NHS England

GIRFT
GETTING IT RIGHT FIRST TIME

GIRFT Greener Pathways: A practical guide to decarbonising the urinary tract stones pathway

June 2026

We are grateful to the clinicians and patients who engaged with the production of this guide through visits and stakeholder discussions.

GIRFT Greener pathways identify opportunities for the NHS to improve or maintain the quality of patient care while mitigating its environmental impact. These pathways are developed using the cross-specialty, clinically-led GIRFT 'Environmental Lessons Learned and Applied' (ELLA) approach, which uses the clinical pathway as its starting point. We support trusts to build a Greener NHS and meet their commitment to deliver a net zero health service. Find out more at www.gettingitrightfirsttime.co.uk/greener-pathways

Get involved

If you have suggestions or comments on this pathway, or could contribute to making other clinical pathways greener, we encourage you to share these on our FutureNHS discussion page or by email to girft.academy@nhs.net

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Foreword

This is the third Greener Pathways guide developed and released by the Getting It Right First Time (GIRFT) programme, supporting the NHS in its target to reduce greenhouse gas emissions while consistently pursuing improvements in care quality. Opportunities to modify urinary tract stone care pathways have been demonstrated which offer major reductions in greenhouse gas emissions.

The analysis that has guided the recommendations that we developed in this document was carried out in accordance with the Environmental Lessons Learned and Applied (ELLA) framework. The modelling undertaken is informed by contemporary data, including randomised controlled trials of urinary stone treatment undertaken in the UK and the NHS Model Health System. Taking a fresh look at clinical data with environmental sustainability in focus has outlined where substantial opportunities exist to improve care, not only from an environmental perspective but in terms of clinical outcomes, patient experience and value for money.

As always, this GIRFT initiative has benefited from the expert input of a range of collaborators spanning primary to tertiary care and representing different national organisations. It has also benefited from the involvement of patients, who have provided valuable insights and shaped the recommendations. This workstream has the support of UKRI and NIHR funding through the Sustainable Health Systems Hub based at the University of Exeter. This support, coupled with engagement and dialogue from across the NHS, will help us to understand how to further improve the ELLA methodology and accelerate our sustainable transition.

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Introduction

Who should use this guide?

This document is designed for healthcare professionals and managers who deliver and support the care for patients with upper urinary tract stones.

Why use this guide?

- The NHS produces 4-5% of the UK's carbon emissions (20-25 million tonnesCO_2e).
- The NHS has a legal net zero target by 2045. Meeting this target across society is crucial to avoid the most severe health impacts of climate change.
- The expert group modelled multiple care pathway adaptations and identified 18 key recommendations for decarbonising the management of urinary tract stones.
- The adaptations described within often offer co-benefits that support the NHS core purpose; to promote health and deliver safe, efficient, cost-effective and high-quality care for all.

Kidney stone disease is common, affecting around one in ten adults, and has a marked tendency to recur. More than 50% of patients will have another episode within 5–10 years without targeted prevention [1,2,3,4]. Stone disease is increasingly recognised as climate-sensitive, with higher ambient temperatures and heatwaves associated with short-lag increases in stone presentations, and modelling suggests that climate change will further increase stone burden and costs [5,6,7]. Lifestyle measures that prevent stones also address upstream cardiovascular and metabolic risk, so prevention-focused, low-carbon pathways deliver multiple co-benefits for patients and the wider health system [8,9,10,11,12,13].

How to use this guide:

The guide describes best practice alongside estimates of the associated greenhouse gas emissions for a typical UK hospital, to guide prioritisation. Each recommendation is intentionally deliverable on a reasonably short timescale. Delivery will involve multiple team members. Support from operational hospital management, sustainability teams and executives is vital for successful delivery. The actions can inform hospital green plans, guiding the NHS net-zero transition.

In keeping with the GIRFT Patient Voice Principles, we have sought insights and feedback from patients with lived experience. The recommendations contained in this guidance are intended to be tailored for local implementation and, in doing so, commissioners and providers should involve patients in accordance with the NHS Act 2006.

Clinical, patient, and scientific acceptability:

This guidance has been co-developed with a wide group of stakeholders to ensure appropriate recommendations and reasonable 'best estimates' of environmental impact.

Addressing climate change – a work in progress:

The 18 recommendations described are not an exhaustive list of all actions that can be taken to deliver sustainable care for patients with urinary tract stones. The intent is that these high impact actions can be updated as new innovations and research on best practice become available.

Approach to estimating carbon emissions reductions:

We used a cradle-to-grave approach to produce attributional carbon emissions reduction estimates for each recommendation. This was supported by evidence from peer-reviewed literature and primary modelling. We adjusted data reported in peer-reviewed studies to better describe contemporary NHS practice, for example by adjusting to the average 'carbon intensity' of UK electricity. We used databases such as Ecoinvent and the Department for Energy Security and Net Zero carbon emissions factor database to identify relevant characterisation factors. Our estimates for the carbon footprint of specific activities, such as patient travel or an hour of operating theatre time, were our best estimates of average hospital activity in England in 2026. Actual values across the NHS will differ depending on local circumstances, for example distance to hospital, the mode of transport used, or the energy efficiency of operating theatres.

To estimate the number of patients for whom a given recommendation could be realised, we used a range of data sources, including Office for National Statistics data, Hospital Episode Statistics, peer-reviewed literature and focused questionnaires of relevant healthcare professionals. These values were then combined with relevant carbon emissions reduction estimates at a patient level to estimate the potential to reduce carbon emissions nationally over one year.

A description of the methodological framework used (Environmental Lessons Learned and Applied - ELLA) is published and available open access [14]. A document outlining the methods and calculation steps informing this guide will be published online.

List of the highest impact recommendations

Highest impact clinical recommendations to decarbonise urinary tract stones care	Annual emissions reduction across England (t CO_2e)*
Prevention	
1. Address modifiable risk factors for stone formation	2,418
Acute ureteric colic	
2. Optimise diagnostic pathways for suspected ureteric colic	140 [110]
3. Provide appropriate medical management for ureteric colic	135 [106]
4. Avoid temporising upper tract drainage for uncomplicated colic	1,382 [1089]
5. Minimise unnecessary ureteroscopy and ESWL for ureteric stones	298 [235]
Extracorporeal shockwave lithotripsy (ESWL)	
6. Offer ESWL first line for ureteric and renal stones requiring treatment and likely to be cleared within three treatments	2,402 [1893]
7. Implement a Greener ESWL procedure	80 [63] (24)
Surgical preparation	
8. Offer same day or remote preoperative assessment	87 [69] (31)
9. Optimise theatre list efficiency for stones	30 [24] (9)
Ureteroscopy (URS) and laser lithotripsy	
10. Decarbonise ureteroscopy, laser lithotripsy and anaesthesia	330 [260] (98)
11. Maximise day-case ureteroscopy rates	95 [75] (28)
Percutaneous nephrolithotomy (PCNL)	
12. Decarbonise PCNL surgery and anaesthesia	21 [16]
13. Minimise length of stay after PCNL	103 [82]
Outpatient management	
14. Maximise virtual case review and remote consultations	343 [271]
15. Streamline follow up of lower risk patients after renal stone treatment	2,299 [1,748] (2,218)
16. Direct access for advice and reassessment	138 [108] (148)
17. Avoid overtreating asymptomatic renal stones	665 [524]
18. Adopt greener endoscope management	-
Maximum total reduction if fully implemented	9,091

*tCO2e = tonnes of carbon dioxide equivalent greenhouse gas emissions
[ ] = estimated GHG emissions reduction if secondary prevention (recommendation 1) optimally achieved
( ) = estimated GHG emissions reduction if ESWL is optimally used instead of ureteroscopy (recommendation 7)
GHG = Greenhouse gas

1. Address modifiable risk factors for stone formation

Actions

- Use all opportunities including acute presentations to educate patients about how they should personally reduce their risk of stone formation.
- Offer access to different resources to support stone prevention, including written information in simple English with pictograms, one-to-one advice, group sessions and social prescribing.
- Address all relevant risk factors, including:
    - Fluid intake: advise 2.5 – 3 litres daily and/or consistently clear urine. Avoid disposable bottled water if tap water is of drinking quality.
    - Diet: low or no meat, low salt, high in seasonal fruit, vegetables and fibre.
    - Metabolic health: address obesity and Type 2 diabetes with diet and exercise.
- Incorporate kidney-healthy lifestyle guidance into existing long-term condition reviews.

Rationale

Many urinary tract stones are preventable through lifestyle modification, possibly by 50% for recurrent stones for many people[15]. A greater focus on secondary prevention is needed to support patients to address their modifiable risk factors, which can also reduce the risk of cardiovascular disease and certain cancers. Multi-modal and flexible approaches are likely to improve suitability for patients and therefore engagement. Low carbon models could include peer support group sessions, nationally available webinars and use of apps.

The environmental and monetary costs of treating urinary tract stones is very large in comparison to the simple measures that many can take to prevent stone formation. Patient reference group contributors reported that information about stone type could help motivate them to pursue preventative lifestyle measures.

Benefits

<u>Emissions reduction</u>
130 kg CO_2e per case
19 tonnes CO_2e per average unit annually
2,418 tonnes CO_2e across England annually

<u>Patients</u>
Fewer painful colic episodes
Less time away from usual activities
Fewer invasive procedures
Reduced risk of cardiovascular events and some cancers [8,9,10,11,12]

<u>Health service</u>
Cost saving
Resource releasing (theatres, inpatients, acute services)

2. Optimise diagnostic pathways for suspected ureteric colic

Actions

- Offer CT KUB to all non-pregnant adults for whom ureteric colic is the primary differential diagnosis.
- Perform ultra-low dose CT KUB for adults with suspected ureteric colic if BMI ≤30.
- Manage suspected colic in ED or an ambulatory surgery clinic rather than via default inpatient admission when safe.
- Offer access to a same-day emergency care (SDEC) pathway with CT KUB for patients attending primary care with suspected ureteric colic.
- Facilitate out-of-hours reporting for CT KUB performed out of hours.
- Ensure systems for image transfer when patients are being referred between trusts to reduce the need for repeat imaging.

Rationale

Managing patients on ambulatory pathways avoids unwarranted hospital admission and patient medicalisation. Same day suspected ureteric colic pathways could be delivered through community diagnostic centres nearer to patients' homes, with urology advice, guidance and onward management provided where necessary.

Ultra-low dose CT imaging can adequately detect most stones ≥3mm. Low and ultra-low dose CT offer greater diagnostic information than plain x-ray and ultrasound while crucially limiting cumulative radiation exposure for recurrent stone formers. Ultrasound or plain x-ray are less diagnostically useful and more likely to introduce management delays, although they can play an important role in planning and delivering ESWL.

Benefits

Emissions reduction

23.5 kg CO_2e per case

1.1 tonnes CO_2e per average unit annually

140 tonnes CO_2e across England annually

Patients

Timely and convenient management

Possibility of investigations nearer to home in CDCs

Health service

Improved inpatient bed availability

Improved efficiency

3. Provide appropriate medical management for ureteric colic

Actions

- If the primary differential diagnosis is ureteric colic:
  - Provide non-steroidal anti-inflammatory drugs, paracetamol and consider tamsulosin.
  - Do not routinely provide opioid analgesia.

Rationale

The British Association of Urological Surgeons (BAUS) renal colic audit identified that 29% of patients were not provided with diclofenac[16]. Effective analgesia with NSAIDs and paracetamol will maximise the likelihood of successful conservative management, reduce reattendances to primary and secondary care and avoidable interventions. Opioid analgesia is less effective for treating ureteric colic pain and often causes side effects such as nausea and vomiting, which can lead to hospital admission and further pharmacotherapeutic management.

Short course NSAID use is likely to be safe to manage acute colic for most patients. This includes those with a minor creatinine elevation without additional acute kidney injury risks (e.g. dehydration, renal vascular disease, sepsis). Patients at a higher risk of ischaemic cardiac events or heart failure can be offered short course NSAIDs that have a lower risk of cardiac toxicity (e.g. ibuprofen or naproxen rather than diclofenac) or non-NSAID analgesia. BNF contra-indications and cautions should be regarded.

The differing ways that pain is communicated by patients should be considered to avoid under-treating certain people, including women and minority ethnic groups [17,18].

Benefits

Emissions reduction
6.26 kg CO_2e per case on average (range 0 - >300 kg CO_2e)
1.05 tonnes CO_2e per average unit annually
106 tonnes CO_2e across England annually

Patients
Improved pain control
Higher rates of successful conservative management

Health service
Fewer hospital admissions
Fewer avoidable procedures
Lower costs

4. Avoid temporising upper tract drainage for uncomplicated ureteric colic

Actions

- The main absolute indications for temporising upper urinary tract drainage with retrograde stent or nephrostomy are infected obstructed kidney or obstructed solitary kidney.
- For refractory pain and renal impairment, provide definitive primary stone treatment.
- Ensure timely (<48 hours) access to primary stone treatment is available, including:
    - Routinely available laser safe theatres (via CEPOD or hot lists).
    - Routinely available laser trained theatre staff for CEPOD / hot lists.
    - Local or regional access to acute primary ESWL.

Rationale

Minimising the rate of temporising upper urinary tract drainage procedures will reduce the total number of surgical procedures that patients undergo in their definitive management. Stents often cause troublesome symptoms which cause additional healthcare encounters, pharmacotherapy use and time off work while awaiting definitive treatment. Nephrostomies are variably tolerated and are prone to blockage and displacement.

Benefits

<u>Emissions reduction</u>
138 kg CO_2e per case
10.8 tonnes CO_2e per average unit annually
1,089 tonnes CO_2e across England annually

<u>Patients</u>
Fewer surgical procedures
Faster definitive management

<u>Health service</u>
Lower cost
Efficient pathways
Greater operating theatre availability

5. Minimise unnecessary ureteroscopy and ESWL for ureteric stones

Actions

- Use an evidence-based calculator, such as the MIMIC calculator, to inform patients of their estimated spontaneous stone passage (SSP) rate.
- Recommend conservative management for patients with a moderate or high probability of SSP.
- Appropriately manage symptoms and expectations.
- Consider medical expulsive therapy for patients with distal ureteric stones <10mm
- Allow sufficient time for SSP, ideally up to four weeks.

Rationale

Here, 'unnecessary treatment' is an intervention delivered when an adequately counselled patient would have been safe and willing to undergo conservative management aiming for spontaneous stone passage.

While rapid access to ureteroscopy and ESWL are important features of a modern urological service, patient selection should be towards those unlikely to spontaneously pass stones. There should be a preference for avoiding the risks and resource use involved in ureteroscopy or ESWL if the SSP probability is high, and treatment should not be offered simply because it is available. Patients should be appropriately counselled about their own SSP probability and what different management options involve. Direct routes back for urological advice and reassessment should be offered to all patients with ureteric stones.

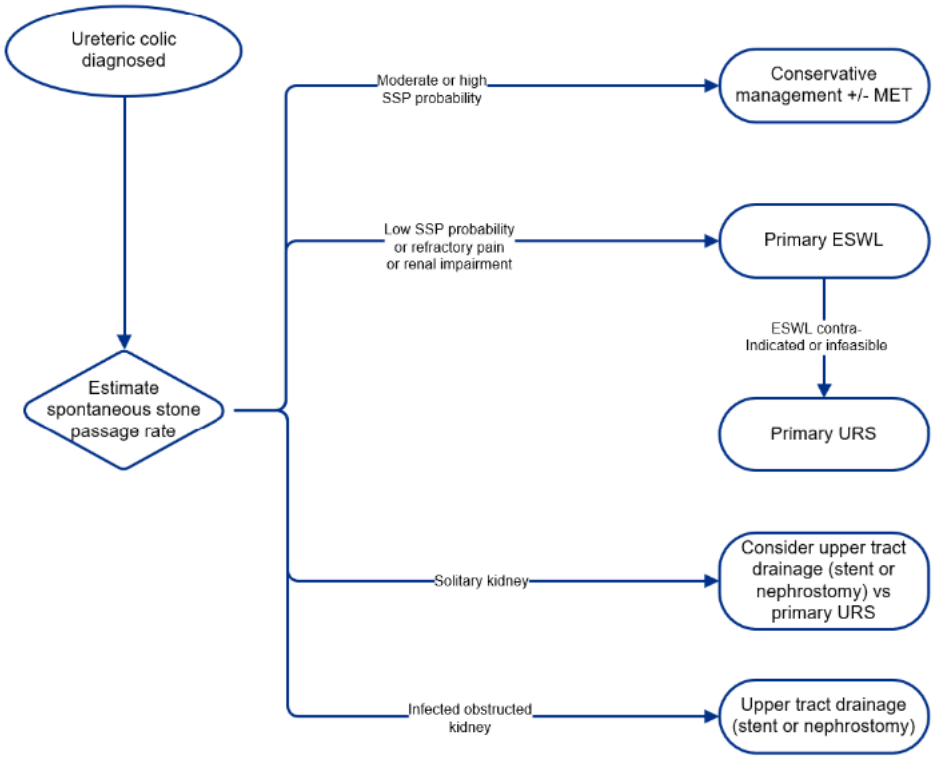
Benefits

Emissions reduction
23 - 151 kg CO_2e per case
2.3 tonnes CO_2e per average unit annually
298 tonnes CO_2e across England annually

Patients
Avoiding unnecessary treatment
Shared decision making
Better access to treatment when needed

Health service
Lower costs
Shorter waiting lists

Figure 1: Recommended acute ureteric colic management



SSP = spontaneous stone passage,
MET = medical expulsive therapy,
ESWL = extracorporeal shockwave lithotripsy,
URS = ureteroscopy and lithotripsy.

6. Offer ESWL first line for suitable ureteric and renal stones requiring treatment

Actions

- For patients with ureteric colic a fast track (<48 hours) ESWL service should be offered.
- Regional services should be configured to support uniform ESWL access.
- Offer fixed site over mobile lithotripsy due to superior clearance rates.
- ESWL centres should perform consultant review of all referrals to ensure suitability and avoid overtreatment of patients who would benefit from conservative management.
- Use a prediction tool or your unit's data to estimate ESWL and ureteroscopy stone clearance rates.
- Enable data-informed patient choice.
- Ensure patients on low income are aware of the Healthcare Travel Costs Scheme.

Rationale

ESWL is less resource and carbon intensive compared to ureteroscopy (~23kg CO_2e per treatment vs ~151kg CO_2e), and it avoids invasive surgery and anaesthesia. Randomised control trial data has demonstrated that ESWL requires a higher number of treatments on average for ureteric and renal stones, yet it remains more cost effective, with patient reported outcomes being the same or better[19,20]. Mobile lithotripters have been shown to have substantially lower stone clearance rates than fixed site lithotripters[21]. The Healthcare Travel Costs Scheme covers travel costs for eligible patients and carers referred to secondary care. This is particularly relevant for ESWL, where fixed site units are often regionalised and patient might require several treatments.

Benefits

Emissions reduction

128+ kg CO_2e per case

18.8 tonnes CO_2e per average unit annually

2402 tonnes CO_2e across England annually

Patients

Avoid invasive surgery and anaesthesia

Health service

Lower costs

Better operating theatre availability

7. Implement a green ESWL procedure

Actions

- Avoid routine use of personal protective equipment (PPE).
- Routinely offer paracetamol and non-steroidal anti-inflammatory drugs, and opiates if required.
- Sedation should not be routinely offered, and do not use Entonox.
- Consider intra-procedure breaks to improve treatment tolerability for patients.
- Aim for at least three patients per half day or six patients per full day list.
- Where >1 stone requires treatment, aim to complete treatment in one session if in anatomically distinct locations and tolerated by the patient.

Rationale

PPE should not be routinely required because ESWL does not involve contact with patient bodily fluids. ESWL can be successfully and comfortably delivered without the use of sedation. If anxiolysis is required following appropriate analgesia, Entonox should not be used because it contains nitrous oxide, which is a potent greenhouse gas. Breaks during lithotripsy, and the use of music, can improve tolerability for patients. By treating more than one stone for a patient when safe to do so, additional travel for additional ESWL might be avoided.

Benefits

Emissions reduction

2.0 kg CO_2e per case

0.62 tonnes CO_2e per average unit annually

80 tonnes CO_2e across England annually

Patients

Improved treatment tolerability

Fewer analgesic side effects

Health service

Lower costs

8. Offer same day or remote preoperative assessment

Actions

- Offer all patients preoperative investigations on the day they are listed for surgery.
- For ASA 1-2 patients, offer same day face-to-face preoperative nursing assessment or remote assessment on another day.
- For ASA 3-4 patients, offer same day face-to-face preoperative nursing assessment.
- Configure services to offer same day consultant anaesthetic review when required.
- Build capacity and expertise to deliver same day assessment close to or within urology investigation units. Procure necessary equipment to facilitate this.

Rationale

More than 30,000 patients undergo surgery for urinary tract stones in England each year, most of whom require preoperative assessment. Currently, very few patients undergo a same-day or remote preoperative assessment nationally. Same day or remote assessment can avoid additional patient travel, is generally preferred by patients, and could shorten the time to surgery depending on service configuration and theatre availability.

Benefits

Emissions reduction

3.4 kg CO_2e per case

0.68 tonnes CO_2e per average unit annually

87 tonnes CO_2e across England annually

Patients

Fewer hospital appointments

Faster management

Health service

Better pathway performance

9. Optimise theatre list efficiency for stones

Actions

- Surgeons and anaesthetists should review operating lists 1-2 weeks in advance to ensure investigations are complete and results actioned.
- Carry sufficient equipment to support high volume low complexity (HVLC) lists.
- Adopt GIRFT guidance on preoperative urine testing for URS and PCNL.
- For primary emergent ureteroscopy and ESWL, proceed if asymptomatic of infection and give antibiotic prophylaxis 30 minutes before the procedure.
- Arrange routine access to microbiology advice for complex surgical prophylaxis cases.
- For ureteroscopy, target six or more cases per all day list, depending on case complexity.
- For ureteroscopy and PCNL:
    - Minimise turnaround time between cases and audit this periodically.
    - Co-ordinate radiographer availability to avoid delays and cancellations and consider training theatre practitioners in C-arm use.
    - Minimise the time for which stented patients are on waiting lists.

Rationale

Teamwork and shared responsibility can enable efficient theatre lists. Timely starts and efficient theatre turnaround ensures the optimal number of patients can be treated. Early start times should be arranged with radiography to enable maximal theatre usage. If radiographers are not available before 9am then theatre practitioners should be trained in safe C-arm use. HVLC lists, such as dedicated ureteroscopy lists, can be more efficient. Having sufficient equipment available will reduce reprocessing delays and cancellations. Urgently treating stented patients will reduce the likelihood of substantial stent encrustation, which can increase case time and complexity.

Benefits

Emissions reduction

9.5 kg CO_2e per case

233 kg CO_2e per average unit annually

30 tonnes CO_2e across England annually

Patients

Better access to treatment

Fewer cancellations

Health service

Lower costs

Better theatres availability

10. Decarbonise ureteroscopy, laser lithotripsy and anaesthesia

Actions

- Only open the following when a clear need is identified: second guidewire, laser fibre, retrieval basket, flexible ureterorenoscope, access sheath, ureteric stent.
- Use reusable gowns and drapes.
- Do not routinely insert ureteric stents following ureteroscopy.
- Use stent on string for all short-term stents, with arrangements for self-removal.
- Avoid PPE for patient transfers.
- Consider spinal anaesthesia for ureteric and renal stones for selected patients and avoid desflurane and nitrous oxide use for general anaesthesia.
- If using laryngeal mask airways, use reusable versions.
- Avoid routine intravenous crystalloid use.

Rationale

An effective theatre briefing and good intraoperative communication can help to reduce avoidable waste. Stent on string removal at home is well tolerated and can avoid additional travel and cystoscopic removal [22]. Patients should be consented for this and offered information and access to support. Some units already perform ureterorenoscopy under short acting spinal anaesthesia, which has a low carbon footprint and can allow rapid recovery of motor function [23]. Desflurane and nitrous oxide are both potent greenhouse gases which should not be used [24].

Benefits

Emissions reduction

11.8 kg CO_2e per case

2.6 tonnes CO_2e per average unit annually

330 tonnes CO_2e across England annually

Patients

Fewer invasive procedures if stent on string used

Health service

Lower costs

11. Maximise day case ureteroscopy rates

Actions

- Adopt a day case as default approach and list as a day case operation.
- Provide written and verbal patient information describing the day case pathway.
- Ensure availability of postoperative home supervision during preoperative assessment.
- Before the day of surgery contact patients to verify day case preparation.
- Utilise cold site day case units / wards where possible.
- Use spinal anaesthesia if appropriate.
- Deliver a protocolised nurse-led discharge by staff trained in day case pathways.
- Advise patients to have simple analgesia available at home.

Rationale

Top performing trusts safely deliver >80% of URS as day case. This involves leadership, clear pathways and team motivation. In the resource-intensive inpatient setting recovery is slower and patients are often subjected to needless tests and monitoring. The GIRFT/BADS day surgery delivery pack provides additional advice on optimising day-case rates. Units can monitor their day case rates using the Model Health System.

Some patients with complex social circumstances might lack sufficient support at home to undergo day case surgery, and others might be unable to afford their own analgesia at home. Preoperative assessment should screen for these circumstances, and appropriate adjustments should be made in advance.

Benefits

Emissions reduction

23.5 kg CO_2e per case

0.75 tonnes CO_2e per average unit annually

95 tonnes CO_2e across England annually

Patients

Faster recovery at home

De-medicalised care

Health service

Inpatient bed availability

Lower cost

12. Decarbonise PCNL surgery and anaesthesia

Actions

- Only open the following when a clear need is identified:
  - Additional guidewires.
  - Retrieval baskets.
  - Stents.
- Use reusable sterile gowns and drapes.
- Avoid nephrostomy unless clinically indicated.
- Avoid ureteric stent unless clinically indicated, using stent on string when appropriate.
- Avoid routine PPE for patient transfers.

Rationale

Equipment waste and energy-intensive reprocessing can be avoided if equipment is readily available but only opened when needed.

Benefits

Emissions reduction

9.0 kg CO_2e per case

279 kg CO_2e per average unit annually

21 tonnes CO_2e across England annually

Patients

Avoidance of nephrostomy and stent and associated symptoms

Health service

Lower costs

13. Minimise length of stay after PCNL

Actions

- Minimise length of stay for admitted patients using enhanced recovery pathways:
  - Provide mixed media patient education about enhanced recovery pathway.
  - Provide a pre-operative glucose drink.
  - Use anaesthetic modalities that reduce post-operative nausea and vomiting.
  - Promote drinking, eating and mobilising post-operatively on the day of surgery.
  - Have a pre-emptive analgesia protocol.
  - If used, clamp the nephrostomy early and aim to remove it day 1 post-op, with clear procedures agreed for removal on the ward.
- Indications for blood tests after PCNL: bleeding or infection concerns, CKD.
- Consolidate low volume practices to form higher volume centralised PCNL centres.

Rationale

There is substantial variation in the postoperative length of stay after PCNL across England, with an upper decile benchmark of 1.8 days and the remaining 90% of units having an average length of stay of 3.9 days. Enhanced recovery pathways can enable shorter length of stay safely and promote faster recovery with fewer hospital acquired complications. There is an association between lower volume practices and longer length of stay for PCNL and centralisation could support improvements in length of stay and outcomes[25].

Benefits

Emissions reduction

50 kg CO_2e per case

1.38 tonnes CO_2e per average unit annually

103 tonnes CO_2e across England annually

Patients

Faster and less medicalised recovery

Health service

Improved inpatient bed availability

Lower cost

14. Maximise virtual case review and remote consultations

Actions

- Most referrals can be assessed using telephone or video consultation, with a review of imaging and investigations and a clinical history.
- Patients requiring physical examination (such as those being listed for surgery or with abnormal anatomy) should undergo in person assessment, ideally on the same day as preoperative assessment.
- Job plan consultant time for virtual case review and stone meetings.
- Stone meetings should be supported by a booking clerk who can access and schedule theatre diaries.

Rationale

Several units already deliver a high-volume stones service with use of virtual and remote review and consultation. This is safe and avoids road travel, expense and time away from the patient's usual activities [26]. It can help to ensure that patients are managed flexibly and in an appropriate timeframe. Delivery of virtual case review and consultations should be appropriately recognised in job plans and the appropriate administrative support available.

Benefits

Emissions reduction

10.8 kg CO_2e per case

2.7 tonnes CO_2e per average unit annually

343 tonnes CO_2e across England annually

Patients

Rapid assessment and management planning

Fewer hospital visits

Less time away from usual activities

Health service

Faster pathways

More efficient use of clinical expertise

15. Streamline follow up of patients after renal stone treatment

Key safety principles

- Inform all patients, carers and family members about the symptoms associated with renal obstruction and advise them to seek medical attention if these occur at any point.
- Follow up patients with ultra-low dose (ULD) CT for the minimum time necessary to determine stone growth kinetics.

Actions

- To detect residual stones, ULD CT should be used rather than x-ray or ultrasound.
- If there is a high stone free certainty after treatment, offer patient initiated follow-up (PIFU) for 12 months and then discharge if no concerns.
- If there is low to moderate stone free certainty: perform early ULD CT, offer PIFU for 12 months if stone free and then discharge if no concerns.
- For smaller residual stones (</=5mm): consider performing a baseline ULD CT and a 12 month follow-up ULD CT. If stone size is stable either discharge or treat up front.
- For larger residual stones (>5mm): consider up front treatment aiming for stone free status.

Rationale

The goals of follow-up after renal stone treatment are to assess for residual stones and, if present, their growth kinetics. Adequate counselling about the symptoms of upper urinary tract obstruction should help to mitigate the risk of delayed presentation of so called 'silent obstruction'. Historic follow-up regimes have involved protracted annual follow-up with low sensitivity imaging (x-ray or ultrasound). This will neither guarantee stone detection nor guarantee detection of obstructive uropathy within a suitable timeframe. Ultrasound also overestimates size of small stones. Shorter follow-up using higher sensitivity CT imaging can facilitate early informed decision making and discharge for many patients.

Benefits

Emissions reduction

49.1	kg CO_2e per case
18	tonnes CO_2e per average unit annually
2,299	tonnes CO_2e across England annually

Patients

Fewer healthcare encounters

Less time away from usual activities

Health service

Lower costs

Less resource use (clinical and diagnostic imaging)

16. Provide direct access for specialist advice and reassessment

Actions

- All patients with conservatively managed colic, and postoperative patients, should have access to specialist advice and pathways for specialist reassessment.
- In office hours: provide telephone contact for a specialist stone or urology nurse.
- Out of hours: provide telephone access to the acute surgical admissions ward who can liaise with urology out of hours cover when necessary.
- Pathways providing access to acute surgery/urology reassessment should be available. Where possible, these should bypass primary care and the emergency department and capitalise on same-day emergency care (SDEC) facilities.
- All patients should be informed about the expected symptoms after treatment of stones, or when undergoing conservative management of ureteric colic. Pre-emptive analgesia should be provided for these patients.

Rationale

These measures can ensure that patients requiring advice or reassessment do not undergo unwarranted delays in accessing this. For those patients developing serious complications, more direct access to urology advice and reassessment could provide more timely definitive specialist management. Setting patient expectations and advising about symptom management can help to avoid hospital reattendances in some instances.

Benefits

Emissions reduction

16.3 kg CO_2e per case

1.1 tonnes CO_2e per average unit annually

138 tonnes CO_2e across England annually

Patients

Faster access to specialist advice and care

Health service

Lower burden on ED and primary care

17. Avoid overtreating asymptomatic renal stones

Actions

- Primary care physicians should have access to timely advice and guidance and use this in the first instance for asymptomatic renal stones.
- Referrals for patients with asymptomatic renal stones should document a validated frailty score and comorbidities.
- Provide information about stone prevention to all patients with renal stones.
- Consider the risk of harm from an asymptomatic renal stone against patients' competing health risks, including frailty and the risks of undergoing treatment.
- Recommend watchful waiting for patients with moderate or severe frailty unless there is a high risk of harm which outweighs any treatment and competing health risks.

Rationale

Asymptomatic renal stones are common, and their incidental detection is likely to continue to rise due to increasing rates of imaging. Many renal stones will remain asymptomatic or pass spontaneously and do not necessarily require treatment [16,27].

Frail patients have a greater propensity to form renal stones and are those most at risk of treatment complications and of realising no treatment benefit due to competing health risks [28]. Frailty scores such as the Electronic Frailty Index (eFI), Hospital Frailty Risk Score (HFRS) and Rockwood Frailty Scale can support improved shared decision making [29].

Benefits

Emissions reduction

107.9 kg CO_2e per case

5.2 tonnes CO_2e per average unit annually

665 tonnes CO_2e across England annually

Patients

Fewer unnecessary treatments

Health service

Lower costs

Less service demand

18. Adopt greener endoscope management

Actions for urologists and researchers:

- Urologists should not base their decision to use single use urological endoscopes on sustainability grounds as current evidence is low quality and not generalisable.
- Follow international standards for conducting and reporting life cycle assessments for endourology equipment and fully explore how sustainability can be optimised.

Actions for trusts to optimise reusable endoscope reprocessing:

- Handle endoscopes with care and ensure decontamination staff are highly trained.
- Transport scopes in protective containers to, ideally, same-site decontamination facilities.
- Use optimally filled automated decontamination units and avoid excessive PPE use during decontamination (1 x apron, 1 x non-sterile gloves, 1 x reusable face shield or goggles).
- Aim to avoid vacuum packaging endoscopes for storage.

Actions for endoscope manufacturers:

- Commit to understanding 'hotspots' in your product life cycles and generate ambitious, evidence-based mitigation plans for these.
- Explore introducing circular design, including moving towards reuse of components.
- Recognise that open loop recycling of materials is generally not a suitable end goal in the pursuit of optimal environmental sustainability.

Rationale

There is a substantial body of published data describing the environmental performance of single use cystoscopes and ureteroscopes compared to reusable alternatives. Most of these studies do not present sufficient data and methodological descriptions to determine their reliability or the generalisability of their findings. Progress in sustainable endoscopy research will require leadership and a transparent open science approach.

The management of reusable cystoscopes and ureteroscopes can be optimised in numerous ways and units should seek to achieve these to reduce the environmental impact of reprocessing and maximise the working lifetime of endoscopes. The environmental impact of single use devices is predominantly determined by manufacturing and disposal.

Glossary

Organisations / groups

APOM	Anaesthesia and Perioperative Medicine
ASA	American Society of Anaesthesiologists
BADS	British Association of Day Surgery
BAUN	British Association of Urological Nurses
BAUS	British Association of Urological Surgeons
BSoT	BAUS Section of Trainees
BSUR	British Society of Urogenital Radiology
GIRFT	Getting It Right First Time
NHS	National Health Service
NIHR	National Institute for Health and Care Research
RCoA	Royal College of Anaesthetists
RCP	Royal College of Physicians
RCS	Royal College of Surgeons
UKRI	UK Research and Innovation

Definitions

Where emission reductions are described in ‘tonnes CO2e per average unit annually’, an average unit means a unit that is an average size and with average performance relative to defined optimal practice.

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Acronyms / abbreviations

CDC	Community Diagnostic Centre
CEPOD	Confidential Enquiry into Perioperative Deaths
CO_2e	Carbon dioxide equivalent greenhouse gas emissions
CT	Computed tomography
ED	Emergency department
ELLA	Environmental Lessons Learned and Applied
ESWL	Extracorporeal Shockwave Lithotripsy
GHG	Greenhouse gas
HFRS	Hospital Frailty Risk Score
HVLC	High volume low complexity
KUB	Kidneys, ureters and bladder
MET	Medical Expulsive Therapy
NSAID	Nonsteroidal Anti-Inflammatory Drug
PCNL	Percutaneous Nephrolithotomy
PIFU	Patient initiated follow up
PPE	Personal protective equipment
SDEC	Same Day Emergency Care
SSP	Spontaneous Stone Passage
ULD CT	Ultra-low dose computed tomography
URS	Ureteroscopy

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This is the third guide in the series and follows the release of the Greener Bladder Cancer and Greener Hip Replacement pathway guides.

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