Designing a Safer Future for Sonographers: The EchoBed X

Sonography: A profession with unique hazards

Sonography is a unique profession in today's medical workplace. While technological advances have displaced many of the physical demands of healthcare professionals, sonography remains a modality that requires sustained physical exertion.

Sonographers face musculoskeletal disorders (MSKDs) and repetitive stress injuries (RSIs) because their jobs inherently involve:

- Wrist and arm abduction
- Transducer grip pressure and the use of force to attain an image
- Poor and/or static posture
- Daily/hourly repetition of these strains
- Workload management issues –sequential exams, often with little rest time between
- An obesity epidemic that has yet to level off, magnifying MSK stress
- Older average age of sonographers, raising odds of injury

A 2014 survey[1] underscores what we know anecdotally: constant, fine, repetitive movements that are forceful and awkward, lengthy examination times and poor ergonomic design of ultrasound equipment are culprits in sonographers' MSKDs. These add to other risks sonographers face from acute lifting and support strain.

Echocardiograms will continue to dominate the cardiac imaging world

The American College of Cardiology underscored the utility and prevalence of the transthoracic echo exam (TTE) as a first line test when it introduced its new Appropriate Use Criteria (AUC) for imaging for valvular and non-valvular cardiac disease in 2017 and 2018.

TTEs provide a wealth of information, have a very low radiation risk, low relative cost and are non-invasive. For these reasons, when the AUC writers evaluated imaging tests, including TTE, TEE, speckle or tissue Doppler, stress echo, RVG, MPI (SPECT/PET) and CT, the TTE was ranked as an "appropriate" test more often than any other test by a wide margin.

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The Bureau of Labor Statistics predicts that from 2014-2024, the sonography job field will grow **17 percent**.

The Bureau of Labor Statistics predicts that from 2016-2026, the sonography job field will grow 17 percent,[2] equating to 21,100 additional sonographers in the work force. As the demand for sonographers continues to grow, part of attracting the best talent is providing functionally superior equipment.

As the work force ages, and as obesity continues to climb, the practice of sonography will only become more hazardous. Healthcare administrators providing quality, ergonomically sound equipment that optimize accessibility and safety for both sonographers and patients, enjoy increased lab productivity, improved patient safety and reduced injury risks.

Sonographer injury: A costly "fact of life"?

Small strains accumulate if unaddressed

Performing a TTE is inherently awkward, largely due to the precise and often elusive angles that must be maintained to capture a quality image. Sonographers often work under significant physical and mental stress as they try to acquire quality images, ensure patient comfort and maintain productivity standards.

Injuries largely derive from strain on tendons when muscles are overtaxed or when awkward positions overwhelm muscles, causing other tissues to assume the burden. When they fail to meet the task, injury to connective tissues can occur, resulting in inflammation.

Shoulder pain is the most common complaint, followed by neck, wrist, hand/fingers, and upper back.

SHOULDER	17%
NECK	15%
WRIST	11.4%
HAND/FINGERS	10.2%
UPPER BACK	10.2%

Shoulder pain is the most common complaint (17%), followed by neck (15%), wrist (11.4%), hand/fingers (10.2%), and upper back (10.2%).[3] Tendonitis (including trigger finger and De Quervain syndrome), tenosynovitis, bursitis, rotator cuff tears and nerve entrapment (carpal tunnel, cubital syndrome), are characteristic injuries. Numbness, tingling, muscle spasm, loss of strength and pain occur as these strains, not given the opportunity to fully heal, accrete over time.

Injuries are broadly underreported

Numerous studies document the high rates of injury sonographers suffer. A seminal study in 2009 by Evans, et al. found that 90 percent of sonographers scan in pain.[4] An earlier study by Pike et al. found 20 percent of sonographers who were symptomatic suffered career-ending injuries.[5]

Caught early and allowed to heal, these injuries are mostly resolvable. But a SDMS survey showed that 57 percent of participants did not report their injury to their administrator or occupational health department.[6]

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A 2016 study suggests that too little is done in the workplace to address ergonomics. They also found that “most sonographers reported no formal training in ergonomics and no support from upper management for an injury prevention program.”[7]

According to Baker and Jones, most hospitals and imaging organizations don’t provide ergonomic equipment—examination tables, chairs, and stools—that are adjustable or have foot rests or arm support, nor do they schedule breaks between procedures.[8]

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In short, too many sonographers are resigned to pain as a given hazard of the job. Baker and Jones concluded that "workplace culture appears to prevent sonographers from reporting their injuries to management, citing lack of formal mechanisms to do so, fear of retaliation or job loss, and feelings of hopelessness that the problem would be addressed."[9]

Mounting injury hazards and their costs

Demographic trends do not portend a less physically taxing role for sonographers. Year by year, we are steadily moving toward an older[10] and more obese population in the United States.

As America grays and more defer retirement, the average age of sonographers rises as well. With age-related decline in muscle strength, risk of injury increases.

The rising prevalence of obesity is a clear threat to sonography safety. Exams are made more difficult as sonographers must exert more pressure and extend their reach further to scan obese patients and attain quality images. Sonographers who are themselves obese stand to develop health conditions that make them more likely to develop a MSKD/RSI.[11]

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The Bureau of Labor Statistics says work-related MSKDs across all industries cost employers up to $20 billion annually in direct costs such as worker's compensation and medical expenses, and up to five times that in indirect costs such as lost revenue, absenteeism, and hiring and training new employees. All told, estimates are that over $120 billion a year is spent on work-related

MSKDs. $1 of every $3 of workers' compensation costs are spent on occupational MSKDs, and a typical claim costs $29,000 - $32,000 per year.[12]

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The number of people working as traveling sonographers attests to the frequency of lost time injury in this profession. Jeremy, an MPI customer with Seton Heart Institutes, remembers this problem well. "When I worked as a travel tech, 60-70 percent of all contracts were for sonographer injury. They needed to fill the job while the sonographer healed from carpal tunnel or a rotator cuff tear repair," he said.

Professional association recommendations for safe scanning:

The Society of Diagnostic Medical Sonography plays an active role in defining the sources of injury and recommending product features that reduce the risk.

SDMS explains that injuries typically occur through:

1. Awkward or sustained postures occur when body parts are positioned away from their neutral position and increase as they are sustained. They explain, "*Sonographers often exhibit awkward postures during scanning in an effort to access the region of interest or as a result of insufficient adjustability of equipment.*"
2. Sustained contact pressure, for example from resting the hip or forearm against the exam table while scanning.

While recognizing that risk is inherent in the job, they offer mitigation guidance within seven categories of ultrasound equipment: system console, control panel, monitors, transducer, **examination table**, scanning chair and accessories.

In their white paper, the SDMS exhorts employers to "provide equipment with exam specific features and adjustability for optimizing scanning posture. This includes not only the ultrasound system, but also the exam tables, scanning chairs, external monitors, and adaptive support devices."[13]

They make six general recommendations for helping sonographers work safely. Two have implications for the table used for exams, suggesting that employers:

- Limit portable/bedside exams to critical patients, with task rotation implemented to reduce exposure rate.
- Provide equipment with exam-specific features and adjustability for optimizing scanning posture. This includes not only the ultrasound system, but also the exam tables, scanning chairs, external monitors, and adaptive support devices.

The Intersocietal Accreditation Commission (IAC) Standards and Guidelines for Adult Echocardiography Accreditation also offer guidance on the echo bed, highlighting "proper patient positioning during image acquisition (beds with imaging drop sections are strongly recommended)."[14]

To help sonographers gain an advantage over occupational hazards, these organizations support maintaining an ergonomic triangle of equipment that consists of an ultrasound machine with a swivel keyboard, an adjustable chair with back support, and an exam table with features that encourage scanning in a neutral posture.

MPI: First to market with ergonomic features

Introduced in 1988, the EchoBed was the first to market with a specialty medical bed to feature the imaging drop section for unhindered ergonomic access to the apical view during echocardiograms.

At the time, Mike Falbo was an engineer and designer at Kansas City-based Colonial Upholstery Company, which both built and reupholstered furniture. He built the first echo bed in response to a request by cardiologist Linda Crouse of the Mid-America Heart Institute of St. Luke's Hospital for an ergonomic bed. The product Falbo developed enabled such quality images that the news spread fast. Falbo patented the drop-down feature and American Echo — now Medical Positioning Inc. (MPI) — was born.

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What should an ergonomic exam bed look like?

A 2013 review of the literature on best practices for reducing sonographer injury concluded that:

> "The exam table should be height adjustable, ideally by electric controls rather than manual. It should go low enough to accommodate wheelchair transfers and to perform lower extremity exams, and high enough to allow sonographers of various heights to stand during exams. Other features can be added to the exam table to enhance its ergonomics. Some of those features might include…a right-side back access panel that allows the sonographer to roll the patient on to his/her left side and step in closer to the patient, a removable left panel that is used to access the apex of the heart during cardiac exams, a detachable headrest for access to the patient's neck, and a detachable arm board for upper extremity exams."[15]

Today, many healthcare centers want more flexibility, more options from their echo bed, to protect patients and sonographers, particularly as the proportion of older and heavier patients rises. Echo beds with the capacity to be lowered to ADA-compliant 19 inches and the ability to accommodate the largest bariatric patients represent a major forward stride in preventing sudden acute injury for patient and sonographer.

In 2017, MPI responded to these industry needs in introducing the EchoBed X, which features a 19" low height entry, a 600 pound patient weight capacity and a 1,000 pound static load capacity. Down to the small details, like the pinch flaps which cover the gaps of the drop section, the EchoBed X is designed to provide the best ergonomic experience for the sonographer and the patient.

ADA compliant features equate to patient and sonographer security

43 percent of all middle-aged adults today are not just overweight, but obese (CDC citation).[16] In acknowledgement of this and to reduce fall risks and improve transfers for all patients with

limited mobility, the Americans with Disabilities Act (ADA) issued revised recommendations for exam tables in 2013 to provide adjustability down to 17-19 inches.[17]

MPI customers see these ADA-compliant features as invaluable for transferring patients who are obese and/or have immobility issues.:

> *"We do a lot of pre-op clearances for bariatric surgeries and such, so we get patients who are over 400 pounds on a regular basis and a lot of beds max out at 400 or 350 pounds. The bed that we have will lift up to 600 pounds and hold up to 1000. It's good ergonomically not only for the sonographer but for the patient. It also lowers to 19 inches, so the patients we have that are in wheelchairs or walkers don't have to get up and down. We can adjust the bed based on the patient and don't have to worry about their climbing or using a step stool."* Carrie at Capitol Cardiology.

> *"Ergonomics is part of our IAC accreditation. Our cardiologists rely HEAVILY on the quality work our sonographers perform, so we take their health and safety very seriously. This is one of the reasons we ordered these EchoBed X's. They can be lowered to accommodate our aging population and help eliminate the need for our sonographers to do any lifting."* Shaunda at Via Christi Clinic

What differentiates an MPI EchoBed X purchase from alternatives?

MPI's EchoBed X has undergone a rigorous, seven year equivalent testing cycle. Its mechanical and electrical durability are unmatched. The electronic controls the EchoBed X offers are important for sonographer comfort. These are not yet the industry norm. Studies report that approximately 80 percent of sonographers have access to adjustable scanning tables and height-adjustable chairs, but that the tables may not have electric controls and the chairs may not be adequate for proper scanning postures.[18]

EchoBed X customers can choose to add a variety of supports, extensions and safety straps, as well as electric Fowler (0° - 65°) and Trendelenburg (±15°) adjustability.

MPI stands alone as the only significant supplier of exam beds to have all operations under one roof. Our engineering, sales team, customer support, assembly are all in Kansas City, Kansas, allowing us to be optimally responsive to our customers' needs.

Here is a sampling of customer reflections on their choice to purchase EchoBed X:

> "*This is the best bed out there. When I see other beds other places, more often than not they seem a little flimsier to me and not as nice. People do notice the furniture that they're on. When we are opening up a new place in a nice town we want things to look nice, and aesthetically, off the bat, this bed looks professional and sturdy. Wear and tear is very minimal…it holds up well over time."* Darrel at Stamford Hospital

"My techs were complaining about their backs and their wrists hurting because of the way they had to position themselves and how hard they had to press to get quality images. Since using the EchoBed X, my worker's comp injuries have gone down and my employees are happier. By preventing just one back injury, that more than pays for the cost of bed." Catherine at Kaiser Permanente

"I like the sonographer extension seat that it has, the dropout and the patient positioning wedge that are built into the bed. It's hard to find beds that will accommodate patients of a heavier size, but the Echo Bed X lifts more and goes lower than the previous bed I worked with." Carrie at Capitol Cardiology

> Since using the EchoBed X, my worker's comp injuries have gone down and **my employees are happier**.

" I have sonographers who have had hip replacement, knee replacement, shoulder surgery, carpal tunnel issues, but this bed is able to go up and down enough and with the dropouts on both sides of the bed, it just works for everybody. We haven't had any MSKD issues yet in those who use these beds. It works for every different type of sonographer to prevent every type of injury." Darrel at Stamford Hospital

"MPI has a great sales team. They were very helpful in getting me the right product for the right price. We received the product in a very timely manner." Shaunda at Via Christa Hospital

Expect a strong ROI with the EchoBed X

Cardiac sonographers spend the better part of eight hours a day with their echo machine, table and chair. Managers responsible for recommending and purchasing equipment that forms this "ergonomic triangle" have significant tradeoffs to consider.

In 2002, Amick et. al. demonstrated that ergonomics in healthcare workplaces improves performance by 17.7 percent, and delivers a benefit-to-cost ratio of 24:1.[19] Higher end machines with swivel keyboards may equate to higher quality images and shorter exam times. A top-of-the-line chair may avoid back strain and trip hazards and compliment an ergonomically sound exam bed. The ergonomic bed helps assure patient safety and enables the all-important neutral posture that keeps sonographers in the work force and free of long-term injury.

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But at what cost? What is reasonable for maintaining this ergonomic triangle?

Direct and indirect costs associated with an occupational injury include the medical cost of treating the injury, the cost of replacement staff, and the loss of revenue secondary to decreased productivity during time loss. We have looked at worker's compensation costs and medical bills, but add to this the cost of hiring a contract sonographer as a placeholder, factor in lost lab productivity while the sonographer heals and after returning to a modified workload to protect against reinjury.

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Sample costs if a sonographer (average salary $67,622) is out due to a MSKD/RSI for 12 months:

DIRECT COSTS:

$22,858	Additional cost of hiring a traveling or per diem replacement in lieu of employee's salary
$10,500	Recruiting costs for new hire if sonographer doesn't return to the job

INDIRECT AND OTHER COSTS:

$29,000 - 32,000	Worker's compensation medical expenses, impacting rates
$45,082	Worker's compensation lost time compensation benefits paid to employee
$4,500	Daily lost echo lab revenue while finding and training replacement (an ultrasound room down)
$1,125	Daily lost echo lab revenues if sonographer returns to a three-quarter workload

Intentional safety

We are doing more imaging than ever in the U.S. The primacy of TTE was recently reinforced through new AUC documents that recommend TTE as a best first study for most cardiac conditions. The traditional echo exam room, as an outpatient procedure in the hospital or at a physician's office, is still the primary means of attaining echo images. The echo bed remains the site of most sonographers' time.

As the work force ages, and as obesity continues to be pandemic, this job is not on pace to become easier. Demand for sonographers will continue to grow, and part of attracting the best talent is offering an optimally safe workplace.

Injury rates will not improve without improved planning and vigilance. This entails:

1) an optimized ergonomic triangle of equipment to support neutral posture and safety
2) training for safe scanning
3) sonographers performing exercises for muscle strengthening and flexibility
4) intentional scheduling, with a sensitivity to the need for rest
5) enforced SOPs on assisted lifting and other risk-laden practices
6) education and open communications about symptoms, so strain and injury are detected and treated before chronic conditions develop

We may add robotics and other high-dollar technology to our hospitals that lower the labor-intensive nature of many healthcare professionals' jobs. Sonography, however, is unlikely to experience such a sea change. Managers can commit to reducing injuries incurred in this intensively hands-on profession by providing a quality ultrasound system, supportive chair and the right exam table, one that optimizes accessibility and comfort.

Doing so pays off in higher productivity in their lab, patient safety, quality imaging studies, and retention of healthier, happier sonographers.

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