

Main Article

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Disposable versus reusable fibre-optic nasendoscopes: a national survey of UK ENT surgical trainees and a single-centre cost-analysis

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Abstract

Background. This study primarily assessed ENT surgical trainees' preferences for the qualities of disposable and reusable fibre-optic nasendoscopes. Secondary aims included eliciting trainees' views on ENT surgery and climate change, and creating a single-centre per-use cost analysis for disposable and reusable fibre-optic nasendoscopes.

Methods. A cross-sectional study was formulated. An online survey consisting of multiple-choice and Likert-scale questions was distributed nationally. Cost analysis was performed using 2021–2022 data from the host institution.

Results. Twenty-four trainees responded. Data on disposable fibre-optic nasendoscopes showed no difference in overall satisfaction ($p = 0.244$). Reusable fibre-optic nasendoscopes had a lower cost per use compared with disposable nasendoscopes at 5 years (4.7 per cent reduction) and 10 years (7.1 per cent reduction). Of the trainees, 79.2 per cent were supportive of climate-friendly initiatives within ENT surgery, and 25 per cent felt supported by their departments.

Conclusion. Trainees' satisfaction with disposable and reusable fibre-optic nasendoscopes is similar. Cost analysis favours reusable fibre-optic nasendoscopes in the long term at the host institution. Empowering departments and trainees to pursue climate-friendly initiatives should be encouraged.

Introduction

Fibre-optic nasendoscopy is a commonly used procedure within the field of ENT surgery, primarily as a diagnostic evaluation tool for the upper aerodigestive tract.¹ Furthermore, it can be used therapeutically in situations ranging from aiding in the removal of foreign bodies to procedures involving the vocal folds.^{1,2} The versatility of this procedure means that fibre-optic nasendoscopes are used in a wide range of clinical settings, ranging from out-patient clinics to hospital in-patient and emergency consultations.¹

In the UK, there is a growing trend for ENT centres to have a mixture of reusable and disposable fibre-optic nasendoscopes available for clinicians to use.³ The coronavirus disease 2019 (Covid-19) pandemic has resulted in local infection policy and standard operating procedures being amended in some ENT centres, which potentially prevents clinicians from utilising Tristel (Newmarket, UK) or other cleaning wipes to reprocess their reusable fibre-optic nasendoscopes.³ Reusable fibre-optic nasendoscopes are designed to be multi-use; thus they require reprocessing after every use to sterilise them in order to reduce cross-contamination and clean the nasendoscope of bodily fluids sustained during previous use. Common manufacturers of reusable nasendoscopes within the UK are Olympus and Karl Storz. In contrast, disposable fibre-optic nasendoscopes are designed to be single-use, thus avoiding the need for reprocessing. In the UK, they are supplied by companies such as Ambu, a Danish company specialising in single-use endoscopy solutions.

The 26th United Nations Climate Change Conference ('COP 26'), which was held in Glasgow, Scotland, in November 2021, saw for the first time an open letter written by healthcare organisations representing 46 million healthcare professionals globally (approximately two-thirds of the global healthcare workforce), calling for national leaders and 26th United Nations Climate Change Conference country delegates to urgently step up action on climate change.⁴ Furthermore, in recent years, there has been an increased drive within the National Health Service (NHS) to address the impact that its healthcare services have on climate change, with action groups being formed to reduce the environmental impact of its equipment, medicines and resources.^{5,6} The Health and Care Act

2022 consequently put the NHS as the first healthcare organisation worldwide to integrate net zero carbon emissions into legislation, with the aim of reaching net zero for carbon emissions that the NHS controls directly (the NHS Carbon Footprint) by 2040 and reaching net zero for carbon emissions that the NHS can influence (the NHS Carbon Footprint Plus) by 2045.^{7,8} In addition, the NHS legislated that it will reduce its NHS Carbon Footprint by 80 per cent between 2028 and 2032 and its NHS Carbon Footprint Plus by 80 per cent between 2036 and 2039.^{7,8}

Anecdotally, there have been concerns about the increased plastic waste produced and the local environmental impact that occurs with disposable fibre-optic nasendoscopes. This study primarily aimed to be the first UK study to obtain a national impression of Health Education England ENT specialty trainees' and ENT-themed core surgical training trainees' views on disposable and reusable fibre-optic nasendoscope use during an emergency on-call consultation. The secondary aims of this study included: (1) creating a single-centre per-use cost analysis for reusable and disposable fibre-optic nasendoscopes based on usage during emergency on-call consultations and (2) eliciting participants' views on climate change and the ability to implement climate-friendly initiatives within their ENT surgery department.

Materials and methods

The NHS Research Ethics Committee tool provided by the Medical Research Council deemed that ethical approval was not required for this study.

A cross-sectional study was designed. The survey consisted of a mixture of multiple-choice, five-point Likert scale of agreeableness and free text questions in order to obtain a comprehensive overview of respondents' views on disposable and reusable fibre-optic nasendoscopes. Google® Forms was utilised as the online platform of choice to deliver the self-administered surveys. Google Forms requires participants to be signed in to a Google account to complete the survey, which prevents multiple entries from individual respondents. On 15 March 2022, an invitation to participate in the survey was sent out to ENT specialty training registrars and ENT-themed core surgical training trainees in the UK via their respective post-graduate departments alongside an introductory message. This invitation to participate closed to new responses on 15 May 2022. At the time of the survey being distributed, clear instruction was given to only participate if individuals were on a Health Education England ENT specialty training programme or an ENT-themed core surgical training programme. Study participation was voluntary, and no identifying information was collected.

Cost analysis for reusable fibre-optic nasendoscopes was performed using information obtained from the study host institution, the Norfolk and Norwich University Hospitals NHS Foundation Trust, over the financial year from April 2021 to April 2022. The Norfolk and Norwich University Hospitals NHS Foundation Trust is a tertiary centre whose ENT department supplies ENT services for patients within the Norfolk county region. This cost analysis was performed for fibre-optic nasendoscopes used for emergency on-call consultations only. Given that clinicians at the Norfolk and Norwich University Hospitals NHS Foundation Trust ENT department utilise a combination of reusable Karl Storz and disposable Ambu fibre-optic nasendoscopes, the total number of uses of fibre-optic nasendoscopes, regardless of reusability

status, was calculated by the summation of the number of times the ENT department had sent off reusable fibre-optic nasendoscopes for cleaning and the number of boxes of disposable fibre-optic nasendoscopes being bought every month to replenish existing stocks within that financial year.

The calculations used for this cost analysis were based on a similar US-based study investigating the per-use cost of reusable and disposable fibre-optic nasendoscopes.⁹ Initial, maintenance and repair costs were totalled for the reusable fibre-optic nasendoscopes and divided by annual number of uses to calculate a per-use cost. The current Karl Storz fibre-optic nasendoscope that Norfolk and Norwich University Hospitals NHS Foundation Trust utilises has been in service for 20 years; a 1-year, 5-year and 10-year per-use cost analysis was created by division of initial costs by the number of years. For the 5- and 10-year cost analysis, a 3.5 per cent discounting rate (as suggested by the National Institute for Health and Care Excellence (NICE)) was applied to future costs to account for opportunity and value cost lost.^{10,11} Maintenance and fees associated with reprocessing the reusable fibre-optic nasendoscope were added once subject to the 3.5 per cent discount, to calculate the per-use cost of the reusable fibre-optic nasendoscopes.

Statistical analysis was performed using R programming software (version 3.6.1). A Mann–Whitney U test was used to compare responses between disposable and all reusable fibre-optic nasendoscopes. Statistical significance was determined at $p < 0.05$. Likert-scale questions were converted to numeric values for analysis as follows: strongly disagree = 1; disagree = 2; neutral = 3; agree = 4; strongly agree = 5.

This study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology statement¹² (see Table 1 in the supplementary material, available on *The Journal of Laryngology & Otology website*).

Results

Demographic data

Twenty-four participants responded to our survey (16 specialty registrars and 8 ENT-themed core surgical training trainees). The breakdown of participants per hospital trust can be seen in Figure 1.

Table 1. Comparison of respondents' views on qualities of reusable and disposable fibre-optic nasendoscopes

Parameter	Disposable FNE* (score)	Reusable FNE† (score)	P-value
Ease of learning how to perform fibre-optic nasendoscopy	4.5	4.0	0.103
Image quality	3.9	3.5	0.897
Setup	4.6	3.9	<0.001
Manoeuvrability	4.4	3.9	0.105
Ergonomics	4.3	2.2	0.137
Ease of transport around the hospital	4.4	3.3	<0.001
Ease of access in the hospital	4.0	3.9	0.009
Overall satisfaction	3.7	3.4	0.244

*n = 21; †n = 24. FNE = fibre-optic nasendoscope

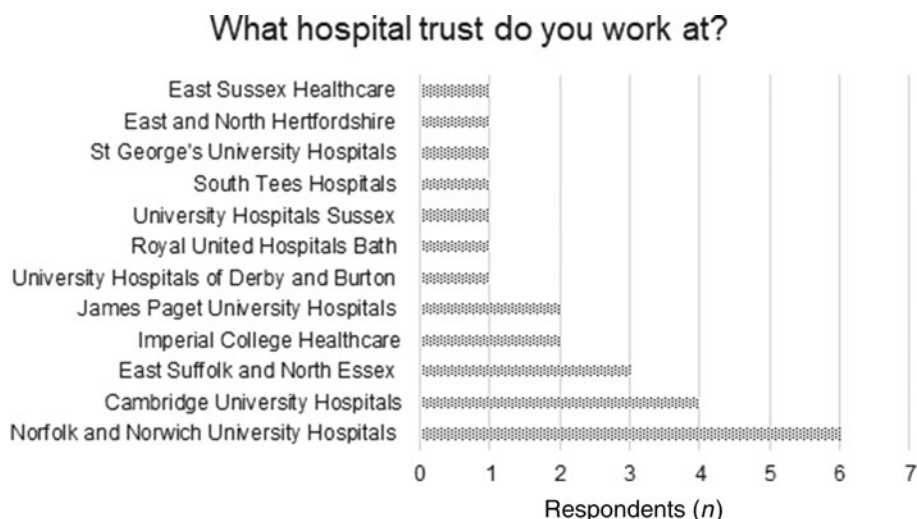


Figure 1. Respondents' current hospital trust employer.

Of the respondents, 79.1 per cent had initially learned to perform fibre-optic nasendoscopy using reusable fibre-optic nasendoscopes ($n = 19$), with the remainder learning to use disposable fibre-optic nasendoscopes ($n = 5$).

Reusable fibre-optic nasendoscopes were utilised by 100 per cent of participants in their practice, with an equal distribution between Karl Storz fibre-optic nasendoscopes ($n = 12$) and Olympus fibre-optic nasendoscopes ($n = 12$), and 87.5 per cent of participants utilised disposable fibre-optic nasendoscopes in their practice ($n = 21$), all of which were supplied by Ambu. Participants were split equally between disposable fibre-optic nasendoscopes ($n = 12$) and reusable fibre-optic nasendoscopes ($n = 12$) as the type of fibre-optic nasendoscope they used more on average in the clinical setting.

Fifty per cent of participants responded that their reusable fibre-optic nasendoscopes were sent to the endoscopy department for cleaning ($n = 12$); 20.8 per cent of participants responded that Tristel wipes or other cleaning wipes were used for cleaning their fibre-optic nasendoscopes ($n = 5$); 16.7 per cent responded that cleaning of their nasendoscopes involved a mixture of both sending the nasendoscopes to endoscopy and the usage of wipes ($n = 4$); and the remainder stated that cleaning was performed in house in the ENT department ($n = 3$).

Comparison of trainees' views on nasendoscopes

As seen in Table 1, respondents gave significantly higher average Likert scores in favour of disposable fibre-optic nasendoscopes over reusable fibre-optic nasendoscopes for ease of set-up ($p < 0.001$), ease of transport around the hospital ($p < 0.001$) and ease of access at the hospital ($p = 0.009$). Non-significant improvements in average Likert scores in favour of disposable fibre-optic nasendoscopes were noted for image quality ($p = 1.000$), manoeuvrability ($p = 0.084$), ergonomics ($p = 0.079$) and ease of learning ($p = 0.103$).

Overall satisfaction by trainees showed a marginal non-significant improvement in average Likert scores in favour of disposable fibre-optic nasendoscopes ($p = 0.244$). Furthermore, 58.3 per cent of respondents stated they would preferentially select a reusable fibre-optic nasendoscope as their tool of choice in an ideal world ($n = 14$).

Cost analysis of nasendoscopes

During the financial year from April 2021 to April 2022, Norfolk and Norwich University Hospitals NHS Foundation

Trust utilised a combination of 520 disposable and reusable fibre-optic nasendoscopes during emergency on-call consultations. Initial costs and maintenance costs for reusable and disposable fibre-optic nasendoscopes can be seen in Table 2. Initial purchase costs for the reusable Karl Storz fibre-optic nasendoscope amounted to £17 061, consisting of £8000 for the purchase of one fibre-optic nasendoscope, £1061 for the purchase of the light box and its associated charging station, and £8000 for the purchase of the endoscopy stack. Costs for an individual disposable fibre-optic nasendoscope consisted of £105 for an individual fibre-optic nasendoscope and an initial down payment of £4000 for the portable screen that the fibre-optic nasendoscope can be connected to.

Repair costs for the reusable fibre-optic nasendoscope were included within the maintenance service charge, amounting to £20 000 per annum. Reprocessing costs for the reusable fibre-optic nasendoscope consisted of £370 for a pack of 50 Tristel wipes and £35 for single-use endoscopy cleaning brushes. Personal protective equipment (PPE) required for the technicians involved in reprocessing nasendoscopes can be seen in Table 2. Reprocessing the reusable fibre-optic nasendoscopes at a central location within the endoscopy department took an hour to complete and was performed by sterile services technicians, who range from band 2 to band 4 on the NHS payscale.¹³ For the purposes of this cost analysis calculation, it was assumed that the average worker was in the band 4 pay scale bracket, thus earning £11.53 per hour.¹⁴ There were no maintenance or reprocessing costs associated with the disposable fibre-optic nasendoscopes. The reprocessing cost of reusable fibre-optic nasendoscopes was calculated with the assumption that it would take one service technician, wearing one set of PPE (one gown, two oversleeves, two long gloves, one face mask and one face shield), one hour to complete the reprocessing.

The 1-, 5- and 10-year per-use cost analysis can be seen in Table 3. For disposable fibre-optic nasendoscopes, the cost of the monitor was divided by the number of years to add onto the single-use cost per nasendoscope. As the single-use endoscope will have to be bought in future years, this was subject to a 3.5 per cent real health discount for the 5- and 10-year analysis. In total, this results in a per-use cost of £112.69, £89.95 and £75.21 for disposable fibre-optic nasendoscopes at 1 year, 5 years and 10 years of use, respectively. For reusable fibre-optic nasendoscopes, initial purchase price per use was calculated as initial purchase price divided by the number of

Table 2. Costs associated with reusable and disposable FNEs at Norfolk and Norwich University Hospitals NHS Foundation Trust from April 2021 to April 2022

Parameter	Reusable FNE (Karl Storz)	Disposable FNE (Ambu)
Uses (n)	520	Single use
Cost of nasendoscope (£)	8000.00	105.00
Endoscopy stack cost (£)	8000.00	4000.00
Light box and charging station cost (£)	1061.00	N/A
Total purchase cost (£)	17 061.00	1105.00
Maintenance service charge (£)	20 000.00	0.00
Cost of repairs	Covered in maintenance service charge	N/A
Re-processing Materials		
- Tristel wipes (50 wipes) cost (£)	370.00	N/A
- Endoscopy cleaning brushes (single use) cost (£)	35.00	N/A
Personal protective equipment		
- Gown (50 gowns) cost (£)	50.00	N/A
- Oversleeves (100 oversleeves) cost (£)	3.50	N/A
- Long gloves (100 gloves) cost (£)	17.50	N/A
- Surgical masks (50 masks) cost (£)	2.00	N/A
- Face shields (100 face shields) (£)	12.00	N/A
Endoscopy department costs		
- Time to re-process	1 hour	N/A
- Staff wages (per hr) (£)	11.53	N/A

NHS = National Health Service; FNE = fibre-optic nasendoscope; N/A = not applicable

Table 3. Disposable and reusable fibre-optic nasendoscopes per use cost analysis at 1, 5 and 10 years at the Norfolk and Norwich University Hospitals NHS Foundation Trust from April 2021 to April 2022

Parameter	Reusable FNE			Disposable FNE		
	1 year	5 years	10 years	1 year	5 years	10 years
Initial equipment purchase cost (£)	17 061.00	3412.20	1706.10	4000.00	800.00	400.00
Cost of 1 scope (£)	N/A			105.00	88.41	74.44
Price per use (£)	32.81	6.56	3.28	112.69	89.95	75.21
Cost of repairs (£)	0.00	0.00	0.00	N/A		
Maintenance cost per use (£)	38.46	32.38	27.27	N/A		
Reprocessing material cost per use (£)	42.40	35.70	30.06	N/A		
PPE cost per use (£)	1.58	1.33	1.12	N/A		
Labour cost per use (£)	11.53	9.71	8.17	N/A		
Total cost per use (£)	126.78	85.68	69.90	112.69	89.95	75.21

FNE = fibre-optic nasendoscope; NHS = National Health Service; N/A = not applicable; PPE = personal protective equipment

years and number of uses. This resulted in an initial purchase price per use of £32.81, £6.56 and £3.28 at 1 year, 5 years and 10 years, respectively. Maintenance costs at one year were calculated as maintenance service charge divided by number of uses, equalling £38.46. This cost, alongside future costs including reprocessing material costs, PPE costs and labour costs, was subject to a 3.5 per cent real health discount as recommended by NICE. In total, per-use costs for reusable fibre-optic nasendoscopes amounted to £126.78, £85.68 and £69.90 at 1 year, 5 years and 10 years, respectively.

Views on ENT surgery and its impact on the climate

As seen in Figure 2, 79.2 per cent of respondents agreed or strongly agreed with the statement that they considered

themselves to be supporters of climate-friendly initiatives in ENT surgery ($n = 19$), and 50 per cent ($n = 12$) of respondents reported neutral opinions on being supported by their ENT department when suggesting climate change initiatives within their ENT department, with the remainder being split on agreeing ($n = 6$) or disagreeing ($n = 6$) with this statement. Responses to trainees' ease of implementing climate friendly initiatives within their department were mixed, with 45.8 per cent of respondents disagreeing or strongly disagreeing with this statement ($n = 11$), and the remainder being neutral ($n = 7$) or agreeing or strongly agreeing ($n = 6$).

Of the respondents, 62.5 per cent agreed or strongly agreed that 26th United Nations Climate Change Conference and similar climate change events in the news had increased their awareness of healthcare contributions to climate change

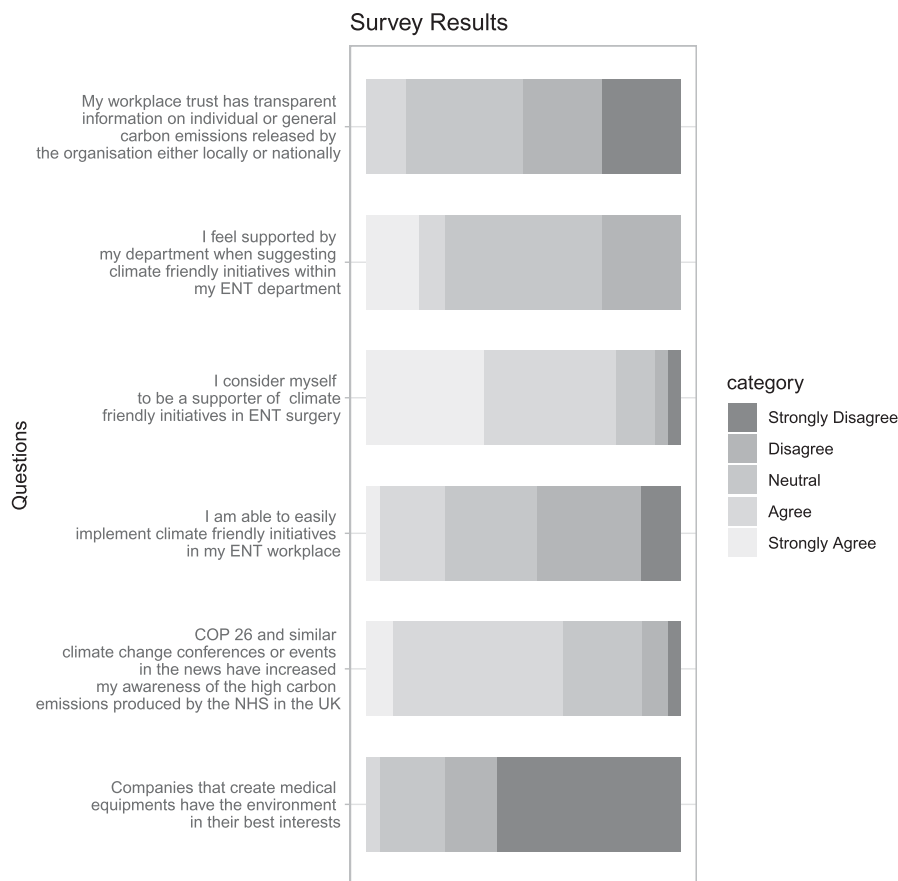


Figure 2. Likert scale responses from Health Education England ENT specialty trainees and ENT-themed core surgical training trainees with regard to their views of ENT surgery and climate change. COP 26 = 26th United Nations Climate Change Conference; NHS = National Health Service

($n = 15$). Seventy-five per cent of respondents disagreed or strongly disagreed with the statement that companies who manufacture medical equipment have the environment in their best interest ($n = 18$). Fifty per cent of respondents disagreed or strongly disagreed with the statement that their trust or workplace had transparent information on general carbon emissions released by the organisation ($n = 12$), with the remainder remaining neutral ($n = 9$) or agreeing ($n = 3$).

Discussion

There are estimated to be around 250 Health Education England ENT specialty registrars and 46 Health Education England ENT-themed core training posts in the UK,¹⁵ although the latter of these are not completely occupied at any one time. Based on these figures, our overall estimated response rate is 8.1 per cent, with a 6.4 per cent response rate amongst Health Education England ENT specialty training registrars and a 17.4 per cent response rate amongst Health Education England ENT-themed core surgical trainees. As mentioned beforehand, this is the first study in the UK, to our knowledge, to assess primarily ENT specialty trainees' and ENT-themed core surgical trainees' views on disposable fibre-optic nasendoscopes in comparison with their reusable counterparts. Furthermore, this is the first UK study to perform a cost analysis of both reusable and disposable fibre-optic nasendoscopes for emergency on-call consultations.

Respondents' preferences on fibre-optic nasendoscopes

Respondents in our survey favoured the disposable fibre-optic nasendoscope significantly because of its ease of access, ease of transport around the hospital and ease of set-up. Disposable

fibre-optic nasendoscopes tend to consist of a lightweight plastic-based nasendoscope with a portable touchscreen; reusable nasendoscopes tend to be heavier with weightier scopes and an associated lightbox that needs to be carried around. Given that fibre-optic nasendoscopes are predominantly used on call during the acute medical take, which may require responding to life-threatening airway emergencies in different parts of the hospital, and that 48 per cent of referrals seen by an on-call ENT doctor may require the use of a fibre-optic nasendoscope,¹⁶ it is clear why trainees prefer the disposable nasendoscopes. These results are mirrored in a similar US-based study, where ENT residents favoured the disposable fibre-optic nasendoscopes for the same reasons as well as being easier to learn to use when compared with reusable fibre-optic nasendoscopes.⁹ In addition to these qualities, a Covid-19 study found that the option for video playback and recording (which is present on the portable screens that the disposable fibre-optic nasendoscopes connect to) was the most important feature for their respondents in determining their choice of fibre-optic nasendoscope.³ This ability to record and play back images and videos allows trainees to share images with different members of the multidisciplinary team (e.g. with anaesthetists during airway emergencies or with colleagues during handover). These qualities may also explain why 50 per cent of respondents tend to use disposable fibre-optic nasendoscopes in their day-to-day clinical practice despite 79.1 per cent of respondents initially learning fibre-optic nasendoscopy using reusable fibre-optic nasendoscopes.

The financial cost of fibre-optic nasendoscopy

Without accounting for overhead costs that may be associated with reprocessing the reusable nasendoscopes, it appears that

reusable nasendoscopes have a lower cost per use at 5 years and 10 years of use, with disposable nasendoscopes having a lower cost per use at 1 year. This contrasts with the similar US-based study, which reported high costs associated with the initial purchase and repair costs associated with their reusable nasendoscopes, and thus concluded that disposable fibre-optic nasendoscopes were seen to be more cost-effective.⁹ Although similar calculations were performed, the differences may result from subtle differences between the NHS and its US counterparts in procuring medical equipment. Generally, the NHS procures equipment on a national basis, spending over £20 billion annually,¹⁷ and this huge purchasing power may allow it to negotiate prices for medical equipment at a discount compared with its US counterparts, which, alongside their respective purchasing agencies, state and local governments, and federal authorities, all compete with one another to purchase medical supplies.¹⁸ This may explain why the Norfolk and Norwich University Hospitals NHS Foundation Trust is able to negotiate a discounted price for initial purchases of its reusable nasendoscopes and for there to be a maintenance contract to cover the repair costs of its nasendoscopes. Financial costs tend to be key in determining healthcare procurement in many healthcare systems, and from this cost analysis, it appears that reusable scopes are preferred for this reason. However, it is important that the concept of 'value-based procurement', including the 'outcomes that matter to people at the lowest possible cost', is adopted¹⁹ rather than a linear and short-sighted perception of financial cost only.

Environmental cost of fibre-optic nasendoscopy

The King's Fund estimates the NHS in England to be responsible for around 20 million tonnes of carbon dioxide emissions annually, and consequently it spends over £50 million a year on carbon permits, with the cost of permits predicted to increase over time.²⁰ Fifty-nine per cent of NHS carbon emissions are linked to procured goods,²⁰ however, it is acknowledged that the emissions associated with this are the most difficult to influence directly.²¹

This study does not go as far as calculating carbon dioxide (CO₂)-equivalent emissions associated with both reusable and disposable fibre-optic nasendoscopes. An Ambu-funded study, examining the environmental impacts of reusable and single-use bronchoscopes by utilising a simplified life cycle methodology, concluded that reusable nasendoscopes that were reprocessed using one set of PPE had higher energy consumption, CO₂-equivalent emissions and consumption of scarce resources when compared with their disposable counterparts.²² Interestingly, this becomes equivalent to disposable nasendoscopes once two or more reusable endoscopes are cleaned using the same set of PPE, resulting in the study becoming inconclusive on which bronchoscope was better in the environmental outcomes measured. Reprocessing has potential to be a cost-intensive procedure with significant environmental impacts, from requiring high volumes of water per decontamination cycle to the usage of multiple disinfectants.²³

However, it is important to note that this study does not incorporate the raw material and energy used to produce the reusable nasendoscopes within its calculations, which leads to results potentially being skewed in favour of disposable scopes. Ambu states that it is working on methods to make its products more recyclable; at present the disposable nasendoscope equates to 349 g of household waste and is

incinerated,²⁴ which may contribute to the heating of hospitals within the NHS. Recycling, although a core principle in the NHS Long Term Plan and seen as a highly visible tool that has potential to raise awareness and inspire other resource-conservation behaviours,²⁵ is not energy or emissions free. The process of recycling requires energy to transport, shred, separate, clean and remelt material, with this product then requiring further work to shape it into the new recycled instrument. It is also important to acknowledge that material recycled from healthcare waste tends to be downcycled, with an example being medical steel being combined with other ferrous scrap to form carbon steel.²⁶ Within the NHS, in 2016–2017, it was calculated that NHS providers generated nearly 590 000 tonnes of waste, with 15 per cent going directly to the landfill and only 23 per cent of the waste recycled.⁵ It is for these reasons that the aim of reducing waste at the source is prioritised within the NHS Long Term Plan, with reusing and recycling being a secondary purpose.⁶ These measures, when applied trust-wide within an NHS hospital in Cornwall, were seen potentially to reduce disposal quantities by as much as 20–30 per cent in weight and costs by approximately 25–30 per cent.²⁷

Barriers to climate-friendly initiatives in ENT surgery

Surgeons and other healthcare professionals are key stakeholders and are essential in advocating for the reduction and prevention of climate impacts on healthcare and vice versa. The vast majority of trainees consider themselves to be advocates of climate-friendly initiatives within ENT surgery, in keeping with other studies in literature, and surgical trainees within the UK and Ireland are overwhelmingly supportive of the need to make surgery more climate friendly.²⁸ Furthermore, the mixed feelings reported by respondents about the ease and the support of their department in implementing climate-friendly policies are mirrored in the literature, with studies citing a plethora of personal, professional and societal factors, including lack of time and lack of leadership, impeding participants from implementing climate friendly initiatives within their field.²⁹ However, it was noted that increased awareness of healthcare's impact on the climate, as mirrored in our study by respondents and their views on the 26th United Nations Climate Change Conference, alongside other initiatives, including continuing professional education, communication training, patient education materials and guidance on how to make healthcare workplaces sustainable, was key to addressing these barriers.

- Disposable and reusable fibre-optic nasendoscopes are equally utilised among Health Education England ENT specialty trainees and ENT-themed core-surgical training trainees in the UK
- There was a marginal non-significant improvement in the trainees' overall satisfaction on the use of disposable fibre-optic nasendoscopes compared with reusable fibre-optic nasendoscopes
- There was a significant preference for the disposable fibre-optic nasendoscopes in terms of ease of set up, ease of access in the hospital and ease of transport around the hospital
- This single-centre cost-analysis showed a lower cost per use of reusable fibre-optic nasendoscopes compared with disposable fibre-optic nasendoscopes at 5 and 10 years
- Manufacturer refinement of reusable fibre-optic nasendoscopes in regards to ease of setup and ease of transport could attract ENT trainees to use reusable fibre-optic nasendoscopes
- Efforts should be concentrated at empowering local departments and trainees to pursue climate friendly initiatives in ENT surgery

Moreover, an overwhelming majority of respondents disagreed or strongly disagreed with the notion that companies have the environment in their best interests when developing medical equipment; this has been mirrored among healthcare professionals in general with regard to pharmaceutical companies.^{30,31} This general feeling may be a consequence of there being a lack of value-creation potential formed during the co-operation between a company and the clinician; the literature has yet to reach a consensus on whether this partnership has any overall beneficial effect or enhances social value.³² Furthermore, there are negative connotations of interactions between pharmaceutical companies and healthcare providers documented in the literature, including the presence of a conflict of interest, which negatively affects clinicians' prescribing behaviours as well as the clinician being portrayed in a negative light to the general public.³³ Nevertheless, the presence of two-way interactions, whereby both clinicians and companies work together for value-creation potential that is agreeable to both parties, and more importantly the patients, is key to addressing the potential impact that healthcare can have on the climate.

Limitations

The authors acknowledge that the study's sample size may result in findings that are not generalisable to views of all UK ENT specialty trainees and ENT-themed core surgical training trainees. Furthermore, the authors acknowledge that the cost analysis performed is only specific to the emergency on-call presentations that the ENT department at Norfolk and Norwich University Hospitals NHS Foundation Trust receives, and concrete conclusions cannot be drawn from this analysis for all NHS ENT departments across the UK. Further research into the cost analysis of fibre-optic nasendoscopes during elective and out-patient consultations may provide additional granularity on this topic. The authors also acknowledge that certain overheads for reusable fibre-optic nasendoscope processing, such as utility costs and the unpredictable nature of inflation, are not incorporated into this analysis, which may impact on the calculations performed for the cost analysis.

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Competing interests. None declared

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