Musculoskeletal Disorders among Medical Technologists in a Tertiary Hospital

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ABSTRACT

Background: Healthcare workers (HCWs) are reported to have increased risk of Musculoskeletal Disorders (MSDs).

Aims: To evaluate the prevalence and risk factors associated with MSDs among medical technologists working in specialized diagnostic laboratories at a tertiary hospital in Singapore.

Methods: A cross-sectional questionnaire survey was administered to all medical technologists working in specialized vascular and neurological diagnostic laboratories. This study used the Nordic Musculoskeletal Questionnaire (NMQ) and the Work Ability Index to assess for symptoms of MSDs and work ability respectively. Workplace assessments were also performed to correlate with questionnaire findings.

Results: 95.5% of all medical technologists experienced MSDs over at least one body region in the past 12 months. The shoulders were the most commonly affected (86.4%), followed by the neck (72.7%) and lower back (63.6%). Having MSDs that prevented normal activities was associated with lower work ability. The mean work ability index score among medical technologists with MSDs preventing normal activities was 39.6, which was lower than the score of 43.2 among those without MSDs affecting normal activities (p=0.020). A higher proportion of medical technologists performing neurodiagnostic investigations had MSDs over the knees and ankles compared to those performing vascular ultrasonographic studies. Awkward posture was the predominant ergonomic risk factor, especially when performing electroencephalography and venous scans which had RULA scores of 7 each.

Conclusion: The high prevalence of MSDs among medical technologists is likely due to significant ergonomic risk factors observed at their workplaces. There is a need for increased awareness and an effective ergonomic program to prevent MSDs among medical technologists.

Key words: Musculoskeletal diseases, Ergonomics, Health personnel

INTRODUCTION

Musculoskeletal disorders (MSDs) are an increasing cause of morbidity among workers [1]. In the 2016 global burden of disease study, musculoskeletal conditions were the second highest contributor to global disability, with lower back pain being the single leading cause of disability. Work-related MSDs were reported to result in rising compensation and healthcare costs, lower quality of life, reduced productivity and increased absenteeism [2-4]. In North America, MSDs accounted for the largest proportion of lost productivity at the workplace [5].

Studies have reported that Healthcare Workers (HCWs) are at increased risk of work-related MSDs [6]. Not only are doctors, nurses and dentists at risk of MSDs,[7-8] but allied health professionals such as physiotherapist and laboratory staff have also reported increased risk of work-related MSDs [9-10]. A narrative review of MSDs among HCWs working in a medical laboratory reported that the overall prevalence of MSDs ranged from 40 to 60%[10]. Factors associated with work-related MSDs include age, BMI, marital status, gender as well as work-related factors such as awkward postures, excessive work load and time pressures [11-12].

Medical technologists working in specialized diagnostic laboratories performing vascular ultrasonographic studies and neurodiagnostic investigations are exposed to various ergonomic hazards such as awkward postures as well as repetitive and forceful movements. However, there is limited literature on the extent of, and risk factors associated with work-related MSDs in this group of HCWs. As such, the objective of this study is to review the prevalence and risk factors associated with MSDs among medical technologists working in specialized diagnostic laboratories at a tertiary healthcare institution.

METHODS

Design and sampling

All medical technologists who were above the age of 21 years old and have worked in a tertiary hospital's specialized vascular and neurological diagnostic laboratories for at least 6 months were administered a cross-sectional questionnaire survey over a period of 4 weeks from 1st to 31st August 2018. Each questionnaire survey form came with a consent form explaining the nature and purpose of this study, and the forms were distributed to medical technologists through their respective supervisors. They would complete the questionnaires and deposit them in secured repository boxes provided at their workplaces.

Our study used the Nordic Musculoskeletal Questionnaire (NMQ) which was developed from a project funded by the Nordic Council of Ministersto determine the prevalence of musculoskeletal disorders among medical technologists [13]. It followed a standardized questionnaire methodology allowing comparison of various body regions such as lower back, neck and shoulder for use in epidemiological studies. The NMQ is the most commonly-used symptom survey in occupational health [13,14].

In addition, our study also evaluated the work ability of the medical technologists using the Work Ability Index which is an instrument used in clinical occupational health and research to assess work ability during workplace surveys [15]. The Work Ability Index has been reported to be a internally coherent, predictive and cross-nationally stable tool to assess work ability with high test and retest reliability [16,17].

Additional information on demographic and work-related risk factors were also collected in this survey. The demographic information collected include age, gender, ethnic group, marital status and Body Mass Index (BMI). Work-related details obtained include occupation, work activities and total working hours.

As in any cross-sectional study, non-response is a key source of selection bias which would affect the validity of our study. As such, we sought to increase response rate by personally explaining the objectives and nature of the study to all medical technologists. Weekly reminders were also conveyed throughout the study period.

Statistical analysis

Descriptive analysis was performed to obtain the demographic characteristics, job tasks and prevalence of MSDs among medical technologists working in the specialized diagnostic laboratories. Continuous variables were summarized by mean and standard deviation while categorical variables were summarized by percentages. The Chi-square test was applied to study any association between categorical variables while the student t-test was used to compare mean values. Bivariate analysis was performed to assess the relationship between demographic characteristics and work tasks with MSDs in the study population. Subgroup analysis was performed comparing medical technologists performing vascular ultrasonographic studies versus those performing neurodiagnostic investigations. Adjustment for confounders was not performed due to the small sample size in this study. All statistical analyses were performed using STATA version 14 (Stata Corporation, TX).

Workplace assessment

Workplace assessments were performed to evaluate the ergonomic risk factors at the workplaces. Evaluation of the various work tasks was performed by a trained occupational physician using the RULA ergonomic assessment tool. The RULA assessment tool is a valid and reliable observational method to investigate risk factors of work-related upper limb MSDs [18].

Data approval process

This study was performed at Singapore General Hospital. No ethics approval was required as this study was part of an operational review process to improve the health of medical technologists in a tertiary hospital. Only aggregate data was reported with anonymity of individual participants preserved. Informed consent however was obtained for all participants.

RESULTS

The total study population comprises 22 medical technologists which represents the entire population of medical technologists performing either vascular ultrasonographic studies or neurodiagnostic investigations in our hospital. Our study thus achieved a response rate of 100%. Item non-response was minimal at 1.37% and did not significantly affect the results of our questionnaire survey.

Characteristics of medical technologists

A total of 22 medical technologists from specialized diagnostic laboratories were included in our study. Their work activities were similar, involving either the use of ultrasonographic probes to evaluate extremity and neurological vasculature or the use of electrodes and probes to evaluate central and peripheral nervous systems. Their mean age was 36.5 (SD=11.3; range 23-63) years. More than half of the study participants were between 21 to 40 years of age. Most of the medical technologists in specialized diagnostic laboratories were females and of Chinese ethnicity. They worked a mean of 41.9 (SD=0.4) hours a week, ranging from 40 to 42 hours a week. Among 22 medical technologists, 3 (13.6%) had an additional managerial/supervisory role (Table 1).

21 (96%) medical technologists experienced MSDs over at least one body region in the past 12 months. The shoulders were the most commonly affected region (86%), followed by the neck (73%) and lower back (64%). 15 (68%) of all medical technologists also reported difficulties performing normal activities due to MSDs. The MSDs affecting normal activities occurred predominantly over the lower back (41%), followed by shoulders (36%) and wrist/hand (27%). 8 (36%) of all medical technologists had seen a physician for their MSDs. MSDs requiring medical attention occurred predominantly over the neck region (14%). 15 (68%) of all medical technologists reported MSDs over the past 7 days. These symptoms occurred predominantly over the shoulders (55%) and lower back (36%) (Table 2).

In terms of work ability, 2 (9%) medical technologists reported excellent work ability, 17 (77%) reported

having good work ability while 2 (9%) reported having only moderate work ability. One (5%) had item non-responses affecting the calculation of the work ability index score.

Factors associated with musculoskeletal disorders among medical technologists

Having MSDs that prevented normal activities was associated with lower work ability. The mean work ability index score among medical technologists with MSDs preventing normal activities was 39.6, which was lower than the score of 43.2 among medical technologists without MSDs affecting normal activities ($p<0.05$) (Table 3). No statistically significant associations were observed between work activities/gender/ethnic group/marital status and MSDs among medical technologists in specialized diagnostic laboratories.

Workplace ergonomic assessments

Medical technologists working in specialized diagnostic laboratories were subdivided into those performing neurodiagnostic investigations and those performing vascular ultrasonographic studies.

Neurodiagnostic investigations performed by medical technologists include Electroencephalography (EEG), Electromyography (EMG), Nerve Conduction Study (NCS), Neurovascular Ultrasonography and Transcranial Magnetic Stimulation (TMS). Additional work tasks include patient transfer and administrative tasks. Risk factors observed include awkward sustained postures and repetitive movements (Figures 1). Five (33%) medical technologists performing neurodiagnostic investigations each cited difficulties in performing EEG and patient transfer, followed by four (27%) medical technologists each having difficulties performing EMG/NCS and administrative computer work. Three (20%) medical technologists also reported difficulties in performing neurovascular ultrasonography while two (13%) medical technologists experienced difficulties with TMS.

We evaluated the various work processes using the RULA assessment tool. The RULA assessment score for performing neurovascular ultrasonography was 4 due to poor postures over the lower arms and wrists with individual sub-scores of 3 and 2, respectively. Medical technologists performing NCS/EMG also had an RULA score of 4 due to poor postures over the upper, lower arms and wrists with sub-scores of 3 each. The RULA score for performing TMS was 5 mainly due to awkward sustained posture over the neck and trunk region with sub-scores of 4 and 3, respectively. The RULA scores of 4 and 5 suggested that further evaluations were needed for these work processes and changes may be required. However, the RULA score for performing EEG was 7 due to awkward sustained postures over the upper arm, neck and trunk with sub-scores of 4, 5 and 4, respectively. The RULA score of 7 indicated that the working postures were at or near the end of range of movement and investigations and modifications of the work process was required immediately.

Vascular ultrasonographic studies performed by medical technologists include arterial and venous scans, as well as occasional administrative computer work and patient transfer. Risk factors observed include awkward sustained postures and occasional forceful movements (Figures 2 and 3). Five (56%) medical technologists performing vascular ultrasonographic studies cited difficulties in performing patient transfer, followed by two (22%) medical technologists each experiencing difficulties performing arterial scans, venous scans and abdominal scans respectively. None of medical technologists cited difficulties in performing administrative computer work.

We evaluated the various work processes using the RULA assessment tool. The RULA score for performing arterial scans was 4 due to elevated individual sub-scores of 3 in the upper, lower arm and wrists. The RULA score of 4 suggests that further investigations were needed for these operations and changes may be required. However, the RULA score for performing venous scans was 7 contributed by elevated sub-scores of 4 and 5 in the upper arm and neck, respectively. The RULA score of 7 indicated that the working postures were at or near the end of range

of movement and investigations and modifications of the work processes were required immediately.

Subgroup analysis

The 22 medical technologists working in specialized diagnostic laboratories were further divided into those performing neurodiagnostic investigations (n=13) and those performing vascular ultrasonographic studies (n=9).

Medical technologist performing neurodiagnostic investigations were similar to those performing vascular ultrasonographic studies in terms of various demographic characteristics, except that a greater proportion or 69% of those performing neurodiagnostic studies had more than 2 hours of exercise per week compared to only 22% of those performing vascular ultrasonographic studies ($p<0.05$).

The distribution of MSDs was similar between both groups of medical technologists. The body regions most commonly affected among both groups of medical technologists were the shoulders, neck, lower back and wrists. This corresponded to the RULA assessment scores for medical technologists performing vascular ultrasonographic studies and neurodiagnostic investigations with majority having elevated scores over the upper and lower arms, neck and lower back.

However, a greater proportion of medical technologists performing neurodiagnostic investigations had MSDs over the knees and ankles compared to medical technologists performing vascular ultrasonographic studies. For example, 69% of medical technologists performing neurodiagnostic investigations experienced MSD symptoms over the knee for the past 12 months compared to none of the medical technologists performing vascular ultrasonographic studies ($p<0.01$). Evaluation of work activities showed that medical technologists performing neurodiagnostic investigations such as EEG and TMS had to adopt a standing flexed knee posture which may result in excessive strain over the knee and ankles.

DISCUSSION

This study was carried out to evaluate the prevalence and risk factors associated with MSDs among medical technologists working in specialized diagnostic laboratories. Although several studies have demonstrated that HCWs are at increased risk of MSDs, no study has, to the best of our knowledge, evaluated the prevalence and risk factors associated with MSDs among medical technologists in specialized diagnostic laboratories in Singapore.

The prevalence of MSDs among healthcare workers (HCWs) ranged from 26% to 69% [6,19,20]. Among HCWs working in a medical laboratory, a study done among female biomedical scientists showed a 3 month prevalence of 79% for MSDs while another study done among medical laboratory scientists showed that the 12 month prevalence of MSDs was 67% with the lower back and neck being the most commonly affected [21,22]. These studies indicated that HCWs working in medical laboratories have a high prevalence of MSDs due to the presence of ergonomic risk factors. Our study however looked at medical technologists working in specialized diagnostic laboratories, which have different work activities, equipment handling and patient interface requirements compared to clinical laboratories handling patient samples.

In our study, medical technologists working in the specialized diagnostic laboratories had a high overall prevalence of MSDs over the past 12 months of 96% with the shoulder, cervical neck and lower back being the most commonly affected. Based on our workplace assessments, several ergonomic risk factors among these medical technologists were sustained awkward postures and forceful repetitive movements. Work activities with the highest ergonomic risks were performing EEG and conducting venous ultrasound scans, which were both assessed to have a RULA score of 7 warranting immediate work modifications to prevent MSDs among medical technologists.

Among the risk factors evaluated in our study, there were no significant associations demonstrated between

risk factors such as work activities/gender/BMI/age and the development of MSDs.

MSDs has been shown in our study to lead to a lower work ability. The mean work ability index scores among medical technologists with MSDs affecting normal activities was 3.6 points lower than those without MSDs affecting normal activities. Lower work ability index scores are associated with future long-term sickness absence and lower productivity at work which may affect the ability of healthcare organization to provide quality care to its patients [23,24]. Hence, it is important that effective ergonomic interventions are implemented to reduce MSDs among medical technologists and improve their work productivity and reduce sickness absenteeism.

Possible ergonomic interventions should target MSDs affecting the shoulders, neck and back as these regions are most commonly affected among medical technologists in specialized diagnostic laboratories. Possible engineering control measures include the use of forearm supports especially for those performing EMG/NCS and vascular ultrasonography, as well as the use of chairs with adequate back and neck support. These engineering measures may help reduce excessive strain over the shoulders, neck and back, which have the highest rates of MSDs among affected HCWs. Administrative controls include scheduling frequent rest breaks in between patients to allow medical technologists to perform simple stretching exercises to reduce the risk of musculoskeletal disorders, work task rotations, as well as conducting pre- and post-intervention survey for musculoskeletal symptoms to review the effectiveness of the aforementioned measures.

Although our study achieved 100% response rate among medical technologists in specialized diagnostic laboratories, the number of medical technologists is small, and the study still remained underpowered to detect clinically significant factors associated with MSDs among medical technologists. In addition, the retrospective nature of the survey questions may result in recall bias where HCWs with MSDs tend to recall occupational exposures differently from those without MSDs. Furthermore, the ergonomic assessment of the tasks observed may not be fully representative as techniques and postures adopted may vary among different HCWs due to variations in body habitus, work habits and workload. Similarly, the generalizability of our study results may also be limited as specialized diagnostic laboratories in other institutions may have different equipment and work practices among their medical technologists.

Despite its limitations, our study served to highlight the ergonomic risks and the high prevalence of MSDs experienced by medical technologists in specialized diagnostics laboratories which were not as well-studied and characterized as compared to other groups of HCWs such as nurses and physicians. Moreover, our study also attempted to correlate findings from the quantitative questionnaire survey with the ergonomic risk factors observed during the workplace assessments. This allowed for a more holistic evaluation of the prevalence and risk factors associated with MSDs among medical technologists.

Moving forward, a deeper understanding of the pathophysiology and risk factors for work-related MSDs in this group of medical technologists will allow diagnostic equipment which needs to be handled by an operator, to be designed with more robust ergonomic considerations. It will also allow prevailing work processes to be reviewed to reduce ergonomic stress and strain. A more detailed task analysis and ergonomic evaluation together with measurements on time-on-tasks, force, posture and pressure can be performed [25]. Impact of MSDs on the quality of life, work productivity and absenteeism among medical technologists can also be evaluated using validated questionnaire surveys and reviewing sickness absence records.

KEY POINTS

What is already known about this subject

- Studies have reported that healthcare workers (HCWs) are at increased risk of musculoskeletal disorders (MSDs).
- However, to the best of our knowledge, there is very limited literature on the prevalence

and risk factors of MSDs among medical technologists working in specialized clinical laboratories.

What this study adds

- 96% of medical technologists experience MSDs over the past 1 year with the shoulder, neck and lower back being the most commonly affected.
- Risk factors such as awkward sustained postures and repetitive forceful movements were observed during their work activities and MSDs were also associated with reduced work ability.
- As such, development of effective ergonomic measures is essential to improve the health and productivity of medical technologists.

What impact this may have on practice or policy

- There needs to be increased recognition of work-related MSDs among medical technologists in healthcare institutions.
- The ergonomic risk factors associated with work activities of medical technologists needs to be identified and mitigated with effective ergonomic measures such as better design of diagnostic equipment and adequate work-rest cycle.
- Moreover, further studies using detailed task analysis and ergonomic evaluation are needed to better understand and prevent MSDs among medical technologists.

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Figure 1: Performance of EEG by the medical technologist (Awkward back, neck and shoulder postures were observed among medical technologists performing EEG).

Figure 2: Performance of venous ultrasound by the medical technologist (Awkward sustained postures over the upper limbs, back, neck and lower limbs were observed among medical technologists performing venous scans).

Figure 3: Performance of arterial ultrasound by the medical technologist (Forceful fine movements over the hands with awkward sustained wrist postures were observed among medical technologists manipulating the ultrasound probe).

Table 1: Demographic characteristics of medical technologists in specialized diagnostic laboratories.

Variables		Perform neurodiagnostic investigations [n(%)]	Perform vascular ultrasonographic studies [n(%)]	p-value	Overall sample [n(%)]
Number of study participants		13 (59%)	9 (41%)	NIL	22 (100%)
Age	21-30	6 (46%)	3 (33%)		9 (41%)
	31-40	3 (23%)	3 (33%)		6 (27%)
	41-50	2 (15%)	2 (22%)		4 (18%)
	>50	2 (15%)	1 (11%)	NS	3 (14%)
	Mean (Standard deviation)	36.5 (12.7)	36.6 (9.6)	NS	36.5 (11.3)
Gender	Male	0 (0%)	1 (11%)		1 (5%)
	Female	13 (100%)	8 (89%)	NS	21 (95%)
Ethnic group	Chinese	13 (100%)	7 (78%)		20 (91%)
	Malay	0 (0%)	0 (0%)		0 (0%)
	Indian	0 (0%)	0 (0%)		0 (0%)
	Others	0 (0%)	2 (22%)	NS	2 (9%)
Body mass index (BMI)	<18.5	1 (8%)	0 (0.0%)		1 (5%)
	18.5-22.9	6 (46%)	6 (67%)		12 (54.6%)
	>23	5 (39%)	1 (11%)		6 (27.3%)
	Missing	1 (8%)	2 (22%)	NS	3 (13.6%)
	Mean (Standard Deviation)	24.6 (7.2)	21.9 (2.6)	NS	23.6 (6.0)
Hours of	0-2 hours	4 (31%)	4 (44%)	NS	8 (36.4%)

exercise per week	> 2hours	9 (69%)	2 (22%)		11 (50.0%)
	Missing	0 (0%)	3 (33%)		3 (13.6%)
Marital status	Single	7 (54%)	4 (44%)		11 (50.0%)
	Married	6 (46.1%)	5 (56%)		11 (50.0%)
	Divorced/separated	0 (0%)	0 (0%)		0 (0.0%)
	Widowed	0 (0%)	0 (0%)		0 (0.0%)
	Others	0 (0%)	0 (0%)	NS	0 (0.0%)
Occupation	Technologist/Technician	10 (76.9%)	9 (100.0%)		19 (86%)
	Supervisor/Manager	3 (23.1%)	0 (0.0%)	NS	3 (14%)
Work ability index	Moderate	1 (8%)	1 (11%)		2 (9%)
	Good	11 (85%)	6 (67%)		17 (77%)
	Excellent	1 (8%)	1 (11%)		2 (9%)
	Missing	0 (0%)	1 (11%)	NS	1 (5%)

Table 2: Musculoskeletal disorders among medical technologists in specialized diagnostic laboratories.

Musculoskeletal regions		Perform neurodiagnostic investigations [n(%)]	Perform vascular ultrasonographic studies [n(%)]	p-value	Overall sample [n(%)]
Neck	Symptoms over past 12 months	8 (62%)	8 (89%)	NS	16 (73%)
	Symptoms affecting normal activities	2 (15%)	1 (11%)	NS	3 (14%)
	Seen a physician for musculoskeletal symptoms	1 (8%)	2 (22%)	NS	3 (14%)
	Symptoms over past 7 days	5 (39%)	1 (11%)	NS	6 (27%)
Shoulder	Symptoms over past 12 months	10 (77%)	9 (100%)	NS	19 (86%)
	Symptoms affecting normal activities	4 (31%)	4 (44%)	NS	8 (36%)
	Seen a physician for musculoskeletal symptoms	1 (8%)	0 (0%)	NS	1 (5%)
	Symptoms over past 7 days	6 (46%)	6 (67%)	NS	12 (55%)
Upper back	Symptoms over past 12 months	3(23%)	5 (56%)	NS	8 (36%)
	Symptoms affecting normal activities	1 (8%)	1 (11%)	NS	2 (9%)
	Seen a physician for musculoskeletal symptoms	0 (0%)	2 (22%)	NS	2 (9%)
	Symptoms over past 7 days	2 (15%)	1 (11%)	NS	3 (14%)
Elbow	Symptoms over past 12 months	3 (23%)	2 (22%)	NS	5 (23%)
	Symptoms affecting normal activities	1 (8%)	0 (0%)	NS	1 (5%)

	Seen a physician for musculoskeletal symptoms	0 (0%)	1 (11%)	NS	1 (5%)
	Symptoms over past 7 days	1 (8%)	1 (11%)	NS	2 (9%)
Wrist/ hand	Symptoms over past 12 months	7 (53%)	3 (33%)	NS	10 (46%)
	Symptoms affecting normal activities	3 (23%)	3 (33%)	NS	6 (27%)
	Seen a physician for musculoskeletal symptoms	0 (0%)	0 (0%)	NS	0 (0%)
	Symptoms over past 7 days	3 (23%)	3 (33%)	NS	6 (27%)
Lower back	Symptoms over past 12 months	8 (62%)	6 (67%)	NS	14 (64%)
	Symptoms affecting normal activities	5 (39%)	4 (44%)	NS	9 (41%)
	Seen a physician for musculoskeletal symptoms	2 (15%)	0 (0%)	NS	2 (9%)
	Symptoms over past 7 days	5 (39%)	3 (33%)	NS	8 (36%)
Hip/th igh	Symptoms over past 12 months	5 (39%)	2 (22%)	NS	7 (32%)
	Symptoms affecting normal activities	2 (15%)	0 (0%)	NS	2 (9%)
	Seen a physician for musculoskeletal symptoms	2 (15%)	0 (0%)	NS	2 (9%)
	Symptoms over past 7 days	3 (23%)	0 (0%)	NS	3 (14%)
Knee	Symptoms over past 12 months	9 (69%)	0 (0%)	<0.01	9 (41%)
	Symptoms affecting normal activities	4 (31%)	0 (0%)	NS	4 (18%)
	Seen a physician for musculoskeletal symptoms	1 (8%)	0 (0%)	NS	1 (5%)
	Symptoms over past 7 days	4 (31%)	0 (0%)	NS	4 (18%)
Ankle/ feet	Symptoms over past 12 months	6 (46%)	2 (22%)	NS	8 (36%)
	Symptoms affecting normal activities	3 (23%)	2 (22%)	NS	5 (23%)
	Seen a physician for musculoskeletal symptoms	0 (0%)	1 (11%)	NS	1 (5%)
	Symptoms over past 7 days	3 (23%)	0 (0%)	NS	3 (14%)

Table 3: Factors associated with musculoskeletal disorders among medical technologists in specialized diagnostic laboratories.

	Symptoms over past 12 months			**Symptoms affecting normal activities**			**Seen a physician for musculoskeletal symptoms**			**Symptoms over past**	
ssociated with keletal disorders											
	No	Yes	p value	No	Yes	p value	No	Yes	p value	No	Yes
	46	37.2	NS	34.3	37.5	NS	37.9	34	NS	31	39.1
	24.2	23.6	NS	22.6	24	NS	21.7	26.8	NS	22.7	24
index	43	40.5	NS	43.2	39.6	<0.05	41.3	39.4	NS	42.5	39.8
(n=22)											
st/technician	1 (5%)	18 (95%)	NS	6 (32%)	13 (68%)	NS	12 (63%)	7 (37%)	NS	7 (37%)	12 (63%)

Manager [n(%)]	0 (0%)	3 (100%)		1 (33%)	2 (67%)		2 (67%)	1 (33%)		0 (0%)	3 (100%)
ercise (n=19)											
s [n(%)]	0 (0%)	8 (100%)	NS	2 (25%)	6 (75%)	NS	5 (63%)	3 (38%)	NS	4 (50%)	4 (50%)
(%)]	1 (9%)	10 (91%)		4 (36%)	7 (64%)		7 (64%)	4 (36%)		3 (27%)	8 (73%)
us (n=22)											
d [n(%)]	0 (0%)	11 (100%)	NS	5 (46%)	6 (55%)	NS	6 (55%)	5 (45%)	NS	5 (45%)	6 (55%)
%)]	1 (9%)	10 (91%)		2 (18%)	9 (82%)		8 (73%)	3 (27%)		2 (18%)	9 (82%)
-22)											
%)]	1 (5%)	19 (95%)	1	7 (35%)	13 (65%)	NS	13 (65%)	7 (35%)	NS	7 (35%)	13 (65%)
)]	0 (0%)	2 (100%)		0 (0%)	2 (100%)		1 (50%)	1 (50%)		0 (0%)	2 (100%)