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Brief report

Education, training, and knowledge of infection control among endoscopy technicians and nurses



Sanjivini Suresh MEd ^{a,*}, Mala Pande PhD, MPH, MBBS ^a, Kalpesh Patel MD ^b, Liben D. Mahometano MBA ^a, Laura G. Romero BBA ^a, Denise Barringer MS ^a, Robert J. Sealock MD ^b, Gottumukkala S. Raju MD, FASGE ^a

^a Department of Gastroenterology, Hepatology, & Nutrition, The University of Texas MD Anderson Cancer Center, Houston, TX

^b Department of Gastroenterology and Hepatology, Baylor College of Medicine, Houston, TX

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A B S T R A C T

Our survey of 88 endoscopy technicians and nurses to determine their experience, training, and knowledge of infection control found that few personnel (<15%) received formal training in endoscope reprocessing or infection prevention before or after joining an endoscopy unit. While self-reported confidence in endoscope reprocessing was high (9 out of 10), knowledge of best practices in this regard lagged (average assessment score of 62%).

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BACKGROUND

Past research around endoscope reprocessing has primarily studied personnel's levels of adherence to institutional reprocessing protocols, demonstrating that compliance to protocol is typically low.^{1,2} However, these studies do not explore how personnel's understanding of reprocessing guidelines and infection control factor into the issue.

Our study sought to understand whether levels of competency, experience, and confidence play a role in compliance to protocol, specifically among gastrointestinal endoscopy technicians and nurses. In addition to assessing respondents' understanding of endoscope reprocessing, respondents' levels of healthcare experience, training in endoscopy, and confidence reprocessing endoscopes were surveyed. By comparing and analyzing responses from endoscopy technicians and nurses, we hoped to have the foundation needed to improve the quality of endoscope reprocessing.

METHODS

We conducted a paper survey (see Appendix A) of endoscopy technicians and nurses who attended Texas Interventional Endoscopy

Group's annual training course in 2019, an event for personnel in the Greater Houston area.

Surveys were distributed and collected prior to programming. The survey assessed each respondent's demographic characteristics, education, endoscopy experience, and knowledge of infection control in endoscopy (10 questions). These characteristics were compared between technicians and nurses using Fisher's exact test for categorical variables and the Mann-Whitney test for continuous variables, with statistical significance defined as $P < .05$. Answers to the assessment were not reviewed during programming.

RESULTS

Of the 105 technicians and nurses in attendance, 88 (84%) completed the survey. Respondents' education and experience are summarized in Table 1. Results of the 10-question assessment are listed in Table 2.

Of those surveyed, the median duration of experience in healthcare was 20 years; median endoscopy experience was 6.5 years (a range of 27 years for technicians and 41 years for nurses). Among technicians, a minority had prior training as either surgical technicians (15%) or sterilization technicians (13%). Few nurses were previously certified in either field (2%).

Despite limited formal training, respondents expressed a high level of confidence around endoscope reprocessing. Nonetheless, average assessment scores hovered around 62%. Overall, technicians were more knowledgeable about the steps involved in

* Address correspondence to Sanjivini Suresh, MEd, The University of Texas MD Anderson Cancer Center, Gastroenterology Research, 1515 Holcombe Blvd, Houston, TX 77030-4009.

E-mail address: ssuresh1@mdanderson.org (S. Suresh).

Conflicts of interest: None to report.

Table 1
Education, experience, and training of technicians vs nurses

	Total	Technician	Nurse
Number of participants (%)	88	34 (38.6)	54 (61.4)
Education prior to working in an endoscopy unit, n (%)			
High School/GED	21 (23.9)	21 (61.8)	0
Associate's	24 (27.3)	10 (29.4)	14 (25.9)
Bachelor's	38 (43.2)	1 (2.9)	37 (68.5)
Master's	3 (3.4)	0	3 (5.6)
Other	1 (1.1)	1 (2.9)	0
No data	1 (1.1)	1 (2.9)	0
Months before reprocessing independently, n (%)			
Never or N/A	15 (17.1)	0	15 (27.8)
1	27 (30.7)	18 (52.9)	9 (16.7)
3	14 (15.9)	4 (11.8)	10 (18.5)
6	4 (4.5)	2 (5.9)	2 (3.7)
>6	14 (15.9)	5 (14.7)	9 (16.7)
No data	14 (15.9)	5 (14.7)	9 (16.7)
Months before training others in reprocessing, n (%)			
Never or N/A	21 (23.9)	0	21 (38.9)
1	8 (9.1)	6 (17.7)	2 (3.7)
3	8 (9.1)	3 (8.8)	5 (9.3)
6	4 (4.5)	2 (5.9)	2 (3.7)
>6	28 (31.8)	15 (44.1)	13 (24.1)
No data	19 (21.6)	8 (23.5)	11 (20.4)
Certified to reprocess, n (%)	13 (14.8)	12 (35.3)	1 (1.9)
Confidence (1 = not confident; 10 = highly confident), Median (min-max)	9 (1-10) [n = 61]	10 (6-10) [n = 26]	6 (1-10) [n = 35]

reprocessing while nurses were more knowledgeable about general infection control.

DISCUSSION

The results of this study demonstrate that infection control is not well-understood by endoscopy personnel. Respondents' high levels of confidence, limited formal training, and low assessment scores suggest that confidence and experience do not correspond to competency, a discrepancy that may hinder infection prevention efforts.

The study's 10-question assessment revealed respondents' beliefs and misconceptions around infection control. For instance, approximately half of respondents were unaware of the guidelines created by the Centers for Disease Control and Prevention for using Personal Protective Equipment.³ Similarly, less than one-third of technicians associated outbreaks of carbapenem-resistant *Enterobacteriaceae* with Endoscopic Retrograde Cholangiopancreatography,^{4,5} and less than half considered the elevator channel to be the most likely to transmit infection despite evidence that the channel remains contaminated after reprocessing.^{6,7} While there are no definitive studies comparing channels' rates of infection transmission, these results suggest that many respondents (including some who may not work with duodenoscopes) do not perceive the elevator mechanism to be a greater threat to infection control than other components of the endoscope. Personnel's disparate beliefs around issues of infection control indicate a need for more robust educational interventions.

Respondents tended to be more familiar with reprocessing protocols, like those developed by the Association for the Advancement of

Table 2
Results of the 10-question assessment

Knowledge of infection control in endoscopy among technicians (techs) and nurses. Answers deemed "correct" by the authors are italicized. P values are included to compare the proportion of nurses vs technicians who chose the "correct" answer.						
Question 1: When wearing PPE, which of the following should you put on last?						
Gown	Goggles	Gloves	Mask	I Don't Know	No Answer	P
N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	value
Techs (n = 34) 1 (2.9)	5 (14.7)	22* (64.7)	2 (5.9)	1 (2.9)	2 (5.9)	.82
Nurses (n = 54) 4 (7.4)	7 (13.0)	34 [†] (63.0)	4 [†] (7.4)	3 (5.6)	2 (3.7)	
Question 2: When removing PPE, which of the following items should you take off last?						
Gown	Goggles	Gloves	Mask	I Don't Know	No Answer	P
N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	value
Techs (n = 34) 6 (17.6)	4 (11.8)	7 (20.6)	14 (41.2)	1 (2.9)	2 (5.9)	.66
Nurses (n = 54) 3 (5.6)	8 (14.8)	14 [†] (25.9)	26 (48.1)	1 (1.9)	2 (3.7)	
Question 3: Which channel of the endoscope most often contributes to infection transmission?						
Air/Water	Biopsy	Elevator	Water jet	I Don't Know	No Answer	P
N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	value
Techs (n = 34) 2 (5.9)	12 (35.3)	15 [†] (44.1)	0 (0)	3 (8.8)	2 (5.9)	.26
Nurses (n = 54) 4 (7.4)	11** (20.4)	32 ^{††} (59.3)	0 (0)	5 (9.3)	2 (3.7)	
Question 4: Carbapenem-resistant Enterobacteriaceae (CRE) infection is linked to which procedure?						
EGD	Colonoscopy	Enteroscopy	ERCP	I Don't Know	No Answer	P
N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	value
Techs (n = 34) 1 (2.9)	3 (8.8)	2 (5.9)	10 (29.4)	8 (23.5)	10 (29.4)	.08
Nurses (n = 54) 0 (0)	6 (11.1)	3 (5.6)	32 (59.3)	7 (13.0)	6 (11.1)	
Question 5: When should an EGD scope be precleaned when a patient undergoes an EGD followed by a colonoscopy?						
Immediately after the EGD	After completion of both procedures	Within 1 hour of the colonoscopy	Within 6 hours of the colonoscopy	I Don't Know	No Answer	P
N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	value
Techs (n = 34) 28 ^{††} (82.4)	2 (5.9)	0 (0)	0 (0)	1 (2.9)	3 (8.8)	.53
Nurses (n = 54) 44 ^{††} (81.5)	4 (7.4)	1 (1.9)	0 (0)	3 (5.6)	2 (3.7)	
Question 6: How often is leak testing of endoscopes required?						
After every procedure	Once a day	Once a week	I Don't Know	No Answer	P	
N (%)	N (%)	N (%)	N (%)	N (%)	value	
Techs (n = 34) 31 (91.2)	0 (0)	0 (0)	1 (2.9)	2 (5.9)	.64	
Nurses (n = 54) 47 (87.0)	0 (0)	0 (0)	4 (7.4)	3 (5.6)		
Question 7: How soon after precleaning should an endoscope be manually cleaned?						
Immediately	After 15 minutes	After 30 minutes	After 60 minutes	I Don't Know	No Answer	P
N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	value
Techs (n = 34) 25 (73.5)	1 (2.9)	1 (2.9)	1 (2.9)	2 (5.9)	4 (11.8)	.19
Nurses (n = 54) 34 (63.0)	3 (5.6)	5 (9.3)	3 (5.6)	4 (7.4)	5 (9.3)	

(continued)

Table 2 (Continued)

Knowledge of infection control in endoscopy among technicians (techs) and nurses. Answers deemed "correct" by the authors are italicized. P values are included to compare the proportion of nurses vs technicians who chose the "correct" answer.						
Question 8: How far into the cleaning solution should the endoscope be immersed during manual cleaning?						
	Fully immersed N (%)	Fully immersed except for the valves N (%)	Half immersed N (%)	I Don't Know N (%)	No Answer ^P N (%)	value
Techs (n = 34)	29 (85.3)	0 (0)	0 (0)	3 (8.8)	2 (5.9)	1.0
Nurses (n = 54)	46 (85.2)	0 (0)	0 (0)	5 (9.3)	3 (5.6)	
Question 9: How often should the disinfectant used during high-level disinfection be tested for effectiveness?						
	Prior to every use N (%)	Once a day N (%)	Once a week N (%)	Once every 2 weeks N (%)	I Don't Know N (%)	No Answer ^P N (%)
Techs (n = 34)	30 (88.2)	0 (0)	0 (0)	0 (0)	2 (5.9)	2 (5.9)
Nurses (n = 54)	35 (64.8)	5 (9.3)	3 (5.6)	0 (0)	6 (11.1)	5 (9.3)
Question 10: What is the minimum amount of time filtered air should be blown into the endoscope in order to completely dry the channels?						
	1 minute N (%)	5 minutes N (%)	10 minutes N (%)	15 minutes N (%)	I Don't Know N (%)	No Answer ^P N (%)
Techs (n = 34)	7 (20.6)	10 (29.4)	7 (20.6)	1 (2.9)	6 (17.7)	3 (8.8)
Nurses (n = 54)	18 (33.3)	5 (9.3)	7 (13.0)	4 (7.4)	16 (29.6)	4 (7.4)

EGD, esophagogastroduodenoscopy; ERCP, endoscopic retrograde cholangiopancreatography; PPE, personal protective equipment.

*Includes 2 respondents who chose all 4 answers.

[†]Includes 1 respondent who chose all 4 answers, and 1 respondent who also chose "Goggles."

[‡]Includes 1 respondent who also chose "I Don't Know."

[§]Includes 1 respondent who also chose "Water jet."

[¶]Includes 1 respondent who also chose "Air/Water."

^{||}Includes 2 respondents who also chose "Biopsy."

^{‡‡}Includes 5 respondents who also chose "Within 1 hour of the colonoscopy," and 1 respondent who also chose "I Don't Know."

^{§§}Includes 1 respondent who also chose "After completion of both procedures," and 1 respondent who also chose "Within 1 hour of the colonoscopy."

Medical Instrumentation.⁸ In general, technicians and nurses agreed on the basics of precleaning, leak testing, and manual cleaning. However, respondents were more divided on other aspects of reprocessing. For instance, manual cleaning is best conducted immediately after use⁸ but may be delayed up to an hour.⁹ Yet, one-fifth of respondents suggested that manual cleaning be conducted 60 minutes after precleaning or indicated that they were unsure when it should be performed. Similarly, one-sixth of nurses indicated that high-level disinfectant may be tested for efficacy once a day or week, rather than each use.⁸ Even when considering the variability in institutional reprocessing protocols, these results indicate that a subset of personnel are unfamiliar with evidence-based practices.

The data also suggest that personnel are unfamiliar with novel research. Approximately half of technicians and two-fifths of nurses indicated that administering filtered air for 5 minutes or less completely dries an endoscope's inner channels. This contrasts the results of a novel study demonstrating that dryness is ensured only when filtered air has been administered for 10 minutes.¹⁰

Personnel's high self-confidence and limited training exacerbate these problems. Half of technicians reported reprocessing endoscopes independently 1 month after joining an endoscopy unit and one-sixth subsequently began training others. While reprocessing without oversight may increase personnel's confidence, those with limited training may inadvertently propagate missteps, especially when tasked with teaching others.

To address these issues, endoscopy units must invest in formal training. Given the small sample, a meaningful stratified analysis by training could not be performed; however, anecdotally, those who had undergone certification, sterilization technician training, or surgical technician training demonstrated greater competency than untrained technicians (assessment scores of 80%, 78%, 68%, and 53%, respectively). Informal assessments may be administered periodically to monitor misunderstandings that impact patient care.

This study has several limitations. First, "correct" answers to questions 7, 9, and 10 may vary depending on the protocols used at respondents' institutions. Second, questions 3 and 4 may have multiple correct answers depending on respondents' experience in the field. Finally, given that one-fourth of nurses never reprocessed endoscopes

independently, the data may unintentionally reflect personnel who do not contribute to reprocessing-related lapses in infection control.

Follow-up studies should gauge respondents' current involvement in reprocessing, whether respondents underwent training on infection control upon hire, and whether they receive annual training from their facilities' Infection Preventionists. Future research should investigate the optimal frequency for training.

CONCLUSIONS

This study explores the education, training, and competency of endoscopy technicians and nurses. The results suggest that endoscopy leadership should not rely on personnel's levels of confidence or length of experience as proxies for competency. To improve the quality of endoscope reprocessing, leadership must observe personnel's technique and assess their knowledge firsthand.

SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at <https://doi.org/10.1016/j.ajic.2021.01.010>.

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