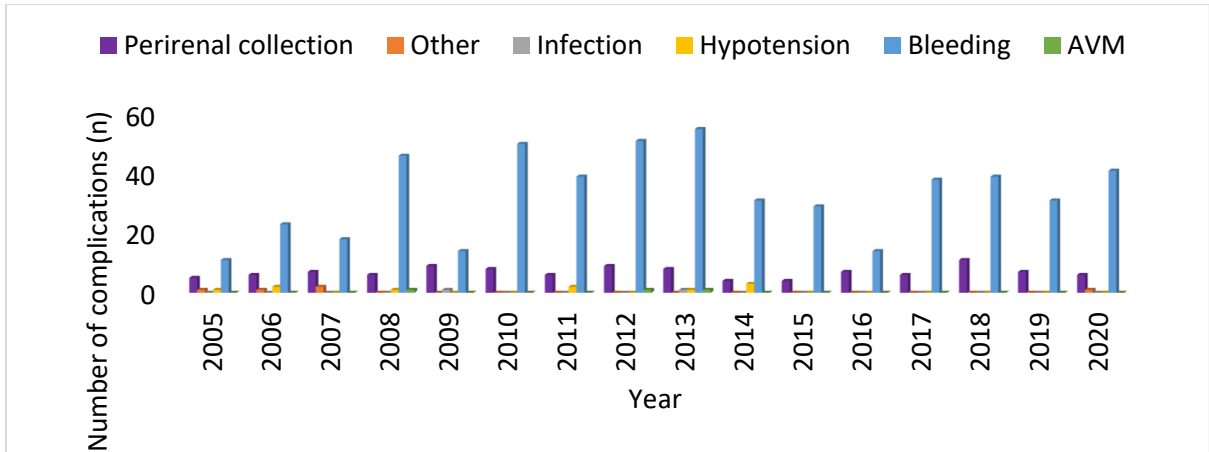


Figure 1.5.4: Types of complications of biopsy, 2005-2020

1.5.5 Intervention for biopsy complications

Three quarters required blood transfusion only and 21.3% needed radiological intervention. Only 3 patients received surgical intervention to treat the biopsy complication. (Figure 1.5.5)

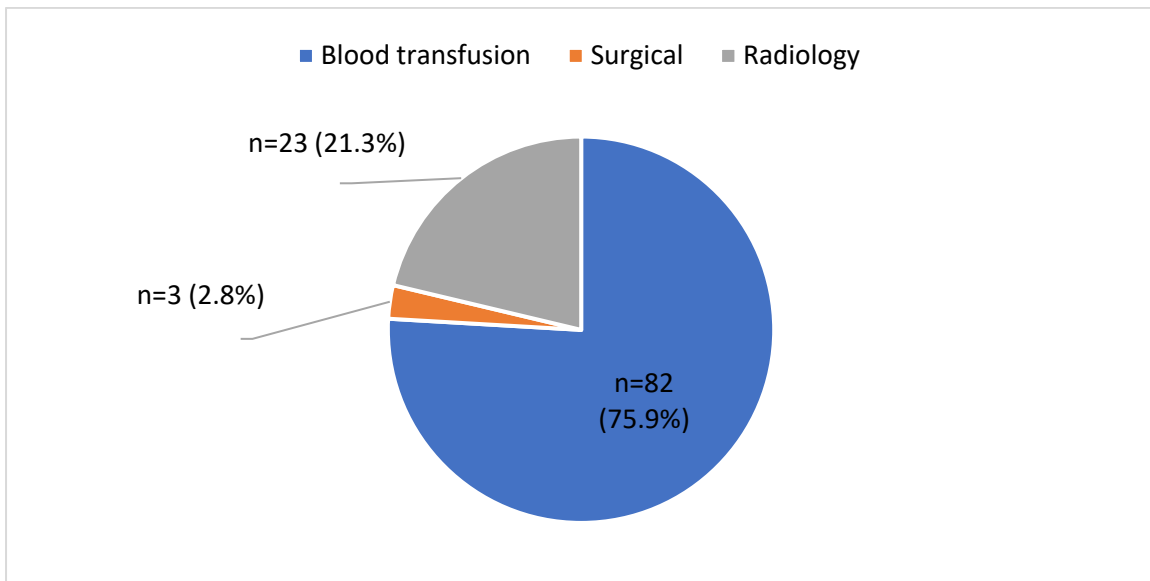


Figure 1.5.5: Intervention for biopsy complications, 2005-2020

1.6 Histopathological Lab

The percentage of biopsy reported in-house had steadily grow over the years while those reported by external laboratories had declined, with only 17.7% of biopsies reported by external laboratories in 2020. (Table 1.6.3 and Figure 1.6.1)

Table 1.6.1: Summary of biopsies received by in-house and external laboratories, 2005-2020

| Summary of biopsies received | 2005-2009 (n=4427) | | 2010-2014 (n=7244) | | 2015=2019 (n=8262) | | 2020 (n=1684) | | Total (n=21617) | |
|------------------------------|--------------------|------|--------------------|------|--------------------|------|---------------|------|-----------------|------|
| | n | % | n | % | n | % | n | % | n | % |
| In house | 2100 | 45.7 | 4649 | 66.0 | 5706 | 69.4 | 1215 | 72.3 | 13670 | 67.3 |
| External | 2291 | 50.7 | 2412 | 31.0 | 2122 | 25.2 | 303 | 17.7 | 7128 | 27.5 |
| Not available | 36 | 3.6 | 183 | 3.0 | 434 | 5.4 | 166 | 9.9 | 819 | 5.3 |

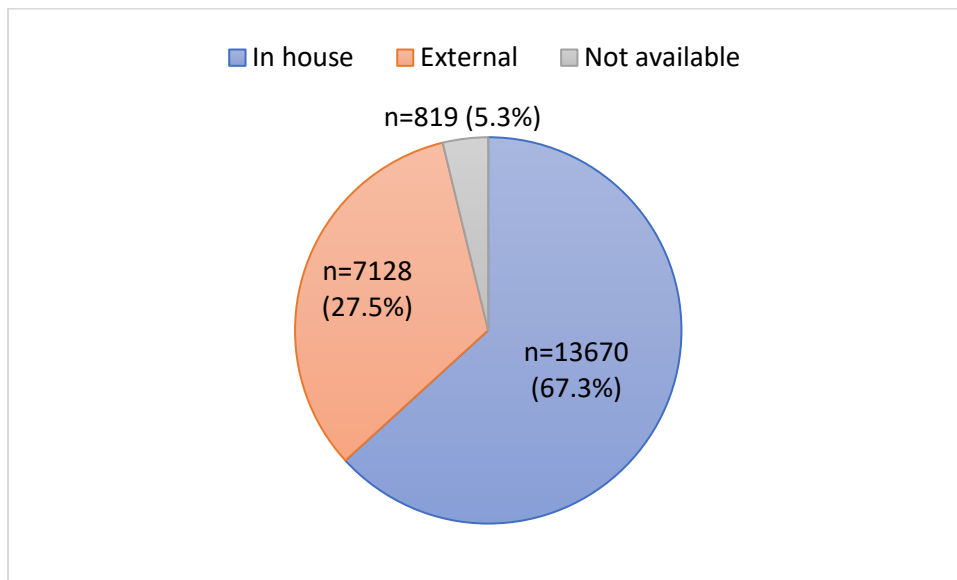


Figure 1.6.1: Summary of biopsies received by in-house and external laboratories, 2005-2020

1.7 Clinical Indications of renal biopsy

Less than half of the renal biopsies were performed due to nephrotic syndrome and more were performed for asymptomatic urine abnormalities. About 20% of the biopsy indications were either nephritic- nephrotic syndrome or nephritic syndrome. (Figure 1.7.1)

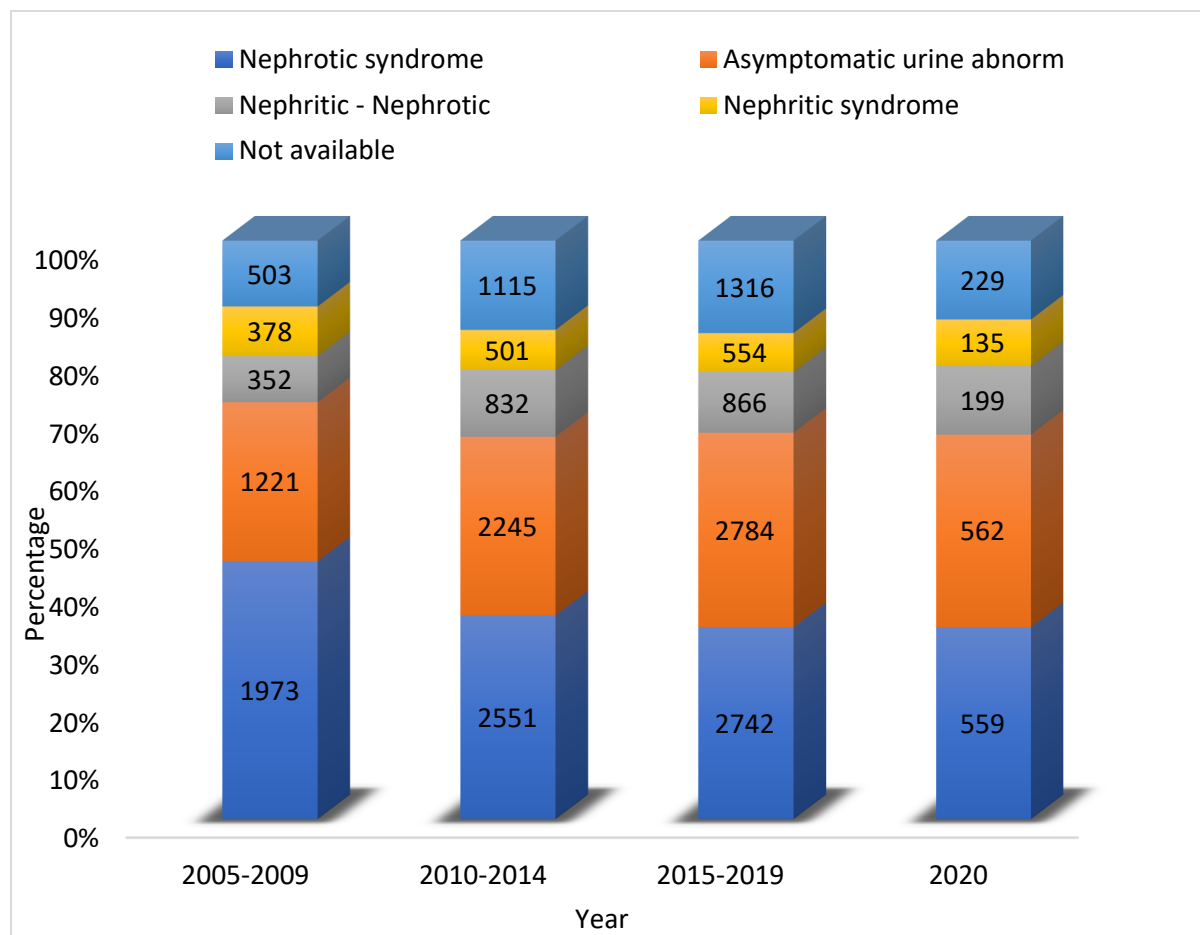


Figure 1.7.1: Indications for native renal biopsies, 2005-2020

1.8 Renal function at time of biopsy

Approximately half of all patients had normal kidney function at the time of biopsy and 35 – 40% had impaired kidney function. When categorised into kidney function by estimated glomerular filtration function (eGFR), most had at least 90mls/min/m². (Table 1.8.1 and Figure 1.8.1)

Table 1.8.1: Renal function at time of biopsy, 2005-2020

| Renal function | 2005-2009 (n=4427) | | 2010-2014 (n=7244) | | 2015=2019 (n=8262) | | 2020 (n=1684) | | Total (n=21617) | |
|----------------|-----------------------|------|-----------------------|------|-----------------------|------|------------------|------|--------------------|------|
| | n | % | n | % | n | % | n | % | n | % |
| Normal | 2333 | 50.5 | 3495 | 47.5 | 3915 | 47.8 | 827 | 49.0 | 10570 | 48.1 |
| Impaired | 1514 | 35.7 | 2753 | 37.8 | 3303 | 40.1 | 677 | 40.3 | 8247 | 39.2 |
| Not available | 580 | 13.7 | 996 | 14.7 | 1044 | 12.1 | 180 | 10.7 | 2800 | 12.7 |

| | | | | | | | | | | | |
|---------------------|-------------------------------------|------------------------------------|--------------------------|---------------------------|--------------------------|---------------------------|--------------------------|---------------------|---------------------|-----------------------|-----------------------|
| | IgA nephropathy | 355 | 17.6 | 695 | 22.8 | 831 | 25.4 | 193 | 27.6 | 2074 | 23.0 |
| | Membrano-proliferative | 42 | 2.1 | 44 | 1.4 | 59 | 1.8 | 13 | 1.9 | 158 | 1.8 |
| | Membranous nephropathy | 165 | 8.2 | 257 | 8.4 | 335 | 10.3 | 84 | 12.0 | 841 | 9.3 |
| | Messangial Prol: non-IgA | 67 | 3.3 | 101 | 3.3 | 77 | 2.4 | 24 | 3.4 | 269 | 3.0 |
| | Idiopathic Crescentic GN | 29 | 1.4 | 33 | 1.1 | 25 | 0.8 | 4 | 0.6 | 91 | 1.0 |
| | Crescentic ANCA | 9 | 0.4 | 21 | 0.7 | 23 | 0.7 | 11 | 1.6 | 64 | 0.7 |
| | Not Available | 5 | 0.2 | 35 | 1.1 | 75 | 2.3 | 6 | 0.9 | 121 | 1.3 |
| Secondary GN | Histopathological Diagnosis | 2005-2009 (n=1912) | | 2010-2014 (n=3088) | | 2015-2019 (n=3351) | | 2020 (n=701) | | Total (n=9052) | |
| | | n | % | n | % | n | % | n | % | n | % |
| | Lupus Nephritis | 1590 | 83.2 | 2413 | 78.1 | 2626 | 78.4 | 504 | 71.9 | 7133 | 78.8 |
| | Diabetic nephropathy | 167 | 8.7 | 373 | 12.1 | 433 | 12.9 | 147 | 21.0 | 1120 | 12.4 |
| | Post Infectious GN | 80 | 4.2 | 170 | 5.5 | 135 | 4.0 | 18 | 2.6 | 403 | 4.5 |
| | Amyloidosis | 9 | 0.5 | 21 | 0.7 | 23 | 0.7 | 8 | 1.1 | 61 | 0.7 |
| | Anti GBM disease | 0 | 0.0 | 4 | 0.1 | 7 | 0.2 | 3 | 0.4 | 14 | 0.2 |
| | Henoch Schonlein Purpura | 29 | 1.5 | 21 | 0.7 | 29 | 0.9 | 5 | 0.7 | 84 | 0.9 |
| | HUS / TTP | 3 | 0.2 | 5 | 0.2 | 5 | 0.1 | 3 | 0.4 | 16 | 0.2 |
| | Immunotactoid / fibrillary | 0 | 0.0 | 1 | 0.0 | 2 | 0.1 | 1 | 0.1 | 4 | 0.0 |
| | Light / Heavy chain deposit disease | 2 | 0.1 | 2 | 0.1 | 6 | 0.2 | 1 | 0.1 | 11 | 0.1 |
| | Malignancy | 4 | 0.2 | 4 | 0.1 | 1 | 0.0 | 0 | 0.0 | 9 | 0.1 |
| | Multiple myeloma | 8 | 0.4 | 4 | 0.1 | 7 | 0.2 | 1 | 0.1 | 20 | 0.2 |
| | Other infection | 8 | 0.4 | 19 | 0.6 | 17 | 0.5 | 4 | 0.6 | 48 | 0.5 |
| | Systemic vasculitis | 8 | 0.4 | 15 | 0.5 | 12 | 0.4 | 0 | 0.0 | 35 | 0.4 |
| | Not Available | 4 | 0.2 | 36 | 1.2 | 48 | 1.4 | 6 | 0.9 | 94 | 1.0 |
| | Tubulointerstitial disease | Histopathological Diagnosis | 2005-2009 (n=322) | | 2010-2014 (n=468) | | 2015-2019 (n=501) | | 2020 (n=104) | | Total (n=1395) |
| n | | | % | n | % | n | % | n | % | n | % |

| | | | | | | | | | | | |
|-------------------|------------------------------------|-------------------------|----------|--------------------------|----------|--------------------------|----------|--------------------|----------|----------------------|----------|
| | Acute tubular necrosis | 152 | 47.2 | 159 | 34.0 | 148 | 29.5 | 33 | 31.7 | 492 | 35.3 |
| | Acute interstitial nephritis | 64 | 19.9 | 157 | 33.5 | 154 | 30.7 | 27 | 26.0 | 402 | 28.8 |
| | Chronic interstitial nephritis | 102 | 31.7 | 142 | 30.3 | 151 | 30.1 | 32 | 30.8 | 427 | 30.6 |
| | Missing | 4 | 1.2 | 10 | 2.1 | 48 | 9.6 | 12 | 11.5 | 74 | 5.3 |
| Vascular | Histopathological Diagnosis | 2005-2009 (n=63) | | 2010-2014 (n=157) | | 2015-2019 (n=223) | | 2020 (n=71) | | Total (n=514) | |
| | | n | % | n | % | n | % | n | % | n | % |
| | Athero-embolic disease | 0 | 0.0 | 2 | 1.3 | 1 | 0.4 | 0 | 0.0 | 3 | 0.6 |
| | Benign / Malignant Hypertension | 58 | 92.1 | 130 | 82.8 | 189 | 84.8 | 70 | 98.6 | 447 | 87.0 |
| | Systemic sclerosis | 2 | 3.2 | 14 | 8.9 | 9 | 4.0 | 1 | 1.4 | 26 | 5.1 |
| | Not Available | 3 | 4.8 | 11 | 7.0 | 24 | 10.8 | 0 | 0.0 | 38 | 7.4 |
| Hereditary | Histopathological Diagnosis | 2005-2009 (n=10) | | 2010-2014 (n=14) | | 2015-2019 (n=17) | | 2020 (n=2) | | Total (n=43) | |
| | | n | % | n | % | n | % | n | % | n | % |
| | Alport's syndrome | 3 | 19.5 | 2 | 13.1 | 4 | 22.8 | 0 | 0 | 9 | 17.8 |
| | Thin Basement Membrane disease | 5 | 63.8 | 3 | 20.8 | 3 | 17.6 | 0 | 0 | 11 | 20.4 |
| | Others | 2 | 16.6 | 2 | 16.1 | 0 | 0 | 0 | 0 | 4 | 5.9 |
| | Not Available | 0 | 0 | 7 | 50.0 | 10 | 59.6 | 2 | 100 | 19 | 55.9 |
| Advance GN | Histopathological Diagnosis | 2005-2009 | | 2010-2014 | | 2015-2019 | | 2020 | | Total | |
| | | n | % | n | % | n | % | n | % | n | % |
| | Total | 122 | | 137 | | 108 | | 26 | | 393 | |
| Others | Histopathological Diagnosis | 2005-2009 | | 2010-2014 | | 2015-2019 | | 2020 | | Total | |
| | | n | % | n | % | n | % | n | % | n | % |
| | Total | 38 | | 199 | | 324 | | 62 | | 623 | |

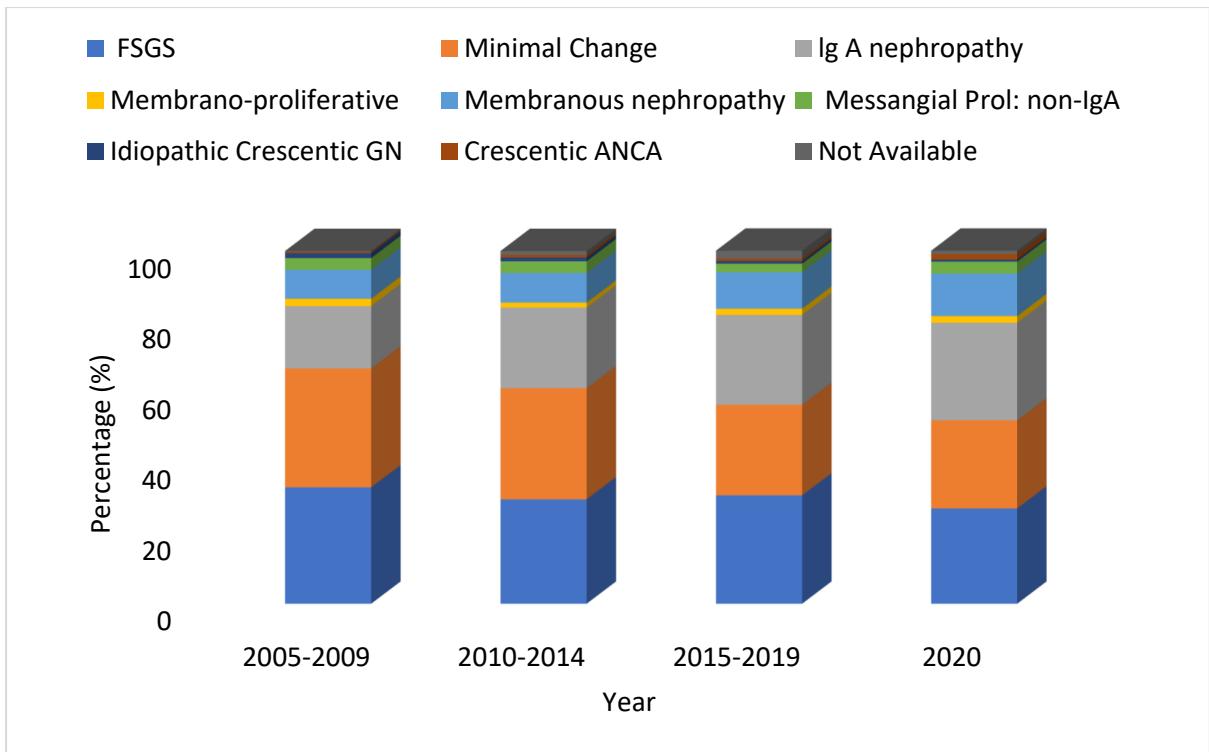


Figure 1.9.1: Histopathology of primary glomerulonephritis on native renal biopsies, 2005-2020

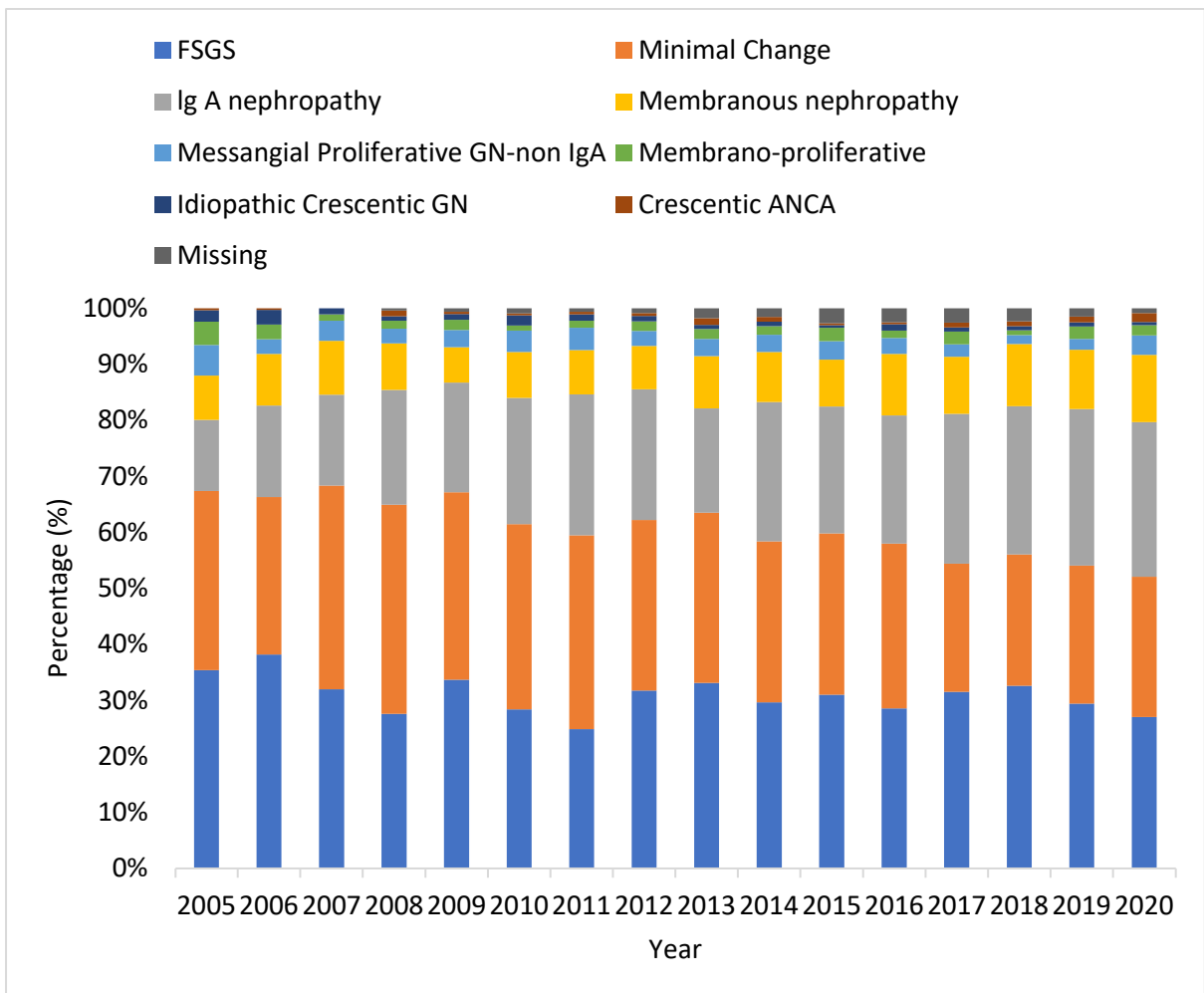


Figure 1.9.1: Histopathology of primary glomerulonephritis on native renal biopsies, 2005-2020

1.9.2 Histopathology findings in common clinical presentation

1.9.2.1 Nephrotic syndrome

Patients who presented with nephrotic syndrome were frequently attributed to primary glomerulonephritis with minimal change disease (24.6%) and FSGS (19.5%) being the most common. Lupus nephritis (22.8%) was the main diagnosis in the secondary glomerulonephritis group. (Table 1.9.2.1)

Table 1.9.2.1: HPE diagnosis in patients presenting with Nephrotic Syndrome, 2005-2020

| Type | Histopathological Diagnosis | n | % |
|--------------|-------------------------------------|------------------|-------------|
| Primary GN | FSGS | 1524 | 19.5 |
| | Minimal Change | 1926 | 24.6 |
| | Membranous nephropathy | 476 | 6.1 |
| | Ig A nephropathy | 444 | 5.7 |
| | Idiopathic Crescentic GN | 16 | 0.2 |
| | Membrano-proliferative | 62 | 0.8 |
| | Mesangial Proliferative GN-non-IgA | 88 | 1.1 |
| | Crescentic ANCA | 2 | 0.0 |
| | Not available | 43 | 0.5 |
| | Sub total | 4581 | 58.5 |
| Secondary GN | Lupus Nephritis | 1786 | 22.8 |
| | Diabetic nephropathy | 429 | 5.5 |
| | Post Infectious GN | 66 | 0.8 |
| | Amyloidosis | 31 | 0.4 |
| | Henoch Schonlein Purpura | 8 | 0.1 |
| | HUS / TTP | 2 | 0.0 |
| | Light / Heavy chain deposit disease | 4 | 0.1 |
| | Malignancy | 2 | 0.0 |
| | Multiple myeloma | 2 | 0.0 |
| | Anti GBM disease | 1 | 0.0 |
| | Other infection | 26 | 0.3 |
| | Systemic vasculitis | 4 | 0.1 |
| | Not Available | 23 | 0.3 |
| | | Sub total | 2384 |
| Others | | 860 | 11.0 |
| Total | | 7825 | 100 |

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 nephritis syndrome (9.8%). In the secondary GN group, majority were diagnosed with lupus nephritis, 39.3%. (Table 1.9.2.2)

Table 1.9.2.2: HPE diagnosis in patients presenting with nephritic syndrome, 2005-2020

| Type | Histopathological Diagnosis | n | % |
|--------------|------------------------------------|-------------|-------------|
| Primary GN | FSGS | 124 | 7.9 |
| | Minimal Change | 93 | 5.9 |
| | Membranous nephropathy | 28 | 1.8 |
| | Ig A nephropathy | 154 | 9.8 |
| | Idiopathic Crescentic GN | 15 | 1.0 |
| | Membrano-proliferative | 16 | 1.0 |
| | Mesangial Proliferative GN-non-IgA | 26 | 1.7 |
| | Crescentic ANCA | 15 | 1.0 |
| | Not available | 10 | 0.6 |
| | Sub total | 381 | 30.7 |
| Secondary GN | Lupus Nephritis | 617 | 39.3 |
| | Diabetic nephropathy | 54 | 3.4 |
| | Post Infectious GN | 106 | 6.8 |
| | Henoch Schonlein Purpura | 12 | 0.8 |
| | HUS / TTP | 2 | 0.1 |
| | Amyloidosis | 2 | 0.1 |
| | Anti GBM disease | 5 | 0.3 |
| | Systemic vasculitis | 8 | 0.5 |
| | Malignancy | 1 | 0.1 |
| | Other infection | 2 | 0.1 |
| | Not Available | 9 | 0.6 |
| | Sub total | 818 | 52.1 |
| | Others | | 269 |
| Total | | 1568 | 100 |

1.9.2.3 Asymptomatic Urine Abnormalities

Among patient who presented with asymptomatic urine abnormalities, lupus nephritis (38.45) was the major diagnosis made, followed by Ig A nephropathy which accounted for 14.4%. (Table 1.9.2.3)

Table 1.9.2.3: HPE diagnosis in patients presenting with asymptomatic urine abnormalities, 2005-2020

| Type | Histopathological Diagnosis | n | % |
|------------------|-------------------------------------|-------------|-------------|
| Primary GN | Ig A nephropathy | 978 | 14.4 |
| | FSGS | 615 | 9.0 |
| | Minimal Change | 333 | 4.9 |
| | Membranous nephropathy | 198 | 2.9 |
| | Idiopathic Crescentic GN | 23 | 0.3 |
| | Membrano-proliferative | 27 | 0.4 |
| | Mesangial Proliferative GN-non-IgA | 91 | 1.3 |
| | Crescentic ANCA | 19 | 0.3 |
| | Not Available | 33 | 0.5 |
| | Sub total | 2317 | 34.0 |
| Secondary GN | Lupus Nephritis | 2613 | 38.4 |
| | Diabetic nephropathy | 351 | 5.2 |
| | Post Infectious GN | 52 | 0.8 |
| | Henoch Schonlein Purpura | 42 | 0.6 |
| | Amyloidosis | 17 | 0.2 |
| | Systemic vasculitis | 12 | 0.2 |
| | Multiple myeloma | 9 | 0.1 |
| | Other infection | 10 | 0.1 |
| | Light / Heavy chain deposit disease | 3 | 0.0 |
| | Anti GBM disease | 4 | 0.1 |
| | HUS / TTP | 5 | 0.1 |
| | Malignancy | 1 | 0.0 |
| | Immunotactoid / fibrillary GN | 1 | 0.0 |
| | Not Available | 44 | 0.6 |
| Sub total | 3164 | 46.4 | |
| Others | | 1331 | 19.5 |
| Total | | 6812 | 100 |

1.9.2.4 Nephritic-nephrotic syndrome

Lupus nephritis, 44%, was also the greatest proportion of histopathological diagnosis made when patient presented with nephritic-nephrotic syndrome. Less than a third of glomerulonephritis was due to primary GN, mostly FSGS and Ig A Nephropathy. (Table 1.9.2.4)

Table 1.9.2.4: HPE diagnosis in patients presenting with nephritic-nephrotic syndrome, 2005-2020

| Type | Histopathological Diagnosis | n | % |
|---------------|-------------------------------------|-------------|-------------|
| Primary GN | FSGS | 223 | 9.9 |
| | Ig A nephropathy | 200 | 8.9 |
| | Minimal Change | 128 | 5.7 |
| | Membranous nephropathy | 71 | 3.2 |
| | Mesangial Proliferative GN-non-IgA | 18 | 0.8 |
| | Membrano-proliferative | 30 | 1.3 |
| | Idiopathic Crescentic GN | 35 | 1.6 |
| | Crescentic ANCA | 22 | 1.0 |
| | Not Available | 12 | 0.5 |
| | Sub total | 739 | 32.9 |
| Secondary GN | Lupus Nephritis | 990 | 44.0 |
| | Post Infectious GN | 126 | 5.6 |
| | Diabetic nephropathy | 84 | 3.7 |
| | Henoch Schonlein Purpura | 17 | 0.8 |
| | Other infection | 8 | 0.4 |
| | HUS / TTP | 2 | 0.1 |
| | Malignancy | 2 | 0.1 |
| | Immunotactoid / fibrillary GN | 1 | 0.0 |
| | Light / Heavy chain deposit disease | 1 | 0.0 |
| | Multiple myeloma | 1 | 0.0 |
| | Amyloidosis | 3 | 0.1 |
| | Anti GBM disease | 2 | 0.1 |
| | Systemic vasculitis | 7 | 0.3 |
| | Not Available | 8 | 0.4 |
| | Sub total | 1252 | 55.7 |
| Others | | 258 | 11.5 |
| Total | | 2249 | 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

Children less than age 15 and young adults below 25 years old frequently had minimal change disease (40.5 – 41.6%) but in adults above age 25, FSGS was more common, 27.9 – 34.7%. Minimal change disease and Ig A nephropathy became less common with advanced age, while membranous nephropathy and Crescentic ANCA became more common. Roughly 30% were diagnosed with membranous nephropathy in those >65 years old and 25% amongst those age between 55 to 65. (Table 1.9.3 and Figure 1.9.3)

Table 1.9.3: Primary glomerulonephritis according to the various age group, 2005-2020

| Age group | <15 (n=1233) | | 15-<25 (n=2385) | | 25-<35 (n=2052) | | 35-<45 (n=1396) | | 45-<55 (n=948) | | 55-<65 (n=662) | | ≥65 (n=352) | | Total (n=9028) | |
|--------------------------|-----------------|------|--------------------|------|--------------------|------|--------------------|------|-------------------|------|-------------------|------|----------------|------|-------------------|------|
| | n | % | n | % | n | % | n | % | n | % | n | % | n | % | n | % |
| FSGS | 437 | 35.4 | 673 | 28.2 | 626 | 30.5 | 439 | 31.4 | 275 | 29.0 | 185 | 27.9 | 122 | 34.7 | 2757 | 30.5 |
| Minimal Change | 513 | 41.6 | 967 | 40.5 | 511 | 24.9 | 265 | 19.0 | 205 | 21.6 | 130 | 19.6 | 62 | 17.6 | 2653 | 29.4 |
| Ig A nephropathy | 162 | 13.1 | 498 | 20.9 | 643 | 31.3 | 427 | 30.6 | 209 | 22.0 | 104 | 15.7 | 31 | 8.8 | 2074 | 23.0 |
| Membrano-proliferative | 16 | 1.3 | 36 | 1.5 | 42 | 2.0 | 28 | 2.0 | 18 | 1.9 | 13 | 2.0 | 5 | 1.4 | 158 | 1.8 |
| Membranous nephropathy | 34 | 2.8 | 90 | 3.8 | 118 | 5.8 | 147 | 10.5 | 179 | 18.9 | 175 | 26.4 | 98 | 27.8 | 841 | 9.3 |
| Mesangial Prol: non-IgA | 44 | 3.6 | 63 | 2.6 | 65 | 3.2 | 53 | 3.8 | 22 | 2.3 | 17 | 2.6 | 5 | 1.4 | 269 | 3.0 |
| Idiopathic Crescentic GN | 11 | 0.9 | 21 | 0.9 | 16 | 0.8 | 15 | 1.1 | 14 | 1.5 | 10 | 1.5 | 4 | 1.1 | 91 | 1.0 |
| Crescentic ANCA | 3 | 0.2 | 4 | 0.2 | 8 | 0.4 | 4 | 0.3 | 10 | 1.1 | 17 | 2.6 | 18 | 5.1 | 64 | 0.7 |
| Not Available | 13 | 1.1 | 33 | 1.4 | 23 | 1.1 | 18 | 1.3 | 16 | 1.7 | 11 | 1.7 | 7 | 2.0 | 121 | 1.3 |

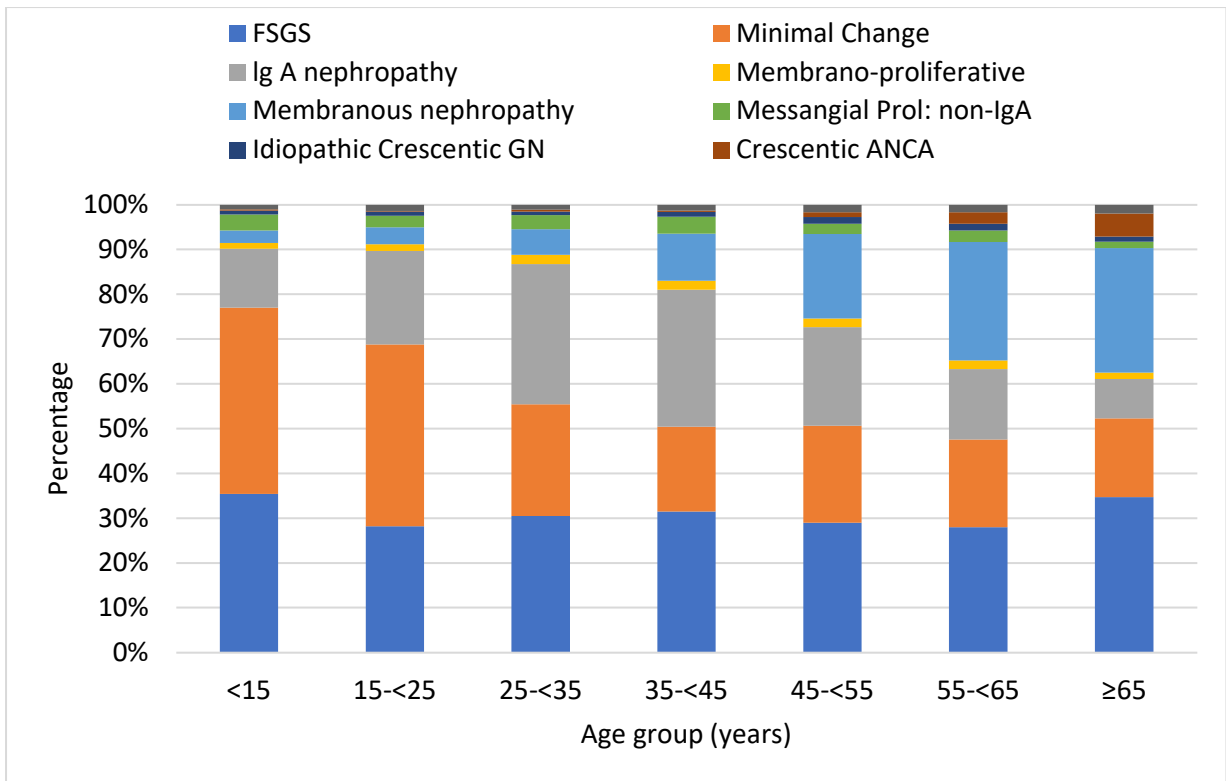


Figure 1.9.3: Primary glomerulonephritis according to the various age group, 2005-2020

1.9.4 Secondary GN according to age groups

Although more than three quarters of all secondary glomerulonephritis was attributed to lupus nephritis, this diagnosis was less common in those older than 55 years old. In the older age groups, just above 50% of kidney disease was caused by diabetic nephropathy. All the other glomerulonephritis were rare except for 20.8% of post-infectious GN in children (age <15). Five to 8% of elderly patients above 55 years old were diagnosed with amyloidosis. (Table 1.9.4)

Table 1.9.4: Secondary glomerulonephritis according to the various age group, 2005-2020

| Year | <15 (n=803) | | 15-<25 (n=2543) | | 25-<35 (n=2416) | | 35-<45 (n=1599) | | 45-<55 (n=1023) | | 55-<65 (n=499) | | ≥65 (n=169) | | Total (n=9052) | |
|-------------------------------------|----------------|------|--------------------|------|--------------------|------|--------------------|------|--------------------|------|-------------------|------|----------------|------|-------------------|------|
| | n | % | n | % | n | % | n | % | n | % | n | % | n | % | n | % |
| Lupus Nephritis | 545 | 67.9 | 2397 | 94.3 | 2147 | 88.9 | 1229 | 76.9 | 609 | 59.5 | 173 | 34.7 | 33 | 19.5 | 7133 | 78.8 |
| Diabetic nephropathy | 0 | 0.0 | 33 | 1.3 | 161 | 6.7 | 258 | 16.1 | 332 | 32.5 | 251 | 50.3 | 85 | 50.3 | 1120 | 12.4 |
| Post Infectious GN | 167 | 20.8 | 77 | 3.0 | 62 | 2.6 | 47 | 2.9 | 29 | 2.8 | 14 | 2.8 | 7 | 4.1 | 403 | 4.5 |
| Henoch Schonlein Purpura | 67 | 8.3 | 6 | 0.2 | 1 | 0.0 | 2 | 0.1 | 6 | 0.6 | 1 | 0.2 | 1 | 0.6 | 84 | 0.9 |
| Amyloidosis | 1 | 0.1 | 0 | 0.0 | 1 | 0.0 | 7 | 0.4 | 13 | 1.3 | 25 | 5.0 | 14 | 8.3 | 61 | 0.7 |
| Other infection | 1 | 0.1 | 4 | 0.2 | 11 | 0.5 | 15 | 0.9 | 7 | 0.7 | 8 | 1.6 | 2 | 1.2 | 48 | 0.5 |
| Systemic vasculitis | 8 | 1.0 | 3 | 0.1 | 6 | 0.2 | 4 | 0.3 | 5 | 0.5 | 5 | 1.0 | 4 | 2.4 | 35 | 0.4 |
| Multiple myeloma | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 3 | 0.2 | 5 | 0.5 | 7 | 1.4 | 5 | 3.0 | 20 | 0.2 |
| HUS / TTP | 6 | 0.7 | 2 | 0.1 | 4 | 0.2 | 3 | 0.2 | 0 | 0.0 | 1 | 0.2 | 0 | 0.0 | 16 | 0.2 |
| Light / Heavy chain deposit disease | 0 | 0.0 | 1 | 0.0 | 1 | 0.0 | 1 | 0.1 | 3 | 0.3 | 2 | 0.4 | 3 | 1.8 | 11 | 0.1 |
| Anti GBM disease | 1 | 0.1 | 2 | 0.1 | 2 | 0.1 | 3 | 0.2 | 2 | 0.2 | 1 | 0.2 | 3 | 1.8 | 14 | 0.2 |
| Malignancy | 1 | 0.1 | 1 | 0.0 | 0 | 0.0 | 2 | 0.1 | 1 | 0.1 | 2 | 0.4 | 2 | 1.2 | 9 | 0.1 |
| Immunotactoid / fibrillary GN | 0 | 0.0 | 1 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 0.4 | 1 | 0.6 | 4 | 0.0 |
| Not Available | 6 | 0.7 | 16 | 0.6 | 20 | 0.8 | 25 | 1.6 | 11 | 1.1 | 7 | 1.4 | 9 | 5.3 | 94 | 1.0 |

1.9.5 Histology of repeat biopsies

The majority of repeat renal biopsies were performed in patients with lupus nephritis; 56.3% required 2 biopsies, 72.4% had 3 biopsies and 73.5% received 4 biopsies. The other histology of repeat biopsies include FSGS (8.9 – 11.7%), Ig A nephropathy (5.2%), Minimal change (2.4 – 5%), chronic interstitial nephritis (2.3%) and Others. (Figure 1.9.5 (a) to (c))

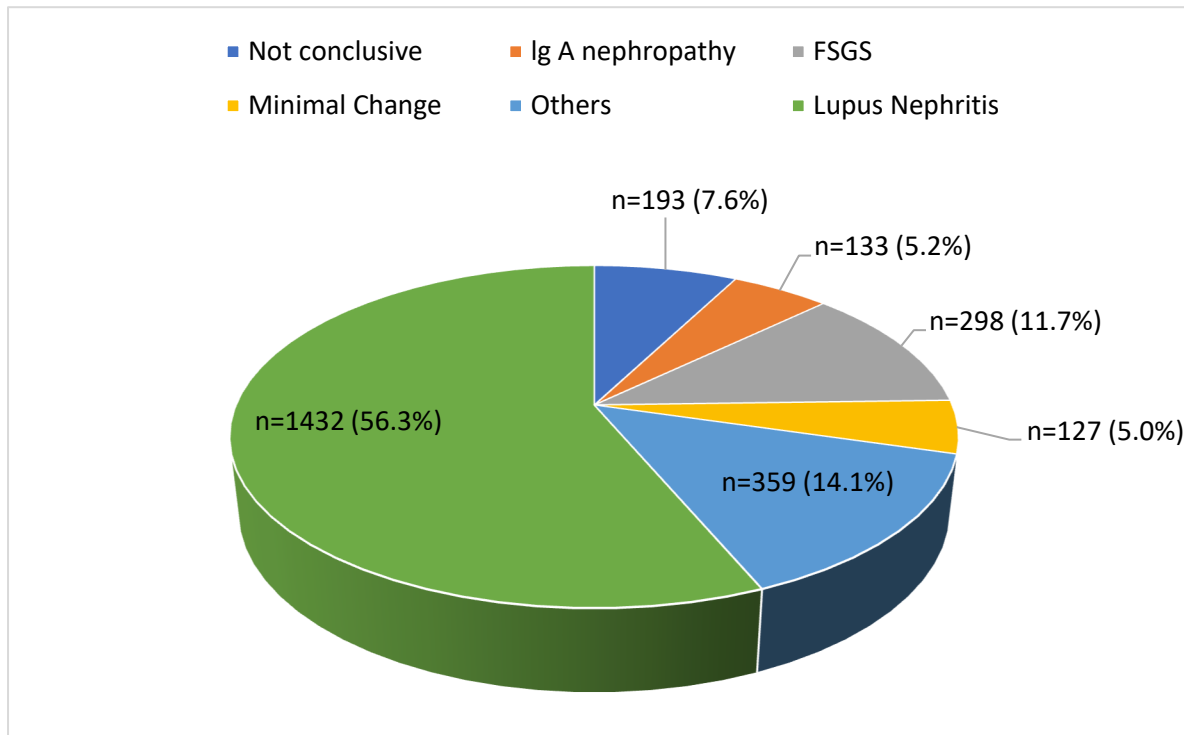


Figure 1.9.5 (a): Histopathological diagnosis of repeat biopsies (2nd episode), 2005-2020

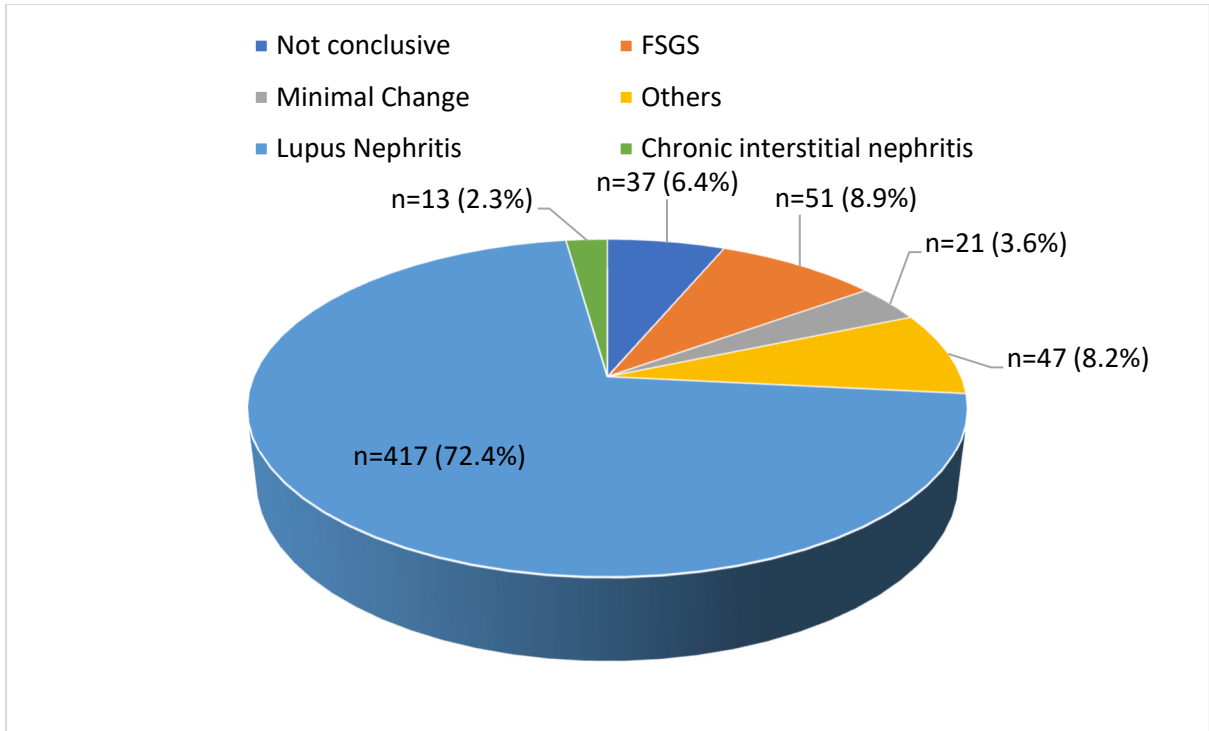


Figure 1.9.5 (b): Histopathological diagnosis of repeat biopsies (3rd episode), 2005-2020

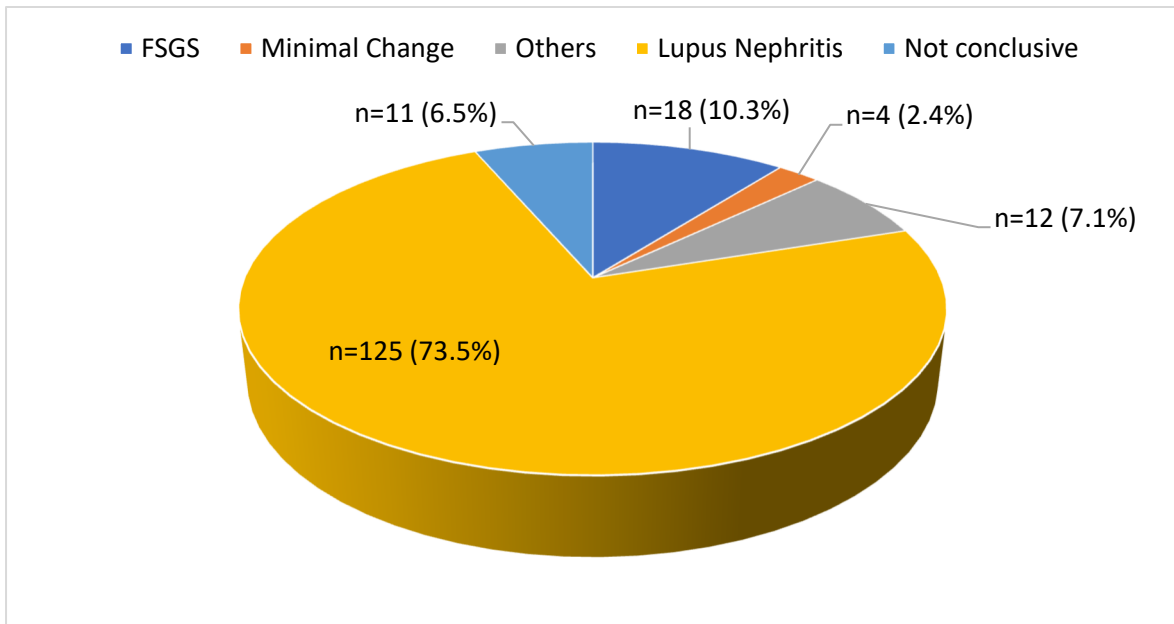


Figure 1.9.5 (c): Histopathological diagnosis of repeat biopsies (4th episode and above), 2005-2020