EVIDENCE SERIES

Urinary stone disease

Incidence, treatment and outcomes in NSW

MAY 2023

Contents

NSW GOVERNMENT | AGENCY FOR CLINICAL INNOVATION

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The information in this resource should not replace a clinician's professional judgement.

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At a glance

This report provides a summary of the evidence available on the treatment of urinary stone disease in NSW and internationally.

11,000 people are admitted to NSW hospitals each year for urinary stone disease

Stent insertion prior to stone removal is common

Rates of stent insertion vary across hospitals from 7% to 94%

The median wait time for stone removal following stent insertion is 36 days

Unplanned emergency department presentations were more common after stent insertion than stone removal

Research evidence	Experiential evidence from NSW urologists	Experiential evidence from NSW nurses
• Evidence is mixed on outcomes for stenting versus no stenting for urinary stone disease. • Some studies report significantly longer operation time, higher urinary symptoms and reintervention, and lower stone-free rate with stenting. Other studies report no significant differences for operation time, urinary tract infections, secondary interventions, or stone-free rate. • Stenting complications include stent encrustation, migration, irritation and discomfort.	• NSW surgical procedures for urinary stone disease include ureteric stenting, ureteroscopy, pyeloscopy, percutaneous nephrolithotomy and extracorporeal lithotripsy. • Indications for surgical treatment and procedure vary between surgeons and by capacity and resource constraints. • Urologists reported main indications for stenting are urinary tract infection and sepsis, pain, stone size and obstruction. • Patient factors in choice of surgical procedure include previous patient experiences, occupation, treatment perceptions and comorbidities.	• Preoperative care should include health education, coordinating care and pain management. • Postoperative care should include monitoring patient pain and wellbeing. It should also include discharge advice, including coordinating follow-up testing, imaging and support. • Barriers to providing pre- and postoperative care include inadequate and delayed pain management; limited specialised knowledge and skill; and a lack of care models, policies and guidelines.

Summary

Introduction

Urinary stone disease is a common condition characterised by the presence of stones within the urinary tract. The stone can cause considerable pain as it passes through the upper urinary tract. Treatment options include immediate stone removal/fragmentation/destruction, temporary stent insertion followed by stone removal, or, in the case of smaller stones, natural passage through the urinary tract with pain relief. Stone treatment may be conducted via ureteroscopy, pyeloscopy, percutaneous nephrolithotomy and extracorporeal shockwave lithotripsy (ESWL).

This report provides a summary of the evidence available on the treatment of urinary stone disease in NSW and internationally. It explores whether there is unwarranted clinical variation in treating urinary stone disease – variation between surgeons or variation from the evidence base.

Methods

This report draws on three main types of evidence:

- quantitative data from NSW Admitted Patient Data Collection (APDC), NSW Emergency Department Data Collection (EDDC) and NSW Waiting List Collection Online System (WLCOS)
- research literature identified through PubMed and Google searches
- experiential evidence collected from 25 responses to a self-reported brief questionnaire. Seven urologists and 18 nurses, including two nurse practitioners and one clinical nurse consultant in NSW, answered the questionnaire.

NSW hospital admissions for urinary stone disease

In the year 2018-19, 11,307 people were admitted to NSW hospitals with a principal diagnosis of urinary stone disease. Some patients had multiple hospitalisations. In total, there were 15,736 admitted patient episodes with a principal diagnosis of urinary stone disease. Among 4,441 patients who underwent a procedure for urinary stone disease, the most common procedure was ureteric stent insertion (2,901, 65%), followed by ureteric stent insertion and stone removal during the same hospital admission (1,336, 30%). The remaining 204 patients either had stone removal only, ESWL only, or a combination of stent insertion, stone removal and ESWL during the same hospital admission.

Among the 2,901 people who underwent ureteric stent insertion, 1,226 (42%) had a subsequent procedure (stone removal or ESWL) within one year. The median time that patients waited for a subsequent procedure was 36 days and 261 (21%) patients waited more than 12 weeks. There is a significant risk of stent encrustation and more morbid treatment for stents left indwelling for more than 12 weeks.

All cause unplanned emergency department presentations within 30 days of urinary stone disease procedure were more common in patients who underwent stent insertion (21% for emergency procedure, 15% for planned procedure), compared with patients whose procedure was stone removal (14% for emergency procedure, 8% for planned procedure). After adjusting for age, sex and comorbidities, the difference remained.

Evidence on stenting for urinary stone disease

Overall, the research evidence on stenting for urinary stone disease is mixed. There is variability in outcomes for stenting versus no stenting and in any association between stent dwell time and complications. Some studies report that ureteral stenting may be associated with significantly longer operation time, higher rates of urinary symptoms and reintervention, and lower stone-free rate compared to no stenting. Other studies report no significant differences in operation time, urinary tract infections, secondary interventions, or stone-free rates. Complications associated with stenting include stent encrustation, migration, irritation and discomfort.

Due to significant heterogeneity across reviewed studies in terms of intervention (e.g., type of stent, definitive treatment option), patient cohort, and outcomes reported, it was difficult to draw direct comparisons. One systematic review concluded stenting failed to improve stone-free rates and resulted in additional complications. Conversely, a separate systematic review found stenting generally improved stone-free rates and reported no significant differences for complication rates. A Cochrane systematic review on the effects of postoperative stent placement reported small effect sizes and uncertain findings for a range of outcomes.

Experiential evidence from urologists and nurses in NSW

Findings from a self-reported brief questionnaire completed by seven urologists and a nurse practitioner and nurse consultant suggested that the indications and decision-making processes for the surgical treatment of urinary stone disease and procedure choice may vary between surgeons. These decisions were also affected by capacity (e.g., availability of staff, including the skill of the surgeon), and local delivery systems (e.g., resource constraints including access to equipment/ instrumentation and theatre). There was consistency for at least one indication for most surgical procedures, e.g., UTI/sepsis for ureteric stenting and stone size for conservative management, primary pyeloscopy or percutaneous nephrolithotomy.

Patient factors that guided the choice of the surgical procedure included:

- previous patient experiences (e.g., ability or inability to tolerate a stent)
- occupation
- perceptions about treatment
- comorbidities.

Eighteen nurses described how nurses should be involved in preoperative and postoperative care.

Preoperative care should include:

- providing health education
- coordinating care
- managing patient expectations
- treating symptoms
- managing pain and discomfort.

Postoperative care should include:

- immediate care
- managing pain and discomfort
- providing discharge advice
- coordination of follow-up testing, imaging and support.

Background

Introduction

Urinary stone disease is a common condition characterised by the presence of stones within the urinary tract. The stone can cause immense pain as it passes through the upper urinary tract. Risk factors for kidney stones may include high blood pressure, diabetes and obesity.[1] Men are more likely to get stones than women; the risk is about one in 10 for men and one in 35 for women.[2, 3]

Treatment options include immediate stone removal/fragmentation/destruction, temporary stent insertion followed by stone removal, or, in the case of smaller stones, natural passage through the urinary tract with pain relief. Stone removal may be conducted via ureteroscopy or via extracorporeal shockwave lithotripsy (ESWL).

Structure

This report provides a summary of the evidence available on the treatment of urinary stone disease in NSW and internationally. This report draws on three main types of evidence and is divided into sections for each type of evidence:

- quantitative data – admitted patient episodes for urinary stone disease, initial and subsequent procedures for urinary stone disease, waiting times for procedures and unplanned emergency department presentations following procedures
- research literature – systematic reviews, meta-analyses, randomised controlled trials, clinical trials or observational studies, published in English language between 2011 and 2021
- experiential evidence – 25 respondents who completed a self-reported questionnaire between 1 December 2021 and 31 March 2022. Seven urologists and 18 nurses, including two nurse practitioners and one clinical nurse consultant filled in the questionnaire.

Data and methods

Health and healthcare databases

Quantitative data were drawn from:

- NSW Admitted Patient Data Collection (APDC) and NSW Emergency Department Data Collection (EDDC), accessed via the Hospital Performance Dataset (HoPeD), NSW Ministry of Health Secure Analytics for Population Health Research and Intelligence
- NSW Waiting List Collection Online System (WLCOS), Enterprise Data Warehouse for Analysis Reporting and Decision support (EDWARD), System Information and Analytics Branch, NSW Ministry of Health.

People admitted to hospital with urinary stone disease principal diagnosis and receiving a procedure (stent insertion, stone removal, extracorporeal shockwave lithotripsy (ESWL)) for urinary stone disease were identified using a selection of diagnosis codes and procedure codes (Appendix 1). Data are provided up to the end of the financial year 2018-19. Although more recent data is available, it overlaps with the COVID-19 pandemic, when elective surgery was interrupted, and is not indicative of usual practice. More details on data analysis methods are provided in Appendix 1.

Literature search

PubMed was searched in June 2021. Two searches were conducted using key terms related to: urinary calculi OR kidney stones OR renal stones AND stents.

Studies were included if they were systematic reviews, meta-analyses, randomised controlled trials, clinical trials or observational studies, published in English language between 2011 and 2021. The population was people with urinary stone disease and the intervention was stenting compared to other treatment. Surgical management guidelines were identified in grey literature.

Studies were independently screened by two people, first by title and abstract and subsequently by full text. Conflicts were discussed in virtual meetings and resolved by a third screener. Thirty-one studies were included from peer-reviewed literature and five publications from grey literature.

Experiential evidence

A self-reported brief questionnaire was used to identify the surgical procedures currently used to treat urinary stone disease in NSW, including indications and decision-making processes that guide the surgical treatment of urinary stone disease. Data were collected using an online questionnaire administered through MS Forms from 1 December 2021 and 31 March 2022 from a purposeful sample of urologists and nurses in NSW using ACI networks. Quantitative data were analysed using descriptive statistics. Verbatim responses to the open-ended questions were analysed using a qualitative content analysis method to identify core concepts through keywords and word frequencies. A limitation is the small sample size.

Limitations

The literature search did not include formal critical appraisal of individual studies. There was heterogeneity between studies in terms of procedure, outcomes reported and patient cohort. This made it difficult to compare outcomes directly.

For experiential evidence, the sample is small and self-selected, and there may be a bias in reporting practices on the part of respondents. The questionnaire was administered during a significant COVID-19 wave in NSW and over the 2021 Christmas holiday period which may have impacted the response rate.

Findings – health and healthcare databases and analysis

Urinary stone disease hospitalisations

In 2018-19, 11,307 people were admitted to a NSW hospital with urinary stone disease principal diagnosis. Among these people, 7,988 were male (71%) and 3,319 were female (29%). The age of people admitted ranged from 3 to 99, with a median age of 53 and an interquartile range of 24 (41 to 65). Further break down by age and sex is provided in Appendix 2.

Over the past 10 years, 2009-10 to 2018-19, the number of people presenting to NSW hospitals with urinary stone disease has increased 79% (57% increase in the age standardised rate), although the number of people has been more stable in recent years (Figure 1).

In 2018-19, there were 15,736 admitted patient episodes with urinary stone disease principal diagnosis. Over the past 10 years, the number of episodes has increased 82% (60% increase in the age standardised rate) (Figure 2). In 2018-19, 12,397 episodes (79%) were in public hospitals and 3,339 episodes (21%) were in private hospitals (Figure 2). In 2018-19, there were 129 public hospitals with urinary stone disease principal diagnosis episodes, ranging from one episode to 829 episodes (Figure 3).

Figure 1: Number of people admitted to NSW hospital with urinary stone disease principal diagnosis, NSW public and private hospitals, 2009-10 to 2018-19

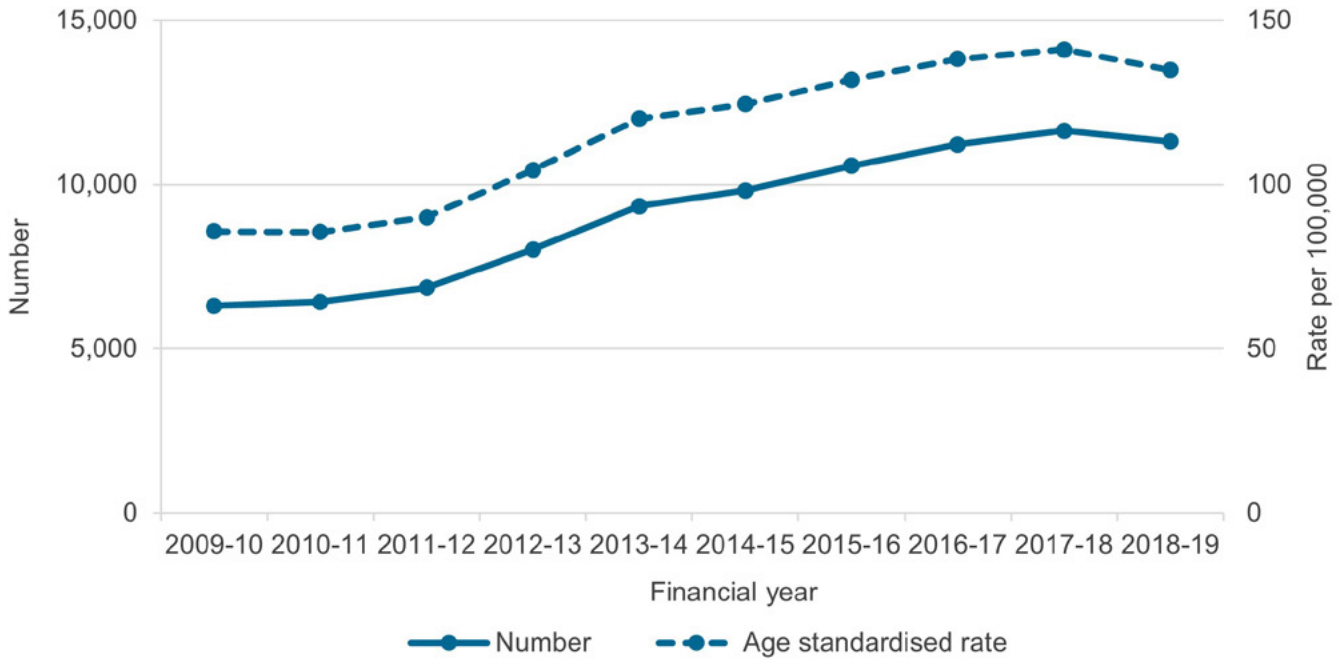


Figure 2: Number of admitted patient episodes with urinary stone disease principal diagnosis, NSW public and private hospitals, 2009-10 to 2018-19

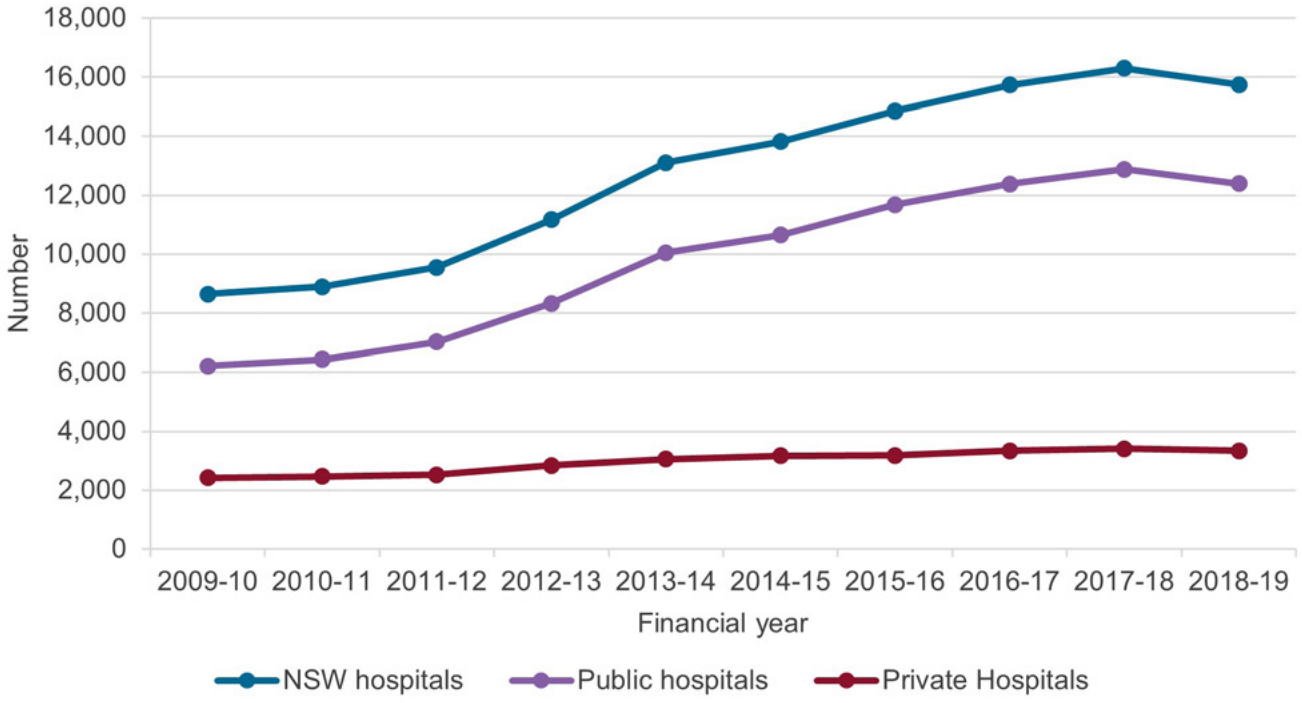
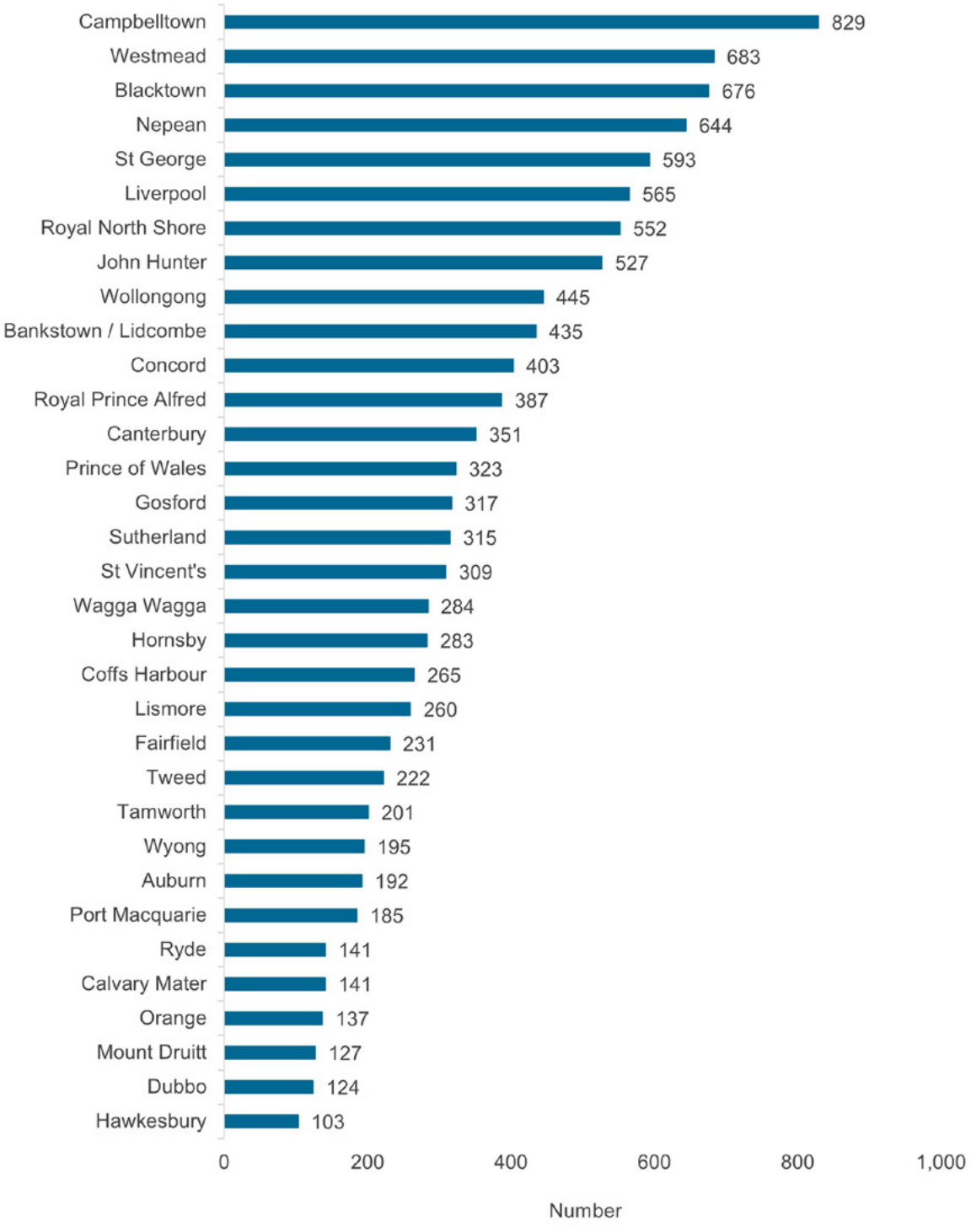


Figure 3: Number of admitted patient episodes with urinary stone disease principal diagnosis, NSW public hospitals, 2018-19 (includes hospitals with at least 100 episodes)



Urinary stone disease initial procedure

In 2018-19, among patients who underwent a procedure for urinary stone disease, the most common procedure performed first was ureteric stent insertion (2,901/4,441; 65%). The next most common procedure was ureteric stent insertion and stone removal during the same hospital admission (1,336/4,441; 30%). Among the remaining 204 patients, 107 underwent stone removal, 83 stent insertion and ESWL during the same hospital admission, nine ESWL, and five stent insertion, stone removal and ESLW during the same hospital admission (Figure 4). People in public hospitals were more likely to have stent insertion first compared to people in private hospitals (2,318/2,957; 78% compared to 583/1,484; 39%).

Over the decade 2009-10 to 2018-19, the percentage of people undergoing stent insertion first has been relatively stable, at about 65% (Figure 5).

In 2018-19, the percentage of patients undergoing stent insertion first varied across public hospitals from 7% to 94% (among hospitals with at least 30 patients) (Figure 6).

Figure 4: First type of urinary tract procedure for people admitted to hospital with urinary stone disease principal diagnosis, NSW public and private hospitals, 2018-19

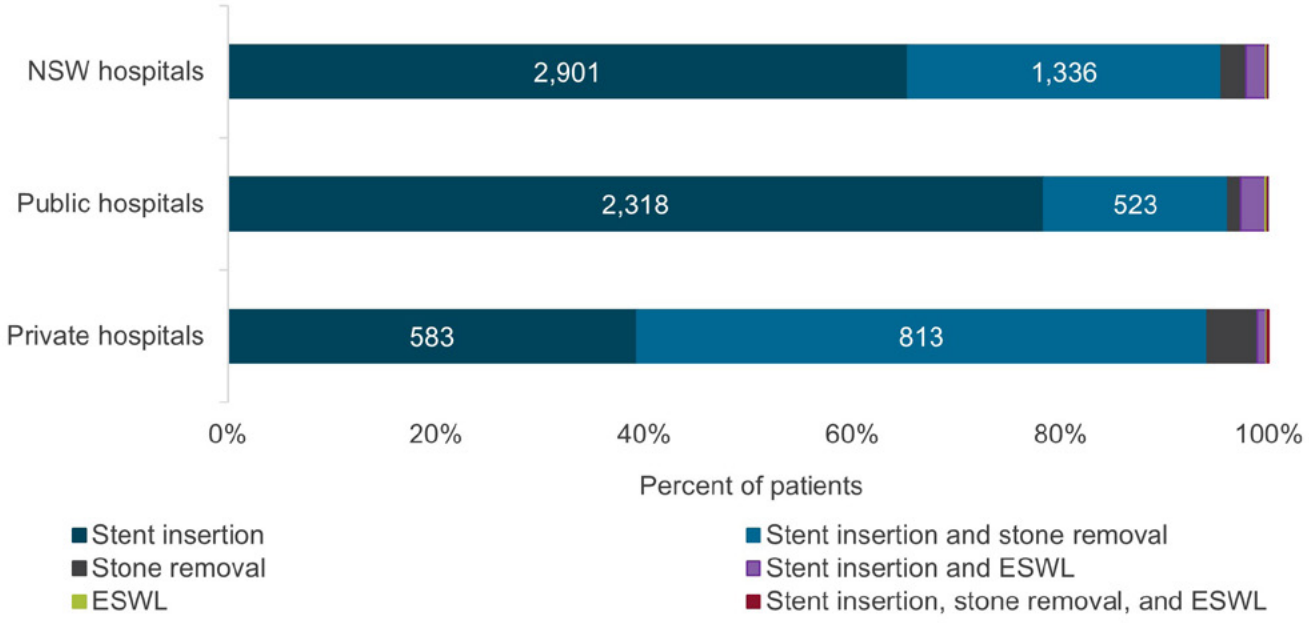


Figure 5: Percentage of people admitted to hospital with urinary stone disease principal diagnosis receiving ureteric stent insertion first, NSW public and private hospitals, 2009-10 to 2018-19

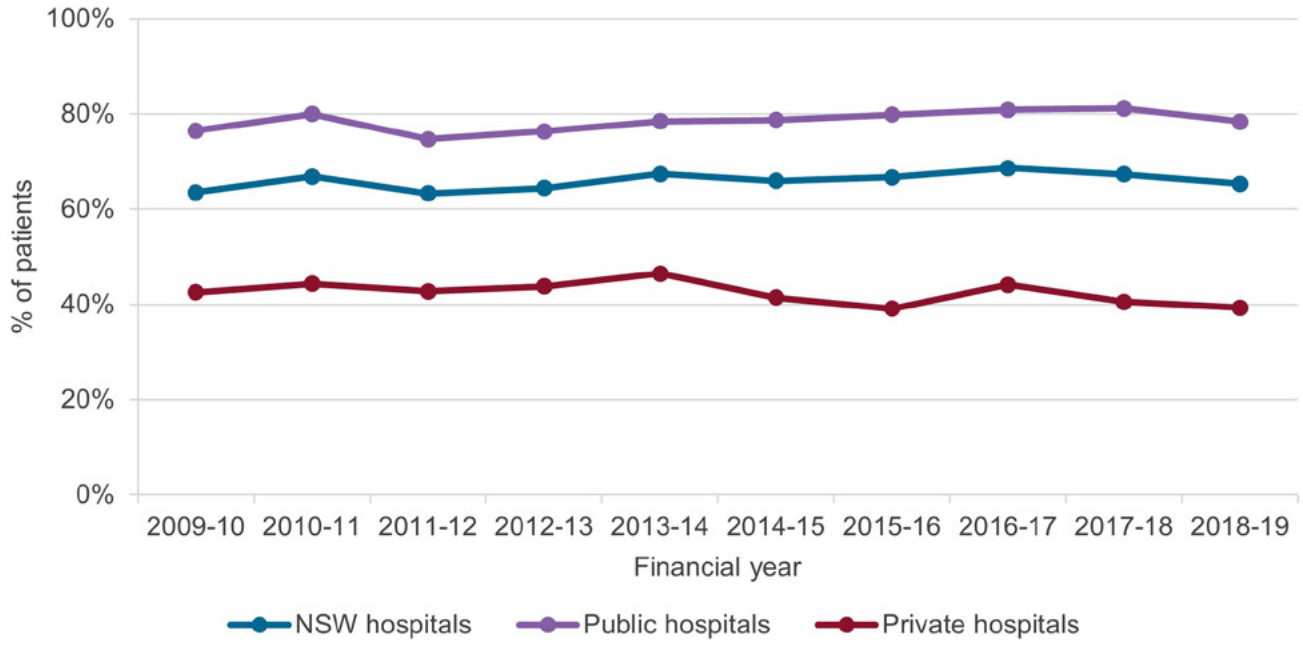
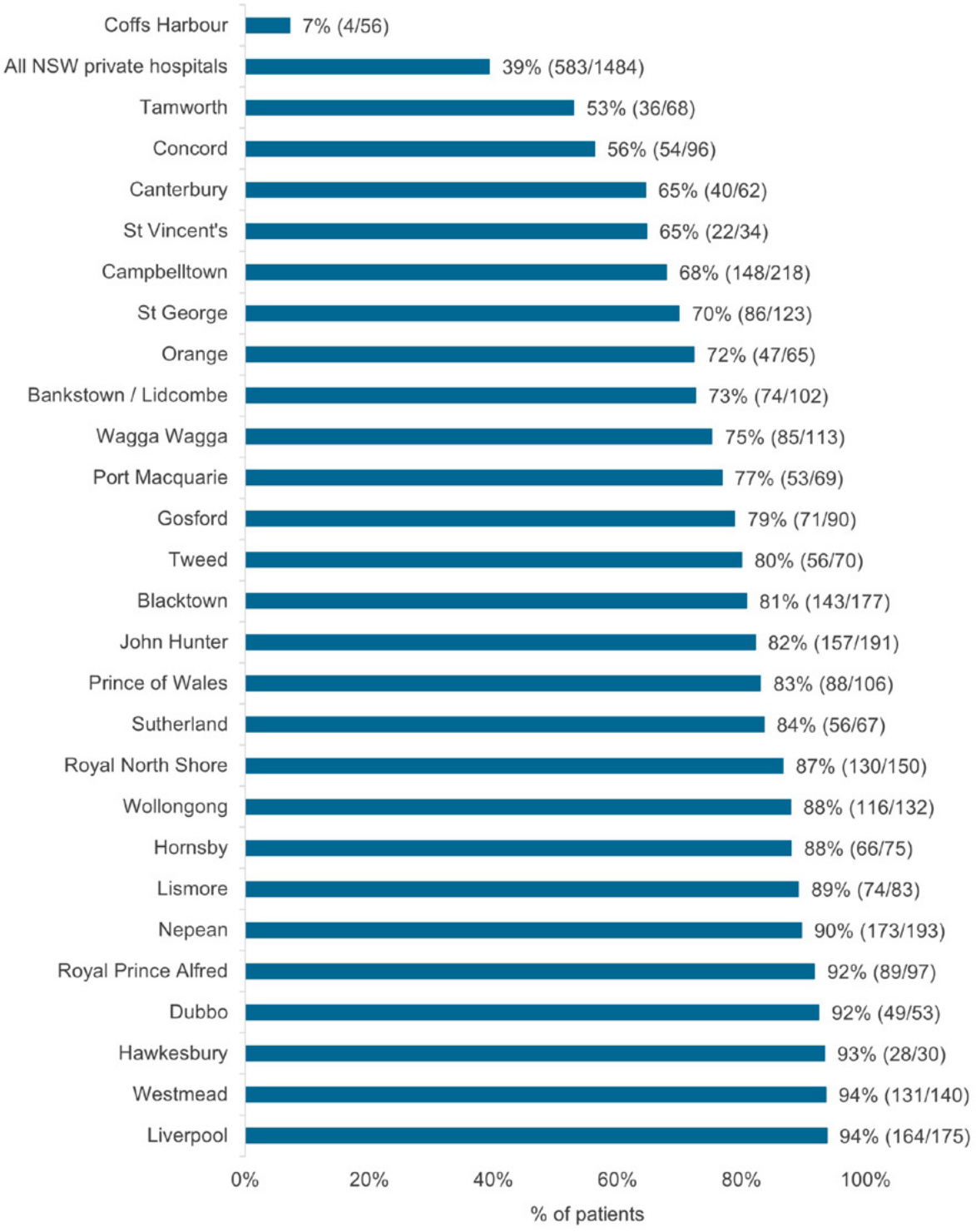


Figure 6: Percentage of people admitted to hospital with urinary stone disease principal diagnosis receiving ureteric stent insertion first, NSW public and private hospitals, 2018-19*



*Hospitals with at least 30 patients are included. Patients are assigned to the hospital where they had a urinary stone disease principal diagnosis and first procedure.

Urinary stone disease subsequent procedure

In 2018-19, among the 2,901 people with urinary stone disease principal diagnosis who underwent ureteric stent insertion first, 1,226 (42%) had a subsequent procedure (stone removal or ESWL) within one year. The percentage undergoing a subsequent procedure within one year was higher for public hospitals compared with private hospitals – 1,014/2,318 (44%) and 212/583 (36%) respectively (note patients are assigned to the hospital where they had stent insertion first).

Over the past 10 years, 2009-10 to 2018-19, the percentage of people undergoing a subsequent procedure within one year has been relatively stable at about 40% (Figure 7).

In 2018-19, the median time that patients waited for a subsequent procedure was 36 days; and 261 (21%) patients waited more than 12 weeks. The time that patients waited varied across age groups and sex, with younger men waiting longer than younger women but older women waiting longer than older men (Figure 8). The time also varied across public and private hospitals from 14 days (for all private hospitals) to 85 days at Wollongong Hospital (among hospitals with at least 30 patients and patients are assigned to the hospital where they underwent stent insertion first) (Figure 9).

Figure 7: Percentage of people with urinary stone disease principal diagnosis with subsequent procedure (stone removal or ESWL) within one year of stent insertion, NSW public and private hospitals, 2009-10 to 2018-19

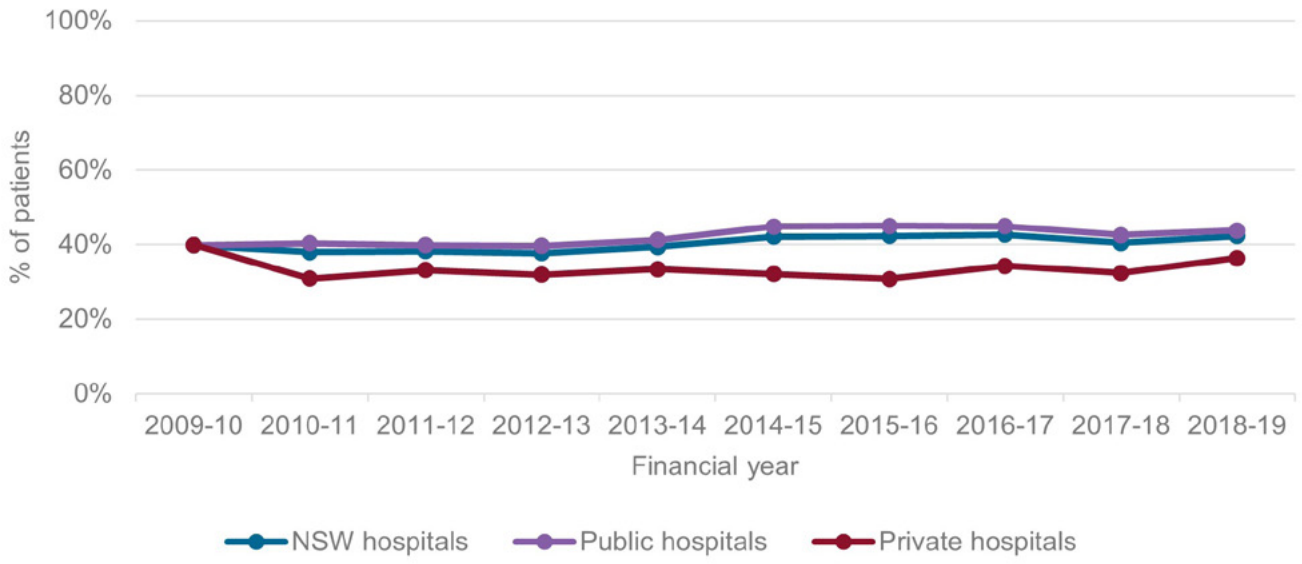


Figure 8: Median waiting time for subsequent procedure (stone removal or ESWL) following stent insertion for people with urinary stone disease principal diagnosis, by age and sex, NSW public and private hospitals, 2018-19

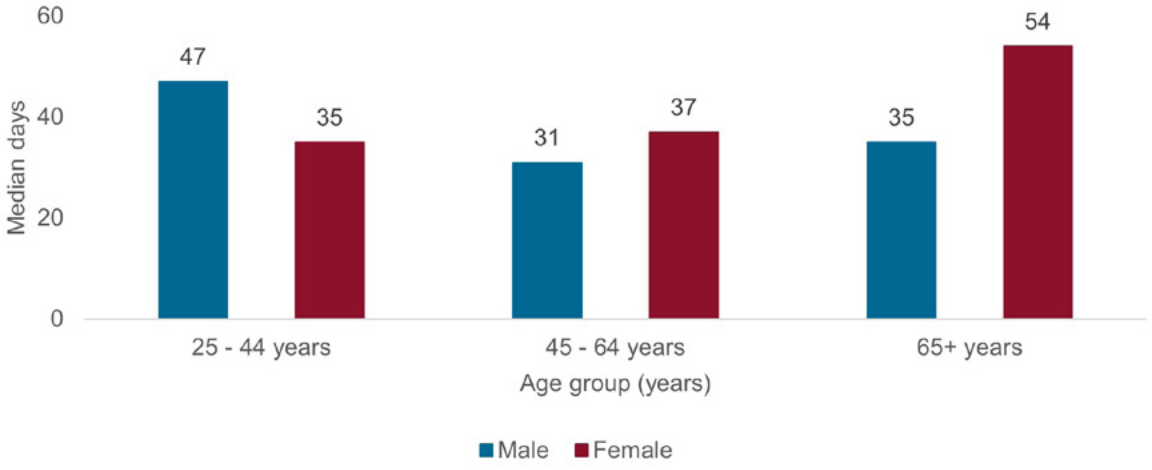
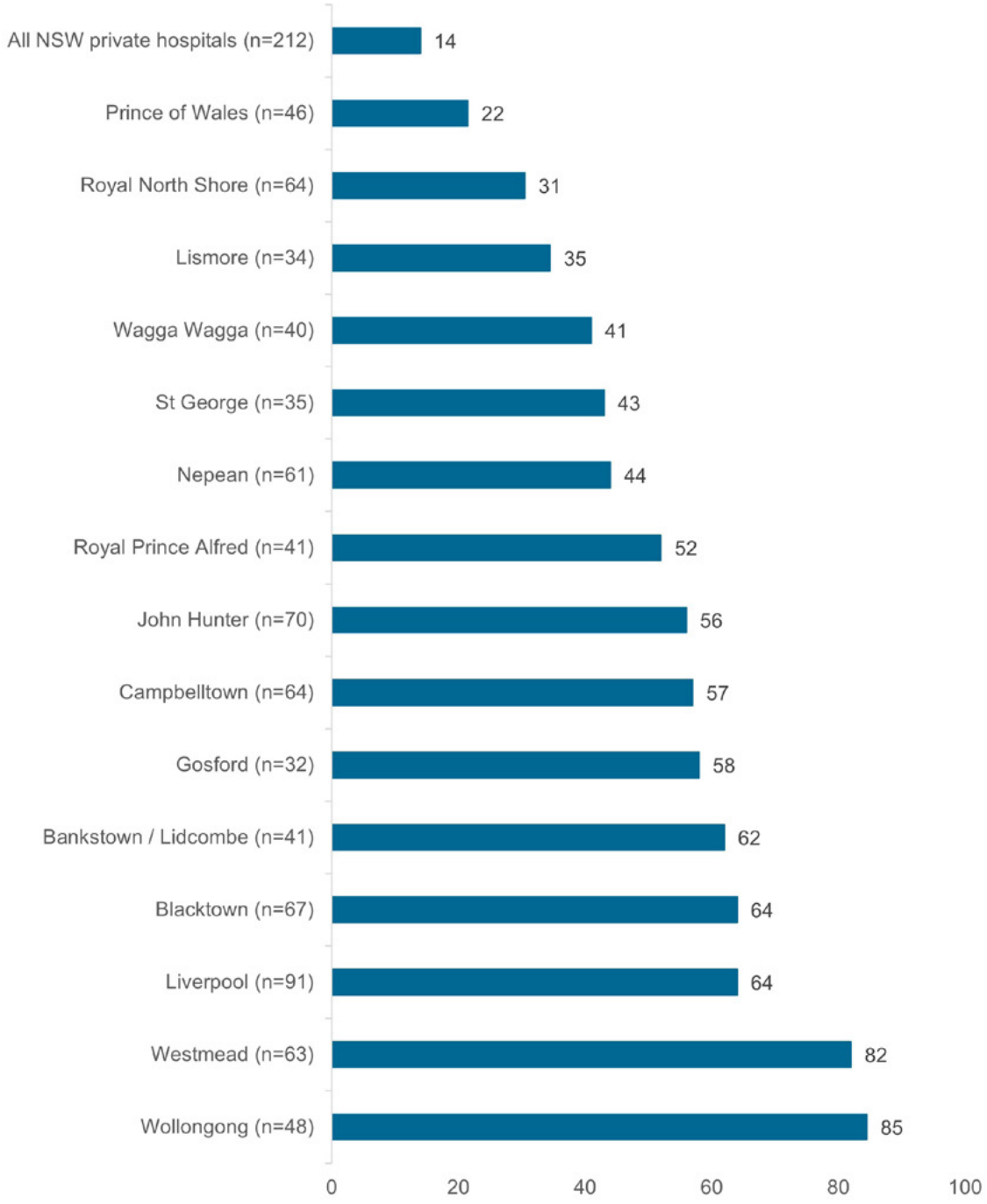


Figure 9: Median waiting time for subsequent procedure (stone removal or ESWL) following stent insertion for people with urinary stone disease principal diagnosis, NSW public and private hospitals, 2018-19*



*Hospitals with at least 30 patients are included. Patients are assigned to the hospital where they had a urinary stone disease principal diagnosis and first procedure.

Urgency and waiting times for urinary stone disease elective procedures

In 2018-19, there were 696 'insertion of ureteric stent' procedures and 749 'removal of stone from urinary tract' procedures performed from the NSW public hospital elective surgery waitlist. They were mostly classified as semi-urgent (42% for stent insertion and 72% for stone removal) (Figure 10).

The median waiting time for stent insertion was six days for urgent, 34 days for semi-urgent, and 103 days for non-urgent. The median waiting time for stone removal was 16 days for urgent, 49 days for semi-urgent, and 134 days for non-urgent (Figure 11). These median waiting times were all within the clinically recommended maximum waiting times for these urgency categories (30 days for urgent, 90 days for semi-urgent, and 365 days for non-urgent).

Median waiting times were similar across age groups for urgent and semi-urgent procedures but differed for non-urgent stone removal (104 days for 25-44 years, 196 days for 45-64 years, and 161 days for 65+ years) (Figure 12).

Figure 10: Number of elective surgery stent insertion and stone removal procedures by urgency category, NSW public hospitals, 2018-19

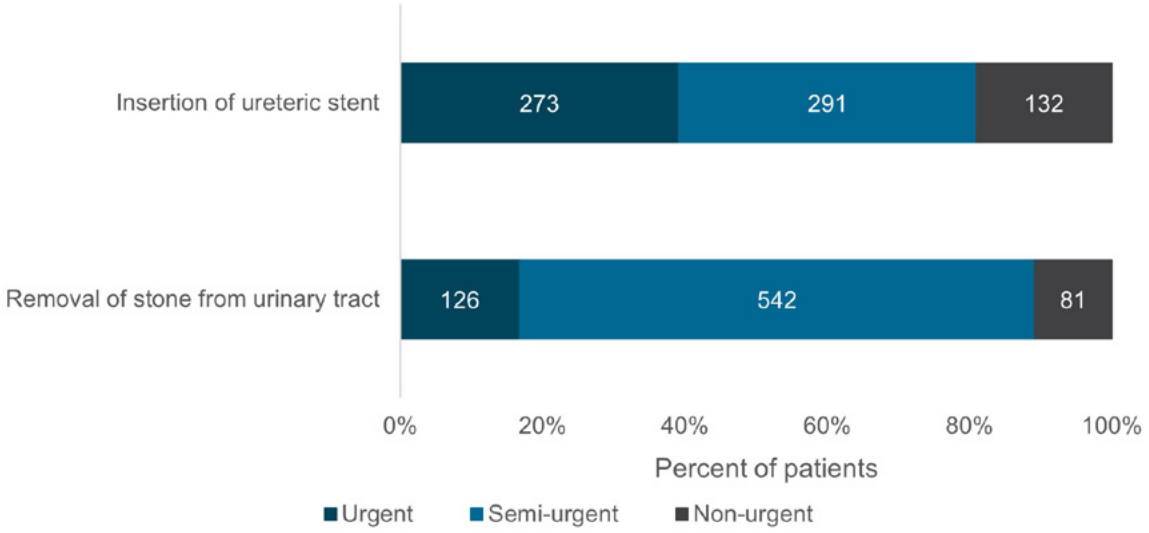


Figure 11: Median waiting time for elective surgery stent insertion and stone removal procedures by urgency category, NSW public hospitals, 2018-19

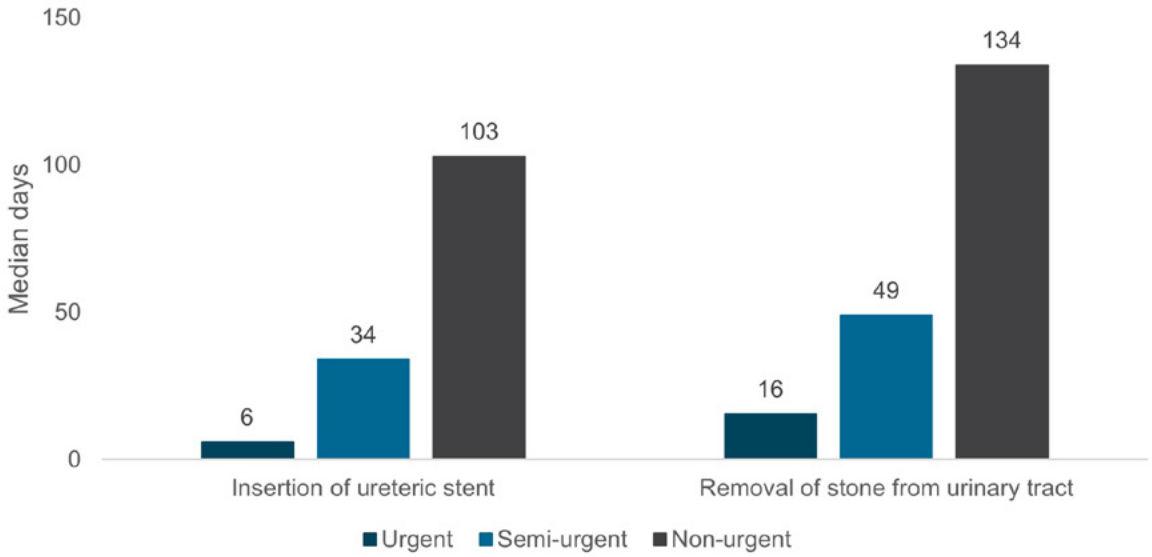
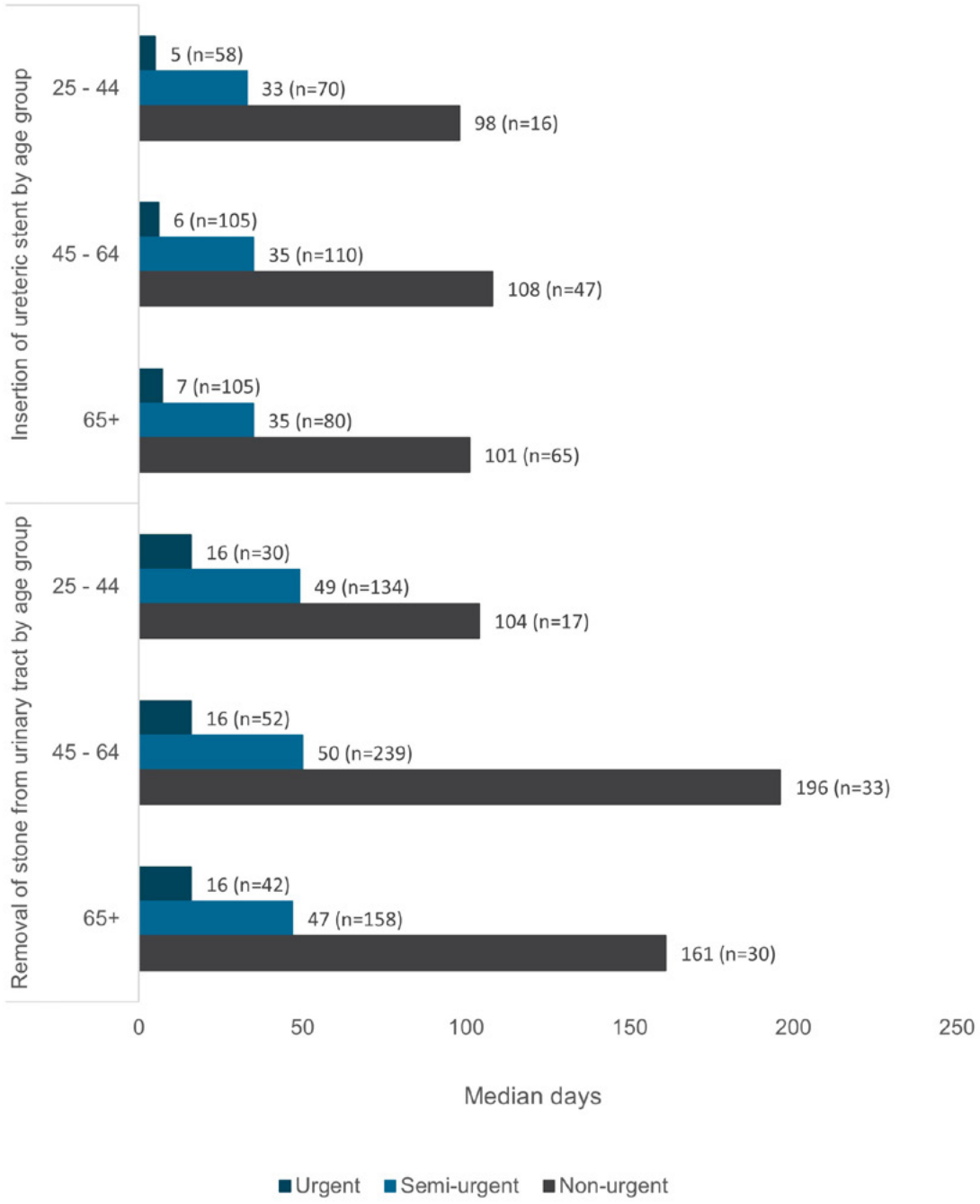


Figure 12: Median waiting time for elective surgery stent insertion and stone removal procedures by age group and urgency category, NSW public hospitals, 2018-19



Unplanned emergency department presentations following urinary stone disease procedure

Over a three-year period, July 2016 to June 2019 (financial years 2016-17, 2017-18, and 2018-19), all cause unplanned emergency department presentations following initial urinary stone disease procedure were more common in patients whose procedure involved stenting compared with patients whose first procedure was stone removal only. For example, 21% of patients who underwent an emergency stent insertion had an unplanned ED presentation within 30 days compared with 14% of patients who had an emergency stone removal ($X2$ (1, N=6622) = 1.18, p=0.28). Similarly, 15% of patients who underwent a planned stent insertion had an unplanned ED presentation within 30 days compared with 8% of patients who had a planned stone removal ($X2$ (1, N=2870) = 11.17, $p<0.01$) (Figure 13).

A generalised linear mixed model was used to estimate the odds of an unplanned emergency department presentation at 30, 60, and 90 days following a urinary stone disease procedure, taking age, sex, comorbidities, and patients clustered in hospitals into account. The odds of an unplanned emergency department presentation were lower for stone removal compared with stent insertion, and for planned presentations it was statistically significant (p-value<0.05) (Figure 14).

For the stent insertion patients admitted to hospital following an unplanned emergency department presentation within 30 days, the most common principal diagnosis was T83 Complications of genitourinary prosthetic devices, implants, and grafts (21%). The most common principal procedure was 36821-03 Endoscopic replacement of ureteric stent (3%). For 638 of the 946 patients admitted (67%), there was no principal procedure recorded (Figure 15).

Figure 13: All cause unplanned emergency department presentations within 30, 60, and 90 days following initial urinary stone disease procedure, by type of procedure and urgency status of procedure, NSW public and private hospitals, July 2016 to June 2019

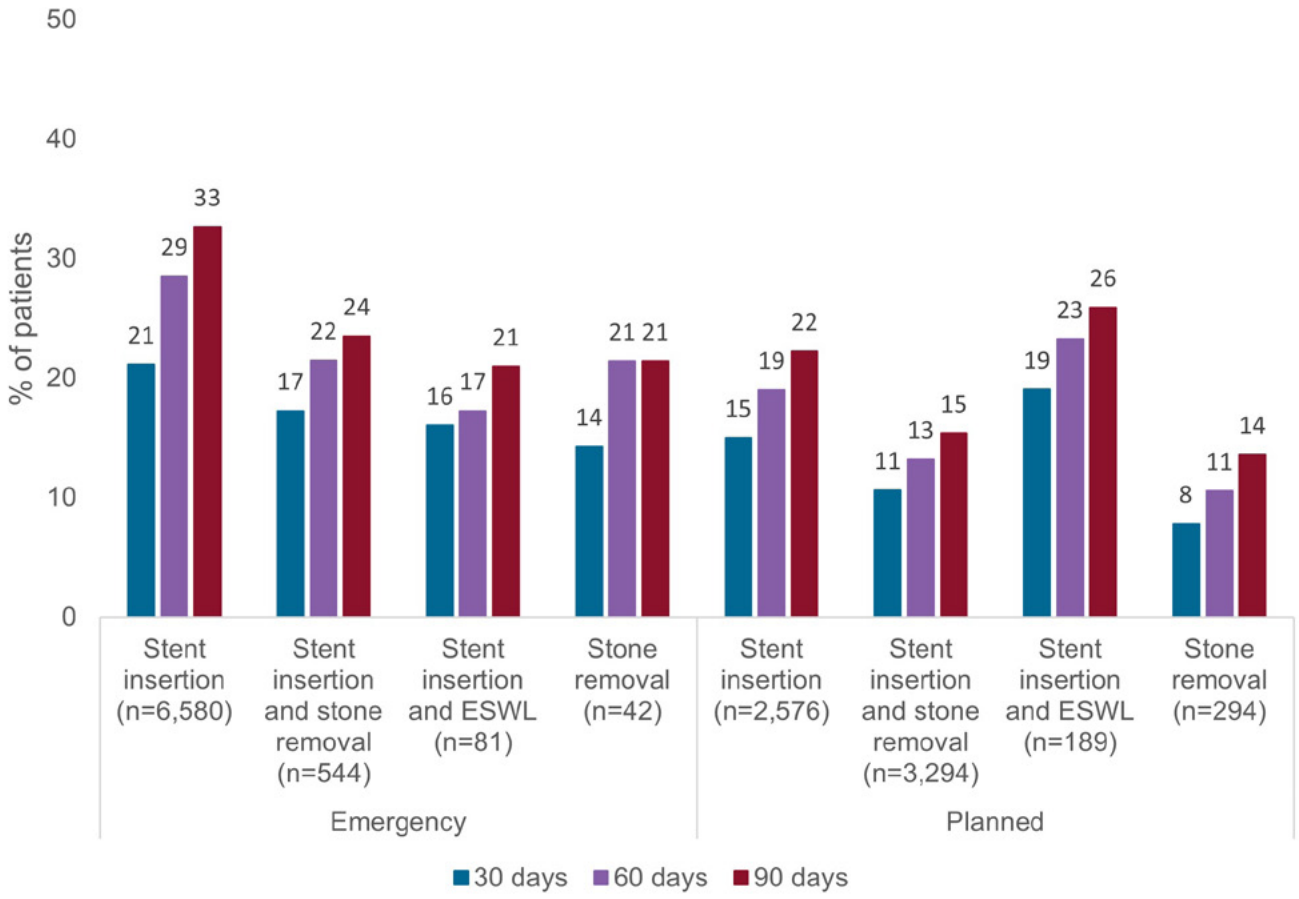


Figure 14: Odds ratio and p-value for factors associated with unplanned emergency department presentations within 30, 60, and 90 days following initial urinary stone disease procedure, by urgency status of procedure, NSW public and private hospitals, July 2016 to June 2019

Emergency

	Odds ratio (p-value)		
Variable	**30 days**	**60 days**	**90 days**
Age	0.99 (<0.01)	0.99 (<0.01)	0.99 (<0.01)
Female	1.21 (<0.01)	1.20 (<0.01)	1.23 (<0.01)
Charlson Comorbidity Index	1.06 (0.04)	1.08 (<0.01)	1.11 (<0.01)
Procedure – relative to stent insertion			
Stent insertion and stone removal	0.91 (0.46)	0.80 (0.06)	0.74 (0.01)
Stent insertion and ESWL	0.61 (0.12)	0.43 (0.01)	0.45 (0.01)
Stone removal	0.55 (0.19)	0.63 (0.23)	0.53 (0.10)

Planned

	Odds ratio (p-value, 95% confidence interval)		
Variable	**30 days**	**60 days**	**90 days**
Age	1.00 (0.58)	1.00 (0.51)	1.00 (0.27)
Female	1.18 (0.04)	1.25 (<0.01)	1.26 (<0.01)
Charlson Comorbidity Index	1.02 (0.68)	1.06 (0.25)	1.12 (0.02)
Procedure – relative to stent insertion			
Stent insertion and stone removal	0.76 (<0.01)	0.75 (<0.01)	0.74 (<0.01)
Stent insertion and ESWL	1.05 (0.82)	1.00 (0.98)	0.94 (0.74)
Stone removal	0.59 (0.02)	0.63 (0.02)	0.70 (0.05)

Figure 15: The most common principal diagnoses and procedures for stent insertion patients admitted to hospital following an unplanned emergency department presentation within 30 days, NSW public and private hospitals, 2018-19

Principal diagnosis	Number (%)	Principal procedure	Number (%)
T83 Complications of genitourinary prosthetic devices, implants, and grafts	196 (21%)	No principal procedure recorded	638 (67%)
N20 Calculus of kidney and ureter	97 (10%)	36821-03 Endoscopic replacement of ureteric stent	33 (3%)
N39 Other disorders of urinary system	83 (9%)	36833-01 Endoscopic removal of ureteric stent	31 (3%)
R10 Abdominal and pelvic pain	72 (8%)	95550-03 Allied health intervention, physiotherapy	29 (3%)
A41 Other sepsis	54 (6%)	95550-09 Allied health intervention, pharmacy	29 (3%)
N13 Obstructive and reflux uropathy	53 (6%)	36818-00 Endoscopic ureteric catheterisation with fluoroscopic imaging of upper urinary tract, unilateral	21 (2%)
N23 Unspecified renal colic	52 (5%)	95550-00 Allied health intervention, dietetics	21 (2%)
R31 Unspecified haematuria	38 (4%)	95550-01 Allied health intervention, social work	19 (2%)
N99 Intraoperative and postprocedural disorders of genitourinary system	21 (2%)	36809-01 Endoscopic destruction of ureteric lesion	17 (2%)
T81 Complications of procedures	20 (2%)	36821-01 Endoscopic insertion of ureteric stent	11 (1%)
Total	**946**	**Total**	**946**

Findings – Evidence synthesis

Key findings

- There is mixed evidence on outcomes for stenting versus no stenting in patients with urinary stone disease and the association between stent dwell time and complications.
- Some studies, including two systematic reviews and a meta-analysis, report that compared to no stenting, ureteral stenting may be associated with significantly longer operation time, higher rates of urinary symptoms, higher reintervention rate and lower stone-free rate.
- A Cochrane review, a systematic review and other studies reported no significant differences for operation time, rates of urinary tract infection, secondary interventions or stone-free rates.
- Complications associated with stenting include stent encrustation, stent migration, stent irritation and stent discomfort.
- The UK National Institute for Health and Care Excellence found no evidence that renal and ureteric stents before surgery improve outcomes and suggests that stents may impede beneficial outcomes for stones of 10-20mm.

Patient outcomes

Ureteral stenting

Two systematic reviews, one meta-analysis, two reviews, one randomised controlled trial and one retrospective study reported on outcomes for ureteral stenting for treating urinary stone disease. Compared to no stenting, ureteral stenting may be associated with:

- significantly longer operation time[4-6]
- higher rates of haematuria,[4, 6, 7] urinary symptoms,[4, 7] urinary infection[4, 6] and dysuria[4, 6]
- lower stone-free rate[4, 6, 8] or similar stone-free rate[5]
- postoperative urosepsis[9]
- higher reintervention rate[10]
- pain[7] or higher pain on postoperative days four to thirty[11]
- negative effects on general health and work performance[7]
- lower risk of unplanned readmissions[4, 6, 11] and hospital admissions[11]
- reduced need for narcotics[11]
- reduced ureteral stricture rates up to 90 days.[11]

Other complications that may be associated with stenting include stent encrustation, stent migration, stent irritation[12] and stent discomfort.[13]

A Cochrane review, one systematic review, one review, one non-randomised prospective study, one randomised trial, two retrospective studies and one retrospective analysis reported no significant differences for stenting compared to non-stenting for:

- operation time[7]
- mean length of stay[6, 14, 15]
- stone-free rates[10, 14]
- spontaneous stone passage[16]
- complication rates[8, 10, 14, 15]
- pain on the day of surgery or on post-operative days one to three[11]
- rates of urinary tract infection[6, 11]
- secondary interventions (three more per 1000 participants)[11]
- anaesthetic events or anaesthesia time[17]
- normalisation of leukocytic count and temperature[15]
- analgesic consumption.[15]

One randomised trial reported significantly lower operation time for stenting group compared to emergency ureteroscopy group.[15] A separate randomised controlled study found ureterorenoscopy without double-J stenting may be more advantageous in terms of patients' daily physical functioning and quality of life[18] compared to double-J stenting and extracorporeal shock wave lithotripsy.

Two studies compared outcomes of stenting in pregnant women. A comparison in pregnant patients of ureterolithotripsy with stenting and stenting only found no significant differences for complications. The ureterolithotripsy group had a significantly higher average operation time, less need for additional intervention and significantly less lower urinary tract symptoms or flank pain between operation and birth.[19] A prospective study on double-J ureteric stenting in pregnant women reported two-thirds of patients had a clinical improvement immediately or soon after surgery.[12]

The National Institute for Health and Care Excellence guideline on renal and ureteric stents before surgery reports no evidence that stents improve outcomes and, rather, may impede beneficial outcomes for stones of 10-20mm. Stenting was associated with more retreatments and adverse events compared to non-stenting.[20] According to the European Association of Urology, routine stenting after uncomplicated ureteroscopy is unnecessary and may be associated with higher post-operative morbidity and costs.[21]

Ureteroscopy without stenting

Two systematic reviews and a retrospective cohort study reported complications following ureteroscopy including:

- febrile urinary tract infection or systemic inflammatory response syndrome[22, 23]
- post-operative fever[23]
- haematuria[24]
- lower urinary tract symptoms[24]
- abdominal/flank/pelvic pain.[24]

One systematic review on bilateral simultaneous ureteroscopy reported stone-free rate close to 90%, mean operative time 57.7 minutes and mean hospital stay of two days.[24] A randomised prospective trial on the safety and efficacy of emergency ureteroscopy found no significant differences in complications or stone-free rate compared with scheduled ureteroscopy. Stone-free rate in the emergency group was 93% and 90% in the scheduled group.[25]

Ureteric stent dwell time

A retrospective cohort study and an observational study on ureteric stenting for seven days, or more than seven days, reported no significant differences for complications including:

- stone clearance[26]
- fever[26]
- mucosal injury[26]
- blood transfusion[26]
- residual stones[26]
- ureteral perforation[26] or ureteral injury[27]
- ureterostenosis requiring surgical intervention[26]
- mean operative time[27]
- stone-free rate.[27]

A survey on pain after ureteral stent removal reported patients with a stent indwelling ≤7 days were significantly more likely to experience pain after stent removal (33.3%) compared to those with a stent >7 days (22.8%).[28] Two prospective studies found prolonged duration (>30 days) of indwelling ureteral stent or ureteral catheter may be associated with a higher risk of operative sepsis[29] or urinary tract infection.[30]

A retrospective observational study reported the amount of encrustation and length-of-hospital stay increased with indwelling time. It also found a significant correlation between indwelling time and stent stone burden. As indwelling time increased, more complicated operations were required for stent removal.[31] Forgotten or encrusted stents may lead to a range of urinary system infections, including loss of renal function.[32] A multimodal approach may be required for the management and removal of forgotten stents.[33]

A retrospective study on the relationship between internal ureteric stent dwell time and urinary tract infections reported optimal ureteric stent dwell time is less than one month to reduce pre-lithotripsy urinary tract infection.[34] According to the European Association of Urology, the ideal duration of stenting is not known but it is often one to two weeks after ureteroscopy.[21]

Findings – Experiential evidence

Key findings

There were 25 responses to the questionnaire: seven urologists and 18 nurses, including two nurse practitioners and a clinical nurse consultant. Respondents were from 10 LHDs (Central Coast, Nepean Blue Mountains, North Sydney, South Eastern Sydney, South Western Sydney, Sydney, Western Sydney, Hunter New England, Mid North Coast and Western NSW). An outline of procedures performed by the urologists in treating urinary stone disease is shown in Figure 16 and the clinical settings is shown in Figure 17.

In total, nine respondents (seven urologists, a nurse practitioner and one nurse consultant) selected from a pre-defined list, the main indications or decision-making processes for surgical stone

Figure 16: Procedures performed by urologists

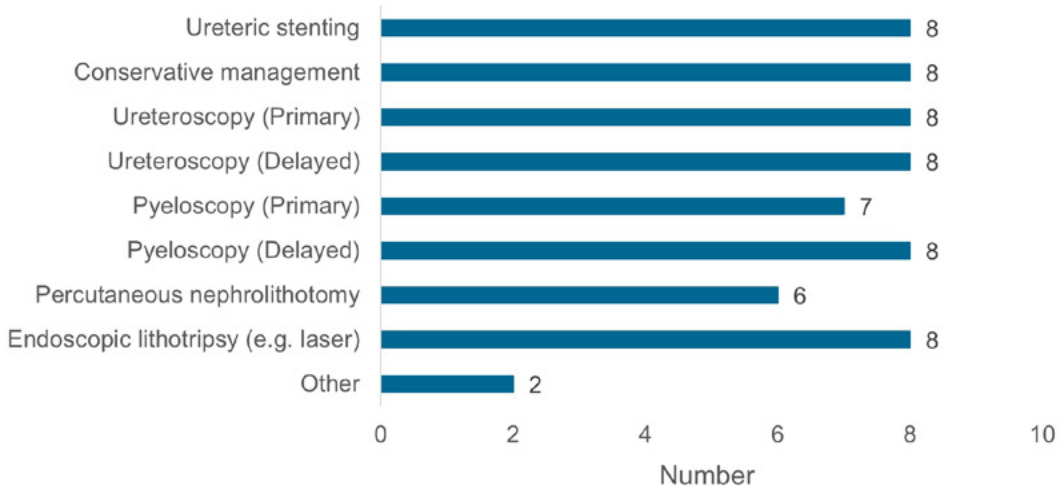
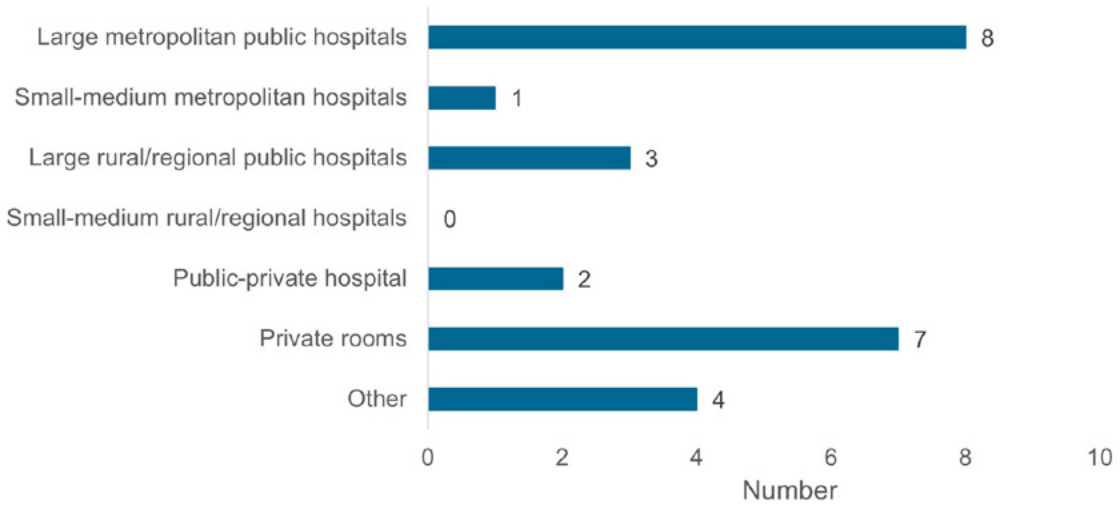


Figure 17: Clinical settings



management for patients with urinary stone disease. Surgical procedures included: ureteric stenting, conservative management, ureteroscopy (primary and delayed), pyeloscopy (primary and delayed), percutaneous nephrolithotomy and extracorporeal lithotripsy (see Table 1).

Most respondents suggested the indicators for ureteric stenting were urinary tract infection (UTI) and sepsis (n=9), pain (n=8), stone size (n=8) and obstruction (n=7). For conservative management, stone size was identified by eight respondents, with variation for other indicators such as UTI/sepsis (n=4), pain (n=5), and obstruction (n=4). Indications and decision-making processes for ureteroscopy (primary) included pain (n=6) and access to laser (n=8). There was variation in responses for stone size (n=5), UTI/sepsis (n=4) and obstruction (n=4). For ureteroscopy (delayed), access to laser (n=6), UTI/Sepsis (n=7) and stone size (n=6) were identified by respondents. For pyeloscopy (primary and delayed) and percutaneous nephrolithotomy, most respondents (n=8) suggested that stone size was the main indicator, with variation reported for UTI incidence and sepsis, pain, and obstruction across these procedures. Access to laser was a key factor for extracorporeal lithotripsy (n=7); however, there was inconsistency in reported indications across respondents, including stone size (n=5), pain (n=4) and obstruction (n=3).

Table 1: Overview of surgical procedures for the surgical treatment of urinary stones and indications and decision-making processes

Indications	UTI/Sepsis	Pain	Stone size	Obstruction	Access to laser	Primary endoscopy
Ureteric stenting	9	8	8	7	3	2
Conservative management	4	5	8	4	1	1
Ureteroscopy (Primary)	4	6	5	4	8	5
Ureteroscopy (Delayed)	7	4	6	4	6	3
Pyeloscopy (Primary)	4	6	8	5	7	3
Pyeloscopy (Delayed)	6	4	8	3	6	1
Percutaneous nephrolithotomy	4	1	8	4	0	0
Extracorporeal lithotripsy (e.g., laser lithotripsy)	2	4	5	3	7	2

Table description: respondents were asked to select what indicators and decision-making processes should guide the selection of each surgical treatment for urinary stones. Nine respondents (seven urologists, in addition to one nurse practitioner and one nurse consultant) answered the multiple-choice question and the number in the table is the total response rate.

Respondents suggested further decision-making processes that guide the choice of surgical approach:

- Ureteric stenting: previous patient experiences (e.g., ability or inability to tolerate a stent), theatre availability, large stone burden and before lithotripsy, hydronephrosis, renal function, or patients with a solitary or transplant kidney.
- Conservative management: stone size (e.g., under 7mm), stone location (e.g., evidence of progression down the ureter), absence of obstruction, sterile urine, duration of symptoms, hydronephrosis, antibiotics use, and the patient's occupation and perceptions about treatment.
- Ureteroscopy: availability of staff, equipment/instrumentation and theatre, failure of conservative management (e.g., increasing pain, stone fails to progress and increasing obstruction), sterile urine, no fever, stent insertion and the location of the stone.
- Pyeloscopy: availability of staff (including the skill of the surgeon), equipment/instrumentation and theatre, sterile urine, stone size (e.g., under 4mm and 2cm in symptomatic or asymptomatic patients, respectively) and any stone in patients with solitary/transplant kidney.
- Percutaneous nephrolithotomy: availability of staff (including the skill of the surgeon), equipment and theatre, stone burden (e.g., greater than 2cm), and patient factors (e.g., obesity) and in the chronic hydronephrotic kidney.
- Extracorporeal lithotripsy: availability of staff and equipment/instrumentation, no infection or hydronephrosis, ureteric and bladder stones, renal stones less than 2cm and sterile urine.

Eighteen nurses, including two nurse practitioners and a clinical nurse consultant, described how nurses should provide preoperative and postoperative care for patients with urinary stone disease.

Nurses suggested their role in preoperative care for patients with urinary stone disease should include providing health education and the provision of resources (n=9), coordinating care (n=4), managing patient expectations (n=4), monitoring and treating symptoms (n=5), assessing and managing pain and discomfort (n=5) and providing supportive care (n=2).

Similarly, nurses suggested their role in postoperative care should include providing immediate care (e.g., catheter and wound care), monitoring and escalation if required (n=4); assessing and managing pain and discomfort (n=1); providing health education and the provision of resources (n=5); discussing lifestyle changes to prevent recurrence (n=4); and providing discharge advice, including the coordination of follow up testing, imaging, and support (n=5).

Barriers to providing care to patients with urinary stone disease included:

- inadequate and delayed pain management (n=3)
- limited specialised nursing knowledge and skill (n=9)
- lack of care models, policies, or guidelines (n=4)
- patient complexity and nurse-to-patient ratios (n=4)
- inadequate communication between the emergency department and ward (n=1).

Some respondents (n=3) also suggested that the identification of stones in the community is often delayed. As well, there is a lack of resources to provide supportive care to reduce the burden of urinary stone disease.

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Appendix 1: Data methods

Quantitative data were drawn from:

- NSW Admitted Patient Data Collection (APDC) and NSW Emergency Department Data Collection (EDDC), accessed via the Hospital Performance Dataset (HoPeD), NSW Ministry of Health Secure Analytics for Population Health Research and Intelligence. HoPeD was established under clause 17(2) of the Health Administration Regulation 2017. HoPeD comprises linked administrative data on emergency department presentations, inpatient admissions, and deaths, and was prepared by the Centre for Health Record Linkage (CHeReL).[32]
- NSW Waiting List Collection Online System (WLCOS), Enterprise Data Warehouse for Analysis Reporting and Decision support (EDWARD), System Information and Analytics Branch, NSW Ministry of Health.

People admitted to hospital with urinary stone disease principal diagnosis were identified using a selection of codes from the International Statistical Classification of Diseases and Related Health Problems, 10th revision, Australian Modification (ICD-10-AM) (Table 1).

We did not include admitted patient episodes where urinary stone disease was an additional diagnosis. We may be underestimating the healthcare required by people with urinary stone disease.

People undergoing procedures in hospital for urinary stone disease were identified using a selection of codes from the Australian Classification of Health Interventions (ACHI) (Table 2).

Removal of people from the waiting list for urinary stone disease procedures were identified using waiting list procedure codes (Table 3).

To identify the first type of procedure for people with urinary stone disease, we selected their first hospital admission with urinary stone disease principal diagnosis AND one of the following procedures – stone removal, stent insertion, and/or ESWL.

To identify the subsequent procedure for people with urinary stone disease principal diagnosis that underwent ureteric stent insertion first, we looked for the earliest episode within one year with stone removal or ESWL procedure, regardless of the principal diagnosis on the subsequent procedure. For most of the subsequent procedures the principal diagnosis was urinary stone disease (88% in 2018-19).

We looked at all cause unplanned emergency department presentations within 30, 60, and 90 days of initial procedure for urinary stone disease. Emergency department diagnoses are recorded by medical, nursing, or clerical personnel at the point of care. They can be non-specific, and symptom or syndrome based. For this reason, it can be difficult to determine the exact reason for an emergency department presentation.

All cause presentations are used in this analysis because of this difficulty and the relative difference in presentations by procedure type is of interest rather than the absolute number of presentations. All cause unplanned emergency department presentations following initial procedure were modelled using a generalised linear mixed model with a logit link and age, sex, Charlson Comorbidity Index, and procedure type as fixed effects and hospital as random effect.

Albury Base Hospital was excluded from all analyses because it is managed by Victoria Health. Hospital admissions that occurred only in the emergency department were also excluded from the analyses.

In some cases, an admitted patient service provided during a hospital stay may be performed by another facility or health service under a contractual agreement. In these analyses the hospital stay and service were attributed to the admitting hospital.

In 2018-19, among the 15,736 admitted patient episodes with urinary stone disease principal diagnosis, 78% had a contract status of "single facility admitted patient care", 21% had "not a contract service provided at this facility", and 1% involved a contract service.

Data are provided up to the end of the financial year 2018-19. Although more recent data are available, they overlap with the COVID-19 pandemic when elective surgery was interrupted and was not indicative of usual practice.

Table 1: Urinary stone disease diagnosis codes

ICD-10-AM	Description
N13.2	Hydronephrosis with renal and ureteral calculous obstruction
N20.1	Calculus of ureter
N20.2	Calculus of kidney with calculus of ureter
N23	Unspecified renal colic

Table 2: Urinary stone disease procedure codes

ACHI code	Description
Stone removal	
36809-00	Endoscopic fragmentation of ureteric calculus
36809-01	Endoscopic destruction of ureteric lesion
Stent insertion, replacement, or removal	
36821-01	Endoscopic insertion of ureteric stent
36821-03	Endoscopic replacement of ureteric stent
36833-01	Endoscopic removal of ureteric stent
Extracorporeal shockwave lithotripsy (ESWL)	
36546-00	Extracorporeal shockwave lithotripsy [ESWL] of urinary tract

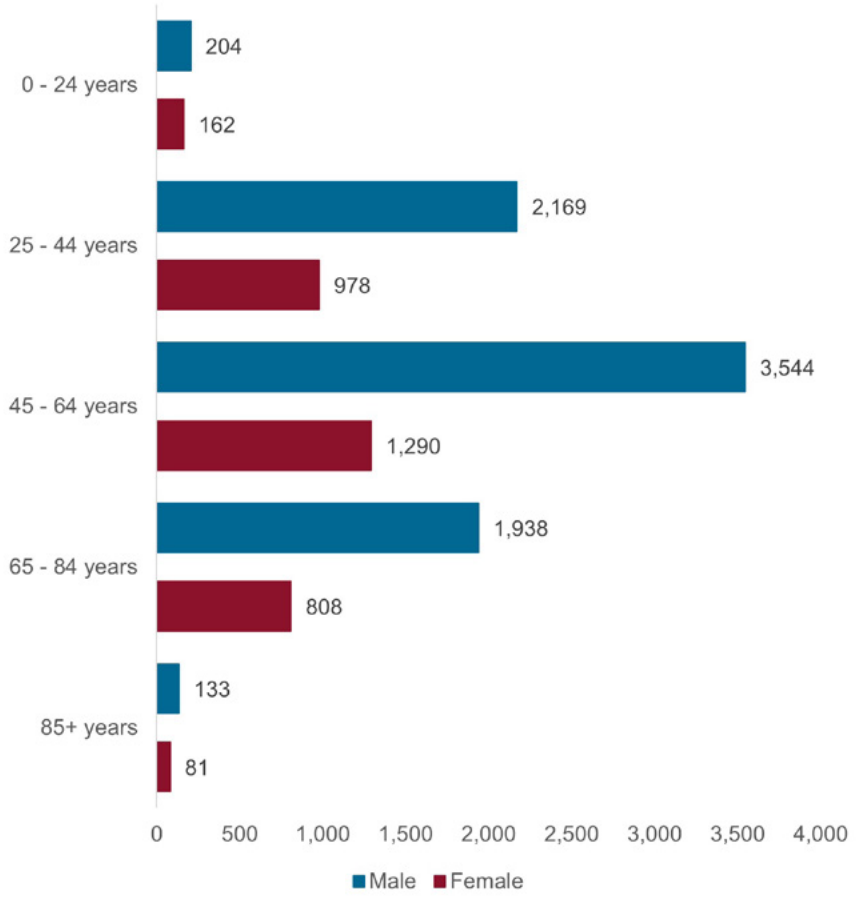
Table 3: Waiting list data procedure codes

Code	Procedure
142	Insertion of ureteric stent
148	Removal of stone from urinary tract

Appendix 2: Additional figures

In 2018-19, 11,307 people were admitted to a NSW hospital with a urinary stone disease principal diagnosis. The age and sex breakdown of these people is provided in Figure 1.

Figure 1: Number of people admitted to NSW hospital with urinary stone disease principal diagnosis by age and sex, NSW public and private hospitals, 2018-19



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