OBG MANAGEMENT

SPECIAL SECTION

THE 2023 SCIENTIFIC MEETING OF THE SOCIETY OF GYNECOLOGIC SURGEONS

HIGHLIGHTS ISSUE, PART 1

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SGS showcases gyn surgeons' impact on innovation, education, equity, and enterprise

The March 19–22, 2023 meeting in Tucson, Arizona, delivered impactful presentations and perspectives

Amy Park, MD

The theme of the 49th Annual Scientific Meeting of the Society of Gynecologic Surgeons was **Impact Factor**—an allusion to scientific journal **impact** factor, as well as how we as gynecologic surgeons have a societal **impact** through our innovation, education, equity, and enterprise-level efforts. This theme and the diverse roster of speakers and presentations on contemporary and controversial issues **impacting** today's gynecologic surgeons clearly resonated, breaking the prior registration record with more than 200 additional attendees than the previous year.

As always, the preconference postgraduate courses delivered relevant content that spanned the educational and surgical spectrum, including: "Innovations in training gynecologic surgeons"; "Urologic surgery for the gynecologic surgeon"; the social media workshop "Gynfluencing: Using social media to find your digital voice"; and "The sim factor: Making an impact in surgical education." This also marked the first year of offering a specific SGS Fellows/Young Attendings' course. The featured speaker of the SGS Equity Council was Patty Brisben, philanthropist, CEO, and founder of Pure Romance.

Dr. Beri Ridgeway, Cleveland Clinic Chief of Staff, delivered the Mark D. Walters Lecture, "Surgeon in the C-suite," on leading approximately 5,000 physicians and the importance of surgeons and specifically ObGyns having a seat at the table. The TeLinde lecturer, Dr. Pam Moalli, Professor and Division Director for Urogynecology at the University of Pittsburgh Magee Womens Hospital, spoke on "Biomaterials for gynecologic surgeons: Toward bioinspired biomimetic devices." The panel on the "Ergonomics of gynecologic surgery" was moderated by Dr. Amanda Fader and Dr. Kim Kho, who shared their experiences with work-related musculoskeletal injury, and featured esteemed panelists Dr. Noor Abu-Alnadi from UNC, Dr. Sue Hallbeck from Mayo Clinic, and Dr. Ladin Yurteri-Kaplan from Columbia University.

The conference also featured a new format of Ted Med Talks:

- Dr. Jason Wright, Editor-in-Chief, *Obstetrics & Gynecology,* and Division Director of Gynecologic Oncology at Columbia University, who spoke on "Surgical volume and outcomes for gynecologic surgery: Is more always better?"
- Dr. Kelly Wright, Division Director, Minimally Invasive Gynecologic Surgery, Cedars Sinai, on "Climate change starts at 7:15"
- Dr. Ebony Carter, Associate Editor, Equity, *Obstetrics & Gynecology,* and Division Director, Maternal Fetal Medicine, Washington University, on "Centering equity in reproductive health research."

In this special section, several of these talks are presented. Additionally, Dr. Laura Homewood and her coauthors will discuss gender and racial biases in a large multi-institutional sample of more than 15,000 Press Ganey patient satisfaction surveys.

Dr. Cheryl Iglesia, SGS former president, and I hope that you will consider attending #SGS2024 in Orlando, Florida, led by Dr. Suzie As-Sanie, program chair, and Dr. Rosanne Kho, current SGS president, which promises to be another exciting meeting. ■

The author reports no financial relationships relevant to this article.

doi: 10.12788/obgm.0289

Raising the bar (and the OR table): Ergonomics in MIGS

Work-related musculoskeletal disorders are an occupational hazard for surgeons. Be aware of their many contributory factors, including long-held awkward postures, and the preventive strategies that both the hospital and surgeon can use to ward them off.

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Work-related musculoskeletal disorders (WMSDs) are "musculoskeletal disorders (injuries or disorders of the muscles, nerves, tendons, joints, cartilage, and spinal discs) in which the work environment and performance of work contribute significantly to the condition; and/or the condition is made worse or persists longer due to work conditions."[1] The health care industry has one of the highest rates of WMSDs, even when compared with traditional labor-intensive occupations, such as coal mining. In 2017, the health care industry reported more than a half million incidents of work-related injury and illness.[2,3] In particular, surgeons are at increased risk for WMSDs, since they repetitively perform the classic tenets of poor ergonomics, including operating in static, extreme, and awkward positions and for prolonged periods of time.[3]

Gynecologic surgeons face unique ergonomic challenges. Operating in the pelvis requires an oblique approach that adds complexity and inhibits appropriate ergonomic positioning.[4] All modalities of surgery incur their own challenges and risks to the surgeon, including minimally invasive gynecologic surgery (MIGS), which has become the standard of care for most conditions. Although MIGS has several benefits for the patient, a survey of gynecologic oncologists found that 88% of respondents reported discomfort related to MIGS.[5]

The authors report no financial relationships relevant to this article.

doi: 10.12788/obgm.0287

Several factors contribute to the development of WMSDs in surgery, including lack of ergonomic awareness, suboptimal ergonomic education and training,[5,6] and ergonomically poor operating room (OR) equipment and instrument design.[7] Furthermore, surgical culture does not generally prioritize ergonomics in the OR or requests for ergonomic accommodations.[7,8]

Within 5 years, a physician workforce shortage is projected for the United States.[9] WMSDs contribute to workforce issues as they are associated with decreased productivity; time off needed for pain and treatment, including short-term disability; and possibly early retirement (as those who are older and have more work experience may be more likely to seek medical attention).[10] In a 2013 study of vaginal surgeons, 14% missed work; 21% modified their work hours, work type, or amount of surgery; and 29% modified their surgical technique because of injury.[10] Work-related pain also can negatively affect mental health, sleep, relationships, and quality of life.[6]

Recently, awareness has increased regarding WMSDs and their consequences, which has led to significant strides in the study of ergonomics among surgeons, a growing body of research on the topic, and guidance for optimizing ergonomics in the OR.

Risk factors for ergonomic strain

Several factors contribute to ergonomic strain and, subsequently, the development of WMSDs.

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Recognizing these factors can direct strategies for injury prevention.

Patient factors

The prevalence of obesity in the United States increased from 30.5% in 1999–2000 to 41.9% between 2017 and 2020.[11] As the average patient's body mass index (BMI) has increased, there is concern for a parallel increase in the ergonomic strain on laparoscopic surgeons.

A study of simulated laparoscopic tasks at varying model BMI levels demonstrated increased surgeon postural stress and workload at higher model BMIs (50 kg/m^2) when compared with lower model BMIs (20 and 30 kg/m^2).[11] This result was supported in another study, which demonstrated both increased muscle activity and increased time needed to complete a surgical task with laparoscopic surgery; interestingly, when the same study measured these parameters for robotic surgery, this association was not seen.[12] This suggests that a robotic rather than a laparoscopic approach may avoid some of the ergonomic strain associated with increased patient BMI.

Surgeon factors

Various surgeon characteristics have been shown to influence ergonomics in the OR. Surgeons with smaller hand sizes, for example, reported greater physical discomfort and demonstrated greater ergonomic workload when operating laparoscopically.[13-15] In particular, those with a glove size of 6.5 or smaller have more difficulty using laparoscopic instruments, and those with a glove size smaller than 7 demonstrate a larger decline in grip strength when using laparoscopic instruments repeatedly.[14,16]

Surgeon height also can affect the amount of time spent in high-risk, nonergonomic positions. In a study that evaluated video recordings of surgeon posture during gynecologic laparoscopy, shorter surgeons were noted to use greater degrees of neck rotation to look at the monitor.[17] Furthermore, surgeons with shorter arm lengths experienced more "extreme positions" of the nondominant shoulder and elbow.[17] This trend also was seen in open and robotic surgery, where surgeons with a height of 66 cm or less reported increased pain scores after operating.[18]

Surgical instruments and OR setup

Surgical instrument characteristics can contribute to ergonomic strain, especially when the instruments have been designed with a one-size-fits-all mentality.[8,19] In an examination of the anthropometric measurements of surgeon hand sizes and their correlation with difficulty when using a "standard" laparoscopic instrument, surgeons with smaller finger and hand spans had trouble using these instruments.[19] Another study compared surgeon grip strength and ergonomic workloads after using 3 laparoscopic advanced bipolar instruments.[16] Gender and hand size aside, the authors found that use of several of the laparoscopic devices led to greater decline in grip strength.[16]

The setup of the OR also can have a profound effect on the surgeon's ergonomics. Monitor placement, for example, is crucial to ergonomic success. One study found that positioning the monitor directly in front of the surgeon at eye level was associated with the lowest neck muscle activity during a simulated task.[20]

Route of surgery

Each surgical approach has intrinsic ergonomic risks. With laparoscopy, surgeons often remain in straight head and back positions without much trunk motion, especially when compared with open surgery.[21] In one study, laparoscopic surgeons spent more than 60% of a case in a static position and more than 80% of a case in a high-risk, "demanding" neck position.[22]

Robotic surgery, in contrast to laparoscopy, often has been cited as being more "ergonomic." While robotic surgery has less of an effect on the neck, shoulders, arms, and legs than laparoscopy[23] and often is associated with less physical discomfort than either open or laparoscopic surgery,[23,24] robotic surgery still maintains its own innate ergonomic risks. Of robotic surgeons surveyed, 56.1% reported neck stiffness, finger fatigue, and eye symptoms in one study.[25] In another survey study, more robotic surgeons (72%) reported physical symptoms than laparoscopic (57%) and open (49%) surgeons.[26]

Vaginal surgery also puts surgeons at ergonomic risk. A majority of surgeons (87.2%) who completed more than 50% of their cases vaginally reported a history of WMSDs.[10] Vaginal

surgery places surgeons in awkward positions of the neck, shoulder, and trunk frequently and for longer durations.[27]

Strategies for preventing WMSDs

As factors that contribute to the development of WMSDs are identified, preventive strategies can be targeted to these individual factors. Research has focused on appropriate setup of the OR, surgeon posture, intraoperative microbreaks, and stretching both in and outside of the OR.

1. OR setup and positioning of the surgeon by MIGS route

The route of MIGS affects OR setup and surgeon posture. Ergonomic recommendations for laparoscopy, robotic surgery, and vaginal surgery are all unique to the risks posed by each particular approach.

Laparoscopic surgery. Laparoscopic monitors should face the surgeon directly, with the screen just below eye level to maintain the surgeon's neck in a neutral position.[28] The table height should be set for the tallest surgeon, and shorter surgeons should stand on steps as needed.[28] The table height also should allow for the surgeon's hands to be at elbow height, with the elbows bent at 90 degrees with the wrists straight.[29] Foot pedals should be placed at the surgeons' foot level and should be reached easily.[28] Additionally, the patient's arms should be tucked at their sides to allow surgeons a larger operative space.[29] When using laparoscopic instruments, locking and ratcheting features should be used whenever possible to reduce prolonged grip or squeeze forces.[28] The laparoscopic camera should be held in the palm with the wrist in a neutral position.[29]

Robotic surgery. Positioning and setup of the robotic console is a main focus of ergonomic recommendations. The surgeon's chair should be brought as close to the console as possible, and the knees positioned in a 90-degree angle.[30] The foot pedals should be brought toward the surgeon to maintain this angle of the knees.[30] The console should be rotated toward the surgeon and then the height adjusted so that the surgeon can look through the eyepiece while sitting upright and can maintain the neck in a neutral position.[28,30] The surgeon's forehead should rest comfortably on the headrest.[29] The forearms should rest on the armrest while the arms are maintained in a neutral position and the shoulders remain relaxed while the surgeon holds the robotic controls.[30] It is important to utilize the armrest often to relieve stress on the arm while operating.[28] Frequent use of the clutch function can keep the robotic controls in the center of the workspace.[28]

Vaginal surgery. Both seated and standing positions are associated with high-risk positioning of the trunk and bilateral shoulders, respectively, in vaginal surgery.[31] However, surgeons who stand while operating vaginally reported more discomfort in the bilateral wrists, thighs, and lower legs than those who operated while seated.[31] This suggests a potential ergonomic advantage to the seated position for vaginal surgery. Chair height should be adjusted so the surgeon can look straight ahead with the neck in a neutral position.[32] Surgeons should consider using a headlamp, as this may prevent repetitive awkward movements to adjust overhead lights.[32] For standing surgery, the table height should be adjusted for the tallest surgeon, and shorter surgeons or assistants should use steps as needed.[3]

Surgical assistants should switch sides during the course of the case to avoid excessive unilateral upper-extremity strain.[32] The addition of a table-mounted vaginal retractor system may be useful in relieving physical strain for surgical assistants, but data currently are lacking to demonstrate this ergonomic benefit.[33] Further studies are needed, especially since many surgeons take on the role of surgical assist in the teaching environment and subsequently report more WMSDs than their colleagues who do not work in teaching environments.[10,34]

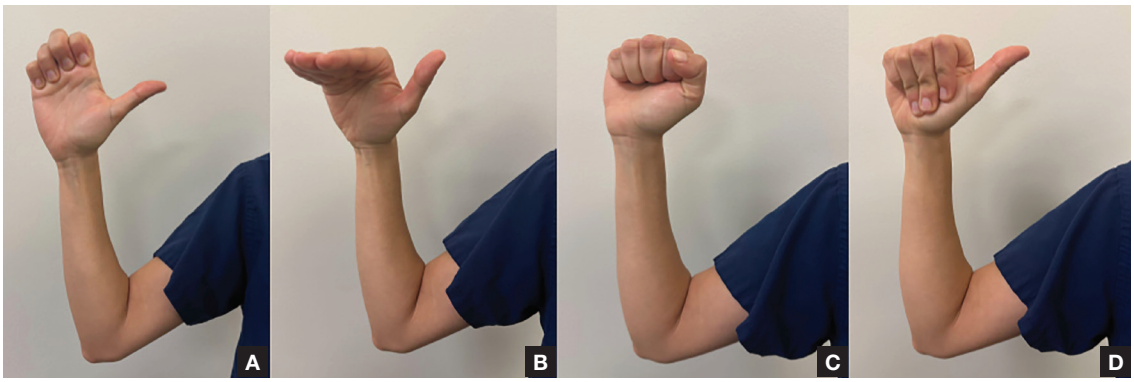
2. Pain relief from individual ergonomic positioning devices

Apart from adjusting how the OR equipment is arranged or how the surgeons adjust their positioning, several devices that assist with surgeon positioning—including gel mats or insoles, exoskeletons, and "augmented reality" glasses—are being studied.

The use of gel mats or insoles in the OR has mixed evidence in the literature.[35-37]

Exoskeletons, external devices that support a surgeon's posture and positioning, have been

FIGURE 1 Finger stretches targeting pain in the hands and fingers that can be used intraoperatively or in between cases[a]



[a]As initially described in the ACS *Surgical Ergonomics Recommendations*[28] and demonstrated here by study personnel. Photo courtesy of Emily Lin, MD.

studied thus far in simulated nonsterile surgical environments. Preliminarily, it appears that use of an exoskeleton can decrease muscle activity and time spent in static positions, with a reported decrease in post-task user discomfort.[38,39] More data are needed to determine if exoskeletons can be used in the sterile setting and for longer durations as may occur in actual OR cases.

Augmented reality glasses project the laparoscopic monitor image to the glasses, which frees the surgeon to place the "monitor" in a more neutral, ergonomic position. In one study, use of augmented reality glasses was associated with decreased muscle activity and a reduction in Rapid Entire Body Assessment (REBA) scores when compared with use of the conventional laparoscopic monitor.[40]

More data are needed on these emerging technologies to determine whether adverse effects occur with prolonged use.

3. Implementing intraoperative microbreaks and stretching

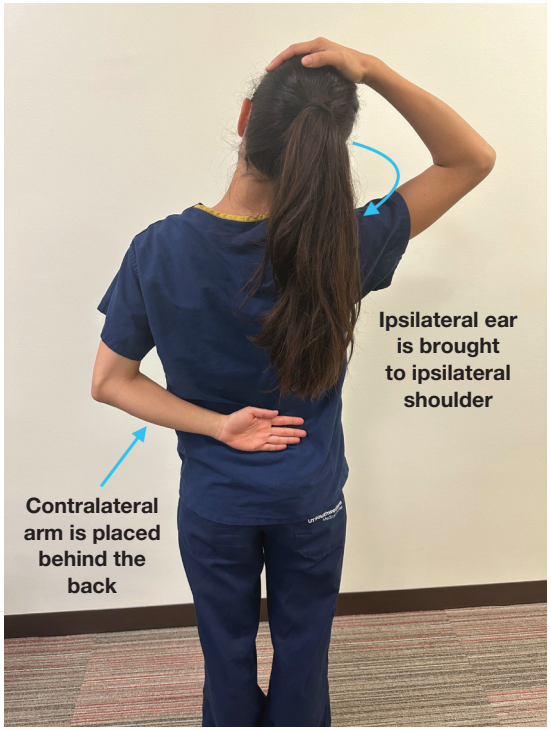
The American College of Surgeons (ACS) recommends that surgeons avoid prolonged static postures during procedures.[28] One strategy for preventing sustained positioning is to incorporate breaks with associated stretching routinely during surgery.[28]

Microbreaks. In a landmark study by Park and colleagues in 2017, 120-second long targeted stretching microbreaks (TSMBs) were completed every 20 to 40 minutes during a surgery, and results demonstrated improved postoperative surgeon pain scores without an associated increase in the length of the case.[41] These surgeons reported improved pain in the neck, bilateral shoulders, bilateral hands, and lower back. Eighty-eight percent of surgeons reported either improvement or "no change" in their mental focus, and 100% reported improvement or "no change" in their physical performance after TSMBs were implemented.[42] Of surveyed surgeons, 87% wanted TSMBs incorporated routinely.[41,42]

Stretches. Multiple resources, such as the ACS and the Mayo Clinic, for intraoperative stretches are available. The ACS recommends performing neck and shoulder stretches during intraoperative microbreaks, including a range-of-movement neck exercise, deep cervical flexor training, and standing scapular retraction.[28] The ACS also demonstrates lumbrical stretches for the fingers and passive wrist extension exercises to be used intraoperatively (or between cases) (**FIGURE 1**).[28] The Mayo Clinic Hallbeck Human Factors Engineering Laboratories has a publicly available "OR Stretch Instructional Video" in which the surgeon is guided through several different short stretches, including shoulder shrugging and side bends, that can be used during surgery.[43]

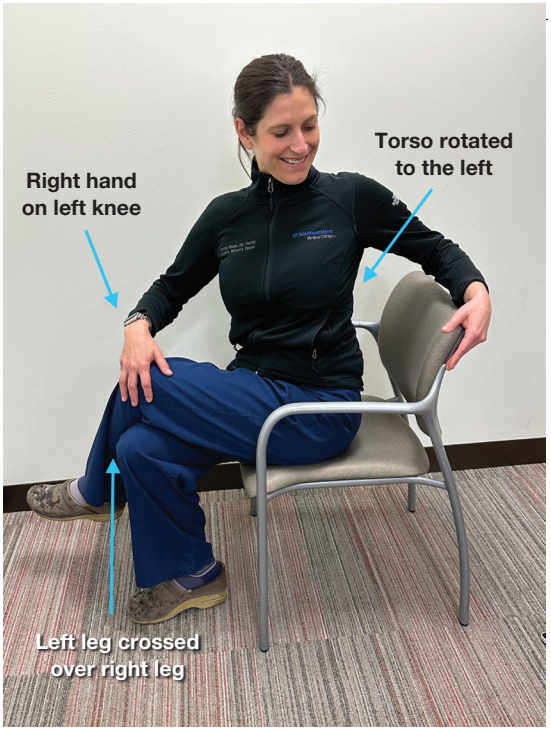
Both the ACS and the Mayo Clinic provide examples of pertinent stretch exercises for use when not in the sterile environment, between cases or after cases are complete. The ACS recommends several neck and shoulder stretches for the trapezius, levator scapulae, and pectoralis and recommends

FIGURE 2 Neck and shoulder stretches for the trapezius muscles[a]



[a]As initially described in the ACS *Surgical Ergonomics Recommendations*[28] and demonstrated here by study personnel. Photo courtesy of Emily Lin, MD.

FIGURE 3 Hamstring, lower back, and arm stretch done in a seated position[a]



[a]As initially described in the ACS *Surgical Ergonomics Recommendations*[28] and demonstrated here by study personnel. Photo courtesy of Emily Lin, MD.

the use of a foam roller to improve thoracic mobility (**FIGURE 2**).[28] As above, the Mayo Clinic Hallbeck Human Factors Engineering Laboratories has a publicly available "OR-Stretch Between Surgery Stretches Video" in which the surgeon is guided through several short stretches that are done in a seated position, including stretches for the hamstring, lower back, and arms (**FIGURE 3**).[43]

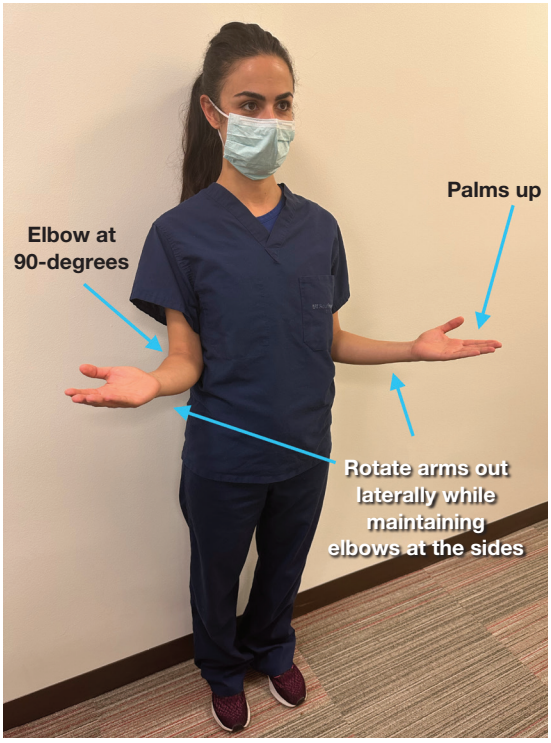
Many of the above-mentioned stretches were designed for use in the context of open, laparoscopic, or robotic surgery. For the vaginal surgeon, the intraoperative ergonomic stressors differ from those of other routes of surgery, and thus stretches tailored to the positioning during vaginal surgery are necessary. In a video recently published by the Society of Gynecologic Surgeons, several stretches are reviewed that target high-risk positions often held by the surgeon or assistant when operating vaginally.[44] These stretches include cervical retraction, thoracic extension, external arm rotation, cervical side bending, and lumbar extension (**FIGURE 4,** page SS8).[44] The recommendation is to complete these exercises 2 times per day, with 8 to 10 repetitions per set.[44]

Prioritizing ergonomic awareness and training

As caregivers, it is not uncommon for us to prioritize the needs of others before those of ourselves. However, WMSDs are prevalent, and their downstream effects may cause catastrophic professional and personal losses. Cumulatively, the global impact of WMSDs is a significant issue for the health care workforce and its longevity.

To prevent WMSDs, it is imperative that surgeons are aware of the factors that contribute to injury development and the appropriate, accessible modifications for these factors. While each surgical modality confers its own ergonomic challenges,

FIGURE 4 External arm rotation stretch[a]



[a]As initially described by Stork et al[44] and demonstrated here by study personnel. Photo courtesy of Emily Lin, MD.

these risks can be mitigated through increased awareness of OR setup, surgeon positioning, and incorporation of microbreaks and stretching exercises during and after surgical procedures.

Formal training in surgical ergonomics is lacking across specialties, including gynecology.[45] Multiple educational interventions have been proposed and studied to help fill this training gap.[30,46-49] When used, these interventions have been associated with increased knowledge of surgical ergonomic principles or reduction in surgeon pain scores, including trainees.[50] As we become more cognizant of WMSDs, standardized resident curricula should be developed in an effort to reduce the prevalence of these potentially career-ending injuries.

In addition to education, cultivating a culture in which ergonomics is prioritized is essential. Although most surgeons report work-related pain, very few report their injuries to occupational health. For example, while 29% of gynecologic oncologists reported seeking treatment for a WMSD, only 1% had reported their injury to their employer.[5] In a study of ACS members, only 19% of injuries were reported, 30% of surgeons stated that they did not know how to report an injury, and 21% felt that the resources for surgeons during and after an injury were inadequate.[6]

As we prioritize the health and safety of our patients, we also need to promote ergonomic awareness in the OR, respect the need for accommodations, encourage injury reporting, support surgeons who need to take time away for medical treatment, and partner with industry to develop new instruments and technology with effective ergonomic features. ■

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10 ways in which ObGyn care can be more environmentally sustainable

A goal for the health care industry is to be carbon neutral by 2050. Given its current path of doubling carbon emissions by that time, these authors propose that ObGyns focus their practices on reducing, reusing, recycling, removing, and reimagining to improve their carbon footprints without compromising patient care.

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Climate change has been called the biggest health threat of the 21st century.[1] The health care sector is a huge contributor to global carbon emissions, accounting for almost double the emissions of global aviation. While other industries and countries are implementing mitigation measures to decrease their emissions, health care is currently on track to double its carbon emissions by 2050, even though it should be carbon neutral by that time to comply with the Paris Climate Agreement.[2] There have been some national efforts to curb health care emissions, including the creation of the Office of Climate Change and Health Equity in 2021 and the passage of the Inflation Reduction Act in 2022.[3] These are top-down, administrative approaches, and to be successful we will also need clinicians to understand and address this problem.

The negative impacts of heat, air pollution, and exposure to toxic substances on human health have been well documented in multiple regions across multiple specialties.[4-7] The United States makes up 27% of the global health care carbon footprint—more emissions than the entire United Kingdom as a country—despite having only 4% of the world's population.[2] Culture and incentives for an overabundance of single-use supplies, not evidence for patient safety, have led to this uniquely American problem. It is evident that our health care industry is an excellent place to implement mitigation measures for carbon emissions that contribute to climate change and can improve health outcomes.

In this article, we recommend 10 practices that can decrease our carbon footprint in ObGyn. We focus on the classic motto of "Reduce, Reuse, Recycle," while adding "Remove" and "Reimagine" to classify the ways in which we can reduce emissions while not compromising our care to patients.

The authors report no financial relationships relevant to this article.

doi: 10.12788/obgm.0288

Reduce

1. Minimize opened materials and single-use devices in the OR and labor and delivery

Health care is a unique setting where a culture of infection prevention and efficiency has led low-cost, single-use supplies to dominate over reusable items. While single-use items can have inexpensive purchasing costs compared to reusable items, the environmental costs required for the production and disposal of the former are often much greater. In operating rooms (ORs) and labor and delivery (LD) units, single-use items are omnipresent. Over the past decade, researchers and clinicians have started to take a closer look at these items and their carbon footprint. One group evaluated hysterectomy through a waste audit and found that the vast majority of waste from all of the cases was Spunbond Meltblown Spunbond, or SMS; plastic material

that comprises gowns; blue wraps; and drapes; followed by hard plastic material that comprises trays and packaging.[8] Moreover, production and manufacturing processes contributed to 95% of the environmental impacts of these items.[8]

In an effort to be time efficient, OR staff will open sterile surgical packs and individual peel-pack items prior to surgery to minimize having to find items during surgery. However, this creates an inordinate amount of waste. One group of neurosurgeons who evaluated their opened but unused supplies found that 85% of their unused items were individually opened items, leading to a waste of $2.9 million per year.[9] Minor procedures like dilation and curettage, cystoscopy, and hysteroscopy do not need such a large sterile field, as these procedures are also safe to perform in the office. Hand surgeons have been quick to lead in this space, particularly with minor procedures such as carpal tunnel release. One division was able to eliminate 2.8 tons of waste and save $13,000 in a 2-year period by reducing the sterile field.[10] ObGyns can work with OR and LD staff to create custom packs that minimize unused or underutilized items, helping to reduce both the carbon footprint and health care spending.

Bottom line: ObGyns can help foster a culture of having supplies available but not opened until needed during a case.

2. Decrease regulated medical waste

Health care is unique from other fields in that there are multiple waste streams to consider. Infectious waste and items saturated in blood or capable of causing infection must be placed into regulated medical waste (RMW), or more commonly, red biohazard bags. RMW is autoclaved or incinerated prior to disposal in a landfill. This process is more financially and environmentally costly than general municipal waste (GMW). This process also requires more transport—1 study revealed that GMW traveled 20 km to a landfill for disposal, compared with the 50 km that RMW traveled for sterilized-prior-to-landfill disposal.[11]

Unfortunately, the vast majority of items placed in RMW are incorrectly triaged and should instead be disposed in GMW.[12,13] One study performed in an emergency department revealed that 85% of waste was incorrectly placed in the RMW.[12]

Bottom line: ObGyns can avoid placing items in RMW that may not qualify and advocate for institution policy changes to remove RMW from places such as waiting rooms, at the patient bedside, or next to scrub sinks.

3. Reduce energy use

ORs and LD units use a lot of energy, and numerous studies have demonstrated that the heating, ventilation, and air conditioning (HVAC) system plays a large role in emissions.[8,11] This can easily be fixed by "HVAC setbacks" and powering down rooms when not in use. One institution powered down ORs when not in use and reduced 234 metric tons of CO_2 emissions and saved $33,000 per year.[14] Transitioning to light-emitting diode (LED) lights reduced energy usage at 1 institution by almost 50%.[15] Finally, computers in clinical offices, examination rooms, and administrative offices can be powered down at the end of the day. One study found that in 1 radiology department, 29 computers left on overnight and on weekends emitted 17.7 tons of CO_2 emissions in 1 year.[16]

Bottom line: We as ObGyns can advocate for how energy can be saved outside of surgical cases, including powering down ORs and LD units, transitioning to LED lighting, and powering down workstations.

Reuse

4. Choose reusable equipment

In ObGyn practice, the most commonly used tool is the speculum. Given its omnipresence, the speculum is a great place to start to decrease our carbon footprint. Two studies have evaluated the environmental impact of reusable versus single-use disposable specula, and both demonstrated that the stainless-steel versions have less global warming potential than the acrylic varieties.[17,18] Donahue and colleagues[17] demonstrated that it only took 2 to 3 pelvic examinations for the cost of stainless-steel specula to break even, even when sterilized in a half-filled autoclave tray. Rodriquez, et al[18] revealed that, compared with an acrylic model, the stainless-steel specula had fewer negative impacts in terms of global warming, acidification, respiratory effects, smog, and fossil fuel depletion.[18]

Bottom line: Strongly consider using stainless-steel specula to reduce costs and carbon emissions.

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TABLE Items that can be recycled and reprocessed by their manufacturer or third-party companies

Arthroscopic shavers and wands	Electrophysiology catheters
Burrs, bits, and blades	SCD sleeves
Reamers and rasps	FemoStop (Abbott)
Laparoscopic scissors, graspers, dissectors	Laparoscopic bipolar sources
Laparoscopic trocars	Pneumatic tourniquet cuffs
Ultrasonic scalpels	Pulse oximeter sensors

Abbreviation: SCD, sequential compression device.

In addition to specula, ObGyns can choose reusable equipment in the OR. For example, surgeons can use stainless-steel trocars instead of disposable trocars.[19] In vaginal cases, Breisky-Navratil retractors can be used instead of disposable self-retaining retractors. Plastic basins that often are included in sterile supply packs can be replaced with stainless-steel basins, which could have profound positive effects on the carbon footprint of gynecologic surgery.[8] One study of ObGyns demonstrated that 95% of physicians supported waste-reduction efforts, and 66% supported utilizing reusable surgical tools instead of disposable tools.[20]

Bottom line: As surgeons, ObGyns have influence over what they want to use in the OR, and they can petition for reusable options over disposable options.

5. Launder the sterile blue towels

Sterile blue towels, which are made of cotton, have the largest environmental footprint compared with other disposable materials, such as plastics, and contribute greatly to toxicity in human health.[8,11] Although these towels cannot be laundered and sterilized again for use in a sterile surgical field, they can be laundered and repurposed, including by environmental services to clean hospital rooms. Blue towels should be able to be laundered no matter how saturated in body fluids they are.

Bottom line: ObGyns should strive to always launder the blue towels and educate trainees and other staff in the OR to do the same.

Recycle

6. Recycle and reprocess materials and devices

While recycling is immensely important, it requires a large amount of energy to break down a material to its raw components for manufacturing. It likely reduces our carbon footprint from OR procedures by only 5%.[8] However, recycling is still a good way to divert appropriate materials from landfill, saving costs and emissions at the end of a material's life. One example is sterile blue wrap, which is a petroleum product with a recycling number of 6 and a filtration rating of N99. Blue wrap can be recycled into plastic pellets, or it can be recreated into other hospital supplies, such as gowns.

Bottom line: ObGyns can petition their hospitals to work with suppliers and waste-processing companies who have recycling programs built into their supply chains.

By contrast, reprocessing can have a much larger impact on carbon emissions. Complex items, such as advanced energy devices that can be reprocessed, result in a greater reduction in carbon emissions due to the reuse of their complex materials and manufacturing when compared with such devices that cannot be reprocessed. Recycling and reprocessing programs are already in place for several devices (**TABLE**). Authors of a systematic review showed that there is no evidence to support the use of single-use supplies and instruments over reprocessed items when considering instrument function, ease of use, patient safety, transmission of infection, or long-term patient outcomes.[21]

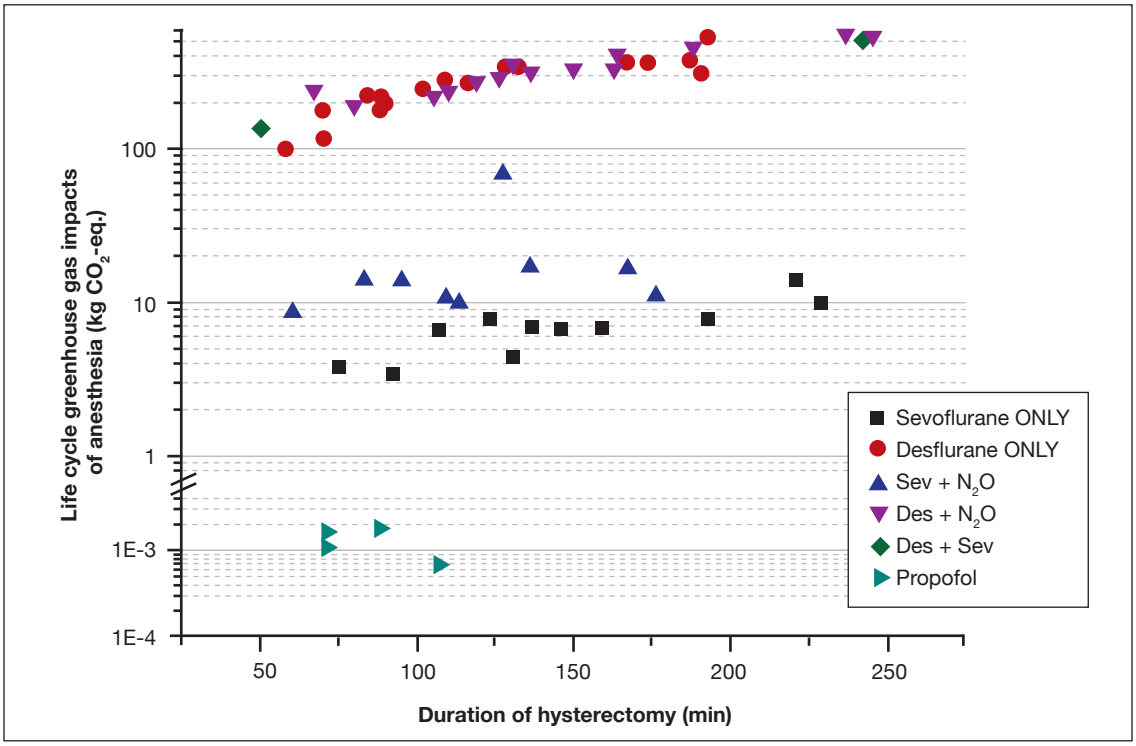
Bottom line: ObGyns can choose to use reprocessed items in ORs instead of single-use devices and educate staff on the safety of these items.

Remove

7. Remove desflurane and other volatile gases from formularies

Volatile anesthetic gases, such as desflurane, isoflurane, and nitrous oxide, are themselves potent greenhouse gases, comprising a large portion

FIGURE Greenhouse gas emissions of anesthetics used in hysterectomy cases during a life cycle assessment study[8]



of the carbon emissions that come from the OR.[22] Desflurane was developed to have a rapid onset for induction and quick recovery; however, studies have shown no clinical benefit over other gases.[23] Furthermore, the costs and greenhouse gas potential are substantial. Desflurane costs 2 to 3 times more and has more than 20 times the global warming potential of the other volatile gases (**FIGURE**).[8] Using 1 hour of desflurane is equivalent to driving 378 miles in a gas-powered vehicle, while the use of isoflurane and sevoflurane create equivalents of only 15 and 8 miles, respectively.[23]

Nitrous oxide is another powerful greenhouse gas that is a direct ozone depletor and can stay in the atmosphere for 114 years.[22] Nitrous oxide has limited clinical use in hospitals, but it is often stored in central hospital piping. Most of the impact of nitrous oxide comes through leaks in a poor system design rather than patient delivery. One estimate reveals that more than 13 million liters of nitrous oxide are lost annually from leaks in European hospitals.[22] The American Society of Anesthesiologists recommends decommissioning central piping of nitrous oxide in favor of cylinders at the point of care.[24]

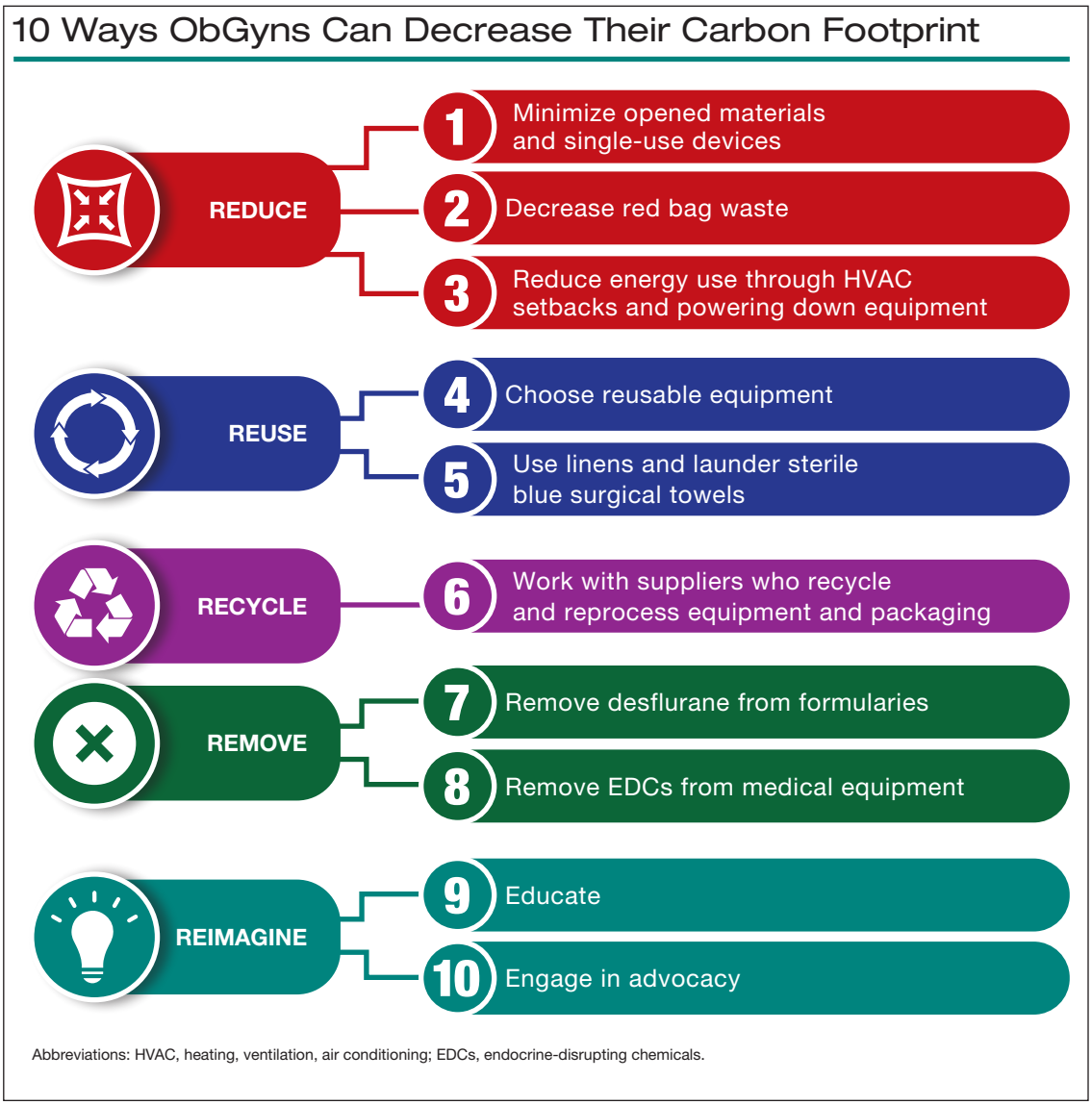
Literature on enhanced recovery after surgery in gynecology promotes the use of propofol over volatile gases for our patients because of the high rate of postoperative nausea and vomiting seen with gases.[25] Volatile gases should be a last-choice anesthetic for our patients.

Bottom line: It is critical that ObGyns work with colleagues in anesthesia to develop climate- and patient-friendly protocols for procedures.

8. Remove endocrine-disrupting chemicals from clinical supplies

Endocrine-disrupting chemicals (EDCs) are a type of chemical that alter the hormonal systems of humans, which can result in adverse health effects. Multiple studies and reviews have tied EDCs to reproductive abnormalities, such as the effects of bisphenol A (BPA) on estradiol levels, antral follicle counts, oocyte quality, and implantation rates; phthalates on fibroid burden; triclosan on embryo quality; parabens on live birth rates; and perfluoroalkyl substances (PFAS or "forever substances") on hypertensive disorders of pregnancy.[5,26,27]

What might be most shocking is that these



EDCs are incorporated into medical supplies and pharmaceuticals. For example, BPA is known to line dialysis and ointment tubes, parabens are used for their antimicrobial properties in ultrasound gel and hep-locks, and phthalates are found in up to 40% of medical-use plastics and controlled-release medications. Authors of an observational study found that 74% of patients admitted to an LD unit were exposed to EDCs. In a neonatal intensive care unit (NICU), most of the supplies contained an EDC, and urinary BPA levels were elevated in neonates admitted to a NICU, raising concerns about long-term health risks.[5]

Bottom line: Physicians and health care institutions have an obligation to petition industry partners and suppliers to remove EDCs from their supply chains.

Reimagine

9. Educate

The field of health care sustainability remains in its infancy, but from 2007 to 2019, publications on climate change and health in academia increased by a factor of 8.[29] Additionally, through waste audits, quality-improvement projects, and life cycle analyses (analytical tools to evaluate product or process emissions from materials extraction to disposal), we have gained insight into the scope of the

problem, with evidence showing that our practices are largely derived from culture. It is time to provide formal education on health care sustainability to medical trainees, staff, and clinicians alike, who desire to see this topic reflected in their formal curricula.[30] Start talking about it!

Bottom line: Commentaries, webinars, formal didactics sessions, in-services, and hospital workgroups to introduce this topic are a good way to teach others about the carbon footprint of our care and solutions to minimize it.

10. Engage in advocacy

Physicians have an ethical duty to advocate for change at the local, regional, and national levels if we want to see a better future for our patients, their children, and even ourselves. We should reimagine this work as an important public health initiative.[31] Surveys of physicians, including ObGyns, reveal a concern about the sustainability of health care and a commitment to addressing this issue.[20] ObGyns are on the frontlines of delivering care every day, so we are poised to implement changes that can impact our patients, especially when we can lead and petition hospital or local committees.[20,28,32] There is much to be done, but every voice counts and can make impactful changes at every level. ■

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