Medical Personnel Injuries: The Problem and the Solution

An Emphasis on Sonographer Workplace Injuries

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Abstract

Injuries in the workplace are a common and a troublesome fact of life for employees as well as employers. This paper focuses on injuries in the medical field, specifically work-related injuries among ultrasound technologists or sonographers. By investigating techniques, procedures, and possibly equipment to aid sonographers in their day-to-day tasks, these acute injuries and long-term disabilities may be prevented. Help comes in many different forms, from general awareness, a deeper understanding of the different imaging modalities and their uses, the use of exoskeletons, and utilizing technology from robotic surgery. By bringing to light the trials and disregard ultrasound technologists encounter, we can mitigate injuries and alleviate the financial burden on the hospital system and the employee. We may also reduce the emotional and mental strain on ultrasound technologists, so our frontline caregivers can focus on providing the best patient care possible while being physically able to remain in the field they love.

Ultrasound, or "sonography," is not considered an occupation with workplace injuries. But, though subtle, injuries sustained injuries due to repetitive movements occur in sonographers more often than most people realize. Frequently, sonographers sustain an injury and keep performing exams as if nothing happened. From being put into strained positions, holding them for prolonged periods, pushing machines, and helping patients into the positions needed for the exam, injuries to the neck, shoulder, wrist, arm, and back occur. Due to the nature of the profession and the overall mentality of ultrasound technologists, there is no time to stop for pain. Working as a sonographer and experiencing profession-related injuries and the surgeries needed to repair them has enlightened me to the extent of the problem. Thus, I come from a position of personal experience and an intimate, albeit painful, knowledge of the subject. By investigating practical solutions, ranging from simple and easy to intricate and revolutionary in medical imaging, answers to this growing problem can be addressed. Looking at other facets of the medical field and showing the issues faced by sonographers and other medical imaging personnel impacted by this may improve productivity and patient care. I will also look at the repercussions of potential shortages of imaging technologists if nothing is done to solve the problem. Utilizing the research available and previous papers written on the subject, I find prevention and previous papers on the subject that injury to our healthcare providers is not out of reach. We live in a world of possibility. By pursuing long-term solutions and previous papers on the subject, we do a disservice to the ones who care for us during our most vulnerable times.

What is "WRMSDS"?

WRMSDS, or "work-related musculoskeletal disorders," is the umbrella term for conditions caused by repetitive strain due to use occurring over an extended period. These are not acute or sudden injuries such as a fall or a slip, as one would associate with most workplace injuries. WRMSDS affects the soft tissues of joints and muscles. In some cases, the damage is career-ending and happens over time. Most symptoms include stiffness of the affected area, weakness, swelling, "pins and needles" (also known as paresthesia), and severe pain. The symptoms are seen most often in the workplace but then bleed over into everyday life, hindering the quality of life for the injured. Simple tasks such as sleeping, dressing in the mornings, writing one's name, or being able to walk more than a few steps due to these injuries are life-altering and lifelong. In 2015, the percentage of sonographers scanning in pain was found to range from 80-90.5% due to work-related musculoskeletal disorders (Harrison & Harris, 2015). According to research published by the Society of Diagnostic Medical Sonographers (SDMS), 72% of sonographers in the 10th year of their career suffer from injuries and continue to scan in chronic pain. Injuries include carpal tunnel syndrome, epicondylitis of the elbow, shoulder capsulitis, tendonitis, and neck and back strains (Murphey, 2017). The CDC reports that environments with manual labor components (i.e., lifting, holding, throwing, pushing, pulling, etc.) and prolonged exposure to those work environments can contribute to developing these issues (CDC, 2019). The Bureau of Labor and Statistics (BLS) predicts that sonographer employment will grow 10% faster than the average for all occupations from 2021 to 2031. With this information, one can only imagine the increase in injuries unless steps are taken to avoid them before they occur (BLS, 2023).

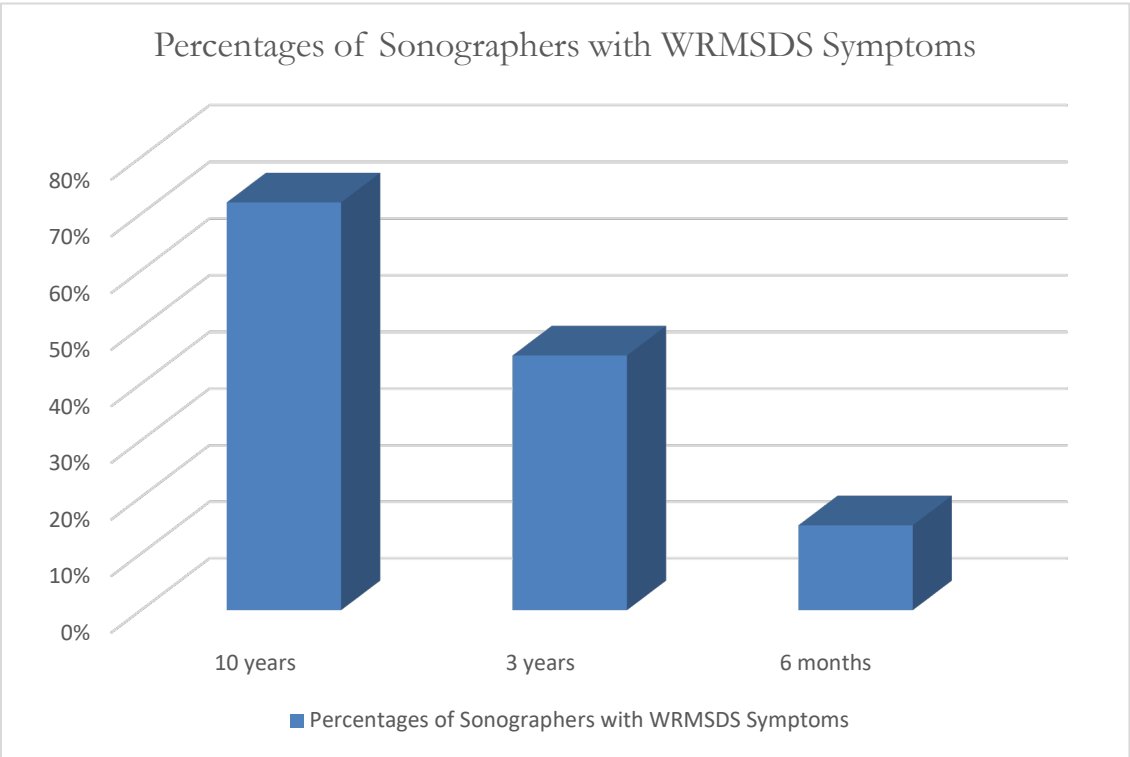

Figure 1: Percentage range of sonographers with WRMSDS symptoms. Data from Murphey 2017.

Ergonomics and Patient Load

Ergonomics is defined as the arrangement and design of office items people use to be more efficient and safer, with the overall goal of reducing injuries and risk of injuries (UCLA Ergonomics, n.d.). Experts, occupational health, and sonographers say ergonomics is the key to stopping all injuries in the ultrasound career field. This is a widely held belief in the medical world because it is valid to an extent, cost-saving, and a simple fix. However, while this may help in some instances for most sonographers, it is only helpful in certain situations. In a perfect world, the ultrasound technologist can alternate between standing and sitting in a neutral position, arm close to their body without reaching and asking the patient to position themselves as close to the sonographer as necessary. Outpatient clinics are more suited to this; however, many barriers make ergonomics challenging in a hospital setting. Medical equipment (e.g., IV pole(s) and ventilators), restricted room size, and limited mobility of the machine, bed, and/or the patient can make imaging difficult. Many people today have higher body mass index (BMI) and varying degrees of limitations, further limiting ergonomics' effects on the work process. Patients who cannot move well, or at all, for the exam, cause more strain on the sonographer due to the difficulty of reaching areas on the body where an organ can be best imaged. In these cases, the sonographer will contort, stand in abnormal positions, and push as hard as needed, if the patient can tolerate the pressure, to achieve the highest quality images. Ultrasound depends on the technologist's ability to obtain exam images for the radiologist to read (Murphey, 2017). With this information alone, it is easy to see how injuries will continue due to the lack of ergonomic capability and a heavy workload. Therefore, ergonomics is a starting point for a better sonographer environment but is not a cure.

Patient Load

Patient load is another problem in ultrasound. As ultrasound has become more popular with ordering physicians, the number of exams being ordered has exploded. While the number of ultrasound exams that should be done is not concrete, some experts say one exam per hour is reasonable. Most job sites do not follow this rule and try to schedule as many ultrasounds as possible, increasing the risk of even more injuries due to muscle and joint fatigue. Many exams, which range from general to vascular and echocardiography (ultrasound of the heart), can be long and complex depending on the disease process and whether the patient can easily be scanned. The exam type and patient condition, the knowledge that patients are waiting on them, and the commitment to provide the best exam drive many sonographers to push themselves beyond their physical capabilities to complete more exams than they should (Orenstein, 2009). Levin et al. reported an increase of 87% in ultrasound orders from 1993 to 2001 from cardiologists and a 43% increase from other physicians in the same period (Levin et al., 2004). As the popularity of ultrasound continues to grow, due to the minimally invasive nature and no exposure to radiation, these numbers will continue to increase, increasing the patient load on sonographers.

Portability

Another problem contributing to the workload of sonographers is the ability of ultrasound to scan at the bedside. While this is a beautiful advancement regarding the new lighter-weight machines and transducers (probes), it still requires the technologist to push the machine up and down hallways, into and out of patient rooms, and into and out of elevators while maneuvering the

machine around other personnel. While this lightweight machine is more accessible for the sonographers to move, it increases the probability for the tech to come up against obstacles presented earlier concerning the environment within the patient room.

Smart Ordering

Based on my work experience in the hospital setting, repeat ordering is a cause of burnout and inefficient use of resources and people. This is not to say repeat exams are a waste of time, but they should be reserved for cases in which it is necessary for patient care. In imaging, Computerized Tomography (CT) scans utilize a series of X-Rays taken at multiple angles to stitch together images of bone, blood vessels, and soft tissues inside the human body (CT scan, 2022). CT and ultrasound are often used in conjunction to aid in diagnosing the patient. Unlike ultrasound, CT can see through bone and air (gas) in the abdomen and image patients with larger body masses. However, it cannot distinguish between solid and cystic tissue, thus requiring ultrasound capabilities. The problem comes when physicians order a CT, get the results of gallstones (which can be evident on CT), then order an abdominal ultrasound for the already known gallstones. This is an example of unnecessary ordering. Nothing is gained by ordering an ultrasound other than confirming what is already known. Educating our physicians on using imaging modalities will save our patients money and the mental trauma of countless exams. It will also alleviate some of the stress on an already overworked staff striving to care for them. By working alongside our radiologists, the instances of superfluous ordering can be significantly reduced.

Using What We Have

Robotic ultrasound

Understanding our abilities and technological advancement can increase the effectiveness of workers and the number of patients that can be cared for safely. The number one goal in any hospital is patient safety. While this proposal initially came about during the Covid-19 pandemic, robotic ultrasound scanning should be investigated for long-term, if not permanent, use. Adapting equipment and techniques used in robotic surgery for ultrasound is another way to take a step closer to stopping this vicious cycle. Akbari et al. recommended using imaging algorithms to calculate the imaging need and adjusting for the best overall image, but also the amount of pressure needed to help acquire the optimal image (Akbari, 2022). Using this technology to take the pressure off the sonographer's body and placing the burden on a machine would not only keep techs from being injured but also from being exposed to different pathogens in the hospital setting. Taking this information and adapting it to robotic surgery would entail creating an ultrasound machine with a single arm to which a transducer can be fixed and operated from the ultrasound machine itself. Having a machine with such capabilities could increase the number of scans that could be done without sacrificing the sonographer.

Exoskeletons

Another possible solution to this problem lies outside the medical field in the realm of exoskeletons. Many companies have developed exoskeletons for the upper and lower body to help aid in the recovery of patients and the prevention of injuries. These can attach to the hands, shoulders, back, and legs to take the pressure off the body part they are attached to. They are a promising solution for the predicament in which ultrasound finds itself. Ekso Bionics has created many exoskeletons,

including one focused on the upper body. It is designed to reduce fatigue and the risk of injury in those exposed to repetitive work and overexertion (Ekso Bionics, 2018).

Health System Impact

A secondary angle to approach this issue is from the employer's viewpoint. How much does an injury cost the company? The term "cost" in this paper is not merely financial but refers to the overall function of the business. Add in the possibility of a staffing shortage and sicknesses contributing to man-hours lost, and one will find a recipe for burnout and other injuries. On average, injuries resulting from a fracture or dislocations cost around $60,943, while other traumas averaged $60,288 per workman's compensation claim between 2019 and 2020, according to the National Safety Council (NSC, 2022). When a sonographer is injured and the injury is reported, workman's compensation is started to aid the healing of the injury of the technologist, thus contributing to the above-mentioned numbers. It is hard to say the total cost for a hospital system per year without knowing exactly how many employees are out at a given time. Another source found the direct and indirect cost to hospitals with workman's compensation claims of over $120 billion yearly (Murphey, 2017).

Traveling Sonographers

Another aspect of the financial strain on the hospital system comes from the hiring of traveling technologists. Most sonographers who do not travel make on average $80,000 depending on experience and the setting in which they are (BLS, 2022). When an ultrasound unit requires help, hospitals, and clinics contact various travel agencies. Traveling companies help hospitals fill the gaps in their workforce when it's hard to find employees or when temporary help is needed. The use of traveling technologists spans from employee illness to a lack of applicants, and the financial burden on the hospital system can be extensive. One job ad for traveling technologists offers up to $2,000-$2,800 per week, making their yearly salary roughly $104,000-$134,400 (AMN Healthcare, n.d.). While their actual paycheck comes from the placement company, the hospital pays to have a contract with the staffing company, costing the hospital money for each traveler. If the use of traveling sonographers and other staff can be dedicated to other areas (i.e., maternity leave or non-injury related issues), we could see a reduction in hospital costs and a possible bump in pay for long-term employees.

Effects of Occupational Burnout

The financial burden aside, we can also look at the human strain of having one or multiple workman's compensation claims open in a unit. This strain leads to occupational burnout and if not dealt with can lead to physical and mental symptoms. According to the World Health Organization (WHO), occupational burnout is a workplace phenomenon resulting from chronic workplace stress that is not effectively managed. There are a few classic symptoms of this phenomenon such as energy depletion, exhaustion, negative or even cynical feelings towards one's job, a feeling of distance from one's job, and reduced professional efficiency (WHO, 2019). The Mayo Clinic links unaddressed job burnout to heart disease, high blood pressure, type 2 diabetes, and vulnerability to illness (Mayo Clinic, 2021). With evidence about the dangers of occupational burnout, why are hospital systems not taking better care of their employees? If one sonographer is out due to an

injury, their shift needs to be covered, causing a burden on the other full-time, part-time, or as-needed employees. This increases the rate of injuries and the chance of occupational burnout among those picking up the extra shift. Everything that happens has a far-reaching cascading consequence. So how can we mitigate this problem? How do we meet the needs of the employees and employer at the same time? There are a few ways in which we can achieve this.

Possible Solutions

Ordering Protocols

Possible solutions can be presented from the simplest to the most complicated with more significant expenditure of resources. The first and most straightforward solution is to make sure the protocols within the hospital state clear and concise steps for ordering multiple forms of imaging. Eliminating the confusion and listing the appropriate imaging methods will allow technologists to do more pressing exams. Additionally, the equipment is not worn out, and time is not taken for an exam that is not completely necessary. For example, if a CT is ordered and the cause of the patient's discomfort is answered, there is no need to turn around and order another test. An ultrasound is warranted if there is a question of cystic versus a solid mass.

Education on the different imaging modalities and their abilities and limitations will also save money for the patient and the hospital system. This will streamline the workflow for the technologists to get to those who genuinely need the exam and save their bodies from the wear and tear of back-to-back patient cases.

Ergonomics

Ergonomics, another solution, is at the forefront of the Occupational Health offices in the hospital systems. Ergonomics, in essence, "fits a job to a person," as OSHA states on its website about the subject (Department of Labor, n.d.). Ergonomics focuses on the angle of computer monitors, the desk's height, lighting, posture, and keeping needed supplies within arm's reach. This creates a workspace conducive to an individual's needs and requirements and the ability to move without being restricted to one posture (What is ergonomics?, 2017). There are three different forms of ergonomics, and all three affect the healthcare professional.

The first category is physical ergonomics, the design of the work environment. The second is cognitive ergonomics. This area relates to the work environment and how it impacts the worker. This encompasses things like information display and decision-making as well as task design. If a sonographer feels supported by the company they are working for, the ability to speak up and advocate for themselves can help mitigate injury. If the worker does not feel they have a say in what happens to them, the problems spiral out of control. The final category of ergonomics is organizational. Organizational ergonomics concerns work hours, breaks, and work-life balance (Abbas, 2022).

By implementing all three categories of ergonomics, hospitals can set their employees up for safety and success while maintaining a high standard of care for the patients depending on them. The education of management and workers are the key to making this solution work. By working on problem identification, training, encouraging reporting of the early symptoms of WRDMS, and enforcing a safety policy for the employee, we can start to cut down on the number of injuries in

hospitals. Ergo Plus, a company specializing in preventing musculoskeletal disorders (MSDs), provides services and software to help prevent workplace injury. Middlesworth for Ergo Plus argues that an average of 59% reduction in musculoskeletal disorders and a 68% reduction in workers' compensation costs can be achieved by simply practicing ergonomics. Another exciting claim by Middlesworth regarding ErgoPlus is its 48% reduction in employee turnover and an average of 58% reduction in absenteeism (Middlesworth, 2013). Stating these goals, however, is not enough. The employee needs to feel that reporting these symptoms is safe. Many technologists scan in pain and do not report their discomfort for these reasons, and this culture needs to change. In a study by Amanda Hogan, 57% of injured sonographers had not reported their injury to management (Hogan, 2021). Solutions to this stigma of reporting injuries start with upper and lower management genuinely caring about employees and their well-being. Management often forgets that if they did not have imaging technologists, nurses, janitorial staff, nutrition staff, and all those in between, their hospital would not operate.

Other Solutions

Exoskeletons

Exoskeletons are being used to aid in the healing and therapy of patients; therefore, the question may be asked why hospital employees should not also use these aids. Ekso Bionics first developed its bionic exoskeleton for those with spinal cord injuries, strokes, acquired brain injuries (ABI), and multiple sclerosis (MS). Over time they developed different exoskeletons to improve the outcome for those with complicated recoveries and have now created wearable exoskeletons for those in the workforce. I agree with their statement, "Every injury is preventable." Ekso Bionics has devised a wearable, lightweight, and durable exoskeleton for those in the workforce called EVO. The EVO allows the user to perform repetitive tasks without injury and helps avoid injuries to the arm, elbow, and other joints. Ekso Bionics states that their EVO device will prevent workplace injuries – especially shoulder injuries, one of the most common complaints in ultrasound. The EVO is a spring-loaded exoskeleton, so the use of batteries or other sources of electricity is not needed. According to their website, companies like Boeing and Ford have reduced production costs and worker injuries while increasing productivity (EVO, n.d.).

Another company delving into the world of medical exoskeletons is Comau. They have created the MATE-XT or Muscular Aiding Tech Exoskeleton. The MATE-XT is used for indoor and outdoor ergonomic support and is designed to provide antigravitational support for shoulder movement. They state that the MATE-XT will reduce muscle fatigue, improve work posture, and increase performance while enhancing the quality of life at work. MATE-XT contains spring-loaded actuation boxes that store energy during the extension or reaching phase and then return as the user bends or returns to a flexion phase (Frequently Asked , n.d.).

One last example is the Japet W. This exoskeleton focuses on those with lumbar constraints, and according to the company, 20% of work accidents are back-related. In the healthcare field, this is a genuine concern in all departments. Most healthcare workers strain their backs while bending over their patients. The company states their exoskeleton "reduces the impact of heavy lifting, constraining postures and repetitiveness on the back by up to 100%" (Japet[w], n.d.). These examples are only a few of the products available for workers. Many different areas of healthcare could benefit from having an exoskeleton available, not just imaging. The ability to move naturally and efficiently will help increase an employee's longevity and overall happiness at work.

A fourth and exciting invention by OpenBionics is the exo-glove. Initially, this glove was made for those who have suffered from paralysis or strokes and for healthy individuals. Made to enhance the wearers grasping capabilities along with the intuitiveness of the operation, it has low autonomy, low maintenance, and low cost. This device evenly distributes the grasping forces over the participating fingers and allows for delicate and precise movements (Exoskeleton Gloves, n.d.).

Surgical Robots

Another solution to the problem of WRDMS in ultrasound technologists is surgical robots. Robotic surgery has been around since the 1980s, with the first use being a brain biopsy (Christiansen, 2022). Medtronic, an American medical device company, has developed a new device called Hugo. Hugo is a portable robotic-assisted surgery device designed to be flexible to fit different special needs and unique patient needs (Hugo™ RAS System, n.d.). If Medtronic can produce a machine capable of performing robotic-assisted surgery anywhere it is needed, why can't the technology be adapted to support the needs of ultrasound technologists? The arm of the device can be remotely controlled by a trained sonographer allowing the exam to be performed safely and without risk to the employee. Also, instead of requiring multiple transducers with lengthy cords that weigh on the sonographer's hand, the software could switch between the different transducers needed for an exam. This eliminates the need to carry around multiple transducers and limits the injuries on the sonographer's body. Finally, this device can be unequipped for specific transducers designed to go inside the human body and operated by the technologist.

Summary

This paper's goal was to open minds to think outside the box and come up with solutions to decades-old problems. Whether we find answers with ergonomics, ordering fewer repeat/excess studies, exoskeletons, robotics, or a combination, the future of our sonographers and other medical professionals hangs in the balance. Healthcare workers deserve attention and care in honor of what they do and the sacrifices they make to help make our lives better when we are at our worst. Let's come together and find solutions to help our medical facilities hold onto their workers, reduce the number of injuries sustained, and reduce the financial burden on our medical facilities. Every injury is preventable with the right mindset and tools.

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