Design for Life Pilot Project

Cambridge University Hospitals NHS Foundation Trust

The Design for Life team, in collaboration with key partners, is working with pilot sites in the NHS to explore the potential for switching from single-use to reusable medtech products. This initiative aims to identify barriers, opportunities, and the benefits of such a transition, focusing on sustainability, cost savings, and improving healthcare efficiency. By quantifying these benefits, the project supports the NHS's broader goal of reducing waste and promoting a circular economy in medical technologies.

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Background:

Medical scopes are essential medical instruments used in diagnostic and therapeutic procedures. While they are used for different clinical purposes, they have similarities in features, all are thin, flexible or rigid tubes equipped with a camera and light source to provide visualisation inside the body. There is some overlap in the clinical teams who use each type of scope. This report has examined current usage of the three types of scope.

Bronchoscopes are used to examine and treat conditions affecting the airways and lungs by inserting a flexible tube with a camera into the airways. They allow doctors to view the inside of the bronchial tubes, diagnose diseases, take tissue samples, remove foreign objects, and perform treatments. Both single use and reusable scopes are available for use in the NHS and practice varies.

We have focussed on exploring practice and use of bronchoscopes in this report, however have highlighted some variation in practice from a sustainability perspective between bronchoscopes and two additional scopes.

- Ureteroscopes are specialised instruments used in operating theatres for procedures involving the ureter and kidneys allowing for examination and treatment of conditions such as kidney stones, ureteral strictures, and tumors. Common procedures performed with ureteroscopes include stone removal, biopsy, tumor resection, and stent placement or

removal, offering patients minimally invasive treatment options with shorter recovery times compared to traditional surgery

- Cystoscopes are used across multiple clinical settings, including theatres, endoscopy units, wards, and outpatient clinics, for examining and treating conditions affecting the bladder. Their primary function is to assess the bladder and lower urinary tract. Cystoscopies are commonly performed to investigate symptoms such as hematuria (blood in urine), recurrent infections, or bladder tumors, and they enable interventions such as biopsy, tumor resection, or catheter placement.

Cambridge context

Cambridge University Hospitals are a founder member of the Circular Economy Healthcare Alliance and the switch to reusables is at the heart of the Green Plan. As a Trust we are anxious to move forward much more strongly with reusable med tech but find this a challenging area due to complexities in clinical needs and practice. Positively, use of bronchoscopes, ureteroscopes and cystoscopes is largely reusable in our Trust. This project is supportive to understand variation in practice and barriers to implementation of 100% reusable.

Specific Aims:

Explore and understand reasons for hybrid use of both reusable and single use bronchoscopes and reusable and single use ureteroscopes/cystoscopes in the Trust

To identify and quantify potential benefits compared to single use and project impact should the Trust adopt reusables more fully.

Methods

Bronchoscopes:

Clinical usage:

Endoscopy:

For many years the Endoscopy service has only used reusable scopes to perform bronchoscopies. Bronchoscopes are ordered through the NHS Supply chain.

Single use was trialled on one occasion for a patient with specific needs (a diagnosis of obsessive compulsive disorder), requiring a brand new scope. It was found by the doctor performing the procedure that the single use scope did not meet the same technological standard as the reusable option. Image quality was felt to be poorer, the scope wise more rigid and therefore slightly harder to maneuver and use, and it would not have been possible to do more beyond diagnostics in the procedure. While this is based on one clinical opinion, there is a perception in the endoscopy team that reusable scopes are able to provide better care and there is no interest to change current practice (e.g. switch to single use).

ICU:

ICU have 3 reusable scopes and it is understood from Central Sterile Services Department (CSSD) that the service switched to single use during the Covid19 pandemic and have not changed back.

However, CSSD continues to disinfect 3 reusable scopes per month for the ICU team which are returning monthly unopened.

The ICU team cited an article Comparative Study on Environmental Impacts of Reusable and Single-Use Bronchoscopes reporting this was discussed with consultants.

The study compares the environmental impacts of single-use and reusable bronchoscopes, specifically focusing on CO_2 emissions and resource consumption. It finds that reusable scopes, due to their cleaning processes, consume more energy and materials, which can lead to higher CO_2 emissions and resource use. However, if multiple scopes are cleaned with the same set of personal protective equipment (PPE), their environmental impact can be reduced, making the results more comparable to single-use scopes. Despite this, cleaning practices and the use of PPE are key factors influencing environmental outcomes. One potential issue with the study is the possible bias introduced by funding from a single-use scope company, which may have influenced the interpretation of results.

As the reusable scopes are reported to have a worse environmental impact in the study, the ICU team have opted to continue with single use scopes. The medical team are very happy with the current single use scopes clinically.

Decontamination Process:

The nursing team is responsible for collecting and preparing the necessary equipment for bronchoscopy procedures. After the procedure, when the doctor has finished using the bronchoscope, the nursing team is responsible for packing up. The bronchoscope is placed in a specific plastic tray with a red plastic cover to contain the bronchoscope during transportation. The nurse transports the scope on a trolley to the 'dirty room' in CSSD (located within the endoscopy department).

CSSD are then responsible for cleaning the scopes according to the manufacturer's instructions as 'gold standard'. Training is provided by the manufacturers if there are any changes. The service also complies with the technical guidelines set forth by the relevant ISO standards to ensure proper cleaning, maintenance, and safety protocols are adhered to during the process. The CSSD service is also accredited by the Joint Advisory Group on GI Endoscopy (JAG).

The scopes are pre cleaned and disinfected (sterilisation is not required) in an automated washer. When the scope is clean and ready to be stored, the tray's cover is green, indicating that the scope is clean and properly prepared for reuse. After cleaning, the bronchoscope is then placed in the clean storage area in a container with a green lid labelled with the time limit of 3 hours, until it is collected by the nursing team for clinical use again. The scopes are appropriate for clinical use for 3 hours. Beyond 3 hours it is viewed to have 'expired' and requires disinfecting in the washer again before clinical use. The CSSD team estimates that re-disinfecting occurs every day. They take steps to mitigate this (e.g. at the end of the day equipment is washed, but not put through washer until the morning to prevent duplication). Scopes that are not used daily are dried and vacuum packed which allows 30 days before disinfecting would need to be repeated before clinical use. It is not resource effective to vacuum pack all items. CSSD also has some dryer spaces, where scopes can be stored for 7 days.

Infection prevention and control (IPC) are not involved in the day to day running of the CSSD. Should there be any issues, such as an infection linked to use of the scopes, they would step in to undertake an investigation. However - this would be an extremely rare occurrence.

Usage Issues:

If there is an issue / malfunctions with the reusable scope or stack (the equipment setup or system used during the procedure) the service has backup options available by liaising with other services in the hospital (e.g. to replace a part). There is a contract in place with Karl Storz for repair of devices.

If there is a decontamination issue and reusable scopes cannot be cleaned, the service does not have single use scopes as a backup as it is felt they can't provide their usual standard of care. When decontamination services are stopped, the team set up an Incident management team (IMT) meeting. This is a multidisciplinary meeting that can be arranged quickly involving clinical nursing, decontamination, management and senior management representatives from the division to identify a plan and next steps. While this is not a common issue, when it does occur it can risk delays to patients accessing assessment, diagnosis and care. CSSD has back up from CCRC within the hospital as they have an endoscope washer.

Additional information

While the bronchoscopes themselves are reusable, many consumables required for the procedure (e.g., mouth guards, single use tubing, biopsy forceps, PPE, etc) are single use. While many of these items were reusable in the past, this change to single use occurred approximately 15 years ago. One key factor contributing to this being concerns related to Creutzfeldt–Jakob disease (CJD) infection. CJD is an incurable brain disease that leads to dementia, brain damage and death that can be transmitted through contaminated medical instruments.

Endoscopy as a specialty has evolved over time with new procedures and practices. Alongside this, infection prevention and decontamination testing and cleaning practices continue to evolve. Small equipment or intricate parts of equipment can be difficult to clean. Even if staff have adequate time to clean thoroughly, some parts of reusable scopes may still be difficult to disinfect completely, raising concerns over patient safety. Single use eliminates the uncertainty of whether equipment has been fully sanitised with greater staff trust in safety.

The BSG Guidance on Decontamination of Equipment for Gastrointestinal Endoscopy states (part 17):

"Single-use accessories should always be used. The choice of single-use biopsy forceps, guidewires and cytology brushes helps to minimise any possible risk of transmitting prion disease. Reusable accessories should be used only in situations where no single-use equivalent accessory exists, and they should be heat tolerant for sterilisation in the Sterile Services Department. Procedures should include a system for tracking use in each patient in these circumstances."

Measures and potential impact

Clinical

The use of reusable bronchoscopes is viewed to be clinically superior by the Endoscopy team.

As above, in rare cases that decontamination services are unavailable, Endoscopy stops their service. This risks delays in patient care which could follow on to delay time to diagnosis and subsequent treatment. Although incidents in decontamination are reported through the Datix system, these reports are not specific to endoscopy procedures. Instead, they reflect a broader issue affecting multiple services that rely on shared decontamination processes, including speech and language therapy (SLT), gynaecology, and others. An Incident management team (IMT) would be quickly established to mitigate delays as much as possible.

Environmental

Bronchoscopes

Greenhouse gas (GHG) emissions for both reusable and single-use bronchoscopes were estimated using a hybrid approach. As direct disassembly and weighing of the scopes was not feasible, material composition data was sourced from Bringier et al. (2023), assuming the scopes in the publication were equivalent in weight and materials to those used by Cambridge NHS Trust. Emissions were calculated by applying conversion factors from the 2024 UK Government GHG database and the ICE database to the materials and packaging. It was assumed both scope types were manufactured in Malaysia and shipped to the UK via container transport.

For the reusable bronchoscopes, it was assumed they would have a lifetime of 2,000 uses as per the published study (Bringier et al, 2023). The disinfection of reusable scopes followed a three-phase approach: pre-cleaning, washer disinfection, and post-cleaning. Data on consumables, as well as electricity and water usage for the washer, was provided by the decontamination training coordinator. For the pre-cleaning phase, this included the use of a single-use apron, a pair of single-use gloves, a cleaning brush, a dry wipe, 30 litres of water, and 90 ml of detergent per scope. For the washer disinfection, 31 litres of water, 3 kW of electricity, 36 ml of detergent, 66 ml of disinfector and 64 ml of activator for a 45 minute cycle was included per scope. After the washer cycle, a single-use apron and a pair of single-use gloves were used per scope. Additionally, it was assumed that scopes were placed in a dryer for 90 minutes.

Due to the seven-day shelf life of disinfected scopes, after which re-disinfection is required if unused, it was estimated that 20% of scopes underwent an additional disinfection cycle over the course of a year.

Table 1 details the GHG emissions of the single use and reusable bronchoscopes per use.

	GHG emissions per use (kgCO2e)		
	Raw materials, packaging, transport and disposal	Sterilisation/washing	Total
Single use Bronchoscope	3.91	n/a	3.91
Reusable Bronchoscope	0.0023	2.57	2.58

Greenhouse gas (GHG) emission modelling compared the current practice—using 207 single-use scopes and 6 reusable scopes to perform 466 procedures annually—with a proposed practice of using 100% reusable scopes for the same number of procedures. Table 2 presents the detailed GHG emissions for both scenarios.

Under current practice, total annual emissions are estimated at 1,611 $kgCO_2e$. Transitioning to fully reusable scopes is projected to reduce emissions to 1,443 $kgCO_2e$ per year, resulting in an annual saving of 168 $kgCO_2e$.

Table 2: Modelled GHG emissions

		Bronchoscopies performed annually	GHG emissions per year (kgCO2e)		
			Scopes	Additional disinfection (assumed 20%)	Annual
Current practice	Single use scopes	207	809	0	809
	Reusable scopes	259	668	133	802
	Total				*1,611*
Proposed practice	Reusable scopes	466	1,203	240	1,443

Financial impacts

Current Spend on Single-Use (Used in ICU, NCCI and A2)

- Total spend for 207 scopes: £46,500
- Cost per scope: £224.60

Reusable Scope Spend (in Endoscopy)

- Total spend for 5 reusable scopes: £27,000
- Cost per scope: £5,400
- Endoscopy used 6 scopes for 466 procedures in last financial year: Approximately 77.7 uses per scope annually
- Sterilisation cost per scope: £38 (taken from paper: Cost analysis of single-use (Ambu® aScope™) and reusable bronchoscopes in the ICU | Annals of Intensive Care inclusive of labour, equipment, and materials required)
- Cost per use: £107.50

Projection of savings: ICU/NICU/A2 switch to reusable

Assuming 207 procedures are undertaken per year and each reusable scope can be used 78 uses per year, 3 scopes would be required in ICU, NCCI and A2. It was reported from CSSD that ICU already have 3 reusable scopes available, however as we don't know their current condition and lifespan we have modelled impact based on purchase of 3 new scopes.

- Cost of 3 scopes: £16,200.

- Cost of sterilisation (207 procedures): £7,866
- Total first-year cost (reusable + sterilisation): £24,066

Potential savings in the first year from a switch to reusable scopes in ICU, NCCU and A2 would be **£22,434**. This does not include a small additional saving in reduced waste disposal costs. The savings will be higher in subsequent years as new scopes do not need to be purchased annually. The Trust expects equipment to last 10 years however significant image quality deteriorates after about 5 years. Research suggests the scopes can be used up to 2,000 times.

Other types of scopes

The below highlights variation in practice from a sustainability perspective between different types of scopes.

Ureteroscopes

Ureteroscopes are used solely by urology services however these services are provided in many locations in the hospital. Both single use and reusable ureteroscopes are available to purchase on the NHS Supply Chain.

Urology uses reusable rigid ureteroscopes and single use flexible ureteroscopes. Reusable flexible scopes were previously in use, however they were frequently damaged. This could lead to the quality of the scope being suboptimal, impacting on patient care. For example, if a reusable scope does not deflect adequately it can prolong operating time and impact clinical outcomes. Replacement also carried a large cost. Single use flexible scopes are now used due to logistics, portability and ease of use in clinics and during emergencies on wards. If reliability of the reusable scope could be improved, it is understood there would be no difference for staff or patients in using the single use or reusable scope.

Cystoscopes

Clinical usage information from endoscopy

Endoscopy reported that they find the quality of the reusable product is better and provides more options clinically. For example, with a single use scope, no therapeutic interventions can be undertaken and a stent cannot be removed. If a patient was identified as needing a therapeutic intervention, they would need to be rescheduled for a second endoscopy, increasing inefficiency and waste. In the event that reusable scopes are not available, the endoscopy team does default to single use. However, they will aim to adjust patient bookings to prevent booking patients who may require a second scope without reusable functions available. This has an impact on patients with delays to their care. The decontamination process is the same as for bronchoscopes as above.

Usage Issues:

If there is a decontamination issue (e.g. washers show high bacterial count when tested) and reusable scopes cannot be cleaned, the service does continue with use of single use scopes. This has occurred twice in the last year, however is usually an infrequent issue.

At the time of report writing, the service was using single use scopes due to a technical issue with the endoscopy machine's stacker processor (component of the machine that is responsible for processing

and transmitting the image from the scope to the monitor). This allows the medical team to view the inside of the patient's body during the procedure. A new part is required to fix the machine, and the team is currently waiting for its delivery to restore full functionality to the reusable scopes. This is not a common issue.

Discussion and conclusion

This review has highlighted variation in clinical practice of reusable versus single-use scopes across teams and departments. Some teams consistently favour reusable scopes, while others prefer single-use models for a range of reasons. Where reusable scopes are preferred, it was interesting to learn that practice varies in instances the scopes are not available (e.g. decontamination issues) from defaulting to single use or to canceling clinics. This could have a varied impact on patients and staff. It is positive that as a Trust we have reusable scopes and decontamination and sterilisation services in-house which provides supply chain resilience that single-use scopes wouldn't.

Several barriers were identified that impact consistent practice and a transition to reusables. There is variation in quality of scopes and what best suits clinical needs. Additionally, conflicting evidence around the environmental impact of reusable scopes contributes to uncertainty in decision-making even when staff have an interest and drive to practice sustainably. Operational challenges, including concerns that reusable scopes may not be returned promptly from the CSSD may impact on buy-in.

This work provides valuable insight into current variability and the operational, environmental, and clinical considerations influencing scope use.