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ScopeMed

A study of work-related musculoskeletal risks associated with the outpatient surgeries

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ABSTRACT

Objective: The purpose of this study is to examine the occupational hazards and risks of work-related musculoskeletal injuries and disorders of surgeons and physicians performing outpatient surgery. **Material and Methods:** A two-page survey instrument was developed to assess the occupational risk factors of general practice physicians and specialty practitioners performing ambulatory or outpatient surgeries. A total of 150 questionnaires were distributed to hospitals, free-standing surgical centers, and doctor offices located in the upper Midwestern United States. **Results:** Twenty-three physicians/surgeons performing outpatient surgery procedures completed the self-reporting questionnaire. About 80% of respondents reported some type of musculoskeletal symptoms or injuries in the neck, back, shoulder, wrists/hands, and legs/knees. The perceived body discomfort scores were significantly higher for the *standing-only* operating position than for the sitting/both operating position. Most respondents did not receive any training or instructions for ergonomic modifications in their practices. **Conclusion:** The outpatient physicians/surgeons are susceptible to prevalence of work-related musculoskeletal injuries and disorders. By properly using the ergonomic assessment techniques, valuable information on ergonomic practices and workplace design/selection could assist in the early interventions of musculoskeletal injury prevention in the outpatient surgery industry.

KEY WORDS: Ergonomics, musculoskeletal, body discomfort, ambulatory, outpatient, surgery

INTRODUCTION

According to the Agency for Healthcare Research and Quality [1], nearly 53 million outpatient procedures are performed annually in the United States. While most of these procedures occur in hospital outpatient departments, a growing number are being performed in nonhospital-based facilities such as ambulatory surgery centers and physician offices. Outpatient surgery, also known as ambulatory surgery, same-day surgery, day case, or day surgery, is surgery that does not require an overnight hospital stay. The term "outpatient" arises from the fact that surgery patients may go home and do not need an overnight hospital bed. Outpatient surgery has grown in popularity due to the rise in outpatient surgery centers and improved technology. Outpatient surgery centers often allow patients to get medical surgery and cosmetic surgery done in much more luxurious settings than a state hospital and are often preferred by patients for minor surgical procedures. With shorter medical procedure duration and fewer complications it makes sense to let patients go home sooner. The most common ambulatory surgeries include lens and cataract procedures, cholecystectomy/common duct exploration, excision of semilunar cartilage of knee, hernia repair, lumpectomy, decompression peripheral nerve, transurethral excision, removal urinary obstruction, pacemaker/cardioverter, and skin graft [2].

With the continued advancements in medical technology and rising cost of health care, the volume of outpatient surgeries is projected to continue to grow. A study by Hollingsworth et al. [3] encouraged providing outpatient surgery in these less-resource-intensive settings. It found that urological surgery performed in ambulatory surgery centers and physician offices was associated with lower overall episode payments than hospitals. Average total payments for outpatient surgery episodes varied widely, from $200 for urethral dilation at a physician office to $5,688 for shock wave lithotripsy at a hospital. Compared to hospitals, office-based prostate biopsies were nearly 75% less costly [3].

Due to the nature of the surgical procedures, surgeons and physicians performing outpatient surgery are exposed to work-related musculoskeletal injuries and disorders (WMSDs) risks including static and awkward body postures, repetitive motions, and extended durations. As the volume of ambulatory surgical procedures increases, the symptoms of work-related musculoskeletal injuries become more prevalent in outpatient surgery settings [4-7]. Musculoskeletal disorders affect the muscles, nerves and tendons. Work-related MSDs including those of the neck, upper extremities and low back are one of the leading causes of lost workday injury and illness. Workers in many different industries and occupations can be exposed to WMSD risk factors such as working in awkward body postures (bending, reaching overhead), and performing the same or similar tasks repetitively [8]. For instance, dermatologic surgeons performing ambulatory surgical procedures put them at risk of developing work-related musculoskeletal discomfort and pain in the neck, lower back, shoulder, and upper back [5]. Ophthalmic plastic surgeons are at risk for musculoskeletal injuries and disorders due to their time operating in prolonged static awkward body postures. It is also reported that the usages of loupes and headlamps further increase the

work load to the surgeon's cervical spine/neck [9].

The purpose of this survey study is to examine the occupational hazards and risks of work-related musculoskeletal injuries and disorders of surgeons and physicians performing ambulatory outpatient surgery.

MATERIALS AND METHODS

A survey instrument was developed to assess the occupational risk factors of general practice physicians and specialty practitioners performing ambulatory surgeries (outpatient procedures). The developed two-page (double-sided) survey questionnaire included questions pertaining to the demographics, the work environment, the working conditions, and the ratings of body discomfort. On the survey's front side it asked questions about the background information of the participant. This background information on the front side was to better understand behind some of the possible ergonomic hazards and risks. The survey on the front side had also included questions asking for information about the tools and equipment they use, what position they were when they were performing a surgery, if they used any visual aids, the typical time and the number of surgeries they performed per week, how fast they worked per day, and if they had any knowledge of ergonomics. The backside of the survey was a very simple but highly useful style of ergonomic survey inquiring the participant's body discomfort in the last 30 days (i.e., the BodyMap instrument). The BodyMap has been shown to be a reliable leading indicator of MSD risk. The BodyMap relies upon worker assessments of both the frequency of discomfort [0=never; 1=rarely (few time/month); 2=frequently (few times/week); 3=constantly (nearly every day)] as well as the intensity level of discomfort [from 0=no discomfort to 10=extreme discomfort]. Based upon a model developed by Marley and Kumar [10], it is then possible to have a worker's evaluation categorized as: (1) likely to seek treatment; (2) somewhat likely to seek treatment; or (3) not likely to seek treatment. For example, if a worker rates his/her discomfort level equal to 5 ("moderate discomfort") and the frequency of occurrence of this level equal to 2 ("few times/week"), then he/she would be placed in the "yellow zone" and would be considered somewhat likely to seek treatment for a work-related discomfort. The BodyMap is not predictive of specific diagnoses. Rather it is predictive of a worker seeking treatment (or not) for his/her discomfort [10].

A total of 150 questionnaires were distributed to hospitals, free-standing surgical centers, and doctor offices located in the upper Midwestern United States. Each survey questionnaire enclosed a cover letter and pre-paid envelope was sent out by postal mail unless otherwise personally hand delivered. The cover letter enclosed provided the researchers' contact information for any further questions that the participant might have. Twenty-three general practice physicians and specialty practitioners performing outpatient surgery completed the self-reporting questionnaire. Statistical analysis for descriptive statistics and univariate and multivariate analysis of the data were conducted using SAS9.3. For the univariate and multivariate analysis, the independent variables were demographic characteristics and work environment/working conditions, and the dependent variable was the perceived frequencies of body discomfort score (each participant's level of frequency, 0-3, multiplied by intensity of discomfort, 0-10).

RESULTS

Table 1 lists the surveyed demographic information and the work environment/working conditions of the participating physicians/surgeons. Table 2 shows the demographic characteristics of the 23 participants. The majority of the respondents were male (~83%). The participants' average age was 47.5 years, and their mean time in practice was 15.2 years. More than 65% of the participants utilized at least one or more of corrective eyewear. Table 3 depicts the work environment/working conditions. About one-third of the respondent (8 of 23) used the "standing-only" operating position and the other two-thirds reported sitting or using both operating positions while performing surgeries. Most participants reported that they had height adjustable operating tables, foot pedals, hand-fitting surgical instruments, and adjustable visual display system in the workplace setting. Most of the participants' day to day pace of work (~83%) was either very fast paced or fast-paced. The most common time spent per outpatient surgery procedure was less than 1 hour (~74%). In regards to the awareness of ergonomics, most of the respondents were somewhat aware of ergonomics, but none of the respondents had experienced in ergonomic studies and research. Only 3 respondents had received any training or instruction on or related to ergonomics.

Table 1. Surveyed demographic characteristics and work environment/working conditions

Demographic Characteristics	Work Environment /Working Conditions
Gender	Operating position
Age	Height adjustable operating table
Time in practice	Leg room under operating table
Height	Use of foot pedals
Weight	Accessible foot pedals
Dominant hand	Surgical instruments fitting hand
Corrective eyewear	Use of visual display system
Specialty	Adjustable visual display system
Completed fellowship	Number of surgeries/procedures per week
	Time spent per surgery/procedure
	Day to day pace of work
	Awareness of ergonomics
	Ergonomics training

Table 2. Demographic characteristics

Variable		Frequency (%)
Gender	Male	19 (82.6%)
	Female	4 (17.4%)
Age (years, mean ± SD)		47.5 ± 9.7
Time in practice (years, mean ± SD)		15.2 ± 7.2
Height (cm, mean ± SD)		178.0 ± 8.0
Weight (kg, mean ± SD)		84.6 ± 12.7
Dominant hand	Right	22 (95.6%)
	Left	1 (4.4%)
Corrective eyewear*	Glasses	7 (30.4%)
	Contacts	6 (26.1%)
	Loupes	6 (26.1%)
	None	8 (34.8%)
Specialty	Cosmetic/Facial plastic surgery	5 (21.8%)
	Dentist, Oral surgery	2 (8.71%)
	Ear, nose, throat, head & neck surgery	1 (4.4%)
	Emergency medicine	1 (4.4%)
	Family medicine	7 (30.4%)
	General surgery	2 (8.7%)
	Orthopedics	1 (4.4%)
	Pathology	1 (4.4%)
	Podiatry	1 (4.4%)
	Reproductive endocrinology	1 (4.4%)
	Urology	1 (4.4%)
Completed fellowship	Yes	10 (43.5%)
	No	13 (56.5%)
Fellowship	Craniofacial/pediatric plastic surgery	1 (10%)
	Facial plastic	1 (10%)
	Hand surgery	1 (10%)
	Head surgery	1 (10%)
	Molecular immunology	1 (10%)
	Oral surgery	1 (10%)
	Reproductive endocrinology	1 (10%)
	Sports medicine	1 (10%)
	No response	2 (20%)

*Three participants wear more than one piece of eyewear.

Table 4 presents the BodyMap "Zones" of probability for a physician to seek treatment for musculoskeletal discomfort by body part. Seventy-eight percent of the respondents reported discomfort experienced during the last 30 days. Discomfort was most frequently reported in mid-to-lower back (61%), neck (52%), shoulders (30%), and upper back (26%). The BodyMap instrument revealed that the participants were somewhat or very likely to seek medical treatment for musculoskeletal concerns in their neck and mid-to-lower back, followed by shoulders, knees and writs/hands.

Univariate analysis for the associations between the continuous variables and the perceived frequencies of body discomfort score showed that there are no the associations between them. The results from one-way ANOVA analysis shows that only operating position (standing vs. sitting/both) was statistically significantly associated with the perceived frequencies of body discomfort score (P value = 0.0142). Two other variables - number of surgeries/procedures per week (P value = 0.1390) and awareness of ergonomics (P value = 0.0908) - were potentially associated with the perceived frequencies of body discomfort score.

For multivariate analysis in Table 5, operating position, number of surgeries/procedures per week, and awareness of ergonomics were used as independent variables to explain the association with the perceived frequencies of body discomfort score. Also, gender and time in practice variables were added in the multivariate model because they are known as confounders. The perceived frequencies of body discomfort score was significantly (P value = 0.0019) higher for the "standing-only" operating position than for the sitting/both operating position given that the other potential risk factors were included in the proposed model after controlling other variables.

Table 3. Work environment and working conditions

Variable		Frequency (%)
Operating position	Standing	8 (34.8%)
	Sitting	3 (13.0%)
	Both	12 (52.2%)
Height adjustable operating table	Yes	21 (91.3%)
	No	2 (8.7%)
Leg room under operating table*	Yes	19 (82.6%)
	No	6 (17.4%)
Use of foot pedals	Yes	16 (69.6%)
	No	7 (30.4%)
Accessible foot pedals	Yes	14 (87.5%)
	No	1 (6.3%)
	Unsure	1 (6.3%)
Surgical instruments fitting hand	Yes	22 (95.7%)
	No	1 (4.4%)
Use of visual display system	Yes	13 (56.5%)
	No	10 (43.5%)
Adjustable visual display system	Yes	10 (76.9%)
	No	1 (7.7%)
	No response	2 (15.4%)
Number of surgeries/procedures per week	1-5 times	9 (39.1%)
	6-10 times	9 (39.1%)
	16-20 times	1 (4.4%)
	More than 20 times	1 (4.4%)
	No response	3 (13.0%)
Time spent per surgery/procedure	Less than 1 hour	17 (73.9%)
	1-2 hours	2 (8.7%)
	2-3 hours	2 (8.7%)
	3-4 hours	1 (4.4%)
	No response	1 (4.4%)
Day to day pace of work	Very fast paced	9 (39.1%)
	Fast paced	10 (43.5%)
	Neutral	4 (17.4%)
	Relaxed pace	0 (0%)
	Leisurely pace	0 (0%)
Awareness of ergonomics	Not aware	2 (8.7%)
	Slightly aware	8 (34.8%)
	Aware	11 (47.8%)
	Good awareness	2 (8.7%)
	Experienced	0 (0%)
Ergonomics training	Yes	3 (13.0%)
	No	20 (87.0%)

*Two participants have both of the conditions.

DISCUSSION

The objective of the present work was to study the prevalence of musculoskeletal symptoms in relation to physical workload and occupational risk factors among surgeons/physicians performing ambulatory outpatient surgical procedures. The present survey study indicated that outpatient surgeons/physicians had experienced body discomfort or pain in their eye, neck, shoulders, upper and low back, thighs, knees, legs, ankles/foot, wrists/ hand. Another similar study in outpatient (dermatologic) surgery found that 90% of respondents reported some type of musculoskeletal symptoms or injuries in the neck, lower back, shoulder, and upper back body regions [5]. Interestingly, the BodyMap results in the present study revealed that the participants were more likely to seek medical treatment for musculoskeletal concerns in their mid-to-lower back, neck, shoulders, and knees. It should be mentioned here that approximately 35% of the surgeons/physicians performing outpatient procedures used the "standing-only" operating position. The perceived frequencies of body discomfort score was significantly higher for the "standing-only" operating position than for the sitting/both operating positions. Also, the participant in the study reported that the most physicians/surgeons' day to day pace of work was in fast-paced or very fast-paced modes. The time spent in the surgical procedures and working postures (standing or sitting) might be associated with work-related musculoskeletal injuries and disorders [7].

Table 4. BodyMap "Zones" of probability for a physician to seek treatment for musculoskeletal discomfort by body part

Body Part	Number of participants with body discomfort	Zone		
		Green*	Yellow**	Red***
Eyes	2 (8.7%)	22 (95.7%)	1 (4.3%)	0 (0%)
Neck	12 (52.2%)	17 (73.9%)	6 (26.1%)	0 (0%)
Right shoulder	4 (17.4%)	22 (95.7%)	0 (0%)	1 (4.3%)
Left shoulder	5 (21.7%)	20 (87.0%)	3 (13.0%)	0 (0%)
Right upper arm	0 (0%)	23 (100%)	0 (0%)	0 (0%)
Left upper arm	0 (0%)	23 (100%)	0 (0%)	0 (0%)
Right elbow	0 (0%)	23 (100%)	0 (0%)	0 (0%)
Left elbow	1 (4.3%)	23 (100%)	0 (0%)	0 (0%)
Right forearm	1 (4.3%)	23 (100%)	0 (0%)	0 (0%)
Left forearm	0 (0%)	23 (100%)	0 (0%)	0 (0%)
Right wrist	2 (8.7%)	22 (95.7%)	1 (4.3%)	0 (0%)
Left wrist	1 (4.3%)	23 (100%)	0 (0%)	0 (0%)
Right hand	4 (17.4%)	22 (95.7%)	1 (4.3%)	0 (0%)
Left hand	2 (8.7%)	22 (95.7%)	1 (4.3%)	0 (0%)
Upper back	6 (26.1%)	22 (95.7%)	1 (4.3%)	0 (0%)
Buttocks	1 (4.3%)	23 (100%)	0 (0%)	0 (0%)
Mid-To-Lower back	14 (60.9%)	18 (78.3%)	3 (13.0%)	2 (8.7%)
Right thigh	2 (8.7%)	23 (100%)	0 (0%)	0 (0%)
Left thigh	2 (8.7%)	23 (100%)	0 (0%)	0 (0%)
Right knee	4 (17.4%)	20 (87.0%)	3 (13.0%)	0 (0%)
Left knee	2 (8.7%)	21 (91.3%)	2 (8.7%)	0 (0%)
Right lower leg	2 (8.7%)	22 (95.7%)	1 (4.3%)	0 (0%)
Left lower leg	2 (8.7%)	22 (95.7%)	1 (4.3%)	0 (0%)
Right ankle or foot	3 (13.0%)	22 (95.7%)	1 (4.3%)	0 (0%)
Left ankle or foot	3 (13.0%)	22 (95.7%)	1 (4.3%)	0 (0%)

*Green Zone: not likely to seek treatment
**Yellow Zone: somewhat likely to seek treatment
***Red Zone: very likely to seek treatment

Table 5. Results of generalized linear model (GLM) for the proposed multivariate model

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	3982.4	568.9	2.66	0.0568
Error	14	2998.0	214.1		
Corrected Total	21	6980.4			
R-Square	Coeff Var	Root MSE	Discomfort Score Mean		
0.571	80.1	14.6	18.3		
Source	DF	Type I SS	Mean Square	F Value	Pr > F
Operating position (standing vs sitting/both)	1	3123.2	3123.2	14.58	0.0019
Number of surgeries/procedures per week	3	686.4	228.8	1.07	0.394
Time in practice	1	31.29	31.29	0.15	0.708
Gender	1	8.736	8.736	0.04	0.843
Awareness of ergonomics	1	132.8	132.8	0.62	0.444

Additionally, most of the physicians/surgeons in the present study utilized at least one or more of corrective eyewear (glasses, contacts, or loupes). It should be pointed out here that, in another observational ergonomic study [9], the plastic surgeons were at risk for musculoskeletal injuries and disorders due to their time operating in prolonged static awkward body postures. It was also reported that the usages of loupes and headlamps further increase the work load (increased in tension in the neck musculature) to the surgeon's cervical spine/neck [9]. The findings from this present study indicated that the outpatient surgeons/physicians had little experiences in ergonomic related studies and research. Similarly, another survey study [5] on musculoskeletal disorders and ergonomics in dermatologic surgery found a high prevalence of work-related musculoskeletal disorders in outpatient surgical procedures. The study also pointed out that most surgeons or physicians performing ambulatory procedures were not using ergonomic modifications in their outpatient surgery practices [5].

CONCLUSION

This study suggests that there are substantial hazards and risks of musculoskeletal injuries and disorders of physicians and specialists performing the outpatient surgery. The study findings showed that the outpatient physicians/surgeons reported a prevalence of work-related MSD symptoms in their neck, back, shoulder, and knees. This study also demonstrated that the ergonomic assessment techniques (e.g., BodyMap) are very useful for initially assessing risk for work-related musculoskeletal disorders in the outpatient surgery work. It is warranted that the outpatient surgery physicians/specialists are needed to receive ergonomic training or instruction in order to better understanding/implementation of job task-specific ergonomic interventions to control the musculoskeletal risks associated with outpatient surgical procedures. A larger sample/specialty areas study should be conducted for further assessment of the prevalence and risk factors of musculoskeletal disorders among the outpatient surgery specialties in the healthcare industry.

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