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Disinfection of flexible fibre-optic endoscopes out-of-hours: confidential telephone survey of ENT units in England – 20 years on

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Abstract

Background. Flexible upper aerodigestive endoscopy is often performed in the emergency setting. To prevent nosocomial infection on-call clinicians must have access to decontaminated endoscopes.

Methods. A telephone survey of 104 ENT units in England replicated previous cycles conducted 10 and 20 years ago. The on-call clinician was asked about decontamination practices, training and cross-cover.

Results. Seventy-one clinicians participated of which 68 had an endoscope available out-of-hours. Twenty-five (36.8 per cent) used single-use endoscopes. Twenty-three (51.1 per cent) of the 45 clinicians using re-usable endoscopes decontaminated them themselves, an increase from 43.3 per cent in 2013 and from 35.1 per cent in 2002. Overall 91.2 per cent had safe practices, up from 68.7 per cent in 2013 and 48 per cent in 2002. One hundred per cent had been trained in decontamination, compared to 37.3 per cent in 2013 and 12.1 per cent in 2002. On-call clinicians from the ENT department increased to 91.5 per cent, compared to 63 per cent in 2013.

Conclusion. There has been a dramatic increase in patient safety, underpinned by the introduction of single-use endoscopes, increased training and reduced cross-cover.

Main Article

Jonathon Clymo takes responsibility for the integrity of the content of the paper

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Introduction

Flexible upper aerodigestive endoscopy is considered a standard investigation of the upper aerodigestive tract, both in planned and emergency settings. It is essential therefore that clinicians working on call in ENT have access to the correct equipment and training to perform endoscopy emergently, to a level that is clinically useful, and without introducing infection to a patient.

For assessment of emergency cases, the resident out-of-hours on-call clinician must have access to an endoscope and be trained how to use it. Further experience in obtaining good views and interpreting the findings is required for endoscope use to be clinically effective. Preventing the introduction of nosocomial infection to a patient from contaminated endoscopes is a more complex subject, particularly when working out-of-hours without the support of nursing teams or a central sterilisation services department.

Endoscopes routinely come into contact with intact mucosa and blood, therefore they have been classified as semi-critical instruments according to the Spaulding classification, thus requiring high-level disinfection (or sterilisation) between patients to prevent nosocomial infection.[1] As well as common bacteria, viruses and fungi, the decontamination process must cover vegetative bacteria, spores, blood borne viruses, such as human immunodeficiency virus (HIV), hepatitis B and C viruses, and mycobacterium such as tuberculosis. In practice this means a minimum of a chlorine dioxide (ClO_2) wipe and spray, because 70 per cent isopropyl alcohol is not sufficiently effective against spores and virus particles.

Disposable sheaths have been used as barriers to infection transmission and have had some uptake over the years. Disposable sheaths still require enzymatic detergent cleaning and rinsing of the endoscope as well as intermediate disinfection with isopropyl alcohol wipes due to the risk of virus particles passing through microscopic traumatic holes during use, therefore the need for out-of-hours disinfection remains.[2] More recently, disposable endoscopes have been introduced to positive reception from clinicians, although concerns about cost and sustainability have been raised.[3]

Nasendoscopes also come into contact with olfactory epithelium, so risk exposure to prion disease such as variant Creutzfeldt–Jakob disease. Prion proteins cannot be decontaminated effectively using standard methods, therefore a register of patients scoped must be kept to allow tracing and destruction of the endoscope.[4]

In 2002, concerns were raised by Kanagalingam *et al.* that decontamination practices were not good enough to prevent nosocomial infection.[5] They found that more than half of sites in England were not cleaning their endoscopes effectively, with 39 per cent using 70 per cent isopropyl alcohol wipes and 12 per cent using just soap and water. They also

found that more than one-third (35.1 per cent) were cleaned by the on-call junior clinician and only 12.1 per cent had any training in how to do so. They concluded that nursing teams would be better placed to complete this task. [5]

In 2006, two deaths were reported as a result of ineffectively decontaminated rigid laryngoscopes.[6] In 2010, ENT UK responded by publishing its first guidelines on the decontamination of flexible and rigid endoscopes. The guidelines focused on four areas: decontamination, storage, training and traceability, with minimum recommendations in each area.[7]

In 2013, Radford *et al.* repeated Kanagalingam *et al.*'s 2002 study and found that improvements had been made in decontamination during the intervening decade, with only 4.5 per cent rather than the previous 51 per cent using inappropriate cleaning methods.[8] However, they found over one-fifth (22.4 per cent) of on-call clinicians had no knowledge of how to use or clean the endoscope. They attributed this to more than one-third (37 per cent) of on-call ENT services at that time being covered by other specialties with the introduction of hospital-at-night cross-cover following the introduction of the European Working Time Directive.[8]

In 2015, the Advisory Committee on Dangerous Pathogens Transmissible Spongiform Encephalopathies Subgroup published an update which triggered an update to the Department of Health policy document on the decontamination of flexible endoscopes. Accordingly, ENT-UK updated their guidelines in 2017. The latest version emphasises central sterilisation services as a gold standard in the context of prion disease and the concept of corporate risk. However, the latest version also acknowledges a significant cost burden on trusts as well as practical limitations, such as distance from clinical areas to sterilisation services which may be to the detriment of administering a clinical service. It therefore accepts that common practice may continue to be chlorine dioxide (ClO_2) wipes such as Tristel (Tristel, Snailwell, UK), a practice which, while acceptable, carries a risk of human error. Transport and local storage should be in trays with a system of sealed covers. Endoscopes should be trackable to the level of their use in individual patients. Clinical staff should be fully trained and conversant with all techniques.[4]

More recently, the coronavirus disease 2019 (Covid-19) pandemic raised awareness of nosocomial transmission, increasing compliance with infection prevention and control measures amongst healthcare workers.[9]

In order to assess the effect of these cumulative changes, we performed a third cycle of the national audit first carried out by Kanagalingam *et al.* in 2002[5] and repeated by Radford *et al.* in 2013.[8]

Materials and methods

This study replicated the national confidential telephone questionnaire first administered by Kanagalingam *et al.* in 2002[5] and repeated with additional questions in 2013 by Radford *et al.*[8] An additional question was added to capture the emerging use of single-use disposable nasendoscopes, such as the Ambu® aScope™ 4 RhinoLaryngo Slim (Ambu, Ballerup, Denmark).

Three of the authors (JC, RB, SM) made out-of-hours telephone calls to the switchboards of the 104 sites with an ENT department in England and asked to contact the on-call clinician for ENT. The authors allowed the on-call clinician to be paged or called twice on each attempt, and for those who did not respond the same process of up to two pages or calls was repeated on a subsequent day. Most calls were made between 5 pm and 8 pm on weekdays with the small number not contactable at this time re-contacted on a Saturday afternoon. Care was taken not to disrupt clinical duties and a note was made of those too busy to participate.

Those agreeing to participate were asked if they had access to a flexible nasendoscope out-of-hours, whether they had been trained in its use and whether the endoscope was disposable or reusable. Those using reusable endoscopes were asked how they cleaned and stored them, who cleaned them, whether they used a sheath, whether they kept a register of patients scoped and whether they had been trained in the cleaning process.

Results

Ten (9.6 per cent) of the 104 sites with ENT departments in England were dual covered by another site out-of-hours. Seventy-one (75.5 per cent) of the remaining 94 on-call clinicians agreed to participate, eight (8.5 per cent) were too busy to participate and 15 (16.0 per cent) were uncontactable after multiple attempts (Table 1).

Access and training

Sixty-eight of the participating on-call clinicians (95.6 per cent) had access to an endoscope outside regular hours compared to 93 per cent in 2013 and 91.3 per cent in 2002. Sixty (88.2 per cent) had been trained how to use it, with nine (15.0 per cent) of those stating they had received informal training and the remainder having been trained during induction or similar, an increase compared to 70.8 per cent who were trained in 2013.

Decontamination

Twenty-five (36.8 per cent) sites had access to disposable endoscopes, of which two sites also had access to traditional re-usable endoscopes. Both sites with dual access stated they used the re-usable clinic endoscopes for ambulant patients and used the disposable endoscopes for emergency department and intensive care referrals.

Of the 45 sites using reusable endoscopes, 23 (51.1 per cent) were cleaned by the on-call clinician, a steady incremental increase from 43.3 per cent in 2013 and 35.1 per cent in 2002 (Figure 1). Endoscopes at four (8.9 per cent) sites were cleaned by nurses, a reduction from 36 per cent in 2013. Endoscopes at sixteen (35.6 per cent) sites were cleaned by central sterilisation services, up from 6 per cent previously. Two (4.4 per cent) sites did not know how their endoscope was cleaned, an improvement from 12 per cent in 2013. Of those on-call clinicians expected to clean the endoscope, all 23 (100.0 per cent) had received training on how to do so, compared to just 37.3 per cent in 2013 and 12.1 per cent in 2002.

Twenty-three (51.1 per cent) sites cleaned their endoscopes with a three-stage system of wipes and spray, such as Tristel, broadly similar to the 49.3 per cent in 2013 (Figure 2). This is in marked contrast to 2002 where the most commonly adopted method at 46.0 per cent of the sites was use of a chemical soak containing 2 per cent glutaraldehyde or 3.2 per cent alkaline glutaraldehyde. One (2.2 per cent) site used alcohol wipes compared to 4.5 per cent in 2013 and 39 per cent in 2002. Endoscopes at 16 (35.6 per cent) sites were sterilised

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Table 1. Summary of survey results

	2023 (*n*)	2023 (%)	2013 (%)	2002 (%)
Participated	71	75.5	77.4	83.1
– Covered by another site	10	9.6	10.6	—
– Too busy to participate	8	8.5	—	—
– Uncontactable	15	16.0	22.6	—
Endoscope available out-of-hours	68	95.8	93.0	91.3
Training in how to use endoscope	60	88.2	70.8	—
Disposable endoscope	25	36.8	0.0	0.0
Who decontaminates endoscope:				
– On-call clinician	23	51.1	43.3	35.1
– Central services	16	35.6	6.0	1.9
– Nursing team	4	8.9	36.0	50.0
– Don't know	2	4.4	12.0	—
Sheath used	4	8.9	32.8	4.9
Decontamination technique:				
– Tristel	23	51.1	49.3	0.0
– Machine	16	35.6	19.4	1.9
– Alcohol wipe	1	2.2	4.5	39.0
– Endozime	0	0.0	4.5	0.0
– Chemical soak	0	0.0	0.0	46.0
– Soap and water	0	0.0	0.0	12.0
– Don't know	5	11.1	22.4	—
Storage:				
– Tray with System of Clean & Dirty Covers	29	64.4	32.8	—
– Hanging Cupboard or Stand	8	17.8	9.0	—
– Non-sterile Bag or Case	4	8.9	49.3	—
– Clean Utility Room	1	2.2	0.0	—
– Don't Know	3	6.7	9.0	—
Register kept	32	71.1	54.0	25.5
Training in how to decontaminate	23	100.0	37.3	12.1
Clinician on-call is from ENT department	65	91.5	63.0	0.0
Simultaneously covering other specialties	27	38.0	68.0	0.0

by machine or central services compared to 19.4 per cent in 2013 and 1.9 per cent in 2002. Five (11.1 per cent) sites did not know how their endoscopes were cleaned, which is half the 22.4 per cent who did not know in 2013.

Four (8.9 per cent) sites used a single-use sheath some or all of the time, a decrease from 32.8 per cent in 2013 and a return to similar levels to the four sites (4.9 per cent) reported in 2002.

Storage

Endoscopes were stored in trays with a system of covers or stickers to determine whether they were clean or dirty at 29 (64.4 per cent) sites, an increase from 32.8 per cent in 2013 (Figure 3). Endoscopes were stored in a hanging cupboard or stand at eight (17.8 per cent) sites, compared to 9.0 per cent in 2013, and only four (8.9 per cent) used a non-sterile bag or carry case compared to 49.3 per cent in 2013. One site (2.2 per cent) stored their endoscope open in the clean utility room, and three (6.7 per cent) did not know how their endoscope was stored, compared to 9.0 per cent in 2013.

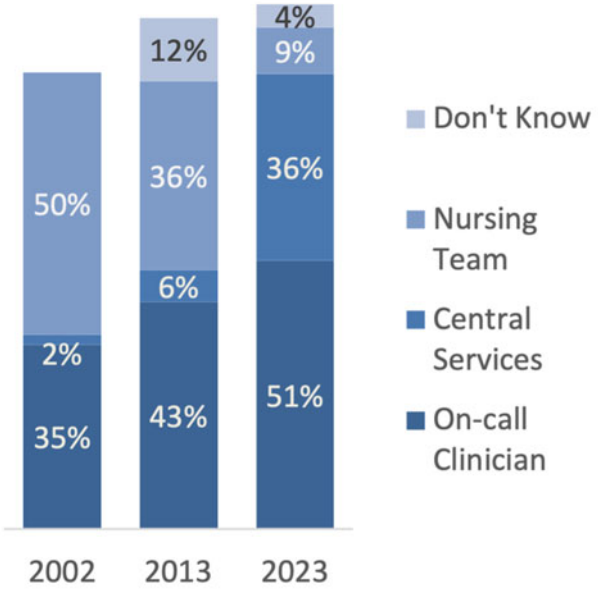

Figure 1. Who decontaminates the endoscope? Percentages shown are rounded to nearest whole number.

Traceability

Thirty-two (71.1 per cent) sites using re-usable endoscopes kept a register of who they had scoped, either in a book or by attaching patient stickers to endoscopes returned to central sterilisation services. This is an increase compared to 54.0 per cent in 2013 and 25.5 per cent in 2002.

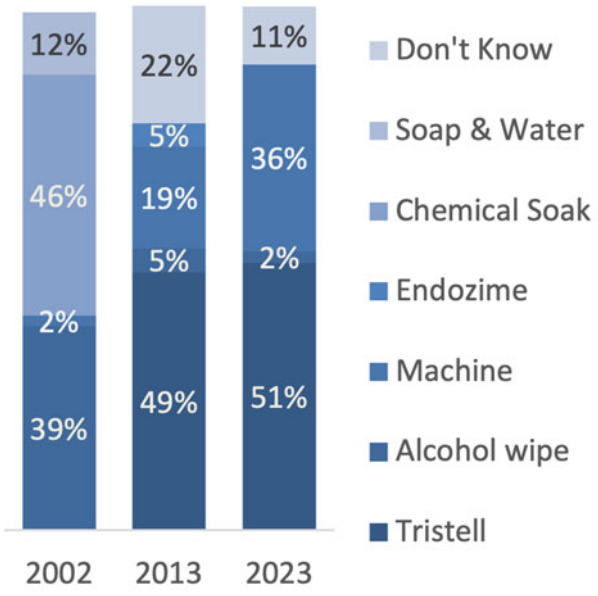

Figure 2. How is the endoscope decontaminated? Percentages shown are rounded to nearest whole number.

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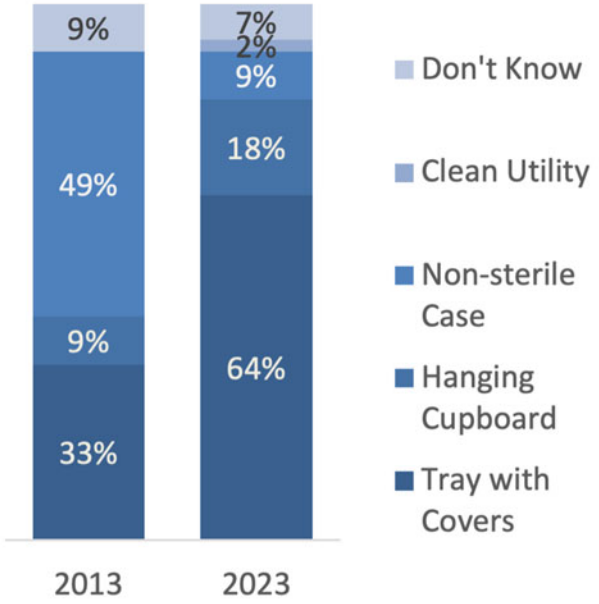

Figure 3. Where is the endoscope stored? Percentages shown are rounded to nearest whole number.

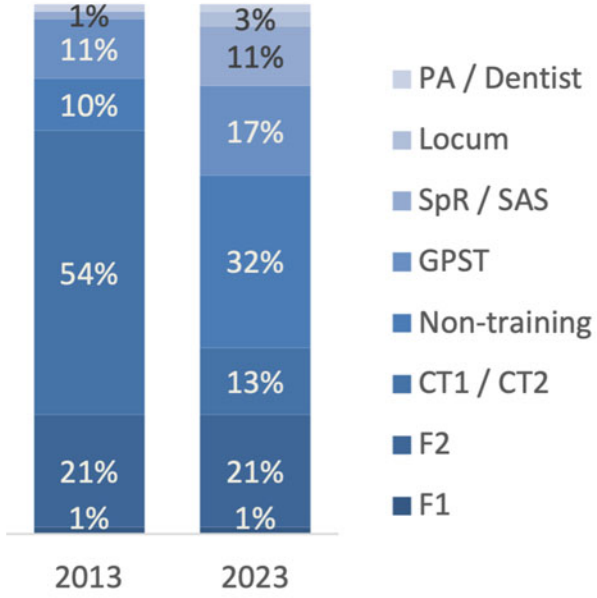

Figure 5. What training grade are you? Percentages shown are rounded to nearest whole number. F = Foundation Trainee, CT = Core Surgical Trainee, Non-training = Trust Grade, GPST = GP Specialty Trainee, SpR = Specialty Registrar, SAS = Associate Specialist, PA = Physician Associate

Expertise

Sixty-five (91.5 per cent) sites had an ENT clinician on call. Of the remaining sites, three (4.2 per cent) clinicians were primarily general surgery, two (2.8 per cent) orthopaedics, and one (1.4 per cent) urology. In return, 10 sites (14.1 per cent) were simultaneously covering maxillofacial surgery, eight (11.3 per cent) general surgery, six (8.5 per cent) urology, four (5.6 per cent) plastic surgery, three (4.2 per cent) orthopaedics, and one each (1.4 per cent) covering neurosurgery, cardiothoracics and obstetrics. In total, 44 (62.0 per cent) sites were covering only ENT, 20 (28.2 per cent) sites were covering one other specialty, and seven (9.9 per cent) sites were covering two other specialties as well as ENT (Figure 4). Multiple sites volunteered that this cover changed after 8 pm, mostly reporting combined coverage with general surgery in one direction or the other; however we did not explicitly ask all sites how cover changed at night.

The most common grade of clinician working was a senior house officer in a non-training post, making up 23 (32.4 per cent) of the 71 clinicians on call (Figure 5). There were 44 (62 per cent) training-grade doctors, including 15 (21.1 per cent) Foundation Year Two, 12 (16.9 per cent) GP trainees, nine Core Surgical Trainees, seven (9.9 per cent) Specialty Registrars, and one Foundation Year 1 doctor. There were two locums, one Associate Specialist doctor and one Physician Associate, not aligned to any full-time post.

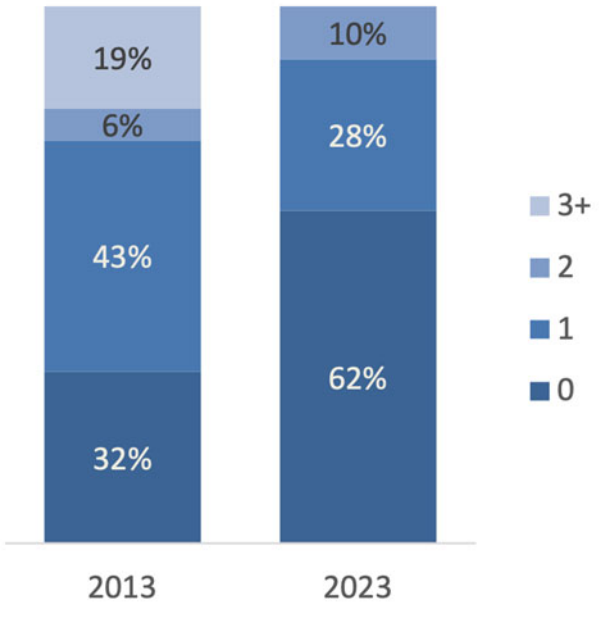

Figure 4. How many other specialties are you cross-covering? Percentages shown are rounded to nearest whole number.

Discussion

Progress has been made over the last 20 years in the safe use of flexible nasendoscopes out-of-hours through improved decontamination processes, availability of cleaning supplies, increased training and expertise, and more recently the introduction of single-use endoscopes. Hospitals in England have responded to individual incidents and changes to guidelines mirrored around the world by dramatically improving patient safety in minimising the risk of nosocomial infection.

Approximately one-third of sites surveyed (36.8 per cent) are now using disposable endoscopes, removing the need for decontamination, storage and an audit trail of cross-infection risk between patients. Disposable endoscopes have financial and environmental costs, although whether this is more or less than reusable endoscopes depends on how you model the effects of the decontamination process.[3,10,11] Disposable endoscopes are popular amongst clinicians and introduce the training benefits of video feedback to out-of-hours endoscopies where junior clinicians gain a large part of their experience.[3,12] This has the potential to reduce the burden of training required prior to performing on-call duties, allowing clinicians to gain valuable experience on the job, whilst simultaneously increasing patient safety. This has not yet been formally studied in an ENT setting.

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- Access to decontaminated endoscopes is essential to reduce the risk of transmission of nosocomial infections
- The responsibility for decontamination out-of-hours has increasingly been placed with on-call clinicians over the last 20 years
- The proportion of on-call clinicians adopting minimum safe decontamination practices according to ENT UK guidelines has increased, underpinned by a dramatic increase in the proportion receiving training and a large decrease in cross-cover from other surgical specialties
- Increased use of single-use endoscopes or central decontamination processes over the last 10 years has further increased the total number of sites adopting minimum safe practices
- Traceability has improved, however record keeping remains the least adhered-to part of the ENT UK guidelines

Decontamination practices have improved considerably in the last 10 years, with 86.7 per cent of the sites using re-usable endoscopes now adopting appropriate practice, rising to 91.2 per cent if those using single-use endoscopes are included. This compares to 68.7 per cent 10 years ago and 48 per cent 10 years before that, underpinned by an increase in training on decontamination techniques from 12.1 per cent initially through 37.3 per cent and now to 100.0 per cent. This in turn is likely to have been made possible by an increase from 63 per cent to 91.5 per cent in the on-call clinician being primarily from the ENT department. Accordingly, the percentage of people who simply did not know how endoscopes were cleaned halved from 22.4 per cent to 11.1 per cent.

A big change in practice has been in the proportion using automated machines or central sterilisation services, which increased from 1.9 per cent in 2002 to 19.4 per cent in 2013 and 35.6 per cent in 2023. However, an equivalent and more clinically important change has been the same proportion that previously used substandard methods now using the minimum acceptable standard of a chlorine dioxide (ClO_2) wipe system. So whilst net usage of Tristel wipes remains at about one-half, this masks a major general improvement in patient safety.

Hand in hand with this was an increase in those using sealed-tray systems from about one-third (32.8 per cent) to about two-thirds (64.4 per cent). Similarly, the number of sites now keeping some form of register has been pushed from about one-quarter (25.5 per cent) 20 years ago to more than one-half (54 per cent) 10 years ago to just under three-quarters (71.1 per cent) now. The move to trays and central services introduces a centrally kept register obtained from patient stickers applied to the trays. However, the widespread uptake of the Tristel system also introduces a physical register book which constitutes an audit trail at many sites. Some clinicians also reported that their training in decontamination and record keeping had been provided by Tristel company representatives during their induction. This suggests that third-party commercial influences may already be playing a part in quality improvement, and that there may be opportunities to leverage this further to close the remaining training gaps.

Beyond the central processes, equipment availability, provision of clinical experts on rotas, and induction training, the final part of the improvements must lie with the clinicians themselves. The on-call clinicians who took part were all keen to explain their local procedures. On the small number of occasions the on-call clinicians did not know information, they were apologetic and committed to finding out. No comments emerged representing gaps between known standards and what was daily practice in reality; there was no evidence of any hidden curriculum undermining stated standards of infection prevention and control.

Based on reported training grade, most clinicians surveyed were either in medical school or foundation training when the Covid-19 pandemic took place, meaning their attitudes to infection prevention and control may be different than those from previous generations. Initiatives such as the World Health Organization five moments of hand hygiene have proved stubbornly slow to become standard practice across the board, and previous generations have criticised some initiatives for not being evidence based or having any direct link to outcome.[13] By comparison, there is evidence that the Covid-19 pandemic has raised awareness of responsibilities to patients in the prevention of transmission of nosocomial infection in the current generation of healthcare workers.[9]

The findings of this study are limited by using a telephone-survey methodology. The sites that were too busy to participate may represent departments where cover was more stretched, meaning we may have under-represented the amount of cross-cover and associated gaps in training and standards. The caveat to this is that the methodology remained consistent with previous methodology, enabling trends over time to be compared.

Conclusion

Much has changed in 20 years, with a noticeable improvement in patient safety and reduced risk of nosocomial infection from incorrectly decontaminated flexible nasendoscopes. Some changes have been detrimental to patient care and efforts have been made to mitigate or reverse them, such as the extensive cross-cover of specialist ENT on-calls by non-specialty doctors seen in 2013. Other changes have proved inexorable, but have presented opportunities for improvement, such as the switch from nurse-led decontamination processes 20 years ago, to placing the responsibility for decontamination in the hands of the clinicians using the equipment. Technological progress in the development of single-use endoscopes has provided further opportunities for improvement in infection control, as well as the potential improvements in quality, safety and training from senior clinicians reviewing endoscopy findings promptly via video recording. However, as with all progress, the perceived financial and environmental costs must be carefully weighed.

The challenges of out-of-hours working will always remain practical ones, with the availability of equipment and supplies in an emergency always taking priority over any ideals of perfection. The current balance of equipment options, levels of training and rota provision appear to be allowing most hospitals in the UK to deliver safe care out-of-hours. The ability to narrow the final gaps in knowledge of correct process will rely on the desire of departments to continue to improve, and on individual clinicians to continue to learn.

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