

MUSCULOSKELETAL DISORDERS IN GEORGIA SONOGRAPHERS

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This thesis is submitted by Lynn K. Reyes and has been examined and approved by an appointed committee of the faculty of the School of Graduate Studies of the Medical College of Georgia.

The signatures which appear below verify the fact that all required changes have been incorporated and that the thesis has received final approval with reference to content, form and accuracy of presentation.

This thesis is therefore in partial fulfillment of the requirements for the degree of Master of Science.

April 13, 2001
Date



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I. INTRODUCTION

A.1. Statement of the Problem

Musculoskeletal disorders (MSD) account for 34% of all missed days of work in the general work force according to the Bureau of Labor and Statistics (BLS). Carpal tunnel syndrome (CTS), one type of MSD, accounts for more days away from work on the average than any other work related injury. The cost of MSD in workman's compensation claims to employers is estimated at \$15 to \$20 billion annually. Severe cases of MSD can lead to permanent disability. Sadly, MSD is known to be preventable, but requires employer intervention and education of both employee and employer. (Occupational Safety and Health Administration [OSHA], 1999) Early detection is crucial if disabling injury is to be reduced and intervention effective. (Yassi, 1997)

Musculoskeletal disorders (MSD) are pathophysiologic processes such as tendinitis, tenosynovitis, neuropathy and a number of other similar disorders affecting the skeletal muscles and their supporting structures. MSD is also known by many other names including: cumulative trauma disorders, repetitive strain injury, overuse syndrome, carpal tunnel syndrome (CTS), and cervicobrachial disorders (see Appendix A). (Pike, Russo, Berkowitz, Baker, and Lessoway, 1997) The causes of these pathologic processes

include: 1) low level, repetitive muscle contractions for long periods of time without rest and 2) prolonged and repetitive loading of muscles. Muscles, tendons and ligaments respond to these stresses with weakness and inflammation. Cartilage will deteriorate when exposed to excessive loading. Nerves will respond with pain, dysfunction and eventually permanent tissue damage. (National Research Council, 1999)

This study is designed to identify: 1) the incidence of MSD and MSD symptoms in sonographers in Georgia; 2) whether there is a relationship between gender and pain while scanning in sonographers in Georgia; 3) whether there is a relationship between the diagnosis of MSD and MSD symptoms and gender; 4) whether a relationship exists between sonographers in Georgia with MSD and MSD symptoms and use of analgesics and/or anti-inflammatory drugs and their continuation of work; 5) whether a relationship exists between gender and the use of analgesics and/or anti-inflammatory drugs in sonographers in Georgia who have developed MSD and MSD symptoms and continue to work in pain; and 6) whether a relationship exists between sonographers in Georgia with MSD and MSD symptoms and the use of nutritional supplements and their continuation of work.

A.2. Limitations of Study

There are several limitations of this study. The first limitation of the study is the use of a survey. Depending on percentage return, the survey results may not be a fully accurate assessment of the population from which the sample was taken. Some of the non-respondents could have provided information that might have changed the results in some way.

The second limitation is the method of sample selection. Random selection was not implemented in this study, because the incidence of MSD and MSD symptoms in Georgia sonographers needs to be understood to the fullest. The sample was the list of members in Georgia from the Society of Diagnostic Medical Sonographers' (SDMS) membership. This membership traditionally represents general sonography more so than the other specialty areas of sonography such as cardiac and vascular technology. An additional 40 surveys were sent to sonographers who were not SDMS members, but wanted to participate in the study. Therefore this sample may not accurately present the incidence of MSD and MSD symptoms in all sonographers in Georgia. This method of sampling was chosen, however, to allow a more accurate comparison with the findings of the Lam et al. (1997) substance use study. Without random sampling of the population, it

is possible that the respondents could have characteristics that would not be seen in a randomized sampling of the general sonographer population in the United States.

Necas (1996); and Vanderpool, Friis, Smith, and Harms (1993) confirmed that MSD is an occupational risk for all sonographers.

The subject of musculoskeletal disorders in the general workforce has been well covered in the literature with more than 2000 studies dealing with MSD having been identified. (Bernard, 1997) In 1998 the National Research Council of the National Academy of Science was requested by the National Institutes of Health to review the scientific literature on work-related musculoskeletal disorders focusing on the lower back, neck and upper extremity. The National Research Council brought together a group of 66 experts in this field in a workshop. These experts were chosen to participate in the workshop based on their active involvement in research in the area. The results of the workshop led to the publication of a text in 1999 entitled, "Work-related Musculoskeletal Disorders: Report, Workshop, and Workshop Papers". This work examines the risk factors that contribute to MSD as well as the strategies for intervention and prevention (National Research Council, 1999).

In 1997 Yassi reviewed the evaluation process of RSI (MSD), clinical course, treatments, and prevention. In the clinical course, Yassi identifies several different stages of RSI (MSD). The first stage is reversible and may be present for weeks or months. During this stage, the symptoms include muscle aching and weakness during work activity with improvement of symptoms during off days. The next stage may persist for

months. Loss of sleep and difficulty maintaining work activities are characteristic of this stage. Yassi emphasizes that early detection is crucial if disabling injury is to be reduced and intervention effective. (Yassi, 1997)

Risk Factors for MSD

There is wide acceptance that MSD has multiple contributing factors beyond the work tasks of any occupation. These factors include, age, gender, systemic disorders, general physical fitness, and height and weight or body mass index. When looking at gender as a primary contributing factor of MSD in the general work force, carpal tunnel syndrome is the main category of MSD associated with gender. (National Research Council, 1999) Bernard (1997) recommends studying jobs where men and women perform approximately the same type tasks. One such job is sonography. Males and females perform the same transducer maneuvers and other work tasks. This would lead one to assume that there would be equal percentages of both male and female sonographers affected by MSD. Further investigation is needed to fully understand gender as an individual risk factor of CTS or MSD in general.

MSD and Sonography

Studies appearing in the published literature that focus on MSD in the sonographer population include an article by Vanderpool, Friis, Smith, and Harms (1993). In this study a survey was mailed to 225 cardiac sonographers with 101 responding (47%). Of

this group, 73 (72%) respondents were female and 28 (28%) were male. This is not an unusual distribution, since sonography is historically a female dominated profession. Of the 73 female respondents, sixty-six (90.4%) of them experienced some type of MSD symptoms. Of the 28 males that responded, twenty-one (75%) of them also experienced some type of MSD symptoms. Symptoms were classified as either carpal tunnel syndrome (CTS) or other work-related musculoskeletal injuries (also called MSD). Vanderpool et al. chose to categorize the number of symptoms experienced by sonographers into three levels as follows: no symptoms, low symptoms (1-4 symptoms), and high symptoms (5 or more symptoms). The pooled frequencies of all respondents, looking at all symptoms, revealed that 14% of all respondents experienced no symptoms, while 44% experienced one to four symptoms, and 42% experienced five or more symptoms. When the responses were analyzed by gender in addition to number of symptoms, twenty-five percent of the males experienced no symptoms where only 9.6% of the females reported no symptoms. The male respondents reported fewer combined symptoms than did the females. Unfortunately, the authors did not include the absolute number of sonographers with each symptom.

Necas (1996) conducted a study concerning sonographers and MSD. This study used a survey designed by the author based on the literature and interviews with sonographers. Four hundred and thirteen surveys were mailed to members of the Society of Diagnostic Medical Sonographers in the states of Washington and Oregon. There was a 36%

response rate to the Necas' survey. Of the 149 responding, one hundred and twenty-six were females and 23 were males. The survey addressed five areas: 1) personal attributes, 2) employment-related information, 3) personal work habits and work environment, 4) musculoskeletal symptomatology information, and 5) information about diagnosed RSIs (MSD).

The goal of the Necas study was to identify the incidence of MSD in the sample population and determine the relationship of physical attributes, workload, and work habits to reported symptoms. The respondents were then placed into 3 groups: asymptomatic, symptomatic, and RSI (MSD) sufferers. The respondents who did not report any symptoms were placed in the asymptomatic group. Respondents were placed in the symptomatic group if they reported symptoms, but had not received a formal diagnosis of RSI (MSD). The final group of respondents, RSI (MSD) sufferers, were identified and placed in this group if they had been diagnosed with RSI (MSD). The mean number of symptoms for the symptomatic group and the RSI sufferers was 9.9 and 10.5 respectively. Both groups, symptomatic and RSI sufferers, also reported similar numbers of symptomatic sites. Necas also found that the occurrence of RSI (MSD) did have a tendency to increase with the increase in the number of years worked, but he did not relate this to an increase in age. Necas also confirmed that MSD has a greater incidence in females than in males in his sonographer population. (Necas, 1996)

Pike et al. (1997) also studied MSD among diagnostic medical sonographers. In this study a pilot survey was developed from a review of the literature, personal interviews with sonographers, and input from professional sonographer societies and associations. Questions related to five areas: 1) work experience, general health, and background, 2) work schedule and work tasks, 3) work equipment, 4) problems, pain, and discomfort, and 5) work environment and corporate culture. Three thousand surveys were distributed randomly to members of the American Registry of Diagnostic Medical Sonographers. This was the largest and most comprehensive sampling of sonographers to date. Of the three thousand surveys distributed 983 or 32.8% were returned. This represents a moderate response rate. Eight hundred and thirty-five (85%) of the respondents were female and 148 (15%) were male with a ratio of 5.66:1. This ratio was consistent with the Necas (1996) survey response. Unfortunately no gender related information was reported by Pike et al. However the Pike et al. study did reveal that 81% (796) of all respondents had experienced pain and discomfort since beginning their careers as sonographers. Of the 983 respondents, ninety-one percent were still experiencing pain or discomfort. This pain and discomfort had been present for more than 5 years on the average. (Pike, 1997)

Fifty-two percent of the respondents reporting pain and discomfort had seen a physician or other health care professional. Sixteen percent of these received a diagnosis of CTS. This study is comparable to the percentage of CTS found in the highest risk

industries and even though a large number of sonographers (796) reported pain and discomfort, only 10% reported being away from work with another 8% reporting a reduction in the number of hours worked. Therefore, the Pike et al (1997) study identifies that a majority of sonographers who experienced pain and discomfort continue to work in pain.

Use of Analgesic Drugs by Sonographers

Lam, Reyes, Etersque, Jense, and Price (1997) reported on the use of chemical substances in the sonographer population of Georgia. The purpose of the Lam et al. sonography article was to report the prevalence and frequency of prescription and non-prescription chemical substance use and associated behaviors within the sonographer population of Georgia. The response rate to the survey was 68.4% (n = 108), a high response rate. Of the 108 respondents, 97 (90%) were female and 11 (10%) were male.

The Lam et al. (1997) study revealed that sonographers identifying the use of only one substance, chose either alcohol or analgesics, with alcohol (85.2%) being used more frequently than analgesics (78.1%). The respondents who used two substances identified six combinations of substances. Alcohol and analgesics was the most common pair. These findings are not surprising since alcohol and analgesics are both legal substances and easily available. The high ranking of analgesics can be associated with the work-related tasks of sonographers that increase their risk of pain. These tasks include, lifting

and transporting patients as well as other tasks specifically related to performance of the sonographic examination such as repetitive motion used in scanning.

Seventy-five percent of sonographers that used analgesics in a lifetime continued to use them in the past 12 months. Of this group, seven and four tenths percent tried to cut down on use, two and eight tenths percent were unable to cut down on use, and ten and two tenths felt they needed the drug. Of the total 108 respondents, fifty one percent (55) of these sonographers used analgesics during work in the past 12 months. (Lam et al, 1997)

Use of Non-Steroidal Anti-Inflammatory Drugs for Muscle and Joint Pain

Fletcher (2000) emphasizes the adverse side effects of NSAIDs (one form of analgesic an/or anti-inflammatory drug) and their complex interactions with the body in the healing process. Adverse side effects with long-term use of NSAIDs include inhibition of a prostaglandin known to protect the stomach lining resulting in ulcers, disruption of normal renal function that can lead to renal failure, and inhibiting the production of fibroblasts, which are necessary for natural healing of injured ligaments, tendons, and other forms of soft tissue. (Fletcher, 2000).

Murray (1996) discusses the use of non-steroidal anti-inflammatory drugs in treating osteoarthritis. Murray states, " ... aspirin and other NSAIDs appear to suppress the

symptoms, but accelerate the progression of osteoarthritis (degeneration of joint tissue). Their use should be avoided." The author supports the use of glucosamine sulfate as an effective alternative to NSAIDS. (Murray, 1996)

Colgan (1999) reviews the medical and scientific research on arthritis. Colgan notes the use of non-steroidal anti-inflammatory drugs (NSAIDs), have been shown to prevent the body from repairing damaged cartilage, tendons, and other forms of soft tissue. NSAIDs have also been shown to accelerate the progression of osteoarthritis, a result of injury to joints and cartilage. Corticosteroids, which are commonly used to treat chronic joint pain, also accelerate the destruction of joints. (Colgan, 1999)

Role of Nutritional Supplementation in Maintaining Healthy Tissue

Diets high in saturated fats impair the body's ability to effectively use essential fats, Omega 3 and Omega 6, which are needed to maintain the health and integrity of our joints and other connective tissues. Our western diet is rich in red meat and saturated fats and lacking in both Omega 3 and Omega 6 essential fats. Omega 3 and Omega 6 can be taken as dietary supplements. Other nutritional supplements that have been proven helpful in maintaining joint and connective tissue health include glucosamine sulfate alone and in combination with N-acetyl-glucosamine (NAG), S-adenosylmethionine (SAME), folic acid, vitamin B12, vitamin A, beta-carotene, vitamin E, selenium, chromium, boron, potassium, zinc, and isoflavones (soy protein). (Colgan, 1999)

Murray (1996) recommends glucosamine sulfate as the favored form of glucosamine to treat osteoarthritis. The function of glucosamine is stimulation of the production of glycosaminoglycans which are the essential constructional units of cartilage. As we age, some individuals can no longer adequately produce sufficient amounts of glucosamine. These insufficient levels of glucosamine lead to cartilage destruction and the development of osteoarthritis. Unfortunately, there are no food sources for glucosamine. Glucosamine found in nutritional supplements is derived from the exoskeleton of shrimp, lobster, and crabs. Approximately 98% of glucosamine sulfate ingested by humans has been found to absorb and travel to the joint tissue where it is utilized by the cartilage, ligaments, and tendons. The safety record of glucosamine sulfate is excellent. Limited side effects include gastrointestinal symptoms such as upset stomach, diarrhea, nausea, and indigestion with no adverse reactions on joint healing as seen with NSAIDs. (Murray, 1996)

II. Methods

Sample

The study sample included 307 names from the SDMS members list for Georgia plus an additional 40 individual requests for a total of 347. Each of the 347 individuals was sent a packet including a survey (see Appendix A), a list of drugs (see Appendix B) to help respondents identify the categories of drugs they currently use, a cover letter (see Appendix C), and an electronic scanner answer sheet. Approximately 4 weeks after the initial mailing, a follow up reminder letter (see Appendix D) was sent to encourage a higher return rate of the survey. One hundred and thirteen of the 347 surveys were returned for a 33 percent response rate.

Instrument

The survey for this study consisted of 120 questions (see Appendix A). Parts of this survey were adopted from the one used by Pike et al (1997) with permission to add or change questions as needed. Because of the works of Murray (1996) and Colgan (1999) in nutritional supplements, dietary needs, and health maintenance, I added questions that addressed these issues. The questions for the survey are divided into 3 categories:

A) background information, general health, and work experience; B) work schedule and task; and C) symptoms of pain and discomfort.

The first section of the survey, questions 1 through 37, included personal information such as age, gender, scanning experience, general state of health, present fitness level, dietary preferences, and personal use of nutritional supplements.

The second section of the survey, questions 38 through 55, focused on work schedule and tasks performed. Areas of interest included: daily hours spent scanning, length of average day, and type of scans performed.

The last or third section, questions 56 through 120, focused on work related pain and discomfort. Questions about which work tasks aggravate the pain and how long the pain has occurred were asked. Participants were questioned as to what type of medical or non-medical intervention they have sought and the results of that intervention.

The data collected from the answer sheets was placed in an Excel file for analysis. The data was analyzed using descriptive statistics, including percentages and sums. Chi square was used to identify the presence of significant relationships of the nominal data collected.

III. RESULTS

Demographics

Of the 347 surveys mailed, one hundred and thirteen were returned. This represented a thirty-three percent return rate. Of the 113 respondents, eighty eight percent were female, twelve percent were male, and one respondent did not identify gender (see Figure 1). This data is also available in Table I at the end of the Results section. The female to male ratio is 7.6 to 1. Some of the respondents did not answer all of the questions so the total number of respondents varied for specific questions.

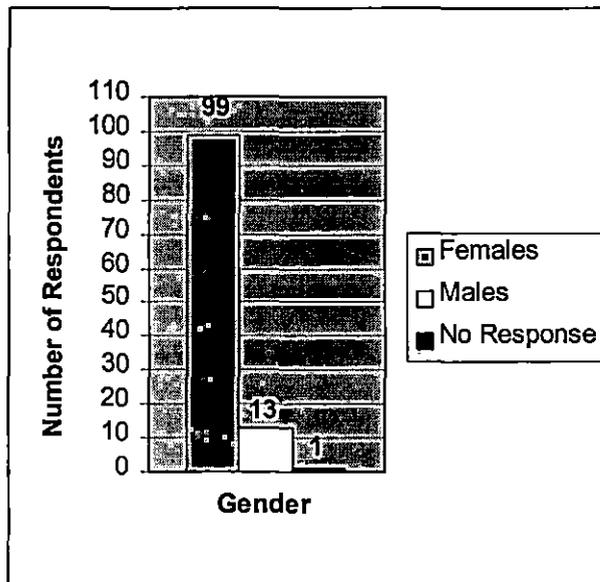


Figure 1. Survey response by gender.

Ninety percent (102), of the 113 Georgia sonographers responding to the study survey reported pain or discomfort while scanning (see Figure 2). Since pain is the primary complaint of MSD, this study used "pain while scanning" as an indicator of MSD symptoms. Therefore the 90% of sonographers reporting pain while scanning were self-reporting the occurrence of MSD symptoms while scanning. Of the individuals that responded affirmatively to the question asking if they had an MSD related diagnosis, seventy seven percent (35) reported having been diagnosed with MSD by a doctor or other health care provider. The sonographers with a diagnosis of MSD represent 31% of the total number of respondents to the survey.

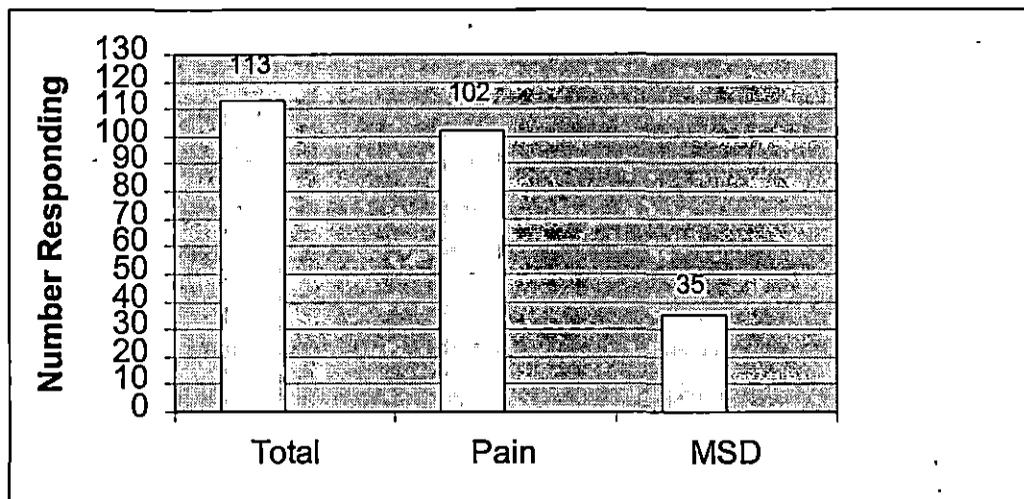


Figure 2. Total number of respondents, respondents with pain, and respondents diagnosed with MSD.

The place of employment and the positions held by respondents are also found in Table I at the end of the Results section. Ninety two percent of the respondents to a question concerning daily job responsibility reported they scanned and performed patient care activities on a daily basis (see Figure 3). Fifty one percent worked in a hospital environment while 34% worked in a private clinic or office.

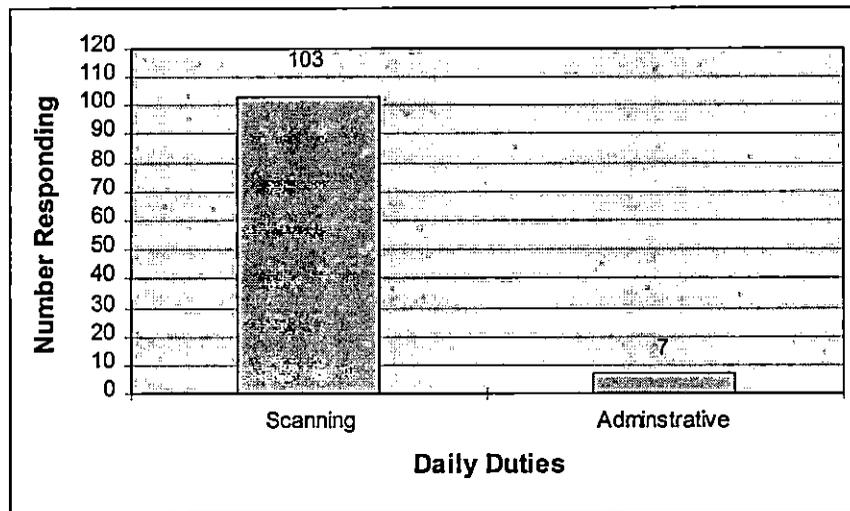


Figure 3. Number of respondents scanning on a daily basis or performing administrative duties.

Thirty-four percent of the respondents answering a question about age were between 20 and 30 years of age with an additional 34% between 31 and 40 years of age (see Table I and Figure 4). Also included in Table I is the summary of the number of years respondents have scanned. Fifty-one percent of the 111 sonographers responding to a question about number of years they have scanned reported scanning between 1 and 10

years with 40% having scanned between 11 and 20 years. Only 9% of responding sonographers had scanned for 21 to 25 years (see Figure 5).

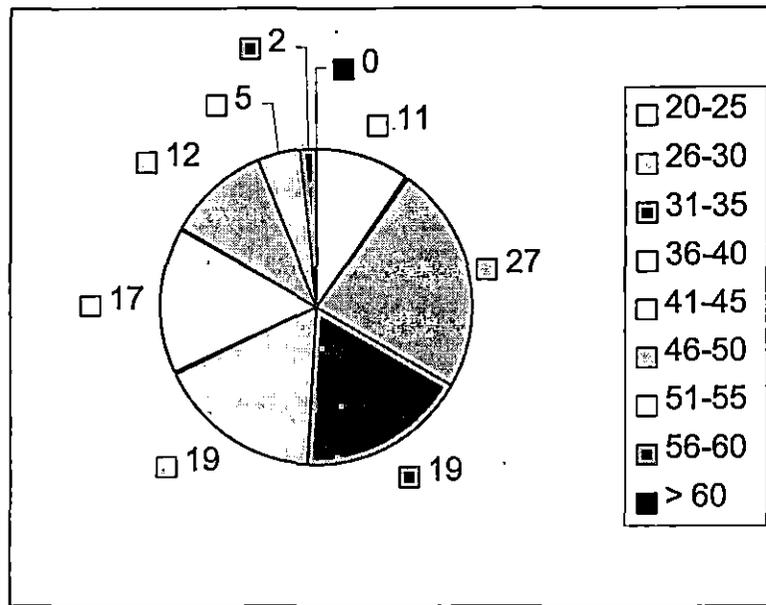


Figure 4. Age of respondents.

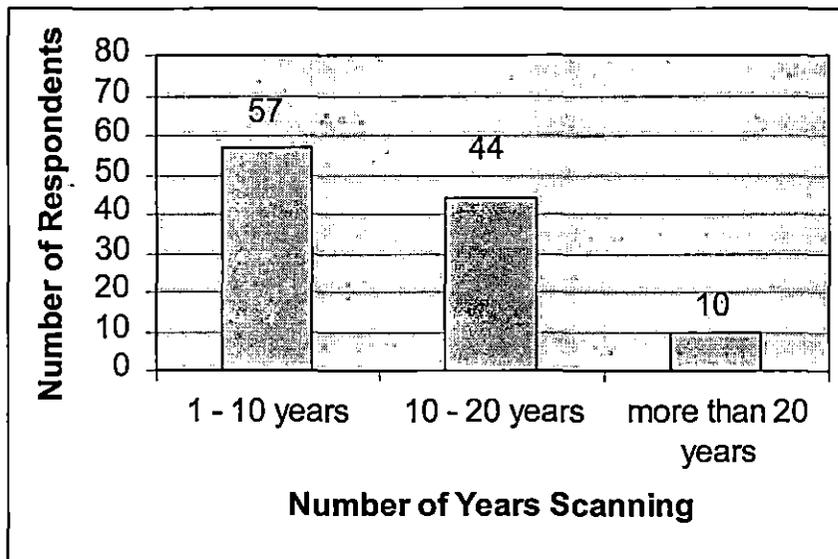


Figure 5. Respondents by number of years scanning. (2 No Response)

Research Question 1: Identify the incidence of MSD and MSD symptoms in Georgia sonographers.

The exact number of male and female respondents with pain can be found in Table II at the end of the Results section along with the number diagnosed with MSD. Ninety percent of the respondents answering a question about pain while scanning reported they had pain or discomfort while scanning (see Figure 2) and 9% reported no pain or discomfort. Of the 99 female respondents to the survey, ninety two (93%) reported having pain or discomfort while scanning as compared to nine (69%) of the 13 male respondents. It should also be noted that all sonographers except one who reported having a diagnosis of MSD also reported pain while scanning.

To understand the incidence of MSD in the sonographer population of Georgia, it is important to know the education these sonographers have had about the types, causes, and prevention of MSD. Fifty one (45%) sonographers out of the 113 respondents reported having received education about MSD (see Figure 6). Out of the 10 sonographers that reported no pain while scanning, none responded to the question about receiving education. Twenty two (63%) of the 35 sonographers with MSD reported having received education about MSD.

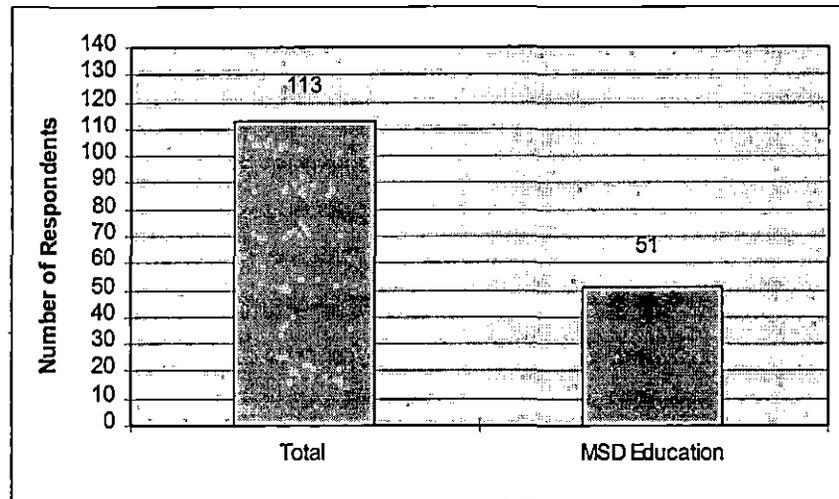


Figure 6. Number of total respondents and respondents receiving MSD education.

Research Question 2: Is there a relationship between gender and pain while scanning (MSD symptom)?

Chi square was used to evaluate whether a significant relationship existed between gender and pain while scanning (MSD symptoms). This data can be found in Table II at the end of the Results section and in Figure 7 which follows. The results of Chi square demonstrated that a significant relationship did exist between gender and pain while scanning (MSD symptoms) ($X^2 = 4.68$, $df = 1$, $p < .05$). Therefore gender appears to be a risk factor for pain (MSD symptoms) in sonographers in Georgia.

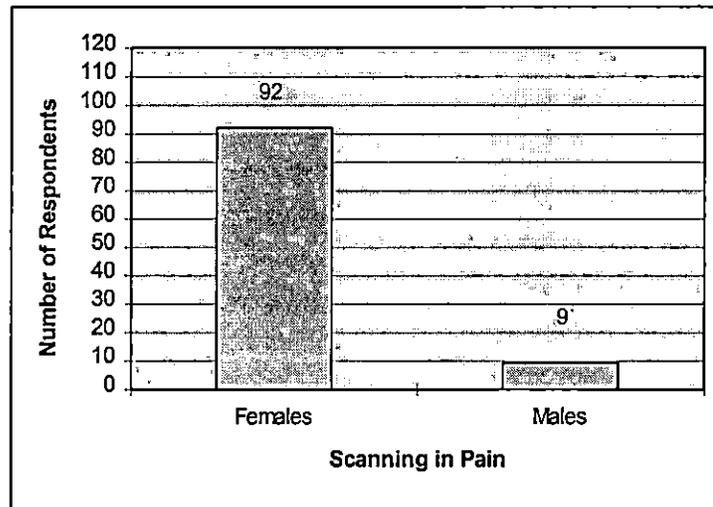


Figure 7. Number of respondents scanning in pain by gender.

Research Question 3: Is there a relationship between gender and a diagnosis of MSD?

Of the 35 sonographers having a diagnosis of MSD (see Table II at the end of the Results section), thirty (86%) were female and five (14%) were male. Chi square was used to identify whether a significant relationship existed for gender and a diagnosis of MSD in Georgia sonographers. No significant relationship was found between gender and a diagnosis of MSD in this study group ($X^2 = 0.0026$, $df = 1$, $p = NS$).

Research Question 4: Is there a relationship between pain and MSD with use of analgesics and/or anti-inflammatory drugs and the continuation of work?

Out of 102 sonographers reporting pain and MSD, fifty three percent of these sonographers reported using analgesics and/or anti-inflammatory drugs. This information

is found in Table II at the end of the Results section. Of these sonographers, sixty five percent did not use leave time and continued to work in pain. While 19 sonographers with pain and MSD using analgesics and/or anti-inflammatory drugs did use leave time. When Chi square analysis was performed to see whether a relationship existed between the use of analgesic and/or anti-inflammatory drugs by sonographers with pain and MSD and the continuation of work, the results demonstrated no significant relationship ($X^2 = 0.7$, $df = 1$, $p = NS$).

Research Question 5: Is there a relationship between gender and the use of analgesics and/or anti-inflammatory drugs for pain and MSD with the continuation of work?

Sixty five percent of sonographers, out of the 54 using analgesics and/or anti-inflammatory drugs from this study, did not use any leave time due to work-related pain. This data is found in Table II at the end of the Results section. Thirty one were female and 4 were male. The 4 males represent 80% of the males with pain and MSD that used analgesics and/or anti-inflammatory drugs and the 31 females represent 63% of the females in the same group. The percentages suggest that a larger percentage of males continue to work while in pain than do females. When Chi square analysis was performed, there was no significant relationship found between gender and the use of analgesics or anti-inflammatory drugs to continue working ($X^2 = 0.059$, $df = 1$, $p = NS$). Therefore, gender does not appear to be related to the use of analgesics and/or anti-

inflammatory drugs and the continuation of work in sonographers with pain and MSD in Georgia.

Research Question 6: Is there a relationship between sonographers in Georgia with pain and MSD and use of nutritional supplements and their continuation of work?

Of the 113 respondents to the survey, seventy five reported that they take nutritional supplements (see Table III at end of Results section). For the group using nutritional supplements, seventy (93%) reported having pain and MSD and 5 (7%) reported no pain and MSD. A total of 32 sonographers (31%) out of the 102 that reported pain and MSD responded negatively to the use of nutritional supplements. Forty one sonographers with pain and MSD using nutritional supplements reported not using any type of leave time for their pain. Chi-square was used to see whether a relationship existed between the use of nutritional supplements in sonographers reporting pain and MSD and their continuation to work ($X^2 = 0.38$, $df = 1$, $p = NS$). No significant relationship was found.

Table I
Demographics of Respondents

Category	Number		
	Female	Male	Total
Respondents to Survey	99	13	113 ^a
Present Position/Job			
Administrative	6	1	7
Scan/Patient Care	90	12	103 ^a
Other	2	0	2
Place of Employment			
Hospital	51	6	57
Private Clinic/Office	33	4	38 ^a
Other	14	3	17
Age in Years			
20-30	36	2	38
31-40	35	3	38
41-50	22	7	29
51-60	6	1	7
> 60	0	0	0
Number of Years Scanning			
1-10	52	4	56 ^a
11-20	36	8	44
21-25	9	1	10
> 25	0	0	0

^aOne respondent did not respond to gender, but did respond to question and is included in the total number of responses to the question.

Table II
*Pain While Scanning, Diagnosed MSD, MSD Education, Use of Analgesics and/or
 Anti-inflammatory Medication and Use of Leave Time*

Category	Number		
	Female	Male	Total
Pain While Scanning	92	9	102 ^a
Diagnosed with MSD	30	5	35 ^b
Pain While Scanning and Diagnosed with MSD	92	10	103
Received Education About MSD	42	9	51
Use of Analgesics and/or Anti-inflammatory Medication with Pain and MSD	49	5	54
Did Not Use Leave Time	31	4	35
Did Use Leave Time	18	1	19
Do Not Use Analgesics and/or Anti-inflammatory Medication with Pain and MSD	10	3	13
Did Not Use Leave Time	9	1	10
Did Use Leave Time	1	2	3

^a One respondent did not respond to gender, but did respond to question and is included in the total number of responses to the question.

^b One respondent answered yes to having a diagnosis of MSD, but did not respond to the question about pain.

Table III

Pain While Scanning and Diagnosed MSD Using Nutritional Supplements and Use of Leave Time

Category	Number		
	Female	Male	Total
Respondents to the Use of Nutritional Supplements			113 ^a
Pain and MSD Use Nutritional Supplements	63	7	70
Pain and MSD Do Not Use Nutritional Supplements	29	2	32 ^b
No Pain and MSD Use Nutritional Supplements	4	1	5
No Pain and MSD Do Not Use Nutritional Supplements	3	2	5
Pain and MSD Use Nutritional Supplements and Did Not Use Leave Time	37	4	41
Pain and MSD Use Nutritional Supplements and Did Use Leave Time	15	3	18
Pain and MSD Do Not Use Nutritional Supplements and Did Not Use Leave Time	17	2	19
Pain and MSD Do Not Use Nutritional Supplements and Did Use Leave Time	5	0	5

^a One respondent did not respond to gender, but did respond to question and is included in the total number of responses to the question.

^b One respondent answered yes to having a diagnosis of MSD, but did not respond to the question about pain.

IV. DISCUSSION

The response rate to the survey used in this study was acceptable at a moderate rate of 33%. For the sonography studies referenced, Pike et al. (1997) had a 32.8% response rate to their survey while Necas (1996) had 36% and Vanderpool et al. (1993) had 47%.

Research Question 1: Identify the incidence of MSD and MSD symptoms (pain) in Georgia sonographers.

Pain while scanning was used as an indicator of MSD symptoms in this study. Ninety percent of the respondents reported MSD symptoms in this study. In the Vanderpool et al. (1993) study, 86% of responding sonographers experienced some type of MSD symptom. Necas (1996) found that 82% of sonographers responding to his survey reported MSD symptoms while Pike et al. (1997) found that 81% of sonographer respondents reported MSD symptoms. The higher percentage of respondents reporting MSD symptoms in this study as compared to the referenced studies may be due to the increased awareness of sonographers to the issue of work-related MSD.

Thirty-five (31%) sonographers responding to this study reported having been diagnosed with MSD by a doctor or other health care provider. In the Pike et al. (1997) study, forty one percent of their respondents reported having received a diagnosis of

MSD while the Necas (1996) study reported 15%. The Vanderpool et al. (1993) study only looked at carpal tunnel syndrome (CTS), one form of MSD, and reported 3% of their respondents had received a diagnosis of CTS. The percentage of sonographers in Georgia reporting diagnosed MSD is less than the percentage Pike et al. reported in their study, but more than Necas and Vanderpool et al. An explanation for the difference in diagnosed MSD between this study and the Vanderpool et al. study is most likely due to the fact that Vanderpool et al. only looked at CTS and not the full spectrum of diagnoses represented by MSD. There is no obvious answer for the difference of diagnosed MSD found between this study and the Necas and Pike et al. studies.

To understand the incidence of MSD in the sonographer population of Georgia, it is important to know the education these sonographers received regarding the types, causes, and prevention of MSD. Only 45% of the respondents to this study reported having received education about MSD. This number is encouraging, but too low. Not surprisingly, none of the sonographers that reported no pain while scanning responded to the question about receiving MSD education. This is probably due to the arrangement of the survey questions. The MSD education question was number 118. Any one responding no to pain while scanning, question 56, was allowed to stop, which is the most likely reason they did not respond to question 118. This was unfortunate. Their responses might have helped explain their lack of pain while scanning. It is also not surprising that 63% of sonographers with MSD reported having received education about

MSD. A further question would be if this education was received at the time of diagnosis or treatment.

Research Question 2: Is there a relationship between gender and pain while scanning (MSD symptom)?

Ninety percent of females and 9% of males responding to this study reported pain while scanning. A Chi square analysis of the data demonstrated that a significant relationship did exist for gender. Therefore gender appears to be a risk factor for pain (MSD symptoms) in sonographers in Georgia.

Also in this study, thirty-one percent of the male respondents reported no symptoms with 7% of the females having no symptoms. These are similar findings to the referenced sonographer based studies. Vanderpool et al. (1993) found in their study that 25% of the males reported no symptoms while approximately 10% of the females reported no symptoms. Necas (1996) reported no symptoms in 26% of males and 17% of the females. Pike et al. (1997) did not identify their reported information by gender. The higher percentage of males reporting no symptoms in all of the studies may be due to the low number of males responding to the study. It cannot be discounted that the higher number of females with MSD symptoms compared to males may be reflective of the results found in the general population.

Research Question 3: Is there a relationship between gender and a diagnosis of MSD?

It has been well documented in the general population that gender is a factor in the development of MSD. Females are at a greater risk of developing certain types of MSD. (Bernard, 1997; National Research council, 1999) However, Bernard (1997) stated that studies were needed that examined job tasks performed uniformly by males and females. Sonography is one such occupation. This study revealed 30 (27%) females and 5 (4%) males out of the 113 respondents reported having been diagnosed with MSD. However, no significant relationship was found for gender and a diagnosis of MSD in this study group. In the Necas (1996) study, twenty (13%) females and 3 (2%) males reported a diagnosis of MSD. Necas reported that differences appeared between the genders related to MSD symptoms and MSD, but these differences were subtle and not identified in the study. When examining percentage of response between the 2 studies, more than twice as many females reported a diagnosis of MSD in this study than in the Necas study. Still neither study was able to demonstrate a significant relationship for gender and MSD within a sonographer population.

It is important to remember that other issues besides gender are related to the development of MSD in the general workforce. These issues are the duration and frequency of the tasks and adequate recovery time (breaks) between tasks. (National Research Council, 1999). In this study the most frequent tasks or exam performed by

respondents with MSD was transabdominal. Twenty five (71%) out of 35 respondents with MSD performed transabdominal exams. Of these 25, 22 (88%) were female and 3 (12%) were male. In the group of respondents with pain while scanning, transabdominal was again the most frequent exam performed. Eighty nine out of 102 respondents (87%) with pain performed transabdominal studies. Of these 89, eighty two (92%) were female and 7 (8%) were male.

Of the respondents to this study answering a question about the length of time between breaks, twenty one of 29 (73%) females and 3 of 5 (60%) males with MSD said the time between breaks for them was 3 or more hours. This implies that these sonographers are getting at the most 2.5 breaks and at the least 1 break in an 8-hour work day. When looking at the percentage of respondents performing transabdominal sonograms and having 3 or more hours between breaks, there is a greater percentage of females (81%) than males (67%).

Even though no significant relationship was found for gender and a diagnosis of MSD in this study, it is interesting to note that a significant relationship was found to exist for gender and pain while scanning (MSD symptoms). It appears from these results that more females have pain while scanning than females who seek a diagnosis or professional help for their pain. Another interesting finding is that a greater percentage of females with MSD and pain while scanning have 3 or more hours between breaks than do males in the

same groups. A greater percentage of females also perform transabdominal exams, the most frequently performed sonographic study, than do males in the same group.

Findings from this study suggest gender is a factor in the development of MSD in sonographers, although there is no simple explanation for these findings. More study is needed to understand if gender is a factor in the development of MSD in sonographers as a population.

Research Question 4: Is there a relationship between pain and MSD with use of analgesics and/or anti-inflammatory drugs and the continuation of work?

Because many forms of these drugs do not require a prescription, it was felt many sonographers with MSD symptoms might self-medicate to continue work. This study identified that fifty three percent of sonographers reported using analgesics and/or anti-inflammatory drugs. Thirty five (65%) sonographers from this group did not use leave time and continued to work in pain. No significant relationship was found between pain and MSD with use of analgesics and/or anti-inflammatory drugs and the continuation of work. Lam et al. (1997) in their study reported that 75% of the sonographers that used analgesics over a lifetime continued to use them in the last 12 months. Lam et al. reported a greater percentage of sonographers using analgesics than this study. However, Lam et al. did not examine the use of leave time for injury. It must be stated that Lam et al. did have a greater response rate and this may have had an effect on the percentages.

Research Question 5: Is there a relationship between gender and the use of analgesics and/or anti-inflammatory drugs for pain and MSD with the continuation of work?

This study revealed that sixty-five percent of sonographers out of the 54 using analgesics and/or anti-inflammatory drugs did not use any leave time due to work-related pain. Eighty percent of the males and 63% of the females with pain and MSD that used analgesics and/or anti-inflammatory drugs did not use leave time related to their pain. The percentages suggest that a larger percentage of males continue to work while in pain than do females. Chi square analysis of the group with pain and MSD using analgesics and/or anti-inflammatory drugs and continuation of work found no significant relationship for gender. Therefore, gender does not appear to be related to the use of analgesics and/or anti-inflammatory drugs and the continuation of work in sonographers with pain and MSD in Georgia. Lam et al. (1997) unfortunately did not examine the use of analgesics by gender in their study, so no comparisons can be made.

Research Question 6: Is there a relationship between sonographers in Georgia with pain and MSD and use of nutritional supplements and their continuation of work?

In this study, ninety three percent of the sonographers reporting the use of nutritional supplements also responded yes to pain and MSD questions. Sixty two sonographers with pain and MSD also reported using multivitamins. It must be noted that none of the questions in this study addressed the specific use of nutritional supplements or

multivitamins for treating pain and MSD. Of the supplements recommended by Colgan that promote healthy joints folic acid, vitamin B12, vitamin A, beta-carotene, vitamin E, selenium, chromium, boron, potassium, and zinc are commonly found in multivitamins. (Colgan, 1999) These 62 sonographers represent 61% of all the sonographers reporting pain and MSD. Forty one (50%) sonographers with pain and MSD using nutritional supplements reported not using any type of leave time for their pain. No significant relationship was found between the group using nutritional supplements with pain and MSD who used leave time and those who did not use leave time.

V. SUMMARY

From the general population, we know that MSD is associated with gender, but the studies stating this looked at jobs that were predominantly performed by women. (National Research Council, 1999) Bernard (1997) suggested that studies looking at jobs where men and women performed the same tasks before gender could be stated as a risk factor for MSD in the general work force were needed. (Bernard, 1997) This study examined a job where both men and women are expected to perform the same tasks, sonography. No significant relationship was found in this study or the Necas (1996) study that gender is a risk factor for MSD in the sonographer populations examined by each study. However, both studies looked at regional populations of sonographers and neither study used a random selection method for identifying participants. Unfortunately, the largest of the sonographer studies performed by Pike et al. (1997) did not report findings by gender. It is important to remember that other issues besides gender such as the duration and frequency of the tasks and adequate recovery time (breaks) between tasks (National Research Council, 1999) are also related to the development of MSD in the general workforce. In this study a greater percentage of females with MSD (88%) than males with MSD (12%) performed the most frequent tasks or exam, transabdominal. A greater percentage of females (73%) than males (60%) with MSD reported that the

time between breaks (recovery time) for them was 3 or more hours. This implies that these sonographers take between 1 and 2.5 breaks per 8-hour work day. There is no simple explanation for these findings. More study is needed to understand if gender is truly a factor in the development of MSD in sonographers as a population.

NSAIDs (analgesics and/or anti-inflammatory drugs) have been shown to reduce symptoms of MSD, mainly pain and tenderness. The down side of NSAIDs is that they hinder the body's ability to heal injured cartilage, tendons, and soft tissue seen with MSD. While glucosamine has been proven to have the same ability to suppress MSD symptoms while not interfering with the body's healing process. (Murray, 1996) Approximately 53 percent of the sonographers with pain in this study are taking NSAIDs. From this study it was also learned that 93% of sonographers using nutritional supplements had pain and MSD. It is encouraging that sonographers are interested in nutritional health. More education is needed to help the sonographer population understand the risk of using NSAIDs long term as well as the benefits of joint healing nutritional supplements such as glucosamine sulfate.

It is clear from the results of this study that more education is needed regarding the types, causes, and prevention of MSD. Less than half of the respondents to this study reported having received education about MSD. This number is far too low. One way to increase sonographer awareness of MSD is through education of students in sonography

programs. For prevention to be effective, the newest sonographers must learn the importance of good body mechanics when scanning and moving patients as well as alternative methods of treatment to prevent acceleration of injuries that occur.

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Appendix A: Survey

29. Do you currently take any form of nutritional supplement to aid in joint health (glucosamine and/or chondroitin, unflavored gelatin (Knox), or shark cartilage, etc.)?

Yes A No B

>>30. If yes, how often do you take them?

Multiple times a day A Once a week D
Once a day B Less than once a week E
Multiple times a week C

31. Do you take any other types of nutritional supplements that have not been listed on this questionnaire that you feel have had a positive affect on your overall musculoskeletal health?

Yes A No B

>>If you answered yes, please list the main ingredient or active compound in the nutritional supplements you use and what preventive effect they have. Place this list on the back of this page.

32. How many times a week do you eat red meat (beef, organ meats, venison, buffalo, etc.)?

0 times A 3 - 4 times C more than 6 times E
1 -2 times B 5 - 6 times D

33. How many times a week do you eat fish excluding sardines, fish roe, caviar, mussels, and anchovies?

0 times A 3 - 4 times C more than 6 times E
1 -2 times B 5 - 6 times D

34. What type of sweetener do you use to sweeten your drinks or foods?

Sugar (white or brown) A Sweet and Low C Fructose E
Saccharin B Nutrasweet D Xylitol F

35. How many glasses of water do you drink a day?

1 - 3 A 7 - 9 C More than 12 E
4 - 6 B 10 - 12 D

36. How often do you eat fresh fruit and vegetables?

3 or more times a day A 3 or more time a week C Never E
Once a day B Once a week D

37. How often do you drink beer, wine, or alcohol (distilled spirits) in a week?

2 or more glasses a day A 2 or more glasses a week C Never E
1 glass a day B 1 glass a week D

END OF SECTION A

SECTION B: WORK SCHEDULE AND TASKS

38. **How many days do you work in sonography in a month, on average?**
 More than 20 days (full time with call) A 10 days (part time without call) D
 20 days (full time without call) B Less than 10 days (PRN) E
 10 days or more (part time with call) C Other: _____ F
39. **If you work full time in sonography, how many hours long is your average work day?**
 More than 8 hours (without call) A Less than 8 hours (without call) D
 More than 8 hours (with call) B Other: _____ E
 8 hours (without call) C Not Applicable F
40. **What is the maximum length of time between your breaks?**
 1 hour A 3 - 4 hours E
 1 - 2 hours B more than 4 hours F
 2 - 3 hours C

For each type of scan, indicate how many you do in a typical week.

	TYPE OF SCAN	NUMBER OF SCANS PER WEEK								N/A
		0-15	16-30	31-45	46-60	61-75	76-90	91-120	>120	
41.	Transabdominal (OB, GYN, Abd, Small Parts)	A	B	C	D	E	F	G	H	I
42.	Echocardiography	A	B	C	D	E	F	G	H	I
43.	Vascular	A	B	C	D	E	F	G	H	I
44.	Endocavitary	A	B	C	D	E	F	G	H	I
45.	Portable (any specialty)	A	B	C	D	E	F	G	H	I
46.	Other: _____	A	B	C	D	E	F	G	H	I

For each type of scan, indicate typical length of the time for a scan.

	TYPE OF SCAN	SCAN DURATION IN MINUTES						>60	N/A
		10-20	21-30	31-40	41-50	51-60			
47.	Transabdominal (OB, GYN, Abd, Small Parts)	A	B	C	D	E	F	G	
48.	Echocardiography	A	B	C	D	E	F	G	
49.	Vascular	A	B	C	D	E	F	G	
50.	Endocavitary	A	B	C	D	E	F	G	
51.	Portable (any specialty)	A	B	C	D	E	F	G	
52.	Other: _____	A	B	C	D	E	F	G	

What percentage of time do you scan with each hand?

		100%	75%	50%	25%	0%
53.	Right	A	B	C	D	E
54.	Left	A	B	C	D	E

55. **What is the maximum time you maintain one body position while scanning?**

Under 10 minutes	A	15 - 30 minutes	C
10 - 15 minutes	B	Over 30 minutes	D

END OF SECTION B

SECTION C: PROBLEMS, PAIN, AND DISCOMFORT

56. Have you ever had any pain or discomfort while scanning?
 Yes A No B

If you answered NO, please answer the next two questions and then you are finished with the survey. Thank you for your help with this project.

If you answered YES, please go on to Question 58, NOW.

- >>57. If you have never experienced any pain or discomfort while scanning, do you think that you do something to prevent this from happening?
 Yes A No B

>> If YES, please describe any such actions you took:

REMEMBER:

If you answered NO to Question # 56, and have completed Question # 57 and your description of the actions you take, then you are finished with the survey. Again Thank You!

Please complete the following questions by indicating in which parts of the body you have experienced pain or discomfort.

ANY PAIN OR DISCOMFORT				
	Body Part	Yes	No	N/A
58.	Neck / Shoulder	A	B	C
59.	Elbow / Forearm	A	B	C
60.	Wrist / Hand / Fingers	A	B	C
61.	Lower Back / Hip	A	B	C
62.	Knee	A	B	C
63.	Calf (lower leg)	A	B	C
64.	Ankle / Foot	A	B	C

If you have experienced pain or discomfort in a part of the body, indicate which side of the body when appropriate.

IDENTIFY SIDE OF BODY WHEN APPROPRIATE				
	Body Part	Rt	Lt	N/A
65.	Neck / Shoulder	A	B	C
66.	Elbow / Forearm	A	B	C
67.	Wrist / Hand / Fingers	A	B	C
68.	Knee	A	B	C
69.	Lower Back / Hip	A	B	C
70.	Calf (lower leg)	A	B	C
71.	Ankle / Foot	A	B	C

Rate each of the following activities by degree to which they aggravate your problem(s). Use the following scale where A = not at all aggravating, B = aggravating 1 day a week, C = aggravating 3 days a week and D = aggravating on a daily basis. Select NA if the situation does not apply to you.

		How aggravating?				N/A
		Not	>>>>>>>>>		Very	
72.	Holding the transducer	A	B	C	D	E
73.	Applying sustained pressure with the transducer	A	B	C	D	E
74.	Sustained shoulder abduction (arm raised out to side)	A	B	C	D	E
75.	Standing	A	B	C	D	E
76.	Sustained twisting of neck and trunk	A	B	C	D	E
77.	Repetitive twisting of neck and trunk	A	B	C	D	E
78.	Lifting or assisting patients	A	B	C	D	E
79.	Transporting equipment for portable on-site scans	A	B	C	D	E
80.	Other: _____	A	B	C	D	E

81. How long have you had or did you have the problem(s), pain, or discomfort?

Less than 1 year	A	4-6 years	C
1-3 years	B	More than 6 years	D

82. Did you see a doctor or other health professional about the problem(s)?

Yes	A	No	B
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>>83. If you answered YES to 82, did you receive a diagnosis for your problem?

Yes	A	No	B
-----	---	----	---

>>If you answered YES to 83, what was the diagnosis?

		YES	NO
84.	Carpal tunnel syndrome	A	B
85.	Cervical syndrome	A	B
86.	Cubital tunnel syndrome / Epicondylitis	A	B
87.	Tendonitis / tendinitis	A	B
88.	Ganglions / synovial cyst	A	B
89.	Thoracic outlet syndrome/Cervicobrachial Syndrome	A	B
90.	Tension neck syndrome	A	B
91.	Myalgia / myositis	A	B
92.	Tenosynovitis / Bursitis	A	B
93.	Other: _____	A	B

94. Did you receive or are you currently receiving treatment for your problem(s)?

Yes	A	No	B
-----	---	----	---

95. Was this treatment a recommendation of the individual who diagnosed your problem(s)?

Yes	A	No	B
-----	---	----	---

>>If you answered NO to 95, was this treatment:

96.	Self prescribed	A
	Recommended by some other physician or health care provider	B
	Recommended by someone other than a physician or other health professional	C
	Other: _____	D

Which treatment(s) did you receive or are you currently receiving for your problem(s)?

	YES	NO
97. Over-the-counter Medication	A	B
98. Prescription Medication	A	B
99. Physiotherapy (Physical Therapy) / Massage therapy	A	B
100. Chiropractic	A	B
101. Acupuncture/acupressure	A	B
102. Nutritional supplements	A	B
103. Other: _____	A	B

>>If you did receive or are currently receiving medication for your problem(s) is/was it:
(Examples of medication categories with commonly associated drug names are attached to this survey on a separate sheet. Please refer to the sheet to help you identify the appropriate category for your medication.)

	YES	NO
104. Sedatives / Tranquilizers	A	B
105. Muscle Relaxants	A	B
106. Analgesics / Pain relievers	A	B
107. Anti-inflammatory	A	B

108. In your opinion, what has been the degree of effectiveness of the treatment(s)/medication(s)?

Not at all	A	Moderately	C
Slightly	B	Very	D

As a result of your work-related problem, which of the following have you used?

	YES	NO
109. Unemployment insurance	A	B
110. Worker's compensation	A	B
111. Short Term disability	A	B
112. Long-term disability	A	B
113. Personal leave	A	B
114. Vacation leave	A	B
115. Sick leave	A	B
116. Leave without pay	A	B
117. Other: _____	A	B

118. Have you ever received education about work-related injury, such as types of injury, causes and prevention? Yes A No B

>>119. If you answered YES to 118, what were the sources of the education? (Choose only one from the following list)

Application specialists	A	Physicians/Specialists (Chiropractors)	F
Safety/ergonomic training	B	Sonographers	G
Professional Association	C	Ergonomists/ "Return to Work" Program	H
Physical / Occupational therapists	D	Occupational health nurse	I
Self Study	E	Other: _____	J

120. Are there situations when you choose to compromise your own health and safety for the benefit of the patient? Yes A No B

>> If you answered yes to Question 120, please explain on the back of this sheet.

END OF SECTION C

Appendix B: Example of Drugs (included in survey packet)

EXAMPLES OF DRUGS BY CATEGORIES

This sheet provides examples of drugs. Please refer to them as a guide to help you identify the appropriate category in which a specific drug best fits. This list is not all inclusive and is only a representation of common drugs in each category.

Sedatives :	Butisol, Buticaps, Amytal, Mebaral, Placidyl, Doriden, Noludar, Nembutal, Seconal, Tuinal, Dalmane, Restoril, Halcion, Amobarbital, Phenobarbital, Methaqualone, Choral Hydrate, Pentobarbital, Secobarbital, Doral, ProSom
Tranquilizers:	Valium, Librium, Limbitrol, Menrium, Serax, Tranxene, Ativan, Centrax, Xanax, Paxipam, Buspar, Miltown, Equanil, Deprol, Vistaril, Atarax, Durrax, Diazepam, Sk-lygen, Meproamate, Elavil, Nardil, Serzone, Zoloft, Effexor, Desyrel, Trancopal, Remeron
Analgesics/Pain Relievers:	Acetaminophen, Tylenol, Advil, Aspirin, Ibuprofen, Darvon, Dolene, Sk-65, (Narcotic & Non-narcotic) Wygesic, Levo-Dromran, Percodan, Demerol, Dilaudid, Tylenol with Codeine, Phenaphen with Codeine, Talwin, Talacen, Propoxyphene, Codeine, Anileridine, Mórphine, Methadone, Stadol, Tegretol, Ultram, Fiorinal, Fioricet, Lorcet, Lortab, Tylox, Vicodin, Disalcid, Salflex, Trilisate
Muscle Relaxers:	Dantrium, Flexeril, Norflex, Parafon Forte, Robaxisal, Robaxin, Skelaxin, Soma, Valium, Zanaflex
Anti-inflammatory: (Non-steroidal- NSAID)	Anaprox, Cataflan, Clinoril, Daypro, Dolobid, Duract, Naprosyn, Ecotrin, Feldene, Indocin, Lodine, Nalfon, Naprelan, Orudis, Tolectin, Toradol, Voltaren

Appendix C: Survey Cover Letter

Dear Fellow Sonographer:

I need your help in gathering information as part of an investigation for my graduate thesis on musculoskeletal disorders (MSD) in the sonographer population in Georgia. My survey contains portions originally developed by the Healthcare Benefit Trust for the British Columbia Ultrasonographers Society (HBT/USBC). The Society of Diagnostic Medical Sonographers (SDMS) adapted the HBT/BCUS survey for use in a nationwide study several years ago. The SDMS survey wanted to determine the extent of musculoskeletal injuries (MSI) experienced by sonographers nationally and how these MSIs are related to equipment and job design factors. Both organizations have approved my use of portions of their survey. However, some sections of my survey are original and reflect only my interest.

The SDMS sponsored survey was not able to look at Georgia as a separate entity. My purpose for this survey is to gather specific baseline data on the extent of musculoskeletal disorders in the sonographer population of Georgia and to what extent these disorders may or may not interfere with work and other routine daily living activities. I would also like to determine the extent of over-the-counter medication use in Georgia sonographers and if it is related to musculoskeletal disorders symptoms and maintaining a continuous work commitment. My ultimate goal is to use this data to develop mechanisms to help educate sonographers and employers of the risk factors associated with musculoskeletal disorders .

I chose to survey all of the sonographers in Georgia that are members of the SDMS. I believe this is the best way to identify the greatest number of sonographers. Since my selection process is not random, I would appreciate you sharing this survey with fellow sonographers who are not SDMS members. If you do this, please have them contact me for a copy of the survey and scantron sheet so their information can be included. I can be reached at the following phone number Monday through Friday or by e-mail anytime:

706-721-3691,
lreyes@mail.mcg.edu

All survey responses are anonymous. There is no coding of survey responses, so there is no way that your response can be tracked. Your help is needed so please answer all of the questions as honestly as you can.

I realize that the survey may initially appear lengthy, but you may not need to answer all of the questions, depending on your responses. Therefore, I urge you to take the 10 to 15 minutes needed to fill out the survey. Your response is extremely important to the profession of sonography.

For your convenience, a postage paid return envelope has been included in which to return your survey and your response sheet. Please do not fold or bend your response sheet (scantron sheet). Thank you for your time and cooperation in completing this survey. I really do appreciate your help in gathering this important information.

Sincerely,

Lynn Reyes, BS, RDMS, RDCS

Appendix D: Follow-up Letter

Dear Fellow Sonographer,

Several weeks ago you received a survey addressing musculoskeletal disorders (MSDs) in sonographers in Georgia. If you have already returned your completed survey please accept my sincere thank you for your help with this important project. For those of you who have not yet completed your survey, please take the few minutes necessary to complete the survey and return it.

The information gathered from this survey will benefit all sonographers, whether they reside in Georgia or not. There is no other research available that answers the specific questions about MSD, sonographer use of medications, sonographer use of nutritional supplements and dietary habits that I have addressed in my survey. Without your help, these questions will go unanswered. Without answers, sonographers will continue to incur job-threatening injuries. Your response is vital to understanding MSD in sonographers and how we as sonographers can help educate ourselves about ways to prevent or minimize MSDs. My goal is to have the results of this survey published in the Journal of Diagnostic Medical Sonography (JDMS) in order to share the results with a maximum number of sonographers and employers.

I would like to urge you once again to take the time necessary to complete the survey. Your help is greatly appreciated.

Sincerely,

Lynn Reyes, BS, RDMS, RDCS