What's Your Position on Ergonomics in the GI Endoscopy Suite?

Introduction

Decades of survey data and prominent gastroenterologist voices are paving the way for ergonomic guidelines to reduce endoscopic-related injuries sustained by practitioners, drawing on design elements and human factors.

The Hippocratic injunction to "first, do no harm" refers to doctors' treatment of patients in a manner that avoids injury.[1] But a growing body of evidence in the GI world suggests that harm, in the form of endoscopic-related injuries (ERI), may be an occupational hazard for physicians in this specialty that requires attention.[2]

Prominent voices in the field who champion for change have increased that momentum. The need for ergonomic improvements is evident in recent publications from GI societies such as the American Society of Gastrointestinal Endoscopy (ASGE) and the American College of Gastroenterologists (ACG). Recent guidelines lay the groundwork for best practices surrounding education, as well as adoption and maintenance of technologies to mitigate ERIs.[2,3]

Doctor: 'It hurts when *I* do this'

ASGE guideline authors found that between 39% to 89% of gastroenterologists report ERIs, and between 20% to 47% of GI fellows report injuries.[2] These rates are based on ASGE's systematic review of surveys, published in 2023 and spanning more than 15 years of data.[2] Another perspective on injury rates comes from one large ACG survey published two years prior, reporting an injury rate of 75% from 1,698 gastroenterologists polled.[3]

ERIs are defined as musculoskeletal injuries caused by repetitive microtrauma to the connective tissues of the body. Most frequent ERI reports include:[2-6]

- Hand and finger injury (especially tenosynovitis of the left thumb, or colonoscopist's thumb)
- Upper back pain in females, lower back pain in males
- Neck pain
- Cervical disc injury
- Wrist pain (right side), including carpal tunnel
- Elbow pain (lateral epicondylitis, or tennis elbow)
- Knuckle injury (biliary endoscopist's knuckle)

Injury rates are reportedly higher in females. In the ASGE paper, pooled survey data from 3,355 gastroenterologists indicated females had an injury rate of 62.4% compared to their male counterparts with an injury rate of 45.5%.[2]

Continued on next page.

What's Your Position on Ergonomics in the GI Endoscopy Suite?

Ergonomist: 'Then don't do that'

Rates of ERIs are largely based on survey data, but ergonomics – the discipline concerned with the interactions between humans and their environment – has some basic established tenets that factor into ergonomic stressors: 1) Force required to complete a task; 2) Awkward or static working postures adopted in completing a task; and 3) Repetitiveness of a task.[7]

To that end, researchers agree that several factors likely contribute to ERIs:[2,4,6,8]

- Repetitive motion (e.g., right hand torquing the shaft of the endoscope)
- Awkward, nonneutral positions maintained for extended periods during a procedure
- High-volume case loads
- Increasingly complex procedures and longer procedure times (e.g., endoscopic retrograde cholangiopancreatography procedures [ERCP])
- Small hand size
- Cumulative time spent in practice and age of practitioner

The severity of the impact these factors can have on practitioners varies widely based on gender (stature, strength, fitness level, hand size), case load (types of cases, daily schedule), years in practice, and age.[2, 8-10]

Consequences of chronic injury

ERIs may correlate to a loss of productivity, but research is scant on how this is borne out. "Repetitive strain injury tends to be chronic," according to Anoop Prabhu, MD, FASGE, from Roswell Park Comprehensive Cancer Center and SUNY Buffalo. In "Ergonomics in Endoscopy: Good Advice or a Pain in the Neck?"[11] Prabhu references a 2015 ASGE survey of 684 gastroenterologists, over half (53%) reporting ERIs. These gastroenterologists did 20 or more cases a week, clocking more than 16 hours of procedures a week, with longer career length equating to more injury.[12] "Perhaps more sobering, of those people who claimed injury, over half of them [55%] required interventions that were above and beyond standard take-a-break [measures]," he said. "They needed injections, prescription pain medications, physical therapy, sustained breaks—meaning several weeks out of endoscopy," as well as splinting or surgery. Unlike acute injuries, chronic injuries have long-term disability implications in lost time, although costs are not well documented, he noted.[11,12]

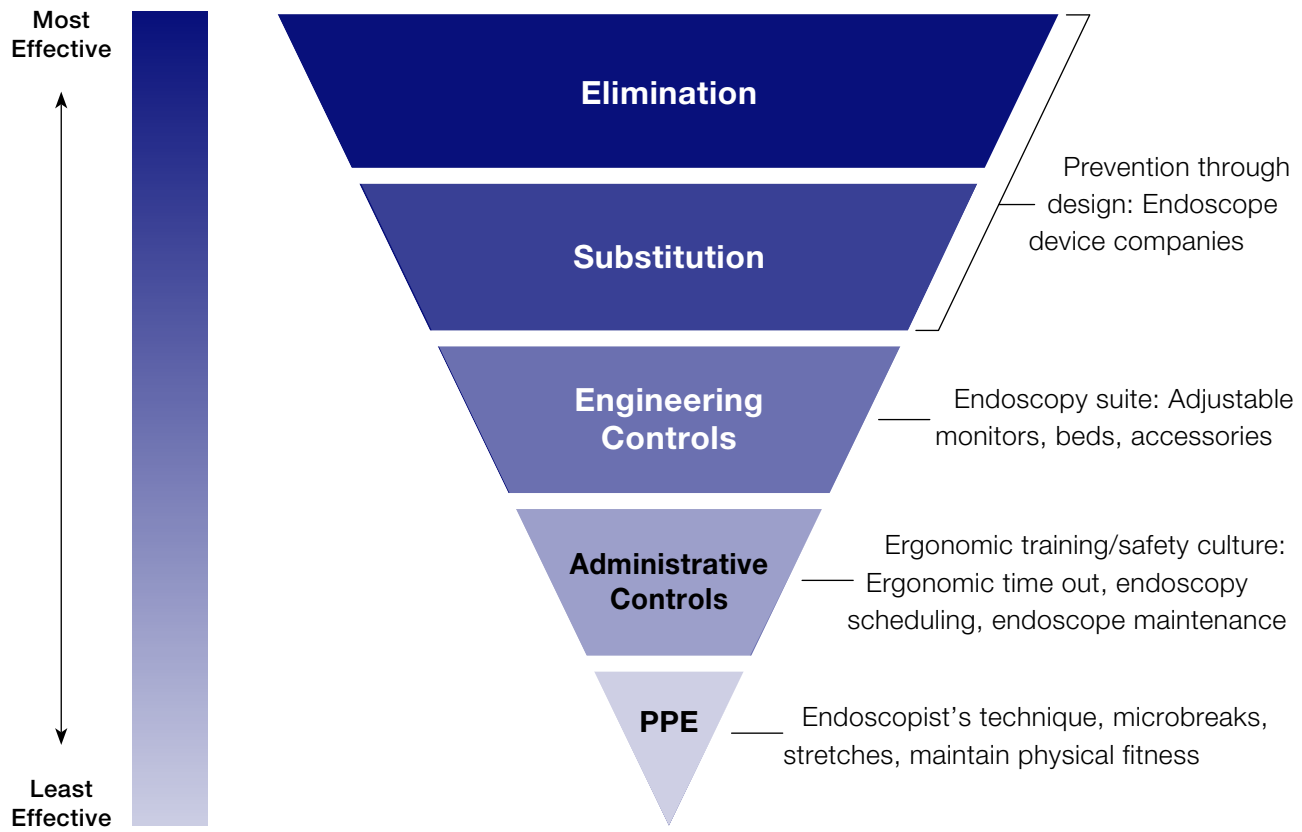
Earlier researchers have speculated on the lack of data. "Because even general information regarding physician disability pertaining to gastroenterology is considered proprietary to insurance carriers, very little is written about short-term and long-term disability from physician injuries related to endoscopy," wrote Glenn Harvin, MD, from ECU Health in Greenville, NC.[4] Still, ASGE's 2023 guideline authors warn: "Long-term consequences of ERIs can be disruptive or even devastating to an endoscopist's livelihood and range from pain and physical restrictions while performing procedures to disability," with career-ending implications.[2]

Continued on next page.

What's Your Position on Ergonomics in the GI Endoscopy Suite?

What's to be done? Hierarchy of Controls

An ergonomist may take the myriad human factors within the ergonomic equation and evaluate them against the Hierarchy of Controls, a funnel chart of most-to-least effective interventions. The model is used by the National Institute for Occupational Safety and Health[13] and is easily adaptable to GI, as demonstrated by Amandeep K. Shergill, MD, MS, FASGE, and Kenneth R. McQuaid, MD, FASGE, both from University of California San Francisco (UCSF), in a 2019 paper that called for more "human-centered design" with impactful changes, so that an endoscope can be held and manipulated "by the smallest, 5th percentile female, and the largest, 95th percentile male."[14] (see **Figure 1**, below)



Adapted from Shergill and McQuaid (ASGE/GIE 2019)[14]

Figure 1

Weighing in on design

"The scope has a weight to it, so there is a static load we are exposing our muscles to by holding the scope, especially during long procedures," Shergill said in a 2021 presentation for the Northern California Society for Clinical Gastroenterology (NCSCG).[15] Endoscope technology falls within the "engineering controls" section of the Hierarchy of Controls.[14] Shergill discussed her research on load-reduction devices like antigravity arms or a scope stand to support scope weight during a procedure, but these are currently not available in the United States, according to ASGE guidelines.[2,15]

Continued on next page.

What's Your Position on Ergonomics in the GI Endoscopy Suite?

Weighing in on design (Continued)

Weight was a consideration in the development of the Olympus® EVIS X1™ endoscopes (GIF-1100 gastroscope and CF-HQ1100DL/I colonoscope). The ErgoGrip control section of this next generation scope is 10% lighter than the control section of the EVIS EXERA™ III 190 series endoscope. Its rounded handle and easy-to-reach angulation control knobs and scope switches are also designed to accommodate users with small hands. The scope is designed to improve user comfort and scope handling. Users can manipulate Up/Down and Right/Left angulation control knobs simultaneously, and reach repositioned scope switches and valves with a single finger.[16] It may allow physicians to experience less fatigue during high volume caseloads and lengthy therapeutic procedures.

Monitoring the situation

In addition to endoscope weight, monitor position during an endoscopic procedure is an important ergonomic factor. The Olympus WM-NP3 mobile workstation is Olympus' newest iteration of an endoscopy workstation on wheels that allows for monitor adjustment. The cart is compatible with current imaging systems, including the EVIS X1 endoscopy system, and is designed to allow the physician to adjust the monitor to the appropriate position relative to the patient on the table during an endoscopic procedure.[17] The working range of the monitor arm is 56.2 to 71.9 inches, measuring from the floor to the center of the monitor plate.[18]

WM-NP3 mobile workstation

ENDOCUFF VISION™ device

Maximizing procedure time to reduce risk

Anything that maximizes procedure time should decrease the risk of injury to gastroenterologists, according to Shergill in her NCSCG presentation.[15] She cited research supporting the use of the ENDOCUFF VISION™ device, which attaches to the distal end of a colonoscope and is designed to maintain and maximize the viewable mucosa during endoscopic therapy by manipulating colonic folds.[19,20] The ENDOCUFF VISION device has resulted in a statistically significant and clinically relevant improvement in adenoma detection rate (ADR) in screening, as compared with unassisted colonoscopy. The ENDOCUFF VISION device is designed to collapse into the body to minimize intubation force and insertion resistance and is designed to allow for controlled withdraw.[19]

Regular service for endoscopes

Maintaining scope performance was also emphasized by ASGE guideline authors.[2] "All endoscopy units should have a robust endoscope maintenance program to identify suboptimal performing endoscopes," the authors stated. "This can protect against the usual wear and tear, which can cause the endoscope to be less responsive to maneuvers over time, requiring endoscopists to expend greater forces for the same task, thereby increasing risk of ERI."[2] Olympus Service is an example of a program that offers customers maintenance and repair service for endoscopes, with full-service contracts designed to support proprietary technology through original equipment manufacturer parts, as well as specialty trained staff who can provide onsite assistance and equipment training.

Continued on next page.

What's Your Position on Ergonomics in the GI Endoscopy Suite?

What's a Gastroenterologist to do?

Many of the recommendations made in the Shergill and McQuaid paper (ASGE/GIE 2019)[14] were included in the ASGE guidelines. Shergill is quick to note in her NCSCG presentation that these efforts have a low-impact status on the Hierarchy of Controls,[15] but the recommendations could be considered low-hanging fruit for those looking for achievable implementations.

✔ **Ergonomic education** in the form of didactic sessions, ergonomic-specific feedback, and videos are ASGE guideline recommendations, some of which are accessible without membership or registration requirements.[2] For example:

- *Ergonomics in Endoscopy* from ACG Education Universe covers ergonomic principles and their application in the endoscopy suite to minimize fatigue, injury, and discomfort.[6]
- *Endoscopy Occupational Injuries: Starting Out Right from the Get Go* speaks to fellows starting out in endoscopy, covering techniques and optimal room layout.[21]
- *Optimizing Ergonomics Before, During, and After Endoscopy* are three separate videos covering attire, equipment, techniques, and post-procedural stretches, among other tips.[22-24]

"We're generally not well educated [in GI ergonomics]," said Prabhu,[11] referencing the ACG survey in 2021 (of 1,698 surveyed, 61.5% reported no training in ERI prevention or ergonomics).[3] He recalled his fellowship days at Icahn School of Medicine at Mount Sinai. "I realized it's one of the anomalous years in training where you're doing endoscopy all day every day, without clinics or any other breaks, so it tends to expose any potential weaknesses that you have already."

ASGE guidelines make recommendations on breaks, room layout, and floormats:[2]

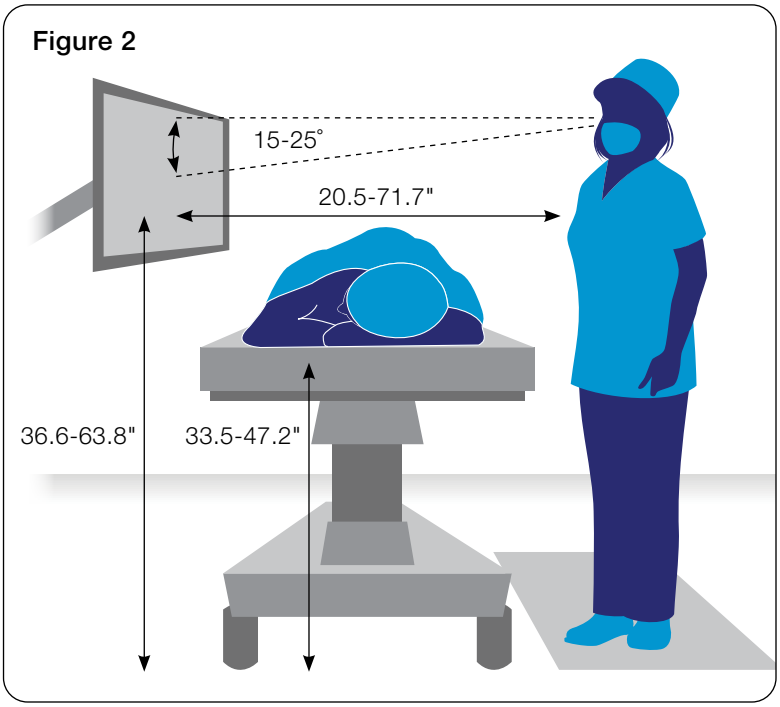
✔ **Microbreaks** are recommended with stretches like the ones seen on this Mayo Clinic OR-Stretch Instructional Video. Scheduled macrobreaks (30 to 45 minutes) are conditional recommendations, as guideline authors conceded that longer breaks require support from administration.

✔ **Neutral monitor position** is suggested, so that a monitor is directly in front of the endoscopist, 15 to 25 degrees below the horizon (eye alignment with top of monitor) with a viewing distance from 20.5 to 71.7 inches to accommodate the 5th percentile female to the 95th percentile male eye height; and the monitor should be adjustable from 36.6 to 63.8 inches (see **Figure 2**).

✔ **Neutral bed height** should be between elbow height and 3.9 inches below the elbow.

✔ **Antifatigue floormats** are recommended on the condition that they can be easily cleaned regularly and have beveled edges to reduce tripping hazards.

Figure 2



Adapted from Pawa S, et al[2]

Continued on next page.

What's Your Position on Ergonomics in the GI Endoscopy Suite?

Is there an ergonomist in the house?

If you work in an academic medical center, you may have access to an ergonomist who can observe you at work and make recommendations. A physical therapist may also be able to address the human factors at play for that aching back and neck.

A 2021 pilot study by Stacy Markwell, a physical therapist in Chapel Hill, NC, who specializes in ergonomics, and colleagues assessed eight endoscopists in an ambulatory surgery center representing "a wide range of ages and clinical experience." Researchers evaluated static and dynamic posture and procedure suite optimization. They provided personalized wellness exercises and pain education, resulting in a "highly variant wellness plans." In eight participants, 63% of the 22 identified pain sites were reduced in intensity or resolved based on a six to twelve month follow up. Researchers spent about three to six hours with each participant, an estimated cost of $500 per person.[25]

ASGE guidelines mark an important step toward mitigating ERIs, but the authors acknowledged the early state of the field's development.[2] A lack of consensus on proper technique also exists, with observational and anecdotal advice on how to hold the controls in the left hand (like a platter, suggests Prabhu[11]), and the benefits and drawbacks of a "bow" grip versus a "tennis" grip, the latter approach sometimes assisted with a wash cloth or grip aids, as discussed by Prabhu[11] and Shergill.[15] So while the first iteration of ergonomic guidelines in GI may fall to what endoscopists can do for themselves, the groundwork has been laid for new designs, from lighter weight scopes to assistive technologies under study, so that all endoscopists can keep doing what they're doing with less ERIs to show for it.

Continued on next page.

What's Your Position on Ergonomics in the GI Endoscopy Suite?

A show of female hands

Although tides are slowly changing, gastroenterology is still a male-dominated field. An average of only 33.6% of GI fellowship positions were filled by women from 2009 to 2019.[26] And how this one-third of the GI population copes with ergonomic challenges is telling.

"Females in general have approximately 60% of male strength," noted Amandeep K. Shergill, MD, MS, FASGE, from UCSF, in a 2021 NCSCG presentation, drawing from NASA data she cited in a 2019 paper published with Kenneth R. McQuaid, MD, FASGE, of UCSF.[14,15] In terms of force and grip strength, "gender is the most important predictor of strength," and she notes that "elite female athletes in the 95th percentile are only about that of the 30th percentile male." Put another way, women are strongest in their 20s, and even at their strongest are generally comparable in strength to a 70-to-80-year-old male. Their pinch and grip force-generation abilities are notably discordant.[14,15]

Based on ACG survey data, 97% of women gastroenterologists surveyed wore an extra-small to medium glove size, versus 73% of men who wore a large to extra-large glove size.[3] "We don't have a lot of data about differences in the way they scope," but Shergill cited a survey presented by Asmeen Bhatt, MD, PhD, of UTHealth, Houston, and colleagues at Digestive Disease Week 2021 looking at endoscopy styles between men and women.[27] Of 107 gastroenterologists, 39% were female. "They found that females were significantly shorter in height, they had smaller hands, and they performed fewer weekly case volumes as compared to male endoscopists," Shergill explained. Interestingly, "female gastroenterologists preferred holding the endoscope with the umbilical cord outside the forearm, using the right hand to turn the small wheel. Presumably…because of that small hand size, in order to get to that right/left dial, they were having to utilize their right/left hand," she explained. "Interestingly, they also preferred to use pediatric colonoscopes to perform colonoscopy in low BMI patients."[15,27]

Shergill and McQuaid note in their 2019 paper that "some have advocated that endoscopists should train as athletes to improve strength and flexibility." While the researchers don't dispute the benefits of physical fitness and flexibility, they argue that "a young female endoscopist should not have to enroll in a strength training program in order to perform endoscopy safely."[14] As more females pursue careers in GI, it may well come down to strength in numbers that accelerates the momentum to implement best practices and to develop more innovative, ergonomically minded technologies.

Continued on next page.

What's Your Position on Ergonomics in the GI Endoscopy Suite?

The EVIS X1™ endoscopy system is not designed for cardiac applications. Other combinations of equipment may cause ventricular fibrillation or seriously affect the cardiac function of the patient. Improper use of endoscopes may result in patient injury, infection, bleeding, and/or perforation. Complete indications, contraindications, warnings, and cautions are available in the Instructions for Use (IFU).

A rare but potential complication when using ENDOCUFF VISION™ device is the detachment of the device during the procedure. Be prepared to retrieve the device if this were to occur. Ensure ENDOCUFF VISION™ device is used only with compatible colonoscopes, that the colonoscope distal tip is in good condition, and that the device is fully seated on the distal tip prior to the application of lubricant to minimize the chance of detachment. Standard risks of colonoscopy including injury, bleeding and perforation still apply when using the ENDOCUFF VISION™ device.

References:

1. Smith CM. Origin and uses of primum non nocere--above all, do no harm! J Clin Pharmacol. 2005 Apr;45(4):371-7.
2. Pawa S, Kwon RS, Fishman DS, et al. American Society for Gastrointestinal Endoscopy guideline on the role of ergonomics for prevention of endoscopy-related injury: summary and recommendations. Gastrointest Endosc. 2023 Oct;98(4):482-491.
3. Pawa S, Banerjee P, Kothari S, et al. Are all endoscopy-related musculoskeletal injuries created equal? Results of a national gender-based survey. Am J Gastroenterol. 2021;116(3):530-538.
4. Harvin G. Review of musculoskeletal injuries and prevention in the endoscopy practitioner. J Clin Gastroenterol. 2014 Aug;48(7):590-4.
5. Ofori E, Ramai D, John F, et al. Occupation-associated health hazards for the gastroenterologist/endoscopist. Ann Gastroenterol. 2018;31(4):448-455.
6. Young PE, Singla, MB, American College of Gastroenterology (ACG) Education Universe, Ergonomics in Endoscopy https://www.youtube.com/watch?v=vJ2bGWyKdWw June 2017. Accessed December 21, 2023.
7. IEA.cc What Is Ergonomics (HFE)? https://iea.cc/about/what-is-ergonomics/ August 2000, Accessed December 27, 2023.
8. Shergill, A.K.; Harris Adamson, C. Failure of an engineered system: The gastrointestinal endoscope. Tech. Gastrointest Endosc. 2019;21(3):116–123.
9. Anderson J. Colonoscopy: Do operator motions and posture count? Endosc Int Open. 2015;3(6):E627-E628.
10. Singla M, Kwok RM, Deriban G, et al. Training the endo-athlete: An update in ergonomics in endoscopy. Clin Gastroenterol Hepatol. 2018;16(7):1003-1006.
11. Prabhu A. Ergonomics in Endoscopy: Good Advice or a Pain in the Neck? https://www.youtube.com/watch?v=QHAExGu3564 April 16, 2012. Accessed December 27, 2023.
12. Ridtitid W, Coté GA, Leung W, et al. Prevalence and risk factors for musculoskeletal injuries related to endoscopy. Gastrointest Endosc. 2015;81(2):294-302.e4.
13. CDC.gov. Hierarchy of Controls. Updated January 17, 2023. Accessed December 21, 2023.
14. Shergill AK, McQuaid KR. Ergonomic endoscopy: An oxymoron or realistic goal? Gastrointest Endosc. 2019;90(6):966-970.
15. Shergill AK. Ergonomics for Your Endoscopy Practice. 2021 NCSCG GI Symposium - Ergonomics in Endoscopy (youtube.com) June 26-27, 2021, Accessed December 28, 2023.
16. Data on file with Olympus (DC00482729, DC00600786, DC00031984, DC00482747, DC00482867, DC00600794, DC00481878, and DC00841888).
17. Data on file with Olympus 1/11/2023.
18. Data on file with Olympus 1/19/24.
19. Data on file with Olympus 12/09/2016.
20. Patel HK, Chandrasekar VT, Srinivasan S, et al. Second-generation distal attachment cuff improves adenoma detection rate: meta-analysis of randomized controlled trials. Gastrointest Endosc. 2021;93(3):544-553.e7.
21. Raju, GS. Endoscopy Occupational Injuries: Starting out Right from the Get Go Zoom Class 9 - Ergonomics for Endoscopists and Trainees (youtube.com) July 26, 2020, Accessed December 27, 2023.
22. Chang MA, Mitchell J, Abbas Fehmi SM. Optimizing ergonomics before endoscopy. VideoGIE 2017;2:169.
23. Chang MA Mitchell J, Abbas Fehmi SM. Optimizing ergonomics during endoscopy. VideoGIE 2017;2:170.
24. Chang MA Mitchell J, Abbas Fehmi SM. Optimizing ergonomics after endoscopy. VideoGIE 2017;2:171.
25. Markwell SA, Garman KS, Vance IL, et al. Individualized ergonomic wellness approach for the practicing gastroenterologist (with video). Gastrointest Endosc. 2021;94:248-59.
26. Starkey M, Daboul J, Lang J, Hart B, Ekwenna O. Trends in female representation in gastroenterology fellowships in the United States. Ann Gastroenterol. 2022;35(6):577-583.
27. Bhatt A, Thosani N, Patil P. Ergonomic study analyzing differences in endoscopy styles between female and male gastroenterologists. Gastrointest Endosc. 2021;93(6):AB42-AB43.

OLYMPUS AMERICA INC.
3500 Corporate Parkway, PO Box 610, Center Valley, PA 18034

For more information, contact your Olympus sales representative or call 800-848-9024.
www.medical.olympusamerica.com

Printed in the USA OAIGI0424WP52633